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Detect and Display the Subterranean Failing of Cables Using IoT

Lanka Padmalatha
(Assistant Professor)
Electronics and Communication Engineering(ECE)
Seshadri Rao Gudlavalleru Engineering College(SRGEC)
Gudlavalleru,India

Miriyala Sailesh
(UG Student)
Electronics and Communication Engineering(ECE)
Seshadri Rao Gudlavalleru Engineering College (SRGEC)
Gudlavalleru,India

Karre Niranjan
(UG Student)
Electronics and Communication Engineering(ECE)
Seshadri Rao Gudlavalleru Engineering College(SRGEC)
Gudlavalleru,India

Madugula Vamsi
(UG Student)
Electronics and Communication Engineering(ECE)
Seshadri Rao Gudlavalleru Engineering College (SRGEC)
Gudlavalleru,India

Penumatcha Vikas
(UG Student)
Electronics and Communication Engineering(ECE)
Seshadri Rao Gudlavalleru Engineering College(SRGEC)
Gudlavalleru,India

Abstract:-
This project aims to demonstrate the distance of a Subterranean cable defect from the main station through the internet. The implementation of Subterranean cables has various advantages over an overhead system, but the main disadvantage is that we cannot identify the specific site of the defect. When a defect occurs for whatever reason, the repair process for that individual cable is difficult due to the precise unknown location of the problem within the cable. This Internet of Things technology is used to determine the accurate location of the defect and convey data in graphical format to the website via an IOT module and accordingly in the LCD panel.. The classic idea of Ohms law is used in this paper.,Since resistance is proportional to the distance when a voltage is provided at the end , the current fluctuates depending on the location of defect in the cable. When a fault occurs occurs, the voltage between series resistors fluctuates according to the resistance, which varies with distance. This is then transmitted to generate precise digital data, which the programmed microcontroller detects and displays on the website in kilometres, along with the latitude and longitude.

Keywords:-*Fault Detection,ArduinoUno,Esp8266, Relays,GPS Module.*

I.Introduction

A cable is a bundle of electrical conductors used to transport power. An subterranean cable typically contains one or more conductors that are insulated and protected by a cover. A cable fault can be any imperfection that causes current to be diverted or impairs cable's performance. As a result, the error must be corrected.Power Transmission can take place via both overhead and subsurface lines. Overhead wires, unlike subterranean cables, are subject to the effects of rain, thunder, and lightning. This needs improved dependability, security, durability, and serviceability in cables.

As a result, subterranean cables are favoured in many regions, particularly in metropolitan areas. Whereas it is simple to discover and rectify defects in an above-ground line, it is impossible to do so in an underground wire. It is difficult to discover problems in them since they are buried deep in the earth. Even when a defect is discovered, pinpointing its exact position is extremely challenging. This results in the dragging of the entire region to find and rectify the issue, resulting in a waste of money and effort. As a result, the precise location of problems in subterranean cables is required. Whatever the issue is, when a fault occurs, the voltage of the cable tends to vary abruptly. To identify the defect, we use the voltage difference between the series resistors.And then the fault is determined and displayed in the website.

II.Subterranean Cable Faults

Fault Occurred by Open Circuit:-

An open circuit in Subterranean cables happens when the electrical route in the cable is interrupted due to a failure. This can happen for a variety of causes, including cable insulation failure, corrosion, or physical damage to the cable. When an open circuit develops, the passage of electrical current is disrupted, which can result in a full loss of power or system problems. Moreover, an open circuit can

cause safety issues such as electrocution or fires, which can endanger both persons and property. To maintain the safe and dependable functioning of electrical systems, open circuits in subterranean cables must be identified and repaired as soon as possible.

Fault Occurred by Short Circuit:-

A short circuit in subterranean cables happens when two or more conductors in the cable come into touch with one other, producing a low-resistance channel for electrical current to flow. This can occur owing to cable insulation degradation, moisture, or physical damage to the cable. When a short circuit develops, a considerable quantity of electrical current can travel through the cable, causing overheating, melting, or even an electrical explosion. Short circuits can also create power outages and interruptions in the electrical system. It is critical to immediately identify and fix short circuits in subterranean cables in order to prevent cable damage and guarantee the safe and dependable functioning of electrical systems.

Earth Fault:-

When a conductor in Subterranean cable comes into touch with the ground, it creates a low-resistance path for electrical current to pass through. This can occur as a result of cable insulation degradation, moisture, or physical damage to the cable. When an earth defect occurs, electrical current travels from the cable into the ground, disrupting the electrical system and potentially endangering persons and property. Ground faults can also cause the electrical system's protection systems to trigger, which can help to avoid additional damage or injuries..

