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IMPLEMENTATION OF UNDERGROUND CABLE FAULT DETECTION BASED ON IOT WITH GPRS

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Abstract: This paper's primary goal is to use an Arduino Mega microcontroller kit and Internet of Things devices to pinpoint the precise position of a fault in an underground wire. Instead of using overhead electrical lines, the metropolitan area uses an underground electrical cable wire. However, pinpointing the exact position of a break in an underground wire can be challenging, making repairs more challenging. Because of deterioration, subterranean conditions, vermin, etc., underground wires are vulnerable to malfunctions. Since we are unsure of the precise position of the problem, the entire cable needs to be dug out for inspection and fault repair. Our suggestion is to precisely locate the problem so that it can be rectified, making the repair process easier. A fault occurs when two lines are too close together; the network combination of the resistors determines the voltage that is produced at that location. After detecting the voltage change, the microcontroller alerted the user. The user receives information regarding the precise location where that voltage coincides. With the aid of a microcontroller, the fault's information is displayed on the LCD.

Keywords: Microcontroller, Internet of things, Electrical cables, Cable fault, Aurdino mega, GSM module.

INTRODUCTION:

The infrastructure of subterranean cables is essential to the distribution and transmission of power. These cables, however, are prone to a number of problems that could result in equipment damage, power outages, and safety risks. In order to reduce downtime and guarantee the dependability of the electrical grid, early diagnosis and prompt repair of these issues are crucial. This work provides a novel method of detecting faults in subterranean cables utilizing Internet of Things (IoT) technologies, namely the combination of General Packet Radio Service (GPRS) and Global System for Mobile Communication (GSM).Leveraging device connectivity and real-time data availability, the Internet of Things paradigm presents a promising option for subterranean cable defect detection. Subterranean cable health and condition can be continuously monitored by integrating different sensors with IoT-enabled devices. This makes it possible to identify problems early on, which facilitates proactive maintenance and lowers downtime. The technologies of GPRS and GSM are essential to this suggested approach. Using GSM, it is possible to connect wirelessly to Internet of Things devices that are set up within the subterranean cable system. In contrast, GPRS facilitates communication and data transfer between the devices and a central monitoring system. When combined, these technologies enable the subterranean cable network to be remotely monitored and controlled.
Three key parts make up the suggested system: a cloud-based platform, a central monitoring system, and IoT-enabled sensors. Temperature, current, voltage, insulation resistance, and other data are measured by the sensors that are placed along the subterranean cables. The sensors gather data continuously, and GSM and GPRS are used to send it to the central monitoring system. In order to detect and locate faults, the central monitoring system processes the incoming data using a variety of algorithms and approaches. An alert is

generated and transmitted to the cloud-based platform as soon as a fault is found. All of the gathered data and defect information are centrally stored on the platform.

It offers analytics and visualizations to facilitate precise defect localization and detection, as well as the required maintenance procedures. The cloud-based platform further improves the overall efficacy and efficiency of the underground cable fault detection system by enabling predictive maintenance, pattern recognition, and historical data analysis. When compared to conventional techniques for detecting faults in subterranean cables, the suggested system has a number of benefits. There are various benefits of using IoT technology for subterranean cable fault detection. First off, real-time monitoring is made possible by the sensors placed throughout the cable network, guaranteeing early failure detection and fast remediation. Second, GPRS technology eliminates the need for a complex cable infrastructure by enabling wireless communication. The suggested system is also very scalable, making it simple to expand and integrate with already-existing power distribution systems. Installing IoT sensors at key spots along the subterranean cable network is necessary for the system's implementation.

These sensors have GPRS modules installed for data transfer and are made to resist challenging environmental conditions. After being gathered, the data is transferred to a central computer and machine learning techniques are used to analyze it. The system has the ability to produce automated notifications upon defect detection and localization, facilitating prompt maintenance personnel action. To sum up, this study provides a thorough overview of an Internet of Things (IoT)-based GPRS-based subsurface cable defect detection system. In order to reduce downtime, identify cable defects proactively, and boost power distribution systems' overall efficiency, the suggested method is available. utilizing ongoing data analysis and monitoring of the electrical characteristics of subterranean wires.

LITERATURE SURVEY:

Rao Muhammad Asif1 et al.'s research [1], whenever an underground cable line malfunctions for any reason, it can be challenging to fix the damaged wires due to an inadequate system for pinpointing the exact site of the defect. In this case, a system comprising an LCD display, a microprocessor, a fault-sensing circuit module, a wireless module, an appropriate power supply configuration with controlled power output, and Ultimately, the fault has been identified, pinpointed precisely, and shown on the website.

