# AUTOMATIC IRRIGATION SYSTEM ON SENSING SOIL

**A Project submitted in partial fulfillment of the requirements for the Award of Degree of**

**Bachelor of Science in Electrical and Electronic Engineering**

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**December 2018**

# CERTIFICATION

This is to certify that this project entitled "**Automatic Irrigation System on Sensing Soil**" is done by the following students under my direct supervision and this work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering of Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering. The presentation of the work was held on November 2018.

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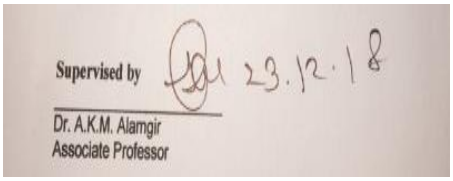

# DECLARATION

The project and thesis entitled **"Automatic Irrigation System on Sensing Soil"** submitted by Name: Sohail Rana . ID: 151-33-2540 Name:Iman Hessen ID:151-33-2540 Name:Umma kulsum ID:151-33-2538 has been accepted as satisfactory in partial fulfillment of the requirements for the degree of **Bachelor of Science in Electrical and Electronic Engineering** on December 2018.

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# ACKNOWLEDGEMENT

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of the Department of Electrical and Electronic Engineering, Faculty of Engineering at the daffodil International University, for his dedication to support, motivation and us guide through this project. This project can not be done without your advice and help. Also, thank you very much for giving us the opportunity to choose this project.

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To our dear family, we want to give our greatest love and gratitude for their great support and also for their inspiration and encouragement during our studies at the University.

# ABSTRACT

The project is designed to develop an automatic irrigation system that activates the ON / OFF pump motor when detecting the moisture content of the soil. In the field of agriculture, the use of an appropriate irrigation method is important. The advantage of using this method is to reduce human intervention and ensure adequate irrigation. The project uses an Arduino Nano with a microcontroller of the ATMega328 series that is programmed to receive the input signal of different humidity conditions of the ground through the detection device. Once the controller receives this signal, it generates an output that drives a relay to operate the water pump. The automation of irrigation systems has several positive effects. Once installed, the distribution of water in small-scale fields or gardens is simpler and must not be controlled permanently by an operator. There are several solutions for the design of automated irrigation systems.

# CHAPTER 1

# INTRODUCTION

## 1.1 Introduction

This chapter deals with the problem statement, system block diagram and interpretation on each block. It also includes the relevance of our project, which are the applications of these projects. In the fast world, human beings require that everything be automated. Our lifestyle requires that everything is controlled remotely. In addition to some things, the man made his life automated. And why not? In the world of advanced electronics, the life of human beings should be simpler, therefore, make life easier and easier than we did "Automatic system of irrigation in the soil of detection." A model of control of irrigation facilities to help millionsof people. This model uses sensor technology with a microcontroller to make a smart switching device

## 1.2 History

Bangladesh is known mainly for its agriculture and can play a key role in growth and economic development. Making a farmer is not an easy task. It is the science or practice of agriculture, including cultivation of soil for cultivation. Culture is the process of trying to acquire or develop a quality or skill. Culture is often used to talk about how farmers take care of cultures. But although there are many factors, soil moisture, water level and temperature. Farmers need to manually register records of these environmental factors to correctly cultivate their crops. In general, agricultural land is so far from the farms that farmers have to look for and analyze the soil, write records of these environmental factors on paper, the tedious work of keeping and memorizing. In addition, farmers should be aware of these factors over a period of time to take the appropriate measures.

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## 1.3 Scope of Project

A critical consideration are the installation costs, since costs generally determine the feasibility and feasibility of a project. Installation must be very simple for a home user. Water savings have also been an important aspect, since there is a demand to minimize water loss and minimize the efficiency of the water used. Finally, the possibility of implementing the system on a larger scale should be investigated.

## 1.4 Examples of Embedded Systems

Embedded systems are found in a wide range of application areas. Originally they were used only for expensive industrial control applications, but as technology reduced the cost of dedicated processors, they began to appear in moderately expensive applications, such as automobiles, communication and office and television equipment

## 1.5 Methodology

• Collection of book and internet information.

• The required components were purchased in the market.

• From this project we offer a new technology for the automation of the field of agriculture. Also avoid the waste of water that occurs in the older irrigation system. From this project we can reduce manpower. The project presents the waters of your plants here automatically and regularly when you have a vocation.

## 1.6 Project Outline

This project organized as follows

Chapter -1 Introduction of the project

Chapter - 2 Reviews the literature

Chapter - 3 Equipment

Chapter - 4 Theoretical Models

Chapter - 5 Hardware development part.

Chapter - 6 Result and discussion

Chapter - 7 Conclusions

# CHAPTER 2

# LITERATURE REVIEWS

## 2.1 Introduction

This chapter will contain information about automatic irrigation. Here we will also discuss Arduino and choosing reason. Also, contains moister sensor and its history.

