DESIGN AND HARDWARE IMPLEMENTATION OF UNDERGROUND CABLE FAULT DETECTOR

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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CERTIFICATION

This is to certify that this project paper that is entitled "**Design And Hardware Implementation of Underground Cable Fault Detector**" is done by the following student under my direct supervision and this work has been carried out by him in 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 in July 2021.

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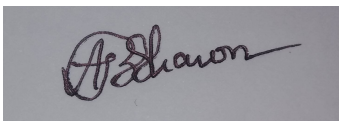

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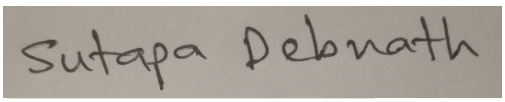

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DECLARATION

The project and thesis entitled **" Design And Hardware Implementation of Underground Cable Fault Detector"** submitted by Name: **Khandaker Maher**, ID: **162-33-3320**, Name: **Md Ariful Baten Shawon**, ID: **163-33-3760**, Session: Summer & fall-2016 has been accepted as satisfactory in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering on July 2021.

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LIST OF ABBREVIATIONS

LCD	Liquid Crystal Display
LED	Light Emitting Diodes
ISP	In System Programming
EEPROM	Electrically Erasable Programmable Read-Only Memory
PWM	Pulse Width Modulation
USB	Universal Serial Bus
ICSP	In-Circuit Serial Programming
AC	Alternating Current
DC	Direct Current
IDE	Integrated Development Environment
SRAM	Static Random Access Memory
UART	Universal Asynchronous Receiver/Transmitter
SPP	Serial Port Protocol
AFH	Adaptive Frequency Hopping Feature
ADC	Analog to digital converter

ACKNOWLEDGEMENT

At first ,I express thankfulness to Almighty Allah or God. Then I would like to take this opening to convey my gratitude and appreciation to my project supervisor **Sutapa Debnath, Lecturer** of **Department of EEE** for being dedicated to assisting, motivating and counseling me through this project. The project would be impossible without her direction and assistance Also We are grateful that she let us choose this project.

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ABSTRACT

The project works for detecting the fault location of The under ground cable line wires from the base point to the exact location point in kilometer standard using an Arduino Nano micro-controller kit. In the Urban areas, the Electrical cables are placed in undergrounds instead of overhead lines. It is difficult to find fault location for repairing of a specific cable wire. Our proposed system can find that location easily of the fault for processing the repairment of that particular cable. The simple Ohm's Law concept is used here for doing the detection. The current sensor used here are the combination of resistors ,ADC and Arduino nano to give digital data to the micro-controller as to represent the cable length in kilometer standard. To show fault several switches are used. The relay switches are controlled by the relay driver. A 16*2 LCD display is connected to the micro-controller for displaying the information. In case of short circuit, the voltage across series resistors changes accordingly, which is then fed to an ADC (analog to digital converter) to develop precise digital data to the programmed Arduino micro-controller kit that further displays exact fault location point in kilometers from the base station. The buzzer rings when the fault occurs to warn the workers for repairment

CHAPTER 1

INTRODUCTION

1.1 Introduction

Here we formulated a fault localizing prototype for the underground cable wires with Arduino Nano . The objective is to specify the distance of the fault of the Underground wires from the base location in kilometers. The simple ohm's law(V=IR) is used here .the fault is shown on the (LCD) display. During this earlier decade, lines were modeled for positioning above the earth and, at current times, no cable lining is more efficient for weather conditions like hurricanes, drizzle, lightning bolt, and pollution than underground cable lines But During fault occurs in underground wires it's hard to recognize the fault in the line. uncovering the exact area of the cable fault is the main Goal. Now for the modern era we would use modern method. This project is a common practice in cities . It is very difficult for the authorities to detect the fault and fix it without knowing the location .So having to know about that fault is our main motto.

1.2 Related Work

The Programs uploaded in Arduino Nano kit for detecting faults from underground cables. When the fault occurs in the cables, we can find out faults through Arduino Nano kit. LCD display shows the faults in Kilometer. In this project, the faults are created manually. There are many different cables. The cable resistances are different according to the materials that we use. The resistance value varies according to the length. Here resistance plays the main role in the project. If any changes are seen in the resistances, the voltage value is changed at that exact point which is identified as a fault. Finding that fault is our mission.

1.3 Methodology

The goal is to detect the location of the fault in cable lines of underground the simpliest way possible. The fault changes the voltage of a certain distance along with current that we used in underground cables without any distress. This procedure is to locate the type of fault; the voltage changes with the predetermined length on the cable, as the current varies. Resistors of a small number defines the cable along with power supply adapter is used at the ending point for the quick detection of the cable fault.

1.4 Proposed System

The model is to find the right location of fault from base post. The main attention is the Resistance(R) that changes in cope with cable size. If the cable length(L) increases, the resistance value (R) will increase as well. If changes are seen in the resistance value(R), then it's called the fault point which can be identified using Arduino tech. That point known as fault position is shown on LCD screen in kilometer standard from the headquarter level

1.5 Project Outline

Chapter 2 of this report shows the previous reviews of related work that were used for developing the following project

Chapter 3 describes all the block diagram, working steps, software details, connecting diagram and brief explanation of the project.

Chapter 4 describes all the hardware materials and power supplying details of the project.

Chapter 5 reviews the results that has been found for this project and provides a discussion on everything that were done in the project.

Chapter 6 specifies the limitations , advantages and all the future works that can be approached for the betterment and finally the conclusion. and also the coding works etc.

1.6 Summary

First of all, we have discussed about the description of the project model, its capability and the real focus of the project. We also discussed about the Benefits of Underground Cable Fault Detection, it's Advantages, Disadvantages regarding the technology. Then we discussed about problems that can occur, the related methodology of the work and objective that is followed for making the project. Lastly, we discussed about the outline related to the project

CHAPTER 2

LITERATURE REVIEWS

2.1 Introduction

The model is constructed for showing the measurement of the affected cable wires set in underground in kilometers from headquarters in (the fault point display) that the system uses. Our proposed model system seems to be followed in Metro cities and other developed areas. If There is any fault occurs for any sort of (reasons), the repairment is tough for not detecting the exact area. Our system will find the precise area location of the problem and transmit data in pictorial structure in order to display it on the system display Our project will use the easiest concept called the Ohms law .If a Dc voltage is applied at supply point along with several resistors through (Cable lines), the current changes at the fault location point as it is known that the resistance is actually proportional to the distance regarding a cable line.

2.2 Underground Cable Fault Distance Locator Analysis

Cable wires construed in Under grounds can be engaged with a wide variety of faults because of the conditions seen in undergrounds. We know how tough it is to dig the entire line road for checking the whole line and fix the fault problems. So here a proposal was made to detect the cable fault in underground using a system called internet of things in short IOT. Repair is very comfortable using IOT. Only the part where we detect the fault is dug to fix the problem.

This is worth saving everything that is wasted due to manual techniques. The IOT uses potential divider network that is attached across the cable to upload fault information over the internet due to the reasons like shorting two or more lines together, a specific voltage is seen to be generated according to resistor network combinated . This voltage is sensed by the micro controller in this case IOT device

sends information to the authority. The authority will use the data to send worker for solving problems that are meant to be detected and fixed.

