International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 06 Issue: 05 | May - 2022 Impact Factor: 7.185 ISSN: 2582-3930

Implementation of Underground Cable Fault Detector

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Abstract:

Usually, underground cables are opted for the applications of smart grid system. Due to the various circumstances in the underground the cables will be affected by various faults. Here the fault identification is the prime concern and complex part of the system. If any occurrence of fault the entire line must be dug. It is mandatory to know which part of the line is under fault which will reduce the time of fault rectification. By this we not only save time but also the system became more economical and reliable. The main objective of this project is to identify the fault location from the base station in Kms by using Arduino.

Key words: Underground cable, Fault detection, Smart grid, Arduino

1. Introduction:

Earlier we used overhead transmission lines but now we have to underground cable lines [1].These lines are unaltered by any switch in weather conditions like storm, snow, rain fall and pollution. The identification of fault phenomena in cable is arduous. Since, the world acquired digitalization the identification of fault takes place in digital way [2].Generally, the occurrence of fault in cable comprises of any defect; inconsistency; breakdown of conductor and insulation failure. Due to these causes the rectification and identification is complex [1][3].Customarily, the underground cables are used in many urban areas. Underground cable detector lowers the fault identification time and operates effectively. Consequently, the fault recognition takes place by using an Arduino board [4].

2. Methodology

In this paper a fault identification model for the underground cable system using Arduino is presented in which the fault location from the base station in KMs is identified. The simple theory of ohms law is implemented. The location of the fault occurrence will be displayed on the LCD provided. One of the main advantage of underground cable system is it doesn't affect by the external weather conditions like storms, rains, heavy winds etc. But the major drawback is identification of the fault location. So, by taking this drawback in to consideration we have to come up to deal with this problem by using Arduino. That is to locate the fault location and reflect that fault location on the display unit in KMs.

2.1Objective:

The main objective of the project is to identify the fault in UG cable line by employing an Arduino microcontroller kit from the base station to the exact location in km. Exemplary model generates bazaar alert when fault occur in underground line to the field worker around.

2.3 Overview

Underground cables are susceptible to fault due to underground condition depreciation. Discovering fault origin is complex to check the entire cable line. The detection of fault origin could the exactly known by the repairmen. Consequently, service of underground cable line becomes faster which in turns saves money and time. Underground cables un touched for storms, snow and pollution. In urban areas then underground cables are commonly used.

3. Faults in Underground Cables:

3.1 Types of Faults:

The following are the faults observed in the underground cables

Open Circuit Fault:

Failure of one or more conductor make them fault occurred. Joint failure of cable, overhead line failure of CB's, melting of conductor in more than one phase are the common origin of these faults.

- These walls are known as serious faults.
- Except the 3-phase open fault the open circuit fault is unsymmetrical in nature.

Short Circuit fault:

The insulation breakdown between phase conductor or earth or both generates a short circuit fault. The short circuit fault is invisible without cable partition. These faults occurs when the insulation of individual cables get damaged. Then Short circuit fault are graded into 2 types

- Symmetrical faults (LLL, LLLG).
- Unsymmetrical faults (LL, LG, and LLG).

3.2 Advantages:

- A chance of fault occurrence is less.
- Minimal damage or may be sometimes no damage to the UG cable system duration bad weather conditions or natural calamities so power interruption will be minimal.
- More reliable than overhead line.
- More efficient than overhead transmission line.
- Easy to install at some places where installing an overhead line is difficult.

3.3 Disadvantages:

- Expensive than overhead transmission lines.
- Installation of the underground system is difficult then over headlines.
- Identification of the fault is one tricky part.
- Troubleshooting of fault is also difficult then compared to the overhead line.
- Number of electronic components involve here is more.

4. Block Diagram:

In this paper simple Ohm's law is used to locate the short circuit fault. A DC voltage is applied at the feeder end through a series resistor, depending upon the length of fault of the cable current varies. The voltage drop across the series resistor changes accordingly; this voltage drop is used in determination of fault location. The block diagram of underground cable fault detector is shown in figure 5.1.