## 2.2Automatic Irrigation system

The irrigation system uses valves to activate and deactivate irrigation. These valves can be easily automated by the use of controllers and solenoids. The automation of agricultural or nursery irrigation allows farmers to apply the right amount of water at the right time, regardless of the availability of work to activate or deactivate the valves. In addition, farmers who use automation equipment are capable of reducing runoff from irrigating saturated soils, preventing irrigation at the wrong time of the day, which will improve the yield of cultures ensuring adequate water and nutrients when necessary. Automatic drip irrigation is a valuable tool for the exact control of soil moisture in the production of highly specialized vegetables and is a simple and precise method for irrigation. It also helps in saving time, eliminating human error in adapting the available humidity levels of the soil and maximizing its net benefits. Irrigation is the artificial application of water to the soil normally to help crops. In crop production it is mainly used in dry areas and in periods of precipitation deficit, but also to protect plants against frost. Types of irrigation Superficial irrigation

• Localized irrigation

• Drip irrigation

• Spray irrigation

Conventional irrigation methods, such as air ducts, flood-feeding systems usually pierce the lower leaves and stem from the plants. The entire surface of the soil
Saturated and, often, it remains wet long after the irrigation has finished. This condition promotes infections by leaf fungi. Instead, dripping or dripping is a type of
Modern irrigation technique that slowly applies small amounts of water to the part of the root of the plant. Water is often supplied, many times daily to maintain a favorable humidity condition of the soil and avoid moisture stress in the plant with the proper use of water resources. Drip irrigation saves water because only the area of the root of the plant receives moisture. Little perforation is lost if the appropriate amount is applied. Drip irrigation is popular because it can increase yields and reduce water requirements as well as work. Drip irrigation requires about half of the water needed by spraying or surface irrigation. The low operating pressures and the flow rates give rise to reduced energy costs. It is possible to achieve a greater degree of water control. Plants can be supplied with more precise amounts of water. Disease and insect damage reduce because the plant foliage remains dry. Operating cost is usually reduced. The bunds can continue during the irrigation process because the rows between the plants remain dry

## 2.3 Arduino pro Mini

Arduino is an open source physical processing that is based on a microcontroller panel and a built-in development environment to program the board. Arduino gains some entries, for example, switches or sensors and controls some multiple outputs, for example, lights, motor and others. The Arduino program can work on Windows and Linux (SO) operating systems compared to most microcontroller frameworks running on Windows only. Arduino's programming is easy to learn and applies to beginners and amateurs. Arduino is an instrument used to build a better version of a computer that can control, interact and feel more than a normal desktop computer. It is a phase of open source physical processing centered on a simple microcontroller card and an environment to compose programs for the board. Arduino can be used to create interactive elements, taking inputs from a diverse collection of switches or sensors, and controlling a variety of lights, motors and other physical outputs. Arduino's activities can remain lonely or may be associated to programs that run on your machine. The plate can be assembled by hand or purchased preassembled; The open source IDE can be downloaded for free. Focused on the multimedia programming programming environment, the Arduino programming language is an execution of Wiring, a comparative physical computation.

## 2.4 Why using Arduino

Arduino has been used in thousands of different projects and applications. It works on Mac, Windows and Linux. Teachers and students use to build low cost scientific instruments, to test the principles of chemistry and physics, or to start programming and robotics. Designers and architects create interactive prototypes, musicians and artists who use it for installations and to experiment with new musical instruments. Arduino is a fundamental tool for learning new things. There are many other microcontrollers and microcontroller platforms available for physical computing. All these tools take the disorderly details of microcontroller programming and get into an easy-to-use package. Arduino also simplifies the work process with microcontrollers, but offers some advantage for teachers, students and fans interested in other systems.

• Cross-platform: Arduino software (IDE) works on Windows, Macintosh OSX and Linux operating systems. Most microcontroller systems are limited to Windows.

• Simple and clear programming environment: Arduino software (IDE) is easy to use for beginners, although flexible enough so that advanced users can take advantage as well. For teachers, it is conveniently based on the programming environment of processing, so students who learn to program in that environment will be familiar with how Arduino IDE works. Here we use Arduino IDE 1.8.1.

• Open and extensible software: Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C ++ libraries and people who want to understand the technical details can take Arduino's jump to the AVR C programming language on which it is based. In the same way, you can add the AVR-C code directly to your Arduino programs if you wish.

• Open and extensible code tools: Arduino license plans are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, expanding it and improving it. Even relatively inexperienced users can build the version of the breadboard module to understand how it works and save money.

# CHAPTER 3

# EQUIPMENT

## 3.1 Introduction

To complete this project, there were many types of research and analysis of the digital cruise system and its theories. Several sources have been the reference of this research, such as textbooks, magazines and internet sources. From the previous investigation, they have achieved many methods to solve the problem of this project and related to the theory.

## 3.2 Component List

1. Arduino Pro Mini
2. LCD
3. Motor
4. Buzzers
5. LED
6. Connector
7. Vero board
8. Soldering Wires

### 3.2.1 Arduino Pro Mini

In this project, we use a microcontroller to control the entire process of a system that is Arduino's board. In fact, Arduino is not a mere controller since it has an operating system or bootloader that works with AVR controllers. Arduino is an open source hardware platform and very useful for project development purposes. [1]

Figure 3.1 Arduino mini

### 3.2.2 LCD

The 16 x 2 LCD drive is widely used in embedded system projects because it is cheap, easy to access, and small and easy to interface. The 16x2 has two rows and 16 columns, which means that it consists of 16 blocks of 5x8 points. 16 pins for connections in which 8 bits of data D0-D7 and 3 bits of control, that is, RS, RW and EN. The rest of the pins are used for the supply, control of brightness and backlight.

