Under Ground Cable Fault Detection Using IoT

Aleenamol Varghese
Department of Computer Applications
Amal Jyothi College of Engineering, Kanjirappally
Kottayam, Kerala.
aleenamolvarghese@mca.ajce.in

Ajith G.S.
Asst. Professor in Computer Science
Amal Jyothi College of Engineering, Kanjirappally
Kottayam, Kerala
gsajith@amaljyothi.ac.in

***Abstract*— Natural disasters, wear and tear, vermin, and other things can all cause damage to underground wires. Furthermore, identifying the fault origin is a challenging task, and the entire line must be dug and checked in order to fix the fault. Using the IOT, we propose a method to detect cable faults and this enables repairing work to be much more convenient because we know the exact location of the fault. Through this system, the service engineer knows exactly which part has a fault, and only those areas that have a fault are to be dug up to find the source of the fault. In addition to saving employees a lot of time, money, and effort, it enables underground cables to be serviced more quickly than in the current situation. We use IOT technology so that employees can monitor and check faults remotely via their mobile devices or laptops. Whenever a fault occurs at a point where two lines are shorted together, a specific voltage is generated in accordance with the combination of resistors. This voltage is sensed by the microcontroller and notified to the user through an LCD display, and it also sends this data over the internet to the worker online.**

Keywords—Underground cable fault, Detection, cables, circuit, LCD

I. INTRODUCTION

The susceptibility of distribution networks to environmental impacts has been significantly reduced since underground cables have been employed for electrical distribution for many years. This also provides increased security in inclement weather and are less prone to damage by storms or thunder strokes, low maintenance costs, lower costs, and are environmentally friendly for longer distances. The type of defect in a buried cable is, however, difficult to determine. To put it another way, this technique relies on a computer to detect and fix problems. It's critical to find the problem spot in an underground cable in order to speed up repairs, increase system reliability, and cut down on blackouts.

II. TYPES OF FAULTS IN UNDERGROUND CABLES

To identify various forms of defects in underground cables, microcontroller programs are employed. Microcontrollers and LCD panels, which display defects in kilometers when they occur, can be used to locate faults in underground cables. Faults are manually detected via switching. The voltage value will fluctuate as the resistance changes, and the point where the resistance is broken is referred to as a fault. There are numerous different forms of flaws, as listed below.

A. Open Circuit Fault

An open circuit fault develops when the conductor of the cable cracks. Whenever a circuit is broken by any failure, an open-circuit fault occurs. When a circuit is not correctly closed, an open circuit problem occurs.

B. Short Circuit Fault

A short-circuit occurs when two conductors of a multi-core cable are electrically connected together by a fault in the insulation. Insulation deficiencies can cause short circuits that cause a short-circuit condition if they are present.

C. Earth Fault

An earth fault occurs when a charged conductor makes an unintentional contact with the ground or a device. The fault current's return path is through the earthling device and any employees or systems that become a part of it.

III. THE PROPOSED SYSTEM AND ITS PARTS IN BLOCK DIAGRAM

Using ohms law, microcontrollers, and relay switches, the proposed system detects underground cable faults and distance from the base station. As illustrated in Fig. 1, it is divided into four sections.

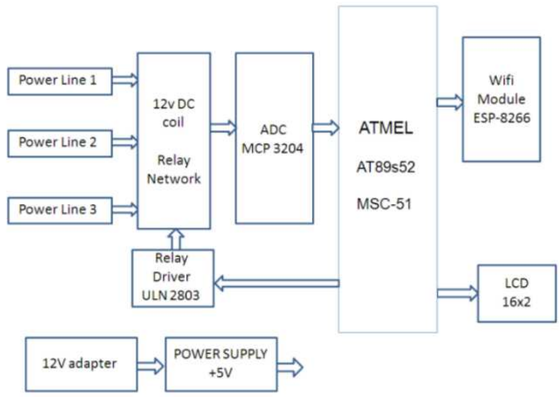

Fig.1 Block Diagram of the Proposed System

A. DC Power Supply

A step-down transformer is used to step down the 230V AC power source. The AC signal is converted into DC using a full-wave bridge rectifier. A voltage stabilizer keeps the DC voltage stable.

DOI: 10.5281/zenodo.6369479
ISBN: 978-93-5607-317-3@2022 MCA, Amal Jyothi College of Engineering Kanjirappally, Kottayam

B. Cable Fault Detection

A collection of resistors, three-phase connections, and switches identify the component. Resistors make up the current detecting segment of the cable, and the switch functions as a fault generator, notifying any flaws in various locations. To detect changes in current, the part monitors the voltage drop caused by differences in resistor length.

