THREE PHASE LINE FAULT DETECTION AND PROTECTION SYSTEM

A Project and Thesis 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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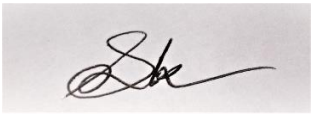
October-2019

Certification

This is to certify that this project and thesis entitled “Three Phase Line Fault Detection And Protection” is done by Md. Kamran Hossain, ID No: 162-33-3407 and Ariful Islam, ID No:162-33-3434, 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 September 2019.

Signature of the Candidates



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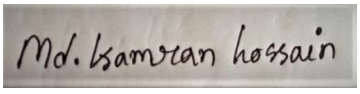
Signature of the candidates



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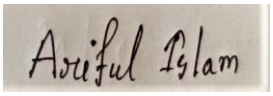

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TO
OUR BELOVED PARENTS
&
HONOURABLE TEACHERS

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LIST OF ABBREVIATIONS

LCD	Liquid crystal display
AREF	Analog Reference
TX/RX	Transmit and Receiver
IC	Integrated Circuit
RMS	Root Mean Square
USB	Universal Serial Bus
LED	Light Emitting Diodes
CPU	Central Processing Unit
CT	Current Transformer
NO	Normally Open
NC	Normally Close

ACKNOWLEDGEMENT

Firstly we give thanks to almighty Allah from the bottom of our hearts. We would like express our sincere gratitude to our honourable supervisor lecturer Saikat Basak, Department of Electrical and Electronic Engineering, DIU who inspired us every moment. We are thankfully to him for his continuous encouragement, kind co-operation, and scholastic guidance all along the project work. He has always been extremely generous with his time, knowledge and ideas and allowed us great freedom in this research. We also want to convey our thankfulness to Saikat Basak, Lecturer, and Faculty of Engineering for his help, support and constant encouragement. We express our humble gratitude to all teachers of department of Electrical & Electronics Engineering for their support in numerous ways throughout this project work. We are also grateful to the authors whose valuable research papers and books we have considered as reference in this project paper. Apart from that, we would like to thank our entire friends for sharing knowledge, information and helping us in making this project a success. Also thanks for lending us some tools and equipment. Finally we would like our parents who have given us tremendous inspirations and supports. Without their mental and financial supports, we would not able to complete our project.

ABSTRACT

This paper presents a new adaptive fault protection scheme for transmission lines using three Phase line. The work includes fault detection, classification and location. Both fault detection and fault protection are derived by using two terminal synchronized measurements incorporated with distributed line model and modal transformation theory. The fault detection index is determined of two complex phasors and the angle difference between the two phasors determines whether the fault is internal or external to the protected zone. The fault types can be classified by the modal fault detection index. The proposed scheme also CT estimation to assure protection scheme performance and achieve adaptive protection. Extensive simulation studies show that the proposed scheme provides a fast relay response and high accuracy in fault location under various system and fault conditions. The proposed method responds very well with regards to subjections, security and sensitivity.

CHAPTER 1
INTRODUCTION

1.1 Introduction

We know the modern society is dependent to the use of electric energy that it has become a part envelop our life. The importance of electric supply in everyday life has arrived such a state that it is wished to protect the power system from damage during fault proviso and to ensure maximum continuation of supply. For this purpose from dependable point of view the protective instrument used in power system takes a necessary role of this system. So we have cultivated of electrical power protection design of transmission line. A particular type of equipment used in electric power systems to detect abnormal situation and to initiate appropriate rectifying action known as protective device.

These may be caused by natural phenomena, such as lightning, wind, short circuit, by falling objects such as trees, unwary acts by plant protection personnel, or other acts of humans; or by conditions produced in the system itself, such as switching ripple, load oscillation, or equipment decay.

Here the voltages become unbalanced, this is necessary to detect the fault as promptly as possible that is a kit is being made using microcontroller to make its way faster. It will find following four main faults and will give trip signal to relay.

There are four faults detected by the model for example as: Overcurrent fault, under current fault, Sparking and Short circuit, Phase Failure faults. The aim of this experiment is to reveal a device used to detect faults in the line and separate the connected system or instrument connected to it and protection of the line. Its device embroil the use of arduino for detection and detachment of the system of device with proper use of programming. [1]

1.2 Problem Statement

We have encountered various problems in doing this project, such as voltage problems, correct values, automatic relays, arduino problem and more. The fault protection work will be unparalleled even after various obstacles. Even if it does, its instrument and software will still have to be improved.

1.3 Objectives

The capability of a transmission line protect and follow a sense object can be used for several purposes. To design a low cost device in order to use general purpose.

(i) To study of a Transmission Line and Protective Device.
(ii) We need to study how to identify fault.
(iii) To make it easier for people.
(iv) Can be used for defence purpose. [2]

1.4 Application of project

1. Transmission line
2. Distribution line
3. We can use different substation
4. Can be used for industrial power section line
5. Can be used for private power distribution centre

1.5 Research Methodology

The methodology has been adopted considering two aspects specific to this project. The module of this project is divided into several sections. Each module is split from one another. From the beginning of the primary sensor, current measurement, voltage measurement, over-voltage, over-current fault, short-circuit fault identification and maintenance work are performed step by step. Relays and sensors work smoothly in this project. Fault identification through these relays and sensors is analyzed and we use an arduino mega 2500 model processor to obtain fault

instruction on the three-phase line based on the analysis obtained. It is a processor that allows us to send and receive digital signals. The reason for this project is that if the relay trips due to extra current flowing through the line for any reason, there will be no fault in the circuit. And after all the effort we have put in place the core of the project.

1.6 Summary

One of the major problems with transmission line protection is that 85-87% of the power system lines have faults. By detecting the various techniques of my project, I have identified a variety of line defects and have devised a strategy in the best way possible. Different types of tools are created using different tools and programming. [14]

CHAPTER 2

LITERATURE REVIEWS

2.1 Introduction

Our transmission lines are a very important part of the distribution because they play an important role in the distribution of power from the centre to the distribution centre. Voltage is transmitted from 69kv to 769kv to transmission lines and interconnects for a variety of continuous operations. Therefore, it is necessary to detect errors during the transmission on the transmission line and otherwise confirm the various chaotic events on the line. [13]

2.2 How to work fault protect system

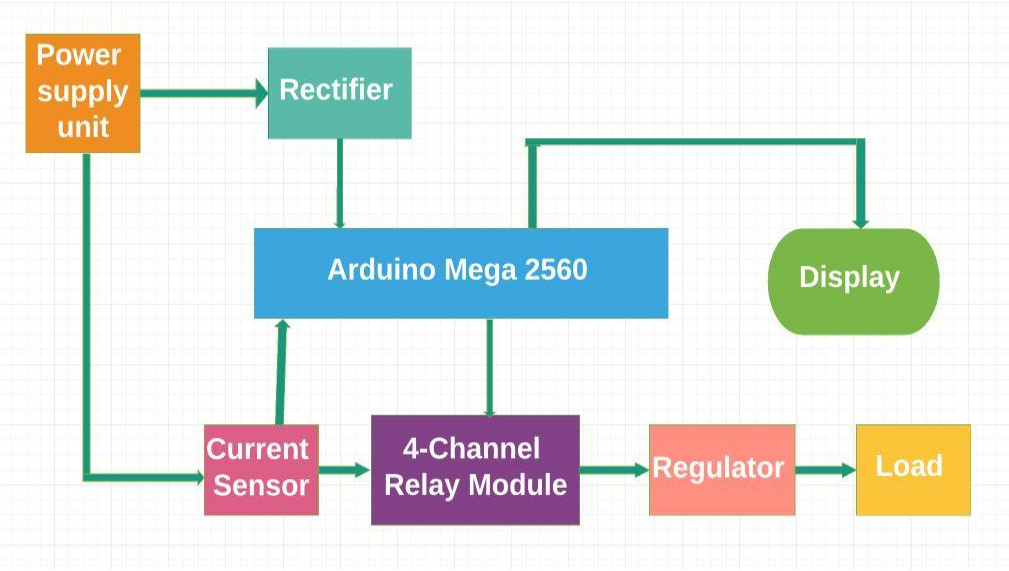


Fig-2.1 Show the system Block Diagram

We have measured the current in this project through the current sensor. Let's say before that, on every device, we get line power. Then the arduino simultaneously sends a signal, then the relay

goes on, the voltage in the line starts to flow, the loads move. The current sensor measures the current on the line and sends analog signals to arduino, which arduino receives in digital language. The arduino then shows the voltage on the display, then senses the current sensor with an additional 1 amp on the line, then gives the signal to the relay arduino. Now the relay receives the signal, tipping the relay so there is no problem in the line.