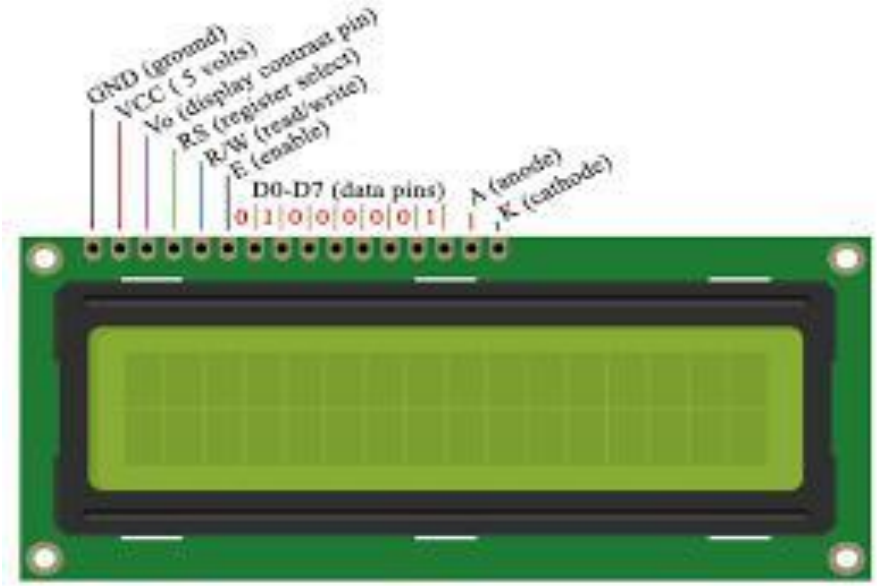


Fig. 3.2 Atmega328 Microcontroller

In this article, we will pass the pin out of the Atmega328 chip. The Atmega328 is a very popular microcontroller chip produced by Atmel. It is an 8-bit microcontroller that has 32K of flash memory, 1K of EEPROM and 2K of internal SRAM.

The Atmega328 is one of the microcontroller chips that are used with the popular Arduino Duemilanove plates. The Arduino Duemilanove card comes with 1 or 2 microcontroller chips, Atmega168 or Atmega328. Of these 2, the Atmega328 is the most advanced and advanced chip. Unlike the Atmega168 that has flash memory program 16K and 512 bytes of internal SRAM, Atmega328 has 32K flash memory and 2K internal SRAM memory. The Atmega328 has 28 pins. It has 14 digital I / O pins, of which 6 can be used as PWM outputs and 6 analog input pins. These I / O pins represent 20 of the pins.

### 3.2.3 Motor

The electric motor is the electromechanical machine that turns the electrical energy into mechanical energy. In other words, devices that produce rotational force are known as the motor. The principle of operation of the electric motor depends mainly on the interaction of the magnetic and electric field. The electric motor is classified mainly in two types. They are the AC motor and the DC motor. The AC motor takes the AC current as an input, while the DC motor has a DC current.

Figure: 3.3 Motor.

### 3.2.4 Buzzers

Buzzers are sound components prepared incorporating a piezoelectric vibration plate in a plastic box (resonator). The piezoelectric sounders are sonorous components that they generate are suitable for use as input signals (including multi-tune tone, etc.) without built-in oscillation circuits. This feature allows them to be used in a wide range of applications. It comes as the SMD type, which is great for the assembly of small and high densities and the type of pin, which can be used for general purposes. Piezoelectric buzzers are sonorous components that generate a monotone using a built-in oscillation circuit. [3]


Figure: 3.4 Buzzers

### 3.2.5 LED

The LED is a light source that uses semiconductors and electroluminescence to create light. There are two main types of light emitting diodes: LED and OLED. The LED is different than the EL bulb because it uses a small semiconductor crystal with reflectors and other parts to make the light brighter and centered on a single point. The OLED is very similar to that of the EL lamp in design, using a flat sandwich of materials. It is different from LED light and EL because it uses organic molecules in the light emitting layer. [4]

**Figure:** 3.5 LED

### 3.2.6 Connector

• An electrical connector, a device for joining electrical circuits together

• Audio and video connector, electrical connectors (or optical connectors) for transporting audio signal and video signal, analog or digital format

• Gender of connectors and fasteners

• Power connector, devices that allow the electrical equipment to be connected to the AC power supply in a building

• RF connector, an electrical connector designed to operate at radio frequencies in the range of several megahertz

Fig: 3.6 Connector

• Circular connector

• Lighter receptacle

• Mate blind connector, one in which the coupling action occurs where you can not see or feel that it ensures that it is correctly aligned. They have self-aligning features that allow a small misalignment when coupled. [6]

### 3.2.7 Vero board

Vero board is a strip board brand, a pre-formed copper strips plate material on an insulation plate. Which is the generic name for a type of widely used electronic prototype plate that is characterized by a regular (rectangular) hole of 0.15 mm (2.5 mm), with parallel copper lining strips running in one direction on one side of the edge? Generally, it is also known as the original Vero board product, which is a trademark in the United Kingdom, the British company Vero Technologies Ltd and the Canadian company Pixel Print Ltd. When using the board, the jumps are made on the slopes, normally near holes, to divide the strips into several electrical nodes. With care, it is possible to break between holes to allow components that have two clues of pins only to be separated by a position like row headers together for IDC.

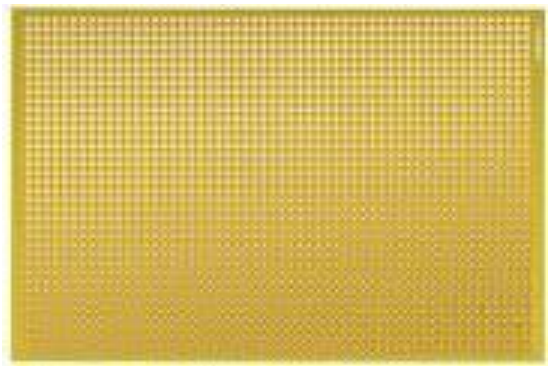

Figure: 3.7 Vero Board

### 3.2.8 Soil Moisture Sensor

The soil humidity sensor is used to measure the volume water content of the soil. This makes it ideal for experiments in courses such as soil science, agricultural science, environmental science, horticulture, botany and biology..

