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FAULT LOCATION DETECTOR ON UNDERGROUND CABLES UNDER NATIONAL GRID SYSTEM

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ABSTRACT

This project is focused on determining the location of the UG fault and also to denote the type of fault, from the base station measured in kilometers, using OHMS LAW. On the occurrence of the short circuit fault, voltage drop varies in relative to the length of the cable, so as the current varies. The representation of the cable is by a using set of resistors .One end of the cable is fed by a DC voltage. By observing the variation in voltage detected using a ADC converter, the fault is ascertained. The calculations are processed in Arduino as it displays the distance of the fault in LCD. So this project is implemented for the relaxation of the human efforts in UG lines maintenance.

KEYWORDS: OHMS LAW, short circuit fault, ADC converter, Arduino, LCD, UG lines.

I. INTRODUCTION

Earlier, only overhead cables are laid. But at present underground cables are setting up. This method is far superior than the initial method as these underground cables don't get upset by any unfavorable weather conditions likely pollution, rain, snow, tornado. Despite of this lead, these cables are in difficulty to locate the occurrence of the fault. As the world is getting digitalized, the intension of this project is detecting the fault in a digital manner. Thus it is implemented in most urban areas.

Transmission and distribution of electric power in areas where there is no chance in laying overhead lines, these underground cables system is being followed. As a result of modern advancement in design and construction, the cables are developed which suits for usage at high voltages. The only drawback is that the high initial cost that impacts in the usage of UG cables for transmission and distribution purposes. Mechanical deliberation and the operating voltage are the two factors that determine the type of the cable to be used. Cable laying methods, spacing, number of cores and thermal conductivity of the soil determines the current rating of the cables. In India, the ground temperature of about 30 degree Celsius is applied to most of the places.

The failure in cables is mostly lies in the sealing box because of substandard workmanship at the time of sealing the end. During installations in industries, the mechanical damage of the lead sheathing of the cable sets an another cause of failure. In some cases damages to the cables can be caused by vibration fatigue or overheating.

II. METHODOLOGY

Fault detecting methods are of two types: **ONLINE method** and **OFFLINE method**.

a) Online method:

Sampled voltages and current are used and processed to detect the fault points. This method for UG cables are inferior to the overhead cables.

b) Offline method:

In the field distinct instrument is utilized for testing the service of cable. This method is of two types: **TRACER method** and **TERMINAL method.**

In the first method, fault detection can be done by walking on the lines. In such the electromagnetic signal or the audible signal detects the fault location.

In the latter method, faults can be detected by no tracking method from both ends of the cable. On buried cables this method is used.

Hence to find the appropriate location of the fault ***Murray loop bridge test*** and ***Varley loop test*** is analysed here.

Murray loop bridge test:

Wheatstone bridge principle is employed in this test for detecting the location of the fault. This test is carried out by placing a sound cable along the faulty cable mandatorily. The voltage source is connected to one end of the faulty cable via a pair of resistors. A connection of null detector is also made. The other end is shorted. The circuit of the murray bridge is shown out in figur 1.

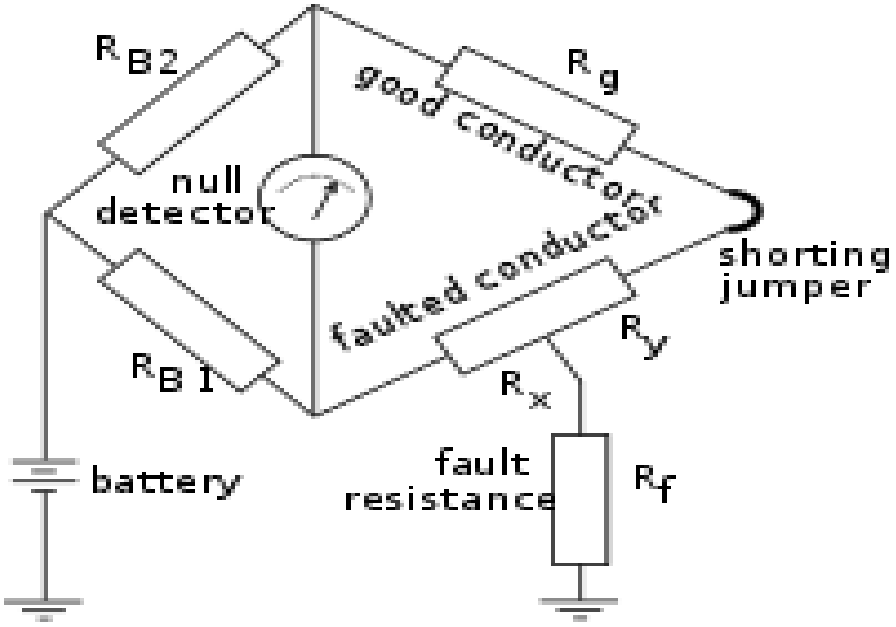

Figure-1: Murray loop

By altering the R_{B1} and R_{B2} values the bridge is brought into balance. Then by applying the bridge equation the distance of the location of the fault can be calculated.