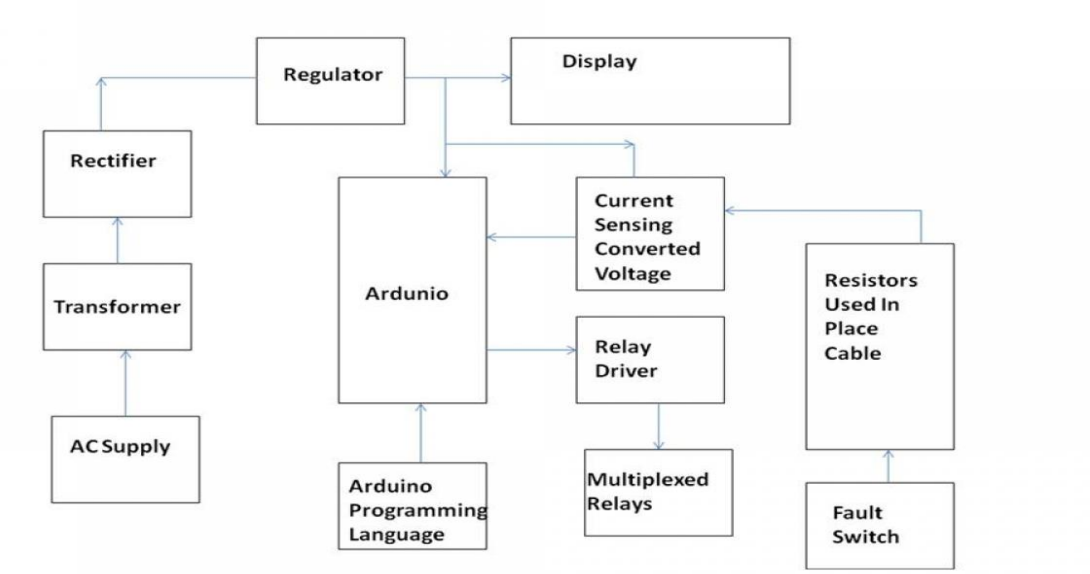

Fig: 4.1 Block diagram of underground cable fault detector

The microcontroller used is Atmega328p which is a High-Performance Low Power CMOS 8-Bit Microcontroller. 8-bit microcontroller means CPU or ALU can process 8-bit data at a time. Means it has to take 8-bit data from memory (which it has to process). Thus, each location in memory is 8 bit and data bus is also 8 bit. Registers in RAM has to be 8 bits for temporary storage of results. This microcontroller has 32KBytes of In-System Flash program memory. Our program is burned into flash memory. It is having a 6 channel PWM (Pulse Width Modulation) channel. One of them is used for LCD back light control. As width of pulse changes back light intensity of LCD varies. Atmega328P consist of 6 channel 10 bit analog to digital converter. This analog to digital converter is used to detect the minor changes in voltage drop across LDR (Light Dependent Resistor) and this change is responsible for change in back light of LCD. The relay driver consists of transistor BC547 which is used as a switch to control relay. We are using only two relays hence it is economical to use BC547. If we want to connect a greater number of relays then relay driver IC ULN2003 can be used instead of transistor. Relay operates on 5V dc supply. One relay is used for switch warning alarm and second one is for indication purpose. LED is used as an indicator.