2.3 Arduino Based Underground Transmission Cable Fault Location System.

The location tracking of cable wires that are constructed underground is very hard if only human effort is used. It wastes time and there are chances of harming the wires. This model proposes a theory to locate the fault automatically by using concept of ohms law and using some material like resistors and power supplier. Here the voltage will change along with current in case of any fault occurrence the proposed system will detect the problem of the specified wire using a rectified power supply and an Arduino micro controller kit. The fault sensor also defined as current sensor is made with series resistors and ADC attached to Arduino board to provide digital data to the micro controller which represents the specified cable length in kilometers. The relay drivers control the relays. A 16x2 LCD display is connected to the micro controller for displaying the data. In short circuit cases, the voltage which is acrossed series resistors would change accordingly, then the data is provided to analog to digital converter to construct a data for Arduino kit to show the fault location in kilometers from the headquarters .

2.4 Underground Cable Fault Detector Using GSM.

The real target for this proposed model is to find the fault location using Global system for mobile communication also known as GSM. The modern cities already uses underground cable lining. The fault detection and fixation is very hard due to the obstacles. It's very tough to discover the fault point in transmission lines of underground. This model will surely be short timing and effective. The problem occurs because of short circuit , high voltage fault and low voltage fault.

The past proposed procedure is used for identifying faults based on short circuit reasons. This model detects problems like high and low voltages too.Here the ohms law is used like all the other models.

The system has the capability to find fault location along with type on GSM technology and also disclose the power transmission for safety reasons. The fault occurrence generates buzzer signal to warn the authority so that authority can take sudden steps.

2.5 Underground Cable Fault Detection using IOT and R-Pi.

The Model is based on raspberry pi and IOT for fault detection in Underground constructed Cables. The Current Transformer concept also known as CT theory is used for this model to work. The current change in fault occurrence is used with CT theory for finding varying current then the change in voltage is manipulated by signal conditioner and the necessary calculations are made by a micro controller to display the fault distance by IOT devices. These details regarding the fault are sent through the internet at any access point and shown on the display screen.

2.6 Summary

At First we have discussed about the basic reviews for the Underground Cable Fault Detection system, then we have discussed what variations can be made on the system using Arduino technology, GSM, micro controller, IOT devices and different electronic materials. Lastly we summarized the entire literature through basic conceptual discussion.

CHAPTER 3

DESIGN & SOFTWARE ANALYSIS

3.1 Introduction

Arduino Libraries is the most important part for Arduino based project. So we will briefly discuss about Arduino libraries, algorithm and working procedure for Underground Cable Fault Detector project. We will present our whole procedure in this project by the algorithm.

3.2 Micro-controller Libraries Used

3.2.1 Software Serial

pins 0 and 1 are used for serial communication that is an assembled support for Arduino board ,it connects through USB port with the computer. UART is the hardware constructed like a chip works as the native serial support. This UART allows to do serial communication to ATMega328 along with other tasks until the space is in 64 byte.

3.2.2 Functions Used

Software Serial (rx Pin, txPin)

Software serial is used for creating the example of a serial object , that name is mentioned below .the optional choice would be inverse logic arguments and all the defaults will be at false position. In order to know about more description objects will be created at multiple serials one option activation at a time.

Rx pin: serial data receiver pin , Tx pin:serial data transmitter pin.return character received in Rx pin

Begin (speed)
Sets the speed (baud rate) for the serial communication.
Read ()
Return a character that was received on the RX pin of the software serial port.

Note that only one Software Serial instance can receive incoming data at a time.

3.3 Block diagram of Underground Cable Fault Detector

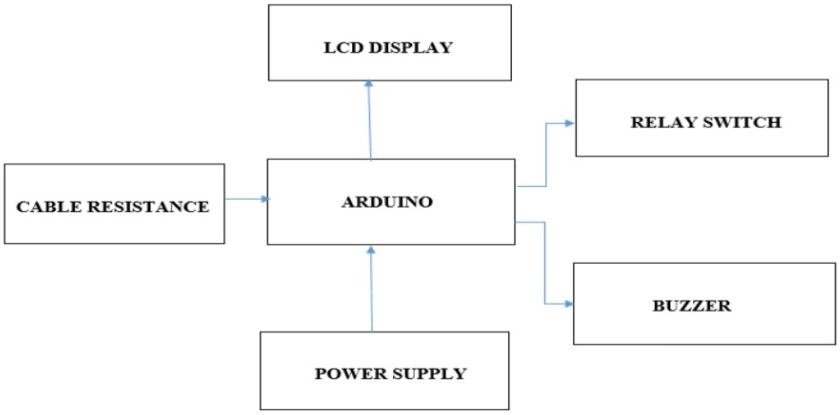

Figure 3.1: : Block diagram of Underground Cable Fault Detector

Here, Arduino would be the base point where everything is controlled. The inputs are power supply unit (12v Dc adapter) and Cable resistances. The outputs are relay switches, buzzer and LCD display. The inputs will give data's to the Arduino which would be processed and be supplied to the outputs where the outputs will follow the instructions accordingly.

3.4 Connection Diagram of Underground Cable Fault detector

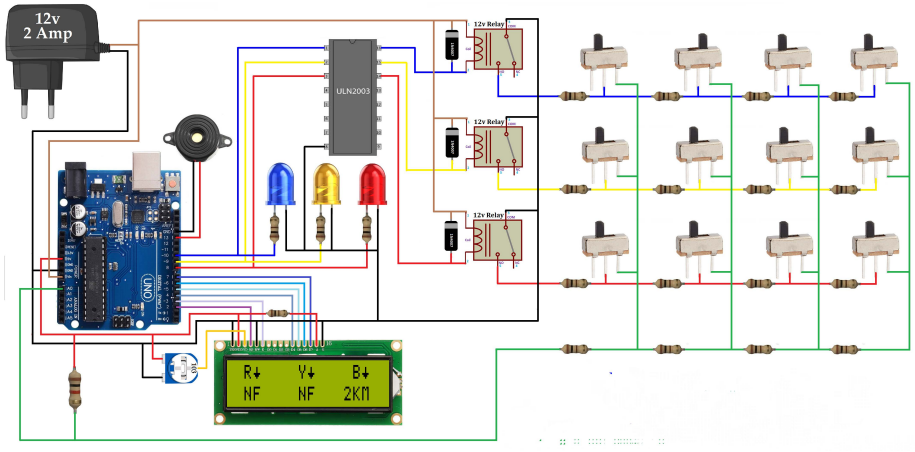

Figure 3.2: Connection Diagram of Underground Cable Fault detector

The connection diagram is made accordingly the block diagram. Here, In the above we can see that the series resistors that represents the cable wire a

are connected to the Arduino through the relay switch and the ADC transistor. The adapter (12V DC) works as the power supply and the LED, Buzzer, LCD display are the outputs of the system.

