IJCAT - International Journal of Computing and Technology, Volume 6, Issue 4, April 2019
ISSN (Online) : 2348-6090
www.IJCAT.org
Impact Factor: 0.835

Underground Cable Fault Detection

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Abstract - This paper proposes fault location model for underground power cable. The aim of this project is to determine the distance of underground cable fault from base station in km. Cable faults are damage to cables which affects the resistance in the cable. If allowed to persist, this can lead to a voltage breakdown. To locate a fault in the cable, the cable must first be tested for faults. This project uses the simple concept of ohm's law. When any fault like short circuit occurs, voltage drop will vary depending on the length of fault in cable, since the current varies. A set of resistors are therefore used to represent the cable and a dc voltage is fed at one end and the fault is detected by detecting the change in voltage using a analog to voltage converter and a microcontroller is used to make the necessary calculations so that the fault distance is displayed on the LCD display.

Keywords - *IoT*

1. Introduction

Power supply networks are growing continuously and their reliability getting more important than ever. The complexity of the whole network comprises numerous components that can fail and interrupt the power supply for end user. For most of the worldwide operated low voltage and medium voltage distribution lines, underground cables have been used for many decades. Underground high voltage cables are used more and more because they are not influenced by weather conditions, heavy rain, storm, snow and pollution. Even though the Cable manufacturing technology is improving steadily; there are still influences which may cause cable to fail during test and operation. A cable in good condition and installed correctly can last a lifetime of about 30 years. However cables can be easily damaged by incorrect installation or poorly executed jointing, while subsequent third party damage by civil works such as trenching or curb edging. Due to fast evolving technology of power system networks, research on transmission of power has reached to an exceptional extent. With the power loss faced due to overhead transmission, transmission of power through underground cable (UG) has taken an exceptional position in power system research. Underground cables are preferred more than overhead cables because it has lesser transmission losses and has the ability absorb emergency power loads. In spite of having higher installation cost it has got a lower maintenance cost. Underground cables are prone to wide variety of faults due to underground conditions, wear and tear, rodents etc. Diagnosing fault source is difficult and entire cable should be taken out from the ground to check and fix faults.

2. Literature Survey

Cable faults are damage to cables which effect a resistance in the cable. If allowed to persist, this can lead to a voltage breakdown. There are different types of cable faults, which must first be classified before they can be located. The insulation of the cable plays a significant role in this. While paper-impregnated cables are particularly susceptible to external chemical and thermal influences, in high-voltage PE or XLPE cables the polyethylene insulation of the conductor is affected, leading to partial breakdowns and cracks that "eat away" the insulation.

2.1 Cable identification

In cable identification, the faulty cables are identified from the fault-free cables at the already determined site.

TYPES OF FAULT IN UNDERGROUND CABLES The most common types of fault that occur in underground cables are.

1. Open circuit fault.
2. Short circuit fault.
3. Earth fault.

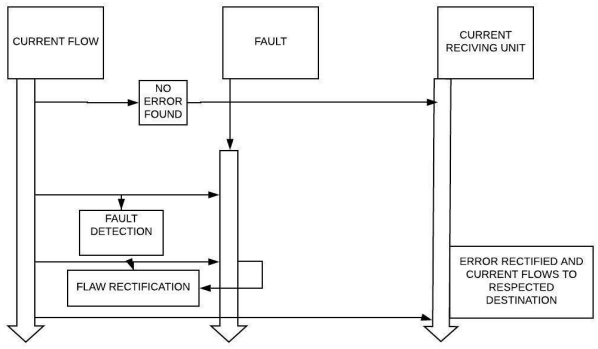
Open circuit fault - When there is a break in the conductor of a cable, it is called open-circuit fault. The open-circuit fault can check by a merger. For this purpose, the three conductors of the 3 core cable at far end are shorted and earthed. Then resistance between each conductors and earth is measured by a merger.

Short-circuit fault -When two conductors of a multi core cable come in electrical contact with each other due to insulation failure, it is so called as short-circuit fault. Merger can also be used to check this fault. For this the two terminals of a merger are connected to any two conductors. If the merger gives a zero reading it indicates short-circuit fault between these conductors. The same is repeated for other conductors taking two at a time.

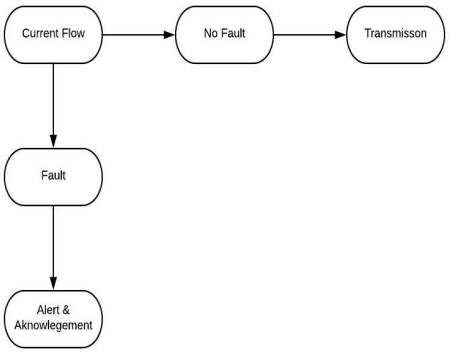
3. Earth fault - When the conductor of a cable comes in contact with earth, it is called earth fault or ground fault. To identify this fault, one terminal of the merger is connected to the conductor and the other terminal connected to the earth. If the merger indicates zero reading, it means the conductor is earthed.

3. Technology Used

The proposed system is an IoT enabled underground cable fault detection system. The basic principle behind 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, and Real-Time Clock. The power supply is provided using step-down transformer, rectifier, and regulator. The current sensing circuit of the cable provides the magnitude of voltage drop across the resistors to the microcontroller and based on the voltage the fault distance is located



State Transactional view



Functional testing in accordance to the concept of the black box testing

4. Conclusions

The aim of the project is to locate and identify and kind of fault in the power line. It ensures the quick solution and rectification of any kind fault and problem that may hinder the power line. Looking at the future potential of the topic it ensures the futuristic approach towards the development of technology that will ease the human daily load and life style. We can detect any kind of fault using the device. The device must be close enough for best detection of faults. It can be used for various transmission lines for detection of faults due to its efficiency, quick response, cheaper in cost and its cost effectiveness.

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