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UNDERGROUND CABLE FAULT DISTANCE OVER INTERNET (IOT) OF THINGS

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ABSTRACT

Underground cables are wide variety of faults due to underground conditions, wear and tear, rodents etc. Also detecting fault of cable is difficult and entire line is to be dug to check line and fix faults. So here we are implementing cable fault detection over IOT that detects the fault position over IOT that makes repairing work very easy and fast. This project uses the simple concept of ohm's law. When any fault like short circuit occurs, voltage drop will vary depending on length of fault in cable, since the current varies. This current is sensed by current sensor .the output of current sensor is given to the microcontroller and wifi module .The information conveyed to the user is the information regarding faults detection. The microcontroller retrieves the fault line data and displays over LCD display, also it transfers this data over internet to display on server. IoT is used to display the information over Internet using theWi-Fi module ESP8266.A webpage is created using HTML coding and the information about occurrence of fault is displayed in a webpage.

Key Words: IOT technology, LCD, PIC microcontroller, wifi module, current sensor

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I. INTRODUCTION

Till last decades cables were made to lay overhead & currently it is lay to underground cable which is superior to earlier method. Because the underground cable are not affected by any adverse weather condition such as storm, snow, heavy rainfall as well as pollution. But when any fault occur in cable, then it is difficult to locate fault. So we will going to find the location of fault. Now the world is become digitalized so the project is design to detect the location of fault in digital way.

The underground cable system is used in many urban areas. While fault occurs for some reason, at that time the repairing process related to that particular cable is difficult due to not knowing the exact location of cable fault. The paper uses the standard concept of Ohms law i.e., when a low DC voltage is applied ,then current would vary depending upon the location of fault in the cable. The fault occurring at a particular distance and the respective line is displayed on a LCD interfaced to the microcontroller. Due to environmental influences the sensitivity of distribution network is reduce hence cable is in the underground is more preferred.

Underground cable is more secure than overhead lines in bad environment, cable is less damage by storms or lighting .It is less expensive for shorter distance, eco- friendly and low maintenance. But if any fault occur in cable, then it is difficult to locate fault. So this project is used to detect the location of fault in digital way. Underground cable is to facilitate quicker repair, improve the

System reliability and reduced outage period. The underground cable system is very useful for distribution mainly in metropolitan cities, airport and defense services. More than 3 million miles of electrical cables are strung overhead across the country.

For utility companies, undergrounding provides potential benefits through reduced operations and maintenance (O&M) costs, reduced tree trimming costs, less storm damage and reduced loss of day-to-day electricity sales when customers lose power after storms. But if any fault occur in cable, then it is difficult to locate fault. So this project is used to detect the location of fault in digital way. The requirement of locating the faulty point in an underground cable in order is to facilitate quicker repair, improve the system reliability and reduced outage period. The underground cable system is very useful for distribution mainly in metropolitan cities, airport and defense services.

II. FAULT IN CABLE

Fault in a cable is defined as a physical condition that causes a device, a component, or an element to fail to perform in a required manner. It will occur because of any defect, weakness or non-homogeneity or by breaking of conductor and failure of insulation.
Power cable fault location techniques are used in power system for accurate pin pointing of the fault positions. The benefits of accurate location of fault are:

- Fast repair to revive back the power system.
- Improve the system availability and performance.
- Reduce operating expense and save the time needed by the crew searching in bad weather, noisy area and tough terrains

III. LITERATURE SURVEY

[1] K.K. Kuan, Prof. K. Warwick, Real-time expert system for fault location on high voltage underground distribution cables, ieee proceedings-c, Vol. 139, No. 3, MAY1997

A method to detect the fault and the distance at which the fault has occurred is calculated. The fault location in the underground cable is a bit cumbersome process so to deal with such problem a method is given in this project. To determine the location of fault a series resistor is used and the voltage across this resistor is measured and then is sent to the microprocessor to calculate the distance at which the fault has occurred. This is a safe and cheap method for obtaining the fault location in an underground cable. This method also does not have a high power requirement and is portable too.

[2] D.Prabhavathi ,:" Localization of Faults in High Voltage Underground Cables by Wavelet Transform ",The International Journal Of Engineering And Science (IJES) ,Volume2 ,Issue4 ,Pages 41-48 ,april2013.

The identification and classification of faults in high voltage radial UG cables by wavelet transform. It presents the use of wavelet as a pattern classifier to perform the tasks of different fault identification and classification .In this work the cable model is taken and the different faults in the cable were identified and classified by wavelet and are compared. The under ground system is very important for distribution systems especially in metropolitan cities, air port and defense service The UG system provides a large capacity in transmission and no harm from visual harassment.

[3] C. M. Wiggins, D. E. Thomas, T. M. Salas, F. S. Nickel, and H.-W. Ng,"A novel concept for underground cable fault location," IEEE Transaction. Power Delivery, Vol. 9, No. 1, pp. 591–597, Jan. 1994.

A technique for detecting faults in underground distribution system is presented. Discrete Wavelet Transform (DWT) based on traveling wave is employed in order to detect the high frequency components and to identify fault locations in the underground distribution system. The first peak time obtained from the faulty bus is employed for calculating the distance of fault from sending end. The validity of the proposed technique is tested with various fault inception angles, fault locations and faulty phases. The result is found that the proposed technique provides satisfactory result and will be very useful in the development of power systems protection scheme.

[4] J. Densley, "Ageing mechanisms and diagnostics for power cables—an overview," IEEE Electr. Insul. Mag., vol. 17, no. 1, pp. 14–22, Jan./Feb. 2001.

