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IOT BASED UNDER GROUND CABLE FAULT DETECTION SYSTEM

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ABSTRACT

The proposed system is meant to solve the problem of accurately finding problems in underground cable lines, especially in cities where these lines are common. Using an Arduino microcontroller kit and a power source that has been connected, the system uses current measuring circuits that are connected to the microcontroller's built-in Analog to Digital Convertors (ADC) device to get a precise reading of the wire length in kilometers. Switches are used to mimic faults, and relay circuit to controls the relays. A 16x2 Liquid Crystal Display (LCD) screen shows problem details in real time. The environmental possibilities like rain, underground pollution, drain leakage etc may cause short circuit faults in the underground cable. Various faults may occur in underground cable; this paper focuses on locating short circuit fault. The location of the short circuit fault is sensed as a voltage changes across the resistor and the distance is calculated from the source fed point and ADC digitizes it to display on the LCD. With the help of Wi-fi module 8266 the fault location details are stored in the cloud for further analysis. This lets the proposed Arduino microcontroller design to show exactly where the fault is (in kilometers) from the base station. A buzzer warning also lets field workers know that they need to take action right away if a fault happens. This novel method is a reliable and effective way to find and spot problems i buried cable lines. This makes servicing easier and cuts down on downtime.

KEYWORDS:NODEMCU,L298N,INTERNET OF THINGS, CABLE FAULT DETECTOR,BLYNK

I. INTRODUCTION

Indian National grid is the electricity transmission network for high voltage. The present Indian grid has power transmission and distribution lines, to transmit electricity through an overhead cable (transmission line) by towers/poles. Electricity transmission networks are developing persistently and their unwavering quality getting more significant than any other time in recent days. The underground cables are used for longer duration of time for supplying lesser and medium voltage. High voltage lines in the underground transmission lines are utilized increasingly more as they usually are not impacted for the cause of climate conditions, over rain, strong wind that is storm, snowfall or pollution in the environment. Despite the fact that the Cable assembling innovation is improving consistently, there are still impacts which may make link come up short during test and activity. Anyway cables can be

effortlessly harmed by erroneous establishment or poor jointing, while resulting outsider harm by common works, for example, digging or control edging. The overhead cables are replaced with underground cables for the transmission of electricity by the undergrounding method. Overhead cables are generally used as maximum of the insulation is provided by air and this reduces the amount of power transmission for huge quantities of electrical energy. The installation cost of overhead cables can be less

but the operational cost is too large. But in case of undergrounding of electrical transmission lines, even though the initial cost is more the operational cost of the cables will reduce over the lifetime. The linemen are to be ready during the days when failure occurs, to figure on the lines as fault may occur at any point of your time or any cause. The most of the reason for the fault is either the low quality of conductors/cables used for transmission/distribution or electrical theft. We might have been observed the negligence of power lines handled by the electricity department or by some linemen. When the fault is occurred due to the civil works on the road causes breakage, then the fault is cleared just by twisting lines rather than providing a joint.

In some situations, the conductors are required to get replaced with the new ones during fault, at that point the inferiority conductors are placed, this might cause fault in future. Techniques to spot the precise location of fault on the road are possible as they can be seen to the bare eyes and we can find the specific distance where the flaw has occurred and so it can then easily repair it within less time.The system needs to be investigated for the electrical theft in the supply lines and so at the distribution lines and at feeders. This can be really not an easily handled straightforward work. It will be a good choice of an undergrounding, if we want a replacement of the system. The electrical accident may happen either while performing a work on the lines or unidentified broken lines laid on the bottom. The death rate of electrical accidents may be reduced by proper installation of under grounding ofcables.However,the undergrounding of cables can be constructed, during that time each and every materials used for construction and for all the requirements including the manhole utmost care needs to be taken. If the entire system is constructed with high quality materials and with all positive intension, then this system will work for a longer duration of time and it lives healthy for an extended period of your time. The long term India with underground electric power lines will avoids electrical theft, reduces the interruption of power supply to the patron, reduced cost requirement of maintenance, enlarges the sweetness of the state, reduces the death rate of electrical accidents, it also acts as a step to be a developed nation. Process of finding the flaws periodically will be defined as fault identification. The damage to the line or conductor of power transmission is called by name line faults and this is due to its effect on its resistance. If permitted for tolerance it will results in breakdown of voltage. The various kinds of cable faults can occur and it depends on the reason of the fault. So first they should be categorized before it is cleared. For this the important action is of the insulation of the conductor. Whereas some kind of cables are at high risk because of effect of thermal effects from external sources and also of the chemical reaction, and such effects can be seen generally in high voltage cables, in those affected part is the conductor's insulation. Finding the underground cable are often a posh job, it is even tougher task because the underground plant is static and it is fixed.

