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Underground Cable Fault Distance Locator Using Node MCU

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ABSTRACT:

Underground cables have been widely used with the development of power system grid. Underground cables are prone to a wide variety of faults due to underground conditions, wear and tear, rodents. Detecting fault source is difficult because entire line is to be dug in order to check fault at cable line. The repairmen know exactly which part has fault and only that area is to be dug to detect the fault source. Thus it saves a lot of time, money and allows to service underground cable lines faster. The aim of this project is to determine the distance of underground cable fault from base station in Km.

1. INTRODUCTION:

Underground cables are now widely used as a result of the expansion of the electrical system grid. Underground cables are prone to a variety of issues because of the subterranean climate, wear and tear, and rodents. Since the entire line must be dug up to check the cable line for issues, it is difficult to pinpoint the exact cause of the issue. The repairmen know precisely which area is defective, thus only that area needs to be dug up to identify the defect's source. As a result, it makes underground cable lines easier to maintain and saves a tonne of time and money. Calculating the underground cable fault's distance in km from the base station is the aim of this research.

Power supply networks are constantly expanding, and their dependability is more crucial than ever. Numerous components that make up the complicated network might malfunction and stop providing electricity to end users. Underground cables have been utilised for many years on the majority of low voltage and medium voltage distribution lines that are in operation globally.

The usage of underground high voltage cables is expanding as a result of their resistance to the effects of pollutants, severe weather, heavy rain, and storms. There are still factors that might lead to cable failure during testing and operation, despite the fact that cable production technology is always improving. A cable with proper installation and maintenance may survive for roughly 30 years. However, improper installation or shoddy jointing can readily destroy wires, and future third-party damage might be caused by civil works like trenching or curb edging.

2. SYSTEM SPECIFICATION:

[8]For the subterranean cable lines, we suggested a fault localisation approach using Arduino in this project. The calculation of the underground cable fault's distance in km is the main goal of this research. We employed the straightforward idea of ohm's low in our project. The liquid crystal display (LCD) shows the distance when a system problem occurs. There is currently no subterranean cable that is higher than the previous approach since cables were created to be placed above the head up to the last ten years. However, when a fault develops in subterranean lines, it is challenging to find the problem in underground cable. Adverse weather conditions including storms, snow, heavy rains, and pollutants do not damage subsurface lines.

[2]We'll locate the fault's precise location. Since the entire world has gone digital, the project's goal is to locate the defect precisely in a digital format. In many urban locations, underground cabling systems are more prevalent. Even when the defect arises for some reason at that time, it is difficult to repair this specific cable since it is unclear where the cable broke down.

Open circuit error Since there is no conducting full loop for current to flow when I=0, there is no current.Supply voltage and output voltage are identical in this malfunction. A short circuit fault is preferable than an open circuit fault. The output voltage in this defect is zero, yet the current is the same.

2.1 HARDWARE CONFIGURATION:

- NODE MCU
- Power supply

- Relay
- LCD Display
- GSM Module
- Wifi module

2.1.1 NODE MCU:

There are open-source prototype board designs for the NodeMCU open-source firmware. "NodeMCU" is a combination of the words "node" and "MCU" (micro-controller unit). In a technical sense, "NodeMCU" only refers to the firmware and not the related development kits. The designs for the prototype boards and firmware are also open source. The Nodemcu ESP8266 and Nodemcu ESP32 are rapidly gaining popularity and are now almost exclusively employed in Iota-based applications.

[3] The Lau programming language is employed by the firmware. The firmware was created using the Espresso Non-OS SDK for ESP8266 and is based on the Eula project. It makes extensive use of open-source initiatives like SPIFFS and lua-cjson. Users must choose the components necessary for their project and create a firmware specific to their requirements due to resource limitations. Support for the 32-bit **ESP32** has also been implemented.

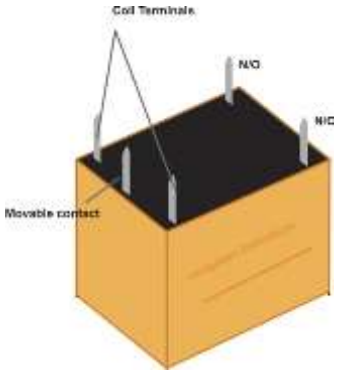
[7] A circuit board acting as a dual in-line package (DIP) that incorporates a USB controller with a smaller surface-mounted board housing the MCU and antenna is the prototype hardware that is frequently utilised. The DIP format's selection makes breadboard prototyping simple. The ESP-12 module of the ESP8266, which is a Wi-Fi SoC combined with a Tensilica Xtensa LX106 core and is extensively utilised in IoT applications, served as the design's basic foundation.

2.1.2 Power supply:

This is a straightforward method for creating a single circuit that can deliver both 12V and 5V DC power. Two ICs, models 7812 and 7805, are used in the circuit to generate the necessary voltages. The transformer will step down the AC mains voltage, the bridge will rectify it, and the capacitor will filter it to provide a constant DC level. The 7812 controls this voltage in order to provide a constant 12V DC. The 7805 will control the output of IC1 such that its output has a constant 5V DC. Both 12V and 5V DC are produced in this manner.

