UNDERGROUND CABLE FAULT DETECTION SYSTEM WITH DISTANCE LOCATOR

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Abstract:- Underground cables are more reliable and effective way for cable communication. It is very less maintenance than regular pole hanging cables. But it is very difficult to identify faults when cable is in underground. Here we have solution that IOT underground cable fault detection using Arduino. Using this project user can easily fault location from remote location using IOT technology. Generally every wire has some resistance according to length. Wire resistance is directly proportional to wire length. In this project we measure wire resistance at some particular locations. Those locations indicated through slide switches. Based on slide switch ON/OFF, it assumes No fault and fault. This project includes WIFI (Esp8266/IOT module) which is connected to Arduino through UART interface. Three relays connected to Arduino through digital IO pins to provide 3 phase. Some resistors connected in series to perform cable fault resistance. All resistors connected to analog pin of Arduino. Initially first will be ON and remaining two will be OFF. In this condition Arduino calculates resistance of R-phase, Based on switches action Arduino identifies fault. Same thing repeat for two more phase (Y-Phase and B-Phase). Fault information of three phases will be displayed on LCD. Same data will be transmitted to IOT server through WIFI (ESP8266/IOT). Monitoring can be done from anywhere using IOT server.

1. INTRODUCTION

1.1 GENERAL

Under normal or safe operating conditions, the electric equipments in a power system network operate at normal voltage and current ratings. • Once the fault takes place in

a circuit or device, voltage and current values deviates from their nominal ranges. • The faults in power system causes over current, under voltage, unbalance of the phases, reversed power and high voltage surges. • This results in the interruption of the normal operation of the network, failure of equipments, electrical fires, etc. Usually power system networks are protected with switchgear protection equipments such as circuit breakers and relays in order to limit the loss of service due to the electrical failures. Electrical networks, machines and equipments are often subjected to various types of faults while they are in operation. When a fault occurs, the characteristic values (such as impedance) of the machines may change from existing values to different values till the fault is cleared.

1.2 Aim of the Project

The aim of a project on Underground Cable Fault Detection with Distance Locator is to develop a system that can efficiently detect and locate faults in underground cables, enabling quick and accurate identification of issues for timely repairs. This is crucial for minimizing downtime, ensuring safety, and reducing repair costs in power distribution systems, telecommunications, and other sectors relying on underground cabling. Key objectives of the project may include:

1. Fault Detection: To identify faults such as short circuits, open circuits, or insulation failures in underground cables.

2. Fault Localization: To determine the exact location of the fault along the cable, allowing for precise excavation and repair work. This is typically done using methods like Time Domain Reflectometry (TDR), impedance measurements, or through signal-based techniques.

3. Distance Measurement: To provide a real-time distance or position of the fault from a known reference point, such as a cable entry point or junction box. This helps technicians quickly identify the exact point of failure.

4. System Integration: To develop a comprehensive system that integrates sensors, fault detection algorithms, and a distance locator device that can be easily used by field engineers.

5. Improved Maintenance: To enhance the maintenance process by reducing the time and effort required to locate faults, leading to reduced service interruptions and more efficient repairs.

6. Cost Efficiency: To reduce costs associated with manual fault finding, repair delays, and unnecessary excavations.

1.3 Objectives

The objective of the project on Underground Cable Fault Detection with Distance Locator is to develop a system that can quickly and accurately detect faults in underground cables and determine the exact location of the fault. This allows for faster repairs, minimizes downtime, and reduces repair costs by avoiding unnecessary excavation. The system aims to enhance the reliability and efficiency of underground cable networks.

1.4 Project Overview

The Underground Cable Fault Detection with Distance Locator project is designed to create an efficient system for identifying and locating faults in underground cables, which are essential for power and communication networks. Underground cables are often difficult to inspect, and fault detection can be time-consuming and costly due to the need for excavation The project aims to enhance maintenance processes, making fault detection faster, more accurate, and more costeffective, ultimately improving the efficiency and longevity of underground cable infrastructure.