3.5 Flow Chart of Underground Cable Fault Detector

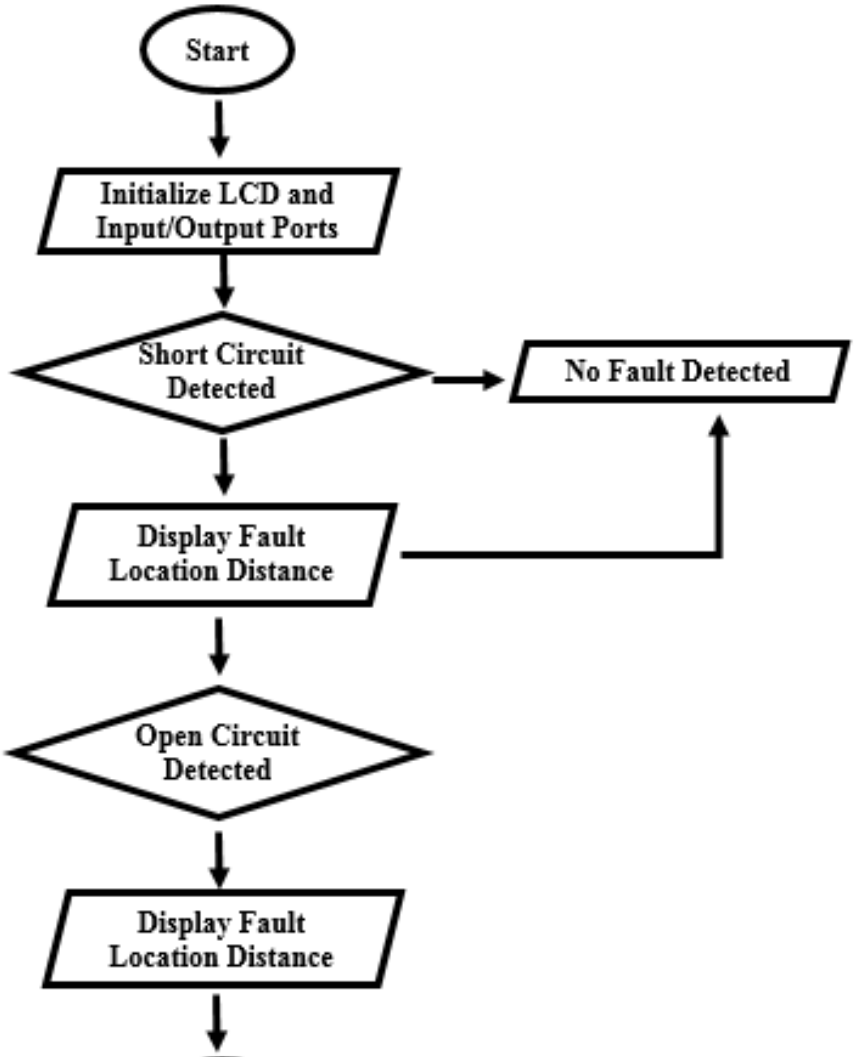

Figure 3.3: Flow Chart of Underground Cable Fault Detector

The above flowchart explains the following steps gradually
step 1: starting the system
step 2: Initializing all the ports accordingly.
step3: check whether the open or short circuit fault is detected or, not. if detected then display the fault on LCD screen otherwise show No fault on the display.
step 4: Stop the system.

Table No 3.1: The function of this project

System Block	Function
Arduino Microcontroller (ATMega328)	As data processing center
Adaptor (12V)	As the power supply
LED	As indicator
LCD	Mechanical working

for installing a program to Arduino board we need Arduino IDE software. There is an EEPROM , and a flash memory built in the Arduino board , this portion will process the instruction and give order to LED .In system programming in other words ISP will be done so that the kit doesn't loose control over the programs.

power supply should supply 5V DC power

The Light emission Diode in other words LED works as pointer

3.6 Summary

Firstly, we showed the connection diagram. Then we discuss about the block diagram and explanation. And lastly we briefly discuss about working procedure and the power requirements and how all the elements are operated through the circuits.

CHAPTER 4

Hardware Development

4.1 Introduction

The main purpose of construction of this project model is to identify belowground cable from the headquarters in kilometer distance by using Arduino nano kit. Overhead lines are easier for problem detection but in over crowded places using overhead lines are riskier and non environmental .That is why people should use below ground cables. They are used at a large manner in urban area instead of using overhead lines. Identifying the below ground damages is very hard. Our project is constructed using Arduino nano kit, buzzer,Lcd (display and LED lights. This project greatly time saving and operates effectively. The underground cable lining system is commonly practiced in over crowded cities.

Below ground problem can occur any time for any reason. Its hard during that moment to find the specific point . Most of the times hardware imposed for a system is the key for a better results . Thats what we are gonna discuss here

4.2 Components Name and Quantity

Table No 4.1: Components Name and Quantity

SL	Component Name	Quantity
1	Microcontroller	1 Pcs
2	Switch	12 Pcs
3	LCD Display	1 Pcs
4	LED	3 Pcs
5	Resistor	20 Pcs
6	ULN2003	1 Pcs

7	7805 Voltage Regulator	2 Pcs
8	Connecting Wire	As Require
9	Adapter	1 Pcs
10	Capacitor	3 Pcs
11	Buzzer	1 Pcs
12	Bread board	1 pcs
13	Relay	3 Pcs

4.3 Microcontroller

A micro controller can be defined as a controller that works for operating a system .It is an integrated circuit. It uses Mpu also known as microprocessor unit , memory , and other elements to work.It works greatly with digital devices and electric circuits.There is another signature to describe the microcontroller that is "uC" .Its a good choice because it express all it's qualities.Micro means smaller and controller means to control .

The element is constructed for creating a very good interaction with processed data and hardware materials.

Detailed explanation by describing all the working principal of an Arduino Nano microcontroller kit that has been used in this project is shown on the other page.

we should keep the fact in mind that this is just a prototype project that why we have used the Nano kit or else ,for huge amount of current supplymation the control process is also needed to be strong ,so there during that time we would use The Arduino Uno controller which has a bigger memory and all the other abilities are also much greater than microcontroller kits.

Now on to the figure explanation below:

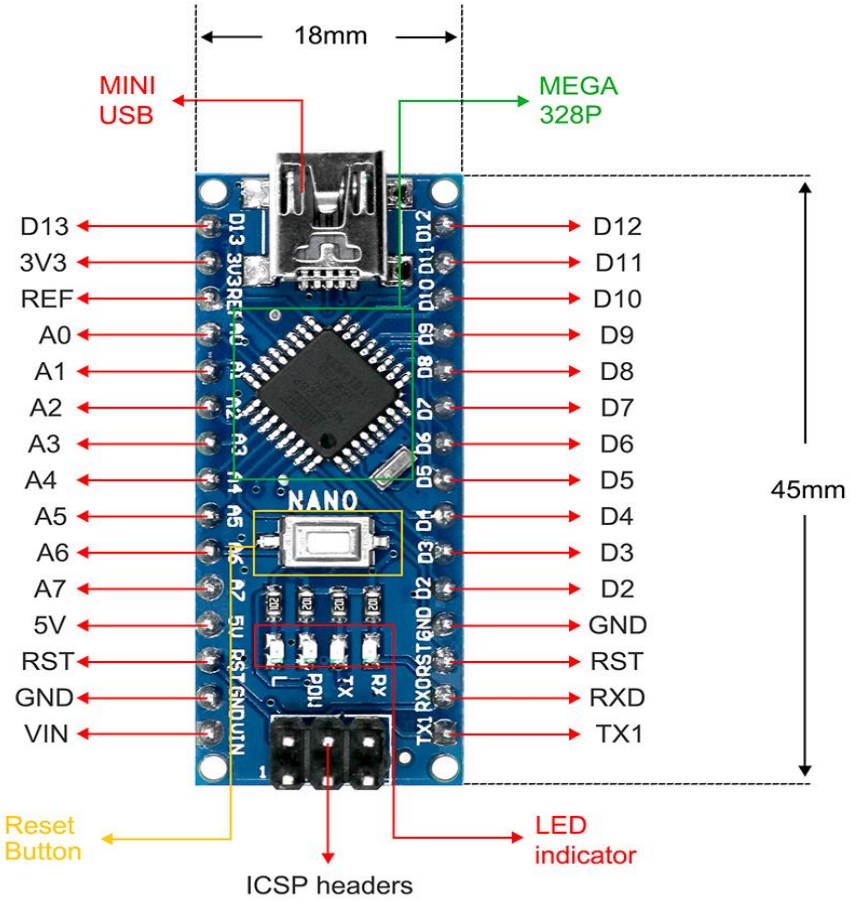

Figure 4.1: Identification Arduino Nano

1.	**USB power port** USB cable can supply power to Arduino .Computers also has USB cables so it can be powered from computer as well
2.	**Barrel Jack** Ac current or alternating current can supply power through barrel jack in the Arduino board
3.	**Crystal Oscillator** It helps arduino in facing time related cases. 16.000H9H or 16000000 hertz or 16 MHz is the num. printed on the board that defines the frequency of the oscillator

4.	**microcontroller** this is the brain of arduino which defies from board to board constructed from ATMEL tech. Being aware of the circuit board description is necessary.Ours is given on the data sheet.
5.	**LED indicator** This works as the pointer to know that the arduino is on power.If this doesn't turn on that indicates there is a problem with the board.
6.	**Tx and Rx ports** This defines as transmit data and receiver data port . tx works to send and rx works for receiving data from machines.

