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Distance Calculation for Underground Cable Fault.

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Abstract: *Nowadays underground cables are used over than overhead lines in urban areas. Locating the fault in the underground (UG) cable is tedious and there is a probability of damaging the insulation while digging the cable. The proposed system offers easy and smart fault detection by automating it using a ATmega16 controller. The basic concept of Ohm's law is applied at the feeder end though a series resistor. In case of short circuit of LL or LLG or LG the current flowing in the faulty sections will vary depending on the length of the line. This paper aims at estimating the location of fault distance and intimate. It is predictable to find a serious solution in maintenance environment of electric power applications to find extensive length of power cables using electrical means. This paper clarifies about length measurement of cable which can be lengthy for finding the location of open circuit point on a power cable using passive electrical parameters like capacitance. For the parameter calculation micro controller helped with display devices and resistive circuit are used. The microcontroller use algorithm to find the capacitance of the underground cable. The algorithm also computes the time charge ratio, with the help of passive parameters like current limiting resistance and definite capacitance of cable. The time charge ratio thus services the microcontroller to estimate the length of the cable.*

Keywords: Underground (UG); Line-Line Ground (LLG); cables; Calculate;

I. Introduction

Underground cables have been extensively used for power distribution networks over the years. This is because of their suitability for underground connections, better security from activities of vandals and thieves, and resistance to hazardous climatic conditions such as thunderstorms and whirlwind. They are cheap, easy to maintain and environmental friendly. They have condensed maintenance and operating costs such as lower storm restoration cost. Also, underground cables remove the danger of wind-related storm damage. They are not subjected to damage caused by flooding which usually pamper and disturb electric service. They ensure rarer transitory disruptions through tree falling on wires or electric poles falling down thus humanizing civic safety. Life-wire contact injuries are drastically reduced. It indications to the removal of unattractive poles and wires on the streets thereby attractive the visual range of the drivers and walkers on the streets. To lessen the threat posed by environmental impacts on the highly sensitive distribution networks, the underground high voltage cables are increasingly used. Despite these advantages, locating faults in underground cables can be a very cumbersome task. It is therefore very necessary to develop very efficient technique for detecting faults in these cables. This paper is geared towards designing a system that can locate the faulty points in an underground cable in order is to facilitate quicker repair, improve the system reliability and reduced outage period to the barest minimum.

The underground cable system is actual beneficial for distribution mainly in urban cities, airport and defense services. When faults occur, the power flow is redirected towards the fault and the supply to the neighborhood is impeded. Voltages turn out to be destabilized. Timely recognition of fault is highly important in electrical cables. To achieve this, the microcontroller is used in this paper to quickly detect four main types of faults and give trip signal to relay. Our role in this paper is the design and implement underground cable fault distance locator device that can be used to identify faults in the line and isolate the connected system or instrument connected to it. The device has the capacity to detect the type of fault that has occurred in a faulty line. The Atmega328p microcontroller is used to detect the fault through the designed circuit and it also displays on the LCD screen. A relay circuit is also connected to the circuit to save the system from being damaged by disconnecting the faulty circuit from the healthy one. The proposed system works by first converting analog signals to digital signals. These signals are generated by the microcontroller, the microcontroller will compare the input digital signal of the ADC and will compare with the given set range of value, if the input is beyond or under the range of set value, the microcontroller will direct a signal to the relay to trip the circuit and also send a parallel signal to the LCD to display the type of fault that has happened.

II. Literature Review and Objective

Till last year's cables were prepared to lay overhead& currently it is lay to underground cable which is greater to previous method. Because the underground cables are not exaggerated by any opposing weather condition such as storm, snow, heavy rainfall as fine as pollution. But when any fault occurs in cable, then it is hard to detect fault.

