World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

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Arduino - Uno Based Underground Cable Fault Detection System (AUCFDS)

S. R. Purohit *, Sunilkumar M. Hattaraki, Soumya P.Hampangoudra, Rashmi Nimbaragi and Savita Mattihal Shweta Bagali

Department of Electronics and Communication Engineering B.L.D.E. A's V. P. Dr. P. G. Halakatti College of Engineering and Technology, Vijayapura, Karnataka, India.

World Journal of Advanced Research and Reviews, 2023, 18(02), 288–292

Publication history: Received on 27 March 2023; revised on 03 May 2023; accepted on 06 May 2023

Article DOI: https://doi.org/10.30574/wjarr.2023.18.2.0810

Abstract

Today, it is very challenging to manually find underground cable faults like wear and tear or rodents, because it costs more and takes more time. Finding the fault sources is also very difficult because the entire line must be dug to check for cable line faults. Our suggested system utilises an Arduino- microcontroller to help locate the fault's exact location. The standard concept of Ohm's law is applied in this system. The location of the shorted cable line determines the current flow when a low DC voltage is applied to underground cable lines at the feeder end through a series resistor. The system makes use of a rectified power supply and an Arduino- microcontroller board. The Arduino - microcontroller board is interfaced with a combination of resistors and current sensing circuits. the cable's length is represented by digital data that is sent from the internal ADC device to the microcontroller and displayed on the LCD Display.

Keywords: Cable; Fault; LCD; SMS

1. Introduction

The primary goal of this paper is to determine the distance of the fault from the base station in kilometres (km). The central idea of this work is the simple concept of Ohm's Law. When a fault is detected, it is displayed on the Liquid Crystal Display (LCD). The main benefit of the proposed system is that the cables will not be affected by any adverse weather conditions such as pollution, snow, storms, heavy rainfalls, and so on. In today's computerised world, the proposed system assists in determining the exact position and location of the fault without wasting time or money, and it also indirectly prevents soil pollution. It is widely used in urban and metropolitan areas because it is difficult to find the exact location of a fault manually because it takes more time and money.

Faults are classified into two types: open circuit faults and short circuit faults. When there is no current flow, i.e. I=0, it indicates that the input voltage is equal to the output voltage. In a short circuit fault, the output voltage is zero but the current is constant. This paper assists cabling companies in improving their wiring and monitoring systems. The proposed system assists in identifying the fault without the need for manual entry, thereby saving many lives.

2. Related Work

Rao Muhammad Asif et al. [1] proposed a system in which a fault sensing circuit is built using a series resistor and a switch alongside each resistor. This proposed system is simulated and tested using PROTEUS version 8.1, and the hardware is designed based on the simulation. Finally, the fault has not only been detected but also pinpointed and displayed on the website "Things Peak."

* Corresponding author: Soumya P.Hampangoudra

A survey on different approaches for locating cable faults was presented by Mane, Vijay, et al [2]. The Time Domain Reflectometer (TDR), Thumper, A frame method, and Bridge methods are among them.

Said, Abdelrahman, et al.[3] proposed a perfect simultaneous fault diagnosis scheme in the fractional Fourier domain based on the Multiclass Support-Vector Machine (MCSVM). The threephase sending currents are first simulated under various conditions before their features are extracted using the Discrete Fractional Fourier Transform (DFRFT). Following that, the features are reduced using the Singular Value Decomposition (SVD) method. The MCSVM scheme is used to diagnose faults (discover, categorise, and trace) by utilising reduced features from the DFRFT and SVD stages. Simulations of the Alternating Transient Program/Electromagnetic Transient Programme (ATP/EMTP) for 22 kV unreachable MVC were performed..

Murugesh, P. D. et al. [4] presented a detecting system for locating faults in optical fibre lines across customer sides. The laser output power is used to monitor the received power supply in optical fibre using a microcontroller. Any sudden change in the power of the optical line is detected, and the fault message is broadcast via Wi-Fi using IoT. To save power, the microcontroller is set to run in low power mode. The precise location of the fault in the optical fibre line is shown.

The system proposed by Verma, Vivek KR, et al. [5] finds the precise location of the cable fault. Due to normal wear and tear, underground conditions, rodents, etc., underground cables are susceptible to faults. Since we cannot pinpoint the exact location of the fault, the entire cable must be inspected and repaired. Our suggestion is to precisely pinpoint the problem's location so it can be repaired more quickly. The fault that was laid across the cable is discovered using the potential divider network system. A fault is created when two lines are shorted together; the voltage generated depends on the resistor network configuration. The microcontroller detected the voltage change and informed the user via a signal. The user receives information about the spot where those voltages coincide.

Badwaik et al.[6] proposed a system for determining the exact location of a fault in underground cable lines from the source station to the fault in kilometres. In this paper, single line to ground, double line to ground, and three-phase faults are discussed. A 16X2 LCD interfaced with the microcontroller displays the fault occurring distance, phase, and time. The ESP8266 Wi-Fi module is used in IoT to display information over the Internet.

