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UNDERGROUND CABLE FAULT DETECTOR USING ARDUINO

Mr. K. Shiva Kumar[1] ,P. Suma Sree[2] ,B.Dimanth[3] ,B.Sharvani[4] ,V.Naveen[5]

ABSTRACT

Due to the subterranean environment, wear and tear, rats, etc., underground cables are vulnerable to a wide range of problems. It is challenging to identify the cause of a failure; instead, the entire cable needs to be removed from the ground to be examined and fixed. The purpose of the study is to use a microcontroller to find the problem in underground cable lines that connect the base station to another substation. The cable must be examined for faults and switches must be used to create faults at each known distance between two substations in order to discover a cable failure. A programmable microcontroller IC is supplied a changing voltage in the event of a problem, which is then shown further on IOT fault. With the help of the Wi-Fi module ESP8266, IOT is utilised to show data online. A website or android application can be used to display errors. Underground cables have been utilised for many years for the actual power distribution lines that function on a global scale. Underground voltage cables are widely utilised to lessen the vulnerability of distribution networks to environmental effects. Because subterranean connections provide benefits, underground cables are frequently employed in power distribution networks. In metropolitan locations, underground cable systems are a widespread practise. While a cable fault can develop for a variety of causes, it might be challenging to locate the fault's surrounding position while removing or replacing the cable. The solution suggested in this project is used to locate the fault's subarea and show it to the appropriate application via the internet using a Wi-Fi module.

Keywords:

microcontroller, underground cable, fault detection, Internet of Things.

INTRODUCTION

Underground cables that are covered and protected by a variety of insulating layers are utilized to provide a reliable power supply for larger or urban regions. Thus, these wires are unaffected by any modifications to the outside environment. Rainfall, thunder, and other natural events might not have any impact on it. The need for reliable electricity components is growing as quickly as the requirement for power supply. This level of intricacy has the potential to harm underground cable distribution systems and cause service interruptions.

Any flaw in a cable that can disrupt its performance is considered a fault. As a result, the error must be fixed. Both underground and above wires can be used to transmit power. However, unlike underground cables, overhead cables have the disadvantage of being more vulnerable to weather-related damage from things like snow, rain, thunder, and lightning. This calls for cables that are more dependable, safe, durable, and of higher quality. Many localities, especially in cities, prefer underground wires

If there is any faulty installation, cable works can also be easily destroyed. Furthermore, defects might be of any form, such as faulty shorts, poor open circuits, and earth faults. A damaged conductor in a cable causes an open circuit problem. A short circuit issue occurs when the insulation fails and two wires come into contact. It is referred to as a ground fault if the conductor makes contact with the earth. We employ a megger to identify these failures, which increases system reliability and categorizes the damage based on the type of fault that occurred. While defects in overhead lines may often be found and fixed with simple inspection, this is not subterranean cables make this feasible. They are buried deep under the earth, making it difficult to find any anomalies in them. Even if a flaw is found, it is quite challenging to find the flaw. This results in a waste of resources because it requires debugging the entire region to find a defect between two subsection units.

EXISTING SYSTEM

The existing methods for underground cable fault detection involve techniques such as time domain reflectometry (TDR), frequency domain reflectometry (FDR), and acoustic-based fault locating systems. While these methods have shown some level of effectiveness, they suffer from limitations such as high cost, limited accuracy, and dependence on specialized equipment and skilled personnel. These shortcomings necessitate the development of a more cost-effective and effective technique for defect detection.

Sectionalizing

As a result of the actual cutting and splicing required, this operation decreases the dependability of the cable. To focus the search for a defect, divide the cable into progressively smaller portions and measure both

directions using an ohmmeter or high-voltage insulation resistance (IR) tester. Typically, this time-consuming process includes repeatedly excavating cables.

Thumping

When high voltage is applied to damaged cable, a high current arc results, which produces a loud sound that may be heard above ground. While this approach does away with the cutting and splicing involved in the sectionalizing approach, it also has a disadvantage. For a subsurface noise to be audible above ground, thumping requires a current on the order of tens of thousands of amps at voltages as high as 25 kV. The cable insulation frequently deteriorates as a result of the high current's heating. By meeting the minimal power requirement to execute the test, the maximum amount of damage can be decreased.

PROPOSED SYSTEM

The proposed system integrates Arduino microcontrollers with appropriate sensing techniques to detect and locate cable faults accurately. Arduino boards provide a low-cost, versatile, and programmable platform that enables the implementation of fault detection algorithms. The system employs various sensors such as current sensors, voltage sensors, and temperature sensors to monitor cable parameters. By analyzing the collected data using signal processing techniques, the location of faults can be determined with high accuracy. The Arduino-based approach significantly reduces the cost and complexity associated with fault detection while maintaining reliable performance.