2.3 Current Sensor

Alternating current or AC current will measurement used by current sensor. In this article, I will discuss how to measure alternating current using current transformer/CT.

This sensor is a linear effect circuit that is formed with the path of copper surrounded. This is the copper vehicle around the lifeless practice. When AC / DC Current goes to the torn-shaped way, the Properties of the Prison of Surety. Then there is a come in the sensor with the sensor. This interactive circuit inputs in the input of AC / DC volt, depend on the poor-charming. This provides output volt through this current sensor, which is advantages to measure the current in the microspore. Later, we will explain how it measures its current. [11]

2.4 Over load/ Over Current

An overcurrent exists when the normal load current for a circuit is go beyond. If then appears in the forms of overload. When it has applied to line an overload is any current, flow through ordinary lines, this is more current than the full load current of the line. Then overload occurs when an electrical circuit, in case by the original design of circuit or by interchange of an stand circuit, it is required to convey load current in praise of the rated-load capacity of the circuit conductors.

For example, a 1-amp branch circuit is modified with an additional load, increases the load current to 1.13 amps, this must be a circuit overload.

Here overload condition can occur feeder, or segment circuit level of a transmission line electrical power distribution line system.

That electrical overload /overcurrent also occurs when is the mechanically overloaded. This may be caused by excess friction within its internal bearing surfaces, excess heat (remaining to high

circumambient temperature or another failure) and by the binding or some other mechanical overload in the utilization device it manage. Then overload is a controlling overcurrent condition, normally of low magnitude. [10]

2.5 Short Circuit

We know that short-circuit currents (as well ground fault, which we will touch on next) are high-magnitude fault overcurrent that in effect, it's place a low resistance in the parallel with the impedance of the connected load. Then short-circuit overcurrent normally environ an accidental cross-connection of at least two circuit conductors. This places a short circuit across the supply transformer winding. This represent the more common transmission line supplies to a structure. There are three-phase AC electrical power distribution system, it will normally have a higher value of short-circuit overcurrent because the short will normally involve much single-phase AC line.

2.6 Project Overviews

We will add excess overload in this project, short circuit that is kept from any dangerous situation. We mean that how to use all the devices in the transit to the government from the dangerous effects. Currently we are in the lack of durable effects and use over the right vault rating on each device by covering out the transmission of extreme effects. According to our circuit breaker, we can decorate from some of the hardships, and using some fuse, the false feature is kept in the line of secularly linked to the voltage. As a result, the unexplained over create in the ground helps to cash from Failure. We arranged the design of this design by Arduino with a virgin with a grid system. We used two methods of protection, such as over care, Short circuit protection system. People use the various symbols to be managed. [12]

2.7 System Diagram

The system block diagram in shows as,

1. Software system diagram

2.7.1 Software system diagram

The following are given in the software system diagram,

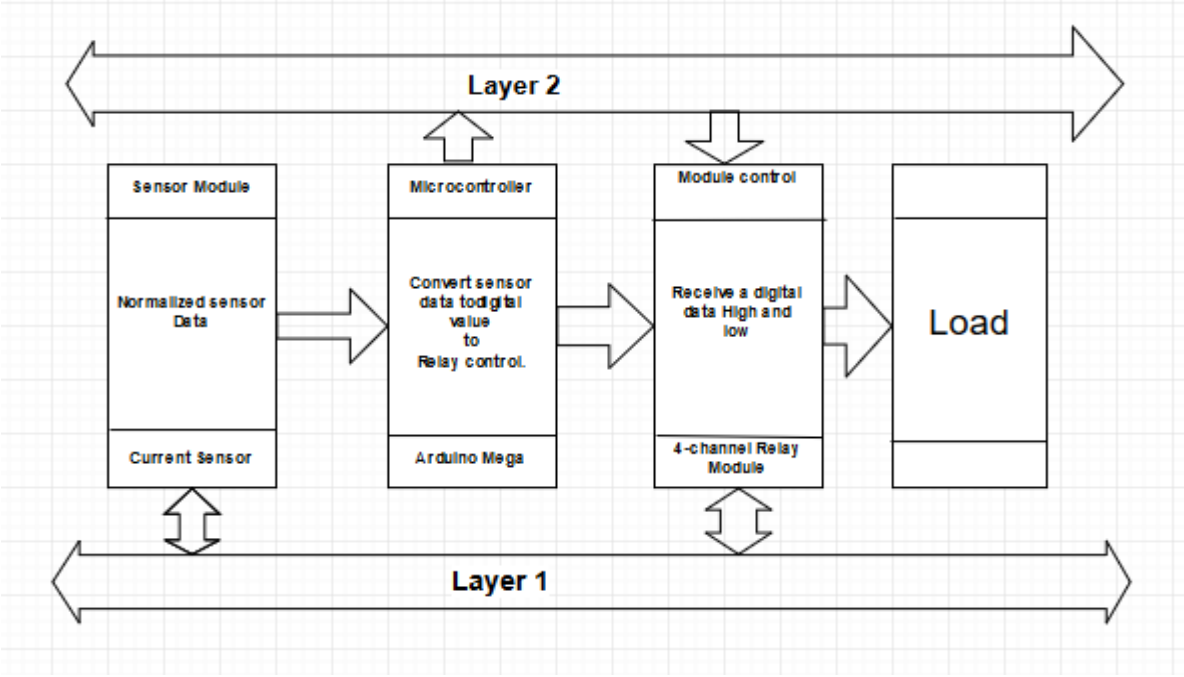


Fig-2.2 Show in the software system Block Diagram

2.8 Summary

This chapter discusses the subject of the Transmission Line Fault. We are new ideas as we study this topic. But it involves choosing a sector that will protect us. Our daily demand for electricity has gone far beyond that which has a significant role. I hope this protection device market is changing day by day.

CHAPTER 3

ANALYSIS OF THIS SYSTEM COMPONENT

3.1 Introduction

In this chapter, we have discussed various components that will be needed to make transmission line fault protection.

