International Journal of Scientific Research in Science, Engineering and Technology
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Underground Cable Fault Monitoring System Using Cloud Computing and IOT

Gouri M S*[1], Kavana M[2], Guru Shankar M R[2], Tarun S G[2], Shaik Mohammed Nubaid[2], Arbaz Ahamad F S[2]
*[1]Assistant Professor, Department of Electronics and Communication Engineering, T John Institute of Technology, Bangalore, Karnataka, India
*[2]Student, Department of Electronics and Communication Engineering, T John Institute of Technology, Bangalore, Karnataka, India

Article Info

Publication Issue :
Volume 10, Issue 1
January-February-2023
Page Number : 317-323

Article History
Accepted : 01 Feb 2023
Published: 15 Feb 2023

ABSTRACT

In order to avoid needless impediment, cables are buried. When underground force cables are used to transmit electrical force, it can be very difficult to pinpoint exactly where a failure occurred. There are many factors or motives that can cause a default, such as burrowing, tremors, construction work, and so forth. The fixing process associated with the cable is difficult because it is unable to pinpoint the precise location of the problem that occurred to the cable. These flaws cause poor power transmission efficiency, which results in a significant annual power loss. The secret to raising the dependability and achieving the best performance out of the system is the development and design of new methods to identify the type of defect and its location. A very fundamental method used in metropolitan areas is underground cable framework. The defects in an underground cable route from the base station to a specific location in kilometres are anticipated to be discovered in this article. With the aid of a prospective divider organise placed over the cable, the framework detects flaws. When a cable line fault is discovered, a voltage is generated in accordance with the resistors' organised mixture. The microcontroller detects this voltage and updates the user. The user is informed about defect detection in the information provided. The microcontroller gets the fault line data and displays it on the LCD screen. It also sends this data over the internet to the Gmail server for display.

Keywords : Microcontroller, Internet of Things, Underground Cable Fault Detection, Fault Sensing Module, Cable Lines, and Fault Location

I. INTRODUCTION

As the electrical grid has grown, underground cables have become increasingly common. In recent decades, cables were manufactured to hang overhead; today, they are made to hang underground, which is a better way than in the past. Because unfavourable weather conditions including storms, snow, heavy rain, and pollutants have no effect on underground cables. But it is challenging to pinpoint the precise location of a defect when it affects an underground wire. Due to losses that occurred, the effectiveness of the cable wire was suddenly impacted since it is extremely difficult to physically locate the precise place or the problematic area. There are several approaches in use today that can be used to find cable line faults. The fault detecting and locating techniques play a very important role in maintaining. The main issue, however, is how to identify a cable wire fault when it is under grounded and how to access or recover those data relating to the fault location anytime it is needed. In order to solve this problem, we presented a system that locates the defect precisely and communicates serially with a server using the IoT idea. The manual process takes a long time, therefore [4] is used to identify and locate the errors. Here, we provide a cable failure detection over IoT that pinpoints the exact location of the defect and makes repair work quite simple. Due to the underground cable's inaccessibility, finding and identifying cable defects may be challenging.

II. PROBLEM STATEMENT

Because it is more effective than the older way, cables are now constructed to run underground rather than overhead. Underground cables are not affected by inclement weather such as torrential rain, snow, storms, or pollutants. Finding a means to pinpoint the exact position of a defect in an underground cable is necessary because it is difficult to notice when one occurs. Because the world is becoming more digitalized, our method is to locate the underground cable fault in a digital manner. This is because our goal is to serve the digitally. Today, installing subterranean cable systems is a widespread practise in many urban areas. There are several factors that can cause a fault to occur in an underground link, and if one does, it can be difficult to detect and repair that particular link because it is difficult to pinpoint the exact location of the cable fault. The existing technology for finding cable faults is heavy, and sometimes more than one way is needed to find the problem in an underground cable because one method is insufficient to find the defect. It takes time to organise numerous tests with sophisticated equipment in order to diagnose the malfunction. For the speeding up of system renovation, fault location techniques that can reduce significant financial loss and operating loss are required.

III. LITERATURE SURVEY

[1] asserts that when a low DC voltage is provided at the feeder end through a series resistor (Cable lines), the current will fluctuate based on where the cable fault is located. The voltage across series resistors varies in response to a short circuit (Line to Ground), and this voltage is then supplied to an ADC to provide exact digital data that the programmed microcontroller of the 8051 family would display in kilometres. The project is built using a collection of resistors that represent the length of the cable in kilometres, and a set of switches that create faults at each known kilometre to double-check the correctness of the same. On an LCD, the problem and its phase are shown to be at a specific distance.