4.3.1 Why Arduino Pro Mini?

It is cheaper in comparison to other controlling platforms. Runs through Arduino IDE software. The programs can installed on the board using all the common operating systems like Microsoft windows , Linux etc.

The software is very easy for beginners and uses c programming language to program which can also be extend to c++ programming for experts. The main target for this hardware is to make their own module by lengthening and developing it .So that a rookie without any knowledge what so ever can use it to make their own version of circuit and be eligible to save money.

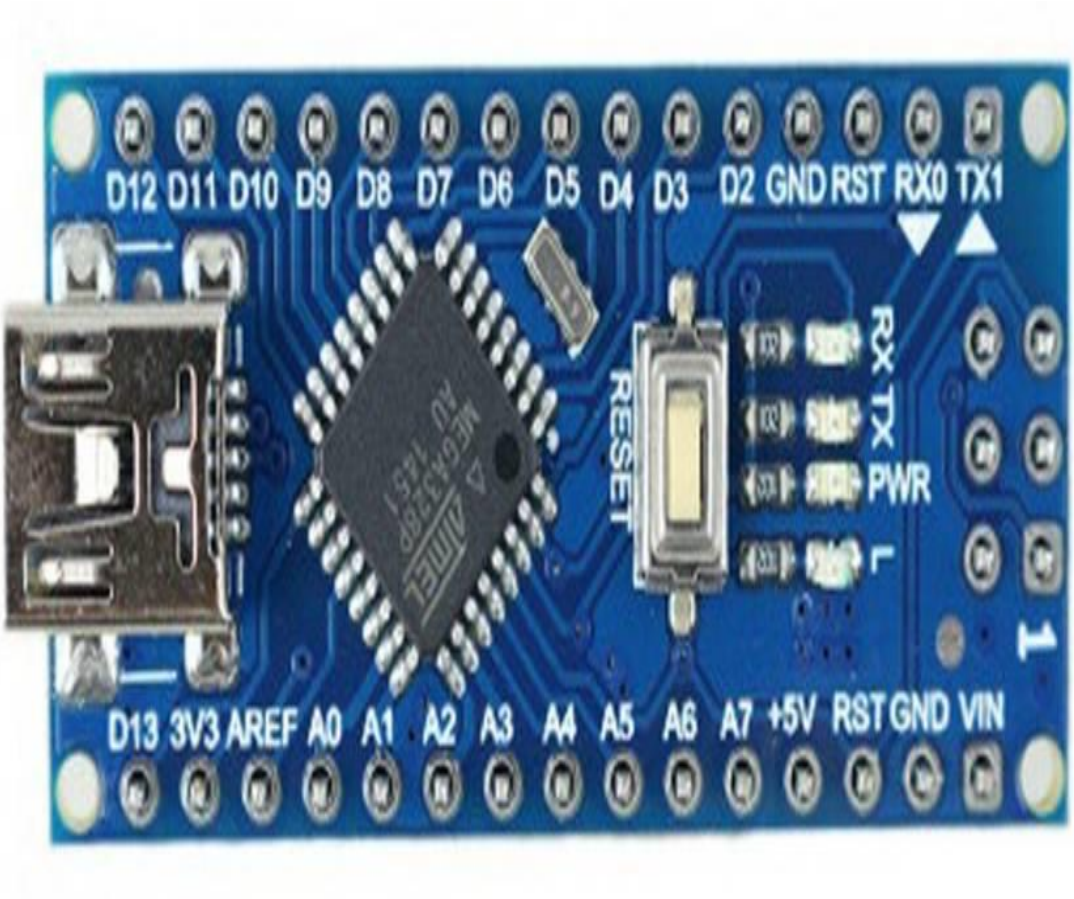

Figure 4.2: Arduino Nano

4.3.2 Technical Specification of Microcontroller

Table No 4.2: Technical Specification

ARDUINO MICROCONTROLLER	
Microcontroller	ATMEGA328P
Architecture	AVR
Operating Voltage	5V
Flash Memory	32 KB of which 0.5 KB used by boot loader
SRAM	2 KB
Clock Speed	4 - 48 MHz
Analog I/O Pins	6
EEPROM	1 KB
DC current per I/O pins	40 mA on I/O pins; 50 mA on 3.3 V Pin

4.3.3 Technical Specification of General

Table No 4.3: Technical Specification (General)

GENERAL	
Input Voltage	5-5.5 V
Digital I/O Pins	20 (from where 6 gives PWM output)
PWM Output	6
PCB Size	53.4 × 68.6 mm
Weight	10 -12gm.

4.3.4 Power

The power pins are as follows:

• VIN: The input voltage while using an external power supplier (it can also be 5 v from USB connection or other power supplier).

• 5V: The voltage that is used to power up the arduino and all the elements attached to it . It can be done by using VIN , or by USB or other power supplies that generates 5V DC.

• GND: Ground pins.

4.3.5 Memory

The ATMEGA328P contains 32kb memory storage along with 2kb SRAM .It also contains 1kb of EEPR0m storage.

4.3.6 Inputs and Outputs

Serial: 0 and 1 signifies TX and RX. that works for transmitting and receiving serial data. They are attached with pins of ATmega8U2 USB-to-TTL .

SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). They assists to help SPI connection, that, is given by the pointed material, not currently provided to arduino kit language.

PWM: 3, 5, 6, 9, 10, 11. are the 8-bit PWM that works for writing AF like Write() function.

LED: 13,there's a constructed LED (light emitting diode) attached to pin digitized 13. at HIGH value(1), the LED is on at LOW value (0), it's off.

Reset. Used in case of there are any blockage in the board function.

4.3.7 Communication

The IC can used for many procedures. computers communications , other Arduinos,or other microcontrollers. The ATMEGA328P provides UARTTTL(5V) serial connection, found in pins like 0 (RX) & 1 (TX).