The most common types of fault that happen in underground cables are:

1. Open circuit fault.
2. Short circuit fault.
3. Earth fault.

2.1 Open Circuit Fault

When there is a breakdown in the conductor of a cable, it is called open-circuit fault. The open-circuit fault can checked by a megger. For this determination, the three conductors of the 3 core cable at faraway are shorted and earthed. Then resistance among each conductors and earth is measured by a megger. The megger will specify zero resistance in the circuit of the conductor that is not cracked. However, if a conductor is cracked the megger will specify an infinite resistance.

2.2 Short-Circuit Fault

While two conductors of a multi core cable rise in electrical contact by each other owed to insulation failure, it is named as short-circuit fault. Megger can too be used to check this fault. For this the two terminals of a megger are linked to any two conductors. If the megger gives a zero reading it specifies short-circuit fault among these conductors. The same is recurring for other conductors captivating two at a time.

2.3 Earth Fault

When the conductor of a cable comes in interaction with earth, it is named earth fault or ground fault. To classify this fault, one terminal of the megger is associated to the conductor and the other terminal associated to the earth. If the megger specifies zero reading, it means the conductor is earthed. The similar procedure is repeated for other conductors of the cable. Finding the location of an underground cable fault doesn't have to be like conclusion a needle in a haystack.

The common methods of locating faults are:

1. Sectionalizing: This process dangers sinking cable reliability, as it depends on physically harsh and joining the cable. Separating the cable into sequentially smaller sections then measuring both means with an ohmmeter or high-voltage insulation resistance (IR) tester allow to thin down quest for a fault. This difficult procedure normally includes recurring cable excavation.
2. Time Domain Reflectometry (TDR): The TDR leads a low-energy signal over the cable, producing no insulation degradation. An academically perfect cable returns that signal in a identified time and in a identified profile. Impedance variations in a "real-world" cable change together the time and profile, which the TDR monitor or printout graphically signifies. One softness of TDR is that it does not locate faults.

Murray loop test: It is a bridge circuit designed for locating faults in underground or submerged cables. It uses the principle used in potentiometer test. One end of the faulted cable is linked through a couple of resistors to the voltage cause. Also a null detector is allied. The extra end of the cable is shorted. The bridge is carried to balance by changing the cost of RB.

2.4 Objectives

1. To design the block diagram and circuit related to system.
2. To simulate the circuit using dip trace software.
3. To write a program in AVR STUDIO.
4. To design the PCB layout using suitable Software.
5. To implement the circuit.

6. To test the developed system.

III. Working

The project usages four groups of resistances in series on behalf of cables i.e. R10,R11,R12,R13 and R17,R16,R15,R14,then R21, R20,R19,R18, then RR24, R23, R22 as shown in the circuit diagram, one set for each phase. To each series resistors signifies the resistance of the underground cable for an exact distance thus 4 such resistances in series signify 1-4kms. 3 relays are used to common point of their contacts are beached though the NO points are linked to the input of the R17, R21 & R25 existence the 3 phase cable input. R10 is nourished with a series resistor R1 to 5v supply.

