

## UNDERGROUND CABLE FAULT DISTANCE IDENTIFICATION WITH GSM AND IOT

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### ABSTRACT

The main aim of the project is to design an underground cable fault detection with distance using microcontroller. Earth fault or leakage of current is a very common problem in underground cable circuits. This leads to unnecessary power loss. The purpose of this project is to develop a system that senses the earth fault in the cables and alerts the user about it with distance with message notification. The line-to-line fault and the open circuit faults are identified based on the voltage drops occurred at the lines. The system also calculates the distance of the fault. After identification of fault, it operates a Relay. The microcontroller-based control system continuously monitors the amount of voltage passing through the power supply circuit. In case of fault, the amount of voltage will be dropped in the circuit. In such situations the microcontroller-based system alerts the user about this in the form of text message displayed on LCD along with the distance by using GSM. The system also alerts through buzzer alarm. The microcontroller is programmed using embedded C language.

### INTRODUCTION

The main aim of the project is to design an underground cable fault detection and location identification with distance using microcontroller. The most common fault occurred in the underground cables is Line to Earth fault.

Earth fault or leakage of current is a very common problem in underground cable circuits. This leads to unnecessary power loss. The purpose of this project is to develop a system that senses the earth fault in the cables and alerts the user about it with distance.

The microcontroller-based control system continuously monitors the amount of voltage passing through both phase and neutral lines of the power supply circuit. In ideal conditions the amount of voltage passing through the phase and neutral should be same. In case of fault, the amount of voltage will be dropped in the circuit. In such situations the microcontroller-based system alerts the user about this in the form of text message displayed on LCD along with the distance. The microcontroller is programmed using embedded c language.

#### Features:

1. Instantaneous earth fault identification.
2. Visual status display on LCD.
3. Fault Information is sent to remote officials over SMS.
4. IoT based communication alerts for multiple users.
5. Reduce production downtime. Decrease maintenance costs. Quick location of faults.

An embedded system is a combination of software and hardware to perform a dedicated task. Some of the main devices used in embedded products are Microprocessors and Microcontrollers.

Microprocessors are commonly referred to as general purpose processors as they simply accept the inputs, process it and give the output. In contrast, a microcontroller not only accepts the data as inputs but also manipulates it, interfaces the data with various devices, controls the data and thus finally gives the result.

The project” IoT and GSM based Under ground cable distance and fault location identification” using PIC16F73 Microcontroller is an exclusive project that can be used to design a under ground cable fault indication and detection.

When the earth leakage protection system detects a fault current, it acts on the electrical installation being protected, opening the circuit while interrupting the supply of electrical energy, thus preventing the danger of electrocution for persons when the fault current reaches dangerous values, either as a result of direct or indirect contact, including any potential damage caused to goods and materials.

An earth leakage protection system is composed of three clearly different parts

- Detecting element or sensor
- Relay
- Circuit breaker

#### **Earth leakage protection systems with self-reclosing:**

Given the current efficient personal and material protection requirements and obligations, and the complexity of some installations that require the continuous supply of electrical energy with the use of overload and earth leakage protection systems, **CIRCUTOR** has developed a wide range of units that make safety and service continuity compatible. Self-reclosing systems are an ideal solution for installations that need a constant supply of electrical energy, without the need for the usual maintenance staff:

- Rural installations
- Refrigeration chambers
- Public lighting
- Mobile telephony repeaters
- Traffic lights
- Lighting of tunnels
- ATMs
- Cable television Etc.

The type of protection element installed, those that can be reclosed and under which reclosing conditions must be known by all self-reclosing systems. Self-reclosing systems act in accordance with the following:

- Earth leakage current (earth leakage)
- Earth leakage current (earth leakage) +overload and short-circuit (circuit breaker).

#### **Earth leakage transformer:**

The earth leakage transformer detects the **earth leakage**. It can be built-in on a relay or as an external element.

#### **Self-reclosing relay:**

Self-reclosing relays add a series of performance features (self-reclosing, thermal or overload protection) to the proven reliability and security of non-reclosing earth leakage protection relays.

It performs the following functions:

- Detection of anomalies (earth leakage or overload) through the signal generated by the transducer.
- They analyze the anomaly to see if it must generate an alarm, depending on the parameters programmed.
- They also act on power elements, which perform the grid load connection disconnection tasks.