The humidity sensor of the soil uses capacitance to measure the water content of the soil (measuring the dielectric permissiveness of the soil, which is a function of the water content). Simply insert this solid sensor into the ground to be tested, and the volume of water in the ground is divided by percentage.

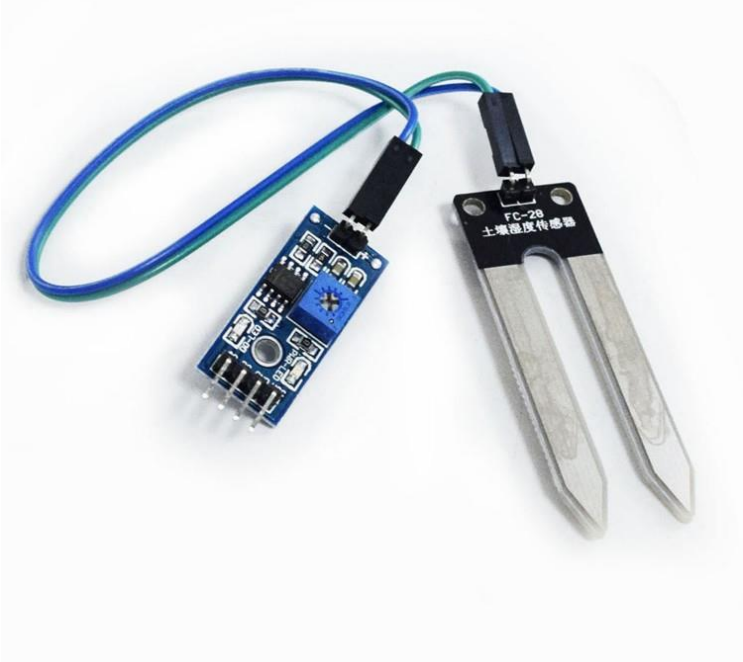


Figure: 3.8 Soil Moisture Sensors

## 3.3 Summary

The chapter describes some important equipment related to the project. Describe all the equipment like Arduino, Motor, Buzzer, LED, Connector, Vero board, Soil Humidity Sensor and LCD that work correctly to show the reading of data related to this project.

# CHAPTER 4

# THEORETICAL MODEL

## 4.1 Basic Block Diagram

In this Arduino IR sensor and Servo motor interfacing, Arduino pro mini is used to


Figure: 4.1 Basic Block Diagram

Control the entire process. A single sensor is used for the detection environment that gives a signal at every 10 mV change in its output pin. You can check it with a voltmeter by connecting Vcc to pin 1 and Ground on pin 3 and the output voltage on pin 2 of the IR sensor. For example, if the output voltage of the IR sensor is 250 m in length, the engine must run a LED.

Arduino reads the output voltage of the sensor of the ground using the digital pin 3 and the pin 3 performs a digital value of servo running motor. After Arduino sends these signals to the engine.

## 4.2 Circuit Diagram and Explanation

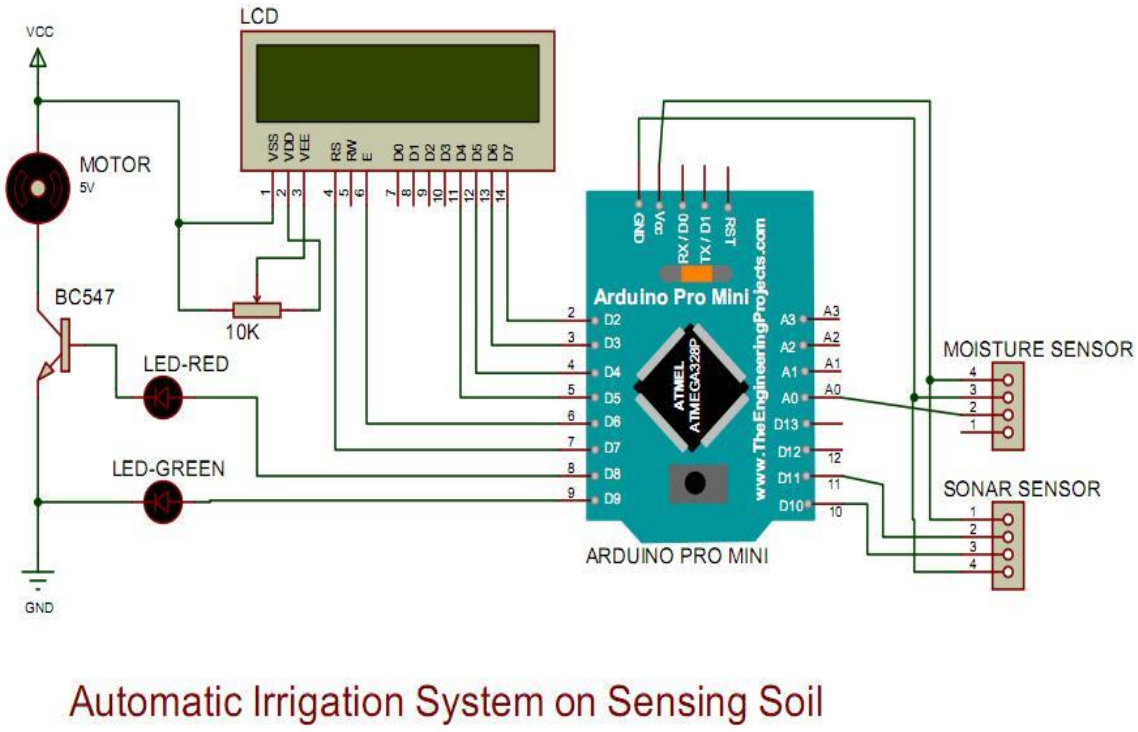


Figure: 4.2 Arduino Circuit Unit.