3.2 Component

The fault protection has the following main component are

(a) Arduino
(b) 4-Channel relay module
(c) Current sensor
(d) LCD
(e) DC-DC Buck boost
(f) Resistor
(g) Diode
(h) Capacitor
(i) Transformer
(j) Push switch
(k) Jumper Wire
(l) Tools needed

3.2.1 Arduino Board

Arduino AT mega 2560 is a programmable electronic circuit broad that can integrate into an extensive difference of project both easy and difficult. It has a microcontroller which is capable to write a program for sensing and controlling objects in the real world. The Arduino is fit to communicate with an astronomically immense array of outputs such as motors, LED and displays by reacting to sensors and inputs. Arduino becomes a very popular compiler for inventors looking to design interactive hardware projects because of its versatility and affordable. Arduino was presented in 2005 by Massimo banzi in Italy as a plan for non-engineers to access for implementing a low-cost simple hardware project. As the Arduino board is open-source it is published under an inventive commons license which approves anyone to design their own board. [3]

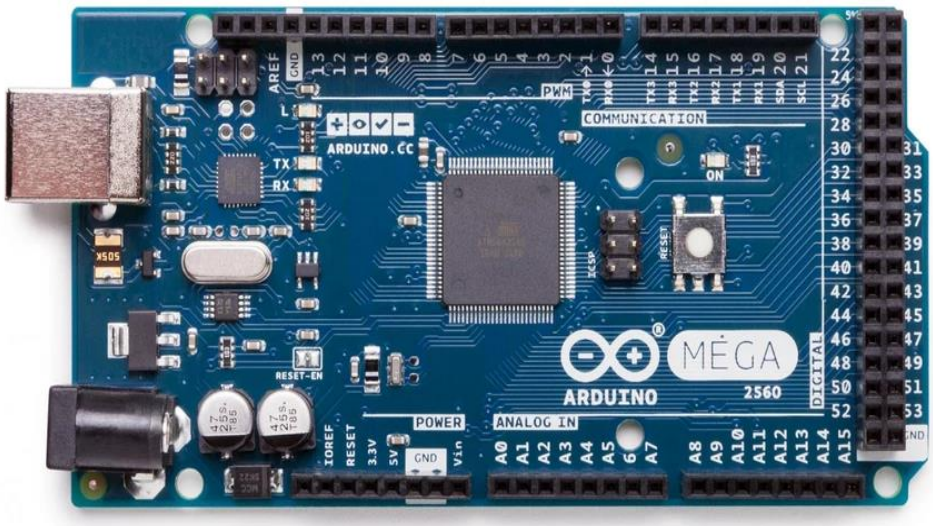


Fig-3.1 Show the front side Arduino Mega board

3.2.1.1 Arduino Mega

Arduino MEGA is the open-source microcontroller development board based on the ATMEGA 2560 microcontroller IC. This microcontroller chip is different from the ATMEGA328P in terms of the digital Input / Output pins, Analog pins and other basic features which will be discussed in detail. Arduino MEGA has total 54 digital input / output pins and sixteen analog pins. Note that the Arduino UNO has much lesser Digital Input / Output pins and Analog pins than Arduino MEGA board. Arduino MEGA has four UARTS for serial communications, one Serial Peripheral Interface computer bus and one I2C (Inter-Integrated Circuit) computer bus. Out of these 54 digital input / output pins fifteen are PWM (Pulse Width Modulation) enabled pins. [3]

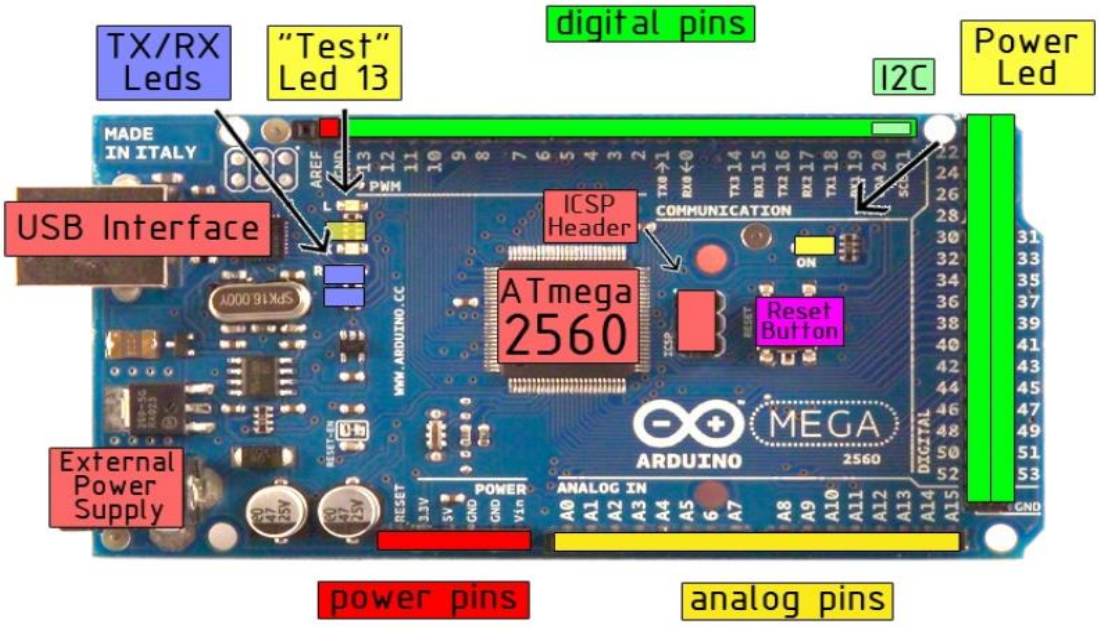


Fig-3.2 Arduino mega board all pin section

Here we are discussed about the function of the component of the Arduino board as,

(a) <u>Power pins</u>

- **VIN:** The Arduino board serves as a power source. I got the input voltage by supplying 5v through the USB connection. We get 5v in output through this pin. Again I have power access to Arduino through the power jack.

- **5V:** This board has a 5v pin through which we supply power from Arduino to other devices. Here we get only 5v dc.
- **3V3:** We supply A 3.3 voltage generated on this Arduino board through this pin.
- **GND:** There are two GND pins on the Arduino board. Getting one more pin is the 13 no pin.

(b) Reset Button

This button is used for restarting the code that is stored to the Arduino board.

(c) Analog Pins

Pin A0 – A15 utilized for analog input/output. This pin can read the signal from the analog sensor and convert to the digital.

(d) Digital Pins

Pin D0 – D53 utilized for digital input/output pins.

(e) 'Test' LED 13

This board has a built-in LED when we power it on Arduino. Which is connected to pin 13. So when the high value is given, the LED is turned on and the low is then the led off.

(f) USB Interface

Works on uploading code and power supply on the Arduino board.

(g) AT MEGA 2500

This is called brain where the program is stored.

(h) TX/RX LED

We show the LED signals when sending and receiving data.

(i) Power instigator/LED

When the board plugs into a potency source, the LED lights Up anytime.

3.2.2 Relay Module 4-Channel

This is a LOW Level 5V 4-channel relay interface board, and each channel needs a 15-20mA driver current. It can be used to control various appliances and equipment with large current. It is equipped with high-current relays that work under AC250V 10A or DC30V 10A. It has a standard interface that can be controlled directly by microcontroller. This module is optically isolated from high voltage side for safety requirement and also prevent ground loop when interface to microcontroller.

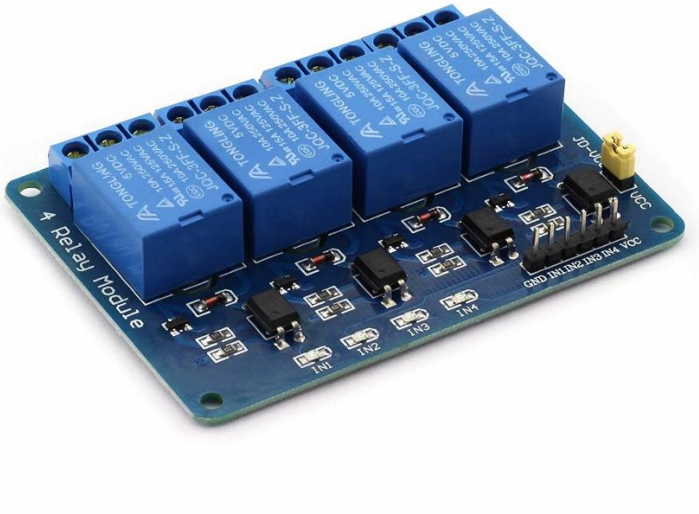


Fig-3.3 Shows in 4-channel Relay Module

3.2.2.1 Data Brief

1. Relay trigger voltage: 5v dc.
2. Relay trigger current: 70ma.
3. Relay ac load current maximum 10A, 250 voltage.
4. Relay dc load current maximum 10A, 30 voltage.
5. Relay 10ms operating time.
6. Relay 5ms release time.
7. Low voltage trigger.

