Underground Cable Fault Detection using Arduino

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Abstract : In urban areas, electrical cables run underground instead of running over, because it does not affected by any adverse effect of weather such as heavy rainfall, snow, thunder storm. Whenever a fault occurs within the underground cable, it is difficult to detect the exact location of the fault for the repair process of particular cable. The proposed system found the point of the exact location of fault. The paper uses the standard concept of Ohm's law i.e. when a low dc voltage is applied at the end of feeder through series resister (cable lines) then the current will vary depending on the location of the fault Short in the cable. This system uses an Arduino microcontroller and a rectified power supply.

Keywords : **Arduino, Underground Cable Fault, Ohm's Law, Fault Detection, Fault Localization, GSM Communication.**

I. INTRODUCTION

In this project we proposed a fault localization model for the underground cable lines with Arduino. The purpose of this paper is to determine the distance from the base station's underground cable fault in kilometres. In this project we used a simple concept of ohm's low. When a fault occurs in the system the distance located on liquid crystal display (LCD). Until the last decade, cables were designed to be placed above the head and, at present, there is no underground cable that is higher than the previous method. adverse weather conditions such as storms, snow, torrential rains and pollution does not effect on underground lines But when a fault occurs in underground lines it is difficult to locate the fault in underground cable. We will find the exact location of the fault. Now the world has become digitized so, the project is to detect exact location of the fault in digital form. Underground cabling system is a more common practice in many urban areas. Although the fault occurs for some reason, at that time, the repair process for this particular cable is difficult because of not knowing the exact location of the cable breakdown.to inefficiency.

II. EASE OF USE

User-Friendly Interface:

The system is designed with a user-friendly interface, ensuring simplicity for operators and technicians. A graphical user interface (GUI) facilitates easy monitoring and control, minimizing the learning curve for users.

Plug-and-Play Integration:

The project is designed for plug-and-play integration, allowing users to connect the Arduino-based system effortlessly to the existing underground cable network.Clear and concise installation instructions simplify the implementation process.

Pre-Programmed Arduino:

The Arduino microcontroller comes pre-programmed with the necessary algorithms, reducing the need for extensive programming knowledge.

Users can focus on system setup without delving into intricate coding requirements.

Modular Components:

Components are modular, enabling users to easily replace or upgrade individual elements without disrupting the entire system.This modularity enhances flexibility and scalability, adapting to varied user needs.

Intuitive Fault Displays:

Fault information is displayed on an LCD in a straightforward manner, providing users with immediate insights into the type and location of the fault. Distances in kilometers are clearly presented, aiding in swift decision-making.

Abbreviations and Acronyms :

1. M2M: Machine-to-Machine
2. HCI: Host Controller Interface
3. RF: Radio Frequency
4. LCD: Liquid Crystal Display
5. IDE: Integrated Development Environment
6. LED: Light-Emitting Diode
7. IR: Infrared
8. CH4: Methane
9. CO2: Carbon dioxide

III. PROJECT OBJECTIVES

Comprehensive Fault Detection:

Short Circuit Identification: Develop a mechanism to rapidly identify short circuit faults within the underground cable network.

Low Voltage Detection: Implement a sensing system to detect instances of low voltage, ensuring that even minor deviations are identified and addressed promptly.

High Voltage Detection: Create a robust method for recognizing high voltage faults, safeguarding the cable network from potential damage or hazards.

Precise Fault Localization:

Distance Measurement: Incorporate advanced techniques to accurately determine the exact distance of the fault from the base station in kilometers.

Fault Type Identification: Enhance fault localization by specifying the type of fault (short circuit, low voltage, or high voltage) at the identified location.

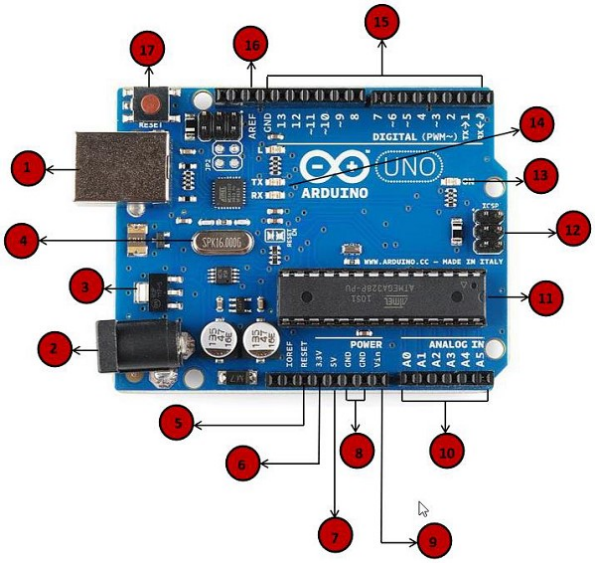
GSM Data Transmission:

Develop a reliable and secure communication system using GSM technology to transmit detailed fault information to the base station.