In line with [2], In the past, overhead cables were used to carry power; today, subterranean cables are employed, and this installation approach is superior to overhead cables. This is due to the fact that underground cables are not influenced by weather conditions like storms, heavy rain, or pollution. However, this method has an issue when the cable has a malfunction because it makes it hard to find it. We will therefore locate the fault's exact location. The world is becoming more digitalized today, thus the project is designed to defect the fault location digitally. In most urban locations, the underground cable system is a standard practise.

Understanding how to calculate the distance in kilometres from the fault in the base station's underground cable requires a thorough understanding of the different fault detecting procedures. We employed the straightforward idea of ohm's low in our project. When a system problem occurs, the distance shown on the liquid crystal display changes (LCD). There is now no underground cable that is higher than the previous approach, and harsh weather conditions like storms, snow, torrential rains, and pollutants have no effect on underground lines. Up until the last ten years, cables were meant to be positioned above the head. However, it might be challenging to find the problem in an underground cable when it affects lines that are below ground. We'll locate the fault's precise position. Since the entire world has gone digital, the project's goal is to locate the defect precisely in a digital format.

In line with [3], Due to recent improvements in circulation system dependability and security considerations, the underground power link is being used more frequently. Underground cables have been essential due to security issues and the necessity for high power in populous regions. The underground cable has the advantage of being safe and impervious to inclement weather. However, it has a limitation that prevents quick identification of underground cable line faults. Electrical engineering has long struggled with the problem of cable failures and accurate cable fault detection. Finding the fault's location and type, as well as its nature after it has happened, is the key challenge. With the development of technology and the employment of various detection algorithms, fault detection techniques for underground cable networks continue to improve daily. Identification of the fault is the initial stage in the fault detection process.

In line with [4], Millions of miles of cables have been suspended in the air across the nation for decades. But now, as opposed to an earlier manner, it is buried underground. Any inclement weather, including smog, torrential rain, snow, and storms, has no effect on underground wires. Underground high voltage cables are being employed to lessen the sensitivity of distribution networks to environmental effects. Due to the advantages of subterranean connections, which provide more security than overhead lines in inclement weather and are less susceptible to damage from storms or lightning, underground cables have been frequently utilised in power distribution networks. For shorter distances, it is less expensive, environmentally beneficial, and little maintenance. In many urban locations, underground cable systems are a prevalent practise. As a result of not knowing the exact location of the cable, it is extremely challenging to pinpoint the exact location of any cable-related problems. Therefore, this project is used to locate the defect in a digital manner. Locating the problematic area in an underground cable is necessary to speed up repairs and increase system reliability.

Underground cables are being used, claims [5,] to advance the intensity framework matrix. These underground cables are not impacted by any weather elements, such as rain, a holiday, or other issues. An issue with an underground cable could arise simply as a result of earth vibrations or other digging operations. It is quite difficult to fix the issue because it occurred in an ambiguous location. Optical fiber framework is used to overcome this obstacle. Alongside the force cables, several optical strands are installed. The optical fibre structure continuously measures various parameters at a number of checkpoints located at regular intervals along the force cable (for example, power, current, and cable temperature). When a problem arises, estimates of the surrounding regions' parameters change in an unexpected way. Information is gathered from the checkpoints' ambient variables where the insufficiency occurred.

IV. METHODOLOGY

Software Process:

The series of actions and outcomes that led to the creation of a software product is known as the software process.

Examples include the spiral model, the waterfall model, and the evolutionary model.

This project's development has adhered to the "Waterfall" process methodology. One of the better process models is this one. This model comes in a variety of forms.

Only when all of the needs are known in advance is this approach at its optimum. Both consumers and system developers can easily comprehend this procedure. Additionally, this process model delivers deliverables at the end of the process, making it more obvious. Project managers consider a number of factors when choosing a process model for a project, with visibility being one of them.

Project managers consider a number of factors when choosing a process model for a project, with visibility being one of them.

