Third International Conference on "Materials, Computing and Communication Technologies"
in association with International Journal of Scientific Research in Science,
Engineering and Technology
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)

Localization of Underground Cable Fault using Arduino and GSM

Kaneesh S, Pavithiravalavan T, Dharshan K, Ashvin S, Indraprasath D, Sanjay A, Alwyn F, Vyshnav M R, Dhilip R M, Thameemum Ansari

Department of Electrical and Electronics Engineering, SNS College of Technology, Coimbatore, Tamil Nadu, India

ABSTRACT

The project is intended to detect the location of fault in underground cable lines from the base station to exact location in kilometers using a microcontroller kit. In the urban areas, the electrical cable runs in undergrounds instead of overhead line Whenever the fault occurs in underground cable it is difficult to detect the exact location of the fault for process of repairing that cable. The proposed system finds the exact location of the fault. This system uses a microcontroller kit and rectified power supply. Here the circuit interfaced to microcontroller kit to help of the internal ADC device for providing Analog data to the microcontroller representing the cable length in meters. The fault creation is made by the set of connectors. An LCD display connected to the microcontroller to display the information. In case of open circuit, the ADC develops the digital data to a programmed micro controller kit that further displays exact fault location from base station in kilometers. Whenever a fault occurs in a cable the SMS will be sent to a particular number to take an immediate action by field workers.

Keywords— Underground Cables, Fault Detection, Exact Location, Microcontroller Kit

I. INTRODUCTION

The objective of this project is to determine the distance of underground cable fault from base station in kilo meters using an Arduino board. Generally, we use overhead lines. We can easily identify the faults but in rushed places or in cities we couldn't use overhead lines. So, we are moving to underground cables. Underground cables used largely in urban area instead of overhead lines. We can't easily identify the faults in the underground cables. This project deals with Arduino microcontroller. This project greatly reduces the time and operates effectively. The underground cabling system is a common practice followed in many urban areas. Many time faults occur due to construction works and other reasons. At that time, it is difficult to dig out cable due to fault on malfunction the exact location of the cable fault. Arduino microcontroller and LCD.

II. LITERATURE REVIEW

In an electric power system, a fault is detected by any abnormal electric current follow. For example, a short circuit is a fault in which current bypasses the normal load. An open-circuit fault occurs if a circuit is interrupted by some failure. In three-phase systems, a fault may involve one or more phases and ground, or may occur only between phases. In a "ground fault" or "earth fault", charge flows into the earth. The prospective short circuit current of a fault can be calculated for power systems. In power systems, protective devices detect fault conditions and operate circuit breakers and other devices to limit the loss of service due to a failure. Transmission lines connect the generating stations and load centers. Heavy short circuit current may cause damage to equipment or any other element of the power system due to over heating or flash over and high mechanical forces set up due to heavy current.

III. EXISTING SYSTEM

A. Introduction

In electrical utilities, transmission lines form the backbone of power systems. With regard to reliability and maintenance costs of power delivery, accurate fault location for transmission lines is of vital importance in restoring power services and reducing outage time as much as possible. Accurately locating faults on high voltage transmission networks is very important for utilities to allow a quick maintenance action of the repair crew Cable faults can be categorized into three main types: Open conductor faults, shorted faults, and high impedance faults. When the underground cable is used to distribution in the urban area, sometime fault occurs is an underground cable that time finding fault in the underground cable is so difficult. Using the microcontroller fault finding method is easily. This project Proposes to use fault location model for underground power cable using a microcontroller. The aim of the project is to determine the distance of underground cable fault from a substation in meters.

B. Block Diagram

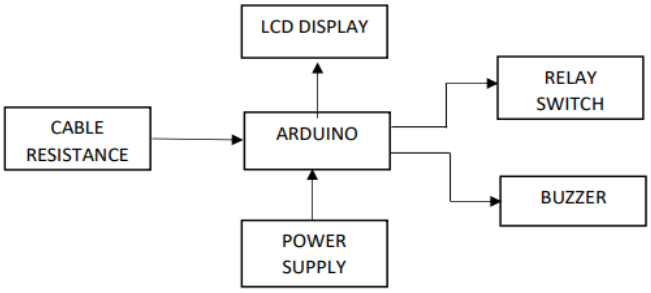

Fig No.3.1 Block diagram

C. Conclusion

The objective of this project is to determine the distance of underground cable fault from the base station in kilometers. This project proposed fault location model for underground power cable using a microcontroller. It uses the simple concept of ohm's law. When any fault like short circuit occurs, the voltage drop will vary depending on the length of fault in the cable, since the current varies. A set of resistors are therefore used to

represent the cable and a dc voltage is fed at one end and the fault is detected by detecting the change in voltage using an analog to voltage converter and a microcontroller is used to make the necessary calculations so that the fault Distance is displayed on the LCD display and send to mobile through SMS.

