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Underground Cable Fault Detection using Arduino and IoT (Internet of Things)

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***Abstract* - Underground cables are prone to a variety of errors due to underground conditions, wear, rodents, etc. Diagnosing the source of the error is difficult and the entire cable must be removed from the floor to check and correct the errors. The project work aims to determine the location of errors in the underground cable lines of the base station in km using an Arduino. To locate a cable fault, the cable fault must be tested. In urban areas, electrical cables run underground instead of overhead lines. Whenever the underground cable failure occurs, it is difficult to determine the exact location of the failure for each cable repair process. The proposed system finds the exact location of the fault. The prototype is modeled with a set of switches representing cable length in km and fault creation is made by a set of switches at every known distance to cross check the accuracy of the same. In case of fault, the voltage across series resistors changes accordingly, which is then fed to the Arduino? The fault occurring is displayed on a 20X4 LCD interfaced with the Arduino. IOT is used to display the information over the Internet using the wifi. A website is created with HTML coding and information about the occurrence of errors is displayed on a website.**

Keywords: Arduino, Voice Reorganization, Bluetooth module, Android application.

I. INTRODUCTION

Power supply systems are constantly evolving and their reliability is becoming more important than ever. The complexity of the entire network includes many components that fail and can disrupt the power supply to the end user. For most of the world's low-voltage and medium-voltage distribution lines, underground cables have been used for many decades. High-voltage cables are increasingly used because they are not affected by weather conditions, heavy rain, storms, snow and pollution. Although cable manufacturing technology is constantly improving, there are still influences that can lead to cable failures during testing and operation. A cable in good condition and installed correctly can last for approximately 30 years. However, cables can easily be damaged by proper installation or poorly made connections, while third parties are damaged by civil work such as trenches or curbs.

II. RELATED WORK

Programs loaded in the Arduino UNO kit for detecting earth cable faults. If an error occurs in the ground cables, we can find errors via the Arduino controller kit. LCD screen showing errors in kilometers. In this project, we create errors manually. The cable has different types. Each cable has a different resistance, which depends on the material used. The resistance value depends on the cable length. Resistance is the main task of the project here. If there is a difference in resistance, the voltage value changes. This particular point is called an ERROR. We discover these mistakes.

III. TYPES OF FAULT

Generally there are different types of faults. Frequently occurring faults are given below.

- Short Circuit Fault
- Open Circuit Fault
- Earth Fault

3.1 Short Circuit Fault

If two conductors of a multi-core cable come into electrical contact due to an insulation fault, one speaks of a short-circuit fault. The two connections of the megger are connected to one of the two conductors. If the megger shows a zero value, this indicates a short circuit fault between these two conductors.

3.2 Open Circuit Fault

If the cable conductor is interrupted, one speaks of a cable failure in the open circuit. The idle error can be checked with a megger. For this purpose, the three conductors of the 3-core cable are short-circuited at the other end and grounded. Then the resistance between each conductor and the earth is measured with a megger. The megger shows a zero resistance in the conducting circuit that is not interrupted. However, if

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the wire is broken, the megger shows an infinite resistance in its circuit.

3.3 Earth Fault

An earth fault is an in advertent contact between an energized conductor and earth or equipment frame.

IV. LITERATURE SURVEY

The bibliographic survey that will begin earlier is that the research project is an article [1] entitled "Failure Distance of the Earth Cable Carried by GSM". In this document, a fault location model for the underground cable using a is proposed. The aim of this project is to determine the distance from the underground cable fault to the base station in kilometers. The simple concept of the switch law is used in this project. If a fault occurs as a short circuit The voltage drop depends on the length of the fault in the cable, as the current varies.

Therefore, a set of resistors is used to represent the cable, DC voltage is applied to one end, and the error is detected by detecting the change in voltage using an analog voltage converter, and a microcontroller is used. Perform the calculations. If the error is required, the distance is displayed on the LCD screen. The aim of this project is to determine the failure of the underground cable. This project uses the simple concept of CT theory. When a fault such as a short circuit occurs, the voltage drop varies according to the length of the fault in the cable. Since the current varies, CT is used to calculate the variation. The signal conditioner takes over the voltage change and a microcontroller carries out the calculations that are necessary for the IOT devices to display the error distance.

V. EXISTING SYSTEM

In general, fault location techniques for underground cable network can be categorized in two groups:

5.1 Tracer method

The tracking process is a complete means of locating a segment that does not "cross" the cable circles. A faulty segment can be determined using sound or electromagnetic signals and requires that the crew members are dispatched to the fault area. There have been various techniques largely used in several of the industries, including the tracing approach through acoustic, electromagnetic or current.

5.2 Terminal method

The terminal method is a technique used to determine a distribution cable network fault location at one or both ends without extensive monitoring. A bridging technique is one of the most popular connection methods that is combined with resistance to determine the location of a fault. This is a technique used to detect the location of the cable fault at one or both ends without tracking.

5.3 Disadvantages of Existing System

The main disadvantage is that underground cables have higher initial costs and higher voltage isolation problems. Another major disadvantage is that it is difficult to locate and repair a bug because it is invisible. The Arduino and other components require a 5 V DC power supply. The relay requires 12V DC. The angle value takes time to read, so there is some delay.