Real-time Reporting: Enable the system to provide real-time updates to the base station, ensuring swift awareness of the fault and facilitating timely responses.

Multifaceted Alert Mechanism:

Buzzer with Arduino Variable Intensity: Implement a variable intensity buzzer system that provides distinct audible alerts based on the severity and type of the detected fault.



Visual Indicator: Integrate a visual indicator, such as an LED display, to supplement the audible alerts and enhance fault notification.

IV. REMOTE MONITORING AND CONTROL

Remote Access to Fault Data: Enable the base station to remotely access detailed fault data, allowing for analysis and decision-making without physical inspection.

Remote Control of Power Supply: Implement a feature that allows the base station to remotely cut off power to the specific cable section affected by the fault for safety and maintenance purposes.

Literature Survey:

The evolution of fault detection systems has been extensively explored in prior research, delving into the application of microcontrollers, GSM modems, and Arduino kits.

Data Type	Size	Range
Char or signed char	1byte	-128 to +128
Unsigned char	1byte	0 to 255
Int or singed int	2byte	-32768 to 32767
Unsigned int	2byte	0 to 65535

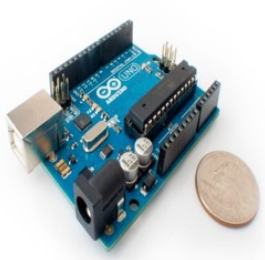
These technological advancements have laid the foundation for sophisticated fault detection methodologies. The proposed system builds upon these well-established concepts, aspiring to achieve a heightened level of accuracy in fault localization, presented in kilometers.

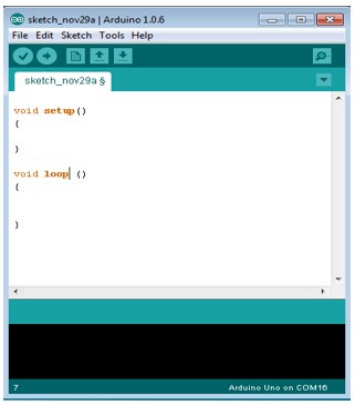
Objectives:

The primary objective of this project is to precisely determine the distance of an underground cable fault from the base station, employing an Arduino board. This innovative approach seeks to streamline the fault identification process, providing an efficient alternative to traditional overhead lines.

V. EXISTING SYSTEM

The current fault identification system relies on the integration of Arduino and GSM technology.





While proven effective, this system encounters drawbacks, including the potential for time-consuming fault correction, leading to disruptions in power supply. Additionally, some methodologies rely on noise detection, introducing possible delays in pinpointing fault locations.

Existing Disadvantages:

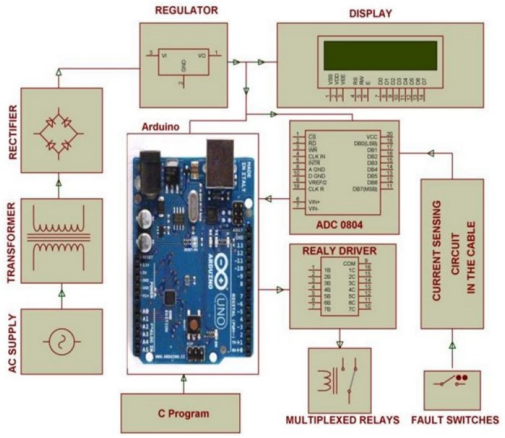
Time-Consuming Fault Correction**:** The current system may result in extended downtime during fault correction, impacting the continuous power supply.

Reliance on Noise Detection: Dependency on noise detection methods can introduce delays in pinpointing the exact location of faults, potentially hindering timely repairs.

VI. PROPOSED SYSTEM:

The proposed system represents a substantial enhancement in fault detection capabilities. Through the integration of an Arduino microcontroller and GSM technology, the system not only identifies short circuit faults but also extends its capabilities to detect low and high voltage faults. Operating on the principles of Ohm's law, the system provides real-time fault information through GSM communication and displays fault types on an LCD. Furthermore, an integrated buzzer serves as an immediate alert mechanism.

Circuit Diagram :



VII. CONCLUSION

This paper introduces a comprehensive solution for underground cable fault detection and localization through the integration of Arduino technology. The proposed system offers notable improvements over existing methods, ensuring quicker response times for fault rectification, minimizing power disruptions, and overall enhancing the reliability of the entire power distribution system. The innovative combination of Arduino and GSM technology brings efficiency and accuracy to the forefront of underground cable fault management**.**

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