III.Problem Statement

Traditional techniques of finding defects in underground power lines are time-consuming and labor-intensive. These include digging up the earth to manually check the wires, which may be both expensive and risky. Moreover, these approaches might cause additional damage to the lines, resulting in protracted power outages.

To solve these issues, the goal of this project is to create Subterranean cable fault detection system using IoT capable of properly detecting and locating problems in underground power lines without the need for physical excavation. The suggested system is inexpensive, scalable, and simple to maintain. We hope that this method would greatly minimise downtime and maintenance costs connected with subterranean power lines, boosting the reliability and efficiency of power distribution networks.

IV.Existing Methods

❖Low Voltage Pulse Method:-

This approach is sending low voltage pulses across the cable to see whether there are any fractures. The approach detects the reflected pulses that reveal the location of the defect.

❖Cable Testing:-

This approach includes physically evaluating the insulation and electrical qualities of the cable by delivering a high voltage to it to see if it can resist the predicted operating voltage. Faults such as insulation failure, short circuits, and open circuits can be detected during cable testing.

❖High Frequency Method:-

With this procedure, high-frequency pulses are injected into the wire to determine the location of a defect. Sensors put on the wire can detect and pinpoint the high-frequency signals created by the defect.

❖Thermo-Graphic Imaging:-

This technology employs infrared cameras to detect temperature differences on the surface of the wire produced by an electrical failure. The heat created by the cable's resistance causes the temperature to increase at the region of the defect.

❖TDR(Time Domain Reflectometry):-

TDR is a technology for detecting defects in subterranean cables that use high-frequency electromagnetic pulses. It operates by sending a signal down the wire and detecting the signal reflection generated by impedance variations. TDR may identify problems in the cable such as breakage and discontinuities.

These procedures are successful for finding defects in subterranean cables, but they are time-consuming and demand a large amount of physical effort, which may be expensive and risky. A fault locator system based on IoT can provide a more efficient and automated approach for detecting defects in subterranean cables.

V.Proposed System

The Internet of Things(IoT) is an internet system capable of storing and transmitting data over a wifi network with no requirement for human interaction. Subterranean cables are prone to a variety of problems as a result of subsurface forces, wear and tear, rats, and other factors. It is often difficult to identify the causes of the defect. To analyse and repair the failure, the entire cable line must be dug.In order to overcome this, we present a Subterranean Cable defect Detector that determines the exact location of the fault and streamlines maintenance. The repairmen know which portion is damaged, and just the affected area needs to be dug to determine the cause of the problem. This can save time, money, and labour while also allowing for simple subterranean cable maintenance. In this scenario, the Arduino board, an IoT module, works as a machine brain and controls sensor data, so we use ohm's law to find and verify defects through the internet. When two lines are severed and a damage occurs, a specific voltage is generated based on the combination of the resistance networks. The microprocessor detects and adjusts this voltage.This voltage's corresponding distance is transmitted. The microcontroller collects fault line data and displays it on the LCD screen, as well as updating information in the Cloud through the IoT module.

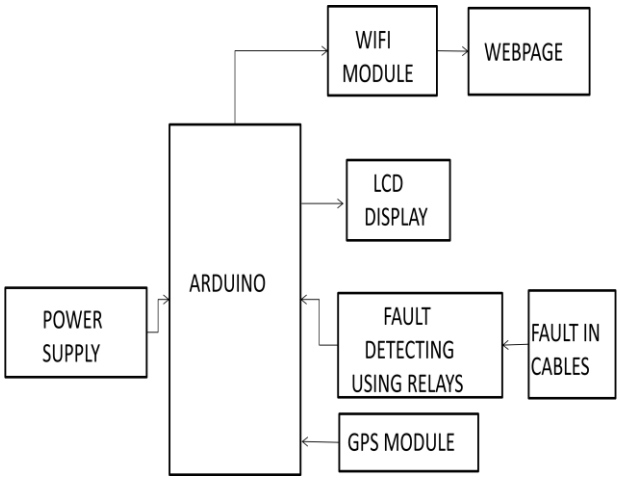

Fig:- Block Diagram for Detect and Display the Subterranean Failing of cables using IoT

In this case, a system is created that includes a microprocessor, an LCD monitor, a Defect Detecting Circuit, a Wi-Fi Module,GPS Module and a suitable power suppply. As a result, if there is a break in the circuit , the voltage across series resistors varies slightly, and the defect Detecting circuit of the system obtains an analog signal in the form of a voltage drop, which is then fed to programmed microcontroller to generate the accurate digital information, and the output is viewed in the connected LCD with the precise location of the failure and, at the same time, identify the appropriate R, Y, B period where the fault happened, as well as the precise distance. The same analysed data output will be displayed on the website via the linked IoT Wi-Fi Module.