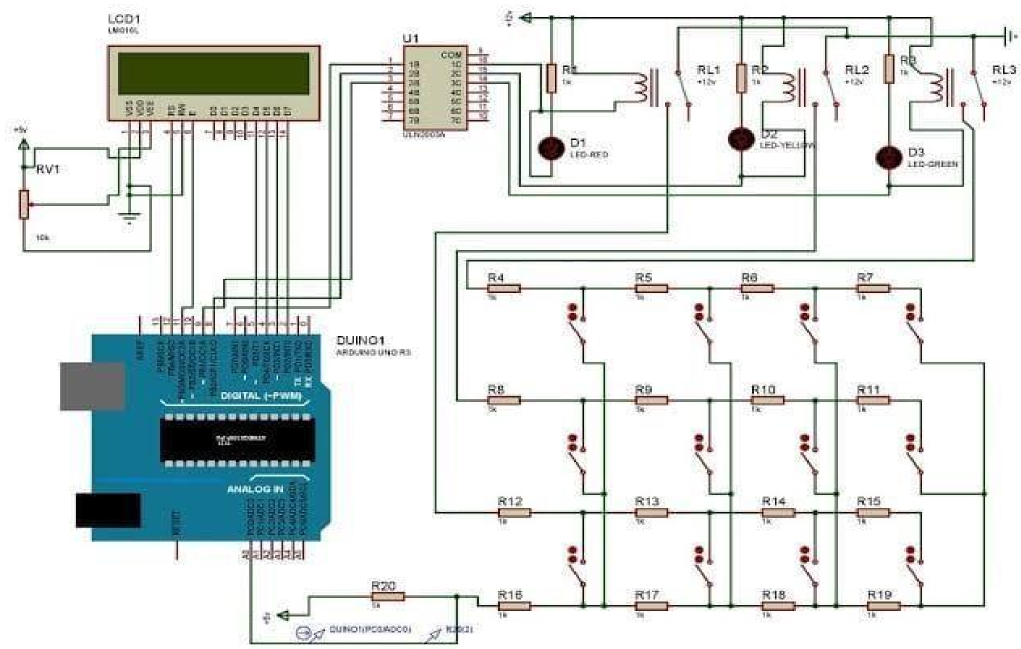

Figure 1: Resistor and Switches Connection

While any of the 12switches (representing as fault switches) are worked they enact situations like line to ground (LG), line to line (LL), line to line to line(3L) fault as per the switch procedure. The program while executed incessantly scans by operating the 3relays in order of 1sec interval. Thus any NO point while determined to GND through the common contact point of the relay progresses a current flow through R1 & some of the cable by the fault switch dependent on the created fault. Thus the voltage drop at the analog to digital (ADC) pin varies responsible on the current flow which is inversely proportional to the resistance value descriptive the length of cable in kilometers. This varying voltage is nourished to the ADC to develop an 8-bit data to the microcontroller port1. Program while executed displays an output in the LCD display upon the distance of the fault happening in km's. In a fault condition it display's R=3km if the 3km's switch is made ON. Therefore, all other faults are specified.

IV. Related Work

In this project OHM's law is used to find the short circuit fault. A DC voltage is practical at the feeder end over a series resistor, liable upon the length of fault of the cable current differs. The voltage drop crosswise the series resistor changes consequently, this voltage drop is used in purpose of fault location. The project is collected with a set of resistors on behalf of cable length in KMs and fault making is made by a set of switches at every well-known KM to annoyed check the accuracy of the same. The voltage drop across the feeder resistor is specified to an ADC which progresses a exact digital data which the programmed microcontroller wanted display the same in Kilo meters. The fault distance and which phase is displayed on a 16X2 LCD interfaced with the microcontroller. In this project we use a microcontroller from 8051 family which is of 8-bit. The program is marked into ROM of microcontroller printed in either Embedded C or assembly language. The power supply contains of a step down transformer 230/12Vwhich steps down the voltage to 12V AC. This is different to DC using a Bridge rectifier. The ripples are separate using a capacitive filter and it is formerly controlled to +5V using a voltage regulator 7805 which is essential for the process of the microcontroller and new components.

4.1 Algorithm

- Step1: Reset the ports, assert timer, ADC, LCD functions.
- Step2: Initiate an infinite loop; turn on relay 1 by creating pin 0.0 high.
- Step3: Show "R:" at the beginning of first line in LCD.
- Step4: Call ADC Function, dependent upon ADC output, shows the fault position.
- Step5: Call delay.
- Step6: Repeat steps 3 to 5 for other two phases.

