IJMRBS

International Journal of
Management Research and
Business Strategy

www.ijmrbs.org

IOT BASED UNDERGROUND CABLE FAULT DETECTOR

Mr. M. RAVI KUMAR[1] , MEESALA SAI KEERTHANA[2] , KOLATI SATYA SHIVANI[3] , KALLA SANDEEP[4] , GOTTAPU HEMANTH KUMAR[5] , BIHAR DEEPTHI[6]

[1]Assistant Professor , Dept.of ECE, PRAGATI ENGINEERING COLLEGE

[23456]UG Students,Dept.of ECE, PRAGATI ENGINEERING COLLEGE

ABSTRACT

Underground cables are prone to a wide variety of faults due to underground conditions, wear and tear, rodents etc. Also detecting fault source is difficult and entire line is to be dug in order to check entire line and fix faults. So here we propose a cable fault detection that detects the exact fault position that makes repairing work very easy. The repairmen know exactly which part has fault and only that area is to be dug to detect the fault source. This saves a lot of time, money and efforts and also allows to service underground cables faster.

The system detects fault with the help of potential divider network laid across the cable. Whenever a fault gets created at a point shorting two lines together, a specific voltage gets generated as per the resistors network combination. This voltage is sensed by the microcontroller and is updated to the user. The information conveyed to the user is the distance to which that voltage corresponds to. The microcontroller retrieves the fault line data and displays over LCD display. The fault in the cable will be identifying by measuring the change in voltage value measured across the resistor is then fed to the in-built ADC of the Arduino. This value is processed by the Arduino and the fault is calculated in terms of distance from the base station. This value is sent to the LCD interfaced to the Arduino board and it displays exact location of the fault from the base station in kilometres for all the three phases. This project is arranged with a set of resistors which represent the length of the cable. At all known kilometre fault switches are placed to induce faults manually. Finally, the fault distance can be determined. The values will be upload to the IoT web app using in-built WIFI of the NodeMCU microcontroller.

INTRODUCTION

 In Underground Cables Even the last cables of the decades were made to put the overhead and is currently put to the underground cable that is superior to the previous method. Because the

underground cable are not affected by adverse weather conditions, such as storm, snow, heavy rain as well as pollution. But when any fault occurs in the cable, then it is difficult to locate fault. When it is easy to detect and correct the faults in overhead line by mere observation, it is not possible to do so in an underground cable. As they are buried deep in the soil it is not easy to detect the abnormalities in them. Even when a fault is found to be present it is very difficult to detect the exact location of the fault. Due to which dugging of entire area has to do, for detecting and correcting the fault which in turn causes wastage of money and manpower. So, it is necessary to know the exact location of faults in the underground cables [1]. So, we will move to find the exact location of fault. Now world has been digitalized so the paper is intended to detect the location of fault in digital form. The underground cable system is the most common practiced followed in many urban areas. While the fault occurs for some reason at that time the repair process related to that particular cable is difficult due to not knowing the exact location of fault [2]. In the event of short circuit (Line to Earth) fault, the voltage accordingly. It is then fed to an ADC to develop precise digital data that is directed to the programmed Arduino to display the same in kilometres. Hence this paper is very helpful for determining exact location of short circuit fault. How to send this message to the base station, how the system works and alerts the field workers.
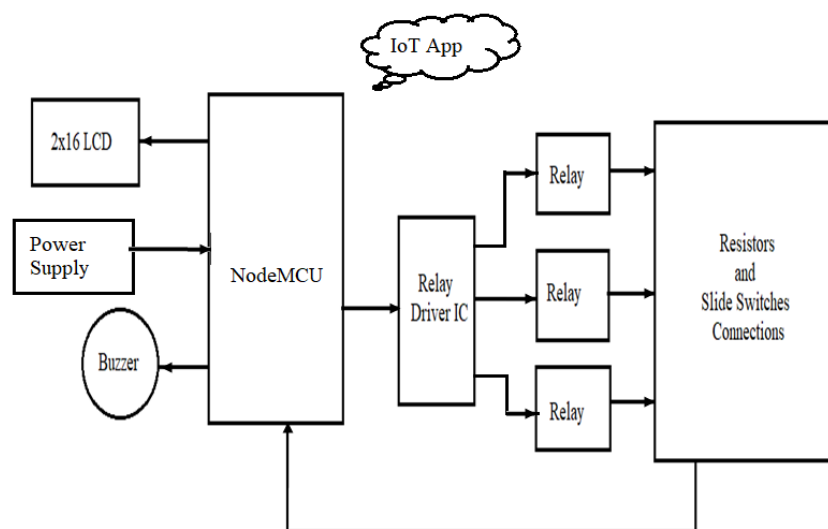

Figure.1 Block diagram

LITERATURE SURVEY

Introduction to IoT in Underground Cable Fault Detection:

Begin with an overview of the role of IoT in underground cable fault detection, emphasizing the importance of real-time monitoring and early detection to minimize downtime and ensure reliable power distribution.

