IOT-POWERED UNDERGROUND CABLE FAULT DETECTION SYSTEM

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ABSTRACT : The project is purposive for underground cable fault detection which measures the fault in underground The project's purpose is to detect problems in subterranean cables using a Renesas microcontroller to calculate the distance in kilometers from the base station. Ohm's law serves as the primary premise guiding this deliberate endeavor. When a low DC voltage is provided to the feeder end, which is connected to the lines via a series resistor, current swings in proportion to the location of the cable problem. The system includes a rectified AC power source as well as a Renesas CPU. An analog to digital converter device transmits digital data indicating cable length in kilometers to a microcontroller, which is then coupled to a resistor and current sensing circuit. For the purposes of example, cables are replaced with watt resistors, and a series of switches is interlaced between the resistors to simulate cable failures. Relay drivers are integrated circuits (ICs) that control the relays, which alternately give power to each line. The data is displayed on a 16x2 LCD screen and sent to the server via a GPRS module.

KEYWORDS:Iot, cable, fault, underground, detection

1.INTRODUCTION

Cabling is now designed to be installed underground rather than above ground, as this method is more effective than its predecessor. Underground wiring is unaffected by unfavorable weather conditions, such as heavy precipitation, snowfall, cyclones, and smog. We need to create a technique for precisely finding underground cable faults because they can be difficult to identify at times. As the globe becomes more digitally networked, digital techniques are used to detect underground cable issues. This contributes to our goal of delivering services in digital format. Subsurface cable installation has becoming increasingly common in many urban areas. An underground link's failure can be caused by a variety of factors, and restoring the link can be challenging because the location of the cable issue is not always evident. The current technology is difficult and heavy, and in some cases, many ways are required to discover a flaw in an underground wire due to the inadequacies of one approach. [5][7] Coordination of many diagnostic procedures using specialized equipment is labor-intensive. To expedite system repair, we need defect localization methods that are both fast and accurate, with the ability to avoid severe financial and operational loss.

2.CLASSIFICATION

Types of fault in the cable :

Short circuit fault: Conductor, earth, or both? A protection failure happens when a brief out state (i.e., abnormally high current circumstances followed by obvious effects such as arcing) develops in the circuit as a result of the short out mechanism being activated.

Two different types of supplemental short circuit flaws can be identified:

Symmetrical fault: This error only occurs in one or two phases. This issue causes a three-phase line imbalance.

Open circuit fault: An open circuit within the wires is one of the elements that constitute the defect. When at least one link conductor (center) fails, chaos ensues. This anomaly is also caused when the link separates from its junction owing to mechanical pressure. This is known as an open circuit fault.

Online strategy: Fault foci are found by processing measured currents and voltages in this manner. Underground links require less Internet planning than above cables.

Disconnected strategy: This method is an excellent tool to evaluate link administration in the field.

3.METHODOLOGY

Hardware Design

The prototype's components include an LCD, transformer, voltage divider circuit, GSM/GPRS module, Renesas microprocessor, and resistor-equipped underground wires.

Renesas serves as the project's essential element, regulating all operational aspects and displayed in the middle of the block diagram. Two underground cables are constructed by connecting resistors in series. The microcontroller's internal ADC turns the analog inputs from the cables into digital values, which are subsequently delivered to the microcontroller via these two wires. Faults are generated and displayed at the junction (series) point of two resistors via toggle switches. At the 1 kilometer, 2 km, and 3 km points, each cable contains two to three toggle switches, which causes issues. The voltage received from the cable to the ADC will be reduced if the second toggle switch in the first cable is enabled, as contrasted to when the toggle switches are disengaged. The ADC will convert the analog voltage to a digital value, which will then be compared to the Renesas controller's threshold value. In the event of a deviation, the microcontroller will immediately alert the relevant authorities (cloud-based) via GPRS.The present condition of the subterranean cable is transmitted and logged in a database via GPRS, allowing data to be accessed from anywhere in the world at any time.

It may also detect overload concerns in a variety of voltage-hungry applications, such as 40W, 60W, and 100W bulbs. The microcontroller will send the overload status to the cloud if it detects that the kit is linked to more than one source.