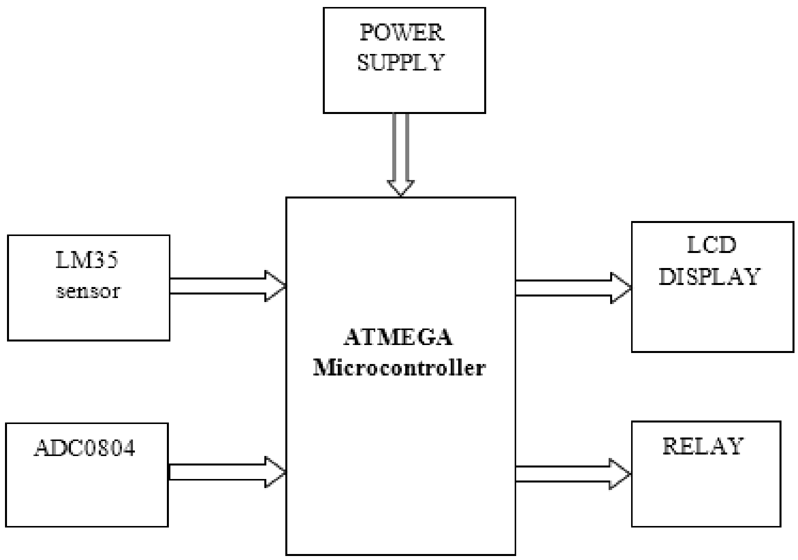

Figure 2: Block diagram of underground fault system

4.2 Tools

A. Arduino

The Arduino Uno is a microcontroller board grounded on the ATmega328. It has 14 digital input/output pins which 6 can be used as PWM outputs and 6 analog inputs, a 16 MHz ceramic resonator, a USB assembly, a power jack, an ICSP header, and a reset button. It holds all needed to support the microcontroller; only connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to become started. The Uno varies from all preceding boards in that it does not use the FTDI USB-to- serial driver chip. Instead, it features the Atmega16U2 automated as a USB-toserial converter.

The Arduino Uno can be driven via the USB connection or with an outdoor power supply. The power source is certain automatically. External power can come also from an AC-to-DC adapter or battery. The adapter can be linked by plugging Leads from a battery can be injected in the GND and Vin pin passes of the power connector. The board can run on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin might supply less than five volts and the board may be unbalanced. If using more than 12V, the voltage regulator may overheat and harm the board. The suggested range is 7 to 12 volts. The power pins are as follows:

VIN: The input voltage to the Arduino board when it's via an external power source. You can supply voltage over this pin, or, if supplying voltage via the power jack, admittance it through this pin 5V. The planned power supply used to power the microcontroller and additional components on the board.

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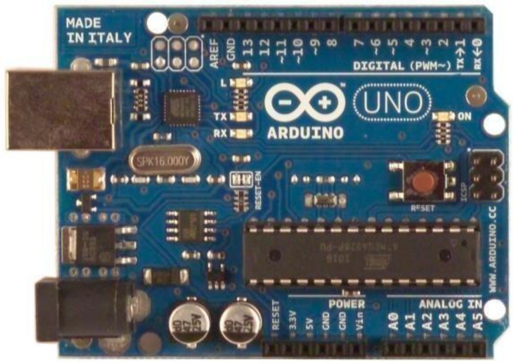
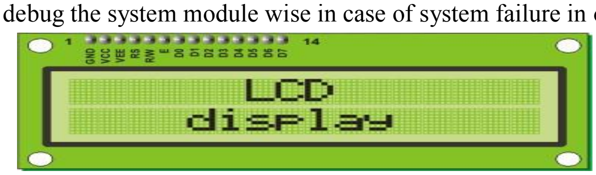


Figure 3: Arduino UNO board

B. LCD

LCD is used to visualize the output of the application. We have used 16x2 LCD which shows 16 columns and 2 rows. Hence, we can write 16 characters in each line. So, total 32 characters we can show on 16x2 LCD. LCD can also use in a project to identify the output of different modules interfaced with the microcontroller. Thus LCD plays a main role in a project to see the output and to debug the system module wise in case of system failure in order to identified the problem.