The ATmega328P microcontroller is used in this system. Here, current sensing circuitry made of resistors are interfaced to an ATmega328 microcontroller via an internally constructed ADC is used to supply digital data to the microcontroller. The defect detecting circuit is made up of a combination of resistors in series and switches that are put beside each resistance. The circuits are managed by the relay controller. A LCD monitor is connected to the microcontroller to display information and the position of the fault in kilometres, as well as the latitude and longitude of the fault location on the website through GPS module.

Hardware Required:-

S.NO	COMPONENT NAME	QUANTITY
1.	Arduino Uno	1
2.	ESP8266	1
3.	Relays	3
4.	LCD Display	1
5.	GPS Module	1
6.	10k Ohm Resistors	Sufficient
7.	SPDT Slide Switches	Sufficient

1.Arduino Uno:-

Arduino Uno is a microcontroller board based on the ATmega328P microprocessor that is open-source. The board features fourteen digital input/output pins, six analog input pins, and a quartz crystal oscillator with a frequency of 16 MHz, allowing it to operate a wide range of sensors and actuators. Even novices can easily get started with the Arduino Uno and bring their ideas to life with to its simple programming language and large library of pre-written code.

Fig:- Arduino Uno

2. ESP8266 :-

The ESP8266 is a cheaper Wi-Fi module that connects to a Wireless network and allows microcontrollers to send and receive data. It is a popular module among makers and is commonly utilised in Internet of Things (IoT) applications. The module includes built-in Wi-Fi and a TCP/IP stack, and it can be programmed using the Arduino IDE. It has a tiny form factor and requires relatively little power, making it excellent for low-power consumption projects. Moreover, the ESP8266 may be utilised as a stand-alone microcontroller or as a slave device in conjunction with other microcontrollers.

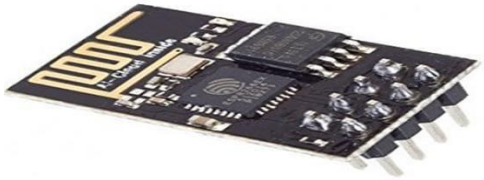

Fig:- ESP8266

3. Relays :-

Relays are electronic switches that enable a low-voltage circuit to regulate a high-voltage circuit. They are used to control a wide range of electrical equipment, including motors, lights, and appliances. A relay is made up of an electromagnetic coil, a moveable armature, and one or more contact sets. When the coil is activated, the armature is drawn towards the coil.When the coil is turned off, it returns to its normal position and contacts open, breaking the high voltage circuit. Relays are widely utilised in automation, automotive, and industrial applications

Fig:- Relay

4.LCD Display :-

LCD (Liquid Crystal Display) is a form of flat-panel display that is often seen in electronic devices such as calculators, watches, and smartphones. It generates graphics or text on a screen by manipulating light travelling through a layer of liquid crystals. LCD screens are used in electrical projects and microcontroller applications. They have various benefits, including low power consumption, a high contrast ratio, and a broad viewing angle. Moreover, LCD displays are simple to integrate with microcontrollers and exist in a variety of sizes and resolutions to meet the needs of various projects. Overall, LCD displays are flexible and inexpensive, making them an excellent choice for showing data in electrical gadgets and microcontroller applications.

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Fig:- LCD Display

5. GPS Module :-

A GPS (Global Positioning System) module is a type of electrical gadget that receives signals from GPS satellites to calculate its location. It operates by collecting signals from numerous GPS satellites and then using triangulation to determine the module's precise location. GPS modules are widely used in navigation systems, position tracking, and geo-fencing. They are available in a variety of sizes and form factors, ranging from small modules for integration into wearable devices to larger modules for use in automobiles and aeroplanes. GPS modules are simple to connect to microcontrollers and can offer precise positional data in real time.

Fig:- GPS Module

6. 10k Ohm Resistors :-

A 10kohm resistor is a circuit component that restricts the passage of electric current. It has a resistance of 10,000 ohms and is often employed in voltage dividers, amplifiers, and signal conditioning circuits. The 10kohm resistor is a common value and is available in a variety of configurations, including through-hole and surface-mount resistors. The 10kohm resistor is a useful component that is commonly used in electronic projects and circuits. Its resistance value is easily adjustable by connecting numerous resistors in series or parallel to produce the desired resistance value.