3. Proposed Methodology

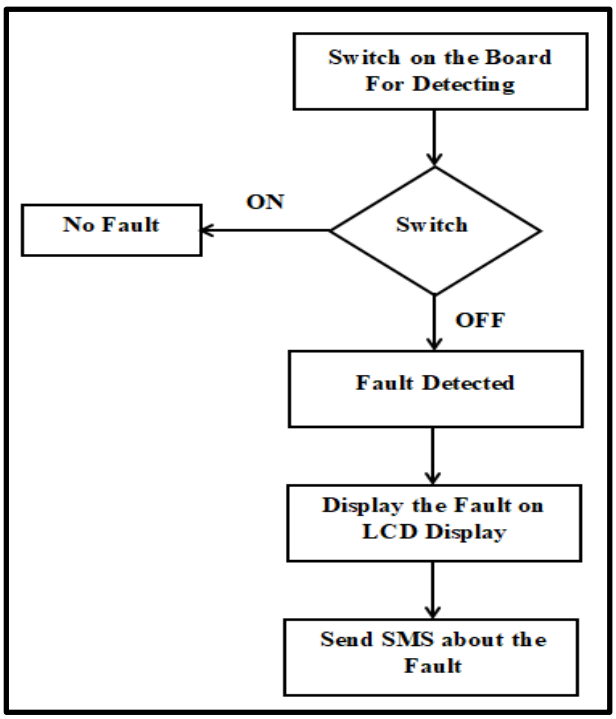

Figure 1 Flow Chart of Proposed System

Detecting faults in underground cables can be challenging, but an Arduino and GSM module can help. An Arduino board, a GSM module, and a power supply are required, and by inserting a SIM card into the GSM module, faults will be

displayed on the LCD display, and any faults will be notified via mobile. R phase, Y phase, and B phase faults are shown in the proposed system at 2km, 4km, and 6km. This system includes an LED that indicates whether or not the board is receiving power.If it blinks, it indicates that the power supply is turned on; otherwise, it is not. In addition, the Arduino and GSM modules show the power status. The power supply for these is extremely straightforward. The GSM module is connected via D-type pins. The Arduino and GSM must be linked to the same device, which could be a laptop or a power bank. The network LED on the GSM will begin to blink once the sim is inserted. If the blink is fast, it means that the network is fast and catching up; if the blink is slow, it means that the network is slow. When the setup is finished, the system begins to function. If there is a fault in the R phase at a distance of 2 kilometres, the LCD display will show R PHASE 2 KM CABLE FAULT. The same message appeared on phone after we turned it off. The same is true for the Y and B phases.

