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UNDERGROUND CABLE FAULT DETECTION USING IOT

[1]Author 1: Mr.V. Hari krishna,Author 2: G.Neelima, Author 3:P.Poojitha, Author 4: M.Madhu, Author 5: D.V.N.Surya, Author 6: Ch. Satwika

Designation of 1st author : Assistant professor, 2nd to 6th author's designation:Student
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
[1]UNIVERSITY COLLEGE OF ENGINEERING NARASARAOPETA, JNTUK, NARASARAOPETA PALNADU(DISTRICT)

Abstract: Underground cables have been widely used with the development of power system grid. Underground cables are prone to a wide variety of faults due to underground conditions, wear and tear, rodents. Detecting the fault source is difficult because entire line is to be dug in order to check fault at cable line. If the repairmen know exactly which has and only that area is to be dug to detect the fault source. Thus, it saves a lot of time, money and allows to service underground cable fault from base station in Km In underground cables, if there is any fault occur at that time the fault detection is achieved by help of Sectionalizing, Thumping and Murray loop methods etc. In sectionalizing method first, we divide the enter cable in the form of sections then we need dig or check total cable from to distance. In thumping the fault detection is achieved with the help noise produced in cable by supplying high voltage. With that too much money, time and money will be waste. So, to overcome those problems we are proposing the underground cable fault detection system using IoT.

IndexTerms- IOT(Internet of Things),Underground Cable, Fault Detection, Fault localization, Remote monitoring, Smart Grid , Power Distribution , Real-time Analytics ,Fault Classification ,Wireless Communication, Energy Management.

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I. INTRODUCTION

INTRODUCTION

Electricity becomes a basic need in our daily life. Mostly activities of our life style depend upon electricity. Electricity has been involved in our life style in such a way that it plays a very important role in every field. The transformer is decisive equipment in power system for transmission and distribution. In power system underground cables are used to transmit the electric power from generators stations to distribution point then it is transferred to the consumer ends by overhead or underground cables. Underground cables have to suffer various problems due to aging and different types of faults. To overcome these problems in cables, lots of research work has been done. Here we proposed a method to rectify these problems. Previously there are so many online and offline methods available for detection of fault and life into underground cables. These methods are used for fault detection of underground cables.

The detection of faults is one of the biggest drawbacks of underground wires. Visual inspection procedures are ineffective because the cables are placed beneath the surface. In the case of Overhead Lines, this is not the case. We'll need to create unique methods to detect cable failures. The problems that can be raised are open circuit fault, whether the cable can be short circuited or cable can be earthen.

When moisture enters the insulation, the majority of the defects arise. Inside the cable, the paper insulation is highly absorbent. Mechanical loss during transit, the lying process, or numerous stresses faced by the wire during its operational life are some of the other causes. The lead sheath is frequently destroyed, mainly as a result of atmospheric pollutants, soil, and water or, on rare occasions, caused by mechanical damage caused by vibration.

NEED OFTHESTUDY.

Developing an effective underground cable fault detection system using IoT is imperative due to the persistent challenges in quickly identifying faults. Current methods suffer from inefficiency, high costs, and prolonged downtime, leading to service disruptions and safety hazards. This project aims to design a reliable and cost-effective solution utilizing IoT sensors and data analytics to accurately detect and locate faults in underground power cables. By leveraging real-time monitoring and advanced algorithms, the system aims to minimize downtime, reduce maintenance costs, and ensure uninterrupted power supply, enhancing overall system reliability and safety

Detect faults in underground power cables promptly and accurately and provide real-time monitoring of cable health and condition. Enable remote monitoring and management of the power distribution network. Minimize downtime by quickly locating and isolating faults. Reduce maintenance costs associated with manual inspection and repair.

