May-June 2020
ISSN: 0193-4120 Page No. 3924-3928

IOT Based Cable Fault Detector

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Article Info
Volume 83
Page Number: 3924-3928
Publication Issue:
May-June 2020

Article History
Article Received:*19 November 2019*
Revised: *27 January 2020*
Accepted: *24 February 2020*
Publication: *12 May 2020*

Abstract

The motive of the project is to find the distance of the cables which are underground or behind the walls from a particular main station and present it over the internet. The cables which are located under the ground are susceptible to wide alterability of faults by virtue of subversive environment, abrasion, rodents and many other types of reasons. Identifying the fault and getting it fixed is problematic work to do because the full cable is under the ground so we have to dig the ground and have to take the cable out of that particular ground or wall to inspect and affix the faults in the cable. The project is supposed to sense the site of the fault at the particular position in the cable lines which are underground and far from the main station in km. This is done by using the ATMEGA8 controller. To site a problem in any particular wire or cables, the wire should be examined against the fault. This model utilizes an easy theory of Ohm's law. There should be a fluctuating current relying on the extent of fault of the underground cable.

Keywords: *Cable Fault Detector, Fault distant finder, IOT.*

1. Introduction

Power providing grids are rising immensely and their dependability is now more significant than ever. The complications of the full network contain variety of components which may crash and disturb the power supply for the one who uses it. In almost the whole world the supply of the power is driven at low voltage and medium voltage distribution wired lines, we are using the underground cables from past many years. High voltage underground wires are consumed at many places because these are not affected by the climatic circumstances, immense raining, thunderstorm, snowfall and pollution. In spite of the very fact that the technologies used in cables that are producing power are rapidly improving and getting updated day by day; there are still some possibilities that these cables can have any type of fault in them which can stop them from operating normally. A cable in normal working condition that is operated at low voltage and medium voltage supply lines, can be easily broken into the condition where it won't be working normally, this situation can be caused by either inappropriate fixing or poorly implemented joints, or because of the successive harm caused by any outside work such as construction works like pit or barrier borders.

2. Faults

1. Open Circuited Faults

The open circuited fault in any wire occurs whenever there is a disruption inside conductor of the wire. This type of electric cable failure can be verified by the Megger, which is an equipment that used for calculating the resistance of the insulation. In this, the 3 conductors of the tripple-core cable on the farthest ends are being shorted and earthing is done.

2. Short Circuited Faults

Whenever there is an electrical connection between any pair of conductors of a multiple-core wire with one another as a result of the insulation failure, it is known as short circuited faults. Any two conductors are then connected with the both end terminals of the megger. If there is zero reading in the megger, there will be short circuited fault among those two conductors. The same procedure can be reiterated for different conductors or cables taking multiple at a time.

3. Earth Fault

The earthing faults will happen whenever the cable's conductor will be in touch with the earth. This can also be

May-June 2020
ISSN: 0193-4120 Page No. 3924-3928

termed as ground faults or earthing. To detect the earthing faults at any place, we will make any one end of the megger in contact with the conductor while the second end will be in contact with earth. If there is null reading in the megger, it shows that the conductor is earthed or there is earthing. These same steps can be reiterated with other conductors also.

So, with the help of this project we will be identifying the faults at any particular location in the cable in a digital way. By doing this we will be able to locate the position of the faults inside the cables which are present under the ground very effectively and we can repair then quickly and thereby reducing the outage periods. This will also improvise the reliability of the system.

3. Existing Systems

Murray Loop Method

The Murray Loop method is an easy and fundamental approach to test and locate the fault in the cable. This type of technique uses simplified instruments that can be collected with ease. To perform this type of test, the underground cables should be either short-circuited or it should be having an earth fault. In such tests the results obtained are not affected by the resistance of the fault but only when the fault in the resistance is its peak. The Murray Loop test and the Varley Loop test are the types of loop tests which are used frequently. The main principle behind this test is the Wheat Stone bridge.

In this test, to trace the faults in the underground cable, we will make one Wheatstone bridge in it and then we will compare the resistance, by doing this we shall locate the faulty underground cable position correctly. In this experiment we will only be using the cables of known length instead of any unknown length. The necessary connection of the Murray Loop test is shown in figure 1 and figure 2.