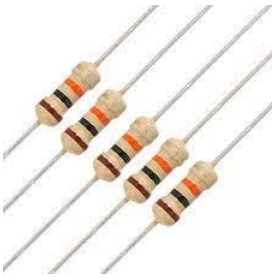

Fig:- 10k Ohm Resistors

7. SPDT Slide Switch :-

A Single Pole Double Throw slide switch is a type of electrical switch that may connect or disconnect two circuits simultaneously. It comprises of a sliding lever with two settings that allows the switch to switch between two separate electrical connections. The SPDT slide switch is widely utilised in a wide range of electronic applications, including audio equipment, lighting, and control circuits. It is a flexible switch that may be used to switch between multiple circuit states or to pick between two separate inputs or outputs. The SPDT slide switch is simple to operate and may be put on a PCB or a panel.

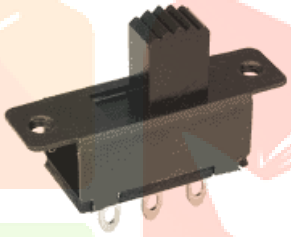

Fig:- SPDT Slide Switch

Circuit Diagram:-

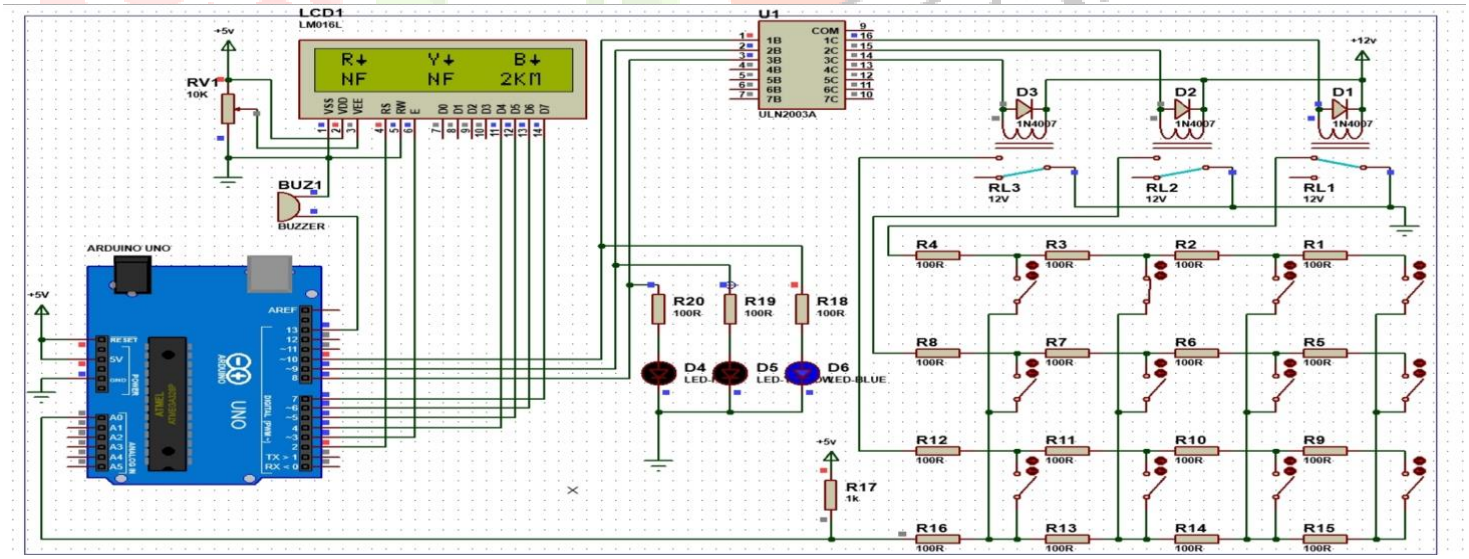

Fig:- Circuit Diagram for Detect and Display the Subterranean Failing of cables using IoT

Software Required :-

❖IoT Cloud Platform (ThingSpeak)
❖Arduino IDE

1. IoT Cloud Platform (ThingSpeak) :-

ThingSpeak is a cloud platform for IoT (Internet of Things) devices that allows users to gather, analyse, and display data.The platform supports a variety of IoT protocols, such as MQTT, HTTP, and HTTPS, and provides RESTful APIs for data access and interaction with other systems. ThingSpeak also includes data analytics and visualisation capabilities built in, allowing users to monitor and analyse data in real time. ThingSpeak also accepts third-party plugins, allowing users to expand its capabilities even further. The platform is extensively utilised in a variety of Internet of Things applications, including smart homes, industrial monitoring, and weather monitoring