The bridge equation is:

$$R_x = (R_g + R_y) * (R_{B1}/R_{B2})$$

The unknown resistance R_x value is directly proportional to the length L_x, where L_x is the distance of the fault location. Therefore the equation becomes,

$$L_x = 2 * L \{R_{B1}/(R_{B1} + R_{B2})\}$$

In which L = Entire length of the cable.

Similarly for the varley loop test fixed resistors for R_{B1} and R_{B2} are employed. A connection of variable resistor to the faulted leg is made. Sensitivity impacts on the usage of murray loop test as the fault resistance becomes high. Thus in those conditions varley loop test is favorable.

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III. CIRCUIT DIAGRAM AND IMPLEMENTATION

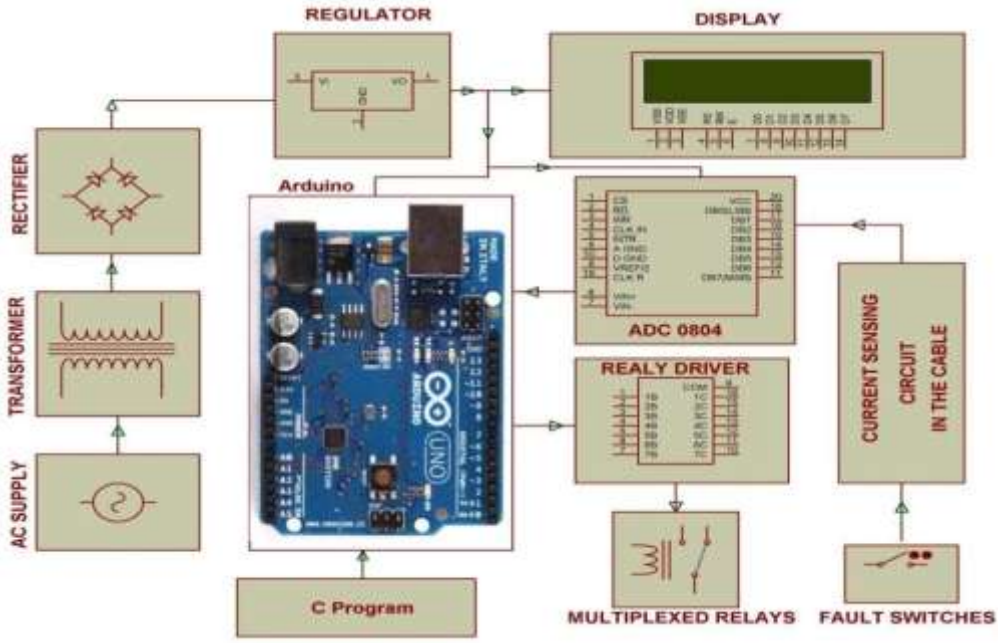

Figure-1: Block diagram

ATmega328 (Arduino Nano 3x) or **ATmega168** (Arduino Nano 2x) is used. 5V regulated power supply can be given externally to power the Arduino. Also it can be powered via the Mini-B USB connection. A highest voltage source is automatically selected. For the Dc supply , AC supply of 230V is stepped down through the transformer. This stepped down AC voltage is then converted to DC signal by bridge rectifier. And thus constant DC voltage is produced by the regulator.