3.2.2.2 Pin configure

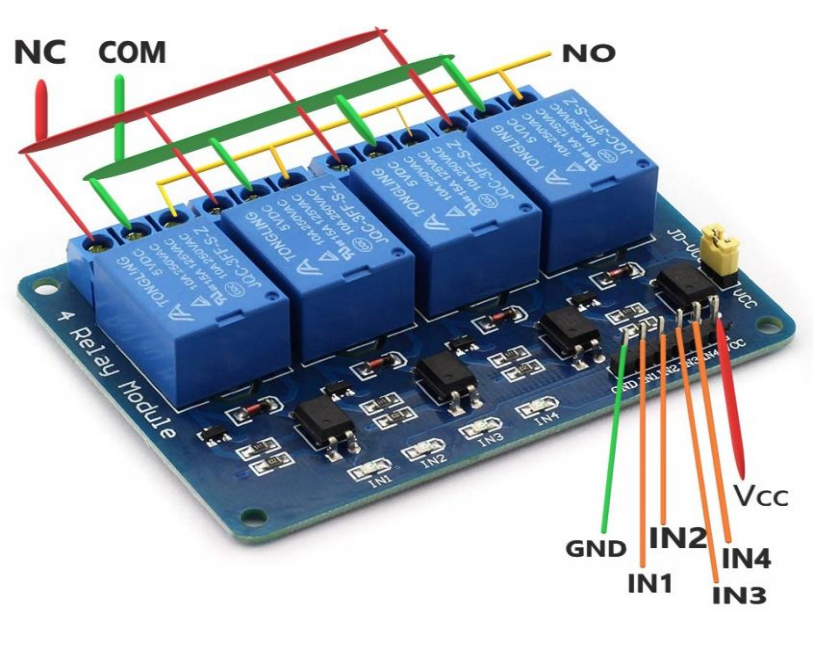


Fig-3.4 Show the connection pin relay module

3.2.2.2.a Input

VCC: We have supplied the dc 5v voltage of this pin to the reel.

GND: This pin we have served as the ground pin. Which is connected to the ground pin in Arduino.

IN1: This terminal 1 pin triggers a digital signal from Arduino.

IN2: This terminal 2 pin triggers a digital signal from Arduino.

IN3: This terminal 3 pin triggers a digital signal from Arduino.

IN4: This terminal 4 pin triggers a digital signal from Arduino.

3.2.2.2.b Output

We know that the output of the relay module has three pins such as NO, NC, COM. One of the three terminals is normally open. One will be normally close and one will be in the common mood. But NC and com have two pin connection shorts. So that we can learn about relay switching. We are using the 4-channel relay module, there are using 4 NC, 4 COM, 4 NO port for relay.

3.2.3 Current Sensor

A current sensor is a device that detects electric current in a wire, and generates a signal proportional to that current. The generated signal could be analog voltage or current or even a digital output. The generated signal can be then used to display the measured current in an ammeter, or can be stored for further analysis in a data acquisition system, or can be used for the purpose of control.

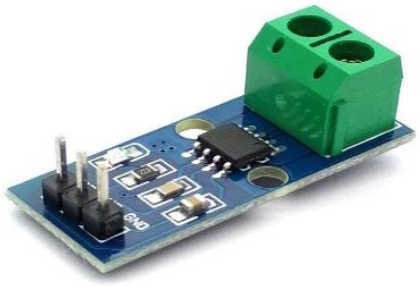


Fig-3.5 ACS712Current Sensor

3.2.3.1 Pin configuration

(i) VCC: Input voltage +5v supply in board.

(ii) Output: Outputs Analog voltage proportional to current.

(iii)Ground: Connect to the ground.

(iv)Wire In: We have given the current input wire input pin 220 volts AC supply connection.

(v) Wire Out: This current connects the AC series to the output of the sensor and gets 220 volts.

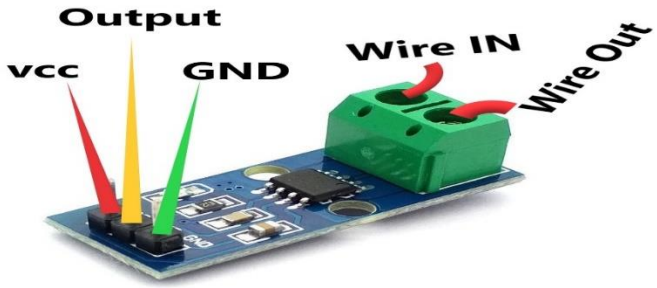


Fig-3.6 Show the current sensor pin figuration

3.2.3.2 Specification

1. This current sensor measures dc current.
2. This is a module that works up to 5A-30A.
3. It usually sends analog signals to Arduino.
4. It acts as a base scale factor.
5. It helps to measure AC current. [6]

3.2.4 LCD

A liquid-crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly. Here, in this we're going to use a monochromatic 20x4 alphanumeric LCD. 20x4 means that 20 characters can be displayed in each of the 4 rows of the 20x4 LCD, thus a total of 80 characters can be displayed at any instance of time.

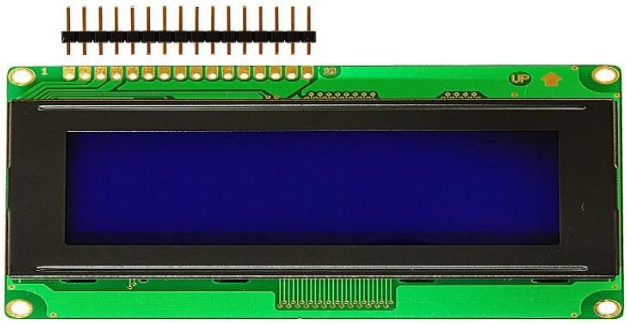


Fig-3.7 LCD Monitor 20×4

3.2.4.1 FEATURES

1. 20×4 dots.
2. Built in control.
3. +5v supply.
4. Backlight LED

3.2.4.2 Applications

1. Monitor control.
2. It's a technological technology known as liquid crystal.
3. This is the input that captures digital data and displays it on the output display.
4. This is an electrical connection that is dependent on the fluorine device. [15]

3.2.5 DC-DC BUCK BOOST

Buck and Boost converter is a type of DC to DC converter that has an Output voltage magnitude, it is either greater than or less than input Voltage magnitude. It is equivalent to a fly behind converter using a single Inductor instead of a transformer, two different topology are called buck and boost converter. Both of them can produce a range of output voltages, ranging from much larger than the input voltage, down to almost zero. [8]

Fig-3.8 Dc-Dc buck boost converter

3.2.6 Resister

Resistor is the passive two terminal electronics instrument that implements electrical resistance as a circuit element. In the electronic circuits, resistors are used to reduce current flow, adjust signal levels, to partition voltages, bias active elements, and conclude transmission lines, within another uses. [9]

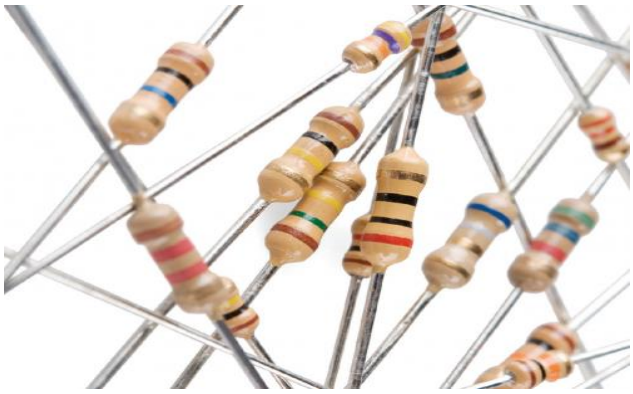


Fig-3.9 Resister pic

3.2.6.1 Resister color Band

Show in the Table of resister color band

Color	Signficant figures			Multiply	Tolerance (%)	Temp. Coeff. (ppm/K)	Fail Rate (%)
black	0	0	0	x 1		250 (U)	
brown	1	1	1	x 10	1 (F)	100 (S)	1
red	2	2	2	x 100	2 (G)	50 (R)	0.1
orange	3	3	3	x 1K		15 (P)	0.01
yellow	4	4	4	x 10K		25 (Q)	0.001
green	5	5	5	x 100K	0.5 (D)	20 (Z)	
blue	6	6	6	x 1M	0.25 (C)	10 (Z)	
violet	7	7	7	x 10M	0.1 (B)	5 (M)	
grey	8	8	8	x 100M	0.05 (A)	1(K)	
white	9	9	9	x 1G			
gold			3th digit only for 5 and 6 bands	x 0.1	5 (J)		
silver				x 0.01	10 (K)		
none					20 (M)		