Circuit diagram for the automatic irrigation system in soil detection, soil sensor, is shown in the figure above. Make the connections carefully as shown in the diagram. The LED data pins are connected to the digital Adu Arduino. The sensor is also connected to Digital Pin 2 and 7 of Arduino. The engine is connected to the digital pin Arduino number 8 and 9.

## 4.3 Advantage

• Highly sensitive

• Works according to the condition of the soil

• Adjust and forget the system

• Low cost and reliable circuit

• Total elimination of manpower

• You can handle heavy loads up to 7A

## 4.4 Flowchart

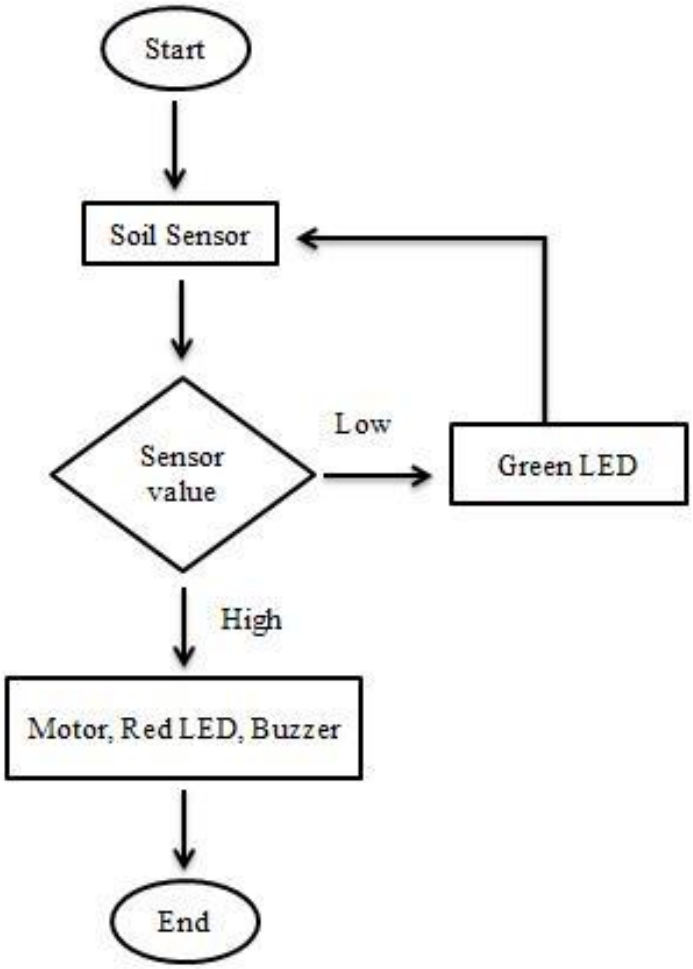


Fig. 4.3 flowchart Diagram

## 4.5 Summary

In this chapter has discussed block diagram, circuit diagram, Advantage and flowchart of this project. It has also explained the operating system of the project.

# CHAPTER 5

# HARDWARE DEVELOPMENT

## 5.1 Writing and Burning Programming into the Arduino

### 5.1.1 Writing Programming

There are several C compilers in the market for the Atmega328 microcontroller. These compilers have many similar characteristics and can be used to develop high-level C-based programs for the Atmega328 microcontroller, some of the C compilers that are most frequently used in commercial, industrial and educational applications.

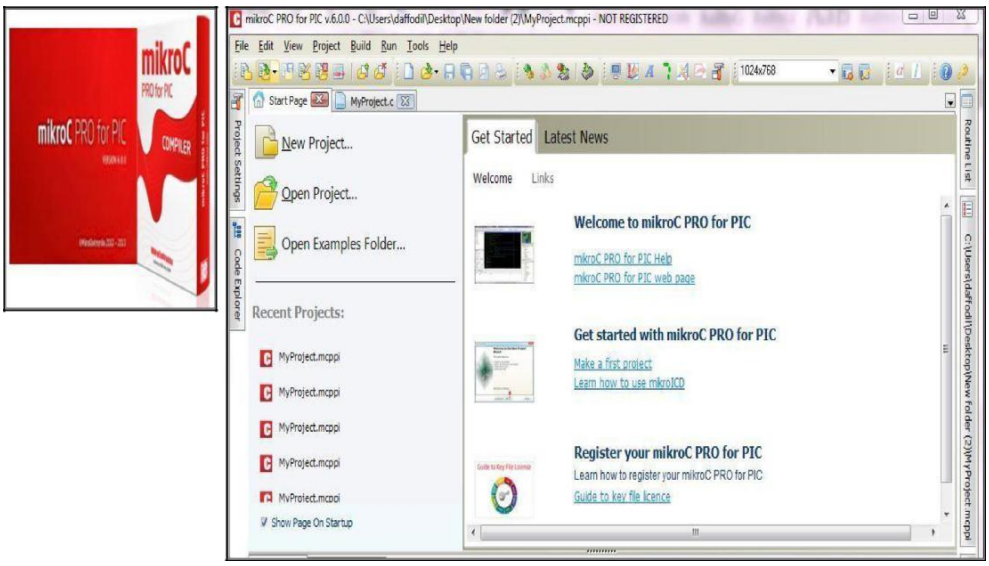


Figure 5.1: Mikro C software

The applications of Atmega328 microcontrollers are: Mikro C, CCS and Atmega328. This project is used by mikro C. The popular and powerful mikro C is easy to learn and comes with high resources. Micro C is an integrated simulator and a circuit debugger. The program is compiled by a Mikro C. compiler. After the conversion process, a hexadecimal code is generated. The microcoder to write the programming shown in figure 4.1