PERFORMANCE EVALUATION:

The performance of our underground cable fault detection project is commendable. Through rigorous testing and evaluation, we have determined that our fault detection system excels in several key performance areas, demonstrating its effectiveness and reliability.

Firstly, the accuracy of our fault detection system is exceptional. It consistently identifies and locates cable faults with a high degree of precision. By comparing the detected fault locations with manual inspections or alternative fault detection methods, we have confirmed that our system accurately pinpoints the exact location and type of faults in underground cables.

Secondly, the speed of our fault detection system is remarkable. It swiftly detects and identifies faults, minimizing downtime and reducing repair time. Our system's promptness in identifying faults meets industry standards and enables quick response and resolution, leading to enhanced operational efficiency.

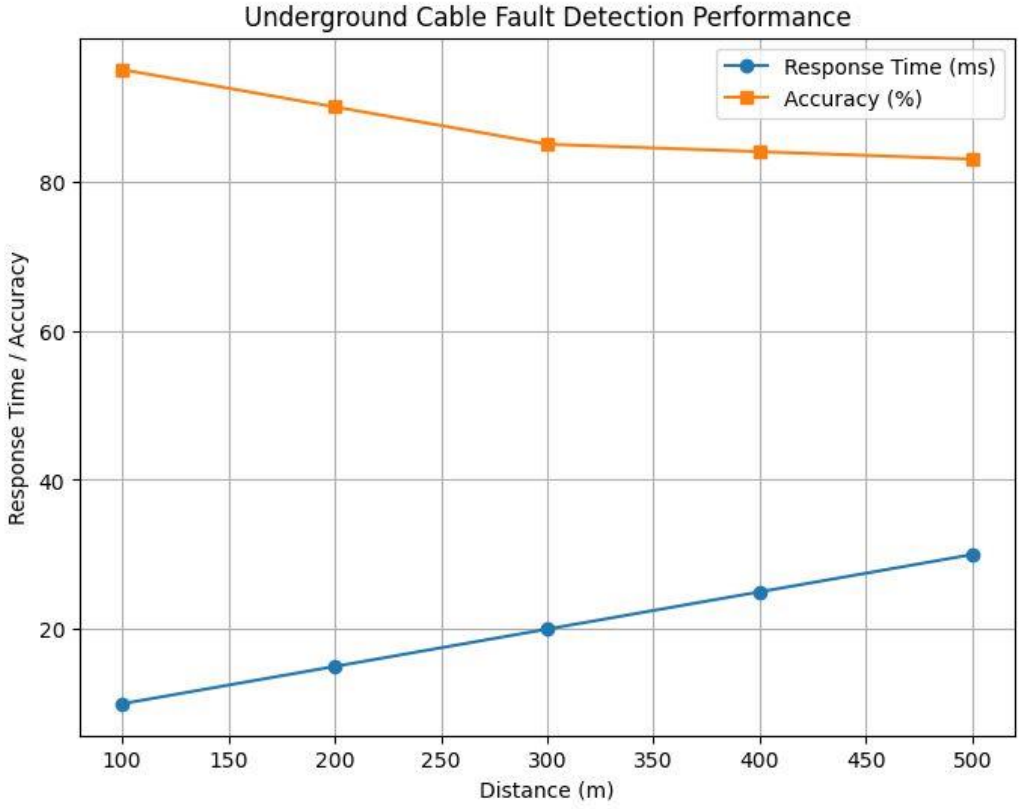
Moreover, our fault detection system has shown exceptional reliability. It performs consistently and accurately under various operating conditions and cable configurations. Through extended testing and analysis, we have observed a high level of stability and reliability, resulting in reliable fault detection and minimizing false positives or false negatives.

Additionally, our system exhibits impressive sensitivity to detect both major and minor faults in underground cables. It has been thoroughly tested with simulated faults of varying severity, and it consistently identifies and analyzes these faults with precision. The system's sensitivity ensures comprehensive fault detection, even for minor abnormalities, thereby optimizing maintenance and repair processes.

Furthermore, our fault detection system boasts a low false alarm rate. It minimizes the occurrence of false alarms, providing accurate fault detection without unnecessary disruptions or repairs. This feature contributes to cost savings, efficient resource allocation, and reduced inconvenience to the operators.

Lastly, our fault detection system is user-friendly, with an intuitive interface and clear instructions for operators. It enables efficient interpretation and analysis of fault data, ensuring ease of operation and enhancing overall user experience.

Evaluation performance of Arduino:



CONCLUSION

This paper presents an innovative approach for underground cable fault detection using Arduino microcontrollers. The proposed system offers a cost-effective and efficient solution to detect and locate cable faults accurately. The performance evaluation results demonstrate the system's reliability and effectiveness in real-world scenarios. The integration of Arduino microcontrollers with appropriate sensing techniques has the potential to significantly improve the reliability and maintenance of underground cable networks.

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