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A SURVEY ON IOT BASED UNDERGROUND CABLE FAULT DETECTOR USING ARDUINO

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Abstract : **This project's main goal is to use a microcontroller to locate where subterranean cable lines have suffered damage. Cables are buried beneath the earth in metropolitan areas to protect them from adverse weather conditions including snow, hail, and severe rain. Underground links are susceptible to a wide range of problems due to subterranean conditions, distance, mice, and various components. It is difficult to pinpoint the cause of a deformity, and in order to confirm and address problems, the entire relationship should be severed. Additionally, it aids in lowering the price of fault detection techniques. The major functional parts needed to show how fault detection and location might be implemented are put together during hardware execution.**

Due to the lack of a suitable technique for determining the precise location and fault type that happened from the cable, it is challenging and problematic when a fault develops in an underground cable. The prototype is represented with a series of resistors that stand in for the cable's length, and switches that are positioned at each distance are utilised to produce faults in order to cross-check the prototype's accuracy at each detection. The voltage across the series resistor will change as needed if a defect is discovered. This a defect sensor circuit module, a microprocessor, a microcontroller, a digital display, and an appropriate power supply configuration with regulated power output are all included in the system software. for failure detection. Information is shown via IOT and a Wi-Fi module through the Internet. On an LCD attached to the IOT device, the accuracy and results of the fault readings of the subterranean are shown.

Keywords: IOT, microcontroller, Underground Cable, Fault detection.

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, faults might be of any kind, including bad open circuit, short circuit, and earth faults. An open circuit fault occurs when a conductor in a cable sustains damage. 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.

LITERATURE SURVEY

Snehal R. Shinde, A. H. Karode[1] : The system gets rid with cumbersome solutions, has the ability to log data in areas with Wi-Fi network coverage, and can be applied to a variety of monitoring tasks. It uses sensors to measure the surroundings or ambient light and transmits messages to an IoT platform. On the basis of the current IEEE 802.11 architecture, a CPS that monitors environmental factors was developed and presented. By attaining low power consumption and providing battery lifetimes of several years, the communication protocol and node design contribute to improve the proposed system's dependability and security.

Viswanath Naik.S1 , S.Pushpa Bai1[2]: There is a greater need for connectivity with our properties wherever we are on the planet in the current situation where people are travelling the world. The job of linking every device to the internet to make it available from anywhere we have internet access comes into play now.This fascinating fact makes it necessary for us to implement a solution that incorporates our current resources. The internet of things enters the scene at this point. The implementation of a smart greenhouse that can be tracked using IOT technology is the main topic of this paper.

Ashlesha A. Patil and Dr. S. R. Suralkar[3]: The suggested setup comprises of a wireless body area sensor network and a Raspberry Pi computer. The sensors for temperature, blood pressure, and heartbeat are employed in this instance. These sensors are applied to the patient's body so that their health may be tracked without interfering with daily activities. Then, long-range wireless technology is used to communicate these health-related data to the doctor's server.

Dhivya Dharani. A and Sowmya. T[4]: There are several benefits, including improved aesthetics, more public acceptability, alleged protection from electromagnetic field radiation (which is still present in buried lines), fewer disturbances, and cheaper maintenance costs. The failure rates of overhead lines and underground cables can vary greatly, however usually underground cable failure rates are around half those of equivalent overhead line types. A circuit can be de-energized and then re-energized by lightning, creatures, and tree branches striking cables briefly may cause considerably fewer fleeting disruptions.

Abishek Pandey, Nicolas H. Younan[5]: In this study, subterranean power cables are Fourier analysis was used to locate defects and calculate the cable's average life duration. Three distinct kinds of cables—a regular cable, a shorted cable, and a cable with holes—are utilised in this experiment. Each time the impedance is determined, the impedance magnitude and phase are investigated in the frequency domain using the Fourier transform. On the experimental data, several windowing techniques are applied to eliminate any interference. The impedance data that was obtained from the differential voltage and transmission end voltage is then subjected to Fourier analysis.

Nikhil Kumar Sain, Rajesh Kajla,[6]: In this research, a microcontroller-based model for Wires that are buried underground are advised for fault location. Calculating the distance in kilometres between the base station is the project's main objective and the underground cable fault. The ohm's law principle is used in this project. Given that the current varies when a problem like a short circuit develops, the voltage drop will vary based on the length of the fault in the cable. The computations required to display the defect distance on the LCD display are handled by a microprocessor. As a result, a collection of resistors is used to represent the cable, a dc voltage is put into one end, and an analogue to voltage converter is used to monitor voltage changes in order to identify faults.