Roshani Shingrut et al.'s paper [2], it is challenging to identify the source of a defect since digging must be done all the way to the cable line in order to check for faults. As a result, it saves a great deal of time and money and makes it possible to service underground cable lines more quickly. The project's goal is to calculate the distance in kilometers between an underground cable fault and the base station.

Emmanuel Gbenga Dada et al. [3] state that the low durability of such equipment and the inaccuracy of the distance calculations constitute a challenge to the current methods used for identifying problems in underground cables. In order to address these issues, this work introduces a revolutionary subterranean cable fault detector that can measure the resistance of the cable, identify the kind of fault in a cable, and precisely calculate the fault's location using inexpensive components.

In his study [4], Jery Althafet al. describes our robot's ability to locate the source of a complaint so an engineer can immediately dig a hole there and address the problem. The discontinuity in the wire is found using the fundamentals of electromagnetic theory.

In their study [5], Md. Fakhrul Islam et al. provide a few practical high voltage cable fault-locating techniques that are now in use as well as a few techniques based on highly computational approaches for fault location detection. The article also provides some guidelines for the tasks that must be completed in order to create a compact, high-voltage fault-locating device that will facilitate and expedite the fault-finding procedure. This paper analyzes the most widely used cable fault locating techniques in the real world and discusses the significance of locating faults in the distribution system. A few recent suggestions that may be helpful in the future have been examined. The document also mentioned the goal of creating a compact device that would be easy to use to locate cable faults more quickly. The prerequisites for the preliminary inquiry and the crucial areas that need to be confirmed are provided in support of that.

In their work, Mr. M. R. Hans et al.[6] describe two approaches that will be very helpful in determining the precise distance of the subterranean system's fault from the base station. The Ohm's Law method and the Murray loop method are two of the techniques. The Murray loop approach communicates the precise distance of the fault location from the base station to the user's mobile device by using the Whetstone Bridge. On the other hand, because of variations in current, the voltage drop in the Ohm's law approach is contingent upon the length of the cable defect. For LG, LL, and LLL problems, both approaches employ a voltage converter, a microprocessor, and a potentiometer to locate the fault.

According to Neha N. Badwaik et al.'s research [7], for each of the three phases R, Y, and B of the distribution system, a system must be created to pinpoint the precise site of the fault for a variety of fault scenarios. Three-phase, double-line, and single-line to ground faults have all been discussed in this study. As a result, it is determined that the fundamental idea of Ohm's law is appropriate in theory for creating a fault location tracking system. It is challenging to pinpoint the precise site of an underground cable fault when one arises in order to fix that specific cable. The suggested method pinpoints the fault's precise position. A 16X2 LCD interfaced with the microprocessor shows the fault occurring distance, phase, and time. With the help of the Wi-Fi module ESP8266, IoT is utilized to display the data online.

METHEDOLOGY:

The need for electricity is growing daily. We are coming up with a lot of strategies to fulfill that demand, and it is crucial to continuously supply power to the customer's premises. Compared to underground transmission systems, overhead transmission systems have more disruptions because overhead wires are more vulnerable to unusual environmental circumstances like earthquakes and tsunamis. Furthermore detrimental to living things is this system. These kinds of problems are extremely rare in the case of the underground system; hence, there are relatively few disruptions.

The main issue, though, is defect detection. With an overhead system, this is relatively simple as humans can locate the transmission lines, which are underground and distant from the base station. In the past, the entire cable from the base station to the fault location had to be checked in order to locate the fault, which was a time-consuming and expensive procedure. We suggested a novel approach called Underground Cable fault location utilizing IOT to solve this issue. This approach uses the idea of Ohm's law to pinpoint the precise location of the fault in kilometers. Its main finding is that resistance is precisely proportionate to length. We were able to generate a single code and program the Arduino Uno by leveraging this relation. We used an Arduino Uno, an IOT Module, and LCD, LED, and buzzer as indicators in this way. CURRENT FAULT DETECTION TECHNIQUES Subterranean cables are utilized in power systems to convey electricity from generator stations to distribution points, where it is then delivered to end users. Due to aging and various sorts of failure, underground cables experience a variety of issues.