## 5.1.2 Burning the Program

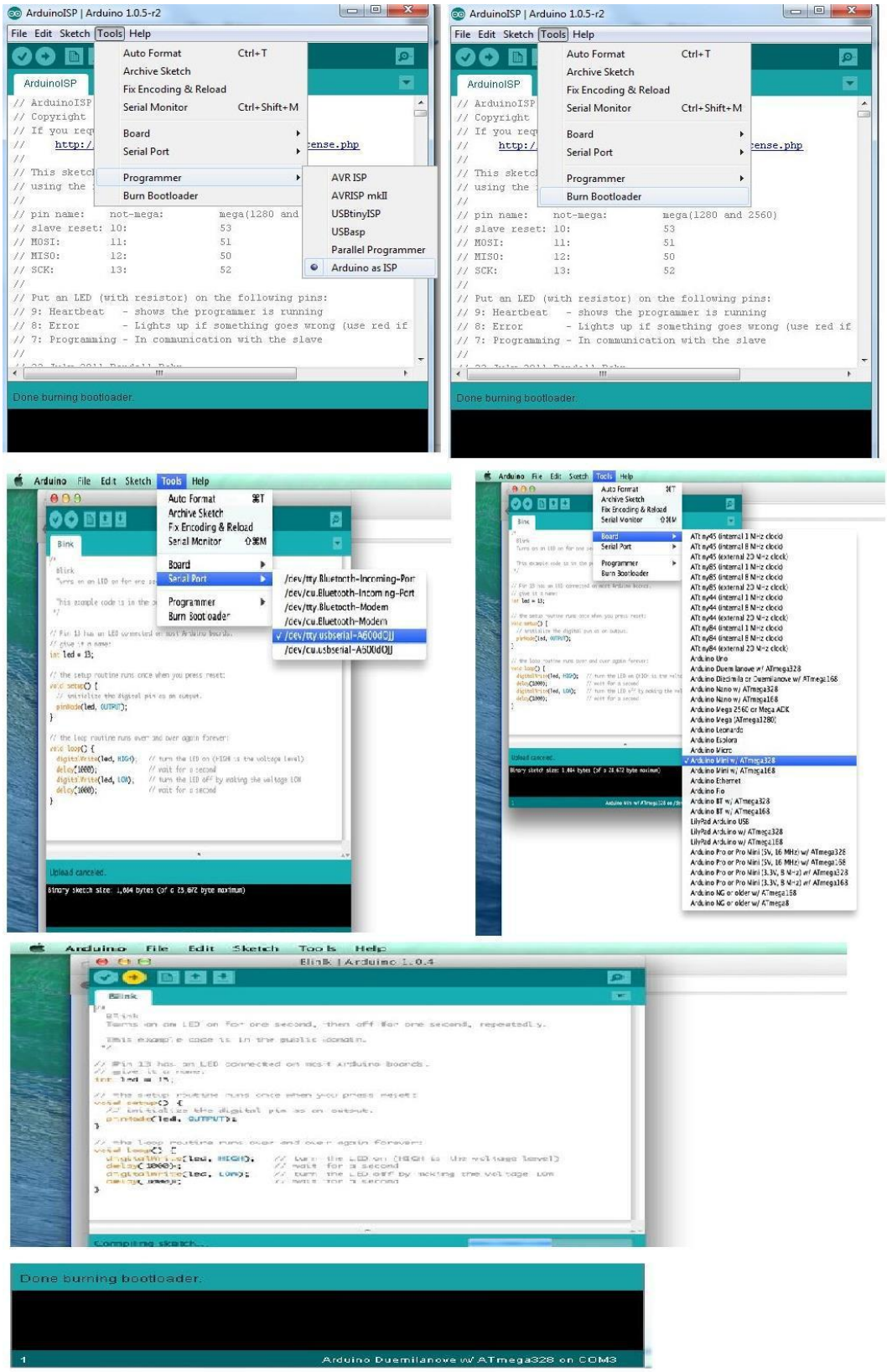


Figure 5.2: Burning Boot Loader Process

Connect the connection of all the circuits now open the Arduino software and select Tools-> Board -> Ardunio Pro or Pro Mini (5V, 16MHZ) / ATmega328. If we select the Arduino pro we can see the selected board at the bottom of the software as shown in the image above.

And open the coding that we want to program and click on the loading button. Now we can see that the program is loaded in miniature. We can see Tx and Rx Led on the Arduino One's blinking board while the program loads. After loading the code. Now it eliminates the entire connection and gives the power supply to the pro mini. Our code works perfectly on Arduino mini.

## 5.2 Power Supply

The most important factor in any project is what will drive you. The Pro Mini does not have a barrel connector or any other obvious way to connect a power supply, then how can we feed the thing?


Figure: 5.3: Power Supply

Choose a source of energy that suits our project. If we want something that matches the compactness of the Pro Mini, a battery: lipo, alkaline, mobile currency, etc. It can be a good option. Or we could use a wall power source along with a canopy adapter.

The Arduino plate already has a built-in power supply section. Here we only need to connect a 5 volt or 9 volt battery box with the plate.

## 5.3 Summary

In this chapter has discussed Writing and burning program. Also discussed power supply and Flowchart system It has also explained about these topics of the project.

# CHAPTER 6

# RESULTS AND DISCUSSIONS

## 6.1 Introduction

This chapter will present all the results and calculations and relevant discussions.