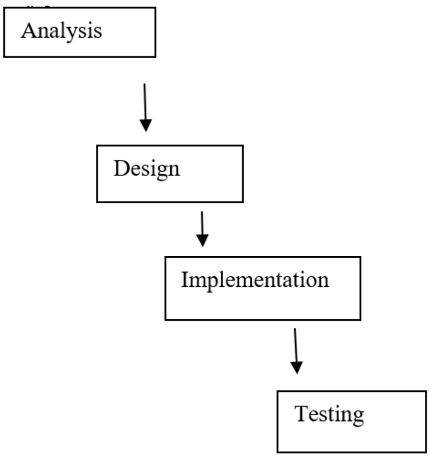

Figure 4.1 Waterfall process model

The waterfall process model has five phases. They are as given below.

(1)Analysis

Users of the system are consulted to determine the system's services, limitations, and objectives.

(2)Design

The requirements are split up into hardware systems and software systems during the systems design phase. It establishes the general architecture of the system. The process of designing software entails expressing how a software system works in a way that can be converted into one or more executable programmes.

(3)Implementation

The software design is implemented at this level as a collection of programmes or programme components.

(4)Testing

Program modules or individual programmes are tested. The software requirements are then verified by integrating and testing the system as a whole. The customer receives the software system after testing.

Advantages:

- The development process is more evident because deliverables are generated at the conclusion of each stage. This will make it easier to always be aware of the project's status.
- This works best for projects where all the requirements are known in advance and where adjustments to the project are not necessary.
- Potentially Reduced Operating and Maintenance Costs
- Lower tree-trimming and storm-restoration costs
- Greater Reliability: An underground system will have higher reliability during severe weather because wind-related storm damage will be significantly decreased, and areas not vulnerable to flooding and storm surges will sustain less damage and experience fewer power outages.
- Less damage from storms; Significantly fewer brief disruptions; Improved utility relations with regard to tree trimming; Increased Public Safety
- A decrease in auto accidents.

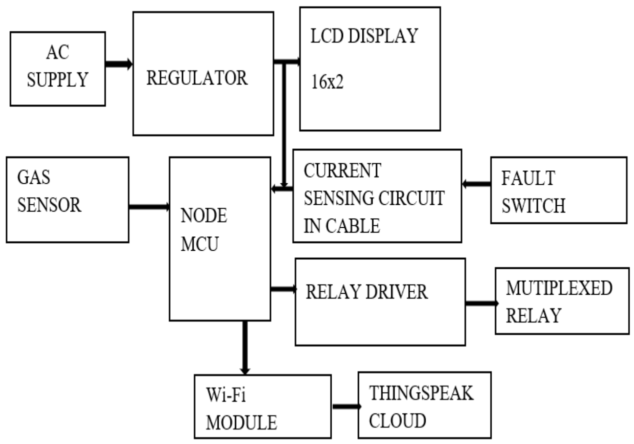

Fig. 4.2. Block diagram of the proposed model

Over the past few decades, numerous approaches for locating cable line faults have been developed. Usually, we employ overhead lines. It can quickly discover the flaws, but we can't use overhead lines in busy areas or well-known cities. We will now switch to underground cables. In this article, IoT technology is used to enable government agencies to track and investigate problems online. The potential divider network that has been installed across the cable aids the system in problem detection. A certain voltage is generated according to the resistor network configuration whenever a fault is created at a spot where two lines are shorted together. This study suggests a system based on IoT because the current system is inefficient. This project's goal is to use an IoT cloud platform to calculate the underground cable fault's distance from the base station in kilometres. In many urban locations, the subterranean cable line system is used. Different fault identification techniques including sectionalizing, acoustic detection, and Murray loop approaches are rarely used because of their numerous drawbacks. Because underground cable cannot be checked in sections, the sectionalizing approach cannot be used. The acoustic method is a bit laborious and can be devastating during rainy weather. Due to varying lead resistances and the Wheatstone principle, the Murray loop approach Numerous underground signal wires, including telephone, power, and other cables are installed. It took a lot of time, and the workload was also greater. Anytime a problem develops in the cable line, we can view the position in the IoT Cloud online system using the IoT-based underground cable line fault locator. The administrator can then let the repairman know. Construction work and other factors are frequently to blame for errors. Because it does not know the precise location of the cable line defect, it is challenging to dig out fully loaded cable lines. The voltage across series resistors adjusts in response to a short circuit. The microcontroller detects this voltage and updates the user. The user is informed of the distance at which the voltage correlates to the fault happening at a specific distance, together with the corresponding phase, which is displayed on an LCD. This information is also transmitted over the internet for online viewing. The online system that links with the system to display the cable faults online was developed by this study using ThingSpeak. The project is built using a collection of resistors that represent the length of the cable in kilometres, and a set of switches that create faults at each known kilometre to double-check the correctness of the same.