IV. PROPOSED SYSTEM

A. Introduction

This project is to determine the distance of underground cable fault from bas e station in kilo meters using an Arduino board. Generally, we use overhead lines. We can easily identify the faults but in rushed places or in cities we couldn't use overhead lines. So, we are moving to underground cables. Underground cables used largely in urban area instead of overhead lines. We can't easily identify the faults in the underground cables. This project deals with Arduino microcontroller and LCD. This proposes greatly reduces the time and operates effectively. The underground cabling system is a common practice followed in many urban areas. Many time faults occur due to construction works and other reasons. At that time, it is difficult to dig out cable due to not knowing the exact location of the cable fault.

B. Block Diagram

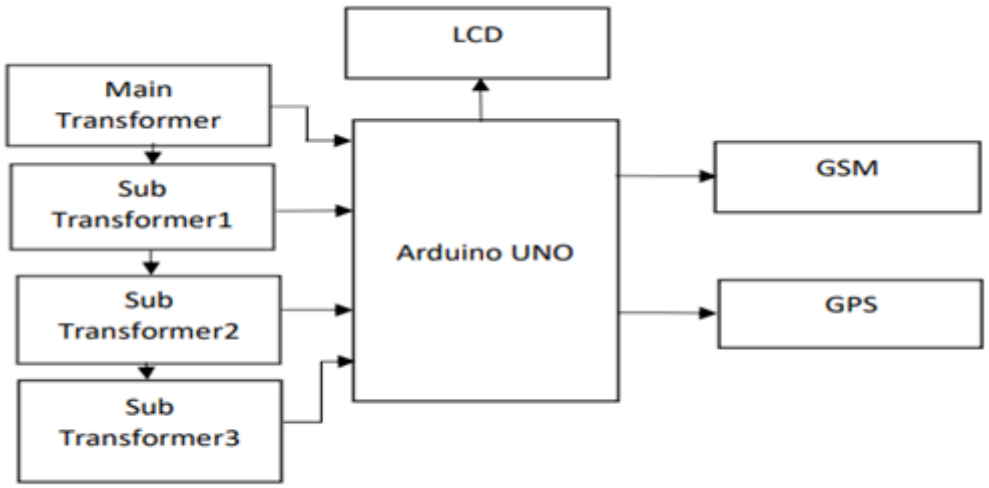

Fig. No 4.1 Block diagram of Exciting system

C. Power Supply

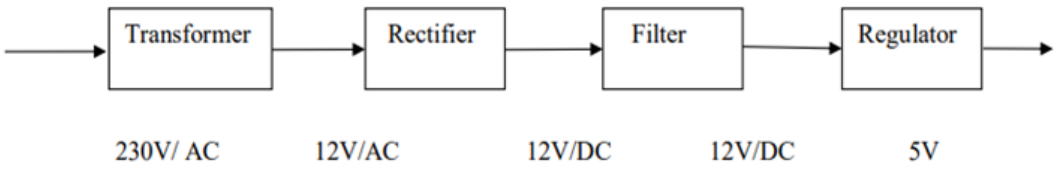

Fig 4.2 Power Section

Since all electronic circuits work only on low DC voltage, we need a power supply unit to provide the appropriate voltage. This unit consists of transformer, rectifier, filter and regulator. A.C voltage typically 230v RMS is connected to a transformer which steps that AC voltage down to the level to the desired AC voltage. A diode rectifier then provides a full wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting DC voltage usually has some ripple or AC voltage variations. Regulator circuit can use this DC input to DC voltage that not only has much less ripple voltage but also remains the same DC value even the DC voltage varies somewhat, or the load connected to the output DC voltage changes. The power supply unit is a source of constant DC supply voltage. The required DC supply is obtained from the variable AC supply after rectification, filtration and regulation by using transformer, rectifier, filter and fixed voltage regulator.