5. Hardware Developed:

The hardware implementation to identify the fault location from the base station in KMs an Arduino is used as shown in figure 5.1

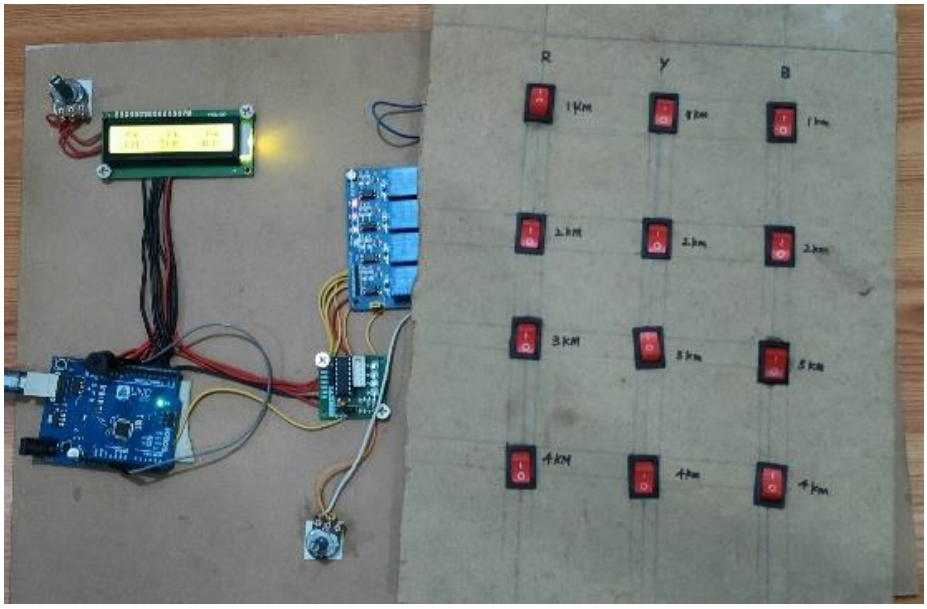

Fig:5.1 Hardware Implementation of underground cable fault detector

The Arduino board is connected to a computer via USB, where it connects with the Arduino development environment. The user writes the Arduino code in the IDE, and then uploads it to the microcontroller which executes the code, interacting with inputs and outputs such as sensors, motors, and lights. The Arduino specifications are mentioned in the table 5.1

Table No. 5.1: Arduino Specifications

Name	Range
Microcontroller	5V
Operating voltage	7-12V
Input voltage	6-20V
Digital I/P pins	14(of which 6 provide PWM output)
PWM digital I/O pins	6
Analog input pins	6
DC current per I/O pins	20mA
DC current for 3.3 V pin	50mA
Flash memory	32KB(ATmega328p)
SRAM	2KB(ATmega328p)
EEPROM	1KB(ATmega328p)16MHz
LED BULTIN	13
length	68.6mm
Clock speed	16MHz
width	53.4mm
weight	25mg

6. Results& Discussions:

Case-1: When fault occur in any one of the phases

From the figure 6.1 it is observed that fault is occurred under Y-phase at 2 KMs, where the Arduino will track the change in resistance and displays the fault location accordingly on the display unit.

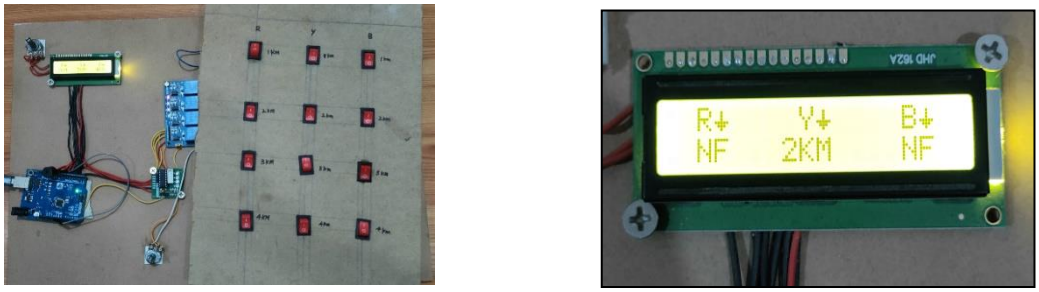

Fig. 6.1: Fault at one of the phases

Case-2: When fault occur in all 3-Phases

From the figure 6.2 it is observed that fault is occurred under R Y B Phases at 1, 3, 4 KMs and displayed on the LCD provided with the help of Arduino.