This module detects gas leaks as well and updates Thingspeak cloud status when necessary.

V. EXPECTED OUTPUT

The paper-based Internet of Things-based underground cable line defect detection device worked as intended. It greatly facilitates defect discovery. It is able to pinpoint precisely where the defect has occurred. Only the area where the fault occurred needs to be excavated by the repairman. With the aid of the IoT Cloud, this article enables researchers to identify and pinpoint underground cable issues. As a result, the method utilised in this research acts sequentially and is effective in locating and identifying problems in underground cables.

As the saying goes, "Necessity is the mother of all inventions," it was realised there was a need for software that would control equipment and processes. The design strategy employed here produced acceptable results, and the microcontroller is adequate for measuring the necessary parameters. The device's measurements are quite accurate, and the power consumption has been kept as low as feasible. In order to address the issue, highly interactive, user-friendly embedded technology using microcontrollers was developed. The newly designed module will simplify the process. The user module has reduced human labour requirements while simultaneously improving comfort.

Consequently, the module is working quite well as a tool. The software would become a useful tool for the user if the future improvements mentioned previously were included.

VI. FUTURE ENHANCEMENTS

The following adjustments can be made to the current circuit to produce an even smarter project.

• The module can include a quicker and more powerful microcontroller to combine control of numerous more devices simultaneously.

• Developed time-controlled technology for use in commercial settings. A huge display in a showroom might be controlled between two different time intervals, for instance, without any user or technical assistance.

Voice alerts can be used to announce the status of various devices under supervision.

VII. REFERENCES

[1]. Sahana S ,Harish Kumar B M, Anu S M Vani H V, Sudha T, Prashanth Kumar H K "Analysis of fault detection and its location using microcontroller for underground cables" International Research Journal of Engineering and Technology (IRJET), June -2017

[2]. Dhanyavathi A1 , Akshay Kumar A.V2 , Harish M.3 , Sachin Chikkond4 , Bharath M P "Underground Cable Fault Detection and Notification System" ISSN: 2319-7064,2019

[3]. Rao. M Asif1 , Syed Rizwan Hassan , Ateeq Ur Rehman , Asad Ur Rehman , Bilal Masood , Zain Ali Sher "Smart Underground Wireless Cable Fault Detection and Monitoring System" ICE4CT,October 12,2022"

[4]. K.R Kavitha, S. Vijayalakshmi, V. B. Kripal, D. Sathishkumar, K. Kishorekumar, S. Dinesh "IOT BASED UNDERGROUND FAULT DETECTON", JOURNAL OF COMPLEMENTARY MEDICINE RESEARCH,10.5455, 2020

[5]. FH Md Arifin1 , MZ Hasan1 , IS A Mahyudin1 , SNM Arshad2 "Development of fault distance locator for underground cable detection" Journal of Physics: Conference Series,2019

[6]. Chao, KANG Xiaoning, MA Xiuda, JIANG Shuai, QU Xiaoyun Shaanxi Key Laboratory of Smart Grid "On-line Incipient Faults Detection in Underground Cables Based on Single-end Sheath Currents" IEEE PES Asia-Pacific Power and Energy Conference,2016

[7]. Schulze, Member, IEEE and Peter Schegner, "Two-Terminal Fault Location on Unsymmetrical Transmission Lines",IEEE,2010

[8]. Xu Sun, Wing Kin Lee1, Yunhe Hou1, and Philip W. T. Pong1 "Underground Power Cable Detection and Inspection Technology Based on Magnetic Field Sensing at Ground Surface Level", IEEE ,2014

[9]. Saurabh Kulkarni, Student Member, IEEE, Surya Santoso "Incipient Fault Location Algorithm for Underground Cables", IEEE,2014.

[10]. Kunal Hasija, Shelly Vadhera, Anurag Kishore "Detection and Location of Faults Underground

Cable using Matlab/Simulink/ANN and OrCad",IEEE,2014

Cite this article as :

Gouri M S, Kavana M, Guru Shankar M R, Tarun S G, Shaik Mohammed Nubaid, Arbaz Ahamad F S, "Underground Cable Fault Monitoring System Using Cloud Computing and IOT", International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Online ISSN : 2394-4099, Print ISSN : 2395-1990, Volume 10 Issue 1, pp. 317-323, January-February 2023.
Journal URL : https://ijsrset.com/IJSRSET22953