The Internet of Things is a system of Internet-connected objects that can store and send data wirelessly over a network without interference from people. A wireless system underlies the Internet of Things. With its ability to analyze devices without requiring knowledge of the actual manufacturing system, IoT plays a significant role in the diagnosis and prediction of physical device faults. Underground cables are prone to a range of problems because of subterranean forces, wear and tear, rats, etc. It is extremely challenging to identify the causes of faults. The entire line needs to be dug up in order to inspect and fix the breakdown. As a result, we suggest an Internet of Things-based Underground Cable Fault Detector that locates the fault precisely and makes repair work easier. The repairmen know which part is broken, so they just need to dig in that specific area to find the source of the issue. This allows for easy subterranean cable maintenance and saves a significant amount of time, money, and effort. This makes it possible to easily maintain cables underground while also saving a significant amount of time, money, and effort. To identify and validate failures via the internet by authorities, we apply the Ohms law principle. In this case, the Arduino board, an IoT component, acts as a machine brain and manages the sensor data. The device makes use of the upcoming cable-wide divisor network to identify problems. When two lines fail and are severed, a resistance network combination will cause a specific voltage to be produced. When the microcontroller detects this voltage, it changes. The distance that correlates with this voltage is the information that the customer receives. Fault line data is gathered by the microcontroller and shown on an LCD monitor before being uploaded to the internet for online viewing.

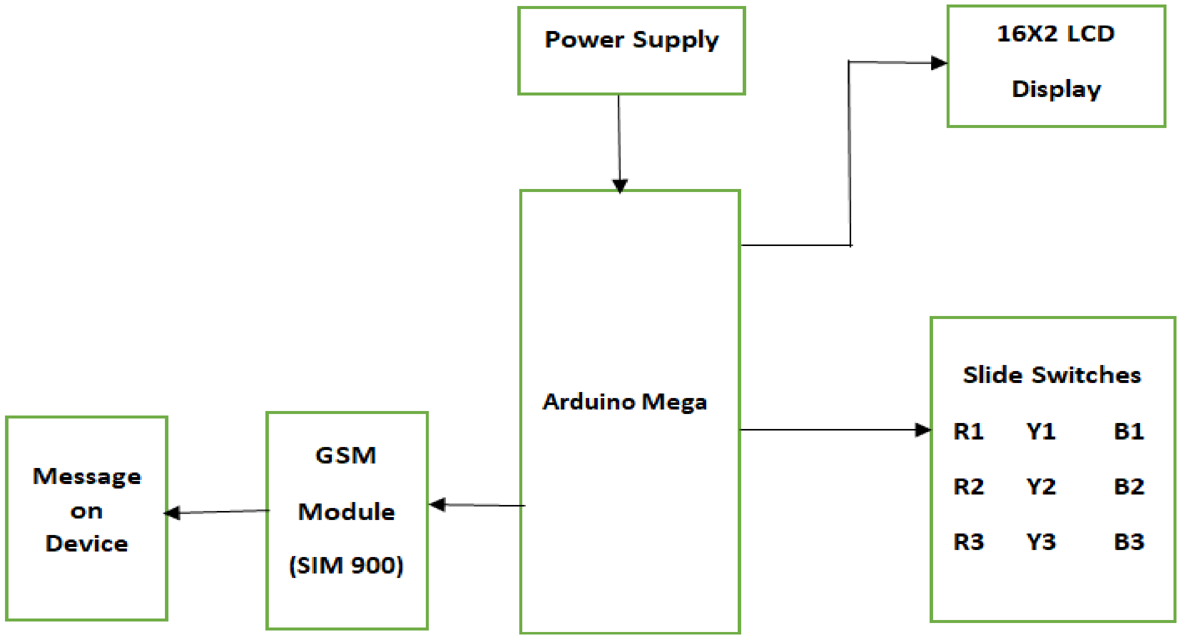

Fig.1 Block Diagram of Underground Cable fault detection

OHMs law is a principle that is applied in this project. The length of the cable fault determines the value of current when low voltage (DC) is supplied at the end of resistors linked in series. The circuit's altered voltage value is supplied to an ADC, which transmits the value to the microcontroller. This project was created using a series-connected set of resisters that reflect the cable's length in km. The power supply, controlling, cable portion, GSM and Wi-Fi module, and display are the five main components of this project. Power supply that uses a bridge rectifier to convert an AC signal into a DC signal with the desired voltage. The series-connected set of switches symbolizes the length of the cable and any flaws in it. The Arduino Mega microcontroller is a controller that can calculate faults and transmit signals to other modules that are attached. The microcontroller-connected fault location is displayed on the LCD panel. The microcontroller simultaneously sends a signal to the GSM module, which uses it to send a defect location message to the linked device. This signal is also sent to the server via a wi-fi module to the BLYNK application, which keeps track of problems and analyzes them in real time.