The figure 1 here is showing the connections in the circuit for locating the faulty position whenever there is a ground fault in the cable and the figure 2 here displays the circuit block diagram of connections for locating the faulty position in the underground cables.

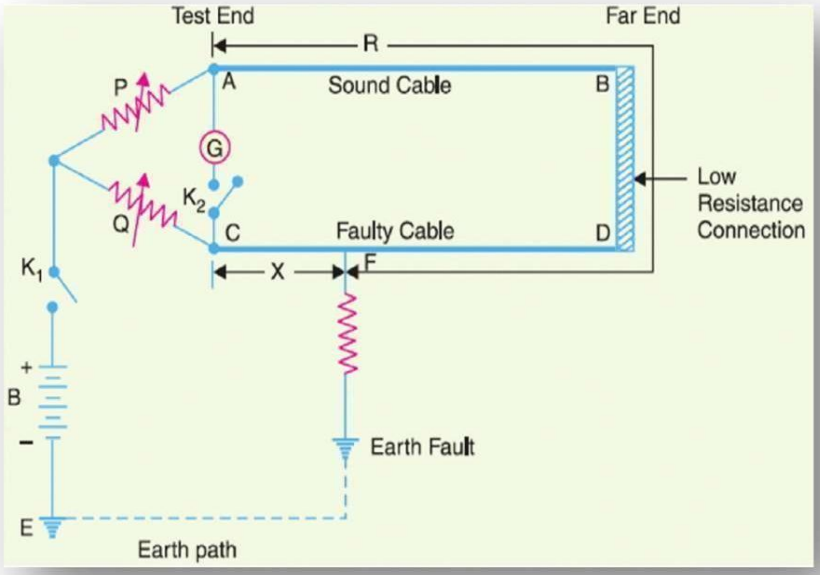

Figure 1: Circuit Connection of Murray Loop test for ground fault.

In above figure 1, we can see that the fault cables are in contact with the sound cables through a low resistance wires, as we can derive that the resistance must not have any impact on the overall cable's resistance, and it is ready to surge within the loop current into the bridge circuit while there is no kind of loss in that. The inconstant resistors P and Q are making the magnitude relation hands. By adapting the inconstant resistors, we can obtain the balance of the Bridge. The galvanometer 'G' will indicate the balance. The final loop resistance [R+X] is the summation of the sound cable and the cable which is having a fault. At the time of balanced situation:

$$\frac{P}{Q} = \frac{R}{X} \gg \frac{P+Q}{Q} = \frac{R+X}{X}$$

$$X = \frac{Q}{P+Q}(R+X)$$

The resistances of the conductors are directly related to their length whenever the cross-sectional region of the

May-June 2020
ISSN: 0193-4120 Page No. 3924-3928

both sound and the flawed cables are same.

So let us say, the length separating the tests finishing to the faults end of the flawed cable is depicted as 'LX'. The overall length of every wire is represented by L, then the formula for 'LX' can be defined as follows:

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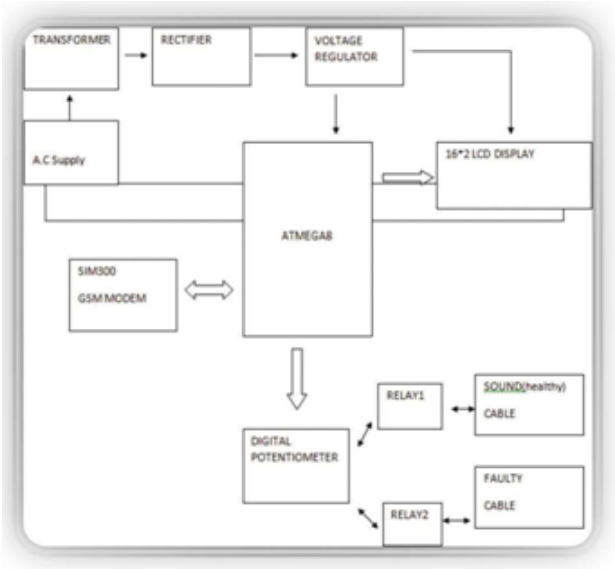

Figure 2: Block Diagram of Murray Loop test

4. Ohms Law Method

In this type of methodology we simply use the Ohms law for locating the short-circuited faults in the cable. At the feeder terminal we will apply a DC voltage through a resistor which is connected in series, the current will vary according to the length of the faults in the cable.