A. Existing System

In traditional underground cable fault detection, two principal techniques are commonly employed:

1. Tracer Technique: This method involves physically tracing the cable path and detecting faults through electromagnetic signals or audible cues. Technicians walk along the route of buried cables using specialized equipment to locate the fault accurately. Although effective, it is labor-intensive and time-consuming.

2. 2.Terminal Technique: This technique evaluates the cable from one or both ends, without inspecting the entire length. It is particularly helpful for identifying common fault types, such as short circuits or open circuits, but lacks the precision required for pinpoint fault localization.

Both methods have notable limitations in modern contexts where real-time monitoring and fast fault resolution are essential. The manual nature of these techniques results in increased downtime, operational costs, and potential damage to other infrastructure during excavation.

B. Problem Statement

Underground cables are increasingly used due to their resilience against environmental factors like wind, rain, and pollution. However, identifying the exact location of a fault within an underground cable network remains a significant challenge. Traditional fault detection methods are slow, costly, and inefficient.

C. Proposed IoT-Based Solution

The proposed system addresses these challenges by incorporating an IoT-enabled micro controller-based fault detection mechanism. The system continuously monitors voltage variations along the cable using sensors and a resistor-switch network. When a fault occurs, the system calculates the location based on the voltage drop using Ohm's Law, displays it on an LCD, and sends an alert via GSM and an IoT platform like Thing Speak

.LITERATURE SURVEY

In this paper [1] it is proposed that, after the detection of instance of deficiency inside the underground cable, the microcontroller cautions the client remotely through the IOT. The event of fault occurrence up to a predefined distance is regularly explored through this proposed framework. The flaw finder in this methodology gauges the current and voltage of underground cable and if there is any high contrast among voltages and current happens at the two terminals of issue identifier then locator will alerts the client remotely without going close [1]. Nowadays a significant number of the nations are settling on underground links rather than overhead links for transmission because of the lots and lots of its advantages over overhead links. The most difficult issue with the underground cables is finding the distance of the flaw in the lines during the event of failure as they are laid under the ground. This task assists with recognizing the sort of flaw just as its area. By utilizing GSM, we can able to get the fault distance by sending the information as a text message format to the respective person using GSM [2]. This venture utilizes the basic theory behind the ohm's law. At any point the flaw like

short out happens, voltage drops depending upon the length of flaw in link. A set of series arrangement of resistors are implemented as a link and some power supply in the form of DC voltage will be provided at one end and the flaw distance is found by recognizing the voltage change utilizing a ADC and a microcontroller is utilized to make the fundamental counts hence the flaw separation is shown on the LCD. Thereby the fault

distance is found and it is printed on the LCD. The flaws and the reason for the flaws in the underground cable network for

transmission is complicate thing as it can be seen barely and so we need to dig the ground and need to check the entire network to

find the place of failure. That's why there is a need of an approach to overcome from this issue thus this paper presents the idea

towards this issue [3].

In this manner, the essential idea of Ohm's law is discovered appropriate on a fundamental level to build up a flaw area following framework. In view of the Ohm's Law, it is discovered that the link's resistivity is relative to its length under consistent states of temperature and the area of its cross section and in this manner if a small power is given at the supply point by using the resistor connected in series, the current would differs w.r.t. the area of deficiency in the link. Here a framework is created which comprises of a microcontroller, LCD, Fault Circuit, Wi-Fi Module and regulated power supply with balanced power yield. The proposed framework gives the actual place of the failure in the underground lines [4]. This proposed system finds the exact location of the fault. The prototype is modeled with a set of resistors representing cable length in km and fault creation is made by a set of switches at every known distance to cross check the accuracy of the same. In case of fault, the voltage across series resistors change accordingly, which is then fed to an ADC to develop precise digital data to a programmed PIC IC that further displaysfault location in distance. The fault occuring distance, phase, and time is displayed on a 16x2 LCD interfaced with the microcontroller. IOT is used to display the information over internet using Wi-Fi module ESP8266. A webpage is created using HTML coding and the information about occurrence of fault is displayed in a webpage [5]