## 6.2 Our Project

After connecting all the equipment according to the circuit, we create the body structure following the other experimental example of the internet. After preparing the structure of the body and the connection of the circuit we prepare a logical program with the help of the C ++ program of Arduino. Our project image appears below:

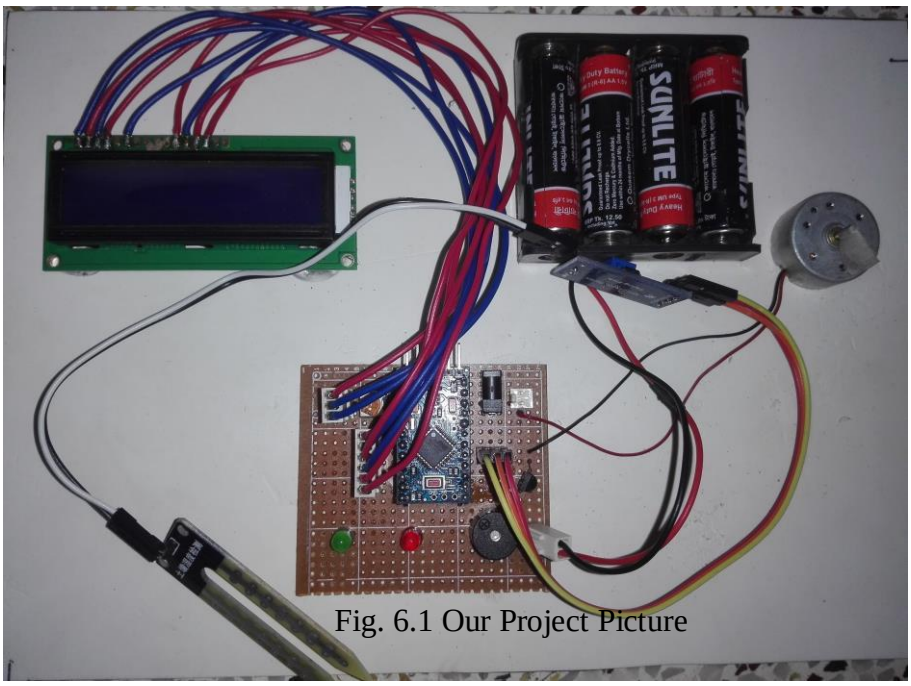


Fig. 6.1 Our Project Picture

After completing the program, we upload the program to the microcontroller. Then we interrelate the part of software and hardware. After completing the entire program and the body with the interface we try to experiment, it is working or not. We saw that our project worked perfectly.

## 6.3 Result

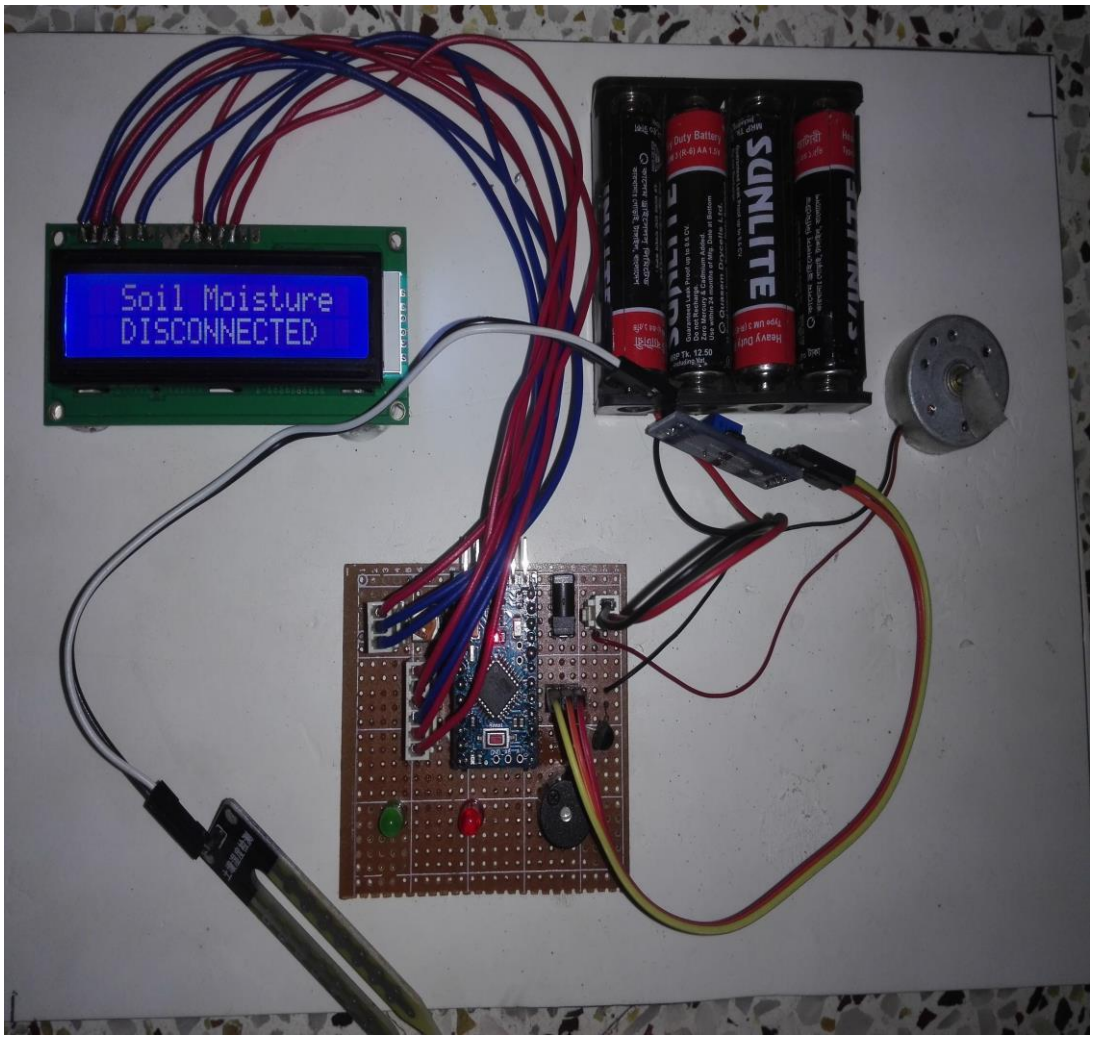


Figure: 6.2 Output displaying on the LCD screen.