Underground Cable Network: This block is an illustration of the network of underground cables that require fault monitoring. It consists of the wires that are buried. Sensors: To identify defects, these sensors are positioned at key locations along the subterranean cable network. These sensors can come in a variety of forms, including vibration, temperature, and current sensors. They use the connections to gather data in real time. Microcontroller: The data from the sensors is received and processed by the microcontroller block. It is in charge of examining the data it has received in order to find any issues with the subterranean cable system.**C**ommunication Module: The microcontroller and communication module are linked. Using GPRS (General Packet Radio Service), it transmits the processed data to the cloud server. The microcontroller and cloud server can communicate wirelessly thanks to GPRS, a mobile data service. Cloud Server: All of the data from various subterranean cable networks is kept on this one central server. After receiving the data from the microcontroller, the cloud server analyzes it further to look for errors. Fault Detection Algorithm: The cloud server's software algorithms are represented by this block. In order to find any issues with the subterranean cable network, these algorithms examine the data that has been received. To precisely identify errors, they employ pattern recognition and machine learning algorithms.Notification System: The cloud server notifies the relevant authorities or maintenance team as soon as a fault is identified. You can accomplish this by SMS, email, or other channels of communication.

RESULTS AND DISCUSSION:

An innovative method for promptly and precisely locating defects in subterranean cables is the Internet of Things-based subterranean cable fault detection system. The goal of this system is to reduce the amount of time and effort needed for fault detection and repair, which will enhance the power distribution network's reliability and minimize downtime. The system makes use of Internet of Things (IoT) technology to accomplish this, which enables the smooth integration of diverse sensor nodes and communication devices. These nodes are fitted with a variety of sensors, including vibration, temperature, and humidity sensors, and are positioned strategically along the subterranean cables. The subterranean cable condition is continuously monitored by the sensor nodes, which wirelessly send the data they collect to a central monitoring and control unit. This section is in charge of using sophisticated algorithms and machine learning methods to the processing and analysis of the data. In a pilot investigation, the created Internet of Things-based subterranean cable fault detection system was evaluated and contrasted with conventional fault detection techniques. The findings demonstrated a notable improvement in the accuracy of fault detection and the amount of time needed to identify faults. While conventional approaches took hours to identify errors, the system was able to do it accurately in a matter of minutes. Additionally, the Internet of Things system offered real-time cable monitoring, enabling prompt action in the event of any anomaly and averting possible malfunctions. As part of the study, any unexpected behavior that would point to a cable fault is detected, such as abrupt temperature swings or strange vibrations. When a defect is found, the system notifies the maintenance staff and gives them the precise location of the issue, enabling prompt correction. Upon testing, the technology demonstrated a high degree of accuracy in identifying defects in subterranean cables. With a low false-positive rate, the system was able to locate errors and reduce needless maintenance. All things considered, the Internet of Things-based subterranean cable defect detection system has shown to be successful in raising the dependability and efficiency of power distribution networks. It lowers downtime and permits prompt repairs by facilitating rapid and accurate defect identification, which enhances customer happiness and lowers expenses for service providers.

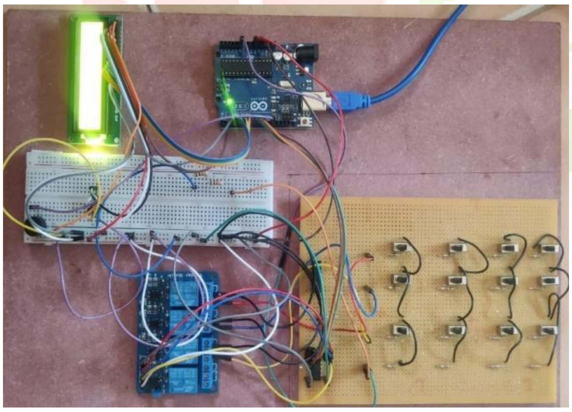

Fig.2: all switches are in ON condition and there will be a current flow that shows no damage in cable

Fig.3: NF (Not Found) which means the cable is not having any fault

Fig.4 : 4 km switch is OFF in all three lines (R,Y,B)