DataandSourcesofData

Forthis study secondary data has been collected. From the M. Khari, A. K. Garg, A. H. Gandomi, R. Gupta, R. Patan, and B. Balusamy, "Securing Data in Internet of Things(IoT) Using Cryptography and Steganography Techniques, "IEEE Transactions on Systems, Man, and Cybernetics: Systems, vol. 50, no. 1, pp. 73–80, 2020. Ajaei, F.B., Sanaye- Pasand, M., Davarpanah, M., Rezaei- Zare, A. and Iravani, R. (2019) 'Compensation of the current-transformer saturation effects for digital relays', IEEE Trans. on Power Delivery, vol. 26, no. 4, pp. 2531– 2540. Cai, D., Regulski, P., Osborne, M. and Terzija, V. (2015) 'Wide area inter-area oscillation monitoring using fast nonlinear estimation algorithm', IEEE Trans. Smart Grid, vol. 4, no. 3, pp. 1721–1731.JRee, D. L., Centeno, V., Thorp, J. S. and Phadke, A. G. (2013) 'Synchronized phasor measurement applications in power systems', IEEE Trans. Smart Grid, vol. 1, no. 1, pp. 20–27.Detection and localization of cable faults by time and frequency domain measurements, Qinghai Shi, Troeltzsch U, Kanoun O. Conf. Systems and Signals and Devices, 7th International conference, Amman.2010; 1-6Nikhil Kumar Sain, Rajesh Kajla, Mr.VikasKumar—UNDERGROUNDCABLE FAULT DISTANCE CONVEYED OVER GSM, p-ISSN: 2320-3331, Volume11-Issue2April2016.

Theoreticalframework

Studies about Underground cable fault detection revealed that there are different techniques for the purpose of fault detection and localization. Some of the techniques are:

- Sectionalising Method
- Thumping Method

Sectionalising means cutting and slicing the cable, dividing the cable into successively smaller sections that will enable finding the faulty point. In this method the faulty cable was isolated and the connection will be continued from the next node itself.

In thumping method the fault detection is achieved with the help noise produced in the cable by supplying high voltage. A thumper is set to thump repeatedly and then walking along the cable route to hear the thumping sound.

RESEARCHMETHODOLOGY

IOT based Fault Detection:

1. Sensor Network: Deploy sensors along the length of the underground cables to monitor parameters such as temperature, voltage, current, and impedance. These sensors collect real-time data about the cable's condition.

2. Data Acquisition: The sensor data is transmitted to a central control unit or gateway using wired or wireless communication protocols such as Wi-Fi.

3. Data Processing and Analysis: The central control unit receives the sensor data and processes it to identify any abnormalities or patterns indicative of a fault. Machine learning algorithms or rule-based systems can be used for fault detection and classification.

Fig.1 IOT Network

4. Fault Localization: Once a fault is detected, the system identifies the precise location of the fault along the cable's length using techniques such as impedance-based localization methods.

5. Alert Generation: Upon detecting a fault and determining its location, the system generates alerts or notifications to inform maintenance personnel or operators. This can be done through email, SMS, or a dedicated monitoring dashboard.

6. Remote Monitoring and Control: Operators can remotely access the system to monitor the health of underground cables in real-time and take necessary actions such as scheduling maintenance or re-routing power.

IMPLEMENTATION

In this system fault location can be detected using Internet of Things this system is dependent on internet signifying that information will be via internet. This technique is used to determine the distance in Kilometers between a cable fault and a base station as well as location of the cable fault. The signal modified in the circuit manipulates the voltage change and the required computations are performed by microcontroller, So that GPS devices can indicate the fault distance. This fault information are then broadcast over the internet to any access point and displayed.