Explore literature discussing the challenges faced by traditional cable fault detection methods and the potential benefits of integrating IoT capabilities into fault detection systems.

Design and Architecture of IoT-Based Cable Fault Detection Systems:

Investigate research papers and articles that discuss the design principles and architecture of IoT-based underground cable fault detection systems.

Look for studies that describe the integration of sensors, data acquisition units, communication modules, and cloud platforms to enable remote monitoring and analysis of cable health status.

Sensor Technologies for Cable Fault Detection:

Review literature on sensor technologies used in IoT-based cable fault detection systems.

Explore studies that discuss the deployment of sensors such as current sensors, voltage sensors, temperature sensors, acoustic sensors, and vibration sensors to detect and locate cable faults.

Data Collection and Transmission:

Examine research papers and articles that discuss data collection and transmission mechanisms in IoT-based cable fault detection systems.

Look for studies that describe how sensor data is collected, processed, and transmitted to central monitoring stations or cloud servers using wired or wireless communication protocols such as Zigbee, LoRaWAN, or cellular networks.

Cloud Platforms for Data Storage and Analysis:

Investigate literature on cloud platforms used for data storage and analysis in IoT-based cable fault detection systems.

Explore studies that discuss the integration of cloud services such as AWS IoT, Microsoft Azure IoT, Google Cloud IoT, or IBM Watson IoT for storing sensor data, running analytics algorithms, and generating fault reports.

Fault Detection Algorithms and Analysis Techniques:

Review research papers and articles that discuss fault detection algorithms and analysis techniques used in IoT-based cable fault detection systems.

Explore studies that describe signal processing methods, machine learning algorithms, and pattern recognition techniques for identifying fault signatures and distinguishing between different types of cable faults.

Localization of Cable Faults:

Investigate literature on localization techniques used in IoT-based cable fault detection systems.

Explore studies that discuss how sensor data is analyzed to estimate the location of cable faults along the underground network, considering methods such as time-domain reflectometry (TDR), frequency-domain reflectometry (FDR), or wavelet transform analysis.

PROPOSED SYSTEM

The IOT based IOT Based Underground Fault Detection model is assemble with a set of resistors that represents the cable length in kilometres and fault creation consists of a set of switches on every kilometre is known to cross check the accuracy of the same. The model for the proposed underground cable fault locator distance using the NODE MCU. It is divided into four parts, the DC power supply part, cable part, controlling part and display part. The DC power supply consists of AC supply, transformer, regulator and uln2003a. AC supply of 230 Volt is step-down by transformer, bridge rectifier converts the AC signal to a DC signal while the regulator is used to generate a constant DC voltage. The cable is represented as a set of resistors with switches. The current sensing part on the cable represented as set of resistors and switches used as fault creator to specify a fault at each location. Then controlling part that comprising an Analog to Digital Converter (ADC) that receives input from the current sensing circuit. ADC converts this voltage to a digital signal and feeds the NODEMCU with the signal. The display part consists of the LCD display interfaced to the NODEMCU which shows the

status of the cable of each phase and the distance of the cable at the particular phase, in case of any fault. The system will initially be displaying no fault [NF] on the LCD screen in every phase represented by R (red), Y (yellow), and B (blue). Theoretically, the switch represents the creator of the fault must be pressed to find fault in the LCD display. The Proteus simulation software is used to illustrate the full circuit diagram of the project. The NODEMCU is the main peripheral of the circuit as it controls the entire working part that are DC power supply part, cable part and controlling part. All this part is combined to produce an underground cable fault distance locator.
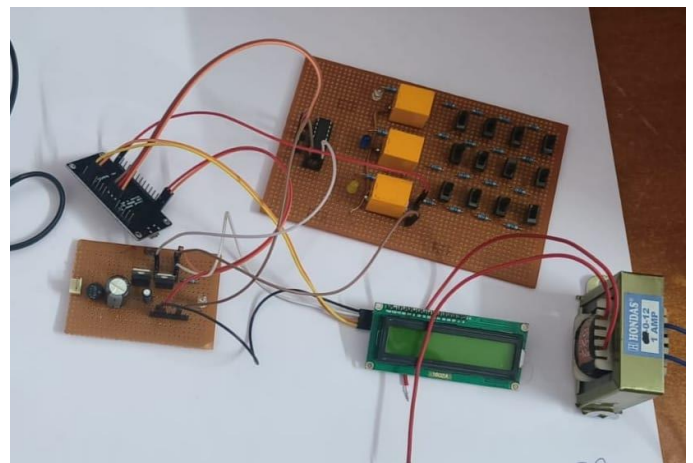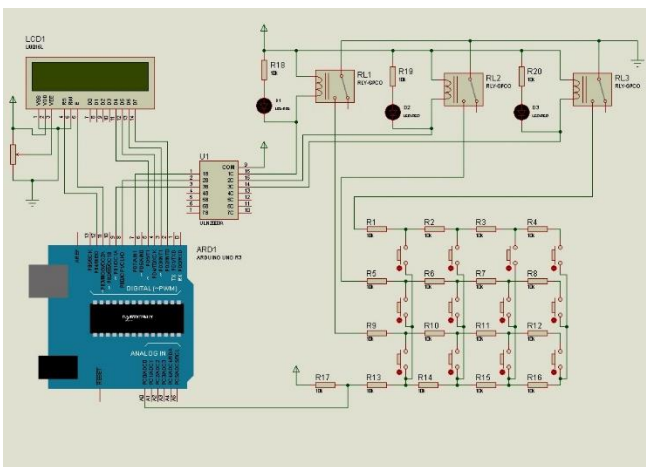