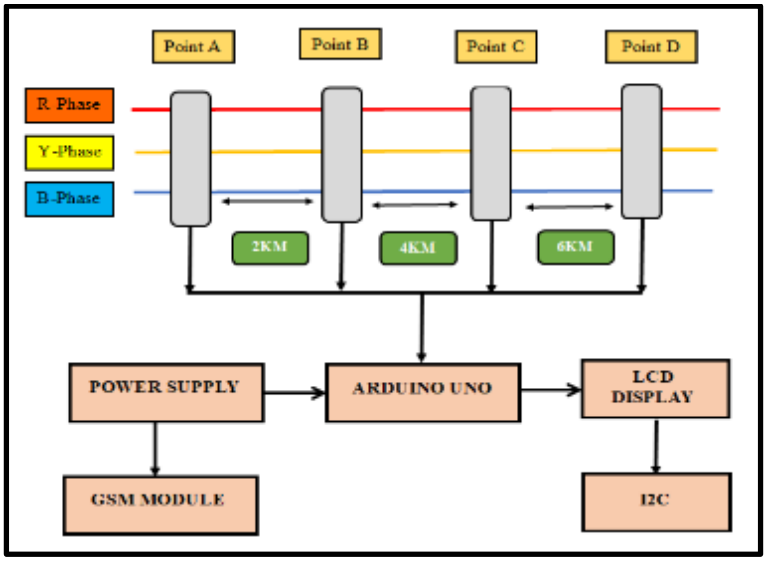

Figure 2 Block diagram of Proposed System

4. Results and Discussion

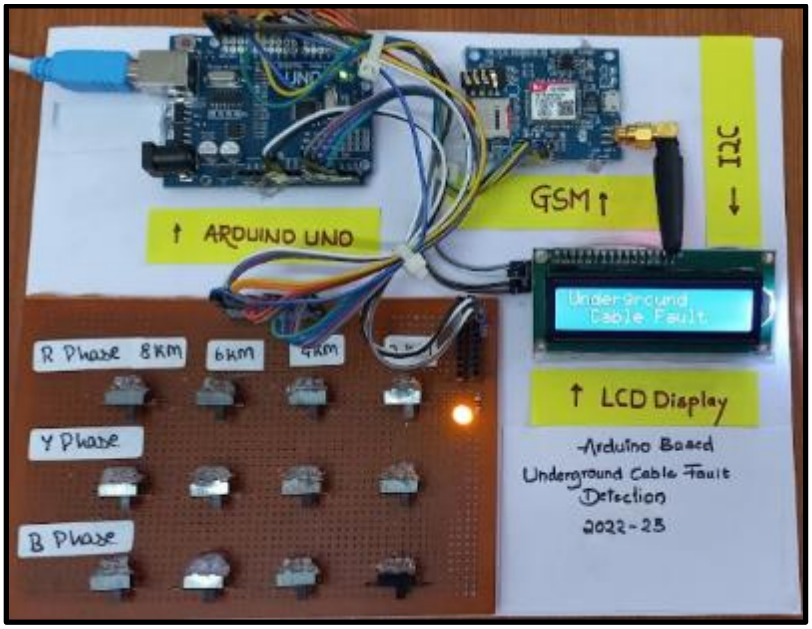

Figure 3 System Design of Proposed System

The above Fig.3. Shows that System Design of Proposed System, which is connection of Arduino-Uno, LCD display, GSM module and Cable lines.

Figure 4 Working Module of Proposed System

The above Fig.4. Shows that Working Module of Proposed System,here blinking LED shows that Kit is ready for functioning.

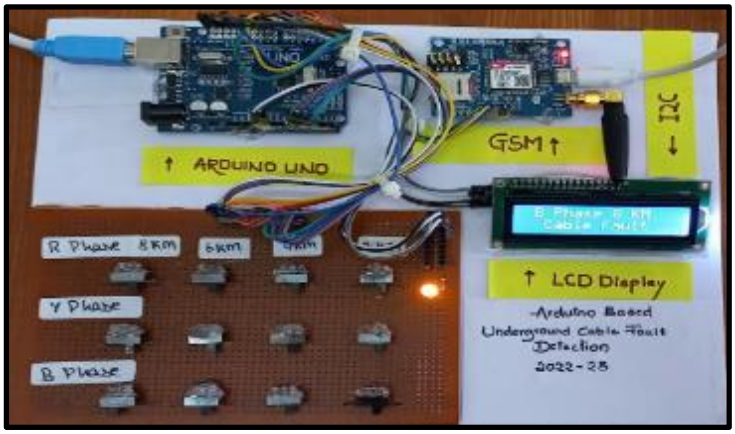

Figure 5 Cable Fault Detected at B-Phase (8Km Distance)

In the above Fig.5. LCD display shows that, the cable fault is detected at B-Phase by the distance of 8kilometers.

Figure 6 Cable Fault Detected at Y-Phase (4Km Distance)

In the above Fig.6. LCD display shows that, the cable fault is detected at Y-Phase by the distance of 4kilometers.

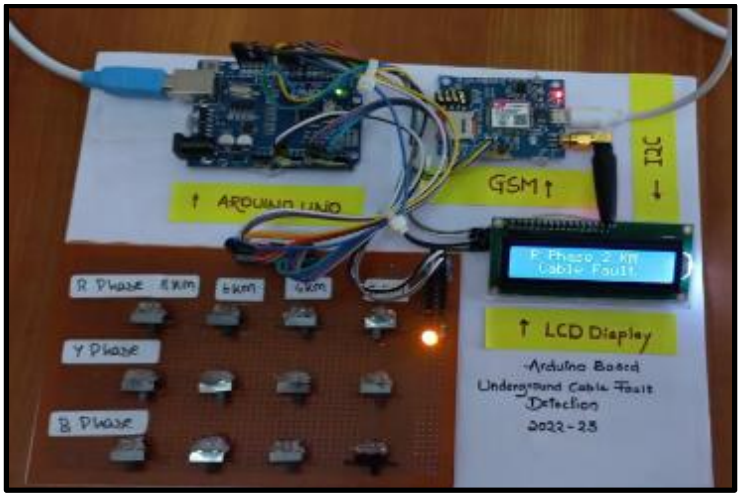

Figure 7 Cable Fault Detected at R-Phase (2Km Distance)

In the above Fig.7. LCD display shows that, the cable fault is detected at R-Phase by the distance of 2kilometers.

5. Conclusion

The proposed system achieves the desired outcomes. Arduino is used to detect underground cable faults. Where it consists of R,Y,B phases, we can find the precise location of faults displayed on the LCD. To make the system suitable for real-time use, components with a wider range must be used. In the future, it may be possible to use a capacitor in an AC circuit to calculate impedance and thus measure open circuit faulting.

Compliance with ethical standards

Acknowledgements

We would like to express my deepest gratitude to our guide Prof. S.R.Purohit and Prof. Sunilkumar M. Hattaraki, for their consistent motivation and aid at some point of the direction of the work.

Disclosure of Conflict of interest

To the best of our knowledge, the named authors have no conflict of interest in any form.

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