Fig :- ThingSpeak Cloud Platform

2. Arduino IDE :-

The Arduino Integrated Development Environment is a free and open-source software tool that allows you to programme Arduino boards. It has an easy-to-use interface for authoring, compiling, and uploading code to Arduino microcontrollers. This System is available for various OS,and supports a number of programming languages, including C and C++. The Arduino IDE includes a number of libraries and examples that may be used to create a variety of applications, including robotics, home automation, and data logging. It also supports a broad range of Arduino boards, including the well-known Arduino Uno, Nano, and Mega. The Arduino IDE is extensively used for prototyping and creating various microcontroller projects by enthusiasts, students, and professionals. Overall, the Arduino IDE is a robust tool that facilitates programming and testing Arduino microcontrollers.

Fig:- Arduino IDE

VI .RESULTS

So, Whenever a fault arises in the Subterranean cables this system senses the fault based on the voltage change across the cable and then the fault location of the cable is identified .The defect detecting circuit sends the voltage drop in the cables to the microcontroller. The hardware findings for fault positions at different kms can be seen in the LCD panel and all the information is carried through the IoT Module and the latitude and longitude of the defect location can be seen in IoT Cloud Platform (ThingSpeak),based on this data the fault can be identified easily.

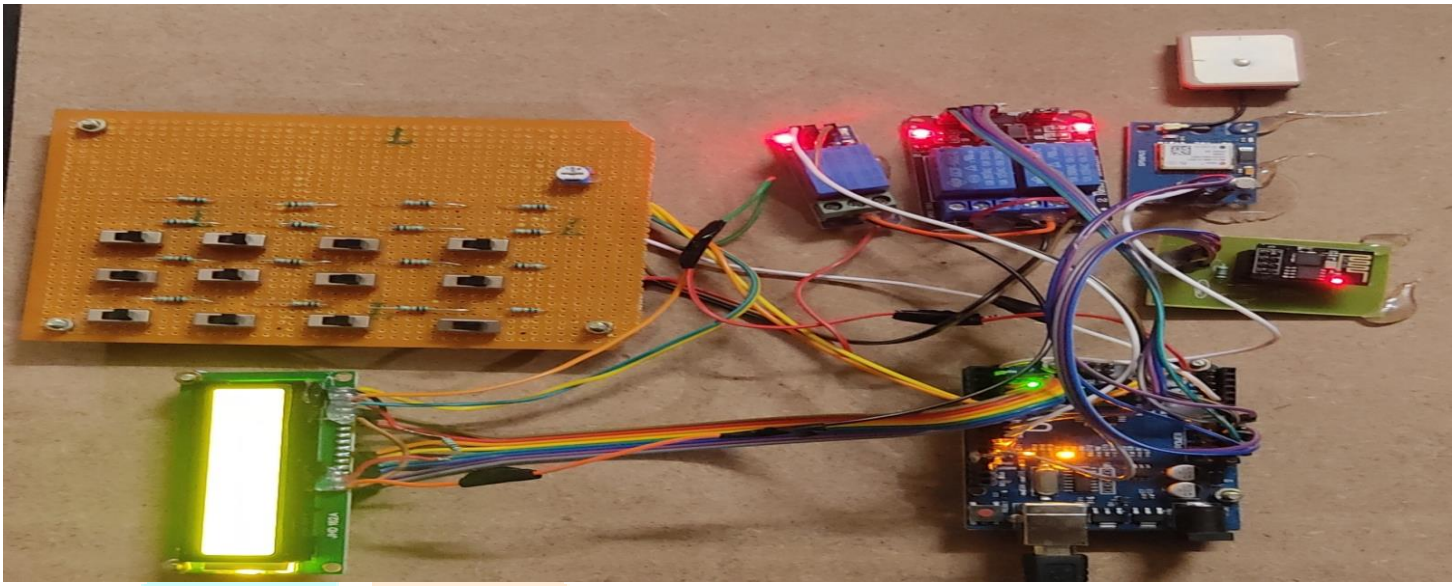

Fig:- Hardware Implementation of Detect and Display the Subterranean Failing of cables using IoT