I. METHODOLOGY

The Module descriptions of the methodology is as follows:

A. Supply Part

It is an electronic unit which is employed to relinquish regulated power supply to any electronic system. The parts/blocks which

form the provision part are:

1) Transformer

2) Bridge rectifier

3) Voltage regulator

Bridge rectifier

7805 voltage regulator

B.control system

Arduino is open source and single board architecture microcontrollers. Arduino Uno is used to produce display according to fault by executing program loaded into it.

Arduino UNO board

The circuit is ready employing a set of resistors arranged in an exceedingly row in serial manner. A row of 4

resistors represent the cable line. That row is scanned through a relay for any fault occurrence.

C. Fault Switches

1) Cable Line: The circuit is ready employing a set of resistors arranged in an exceedingly row in serial manner. A row of 4 resistors represent the cable line. That row is scanned through a relay for any fault occurrence

Push button or switch

Resistor

relay: A relay can operated electrically and it can be utilized like a switch and it can also utilized in a circuit. Relays were

broadly utilized in phone ex-changes and early PCs. To shield electrical circuits from over-burden, relays with adjusted

working attributes are utilized. They're called as protective relays.

Relay board

D. Display Part

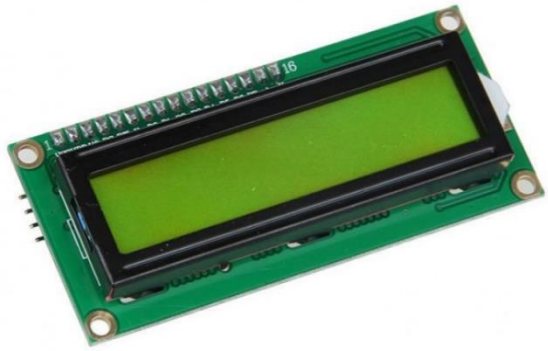
1) LCD Display: This block consists of double line and sixteen character LCD display. LCD stands for liquid Display. It consists

of 16 pins within which there are 8 data lines. Four data lines are used for displaying a line. It will display the message

comparable to the fault occurrence. The controller gives output characters to print the message on the screen of the display. The

contrast LED+ will be given +5V to glow brightly. If the LED+ is grounded, then the message or text is displayed with low

brightness which is enough visible.

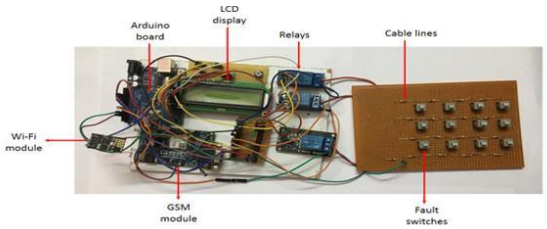


16*2 LCD display

V.EXPERIMENTAL RESULTS

The results of the system are shown below.

1) The complete hardware connection of the underground cable fault detection system.



LCD displaying NF when there is no fault at all the phases.

2.LCD displaying NF when there is no fault at all the phases.

3.LCD displaying when fault occurs at particular distance at particular phase

Conclusion

This project effectively demonstrates how to detect and locate faults in an underground cable using Arduino and the principle of Ohm's Law. By applying voltage at the feeder end through relays, any drop in voltage—caused by a fault such as a short circuit to ground—results in a measurable change across a series resistor. This change is processed by the Arduino's ADC and interpreted by the microcontroller to accurately determine the fault's location in kilometers. The system is calibrated using a series of resistors that simulate the cable length and includes switches at known intervals to validate the accuracy of fault detection. The exact fault location is then displayed, providing a practical and efficient solution for identifying and resolving undergroud cable .

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