4.4 LCD Display

The most used LCD screen is the 16*2 display because of it's being cheap, availability and smaller size. It is also very easy to interface. It has 2rows and 16 columns consists of 40dots in all 16blocks. 16pins 8 for data bit , 3 for control Rs,re, en and others are for power supply, light control, and lights

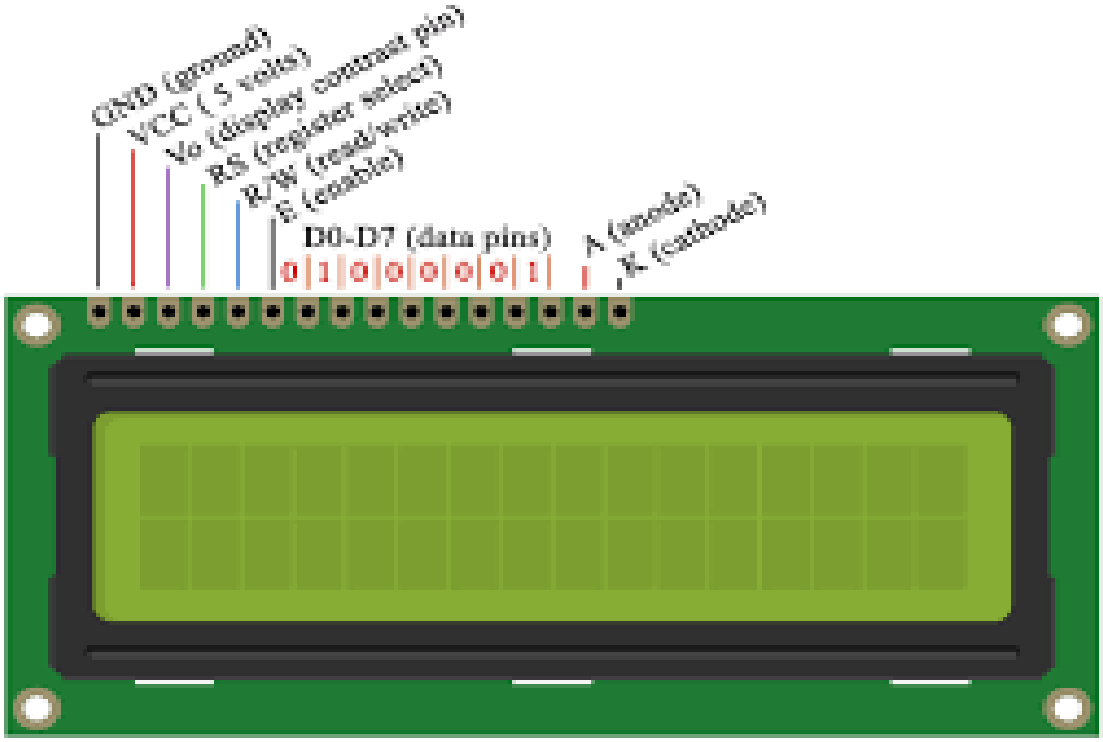

Figure 4.3: LCD Display

4.5 Connector

• An electrical connector can be defined as a device for joining electrical circuits together
• Audio and video connector, electrical connectors (or optical connectors) which are actually used for carrying audio signal and video signal, of either analog or, digital format
• Gender of connectors (male and female) and fasteners
• Power connector, these are the devices that allow electrical equipments to be connected to the primary alternating current (AC) or the main power supply in a building
• RF connector, It's an electrical connector That's been designed to work at radio frequencies in the multi-megahertz range

Figure 4.4: Connector

• Circular connector
• Cigar lighter receptacle
• Blind mate connector, one in which the mating action happens where you can't see or feel it ensures that it's correctly placed. They seem to have self-aligning features that allow a small misalignment at the time of mating.

4.6 LED

It's a diode probably known as light emitting diode. mostly utilized in lighting, commercial and home remedies. They are small so they can be fit in any circuits. The principal depends upon semiconductors has greater life than any other electric lights

Figure 4.5: LED

4.7 Resistor

It's an element used as a limiting or regulating factor for current flow.It can also be used for supplying particular current to devices like transistors , diodes and capacitors. Resistors are identified on different combinations of colour preferences.

Figure No 4.6: Resistor

4.8 Volts Adapter

A power supply adapter or adaptor works as a device for supplying current at DC voltage factor. Some are used for diversifying power or signals and adapting to connect one form of current to another.

Figure 4.7: Volt Adapter

4.9 Buzzers

Buzzers are components that generates sounds with vibration . They are used for input signal generation, uses oscillation circuits by which it is constructed. They can be used for wide range of applications. They are found in different types mainly smd (makes small, high consistency sounds), and pin types for general uses. They can produce monotones using oscillation circuit constructed in it.

Figure 4.8: Buzzers

4.10 Vero board

It's a type of strip board , a completely modified circuit board element made of copper and insulating properties. It is designed with 0.1inch or 2.54mm regular(rectangular) hole grids with parallel copper cladding strips running from one point all the across to the other point of the board. These things are known by their original name that's the name of the manufacturing company itself British company of vero technologies, trademaked by UK. Another company called Canadian company pixel limited also happens to be producing this product . The holes in the board allows the electrical components to be set at any position according to the makers choice. It can be cut through holes for size adjustments very easily.

The following figure represents a simple visualization of a Vero board that was used during the making of the presented project.

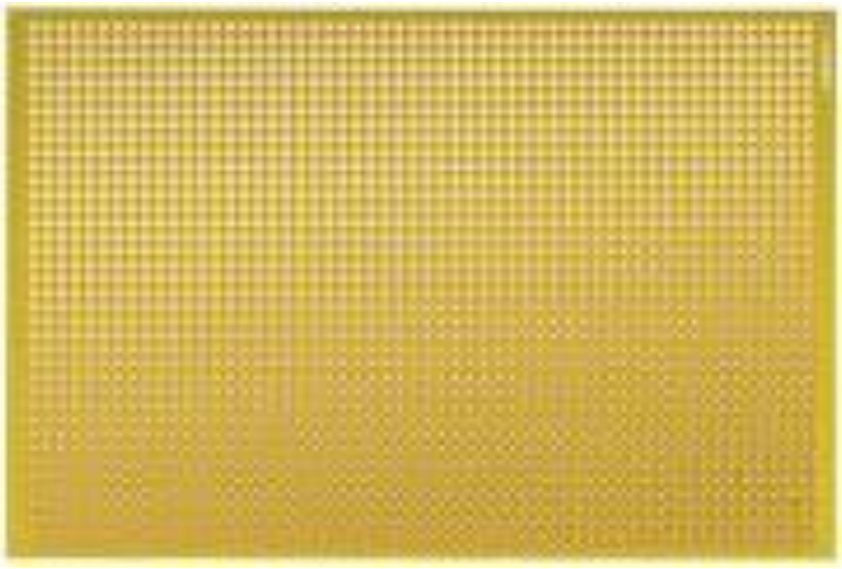

Figure 4.9: Vero Board

4.11 Soldering Wires

It's a metal wire with low melting point that means it takes very low temperature to melt a soldering wire. It is made with the mixture of tin(sn) and Lead (pb). when it cools down it creates a new connection . This is used for making a connected electrical circuit where all the material can be attached to each other and at the same time pass currents through each other. in order to join wires with it we just need to hold the soldering wire and soldering splice together thus melt it like a glue joint and it will form the desired connection of the electrical properties.