C. Controlling

The AC signal from the voltage detecting circuit is converted to digital signals by an ADC. The microcontroller then uses these data as input. Microcontrollers are also included in the controlling unit, and they execute calculations based on the fault's distance from our system.

D. Display Part

It comprises of a microcontroller-connected LCD display that shows the distance from the base station as well as when the cable is not connected. A series resistor is used at the feeder end to apply a low DC voltage using OHMs law.

IV. COMPONENTS

The system have the following components: -

A. Step Down Transformer

A step down transformer converts 230 volts to 12 volts in the power supply portion. The number of turns between a transformer's primary and secondary windings, or its N1:N2 ratio, is widely known to affect its step-down capability.

B. Rectifier

The rectifier receives the transformer's output. The rectifier converts AC to pulsed DC. It is possible to utilize either a half-wave or a full-wave rectifier. A bridge rectifier is utilized in this system because of its additional benefits, including as outstanding stability. The circuit has 4 diodes connected to form a bridge. Direct current, which flows in one direction, is formed from alternating current, which alternates direction regularly. The process is known as rectification. Rectifiers can be used for a variety of applications, but they are typically found in DC supply systems and high-voltage direct current transmission systems. Rectification may be used for purposes other than generating DC

C. Voltage Regulator

1. A rectifier receives the transformer's output. It converts alternating current to pulsing direct current (AC/DC) and the other way around (DC). A full-wave or half-wave rectifier can be used. A bridge rectifier is utilised in this system because of its additional advantages, such as outstanding stability. To build a bridge, four diodes are linked. As alternating current travels in both directions on a regular basis, an alternating current rectifier converts it into direct current, which only travels in one direction. The operation is known as "correction." DC power supply and high-voltage direct current power transmission systems are two of the most common applications for rectifiers. The most common uses of rectifiers are in DC power supplies and high-voltage direct current transmission systems. Rectification can be used for a variety of purposes besides DC production.

D. ADC

Because it combines great performance with low power consumption in a tiny package, the MCP3204 12-bit Analog-to-Digital Converter is perfect for embedded control systems. The MCP3204 is a 12-bit analog-to-digital converter with a sequential approximation register design and an industry-standard serial interface that can be used with any microcontroller. The MCP3204 is well-suited to low-error output and high-resolution analogue signals, with a sampling rate of 100k samples per second.

E. Microcontroller

In 1981, Intel released the 8051 microprocessor series as an 8-bit microcontroller family. This is a popular microcontroller family that is used all around the world. Because it has 128 bytes of RAM, the 8051 microcontroller is often known as a "system on a chip." Because it is an 8-bit processor, the 8051 can only handle 8 bits of data at a time. If the data is more than 8 bits, it must be split down into smaller chunks to allow the CPU to process it efficiently. Despite the fact that a computer's ROM can be expanded up to 64 kilobytes, most manufacturers stick with 4 kilobytes.

F. LCD

LCDs interface with microcontrollers. Most commonly LCD used are 16*2 & 20*2 display. In 16*2 display, 16 represents column & 2 represents rows. LCDs can show variable visuals (as in a general-purpose display) or fixed images with limited data that can be shown or hidden (as in a digital clock).

G. Wi-fi Module

Any microcontroller can connect to your Wi-Fi network using the ESP8266 Wi-Fi Module's TCP/IP protocol stack. The ESP8266 can save application data and update it via a server address on a regular basis. The AT command set software comes pre-installed on each ESP8266 module, so all you have to do is plug in the microcontroller and you've got approximately as much Wi-Fi as a Wi-Fi Shield. The ESP8266 module is a low-cost board with a large and growing community of users.

V. ROUGH DESIGN OF THE SYSTEM

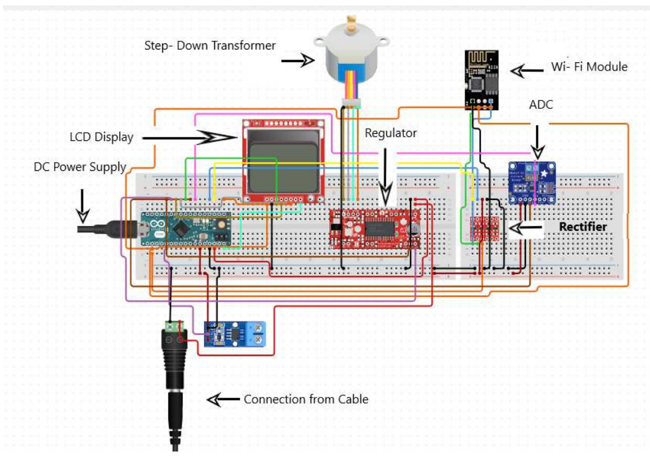

Fig 3, Rough design of the system

DOI: 10.5281/zenodo.6369479
ISBN: 978-93-5607-317-3@2022 MCA, Amal Jyothi College of Engineering Kanjirappally, Kottayam

VI. ALGORITHM AND FLOWCHART

A. ALGORITHM

Step 1
Declare the timer, ADC, and LCD routines, and initialise the ports.