#### **Circuit breaker:**

This element acts as the current interrupting element. It can be a circuit breaker (with trigger coil), a contact, and etc. These three elements can be found in CIRCUTOR's products with different configurations:

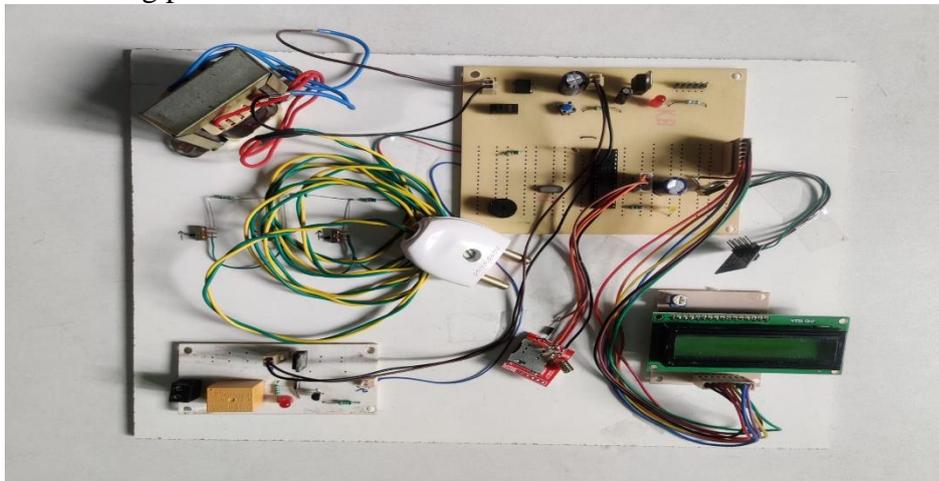
- All elements separately
- Relay with internal transformer

The circuit breaker always interrupts the flow of power, which supports the power in the line protected and is an external element of the relay. The circuit breakers that can be associated to self-reclosing relays are as follows:

- Motorized circuit breaker (MT)
- Contact circuit breaker with remote control (MCB), with a dual circuit breaker and contact function (the function of the contact is bistable).

Features of the circuit breaker:

- Nominal current (in contacts)
- Nominal current and thermal protection curve (in circuit breakers)
- Features of the control inputs of the operational element
- Circuit-breaking power



### **UNDER GROUND CABLE FAULT IDENTIFICATION WITH GSM AND IOT**

The project “**IoT and GSM based Underground cable distance and fault location identification**” was designed such that the Current transformer detects the earth leakage current of active conductors in an installation, also detects the line to line faults with location, also open circuit faults.

#### **Advantages:**

1. Automatic faults detection with distance.
2. Earth fault detection.
3. Audible and visual alerts through buzzer and LCD
4. Efficient and low cost design.
5. Low power consumption.
6. Easy to install.
7. Fast response.
8. Wireless alerts over GSM and IoT networks.

#### **Disadvantages:**

1. Interfacing current transformer to the Micro Controller is sensitive.
2. The entire connections of the system are wired so supports only for limited distance.

#### **Applications:**

1. Underground cable fault location (distance) finding.

#### **Future Scope:**

- ❖ Design of earth fault relay depends upon sensitivity of a system. Hence a varied rated earth fault relays can be designed.

- ❖ The operating time of electromagnetic relay can be improved by using sophisticated electronic components.
- ❖ A similar earth fault protection scheme can also be employed for a 3-phase star connected system.
- ❖ The system also detects the line-to-line faults and also open circuit faults.
- ❖ The system can be extended using GSM modem through which alerting message is sent to authorities in case of emergencies.

## CONCLUSION

A single-phase earth fault protection is relatively easy to establish on most power systems compared to other protection schemes. Flexibility of fault analysis depends upon the complexity of power system. Hence, we can conclude that the occurrence of earth fault at any point in a single-phase system can be easily detected using earth fault protection scheme. By installing the earth fault protection scheme, a consumer can be aware whether he is exactly charged, or not, for his energy consumption.

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC's with the help of growing technology, the project has been successfully implemented. Thus, the project has been successfully designed and tested.

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