Md. Fakhrul Islam, Amanullah M T O, Salahuddin[7]: Long power outages may be very uncomfortable for customers and severely hurt the bottom line for power distributors and retailers. For power distributors and retailers, quick fault identification and confirmation is of utmost importance. Currently, somewhat hefty equipment is employed to locate cable faults. Furthermore, it is frequently the case that combining more than one method is necessary for accurate fault detection. This study discusses many currently used methods for finding high voltage cable faults.

Tobias Neier[8]: The subterranean cable's short circuit defect is positioned there so that it may be fixed effectively utilising the straightforward ideas of Ohms law. With the aid of the PIC 16F877A and ESP8266 Wi-Fi module, the work automatically shows the phase, distance, and time of fault incidence on a webpage. Accurate fault location has several advantages, including quick power system restoration, improved system performance, lower operating costs, and shorter field fault location times.

S No	Title	Technologies	Pros	cons
1	Underground Cable Fault Detection using Robot	IoT, sensors, transistors.	It is accurate. It can be controlled by experts only and it will solve problem with in ground itself.	It is high cost because it uses robot. It is not self-reliable.
2	Design and Implementation of Underground Cable Fault Detector	Micro controllers, sensors, transistors.	It detects all open and short circuits.	It does not detect any circuits outer faults like shield damage and wire cut etc.

3	Wavelet-based method for classifying and identifying faults in underground power line systems	transistors, sensors, and microprocessors.	Wavelets' ability to multiresolve in time and frequency enables precise temporal localisation of fault transients.	It doesn't resolve the issue. It provides only solution for problem only which may successful or may not.
4	LOCATING UNDERGROUND CABLE FAULTS: A REVIEW AND GUIDELINE FOR NEW DEVELOPMENT	Data analytics, transistor and power supply data	It locates accurate location of cable fault and provides type of faults it is.	It just provides only location but not any solution for problems and doesn't resolve it.
5	Conveyed Underground Cable Fault Distance Over GSM	Neural networks, controllers, Transistors.	decreased upkeep. It is more effective. Cable buried underground has a lower fault rate.	it doesn't provide any solution for faults or any reasons for occurrence of fault in the cable. It may be accurate in finding location of fault but it may be hard to rectify the problem.
6	Underground cable fault detection using Raspberry pi and Arduino	Raspberry pi, Arduino.	Achieving best accuracy in detecting open circuit fault, especially for high impedance incipient faults and other types.	It doesn't resolve the issue. It provides only solution for problem only which may successful or may not.
7	Underground cable fault distance locator	ATMEGA 16, micro controllers, transistors.	Best accuracy detection using power fault and ohms law.	It just provides only location but not any solution for problems and doesn't resolve it.
8	Underground Cable Fault Distance Detection System Based on IoT Technology Using the ATmega328P Microcontroller	Raspberry Pi, Arduino, ATMEGA 328P.	The IOT device has best output of finding accurate location of open circuit fault and short circuit, especially for old underground cables.	it doesn't provide any solution for faults or any reasons for occurrence of fault in the cable. It may be accurate in finding location of fault but it may be hard to rectify the problem.

CONCLUSION AND FUTURE SCOPE

The work uses a Microcontroller using an ESP8266 Wi-Fi module in an IOT application or website to automatically send data about a fault to the cloud. As a result of harsh weather conditions like heavy rain, storms, snow, or pollutants having no effect on subterranean high voltage lines, their use is on the rise. Contrarily, cables are susceptible to damage from improper installation or shoddy jointing, as well as future third-party harm from civil works like trenching or curb edging. A cable fault can be any defect it alters the performance route of the wire. Therefore, the mistake has to be fixed. Many places, especially in cities, prefer underground wires. With the use of this device, we are able to locate a defect in an underground wire. As a result, this system does not require the entire region to be debugged in order to find the error. Spending and labour are consequently decreased. The benefits of a fault include quick system fix for better system performance and power restoration. It decreases operational expenses and the amount of time needed to find defects in the field. The microcontroller in the Arduino runs based on the status of the power supply. The IOT module is essential because it enables fast updates to the status of IOT and several substations via an IOT common app. Open circuit abnormalities, short circuit Line to Line Faults (LL), and double Line to Ground Faults (DLGF) can all be included under the work (LLG). By determining the distance of the defect and measuring the change in impedance, a capacitor in an alternating current circuit can identify an open circuit.

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