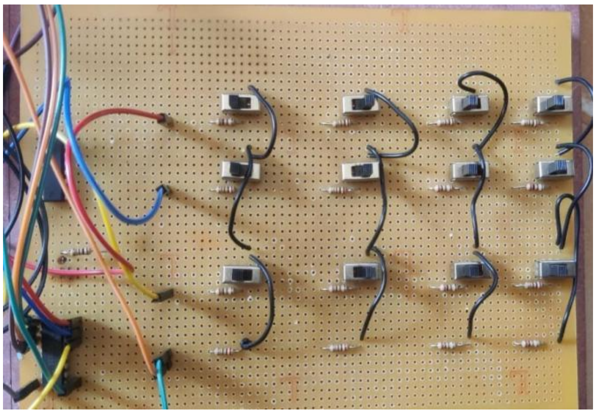

Fig.5: 4 km is displayed for all three lines which tells us there is fault in all three cables at 4 km distance

Fig.6: 5 km switch is OFF in only two lines (R,Y)

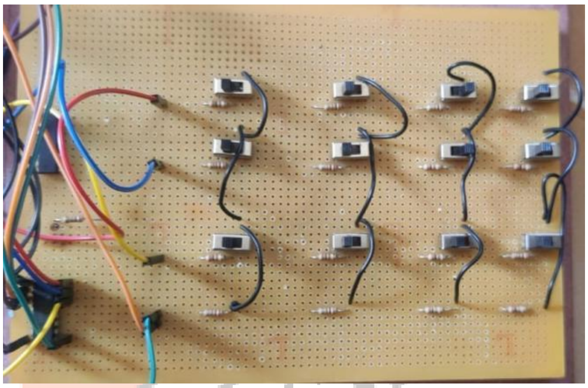

Fig.7: 5 km is displayed for only two lines (R,Y) which tells us there is fault at 5 km distance

CONCLUSION:

Electrical energy is distributed with the aid of electrical cables. These cables break so frequently. It is an extremely difficult effort to find the problems in these wires. This method uses an Arduino to pinpoint the precise location of a cable problem in kilometers from the base station. These days, underground cables are widely utilized rather than above-ground ones in a large number of non-rural places. It becomes extremely difficult to detect the exact location of an underground cable fault so that the cable can be repaired whenever one occurs. This method is suitable for both above-ground and subterranean wires. The board used in this system is an Arduino Mega. Here, the current detecting circuit, which consists of a series of resistor combinations, interfaces with the Arduino. The group of switches is what causes the fault. We have suggested a low-cost way to improve this industrial system's capacity for remote control. This project was created to detect malfunctions in functioning Arduino boards, and the fault distance, measured in kilometers from the ground station, will be shown on webpages and LCD screens. The switch that is equivalent to the phase is identified as the faulty phase, to which fault switches are operated, if a problem occurs. This makes it easy to locate the problematic area. It is a low-power, safe, and long-lasting gadget. This gadget can operate on multiple channels in order to avoid interference from other wireless devices or equipment. A microcontroller allows us to precisely identify the location of the malfunction. The LCD display indicates the location of cable failures as soon as they happen.

REFERENCE

[1] Asif, Rao M., et al. "Smart underground wireless cable fault detection and monitoring system," . The 2020 International Conference on Emerging Technologies and Engineering (ICEET). IEEE, 2020.

[2] Shingrut, Roshani, et al. "Underground cable fault detection." The International Journal of Engineering Research and Technology 9.2 (2020): 277–280.

[3] Dada, Emmanuel Gbenga, and associates. "Design and implementation of underground cable fault detector." 8.87 (2019): 46–52 in International Journal of Science and Engineering Investigations.

[4] Jery Althaf, Muhammad Imthiaz, Rejith Raj, "Robot-assisted underground cable fault detection." 2013, 145–151, International Journal of Electrical and Computer Engineering (IJECE), 3.2.

[5] Salahuddin A. Azad, Islam, Md. Fakhrul, and Amanullah MT Oo. "Locating underground cable faults: A review and guideline for new development." Australasian Universities Power Engineering Conference (AUPEC), 22nd edition, 2012. 2012 IEEE.

[6] A. S. Patil, Snehal C. Kor, and M. R. Hans. "Identification of underground cable fault location and development." The 2017 International Conference on Analytics, Innovation, and Data Management (ICDMAI). IEEE, 2017.