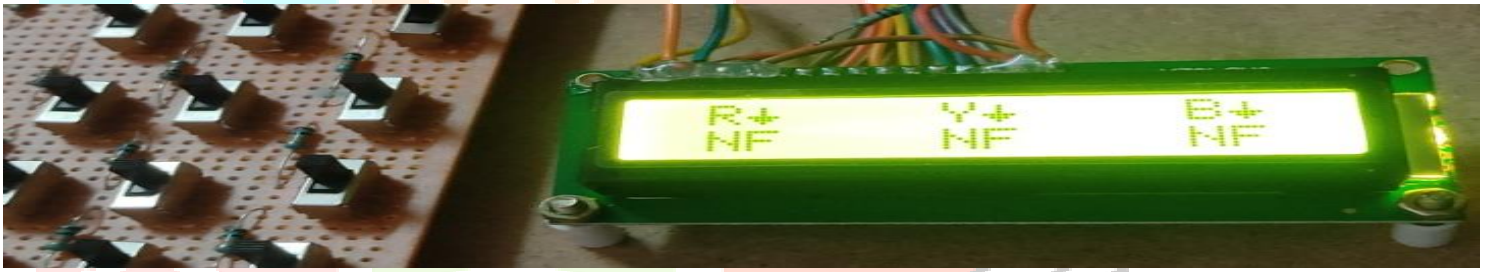

Fig:- LCD displaying No Fault

Fig:-LCD displaying fault in Red cable at a distance of 3km

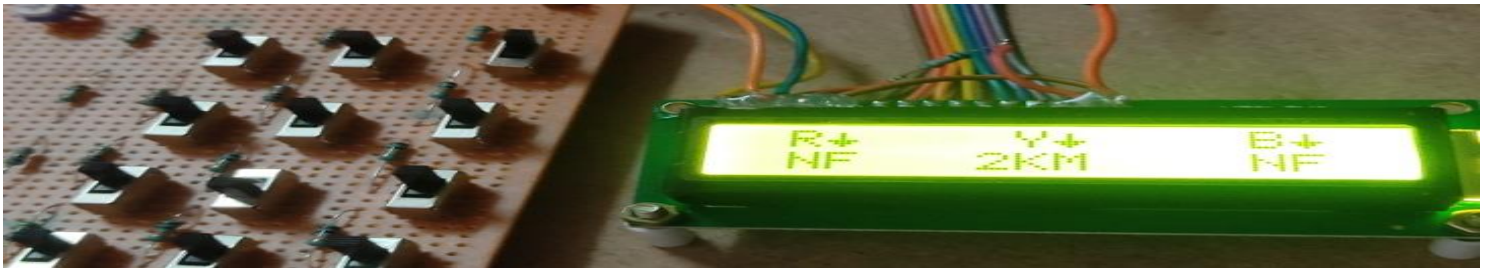

Fig:-LCD displaying fault in Yellow cable at a distance of 2km

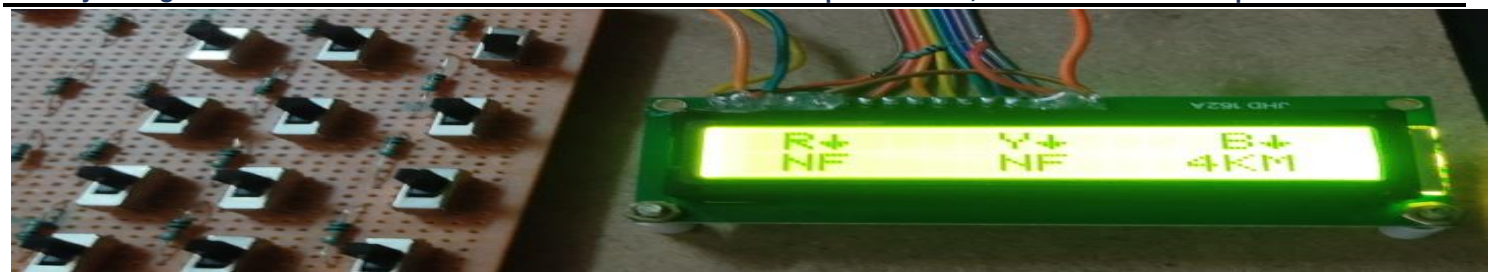

Fig:-LCD displaying fault in Blue cable at a distance of 4km

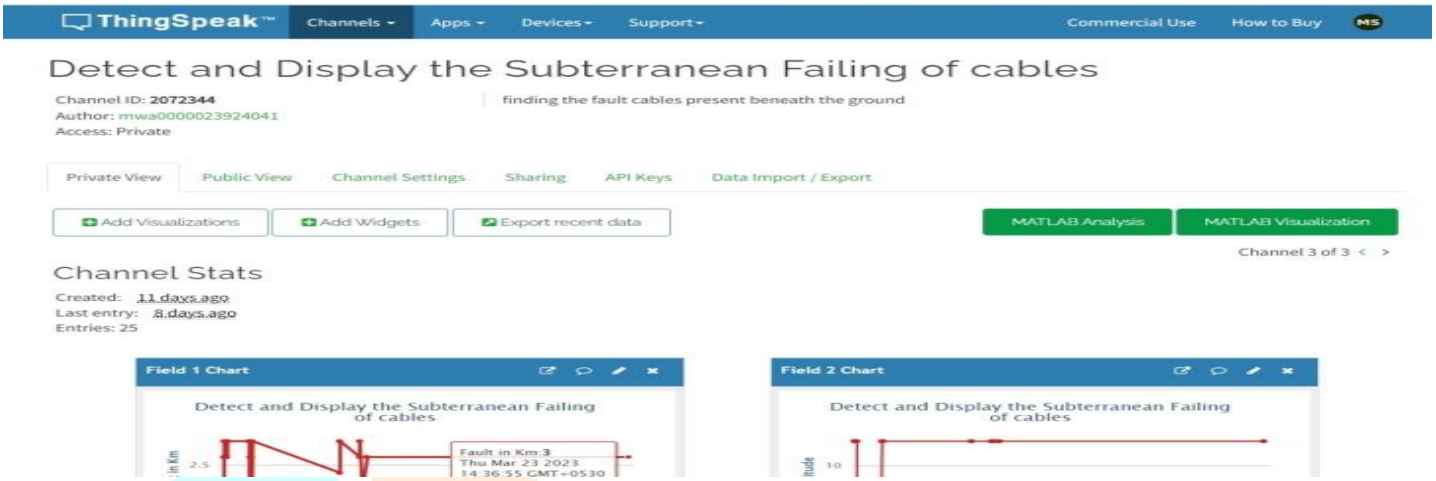

Fig:- Output displayed on IoT Platform(ThingSpeak)