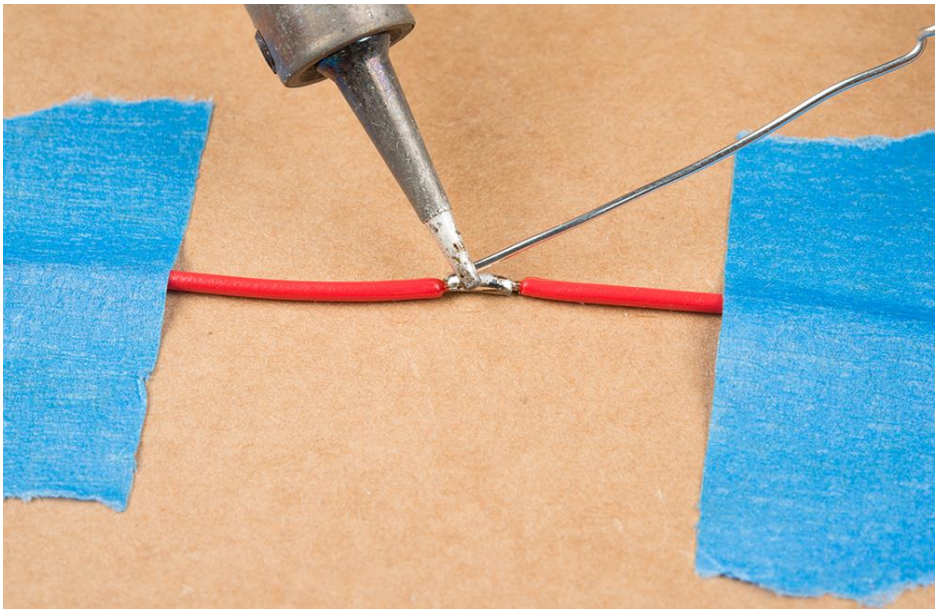

Figure 4.10: Soldering Wires

4.12 Capacitor

capacitor is a two terminal component used for storing electric charge in the form of electric field. There are different capacitors containing different shapes and sizes of insulators in it.These insulators works for storing charge and also increase it according to it's ability .They are vastly used in devices where currents are needed to be increased. using resistor can control the charge storage ability of capacitors .The batteries attaching to capacitors can decrease it's capability. Different shapes and sizes of capacitors are shown below for further understanding

Figure 4.11: Capacitor

4.13 Voltage Regulator

For all sorts of electronic device, the regulated power supply is essential because all these devices generally use semiconductor material with a fixed rating of voltage and current. If there's any difference in the fixed rate of voltage and current, then the device will become damaged. Batteries are known for being one of main DC supply sources but we can't use batteries over time in sensitive electronic circuits as they will eventually lose their potential & drain out ultimately. The batteries usually provide different voltage ranges like 1.2 Volts, 3.7 Volts, 9 Volts, and 12 Volts. Most of the integrated circuits(IC) semiconductors work with 5V supply so we need a device to supply a reliable 5V Supply called voltage regulator. Here, in the following figure is a 7805 voltage regulator comes from 78XX series of the linear voltage regulators. This regulator generates 5V regulated output

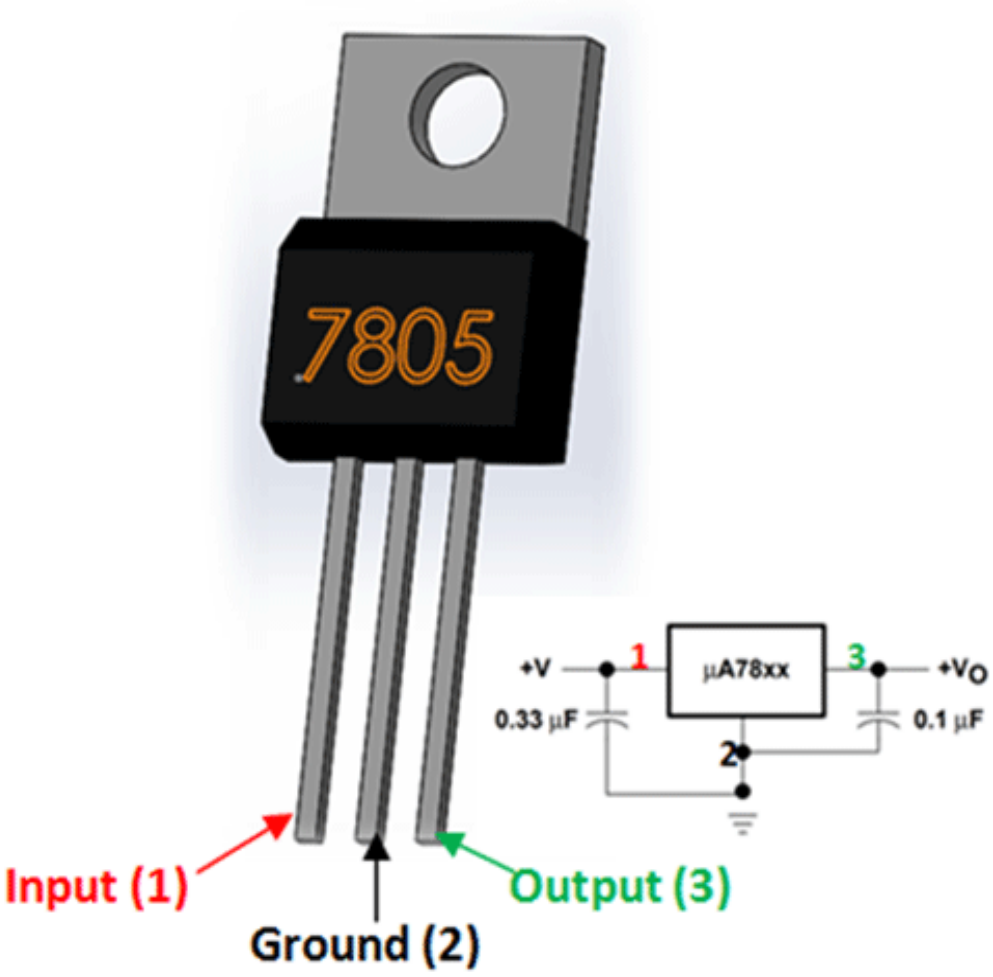

Figure 4.12: Voltage Regulator

4.14 Darlington Transistor Array

The ULN2003 is a monolithic Integrated circuit (IC) that consists of seven NPN Darlington transistor pairs including high voltage and current capability. It's generally used for applications such as relay drivers, display drivers, motors, led lamp drivers, line drivers, logic buffers, hammer drivers and other high voltage current applications. It is consisted of common cathode clamp diodes for each NPN Darlington pair that makes this driver Integrated circuit (IC) useful for switching inductive loads.

Figure 4.13: Darlington Transistor Array

4.15 Relays

Relays can be defined as a type of switch used for controlling a circuit operation. They have contacts of circulation that opens and closes under particular condition .The open contact means there is no flow of current to the element that it controls and close contacts means the opposite. They operate on very small amount of current but can control equipment with larger flow of power. Using relays we can be benefited in many ways. It helps to protect the electrical equipment from being damaged by larger current

flows. Mostly used in sensitive circuits and heating products. Very useful and important. Different types and shapes of Relays are shown below

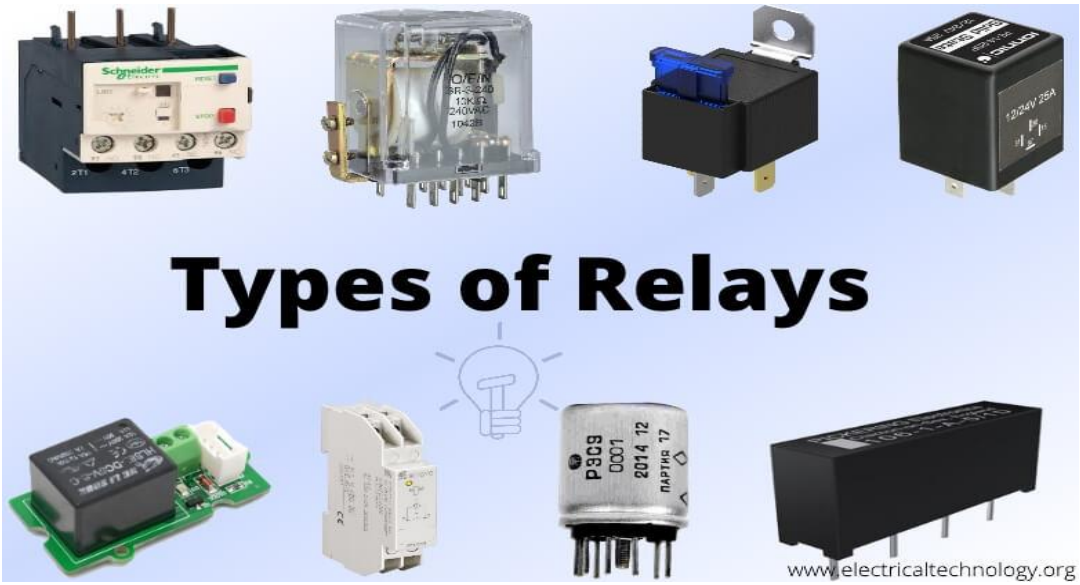

Figure 4.14: Relays

After attaching all the equipments together, The final completed project would look like the following picture

