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IOT Based Distance Calculation for Underground Cable Fault

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ABSTRACT:
The main aim of this paper is to determine the distance of fault that occurs in the underground cable from the base station in kilometres and also send this information to the server. This prototype is based on the concept of Ohm's law, i.e., when a low dc voltage is applied at the feeder end through a series resistor which represents the cable lines, then current would vary depending upon the location of the fault in the cable. When short circuit occurs, the voltage across the series resistors changes accordingly which the programmed microcontroller (At mega AVR 16) would display in kilometres. The prototype consists of a set of resistors which represents the cable length in kilometres and fault is created by a set of switches which are located at a distance of every 1KM (assumed),i.e., when the switch is off then it means a fault exists in the cable and when the switch is on it means there is no fault . The fault occurring at a particular distance due to turning off the switch will be displayed on the LCD which is interfaced to the microcontroller and sent to the server by the GSM Modem.

KEYWORDS:- Cable faults, voltage breakdown, prototype, short circuit, GSM Modem

1. INTRODUCTION:

Until last decades, cables were laid overhead but in the present era cables are laid underground as it is a superior method than the previous method. The reason for this is that the underground cables are unaffected by any adverse weather conditions such as heavy rainfall or storm or snow. Add to it, the maintenance and operating costs of overhead lines is more as compared to underground cables and the factors to improve public safety and quality of life are only forcing the authorities to realize the fact that converting overhead cable lines to underground cables is the only possible way to provide high quality service to the customers.

Cable faults can cause damage to the cables thus affecting its resistance. This can lead to voltage breakdown if it is allowed to persist. Whenever a fault occurs due to any reason, at that time to detect and repair the fault is difficult since we do not know the exact location of the fault.

Undergrounding the cable will also provide benefits to the utility companies by reducing operations and maintenance (O&M) costs, avoiding cutting of trees, less damage which is caused by storms to the overhead cables. Thus underground cable system is very important for distribution in urban areas, airports and defence service.

2. PROCESS:

Here, a simple concept of OHMs law is used where a low DC voltage is applied at the feeder end with a help of series resistors. The prototype consists of a set of resistors which represents the cable length in kilometres and fault is created by a set of switches which are placed in every 1KM (assumed).The fault occurs in the cable when the switch is turned off and when the switch is on then it means that there is no fault in the cable. The voltage drop which occurs across the feeder resistor due to turning off the switch is given to the ADC which is in-built inside AVR ATmega16 microcontroller and the ADC produces accurate digital data and the programmed microcontroller would display that data in Kilometres. The fault which occurs at a particular distance is then displayed on the LCD which is interfaced to the microcontroller. The microcontroller used here is AVR ATmega16. The programming of the microcontroller is done in Embedded C. The power supply circuit consists of a step down transformer

which steps down 220V AC voltage to required 12V AC voltage. Then the bridge rectifier converts the corresponding AC voltage into DC voltage. The capacitor filter is used here to remove the ripples and a voltage regulator 7805 is used to regulate the DC voltage to +5V for the proper functioning of the microcontroller and other components.

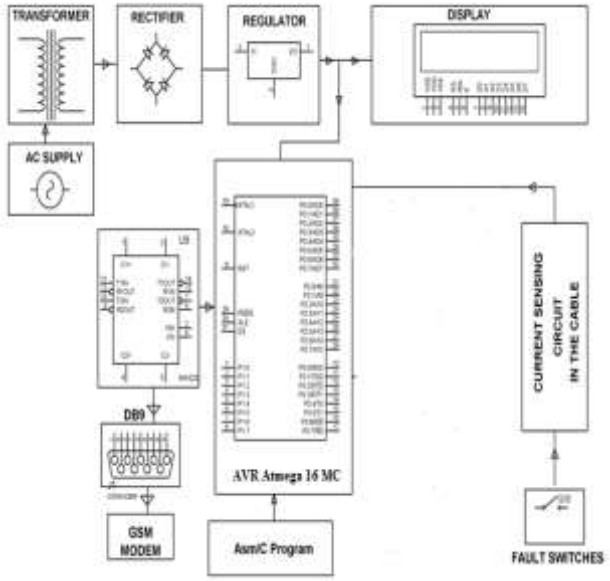

Fig 1 Block Diagram

2.1 POWER SUPPLY:

The power supply[6] circuit consists of a step down transformer which steps down 220V AC voltage to 12V AC voltage as shown in fig2. The circuit consist of four diodes forming a bridge rectifier which converts AC voltage into DC voltage and then this DC voltage is sent to the capacitor filter to remove any ac components which might be there even after rectification. This filtered DC voltage is then received by the voltage regulator which produces 5V constant DC voltage.

2.2 TRANSFORMER:

A transformer[6]is an electrical device that transfers electrical energy between two or more circuits through the principle of electromagnetic induction A step down transformer is used here as shown in fig1. The step down transformer is used so that the ac input available at the mains supply ,ie, 220V can be brought down to the required voltage level ,ie,12V.

