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FAULT DETECTION OF UNDERGROUND CABLES THOUGH NODE MCUMODULE USING IOT

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ABSTRACT

Underground cables are vulnerable to a variety of issues due to subsurface settings, wear and tear, rats, and other factors. It is difficult to diagnose the source of the fault, and to examine and correct issues, the entire cable must be removed from the ground. Using an Arduino, the project effort aims to determine the location of a fault in subterranean cable lines from the base station in kilometres. The wire must be examined for defects in order to discover a fault. This prototype employs the concept of Ohms law. The current would fluctuate depending on the fault length of the cable. The suggested method pinpoints the fault's exact location. To ensure correctness, the prototype is built with a series of resistors that indicate cable length in kilometres, and faults are created by a set of switches at every known distance.

KEYWORDS : NODE MCU module, cable fault, Arduino, switches

1. INTRODUCTION

The goal of this project is to calculate the distance of an underground cable fault from the base station in kilometres using an Arduino board. Normally, we use overhead lines. We can quickly detect the flaws, however we couldn't employ overhead lines in rushed situations or familiar cities. As a result, we're switching to underground wires. Underground cables are widely utilised instead of overhead wires in urban areas. The problems in the subsurface wires are difficult to spot. This project makes use of the Arduino, NodeMCU, and LCD. This suggestion is both time-saving and effective. The use of an underground cabling infrastructure is popular in many urban locations. This suggestion is both time-saving and effective. In many urban areas, underground cabling infrastructure is widely used. Many defects emerge as a result of construction activities and other factors. It is tough to dig out cable at that time since the specific position of the cable fault is unknown.

1.1 Implementation of embedded systems

An embedded system is a type of computer system that is primarily designed to execute activities such as data access, processing, storage, and control in various electronics-based devices. Embedded systems are made up of hardware and software, with the software being called firmware and being embedded inside the hardware. One of the most important features of these systems is that they provide the o/p within the time constraints.

Embedded systems assist in making tasks more precise and convenient. As a result, embedded systems are often used in both basic and complicated products. Embedded systems are used in a variety of products in our daily lives, including microwaves, calculators, TV remote controls, home security, and neighbourhood traffic control systems, among others.

An embedded system is divided into two sections:

1. Hardware

2. Software

Hardware for Embedded Systems: An embedded system, like any other electronic system, needs a hardware platform to run on. Microprocessors or microcontrollers are used in embedded system hardware.

Embedded System Software: Embedded system software is created to perform a specific task. It's usually written in a high-level language and then compiled into code that can be stored in the hardware's non-volatile memory.

Different applications use embedded systems. Smart cards, telecommunications, satellites, missiles, digital consumer electronics, computer networking, and other applications are only a few examples of embedded systems.

2. LITERATURE SURVEY

Rajesh Kajla & Nikhil Kumar Sain Underground Cable Fault Distance Conveyed Over GSM is the title of the second paper.

With the help of a microcontroller, this research provides a defect location model for subterranean power cables. The goal of this research is to calculate the distance in kilometres between a base station and an underground cable fault. The concept of ohm's law is employed in this project. Because the current fluctuates with the length of the defect in the cable, the voltage drop will vary. An analogue to voltage converter is used to detect the defect, and a microcontroller is used to perform the appropriate calculations, resulting in the fault distance being displayed on the LCD display.

Underground Cable Fault Detection Using Raspberry Pi and Arduino [3] by R.K.Raghul Mansingh, R.Rajesh, S.Ramasubramani, and G.Ramkumar

The purpose of this investigation is to find a cable issue beneath. This project employs the CT Theory concept. When a short circuit occurs, the voltage drop varies depending on the length of the fault in the cable, and CT is used to compute the variation. The signal conditioner manipulates the voltage change, and a microcontroller does the necessary computations, allowing IoT devices to display the defect distance.