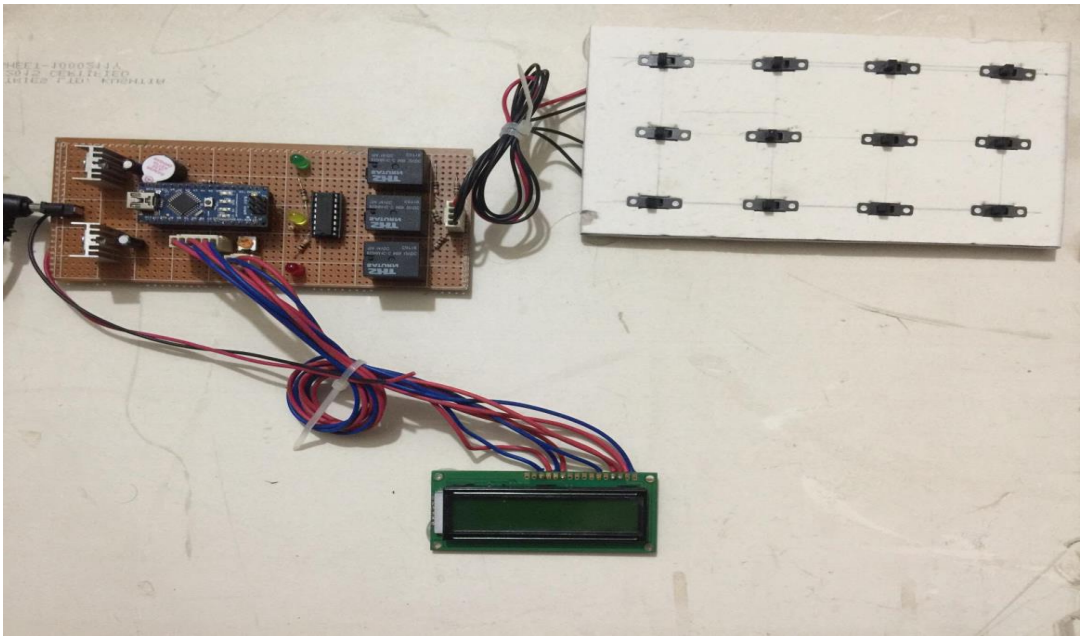

Figure 4.15: The completed project outlook

4.16 Summary

At First we have discussed about components name which are being used in this project. Then we have discussed about Arduino Nano where we briefly discuss about why Arduino Nano is used, the technical specifications, power supplying procedure, inputs and outputs and all the elements relating to the project work, memory, and all the component details etc.

CHAPTER 5

RESULT AND DISCUSSIONS

5.1 Introduction

The outcome that was found during the project and different particular tests that was carried out on the construction work are discussed in this section.

5.2 Underground Cable Fault Detector

Picture taken during the time of running the Underground Cable Fault Detection project

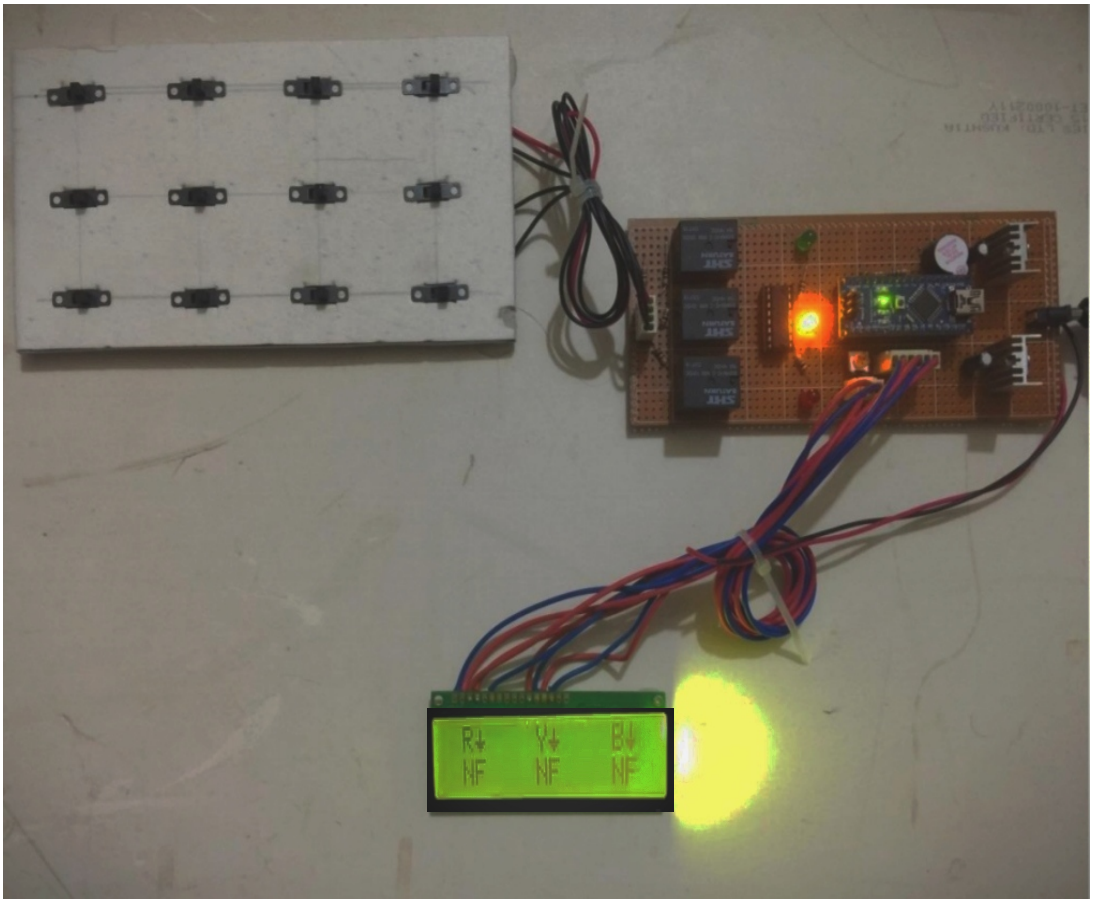

Figure 5.1: Underground Cable Fault Detector running Project

In the above figure We can see that, there are three cables identified as R,Y,B on the LCD display.
The project system has in total of 12 switches along with 12 resistors. Each cable R,Y,B has 4 resistors and 4 switches each. These switches are programmed to be showing the distance 1 km individually. The faults are shown on the project by turning off the switches.
The “NF” on the screen means ‘No Fault’ that means no faults has been detected on the cables during that time.