Figure.2 Schematic diagram
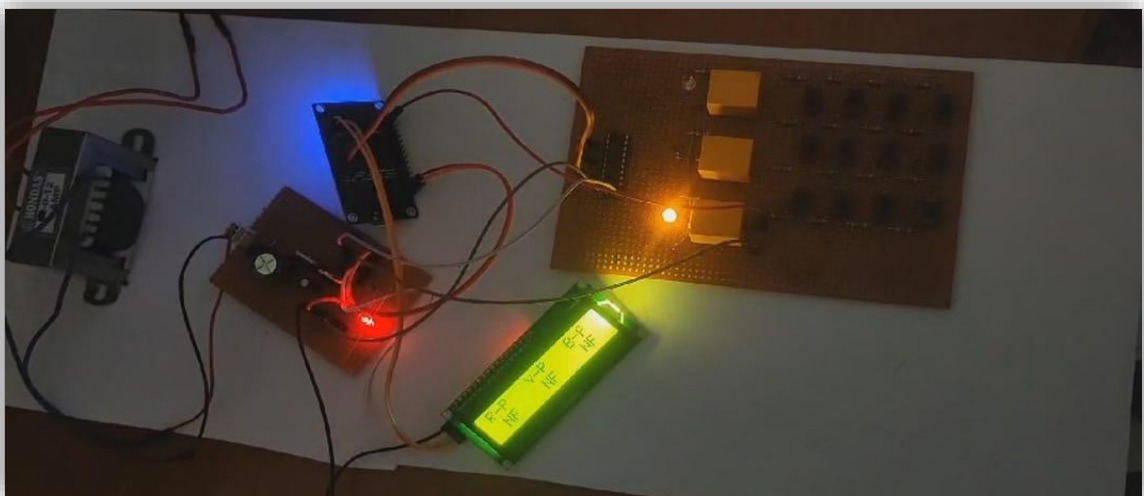

Figure.2 Working Kit
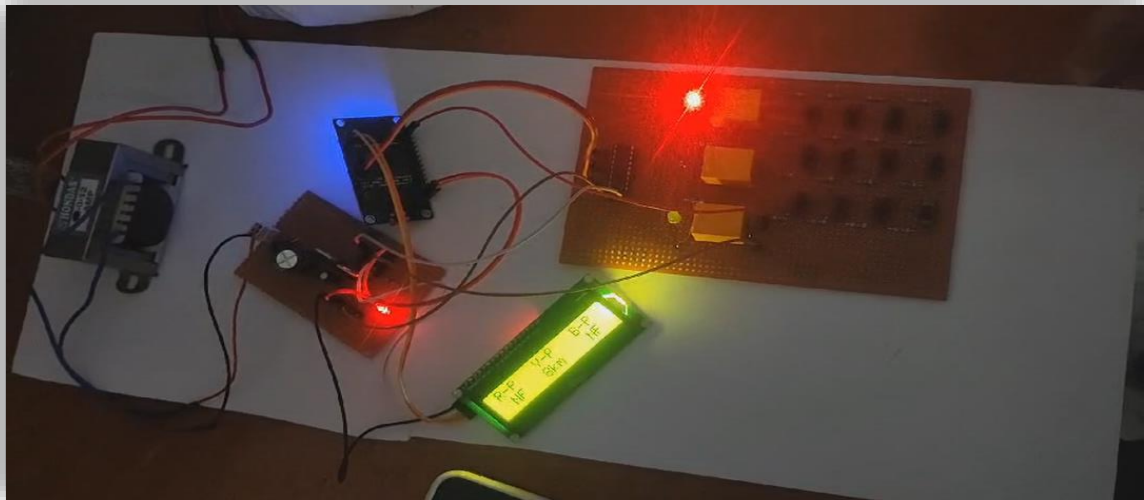
RESULTS

Figure.3 NO fault
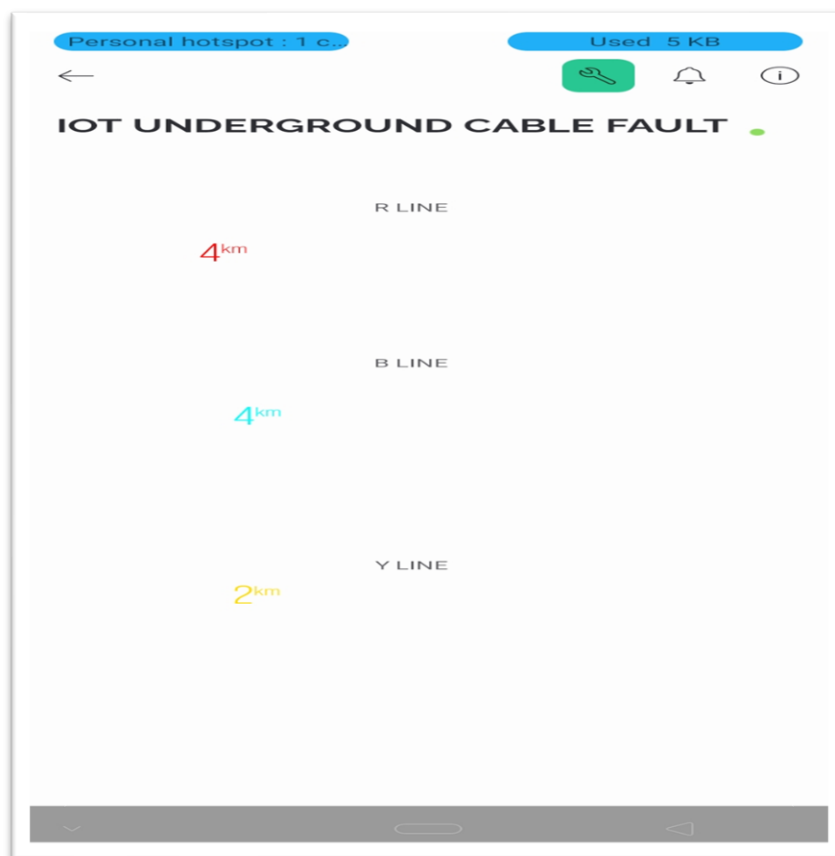
Figure.4 Yellow line fault @ 8Km

Figure.5 Blynk output

APPLICATIONS

There are several applications of Underground cable fault detection using IoT (Internet of Things). Here are a few examples:

Faster repairs: The location of faults can be found digitally, which can help with quicker repairs.

Improved system reliability: Finding the faulty point can help improve system reliability and reduce outage periods.

Faster cable service: Repairmen can use this information to determine which part of the cable has a fault and only that area needs to be dug to find the fault source. This can save time and money.

Internet monitoring: Authorities can use IoT technology to monitor and check faults over the internet.

Online fault information: The distance, phase, and time of the fault can be shown on a computer or mobile device using the internet

ADVANTAGES

Underground cable fault detection can have several advantages, including:

Accuracy: It can pinpoint the location of faults accurately.

Fast service: It can save time, money, and effort, and allow for faster service of underground cables.

Less maintenance: It can lead to lower maintenance costs.

Efficiency: It can be more efficient.

Detection: It can detect a variety of faults, including short circuits, cable cuts, resistive faults, sheath faults, water trees, and partial discharges.

Monitoring: It can monitor and check faults over the internet.

Thermal imaging: It can detect temperature variations caused by faults, such as heating at the fault point.

CONCLUSION

The short circuit fault at a particular distance in the underground cable is located to rectify the fault efficiently using simple concepts of Ohms law. The work automatically displays the phase, distance and time of occurrence of fault with the help of PIC 16F877A and ESP8266 Wi-Fi module in a web page. The benefits of accurate location of fault are fast repair to revive back the power system, it improves the system performance, it reduce the operating expense and the time to locate the faults in the field. The work can be extended for open circuit fault, short circuit Line to Line

Fault (LL) and double Line to Ground Fault (LLG). The open circuit fault can be detected using a capacitor in ac circuit

FUTURE SCOPE

The proposed system in this paper detect only the location of Short Circuit fault in underground cable line, and also detect the location of open circuit fault, to detect the open circuit fault capacitor is used in circuit which measure the change in resistance & calculate the distance of fault. For future research, the system would proceed with similar neural networks structure for different types fault section and fault location estimation.

There are a number of new technologies that could be used to improve the accuracy, speed, and cost of fault detection. For example, artificial intelligence (AI) could be used to develop new algorithms that can more accurately identify faults. Additionally, new sensors could be developed that can detect faults more quickly and at a lower cost.

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