Modification of Murray Loop Test for UG Cables Using Microcontroller and GSM

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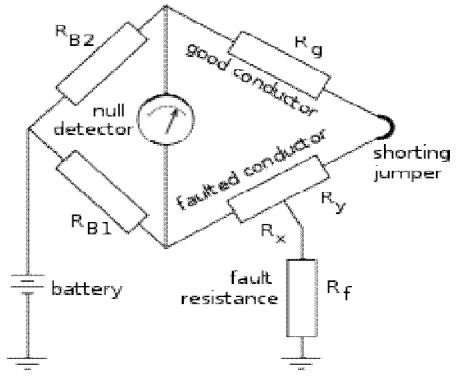
Abstract- *The main function of the electrical transmission and distribution systems is to transport electrical energy from the generation unit to the customers. Generally, when fault occurs on transmission lines, detecting fault is necessary for power system in order to clear fault before it increases the damage to the power system. The demand for reliable service has led to the development of technique of locating faults. The objective of this project is to determine the distance of underground cable fault from the base station in kilometers. Underground cable system is a common practice followed in major urban areas. While a fault occurs for some reason, at that time the repairing process related to that particular cable is difficult due to exact unknown location of the fault in the cable. Proposed system is used to find out the exact location of the fault and to send an SMS with details to a remote mobile phone using GSM module.*

Keywords- LCD 16*2 display, Atmega 328 microcontroller, MCP 4131, relay, GSM module, resistances

I. INTRODUCTION

The objective of this project is to determine the distance of underground cable fault from the base station in kilometers. Underground cable system is a common practice followed in major urban areas. While a fault occurs for some reason, at that time the repairing process related to that particular cable is difficult due to exact unknown location of the fault in the cable. Proposed system is used to find out the exact location of the fault and to send an SMS with details to a remote mobile phone using GSM module.

The project uses the standard theory of Murray's loop :



Murray loop bridge is a bridge circuit used for locating faults in underground or underwater cables.It has been used for more than 100 years.

One end of the faulted cable is connected through a pair of resistors to the voltage source. Also a null detector is connected. The other end of the cable is shorted. The bridge is brought to balance by changing the values of R_{B1} and R_{B2}, which is achieved when:

$$\frac{R_x}{R_g + R_y} = \frac{R_{B1}}{R_{B2}}$$

which is equivalent to:

$$R_x = (R_g + R_y).\frac{R_{B1}}{R_{B2}}$$

The value of resistance R_x is proportional the length L_x, thus the location of the fault can be calculated:

$$L_x = 2L\frac{R_{B1}}{R_{B1} + R_{B2}}$$

where L is the total length of the cable under test - a value proportional to R_g.

The method assumes a single fault exists, of low resistance compared with the undamaged cable insulation resistance, and that the cable conductors have uniform resistance per unit length.

Though Murray's method shows accurate results it has lot of manual work such as varying resistances R_{B1} and R_{B2} till the null point is achieved .Once the null point is achieved we need to measure values of R_{B1} and R_{B2} to calculate location of fault point.

In our Project we are making a everything automatic ,such as:

1. Disconnecting cable from it's network when fault occurs and connecting it to our fault detecting system.
2. Varying resistances R_{B1} and R_{B2} by digital potentiometer using SPI communication protocol with microcontroller till the null point is achieved.
3. Scanning for voltage to detect null point.

4. Once the null point is Achieved ,calculating fault distance and informing user by SMS using GSM modem.

The fault occurring at a particular distance, the respective phase along with the distance is displayed on the LCD. The same information is also sent to the concerned authority mobile phone over GSM, interfaced to the microcontroller.

The currently used Analog kit based on Murray's loop looks like this :

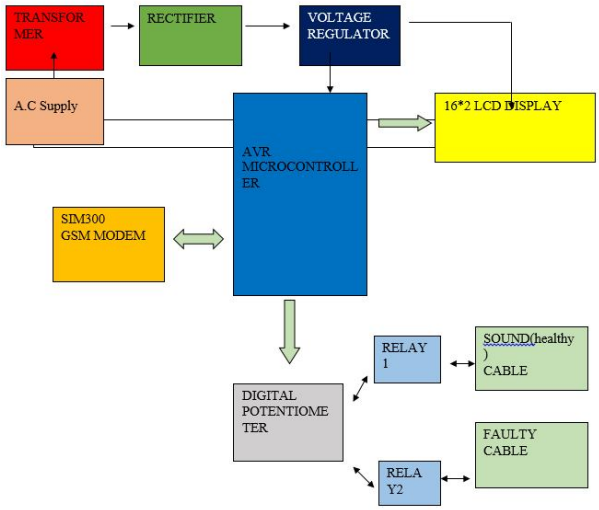
We are making it totally digital by using AVR microcontroller, MCP4131 digital potentiometer and it's supporting circuitry.

Furthermore, this project can be enhanced by using capacitor in an AC circuit to measure the impedance which can even locate the open circuited cable, unlike the short circuited fault that uses only resistors in DC circuit as followed in the above proposed project.

II. WORKING PRINCIPLE

It works on the principle of murrays loop method and wheat stone bridge. When fault detecting instruments detect L-G fault then the circuit balance the bridge using digital potentiometer and microcontroller which saves lot of time in fault location determination system in underground power transmission system and display the distance of fault point on LCD display and send the distance to the operator situated at remote location in control room using GSM module

III. BLOCK DIAGRAM



IV. CONCLUSION

Hence we have done the modification over the traditional murray's loop method for underground detection of fault occurred in power cables by using digital potentiometer-MCP4131 and microcontroller ATMEGA328, it helps to enhance and improve the efficiency and fault clearing speed of underground power transmission system.

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