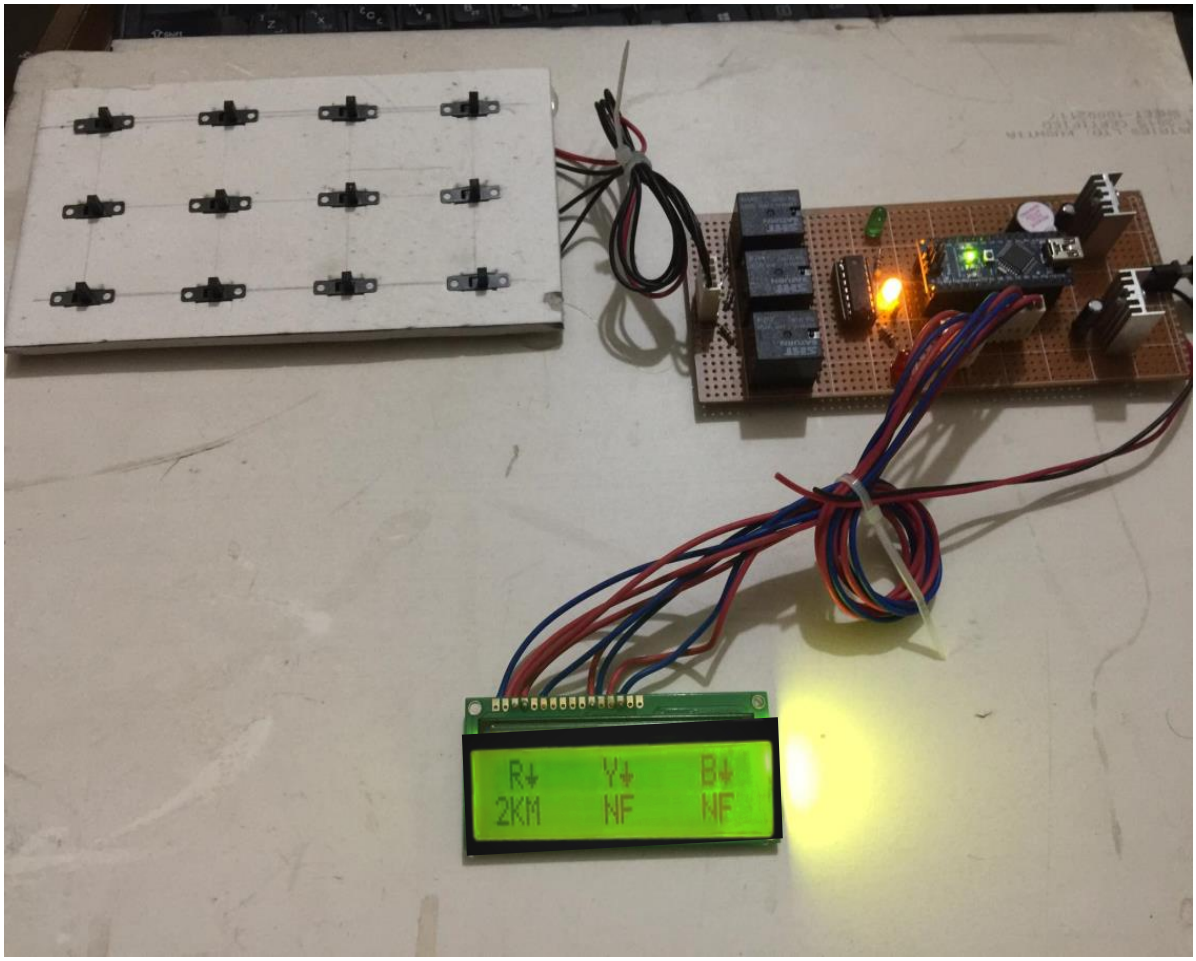

Figure 5.2: Underground Cable Fault Detector Enable Project

In the above picture, We can see the R cable showing 2km on the LCD screen that means their is a fault at 2km distance in the R cable.
That is how this project system works on identifying the fault points

5.3 Total Project Cost, Quantity and Price

Table No 5.1: Equipment Cost

SL	Equipment Name	Quantity	Price(TK)
1	Microcontroller IC	1	600
2	LCD Display	1	300
3	White board	As necessity	150
4	Connector	10	150
5	Wire	As necessity	150
6	Relay	3	150
7	ULN2003	1	100
8	5V adapter	1	100
9	Bread board	1	100
10	Glue	1	50
11	Switch	15	50
12	7805 Voltage Regulator	2	50
13	Resistance	20	20
14	Buzzer	1	20
15	Capacitor	5	20
16	LED	3	10
17	Other	As necessity	300
Total Project Cost = 2,320Tk			

5.4 Summary

The results of the tests that we have performed which has been shown above suggests that the system sub-units are designed effectively and regard to the system as a whole. After the completion of all the various units, the project was cased in a foam cardboard casing for compact presentation. The project is operated by the main power supply but it also has an alternative power source which allows it to run from battery.

CHAPTER 6

CONCLUSIONS

6.1 Conclusions

This paperwork which is known as Design and Implementation of a micro controller based underground cable fault detector. Here We have successfully and properly designed, implemented and tested a cheap underground cable fault detector with satisfying outcome. Our proposed method can identify both open and short circuit faults in underground cables with a maximum distance of 4km. In the near future, efforts will be given to increase the maximum distance for fault detection to 5km or more, and a visual display monitor to improve on its information of the underground cable fault could replace the LCD display.

6.2 Advantages

• Low Maintainance on the
project operation.
• Safety measurements are improvised keeping in mind about peoples uses .
• Consumes very low amount of energy that means it cost effective on energy use.
• Very simple and easy to operate and handling.

6.3 Limitations of the Work

• The Arduino nano consumes energy based on 5 volts of dc voltage supply power.
• The relays need Dc supply voltage of 12 volts.
• The occurance of network and current suppy distinction can also be problematic.
• Measuring the values regarding angle points can also be time consuming and be inaccurate.

6.4 Future Scopes

For this presented project model we were able to successfully detect the location point of below ground faults from headquaters to the fault point in kilometers using just some simple equipments along with Arduino nano kit. For future we are hoping for detecting open circuit fault by calculating impedence using the capacitors .

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APPENDIX

The code used in Microcontroller

```
 #include <LiquidCrystal.h>
LiquidCrystal lcd(2,3,4,5,6,7);


#define sensor A0
#define relay1 8
#define relay2 9
#define relay3 10
#define buzzer 13

void setup() {
pinMode(buzzer, OUTPUT);
lcd.begin(16, 2);
lcd.setCursor(0, 0); // set the cursor to column 0, line 2
lcd.print("Welcome to Cable");
lcd.setCursor(0, 1); // set the cursor to column 0, line 2
lcd.print("Fault  Detection");
}

void loop(){
lcd.print("R");
lcd.write(1);

lcd.print("Y");
lcd.write(1);

lcd.print("B");
lcd.write(1);

if(distance>0){lcd.print(distance); lcd.print("KM  ");}
else{lcd.print(" NF ");}


if(distance>0){lcd.print(distance); lcd.print("KM  ");}
else{lcd.print(" NF ");}


lcd.setCursor(12,1);
if(distance>0){lcd.print(distance); lcd.print("KM  ");}
```

```
else{lcd.print(" NF ");}

}

void data(){
read_ADC = analogRead(sensor);
distance = read_ADC/100;

if(distance>9)distance = 0;

if(distance>0){
digitalWrite(buzzer,HIGH);
delay(200);
digitalWrite(buzzer,LOW);
delay(200);
 }
}
```