VI. PROPOSED SYSTEM

The proposed system is an IOT-compatible fault detection system for underground cables. The basic principle of the system is the switching law. When a cable fault occurs, the voltage changes and is used to calculate the fault distance. The system consists of a Wi-Fi, Arduino, cloud module. Power is supplied via a step-down transformer, a rectifier and a regulator. The cable detection circuit provides the amplitude of the voltage drop between the Arduino resistors, and depending on the voltage, the error margin is [1,2].

6.1 Block Diagram

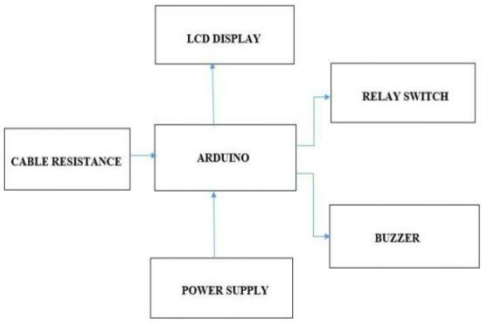

Figure 1: Block diagram of proposed system

6.2 Block Diagram Description

We download the program in the kit. The program has been written and if a fault occurs in the cable, the relay terminal is opened immediately and only this faulty line is disconnected. The other lines work normally. Arduino is the advanced version of the embedded system. These Arduino have many types, but we choose Arduino UNO. Devices that use the serial interface can also be easily adapted to it. The relay is nothing more than an electrical device that acts like a switch. If a fault occurs in the line, disconnect it via the relay.

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The relay connector changes from a normally closed behavior to a normally open behavior. We can easily find the fault and disconnect the faulty line. The display unit is connected to the Arduino kit, which shows where the error occurs. As soon as cable faults occur, the display unit shows the exact location of the fault and also shows which phase in the cable is affected and how long it has been affected, and the buzzer system is used to create a fault the fault in the underground cable occurs in different places.

6.3 Internet of Things

IOT's valuation in the electricity industry has changed its normal functioning. IOT has increased the use of radio technology to connect the assets and infrastructure of the energy industry, thereby reducing energy consumption and costs. IOT applications are not restricted to certain areas, but cover a wide range of applications, e.g. B. electrical systems, households, industries, cities, logistics, health, agriculture, etc. Since 1881, the general power grid has been expanded for more than 13 decades in order to meet the growing energy demand. Electricity grids are now considered one of the essential elements of the infrastructure on which modern society depends. It is important to provide an uninterruptible power supply with no interruption or loss. It is difficult to digest that the energy generated does not match the energy consumed at the end point due to various losses. It's even more difficult to imagine the side effects without eating a minute. Power outages occur due to short circuits. This is an expensive event as it affects industrial production, business and consumer lifestyle. Government and independent electricity suppliers are constantly looking for solutions to ensure good energy quality, maximize grid availability, reduce energy consumption, increase grid efficiency, and prevent failures and failures. Energy loss and theft.

The Internet of Things (IoT) is the network of everyday objects: physical objects that are integrated in electronics, software, sensors and connectivity and enable data exchange. Basically, a small networked computer is connected to an object, which enables information to and from this object to be exchanged. Whether it is light bulbs, toasters, refrigerators, flower pots, clocks, fans, airplanes, etc.

VII. RESULT ANALYSIS

The short circuit fault at a particular distance in the underground cable is located to rectify the fault efficiently using simple concepts Switches. The work automatically displays the phase, distance and time of occurrence of fault with the help of Arduino and ESP8266 WiFi module in a web page.

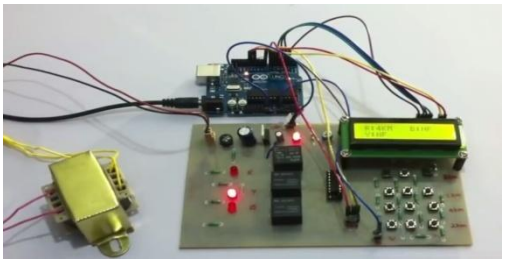

Figure 2: Prototype of hardware

The benefits of accurate location of fault are fast repair to revive back the power system, it improves the system performance, and it reduces the operating expense and the time to locate faults in the field.

VIII. CONCLUSION

We as a group had begun working for more than a year ago and now we come to the completion of our project. It has been a very fulfilling experience for all of us. We have got a thorough learning experience and we shall cherish it for long. Despite being challenging and different from other assignments, it is a path where we have learnt a lot about hardware, software, troubleshooting and other aspects of engineering. It was a chance given to us that we go deep into applying what we had learnt in earlier years of our studies and we grabbed it with both hands. For simplicity we divided the project work into smaller parts and alternately took leads in performing those parts following the principle of the best man for the job. Since we were new to this, at initial stages most of our decisions were not apt for the required situations. At such times our professors and other knowledgeable friends came to our help. From finding the project idea to publishing this report, learning has been a continuous process. There have been times where we have taken inappropriate decisions but have then learnt how to overcome them and not to commit those errors in future tasks.

The project has helped us study the practical use of microcontroller programming and its application. We have learnt that, what are the various stages one needs to follow? When pursuing a project? And how efforts as a team can be put towards finding solution to problems arising in the process?. This opportunity given to us had proved very beneficial as it provided us with an avenue to furthermore dig into analog and digital electronics.

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