Prof. Arjun Nichal, Mr. Sudarshan Bhosal Mr. Vaibhav Shirsavade, Mr. Yogesh Jadhav (2016):

The information will be transferred from end to end in this research, which proposes a defect location model for subterranean power cables using a microcontroller and the internet. That is, to determine the kilometer-long detachment of an underground cable fault from the base station, as well as the precise position of the broken down location. When a fault occurs, such as a short circuit, the voltage drop varies based on the distance between the fault and the end of the cable, because the current varies. Since the cable is represented by a set of resistors at the current end, the fault is detected by detecting a change in voltage using an analogue to voltage converter, and the necessary calculations are performed by a microcontroller, resulting in the fault distance being displayed on the LCD display. This defect information is then supplied to any entry point through the internet.

3. PROPOSED SYSTEM

In this example, switches are employed as cable lines. If any of the switches is pressed, the cable fault will be detected, and the appropriate LED will illuminate, indicating the cable fault in that exact spot. A message is delivered to the pre-determined number after this is uploaded to the cloud.

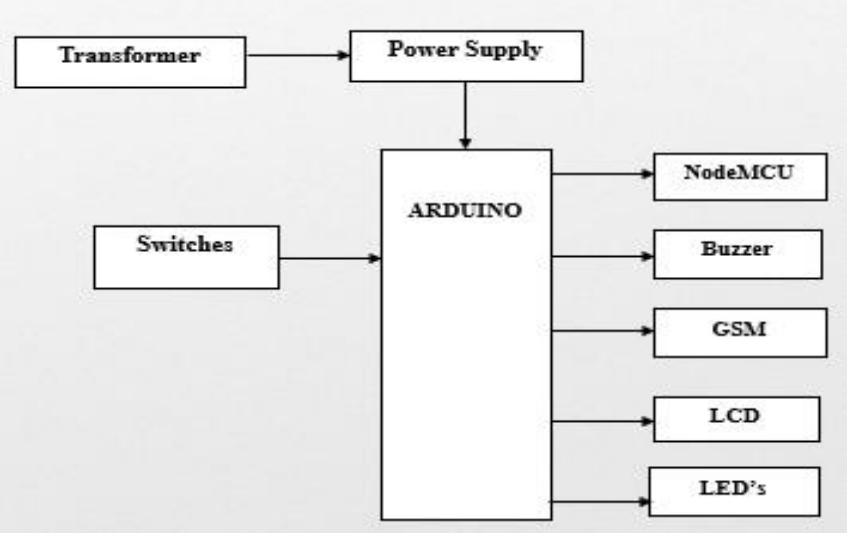

Figure 3.1 Block diagram of the proposed technique.

3.1 REQUIREMENTS FOR HARDWARE AND SOFTWARE

ARDUINO

An ATmega328 controller is included in the Arduino UNO microcontroller. For electronics projects, the Arduino UNO board is a popular choice among beginners. The Arduino UNO is the only Arduino board I'm familiar with. The Arduino board is the most popular of all Arduino boards. The board includes a power jack, USB connector, reset button, ICSP header, and other components, as well as 14 digital input/output pins, including 6 analogue input pins.To make the Arduino UNO board functional and used in the project, all of these components are added to it. The board can be charged via USB or directly from the DC power supply.

Figure 3.2 ARDUINO

NodeMCU - An Overview

With just a few Lua script lines, you can design your own Internet of Things device with NodeMCU, an open-source firmware and development kit. The board has many GPIO pins that can be used to link it to other peripherals and can generate PWM, I2C, SPI, and UART serial communications.

• The module's user interface is split into two sections: firmware and hardware, with the former based on the ESP8266 Wi-Fi SoC and the latter on the ESP-12 module.