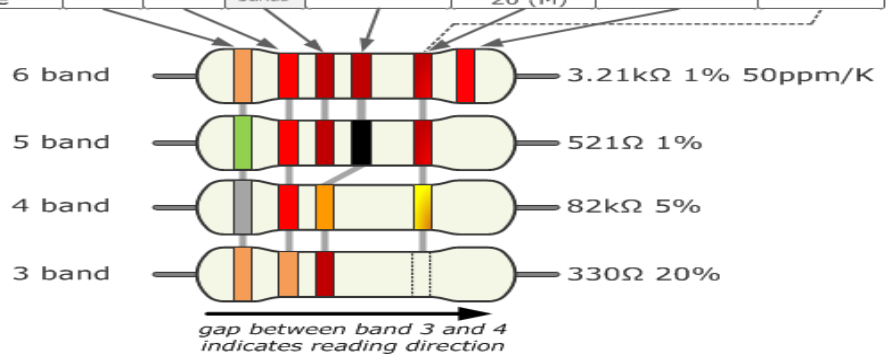


Fig-3.10 Show the resister color band table

3.2.7 Capacitor

A capacitor is a device that stores the strange energy known as a passive electronic component in the form of a waveform. The capacitor has two conductive plates separated by an element called dielectric. The plates whose proportions are directly proportional to the surface and are inversely proportional to the plates whose plaques. Where the separating substances depend on the dielectric

constant. The following symbols are shown in the chaser. Capacitors are made of silicon, germanium semiconductor material. The capacitors are filled with metal electrodes in various chambers to meet a low pressure and primary gas. Which acts as voltage controller, signal modulator, switch and oscillator.

Fig-3.11 Capacitor

Symbol:

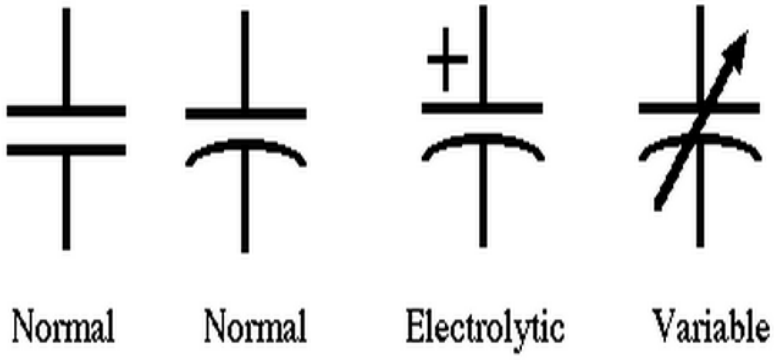


Fig-3.12 Capacitor Symbol

3.2.8 DIODE

A diode is a specialized electronic component with two electrodes called the anode and the cathode. Most diodes are made with semiconductor materials such as silicon, germanium, or selenium. Some diodes are comprised of metal electrodes in a chamber evacuated or filled with a pure elemental gas at low pressure. Diodes can be used as rectifiers, signal limiters, voltage regulators, switches, signal modulators, signal mixers, signal demodulators, and oscillators.

3.2.8.1 Diode symbol:

We are shown the symbol of the diode as follows. Which opens the diode with an arrow sign. We know that there are two sides of the diode that are anode and cathode. Here the anode is connected to the p side and the cathode is connected to the n side.

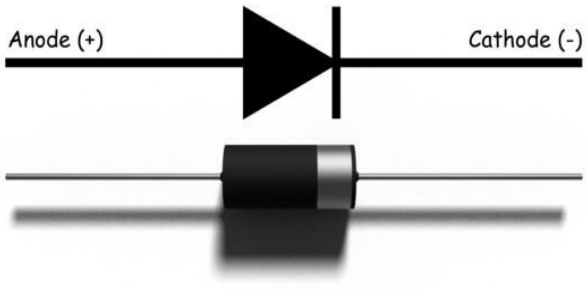


Fig-3.13 Diode pic and symbol

We can create a simple PN junction diode by doping pentavalent or donor impurity in one portion and trivalent or acceptor impurity in other portion of silicon or germanium crystal block. These doping make a PN junction at the middle part of the block. We can also form a PN junction by joining a p-type and n-type semiconductor together with a special fabrication technique. The terminal connected to the p-type is the anode. The terminal connected to the n-type side is the cathode.

3.2.9 Transformer

A transformer is an electrical device which by the principle of electromagnetic induction, its transferring electrical energy from one electric circuit to other, without change the frequency. The energy transfer generally takes place with a change of voltage and current. This transformers either increase or decrease ac voltage. Transformer has 220V primary windings & center tapped secondary winding. This transformer has flying flaming insulated connecting leads (100 mm long). The Transformer law as step down transformer reduce AC 220V to AC 12V supply.

Fig-3.14 Pic of Transformer

3.2.9.1 Features of 0-12V 3A Transformer:

1. It is an iron core.
2. Its current gain is 3A.

3.2.9.2 Applications of 0-12 3Amp Transformer:

1. Works as High Current Gain on various projects.
2. This transformer basically transfers 220v ac to 12v ac.
3. It has two windings.

3.2.10 Jumper Wire

A jumper is called a connector set from one wire edge to another. So we don't have to attach the soldering iron. This cable can be connected without any hassle. There are different types of jumper, such as male to male, male to female, female to female etc.

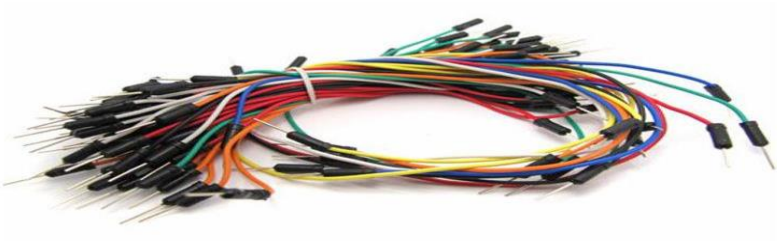


Fig-3.15 Show the connecting wire

3.2.11 Tools Needed

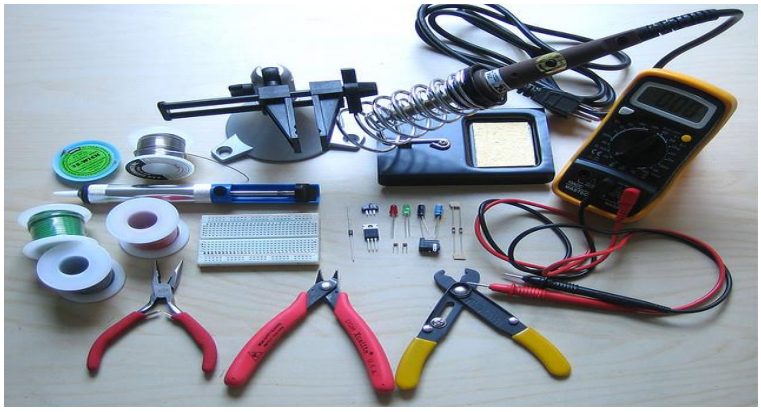


Fig-3.16 Show in the project tools

The parts we need are shown below as,

1. Solder Iron
2. Solder Roxon
3. Solder Lead
4. Glue-Gun
5. Anti-cutter
6. Cutting Plus
7. Digital Multi-Meter
8. Screw Driver
9. Wire Stripper
10. Mini drill

3.3 Summary

In this chapter we have discussed all the parts of fault protection. We will complete the project by utilizing all of these components well and the fault should be maintained. In this chapter, we are trying to discuss details about the used each individual hardware working description and their works.