2. BLOCK DIAGRAM

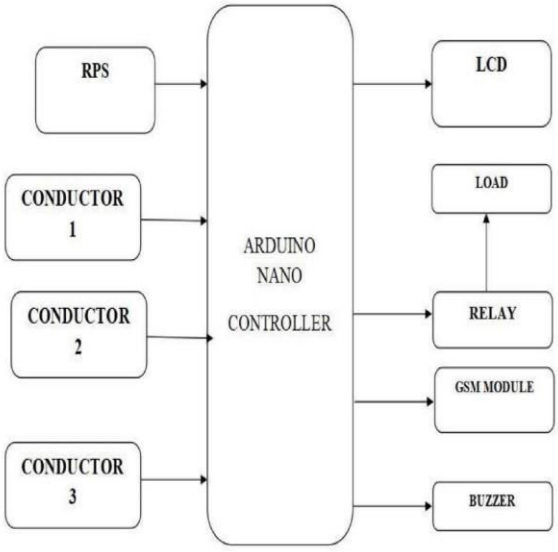

FIG: 1 Block diagram

3.1. HARDWARE COMPONENTS

1. Arduino UNO
2. Wi-Fi Module (ESP8266)
3. Conductivity sensor
4. Buzzer
5. RELAY
6. LED
7. LCD display
8. RPS modules

3.2. SOFTWARE REQUIREMENTS:

- Arduino IDE
- Embedded C

3. IMPLEMENTATION (WORKING PROCEDURE)

The "Underground Cable Fault Detection System with Distance Locator" is designed to identify faults in underground power cables and determine their location. This system ensures quick detection of issues, reducing downtime and repair costs while enhancing safety and efficiency. The project integrates advanced sensing and monitoring technologies to identify faults caused by short circuits, open circuits, or insulation failures. It employs voltage, temperature, and current sensors to detect abnormalities and relay data to a central monitoring unit. A microcontroller processes the collected data, calculates the fault location, and displays it on an interface, such as an LCD or connected software, for easy access by maintenance personnel. The system incorporates several essential components. The Arduino UNO serves as the primary microcontroller, facilitating communication and control between sensors and actuators. The WiFi Module (ESP8266) enables wireless data transmission, allowing remote monitoring and management of the system. The Conductivity Sensor is used to measure the electrical properties of the cable to detect faults. Additionally, the Buzzer provides audible alerts for immediate attention, and the Relay serves as a switch for load protection and control mechanisms. Further, the system utilizes an LED to indicate the operational status of different components and an LCD display to present real-time fault location and system status. Reliable power supply is maintained using RPS modules to ensure uninterrupted functioning. The software implementation is carried out using Arduino IDE and Embedded C programming, enabling efficient data processing and control logic execution. The system not only detects faults but also incorporates preventive measures like load protection, overheating detection, and fire and gas monitoring to prevent catastrophic failures. This ensures that utility companies can maintain uninterrupted power supply and adhere to safety regulations.

4. RESULT

The result of the "Underground Cable Fault Detection System with Distance Locator" is the development of an efficient and reliable solution for detecting and locating faults in underground cables. The system successfully identifies faults such as short circuits, open circuits, and insulation failures, while accurately measuring the distance to the fault. It integrates real-time monitoring using

advanced sensors and provides immediate data on abnormalities, including voltage fluctuations, overheating, and the presence of fire or gas. This ensures quick fault resolution, reduces downtime, and minimizes the need for extensive manual inspections. Additionally, the project enhances safety and operational efficiency by incorporating preventive measures like load protection and hazard detection. The user-friendly interface, with features such as LCD displays and remote monitoring via Wi-Fi, simplifies fault identification and maintenance planning. By significantly reducing repair costs and enabling timely interventions, the system proves to be a valuable tool for industries and utilities managing underground power and communication networks.

Fig:2. Project Model output

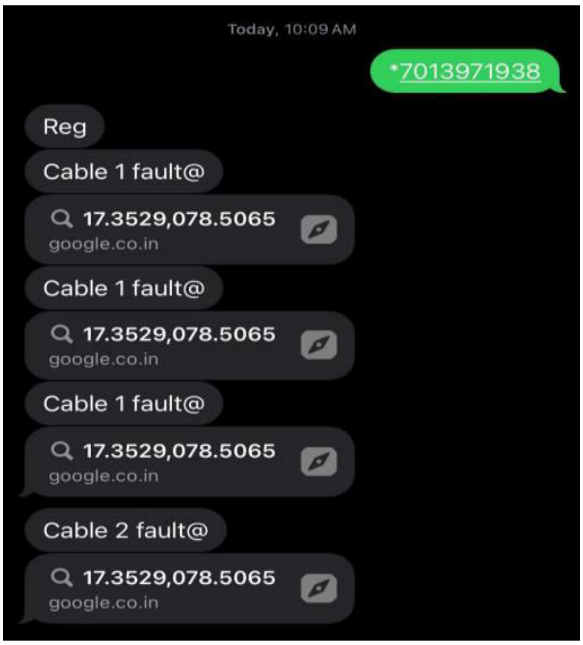

Fig 3 project output

5. CONCLUSION

Each circuit breaker shall be liable to undergo field testing before its initial operation. During the field testing, each circuit breaker must satisfactorily perform and satisfy the requirements of the specification. Special tests, if any, arranged by the purchaser at site to prove any of the requirement of the breaker shall be carried out in the presence of supplier's Engineers who shall fully associate with the testing. Details of the pre-commissioning tests to be carried out on the breakers at site shall be enclosed with the tender for reference of the purchaser.

6. REFERENCES

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