BLOCK DIAGRAM

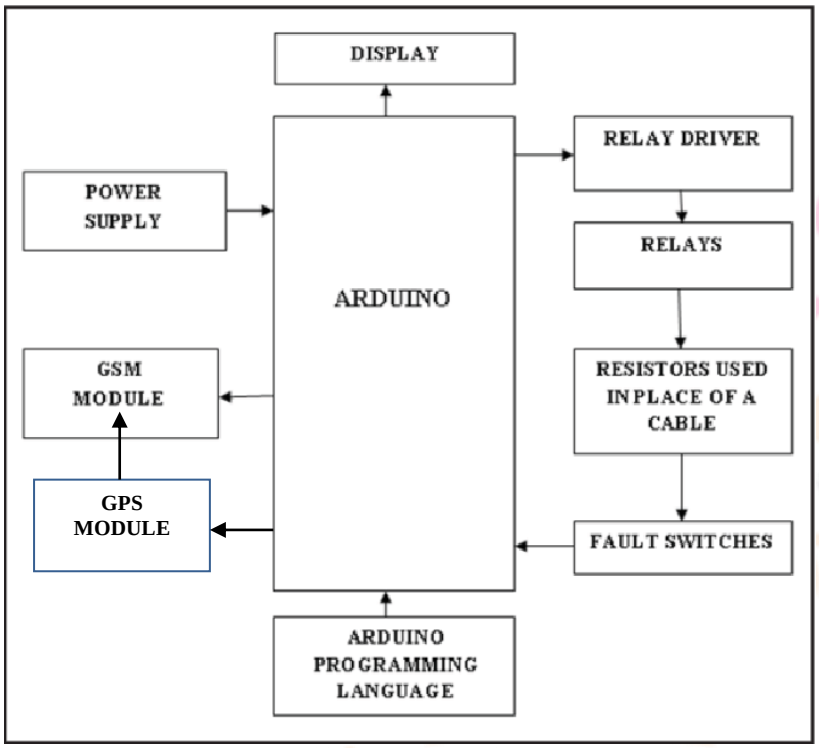

Fig.2 Block Diagram of cable fault detector

This is the network of cables buried underground, typically used for power transmission or telecommunications. IOT sensors are placed along the cable network to monitor parameters like temperature, current, voltage, and impedance. These sensors collect real-time data about the condition of the cables. The data from the sensors is collected and processed by a data acquisition system. This system may be located onsite or remotely, depending on the implementation .The processed data is then transmitted to a central control unit or cloud platform via wireless communication technologies such as Wi-Fi, cellular.

The data received from multiple sensor nodes is stored and analyzed on a cloud platform. Advanced algorithms can detect anomalies or fault conditions by analyzing the data patterns. Machine learning or AI-based algorithms are employed to analyze the collected data and detect any abnormalities indicative of a cable fault. Upon detecting a fault, the system triggers an alert/notification to maintenance personnel or a control center, indicating the location and nature of the fault. In some implementations, the system may allow for remote control and monitoring of the cable network, enabling operators to take corrective actions or reroute power as necessary.

IV.RESULTS AND DISCUSSION

In this project we used IOT and other programming module for detection of cable fault. Whenever the switches that present cable fault will be closed and through the programmed Arduino UNO board the fault will be detected and GPS Module will detect the exact location. The GSM Module will send an alert message to the base station or repairmen.