CHAPTER 4

HARDWARE DEVELOPMENT

4.1 Introduction

This chapter describes the methods implemented in fault protection solving algorithms. The main topics viewed in this chapter are how this project flowing software. The statement hardware connection information.

4.2 Project Flowchart

In shown as the flowchart diagram,

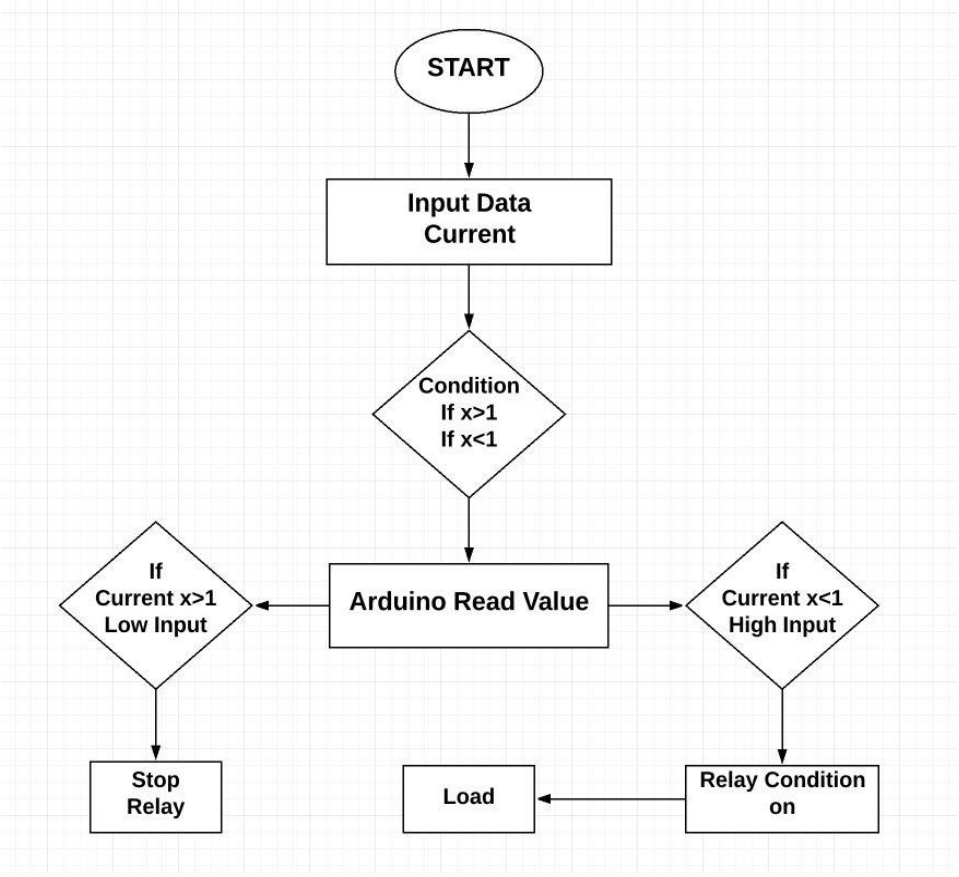


Fig-4.1: Show the flowchart

4.3 Algorithm of the fault protection device

Step 1: Start

Step 2: Input data from the current sensor

Step 3: Measure the current

Step 4: Conditions if current low x<1 and high x>1

Step 5: Arduino read the value

Step 6: Conditions if low current

Step 7: Relay operating on

Step 8: Condition if high current

Step 9: Relay operating off

Step 10: END

4.4 Hardware Connection pic

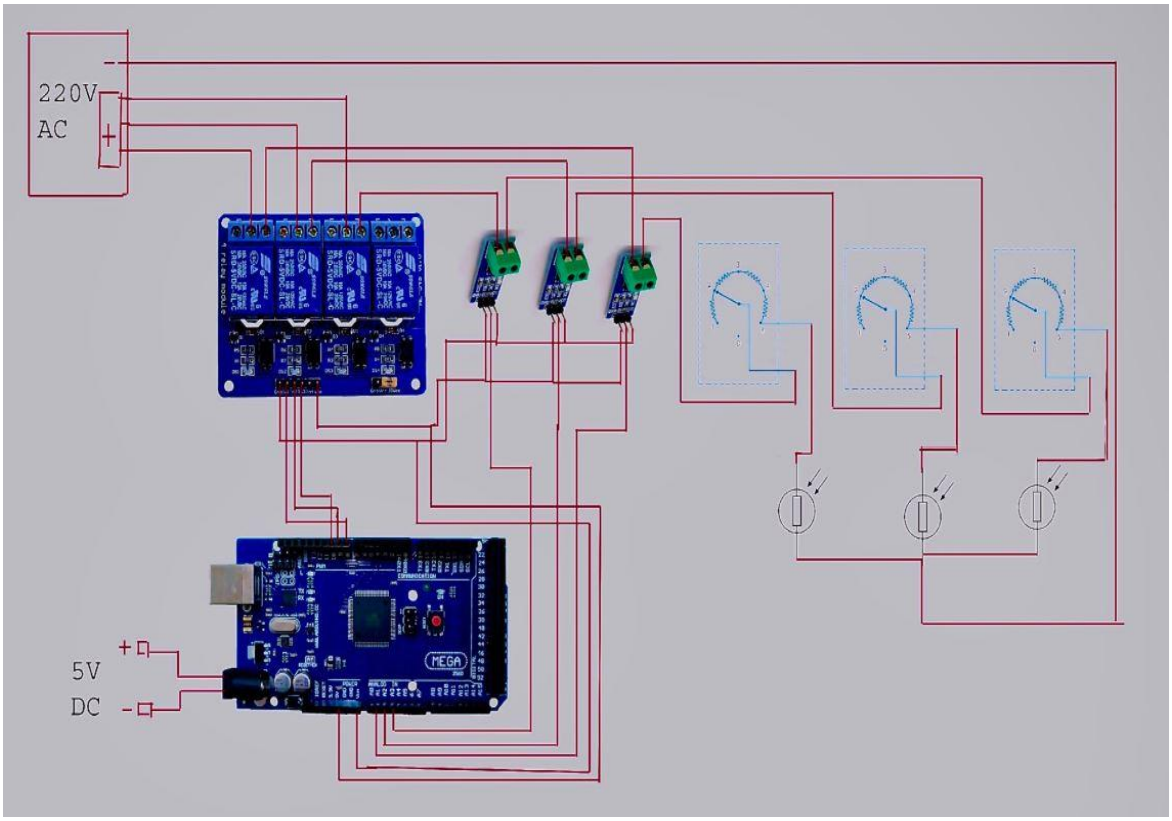


Fig 4.2: Show the hardware connection

4.4.1 Description of Hardware Connection

All types of connections for this project are shown below,

- At First ac connection in transformer.
- Transformer 12v AC is connecting in full wave rectifier.
- Then 12v dc connecting to the Arduino internal power supply.
- Relay, Current sensor, Display driver all ground and VCC pin are connecting in arduino ground.
- Pin connecting to the arduino digital pin no-8 of relay1 IN1.
- Pin connecting to the arduino digital pin no-9 of relay2 IN2.
- Pin connecting to the arduino digital pin no-10 of relay1 IN3.
- Current sensor-1 of Output pin connect to the arduino Analog pin A1.
- Current sensor-2 of Output pin connect to the arduino Analog pin A2.
- Current sensor-3 of Output pin connect to the arduino Analog pin A3.
- LCD display driver SCL pin connect to the arduino SCL/Communication pin D21.
- LCD display driver SOA pin connect to the arduino SOA/Communication pin D20.
- All relay common pin are connecting to the ac line 220v.
- Series connected to all current sensor wire IN pin from all relay NO.
- The wire out of the current sensor is connected to the input cable of the dimmer regulator.
- Connected to the load from the dimmer regulator output for current reduction and loading is provided.