PROGRAMMING IN ARDUINO UNO

```
#include<LiquidCrystal.h>
LiquidCrystal lcd(12,11,5,4,3,2);
char a[60],lat[25],lon[25];
char j=0,i=0,jj=0;
int val=0;
unsigned int value1 = 0;
unsigned int value2 = 0;
unsigned int value3 = 0;
unsigned char aa=1,l1=0;
unsigned long ping();
char phone_no1[]="8248662156";
char phone_no2[]="9597930656";
void msg_send();
void gps_location();
void msg_send()
{
 Serial.println("AT");
delay(2000);
 Serial.println("AT+CMGF=1");
delay(2000);
Serial.print("AT+CMGS=\"");
Serial.print(phone_no1);
23
Serial.write(0x22);
Serial.write(0x0D); // hex equivalent of Carraige return
Serial.write(0x0A); // hex equivalent of newline
delay(2000);
```

```
gps_location();

if(l1 == 1)
{
Serial.print("L1 IN FAULT 10MT DISTANCE");
}
if(l1 == 2)
{
Serial.print("L2 IN FAULT 15MT DISTANCE");
}
if(l1 == 3)
{
Serial.print("L3 IN FAULT 20MT DISTANCE");
}

Serial.println (char(26));//the ASCII code of the ctrl+z is 26

// clear the string:
//inputString = "";
// stringComplete = false;
delay(10000);
Serial.println("AT");
delay(2000);
Serial.println("AT+CMGF=1");
delay(2000);
Serial.print("AT+CMGS=\"");
Serial.print(phone_no2);
Serial.write(0x22);
Serial.write(0x0D); // hex equivalent of Carraige return
Serial.write(0x0A); // hex equivalent of newline
delay(2000);
gps_location();
if(l1 == 1)
{
Serial.print("L1 IN FAULT 10MT DISTANCE");
}
if(l1 == 2)
{
Serial.print("L2 IN FAULT 15MT DISTANCE");
```

```
 }
 if(l1 == 3)
 {
 Serial.print("L3 IN FAULT 20MT DISTANCE");
 }
Serial.println (char(26));//the ASCII code of the ctrl+z is 26
 lcd.clear();

}
void setup()
{
 // put your setup code here, to run once:
 Serial.begin(9600);
 lcd.begin(16,2);
 lcd.setCursor(3,0);
 lcd.print("UNDERGROUND");
 lcd.setCursor(0,1);
 lcd.print("CABLE FAULT");
 delay(3000);
 lcd.clear();
}
void loop()
{
 // put your main code here, to run repeatedly:
 value1 = analogRead(A0);
 value2 = analogRead(A1);
 value3 =analogRead(A2);

 lcd.setCursor(0,0);
 lcd.print("L1:");
 lcd.setCursor(3,0);
 lcd.print(value1);
 lcd.setCursor(8,0);
 lcd.print("L2:");
 lcd.setCursor(11,0);
 lcd.print(value2);
 lcd.setCursor(0,1);
 lcd.print("L3:");
 lcd.setCursor(3,1);
```

```
lcd.print(value3);
delay(1000);
if(value1 < 1000 && value2 < 1000 && value3 < 1000)
{
lcd.setCursor(0,0);
lcd.print("L1 FAULT IN 10CM ");

l1=1;
if(aa){msg_send();}
delay(1000);
lcd.clear();

}
else if((value2 < 1000 && value3 < 1000)&&value1>1000 )
{
lcd.setCursor(0,0);
lcd.print("L2 FAULT IN 15CM ");

l1=2;
if(aa){msg_send();}
delay(1000);
lcd.clear();

}
else if(value3 < 1000&&(value2 > 1000 && value1 > 1000))
{
lcd.setCursor(0,0);
lcd.print("L3 FAULT IN 20CM ");
l1=3;
if(aa){msg_send();}
delay(1000);
lcd.clear();
}
else
{
lcd.setCursor(0,0);
lcd.print("L1:");
lcd.setCursor(3,0);
lcd.print(value1);
```

```
 lcd.setCursor(8,0);
 lcd.print("L2:");
 lcd.setCursor(11,0);
 lcd.print(value2);
 lcd.setCursor(0,1);
 lcd.print("L3:");
 lcd.setCursor(3,1);
 lcd.print(value3);
 // lcd.setCursor(0,0);
 // lcd.print("NO FAULT IN LINE");
 delay(100);
 aa = 1;
 l1=0;
 }
28
}
void serialEvent()
{
 while (Serial.available())
 {
 a[j] = Serial.read();
 if(a[0]!='$'){j=0;}
 else if((a[0]=='$') && (a[1]!='G')){j=1;}
 else if((a[0]=='$') && (a[1]=='G') && (a[2]!='P')){j=2;}
 else if((a[0]=='$') && (a[1]=='G') && (a[2]=='P') && (a[3]!='R')) {j=3;}
 else if((a[0]=='$') && (a[1]=='G') && (a[2]=='P') && (a[3]=='R') && (a[4]!='M')){j=4;}
 else if((a[0]=='$') && (a[1]=='G') && (a[2]=='P') && (a[3]=='R') && (a[4]=='M') &&(a[5]!='C'))
{j=5;}
 else if((a[0]=='$') && (a[1]=='G') && (a[2]=='P') && (a[3]=='R') && (a[4]=='M')
&&(a[5]=='C')){j++;if(j>49){jj=1;}}
 }
}
void gps_location()
{
 Serial.print("LAT:");
 for(i=20;i<=30;i++)
 {
 Serial.print(a[i]);
 delay(10);
```

```
}
Serial.println();
Serial.print("LONG:");
for(i=32;i<=43;i++)
{
Serial.print(a[i]);
delay(10);
}
```

V. PICTORIAL VIEW

Fig No.5.1 Arduino uno

Fig .No 5.2 GSM Module

Fig .No 5.3 GPS

Fig .No 5.4 LCD Display

Fig .No 5.5 Over all kit view

VI. CONCLUSION AND FUTURE WORKS

The main function of the electrical transmission and distribution systems is to transport electrical energy from the generation unit to the customers. Generally, when fault occurs on transmission lines, detecting fault is necessary for power system in order to clear fault before it increases the damage to the power system. Although the underground cable system provides higher reliability than the overhead line system, it is hard to seek out the fault location. The demand for reliable service has led to the development of technique of locating faults. In this equipment detect only the location of open circuit fault in underground cable line. For future research, proceed with similar neutral networks structure for short circuit fault section and earth fault location estimation.

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