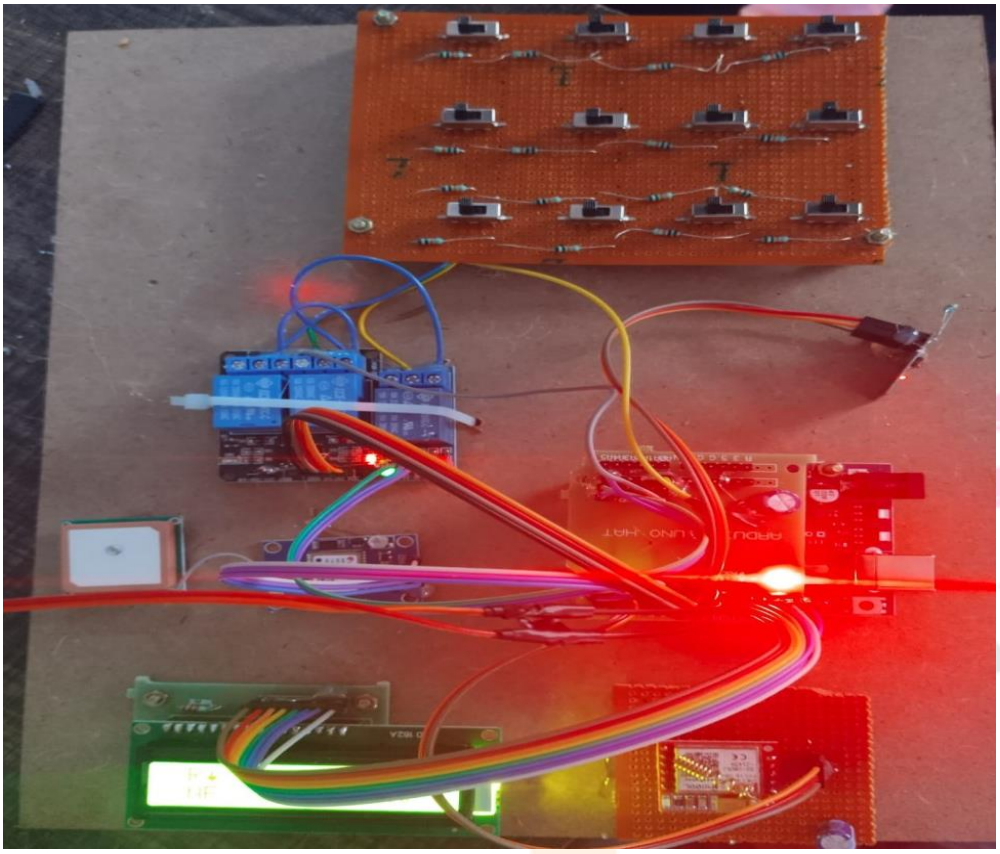

Fig.3 Circuit of underground cable fault detector

The fault will detected in the three lines that has been created in place of a real cable. The distance of fault will be given in terms of kilometers from the base station.

Fig.4 LCD Display indicating fault in R,Y,B line

We have used the Thingspeak IOT platform for cable fault information storage and fault indication and GPS track the exact location.