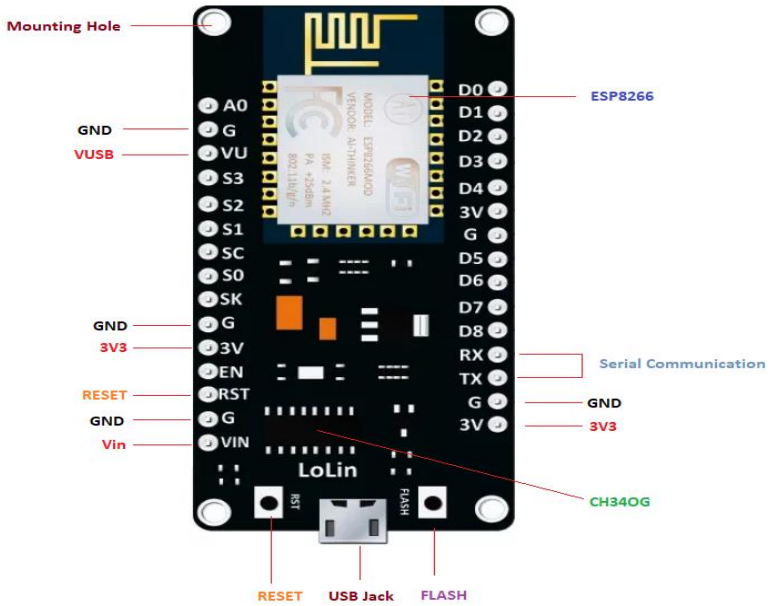

Figure 3.3 Microcontroller unit

- USB to UART converter is added on the module that helps in converting USB data to UART data which mainly understands the language of serial communication.

There is a clear distinction between VIN and VU: the former is the regulated voltage, which can range from 7 to 12 V, while the latter is the USB power voltage, which must be kept around 5 V.

Push Button Switches:

A push button switch is a sort of switch that turns something on or off using a basic electric or air switch mechanism.

LCD: (Liquid Crystal Display)

There are 16 characters per line on a 16x2 LCD, and there are two of them. Each character is displayed in a 5x7 pixel lattice on this LCD. There are two registers on this LCD: Command and Data.

Figure 3.4 LED

BUZZER

Buzzers are DC-powered electronic transducers that are often found in computers, printers, copiers, alarms, electronic toys, automotive electrical equipment, telephones, timers, and other sound devices. Active buzzer (5V) This sensor expansion module and board, when used together, can complete a basic circuit design that is "plug and play."

Figure 3.5 BUZZER

GSM

GSM is a mobile communication modem that stands for global system for mobile communication (GSM). Bell Laboratories came up with the concept for GSM in 1970. It is the most widely used mobile communication technology on the planet. GSM is an open and digital cellular system that provides mobile voice and data services over the 850MHz, 900MHz, 1800MHz and1900MHz frequency bands.

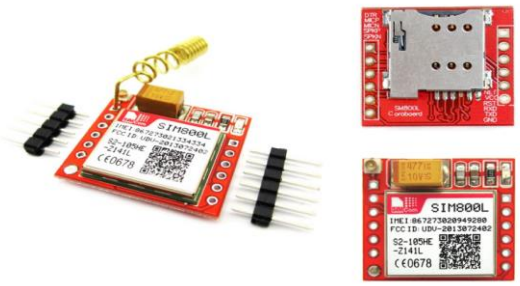

Figure 3.6 GSM

Arduino IDE (Integrated Development Environment): Arduino IDE (Integrated Development Environment) is an official software developed by Arduino.cc for creating, compiling, and uploading code to the Arduino device. Almost all Arduino modules are compatible with this open source software, which is simple to install and begin compiling code on the fly. Both C and C++ are supported in this environment.

4. RESULT

When we manually turn on the switches that are connected to the cables, if a problem occurs, the buzzer sounds, the fault distances are displayed on the LED, As indicated in the diagram, a message is transmitted to the mobile phone using GSM.