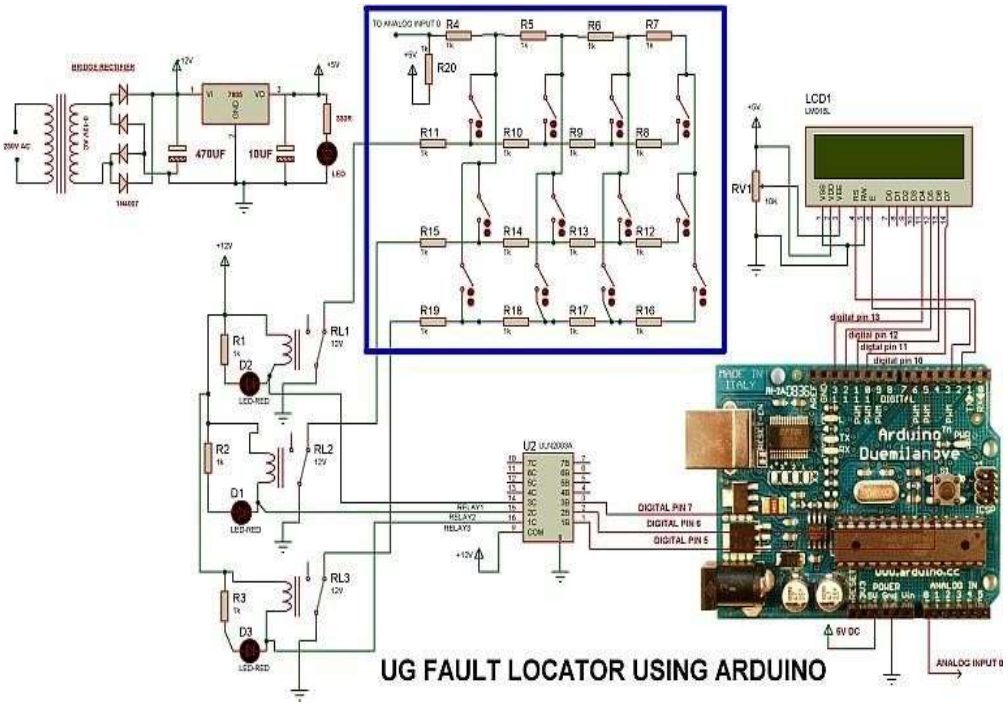

Figure-3: Circuit Diagram

ADC converter receives input voltage and converts them into digital signal. The microcontroller is then fed by this digital signal. The controller is employed for the necessary calculations concerning the fault distance. It also plays a role in driving relays. This in turn, for the proper correction controls the switching of the relays to the respective cables at each phase. This collectively forms the controlling part. An interfacing of LCD is made with microcontroller. At the time of occurrence of the fault, the cables in each phase whose status and in specific phase its distance, can be displayed in LCD.

IV. RESULTS AND DISCUSSION

The result of the short circuit fault can be observed below in accordance with the changing resistance. By operating the switch this can be attained.

a) Under no fault condition:

Figure-4: No fault condition

When no fault condition there will be no switch closed. So LCD shows there is a no fault.

b) Under R phase short circuit condition:

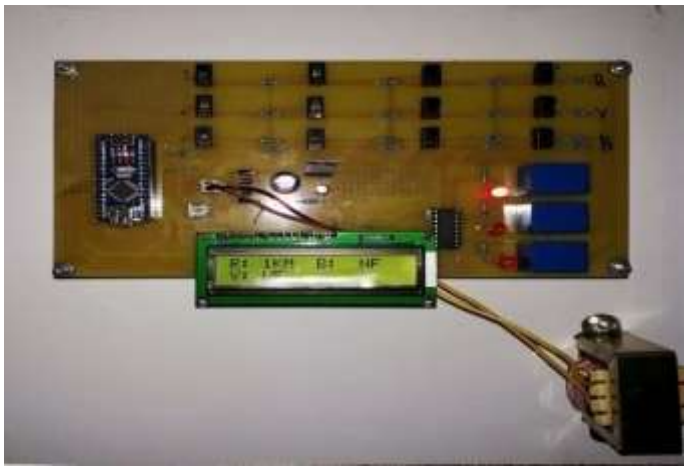

Figure-5: R phase short circuit condition

When fault occur on the R phase, the Arduino will sense the fault and it will calculate and display on LCD.

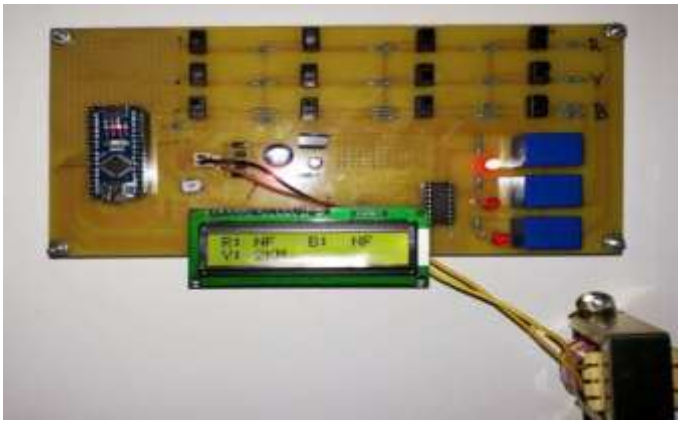

Figure-6: Y phase short circuit condition

c) Under Y phase short circuit condition

When fault occur on the Y phase, the Arduino will sense the fault and it will calculate and display on LCD.