2.1.3 Relay:

Relays are electromechanical switches that include coils. The switch moves to close or open the electrical connection when a tiny current travels through the coil, creating a magnetic field. With no direct electrical connection between them, a relay is typically utilised to regulate high voltage (AC or DC) circuits utilising tiny DC voltage circuits. This indicates that the high voltage and low DC voltage circuits are electrically independent yet magnetically connected.



2.1.4 LCD Display:

The enthusiasts employ a variety of display devices. One of the most advanced display technologies they utilise is LCD. It will be the simplest and most dependable output device you utilise after you figure out how to interface it! Additionally, not every project based on a microcontroller can utilise a debugger. Therefore, output testing may be done using LCD monitors. Data and control signals are the two sorts of signals that LCD may take. The LCD module recognises these signals based on the RS pin's condition.

2.2 Block Diagram:

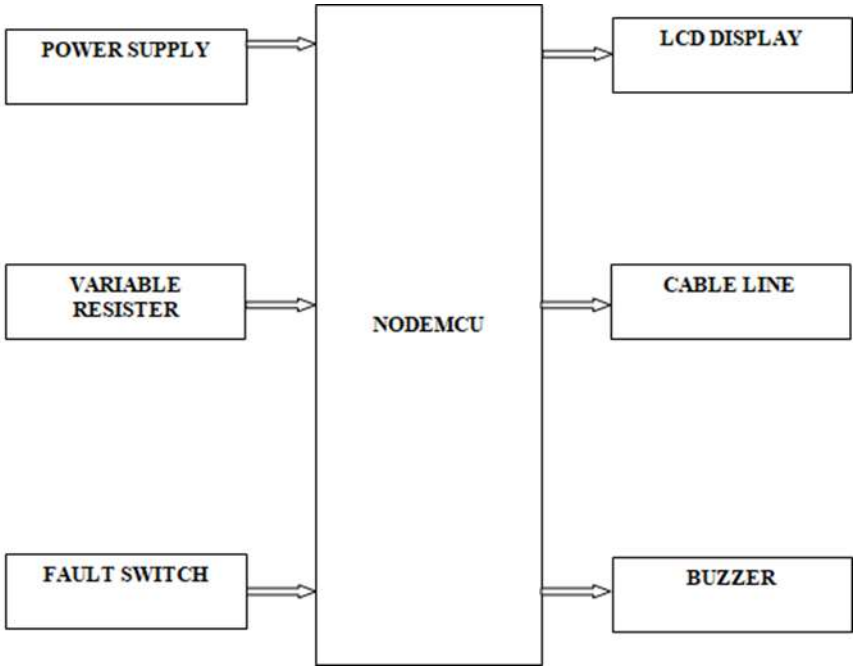


Figure 1: Block Diagram for the underground cable fault distance locator using node mcu

3. SYSTEM STUDY:

3.1 EXISTING SYSTEM:

- Many techniques have been employed in the past to identify cable problems since underground cables are subject to a variety of subterranean defects, wear, rats, etc.
- The issue is how to identify ground cable failures and how to get fault data when necessary.
- This prototype was designed to locate subterranean cable cables' faults.

3.1.1 DRAWBACKS:

- Numerous techniques have been employed in the past to identify cable problems since underground cables are subject to a variety of subterranean defects, wear, rats, etc.
- The issue is how to identify ground cable failures and how to get fault data when necessary.
- High difficulties in fault detection and maintenance. In the event of system failure, it is difficult to find and replace wire breakage.
- This prototype was designed to locate fault in subterranean cable lines. In addition, it takes many days or weeks to resolve the issue.

3.2 PROPOSED SYSTEM

[5] An effective instrument for swiftly locating faults in underground power lines that might be challenging to find and fix is an underground cable fault distance detector. Here is a suggested technique for measuring the distance to an underground cable fault. Installing sensors throughout the cable's length is the initial stage. Changes in electrical parameters like voltage, current, and impedance should be detectable by these sensors. They can be put in place on a regular basis, like every km. A data collection system should be used to gather and process the sensor data.

[6] This system should be able to rapidly analyse the data, sample it at a high rate, and store it for subsequent study. To find any changes in the cable's electrical properties, the obtained data should be evaluated. By contrasting the present data with the baseline data from the time the cable was initially laid, this may be accomplished. Any departures from the norm ought to be marked as potential errors. [9]Locating the defect is the next stage after fault detection. Time-domain reflectometry (TDR), which sends a pulse down the wire and monitors how long it takes for the reflection to return, can be used to do thisThe distance to the problem may be calculated using the time delay. The operator should see the distance to the defect as well as other pertinent details including the kind of the issue and the seriousness of the damage in real-time. To guarantee that the defect is fixed immediately, the system should be able to connect with other devices, such as a control room or maintenance crew.

4. CONCLUSION:

Therefore, the project on Underground Cable Fault Detection Using NODEMCU was completed, and the Fault's Distance from Base Station in Kilometres was presented for the SINGLE stages. In this project, faults may be detected up to a distance of 5 kilometres by testing the circuit with various resistor values to mimic various fault scenarios. The phase corresponding to that specific switch is said to be in fault condition when the fault switches are operated to that state. Thus, it is simple to identify the problematic portion.

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