Solid dielectrics, typically cross-linked polyethylene (XLPE) is often used as the main insulation material in high voltage AC-cables today. Internal failures in these cables result from gradual deterioration of the insulation materials between core and sheath . Voids and impurities in the insulation material or between boundaries of different material can initiate a process called treeing leading to insulation breakdown . Electrical trees are formed by locally increased electrical stress and propagate relatively fast in the insulation material until it breaks down. Water trees are another cause of insulation breakdown. They are formed by a local defect and in the presence of moisture, water trees can propagate in the dry insulation under low electrical stress. Water trees have propagated very slowly over the years and are hard to detect as no partial discharges will appear

[5] Jae-Han Kim, Ju-Yong Kim , Comparison between Underground Cable and Overhead Line for a Low-Voltage Direct Current Distribution Network Serving Communication Repeater"Vol.9,No1,march 2014.

Compares the differences in economic feasibility and dynamic characteristics between underground (U/G) cable and overhead (O/H) line for low-voltage direct current (LVDC) distribution. Numerous low loaded long-distance distribution networks served by medium-voltage alternative current (MVAC) distribution lines exist in the Korean distribution network. This is an unavoidable choice to compensate voltage drop, therefore, excessive cost is expended for the amount of electrical power load. The Korean Electric Power Corporation (KEPCO) is consequently seeking a solution to replace the MVAC distribution line with a LVDC distribution line, reducing costs and providing better quality direct current (DC) electricity. A LVDC distribution network can be installed with U/G cables or O/H lines. In this paper, a realistic MVAC distribution network in a mountainous area was selected as the target model to replace with LVDC.

IV. BLOCK DIAGRAM

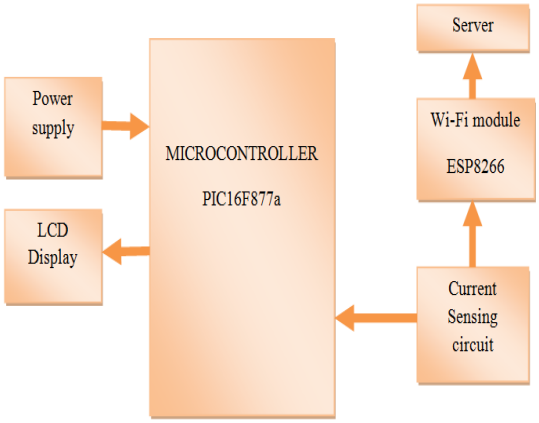

Fig. 1 proposed block diagram

The proposed system is an IOT enabled underground cable fault detection system. The basic principle of the system is Ohms law. When fault occurs in the cable, the voltage varies which is used to calculate the fault distance. The system consists of Wi-Fi module, Microcontroller, LCD display ,power supply .The power supply is provided using step-down transformer, rectifier, and regulator. In the current sensing circuit we use the current sensor IC. Microcontroller based on the current the fault distance is located.

We use IOT technology that updates the monitored fault information to internet. Whenever a fault is detected the signal is applied .This current is sensed by the microcontroller and is updated to the user. The information conveyed to the user is the information regarding faults detection. The microcontroller retrieves the fault line data and displays over LCD display, also it transfers this data over internet to display on Gmail server.

METHODOLOGY

We propose cable fault detection over IOT that detects the exact fault position over IOT that makes repairing work very easy. This paper is designed to achieve monitoring of underground cable and to provide information about detected fault. If any faults occurs that will be detected by current sensors and sends that signal to controller .Controller analyses the received signal and the wifi modules to send information about monitored.

We use PIC Microcontroller 16F877A, LCD Display, WIFI Module ESP 8266, Current sensor ACS 712, Software NETBEAN, PROTEOUS ,MPLAB IDE.

V. ADVANTAGES AND APPLICATION

- This includes aesthetics, higher public acceptance, and perceived benefits of protection against electromagnetic field radiation (which is still present in underground lines), fewer interruptions, and lower maintenance costs. Failure rates of overhead lines and underground cables vary widely, but typically underground cable outage rates are about half of their equivalent overhead line types. Potentially far fewer momentary interruptions occur from lightning, animals and tree branches falling on wires which de-energize a circuit and then reenergize it a moment later.
- Primary benefits most often cited can be divided into four areas:
- Potentially-Reduced Maintenance and Operating Costs:
- Lower storm restoration cost
- Lower tree-trimming cost
- Improved Reliability: Increased reliability during severe weather wind related storm damage will be greatly reduced for an underground system, and areas not subjected to flooding and storm surges experience minimal damage and interruption of electric service.
- Less damage during severe weather
- Far fewer momentary interruptions
- Improved utility relations regarding tree trimming
- Improved Public Safety:
- Fewer motor vehicle accidents
- Reduced live-wire contact injuries

APPLICATIONS

Its main application is the detection of underground cable fault which is very hard to detect as it is not possible to see such faults which are quite possible in the case of overhead transmission line. So for such cases our project is very helpful as the distance at which the fault has occurred can be calculated and then further action regarding the fault can be taken to overcome them.

VI. 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 webpage. 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.

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[1]K.K. Kuan, Prof. K. Warwick, Real-time expert system for fault location on high voltage underground distribution cables, ieee proceedings-c, Vol. 139, No. 3, MAY1997

[2] D.Prabhavathi ,:" Localization of Faults in High Voltage Underground Cables by Wavelet Transform ",The International Journal Of Engineering And Science (IJES) ,Volume2 ,Issue4 ,Pages 41-48 ,april2013.

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