d) Under B phase short circuit condition:

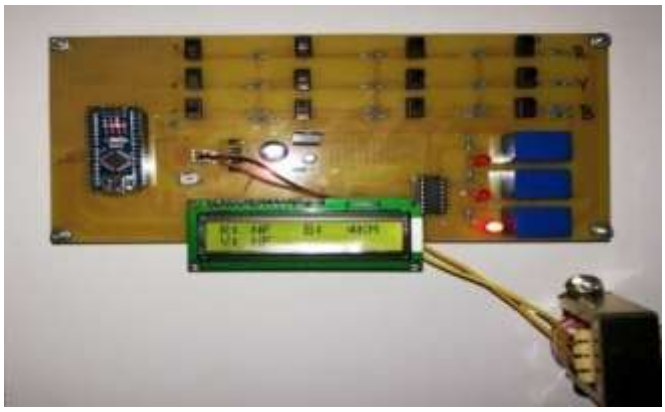

Figure-7: B phase short circuit condition

When fault occur on the B phase, the Arduino will sense the fault and it will calculate and display on LCD.

Table-1: Results of Hardware Implementation

Phase	Switch Closed	Line Resistance In Kilo Ohm	Fault Location In Km	Lcd Display
R	NO	0	0	NO FAULT
Y	NO	0	0	NO FAULT
B	NO	0	0	NO FAULT
R	1	1	1	1 KM
Y	1	1	1	1 KM

B	1	1	1	1 KM
R	2	2	2	2 KM
Y	2	2	2	2 KM
B	2	2	2	2 KM
R	3	3	3	3 KM
Y	3	3	3	3 KM
B	3	3	3	3 KM
R	4	4	4	4 KM
Y	4	4	4	4 KM
B	4	4	4	4 KM

From the results above it is seen clearly that the capability of the working of the project. The LCD displays the absolute location of the fault occurs and also the phases affected in the cables, at the time of occurrence of the fault in the cables.

V. CONCLUSION AND FUTURE SCOPE

The analysis of the locating the distance of the short circuit faults occurring in the underground cables by using the convenient method OHMS LAW has been done. From preventing the severe damage to the underground cables an instant indication about the fault must be demanded and proper methods for the location of the faults. In future it can also be developed for open circuit faults in which the capacitor is used in AC circuit. For measuring the impedance change and for calculating the fault distance it can be used. Hence this is a basic model prototype for UG fault detector as it can be useful for the detection and correction purpose of the faults in future.

VI. REFERENCES

[1] Mirza,G.R., Maheshwari, A.K., Mahar, M.A., Larik, A.S., &Talpur, G. H. (2017). Style and fabrication of underground fault distance surveyor exploitation using arduino and GSM. 2017 International Conference on Open Source Systems & Technologies (ICOSST).doi:10.1109/icosst.2017.8279001

[2] B. Clegg, Underground Cable Fault Location. New York: McGraw- Hill, 1993.

[3] M.-S. Choi, D.-S. Lee, and X. Yang, “A line to ground fault location algorithmic rule for underground cable system,” KIEE Trans. Power Eng., pp. 267–273, Jun. 2005.

[4] E.C.Bascom, “Computerized underground cable fault location experience, ”in Proc. IEEE Power Eng. Soc.General Meeting, Apr. 10–15,1994, pp. 376–382.J. Clerk Maxwell, A written material on Electricity and Magnetism, 3rded., vol. 2. Oxford: Clarendon, 1892, pp.68–73.

[5] Z.Xu and T. S. Sidhu, “Detection of inchoate faults in distribution underground cables”, IEEE Trans. Power Del., vol. 25, no. 3, pp. 1363–1371, Jul. 2010.

[6] Md. Fakhrul Islam, Amanullah M T Oo, Salahuddin. A.Azad1 ,“Locating Underground Cable Faults: A Review and Guideline for brand spanking New Development” ,2013 IEEE.

[7] http://www.scribd.com

[8] http://www.idc-online.com

[9] http://ecmweb.com/content/locating-underground cable-fault