V. Prototype Hardware Model

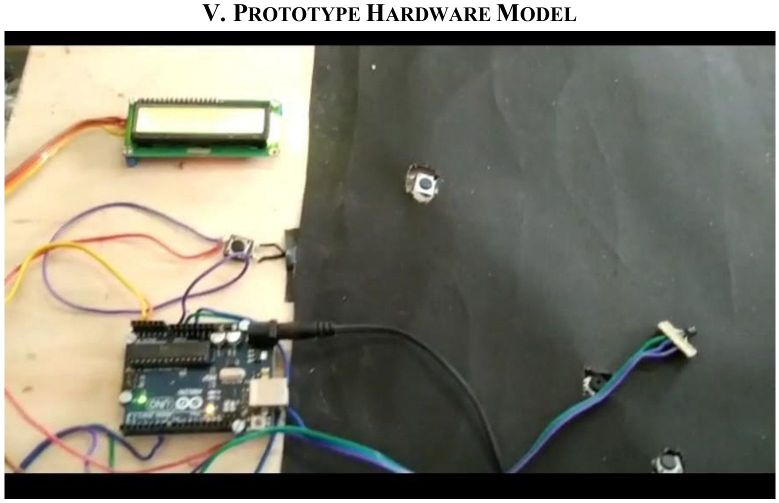


Figure 4: Prototype hardware model

Table 1: Comparison between Actual and Calculated distance of fault

Sr. NO.	Actual distance to fault in (km)	Calculated distance to fault in (km)
1.	1.0	1.05
2.	2.0	2.14
3.	3.0	3.23
4.	5.0	5.34
5.	8.0	8.46

VI. Advantages, Disadvantages And Applications

6.1 Advantages

1. Lower storm repair cost
2. Reduced live wire damages
3. Rise reliability
4. Improves property ethics

6.2 Disadvantages

1. High system cost
2. Maintenance cost is high

6.3 Applications

Its central application is to identify the fault of underground cable which is very hard to identify as it is not likely to see such faults which are fairly possible in the case of overhead transmission line. So for such cases this project is very supportive as the distance at which the fault has happened can be designed and then further action concerning the fault can be taken to stun them.

VII. Conclusion

Detecting the exact location of the fault in underground cables is a difficult task. The exact location of the open circuit fault and short circuit faults are identified from the proposed system. The data is sent to a dedicated website and alert the respective person through SMS by using a GSM module and IoT. On account of fault in the cable, the Buzzer alarm is used to alert the person if he is not using the mobile.

VIII. Acknowledgement

Each project is successful largely due to the work of a number of wonderful people who have always given their respected advice or lent a helping hand. We honestly appreciate the motivation; support and guidance of all those people who have been active in making this project a success.

References

[1]. P. Sawatpipat and Tayjasanant, “Fault classification for Thailand’s transmission lines based on discrete wavelet transform”, International Conference on Electrical Engineering and Information Technology, 2010.

[2]. M. Jaya, R.D. Baraga, R. Vanuatu and D.K. Mohanta, "Robust transmission line fault classification using wavelet multi-resolution analysis.", Computers & Electrical Engineering, May 2013.

[3]. B. Bhuvneshwari, A. Jenifer, J. John Jenifer, S. Durga Devi and G. Shanthi, “Underground Cable Fault Distance Locator”, Asian Journal of Applied Science and Technology (AJAST), Volume 1, Issue 3, Pages 95-98

[4]. A. D. Dhivya and Sowmya, “Development of a Prototype Underground Cable Fault Detector”. International Journal of Electrical, Electronics and Computer Systems, 2014.

[5]. J. P. Singh, N. S. Pal and S. Singh, “Underground Cable Fault Distance Locator”, International Journal of Scientific Research and Management Studies (IJSRMS), Volume 3 Issue 1, pp. 21-26, 2016.

[6]. S. Reshma, G. Monika, P. Ashwini, “Underground Cable Fault Distance Locator By Using Microcontroller”, International Journal of Engineering Sciences & Research Technology, Vol. 5, 2016.

[7]. S. Shahir, S. Tariq, A. Bangi and K. Khot, “Underground Cable Fault Detector Using GSM” International Journal of Research In Science & Engineering, 2017.

[8]. A. Gupta, R. Sharma, R. Meena, R. Choudhary and R. Kumar, "Distance Calculation for Underground Cable Fault", International Journal of Engineering and Management Research, March - April 2016.