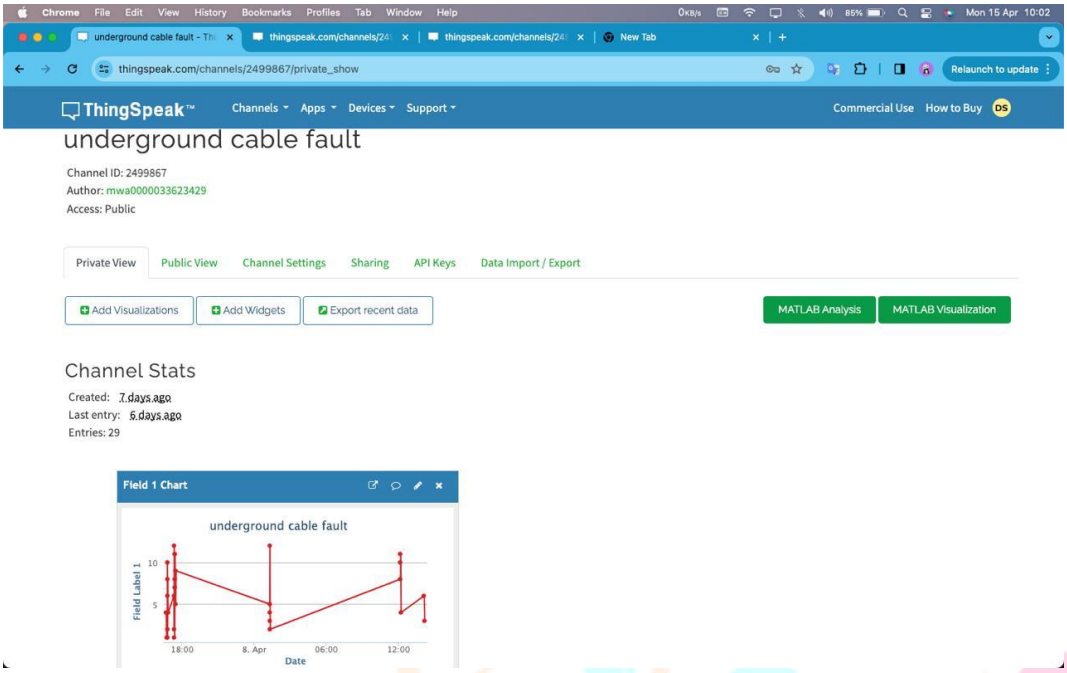

Fig.5 ThingSpeak platform indicating status of fault in cable in form of graph

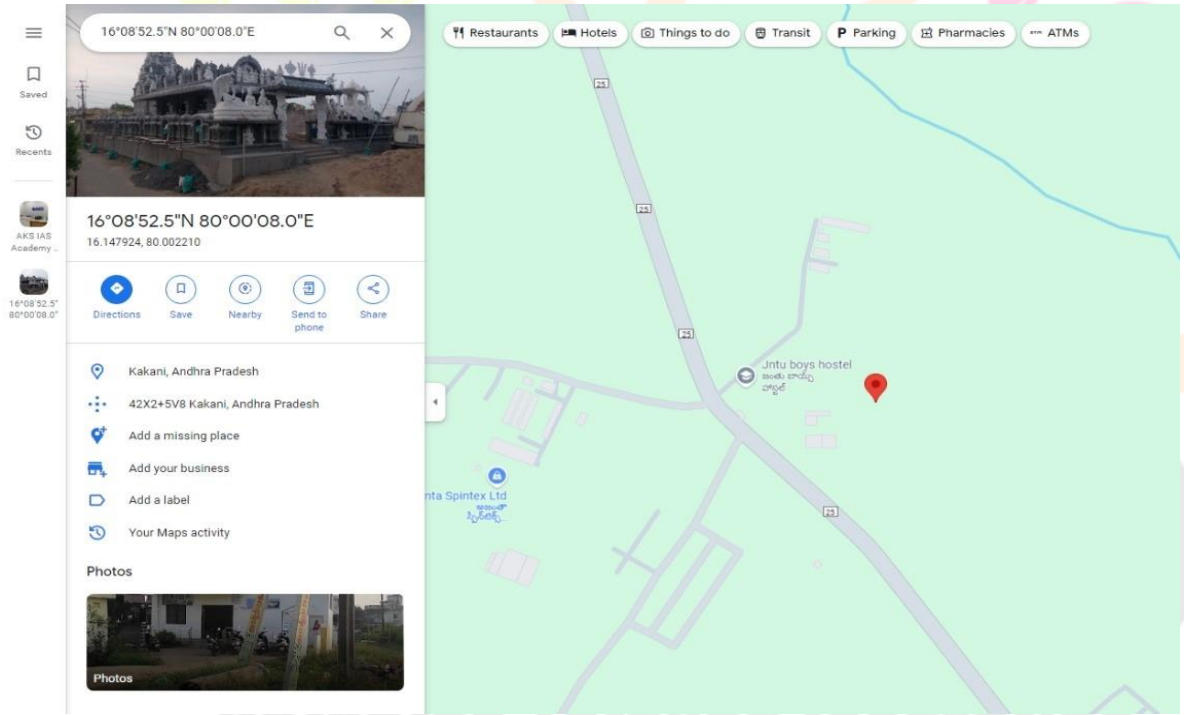

Fig .6 GPS location of the fault detected

CONCLUSION

In this paper, Underground Cable fault detection using IOT is proposed for detection of fault in the underground cable. This techniques can be used in Smart Grid system in Smart cities in power transmission and power management. Further the technique is compared to the methods like thumping and sectionalizing.The result showed that the proposed method for detection fault using IOT produced a good detection of fault and with a feature of sending fault location made the job of repairmen easy and prevented waste of time and efforts.

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