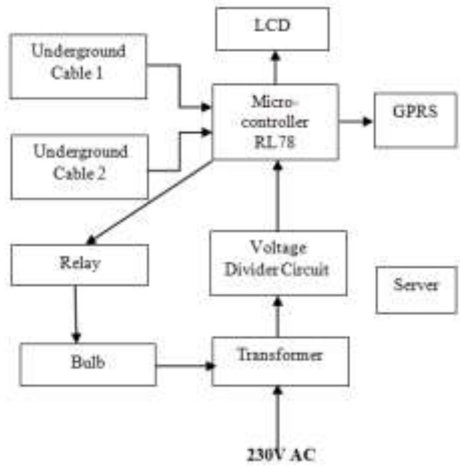

Figure1:Block diagram of prototype system

Software Design

The code is separated into two pieces, one of which is written in embedded C and is designed to be executed by the GPRS module and microcontroller upon bootup. The second phase (AWS) involves creating an Amazon Web Service account and developing a website. The microcontroller communicates with the server via GPRS.

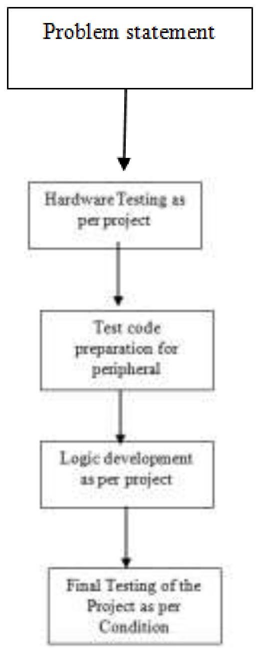

Figure 2: Flowchart of prototype of project

4.RESULT AND ANALYSIS

Faults are generated and displayed at the junction (series) point of two resistors via toggle switches. At the 200 and 400 unit sites, each cable contains two to three toggle switches, which causes failures. The voltage received from the cable to the ADC will be reduced if the second toggle switch in the first cable is enabled, as contrasted to when the toggle switches are disengaged. The ADC will convert the analog voltage to a digital value, which will then be compared to the Renesas controller's threshold value. Figure 3 depicts the difficulty encountered at the 200 and 400 units when using the switch.

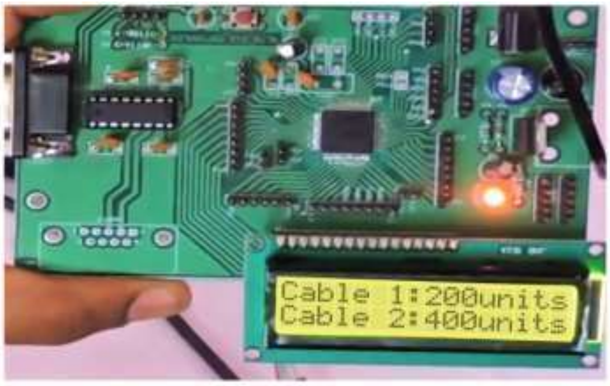

Figure 3. sample output displayed on LCD

In the context of the Internet of Things, a GPRS module is used to send the same data that appears on the LCD to the server. The GPRS module, which connects the microcontroller to the server, makes information more accessible on a global scale. Figure 4 depicts an example output that will be shown on the website.

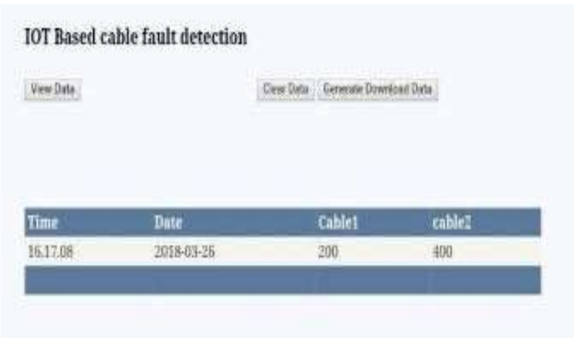

Figure 4. Sample output at webpage

5.CONCLUSION AND FUTURE SCOPE

Our project model has the power to produce the desired results. A few changes allow the model to function as a real-time system (RTS). Because of the ongoing evolution and significant advancement in many scientific disciplines, a wide range of technologies and approaches can be used to attain similar goals. A microprocessor and other components can eventually be merged into a single device, reducing the size of the system while enhancing performance. Real-time systems demand components with high precision and dynamic range.

We created a prototype model with the possibility for future product development. Every product must be not only economical and compact, but also user-friendly and long-lasting. As a result, by leveraging several technologies, a CPU and the majority of components can be combined onto a single board, reducing size and increasing system compactness.

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