Step 2
Begin an infinite loop; turn on relay 1 by making pin 0.0 high.

Step 3
Display "R:" at the starting of first line in LCD.

Step 4
The fault position is displayed using the Call ADC Function, which is dependent on the ADC output.

Step 5
Call Delay.

Step 6
The fault position is displayed when the ADC function is called, depending on the ADC output.

B. FLOWCHART

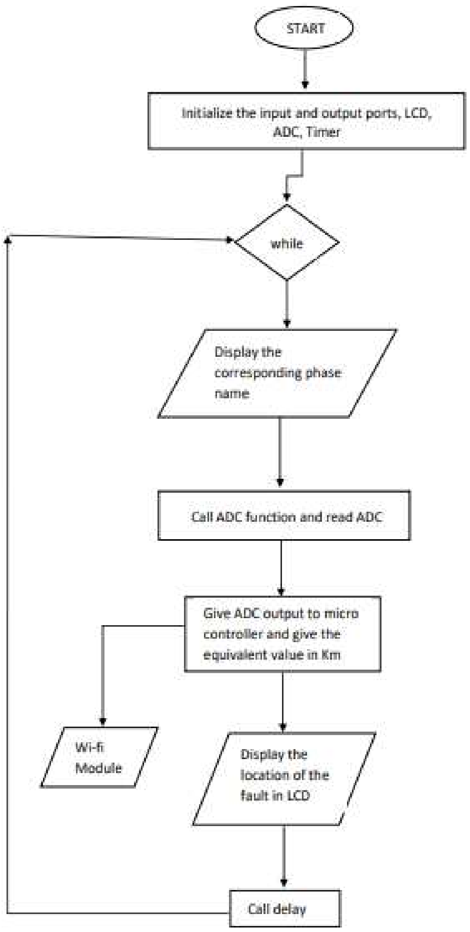

Fig. 2, Flow Chart of the system

VII. CONCLUSION

It's difficult to detect short circuits in underground wires in a timely manner. In the wire phase, we can use Ohms law to locate the specific location of an issue. When a fault arises in the cable, the microcontroller and display unit, with the help of IoT, display the exact location of the issue on a dedicated website. A buzzer system is used to provide a warning signal that is useful to humans if data is not updated to a dedicated website. The buzzer mechanism creates an alerting sound signal whenever a failure in the subterranean cable occurs, assisting us in quickly resolving the matter.

VIII. FUTURE SCOPE

Short and open circuit faults in subsurface cable lines are detected by the system proposed in this paper. By measuring the change in resistance and calculating the fault distance from an open circuit fault, a capacitor is used in the circuit to identify open circuit faults. A similar neural network structure would be used in the future to estimate different types of fault sections and fault locations.

REFERENCES

[1] Jitendra Pal Singh, Narendra Singh Pal, Sanjana Singh, Toshika Singh, Mohd. Shahrukh, "UNDERGROUND CABLE FAULT DISTANCE LOCATOR" International Journal of Scientific Research and Management Studies (IJSRMS) ISSN: 2349-3771 Volume 3 Issue 1, pg: 21-26

[2] Shunmugam.R, Divya., Janani.T.G, Megaladevi.P , Mownisha.P, "ARDUINO BASED UNDERGROUND CABLE FAULT DETECTOR" International Journal of Recent Trends in Engineering & Research (IJRTER) ,Volume 02, Issue 04; April - 2016 [ISSN: 2455-1457]

[3] Nikhil Kumar Sain, Rajesh Kajla, Mr.Vikas Kumar," Underground Cable Fault Distance Conveyed Over GSM" IOSR Journal of Electrical and Electronics Engineering (IOSRJEEE), Volume 11, Issue 2 Ver. III (Mar. – Apr. 2016), PP 06-10

[4] Dhivya Dharani.A, Sowmya.T "UNDER GROUND CABLE FAULT DETECTION " International Engineering Research Journal (IERJ) Volume 2 Issue 2 Page 417-419, 2016, ISSN 2395-1

[5] P.M. Dhekale and R.R. Suryawanshi, "Underground Cable Fault Distance Locator", IJIERT, vol-2, April 2015.

DOI: 10.5281/zenodo.6369479
ISBN: 978-93-5607-317-3@2022 MCA, Amal Jyothi College of Engineering Kanjirappally, Kottayam