Hence there will be a voltage drop around the whole resistor connected in series; so, from this drop in the voltage we can find the location of the occurrence of the fault.

Ohms law technique is complied with a group of resistors depicting the length of the cable in kilo-meters and the faults are created by a group of switches at every possible kilo-meter to counter check the precision of the same. The drop in the voltage which was examined around the feeder resistor is now delivered to an ADC which will be preparing a specific digitalized data. This is the same data which the programmed microcontroller has displayed in Kilometers, the data is converting into a digital form. An LCD screen of size 16x2 which is in connection with the microcontroller will indicate the distance of the occurrence of the fault at the particular position and in which particular phase. We will be using ATMega8 microcontroller, this size of which is 8-bits.

The program is incinerated into ROM of microcontroller which is either written in assembly language or in Embedded C. A step down transformer of 230/12V is used in the supply of power, whose work is to step down the voltage of the system to 12V AC. Then we will be using a Bridge rectifier to convert the AC to DC. Capacitive filters are used in order to remove the ripples and then a voltage regulator 7805 is used to govern it to +5V, this is required for operating the microcontroller and other various types of components.

5. Proposed System

Internet of things (IOT)

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The projected model is an IoT enabled underground cable error detection system. The essential logic for the project is Ohms Law. Once there is any type of errors happens within the wire, the voltage of the system fluctuates that is employed to locate and estimate the distance at which the fault occurred. The model comprises of WiFi module, Micro- controller, and a period timer. The facility provided is supplied with a step-down transformer, many numbers of rectifiers and regulators.

Extent of free fall throughout the resistors is provided by the current sensing network of the wire. This is then transferred to the microcontroller and then the exact location of the fault is found in the underground cable without digging the whole ground.

May-June 2020
ISSN: 0193-4120 Page No. 3924-3928

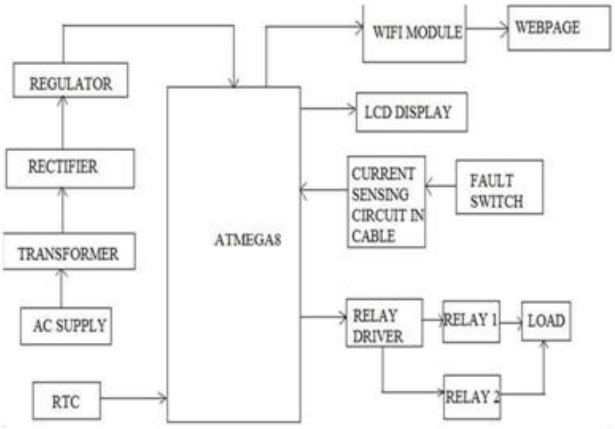
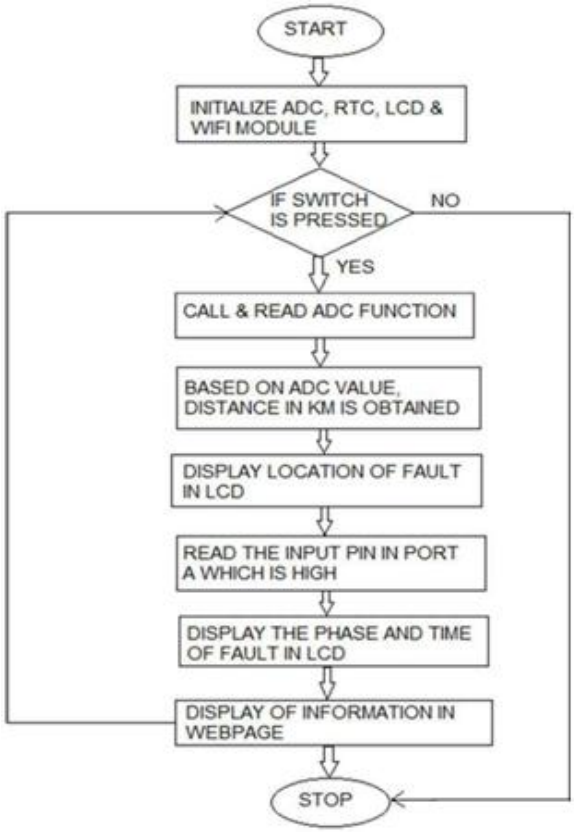