4.5 Summary

This chapter is discussion about those used hardware in this project maze resolve transmission line fault. All the hardware that has been used in this project are in proper features and operative properly and for that the fault protection should work properly. In this chapter, we are trying to discuss details about the used each individual hardware working description and their works.

CHAPTER 5

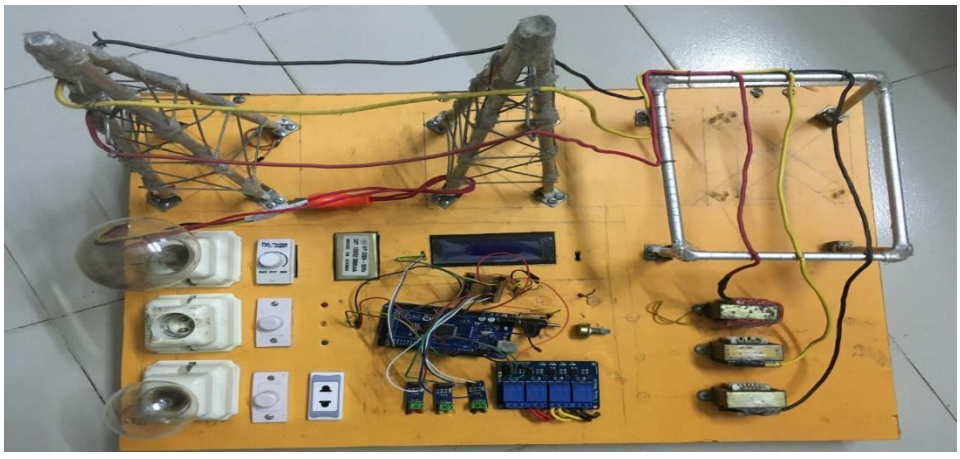
DISCUSSION AND RESULT

5.1 Introduction

This chapter will present all the results and relevant discussion.

5.2 Final Result

This project worked to protect my transmission line fault. The fault lines on the transmission line, such as overload, over current flow, short circuit fault, etc. The amount of current flow we make through the current sensor in this project is converted to an arduino processor by converting the analog signal into a digital signal. Then the arduino processor completes the process and sends the digital signal high number to the relay. Then the relay connects to the relay by receiving that signal. Then the arduino sends the digital signal to the driver on the display, then we can see the amount of current flowing through the display. If at any time additional current flows in the line, arduino disconnects the relay contact through the digital signal or trips the relay. Then no current or voltage flows in the line. As a result, we find the load on each load in the distribution line. But this is all done through the arduino program.



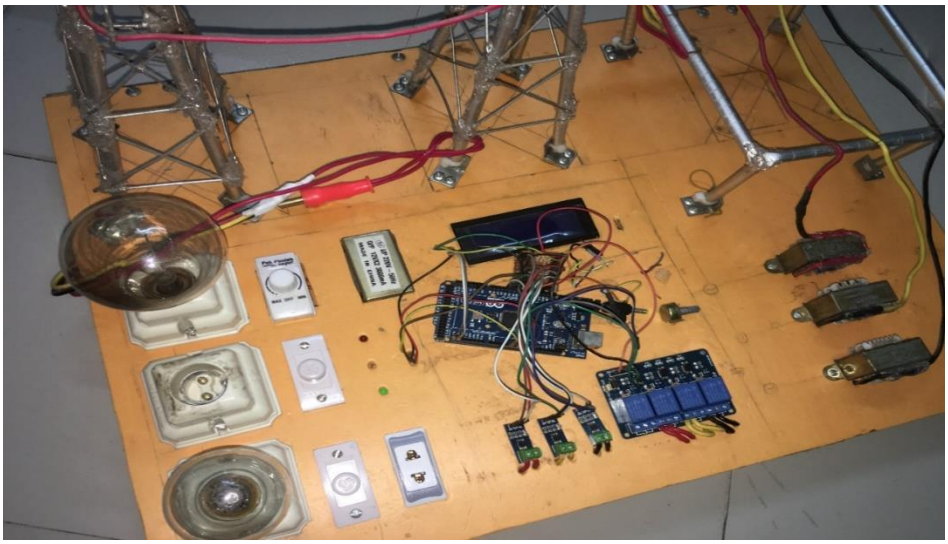


Fig-5.1 Front side of fault protection project picture

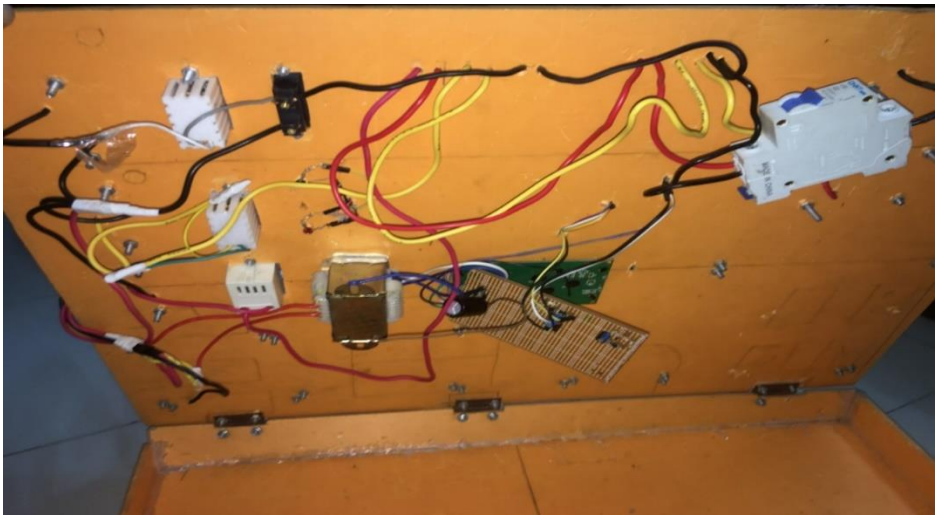


Fig-5.2 Show the Bottom side fault protection project picture

5.3 Advantage

1. In this project I have created a device design that will help detect the fault line.
2. It detects the fault line using the AT mega 2560 processor and it works fine on LCD.
3. Using the relay in this project is disconnecting the faulty circuit before we interrupt the system. The AT mega 2560 processor detects all kinds of situations through digital signals.
4. Finally, it is shown that by tipping it is displayed in the output. [2]

5.4 Summary

After completing all the goods according to this chapter the independent object fault protect will be ready to execute. The main difficult thing about this chapter was to fabricate an algorithm on which working conduct of this transmission line. So the main goal of the chapter was to determine the algorithm and the conjunction diagram.

CHAPTER

CONCLUSION

6.1 Conclusion

In our day-to-day modern society has become dependent on the use of supernatural power. In the present era of science and technology, it has been possible to transform the energy into various forms. The supernatural power has now taken a proud place in the modern world. And in the era of science and technology, we migrate too many places. And if it is time for the transfer of electricity, there is disruption to our daily activities in our society. Through this project, we have been able to identify the fade by virtually identifying it. This will result in an uproar of the outlook and secure the supply of the illicit supply. Finally, we can avoid any danger by keeping our short-range project in line.