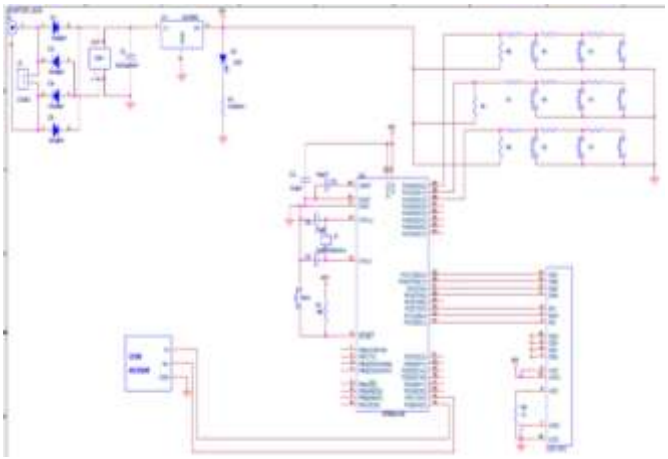

Fig 2 Circuit Diagram

2.3 AVR ATMEGA16 MICROCONTROLLERS:

The microcontroller used here is AVR ATmega16. The ATmega16 is a low power CMOS 8 bit microcontroller. It is a 40pin based microcontroller with four ports as A,B,C and D as shown in fig2. Port A is used for the analog inputs for the A/D converter. Port B,C and D are I/O ports to which other components are connected.

2.4 RECTIFIER:

The output from the transformer is fed to the rectifier which converts AC voltage into pulsating DC voltage. A bridge rectifier is used here as shown in fig2 because it provides good stability and full wave rectification. The bridge rectifier converts AC voltage into DC voltage by using both half cycles of the input AC voltage. Bridge rectifier comprises of four diodes which are connected to form a bridge like structure.

2.5 LIQUID CRYSTAL DISPLAY (LCD):

LCD[6] is an electronic visual display which uses light modulating properties of liquid crystals as liquid crystals do not emit light directly. The LCD used here is 16*2 display as shown in fig2. The LCD is interfaced to the microcontroller to display the distance for a particular cable fault.

2.6 VOLTAGE REGULATOR:

A voltage regulator[6] is an electrical device which automatically maintains a constant voltage level. Here, voltage regulator 7805 is used as shown in fig2 since power supply of 5V is required. The first two digits, ie, 78 represents that the supply is positive and the last two digits, ie, 05 represent the output voltage level that is required.

3. ADVANTAGES:

1) Underground cable system requires less maintenance and time will be consumed in detecting the fault by using this system.
2) Underground cable system provides higher efficiency than overhead cable system.
3) Less number of faults will occur in underground cables as it will be unaffected by adverse weather conditions such as heavy rain, storm or snow.
4) Underground cable system will also improve the issue of public safety.

4. DISADVANTAGES:

1) The initial cost of the underground cables may be high and insulation problems might occur at high voltages.
2) Repairing the faults in the underground cables may require longer time.

5. CONCLUSION:

With the help of this paper, we are able to determine the exact location of the short circuit fault which occurs in the underground cable with the help of switches and by using a microcontroller. In future also, the use of underground cables will only increase as it is a superior method than the overhead cables due to extreme weather conditions and to improve public safety.

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7. REFERENCES:

1. Md. Fakhrul Islam, Amanullah M T Oo, Salahuddin. A. Azad1 , "Locating Underground Cable Faults: A Review and Guideline for New Development" , 2013 IEEE.
2. Tarlochan S. Sidhu, Zhihan Xu, "Detection of Incipient Faults in Distribution Underground Cables", IEEE Transactions on Power Delivery, Vol. 25, NO. 3, JULY 2010.
3. M.-S. Choi, D.-S. Lee, and X. Yang, "A line to ground fault location algorithm for underground cable system," KIEE Trans. Power Eng., pp. 267–273, Jun. 2005.
4. J. Densley, "Ageing mechanisms and diagnostics for power cables—an overview," IEEE Electr. Insul. Mag., vol. 17, no. 1, pp. 14–22, Jan./Feb. 2001.
5. K.K. Kuan, Prof. K. Warwick, " Real-time expert system for fault location on high voltage underground distribution cables", IEEE Proceedings-C, Vol. 139, No. 3, May 1992.
6. Dhekale P.M., Bhise S.S., Deokate N.R. "Novateur Publications International Journal Of Innovations In Engineering Research And Technology [IJIERT]", Vol 2, Issue 4April 2015.
7. Qinghai Shi, Troeltzsch U, Kanoun O. Detection and localization of cable faults by time and frequency domain measurements. Conf. Systems and Signals and Devices, 7th International conference, Amman 2010.