Figure 3: Proposed System



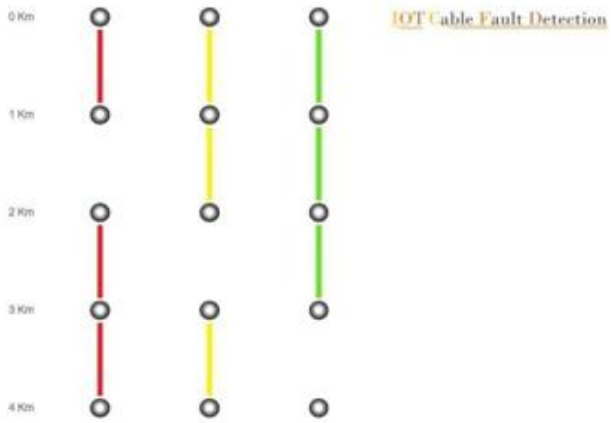
Flow Chart for the System

Table 1: Mapping Table for Fault Identification

S.No.	Switch	Analog	Fault	ADC
1.	SW 1	3.33 V	1 km	682
2.	SW 2	3.99 V	2 km	818
3.	SW 3	4.28 V	4 km	876
4	SW 4	4.4 V	8 km	909

Displaying using IOT

We then use the LAN module to attach the microcontroller to cyber web so show the output from the microcontroller on-line on AN webpage designed victimization IoTgecko. IoTgecko may be a free platform for IoT implementation and it's accustomed produce the webpage for connecting and displaying the ultimate output. this is often a awfully necessary half as a result of this permits real time watching of the transmission grid. we tend to produce an internet page victimization hypertext mark-up language CSS and JS at the side of all the built-in packages of IOTgecko that permits swish transition of information from the Microcontroller to the web site through the LAN Module.



6. Applications

Online Supervision of Energy Network

As the number of infrastructures and square measure are coated with energy cable models, the quantity and intensity of energy breakage is becoming a severe concern in the responsibility of the lower system .These responsibility are very crucial because it results in some severe adverse consequences on public health and economical model of any system. Incorporation of IoT related technologies in conjunction with the ability network, focus to boost the responsibility of energy network through a nonstop supervision of the status of the transmission lines; additionally to, sense the change in the behavior of the underground environment and activities' of the shoppers in order to send the reports time to time to the network management units. The unit management team access and extract the necessary details from the information that they have received in order to discover the fault, segregate the fault, and then finally tackle the faulty locations by performing several energy restoration methods in order to retain the good network and also take care of the particular fault and prevent the blackout in future due to the same fault. Therefore, online inspection of the cables is very much important in order to discover the faults as soon as possible and resolving it.

Management of Energy at Demand Side

Demand Side Energy Management (DSM) is that modification within shoppers electricity intake outlines in

May-June 2020
ISSN: 0193-4120 Page No. 3924-3928

keeping with variable electricity value over a particular periods, and different incentive of payments from convenience firms. Demand feedback is employed to reduce electricity bill of the consumer, load at the time of peak hours of the shift, minimization of usage price of the ability network, and mitigate the loss in the energy power and emissions of different greenhouse gases. The work of Internet of Things is to accumulate the necessities of the power consumed by the various domestic devices and sending the details to good measures.

Incorporation of wide variety of Energy Resources

Sustainable energy assets square measure are installed into today's facility due to ecological cause, altered temperature, and availability in less price. By the usage of sustainable energy resources we can lower the discharges of the greenhouse gases that results in the alteration of the temperature from low to high. Due to less energy resources the local houses, Government buildings, and many different organizations have started to induct the solar panel cells, and wind-mills in order to fulfill their basic necessary energy usage.

7. Conclusion

Any type of fault at a specific location and range within the cable present under the ground can be found to resolve the faulty lines by expeditiously following the straightforward ideas of Ohms law. The model shows the specific location and range and time at which the incidence of fault in the cable has occurred with the assistance of ATMEGA8 and WIFI module, the location and range will be displayed on a webpage. The advantage of this model is to find the accurate position of the fault inside the cable as soon as the fault occurred, this will help to resolve the problem as soon as possible without having any kind of loss in the power. This will improve the efficiency of the power, it's consumption and utilization. It has an edge over previous methods to find the faults because of the time it takes to find the fault and less loss in the power consumption.

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