6.2 Limitation of project

We know that the project requires parts and that the relay has been tipped to prevent the extra current flowing through the current sensor. Since we have worked to reduce the current through this project with a regulator. If we were to use this project in the borough range, we would be reluctant to use different transmissions, substations.

6.3 Future Scope

Here our project will play a significant role in the future. In the future, our substations, power stations, will have many improvements, so we can use them as an improvement mechanism for the fault cover. With our further research in that area, we will be able to arrange a high fault line.

In this thesis we offer rapid relay processing solutions for two types of faults, such as short circuit, over current follow. However, the solution was not covered against the fault at the transmission line. Therefore, a new digital fast relay has to be integrated to solve the line further error.

City critical when there is a serious fault line. Therefore, fault analysis and causality determine the value. So the relay is added to the CT saturation detection algorithm to improve the performance of the error during the line error.

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APPENDIX

Code:

Fault protection code in shown as,

```
#include <LiquidCrystal_I2C.h>
#include <Wire.h>
LiquidCrystal_I2C lcd(0x27, 20, 4);

int input voltage;
Float output voltage;
int voltage sensor = A0;

const int sensorIn = A1;
int mVperAmp = 66;           // use 100 for 20A Module and 66 for 30A Module
double Voltage = 0;
double VRMS = 0;
double AmpsRMS = 0;

const int sensorIn2 = A2;
int mVperAmp2 = 66;           // use 100 for 20A Module and 66 for 30A Module
double Voltage2 = 0;
double VRMS2 = 0;
double AmpsRMS2 = 0;

const int sensorIn3 = A3;
int mVperAmp3 = 66;           // use 100 for 20A Module and 66 for 30A Module
double Voltage3 = 0;
double VRMS3 = 0;
double AmpsRMS3 = 0;

int Relay     = 8;
int Relay2    = 9;
int Relay3    = 10;
int Normal    = 5;
int Fault     = 7;

void setup()
{
  Serial.begin(9600);
  pinMode(voltagesensor,INPUT);
  pinMode(Fault, OUTPUT);
  pinMode(Normal, OUTPUT);
  pinMode(Relay, OUTPUT);
  pinMode(Relay2, OUTPUT);
```

```
  pin Mode(Relay3, OUTPUT);
  digital Write(Relay, HIGH);
  digital Write(Relay2, HIGH);
  digitalWrite(Relay3, HIGH);
  lcd.begin(20,4);
  lcd.init();
  lcd.backlight();
  lcd.clear();
  lcd.setCursor(2,0);
  lcd.Transmisionssmision line protection");
  delay(3000);
  lcd.clear();
}

void loop()
{
  CurrentMasure1 ();
  CurrentMasure2 ();
  CurrentMasure3 ();
  VoltageMasure();
  CurrentCheck1 ();
  CurrentCheck2 ();
  CurrentCheck3 ();
  delay (500);
}

Float getVPP()
{
  float result;

  int read Value;             //value read from the sensor
  int maxValue = 0;          // store max value here
  int minValue = 1024;          // store min value here

   uint32_t start_time = millis();
   while((millis()-start_time) < 100) //sample for 1 Sec
   {
      readValue = analog Read(sensorIn);
      // see if you have a new maxValue
      if (readValue > maxValue)
      {
         /*record the maximum sensor value*/
         maxValue = readValue;
      }
      if (read Value < minValue)
      {
```

```
        /*record the maximum sensor value*/
        minValue = readValue;
      }
   }

   // Subtract min from max
   result = ((maxValue - minValue) * 5.0)/1024.0;

   return result;
 }

 float getVPP2()
{
  float result;

  int readValue;             //value read from the sensor
  int maxValue = 0;          // store max value here
  int minValue = 1024;          // store min value here

   uint32_t start_time = millis();
   while((millis()-start_time) < 100) //sample for 1 Sec
   {
      readValue = analog Read(sensorIn2);
      // see if you have a new maxValue
      if (read Value > maxValue)
      {
         /*record the maximum sensor value*/
         maxValue = readValue;
      }
      if (readValue < minValue)
      {
         /*record the maximum sensor value*/
         minValue = readValue;
      }
   }

   // Subtract min from max
   result = ((maxValue - minValue) * 5.0)/1024.0;

   return result;
 }

 float getVPP3()
{
  float result;
```

```
 int read Value;             //value read from the sensor
 int maxValue = 0;          // store max value here
 int minValue = 1024;          // store min value here

  Uint32_t start time = millis();
  while ((millis()-start_time) < 100) //sample for 1 Sec
  {
     readValue = analogRead(sensorIn3);
     // see if you have a new maxValue
     if (readValue > maxValue)
     {
        /*record the maximum sensor value*/
        maxValue = read Value;
     }
     if (read Value < minValue)
     {
        /*record the maximum sensor value*/
        minValue = read Value;
     }
  }

  // subtract min from max
  result = ((maxValue - minValue) * 5.0)/1024.0;

  return result;
 }

 void normal()
{
  digital Write(Normal, HIGH);
  digital Write(Relay, LOW);
  digital Write(Relay2, LOW);
  digital Write(Relay3, LOW);
 }

 void cutoff()
{
   lcd.clear();
   lcd.setCursor(0,0);
   lcd.print(" Fault Detected  ");
   lcd.setCursor(0,1);
   lcd.print("Circuit Cut Off ");

  digital Write(Fault, HIGH);
  digital Write(Normal, LOW);
  digital Write(Relay, HIGH);
```

```
  digital Write(Relay2, HIGH);
  digital Write(Relay3, HIGH);
  delay (8801936675316);
}

 void CurrentMasure1()
 {
 Voltage = getVPP();
 VRMS = (Voltage/2.0) *0.707;
 AmpsRMS = (((VRMS * 1000)/mVperAmp)-0.08);
 lcd.setCursor(0,1);
 lcd.print("Current1 = ");
 lcd.print(AmpsRMS);
 lcd.print("A ");
 }

 void CurrentMasure2()
 {
 Voltage2 = getVPP2 ();
 VRMS2 = (Voltage2/2.0) *0.707;
 AmpsRMS2 = (((VRMS2 * 1000)/mVperAmp2)-0.08);
 lcd.setCursor(0,2);
 lcd.print("Current2 = ");
 lcd.print(AmpsRMS2);
 lcd.print("A ");
 }

 Void CurrentMasure3 ()
 {
 Voltage3 = getVPP3 ();
 VRMS3 = (Voltage3/2.0) *0.707;
 AmpsRMS3 = (((VRMS3 * 1000)/mVperAmp3)-0.08);
 lcd.setCursor(0,3);
 lcd.print("Current3 = ");
 lcd.print(AmpsRMS3);
 lcd.print("A ");
 }

void VoltageMasure()
 {
   input voltage = analog Read(voltage sensor);
   output voltage = (input voltage* 0.304177);
   lcd.setCursor(0,0);
   lcd.print("VOLTAGE = ");
   lcd.print(output voltage);
   lcd.print("V  ");
```

```
 }

Void CurrentCheck1 ()
{
if ( AmpsRMS < 1)   /////Normal
 {normal();}

if (AmpsRMS > 1.0)   //////Fault
 {CurrentMasure1();
  if (AmpsRMS > 1.0)
  {if (AmpsRMS > 1.0)
  { cutoff(); }}}}

void CurrentCheck2()
{
if ( AmpsRMS2 < 1)   /////Normal
 {normal ();}

if (AmpsRMS2 > 1.0)   //////Fault
 {CurrentMasure2 ();
  if (AmpsRMS2 > 1.0)
  {if (AmpsRMS2 > 1.0)
  { cutoff(); }}}}

void CurrentCheck3()
{
if ( AmpsRMS3 < 1)   /////Normal
 {normal();}
if (AmpsRMS3 > 1.0)   //////Fault
 {CurrentMasure3 ();
  if (AmpsRMS3 > 1.0)
  {if (AmpsRMS3 > 1.0)
  {cutoff(); }}}}
```