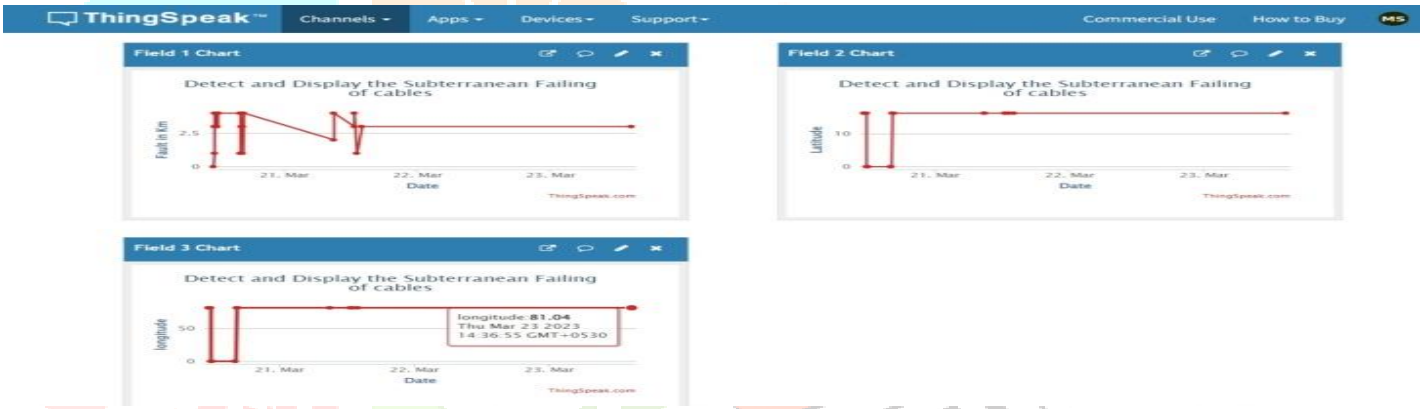

Fig:- IoT platform displaying fault location parameters

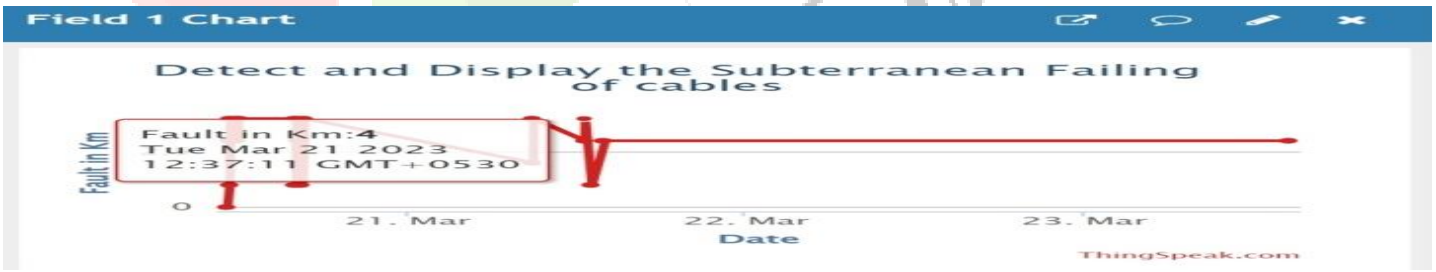

Fig:- The fault location in Kilometers

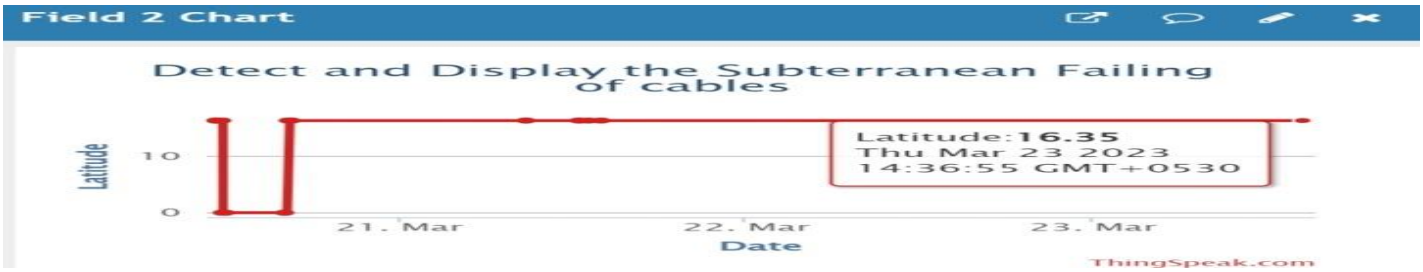

Fig:- The Latitude of the fault location

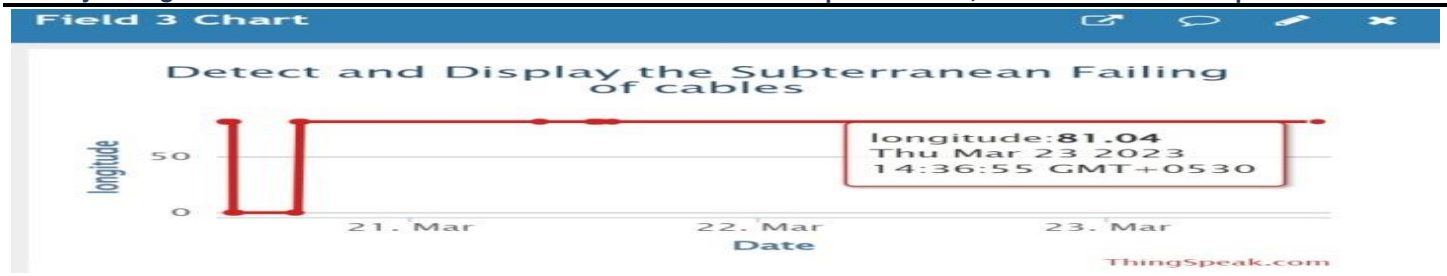

Fig:- The Longitude of the fault location

VII.CONCLUSION

This paper determines and display distance of a Subterranean cable defect from the main station in km and the latitude and longitude of the defect location is showed over the internet. The defect that occurs at a specific distance is shown on the LCD screen. The same data is also supplied to the ThingSpeak Platform over the internet (IOT) that is linked to the microcontroller.

REFERENCES

[1] Yang, Xia, "Fault location for underground power cable using distributed parameter approach" ,Power Systems, IEEE Transactions on 23.4 (2008): 1809-1816.

[2]Computerized underground cable fault location expertise, E.C. Bascom .in Proc. IEEE Power Eng. Soc. General Meeting,

[3] Md. Fakhrul Islam, Amanullah M T Oo, Salahuddin. A. Azadl, "Locating Underground Cable Fault: A Review and Guideline for New Development", 2013, IEEE.

[4] Qinghai Shi, Troeltzsch U, Kanoun O., "Detection and localization of cable faults by time and frequency domain measurements" Conf. Systems and Signals and Devices, 7th International conference, Amman, 2010, pp.1-6.