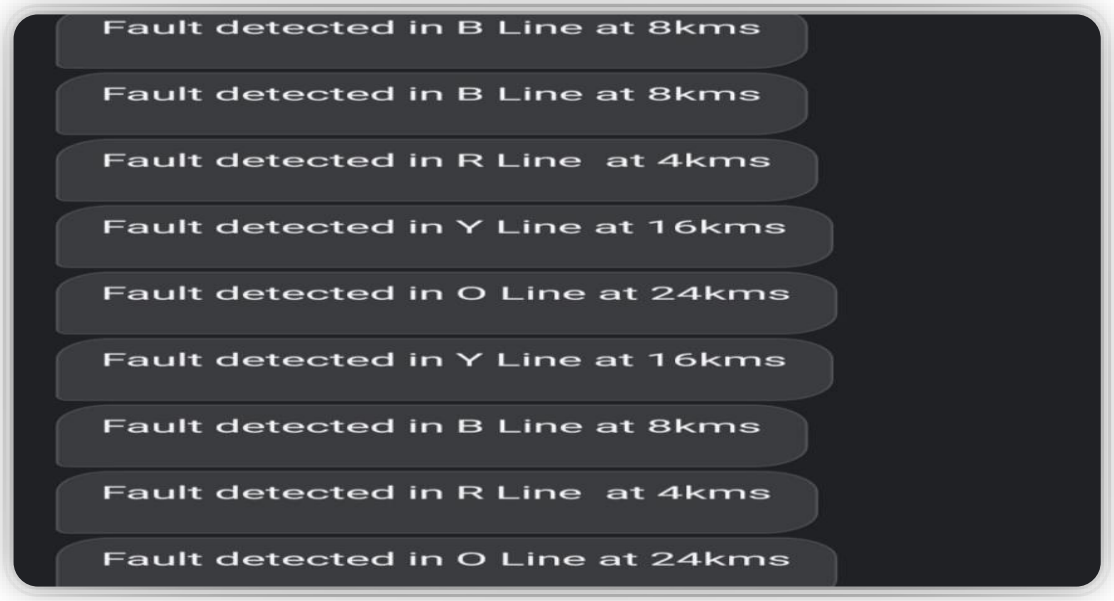

Figure 4.1 OUTPUT

The graph also shows time and distance by using the x-axis for date and the y-axis for fault distances.

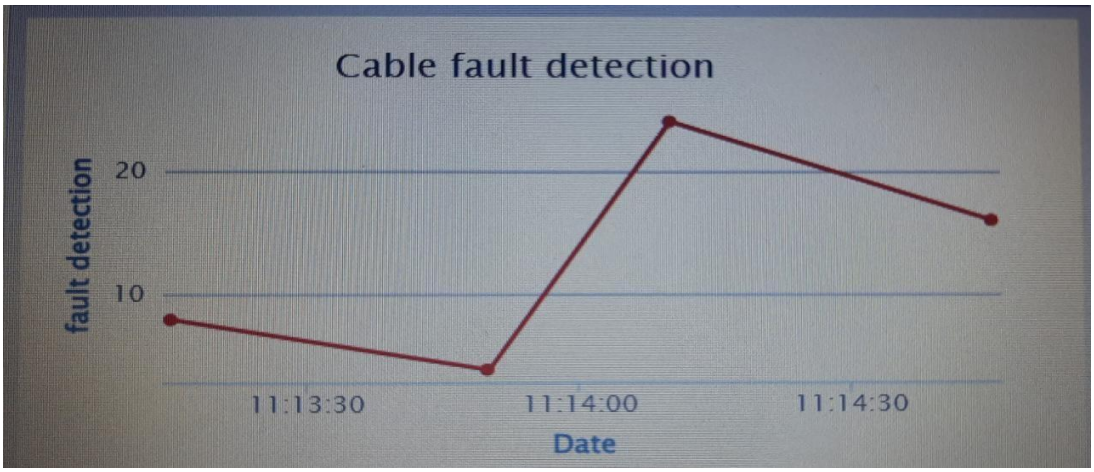

Figure 4.2 Graph Representation

5. CONCLUSION

Using Arduino, this project constructed an Underground Cable Fault Detector. As a proof of concept, a full-fledged prototype model was created to realise and analyse real-time scenarios in the subterranean cable system. The proposed design has been proved in this prototype model to effectively satisfy the requirement of exact fault location detection in the underground cable system, and it is thought that this model could be a promising solution to solve future fault location detection problems.