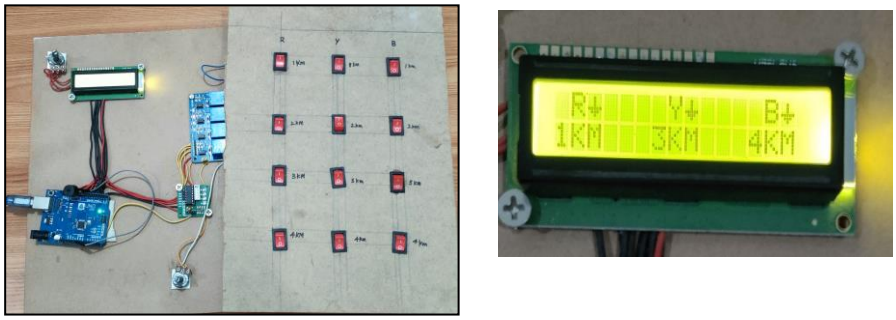

Fig.6.2: Fault at all 3 phases

Case–3: When fault occur in any 2 phases

From the figure 6.3 it is observed that fault is occurred under Y and B phases at 3 and 2 KMs and it is reflected on to the display unit with the help of Arduino.

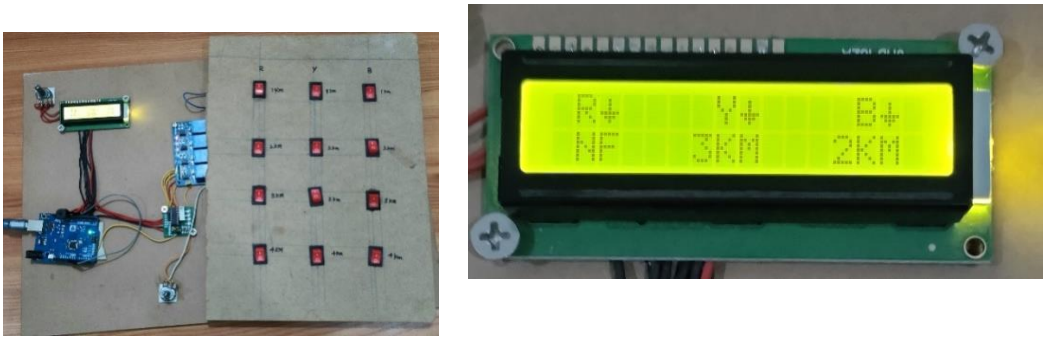

Fig. 6.3: Fault at any 2 phases

7. Conclusion& Future Scope:

This paper perceives the impose location of fault in underground cable from feeder end in km by employing an Arduino microcontroller based on the output of the cable resistance the Arduino microcontroller works relays help to isolate the healthy and fault line. In this paper we detect the exact location of short circuit fault in the underground cable from feeder end in km by using microcontrollerATmega328. For this we use simple concept of Ohm's law so fault can be easily detected and repaired. Thus, the project on Underground cable fault detection using AT Mega 16 Micro controller was done. We have proposed a low cost solution to enhance the fault detection of underground cable. It is secure, robust and power consuming. It can be used to all types of cables so as to avoid fault occurring in the underground cables. In this paper the location of short circuit & open circuit faults in underground cable line are detected using capacitor in ac circuit which measures the change in impedance & calculate the distance of the fault.

REFERENCES:

[1]. Raghu Raja Kalia, Preeti Abrol, 'Design and implementation of wireless live wire fault detector and protection in remote areas', IEEE,(2014),vol. 97,No.17

[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 algorithm for underground cable system," KIEE Trans. Power Eng., pp. 267–273, Jun. 2005.

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

[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]. Tarlochan S. Sidhu, Zhihan Xu, "Detection of Incipient Faults in Distribution Underground Cables", IEEE Transactions on Power Delivery, Vol. 25, NO. 3, JULY 2010.

[7]. 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.

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