This name of the project Automatic irrigation on the detection soil using Arduino mini, sensor of soil and LCD. The project measured the moisture of the ground and gives the output shown on the LCD screen.

## 6.4 Cost Analysis

Table 6.1: Cost Analysis

| Serial | Components | Price in (BDT) |
|---|---|---|
| 01 | Arduino Pro Mini | 350/- |
| 02 | Soil Sensor | 250/- |
| 03 | Connecting wire | 100/- |
| 04 | Power supply | 150/- |
| 05 | Vero board | 30/- |
| 06 | Wire connector | 100/- |
| 07 | Motor | 50/- |
| 08 | LED | 20/- |
| 09 | White Wood Board | 250/- |
| 10 | Glue Gun Stick | 50/- |
| 11 | Reel Connector | 50/- |
| 12 | Charging Port | 20/- |
| 13 | Buzzer | 30/- |
| 14 | Others | 200/- |
| **Total Cost** | | = 2150/- |

## 6.5 Discussion

The main objective of this project is to design a low cost device in order to control the water pump automatically. This automatic irrigation system senses the moisture content of the soil and automatically switches the pump when the power is on. A proper usage of irrigation system is very important because the main reason is the shortage of land reserved water due to lack of rain, unplanned use of water as a result large amounts of water goes waste. For this reason, we use this automatic plant watering system, and this system is very useful in all climatic conditions. The project is designed to develop an automatic irrigation system which switches the pump motor ON/OFF on sensing the moisture content of the soil. In the field of agriculture, use of proper method of irrigation is important. The project uses an ARDUINO NANO open

source microcontroller which is programmed to receive the input signal of varying moisture condition of the soil through the sensing arrangement. Once the controller receives this signal, it generates an output that drives a relay for operating the water pump. 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.

## 6.6 Summary

In this chapter has discussed the result and discussion. With our project, we became successful to demonstrate with regarding the objectives of the project. At last, completing this chapter the project is ready to use. We briefly discuss and show the result of our experiment. Here, we show several outputs and try to make it easier. And we also Advantages and added the cost analysis. So, we hope that this project will be helpful for gardener and farmer their garden and plant watering.

# CHAPTER 7

# CONCLUSIONS AND RECOMMENDATIONS

## 7.1 Conclusion

The primary applications for this project are for farmers and gardeners who do not have enough time to water their crops / plants. It also covers those farmers who are water waste during irrigation. The project can be extended to greenhouses, where manual supervision is far and few in between. The principle can be extended to create totally automated agricultural gardens and fields. Combined with the principle of rainwater harvesting, it could lead to enormous water savings if applied correctly. In agricultural land with severe rainfall shortages, this model can be successfully applied to achieve great results with most types of soil. Even commercial irrigation systems come in several types. There are autonomous systems that come with glasses, water tanks, etc. Water tanks are also available in different models and models. These systems may or may not have timers. These systems take care of the water requirements of individual plants. There are several plant watering systems that can care for a certain amount of plants at the same time. These systems constitute water tanks, tubes that supply water from the tank to individual plants and drips attached to the end of each tube. For a garden, there are available sprinkler and dripping systems with timers. In some sophisticated, floor sensors are also used, so that watering will be done, as long as the soil is dry. Although some of the irrigation systems work with battery power, others use power from the network. There are also simple ones that work under gravity. Each type of plant irrigation system has its own characteristics, which must be understood, before investing in it. Select the one that best suits your requirements

## 7.2 Main Limitations and Constraints:

The main factors where attention should be focused on irrigation practices based on water resources and efficient for risk are the following:

Preliminary evaluation of site specific conditions. Proper selection of soil moisture sensors

Selection of suitable sites, installation and maintenance of sensors. Correct interpretation and use of soil humidity data

## 7.3 Future Work

The proposed system can be expanded in the future by adding functionality for remote monitoring sensors that can detect growth and crop levels. In the future, adding functions that manage and remotely control their equipment with other intelligent connected irrigation equipment in the proposed system. This project can be developed in the future by adding a GSM module to make a text message or telephone call for the alarm. Without this, we can improve the feature of this project by using solar technology for power supply. We can also measure the water level of my reserve tank that can be controlled by this technology.

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# APPENDIX

```
// Programa: Automatic Irrigation on Sensing Soil

(MMI) #include<LiquidCrystal.h>

LiquidCrystal lcd(2, 3, 4, 5, 6, 7);

void setup()
{
  pinMode(A0, INPUT);
  pinMode(8, OUTPUT);
  pinMode(9, OUTPUT);
}
void loop()
{
  int s = analogRead(A0);
  Serial.print(s); Serial.print(" - ");
    if(s >= 1000) {
   Serial.println("Sensor is not in the Soil or DISCONNECTED");
   digitalWrite(8, LOW);
   digitalWrite(9, LOW);
  }
  if(s < 1000 && s >= 601) {
   Serial.println("Soil is DRY");
   digitalWrite(8, LOW);
   digitalWrite(9, HIGH);
  }
   if(s < 600) {
   Serial.println("Sensor in WATER");
   digitalWrite(8, HIGH);
   digitalWrite(9, LOW);
  }
  delay(50);
}
```