

# Underground Cable Fault Detector

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**Abstract:** In the city regions, the electric cable runs in undergrounds rather than overhead line. Whenever the fault happens in underground cable it's far tough to locate the precise area of the fault for method of repairing that Particular cable. The proposed gadget unearths the precise area of the fault. The simple concept at the back of the operating of this Project is ohm's law. At the feeder end, while a DC voltage is Applied, primarily based totally at the area of fault withinside the cable, the fee of Current additionally changes. So in case of a brief circuit fault like L-G Or L-L fault the extradein voltage fee measured throughout the Resistor is then fed to the in-constructed ADC of the Arduino. This fee Is processed with theaid of using the Arduino and the fault is calculated in phrases of distance from the bottom station. This fee is dispatched to the LCD Interfaced to the Arduino board and it shows actual area of the fault from the bottom station in kilometers for all of the 3 Phases. This fault introduction is made with the aid of using the set of switches. Project is organized with a fixed of resistors which Represent the duration of the cable. At each recognized kilometer Fault switches are located to set off faults manually Finally the Fault distance may be decided.

**Keyword:-** Fault, Cable, Ground, Arduino, Circuit.

## 1. INTRODUCTION

An package of electrical conductors used for sporting Electricity is known as as a cable. Underground cables used in large part in city vicinity rather than Overhead strains. We can't effortlessly pick out the faults withinside the Underground cables. This undertaking offers with Arduino Microcontroller, buzzer and LCD. This proposes substantially reduces The time and operates effectively. The undergroundcabling System is a not unusual place exercise observed in lots of city regions. Many time faults arise because of creation works and different Reasons. At that point it's far tough todig out cable because of now no longer Knowing the precise area of the cable fault. No Matter what fault happens, the voltage at the cable Will extrade all at once with every fault. This voltage Change withinside the collection resistance is used to locate a Fault. Power Transmission may be completed in each overhead in addition to in underground cables. But not like underground cables the overhead cables have the downside of being effortlessly at risk of the outcomes of rainfall, snow, thunder, lightning etc. This calls for cables withreliability, Increased safety, ruggedness and extra service. So underground cables are favored in lots of regions particularly in city locations. When it is simple to locate and accurate the faults in over head line with the aidof using mere observation, it isn't always viable to accomplish that in an underground cable. As they're buried deep withinside the soil it isn't always clean to locate the abnormalities in them. Even while a fault is determined to be giftit's far very tough to locate the precise area of the fault. This ends in Dugging

of the whole vicinity to locate and accurate the fault which in flip reasons wastage of cash and manpower. Soit's far vital to understand the precise area of faults withinside the underground cables. Whatever the fault is ,the voltage of the cable has the tendency to extrade unexpectedly on every occasion a fault happens. We employ thisvoltage extrade throughout the collection resistors to locate the fault.

## 2. LITRRATURE SURVEY

[1] M.M. Amarnath, B. Ganesh Ram, Mr. V. Chandrasekaran, Mr. G. Mohan Ram, "IOT Based On Underground Cable Fault Identification Using Arduino" in April 2021. With the development and advancement in technology, things changes. As technology helps us to understand its importance like in urban areas, the electricity runs underground through electrical cable instead of typical overhead lines, which occupies less space and is considered as the most effective and efficient way of transmission but the problem arises when a fault occurs in the underground cable and is also difficult to detect the exact location of the fault during the process of repairing that particular cable and the methods in existence till now follow some algorithm in order to identify the location of the fault. We Use IOT Knowledge That Allows the Doyens To Observer And Check Faults Over Internet. The Edifice Advert Fault With The Help Of Likely Divider Network Laid Across The Cable. Fault Are Fast Repair To Revive Back The Power System. Higher Initial Cost And Insulation Problems At High Voltages.

[2] Raushan Kumar Bhagat, Shrawan Suthar, Chandan Kumar, Sunil Kumar Mina, "Underground Cable Fault Detector Using Arduino And Gsm Modules" in July 2020. The main goal of this project is to identify faults and show these faults in LCD and mobile using Arduino and GSM which is occurring in underground cable. On the feeder side, when a direct current voltage is applied, the current estimates are further changed to address the problem areas of the cable. Therefore, in the event of a short circuit problem (such as an L- G or L-L problem), an ADC made by Arduino will adjust the estimated rated voltage through a resistor. This value is prepared by arduino, and the shortage is well determined by the base station. This value is transmitted to the LCD connected to the arduino board and displays the exact area several kilometers away from all base stations in three phases. The task consists of many resistors that communicate the length of the cable. Faults switches induced in every This Strategy Works For All Kinds Of Links From 1km To 4km. In This Method, Problems Up To 4 Km Can Be Identified. When A Fault Switch Operated The Condition, The Phase Associated With That Particular Switch Is Considered A Fault Phase.

[3] Padmanaban. K, Sanjana Sharon. G, Sudharini. N , Vishnuvarthini. K, "Detection Of Underground Cable Fault

[4] Using Arduino” in March 2017. This paper proposes fault location model for underground power cable using microcontroller. The aim of this project is to determine the distance of underground cable fault from base station in kilometers. This project uses the simple concept of ohm’s law. When any fault like short circuit occurs, voltage drop will vary depending on the length of fault in cable, since the current varies. A set of resistors are therefore used to represent the cable and a dc voltage is fed at one end and the fault is detected by detecting the change in voltage using an analog to voltage converter and a microcontroller is used to make the necessary calculations so that the fault distance is

displayed on the LCD display.

### 3. PROBLEM STATEMENT

- To develop a system that detect the location of fault in underground cable lines from base station.

### 4. OBJECTIVES

- To review and classify faults in underground cables.
- To design and construct an less costly underground cable fault detector.

### 5. BLOCK DIAGRAM

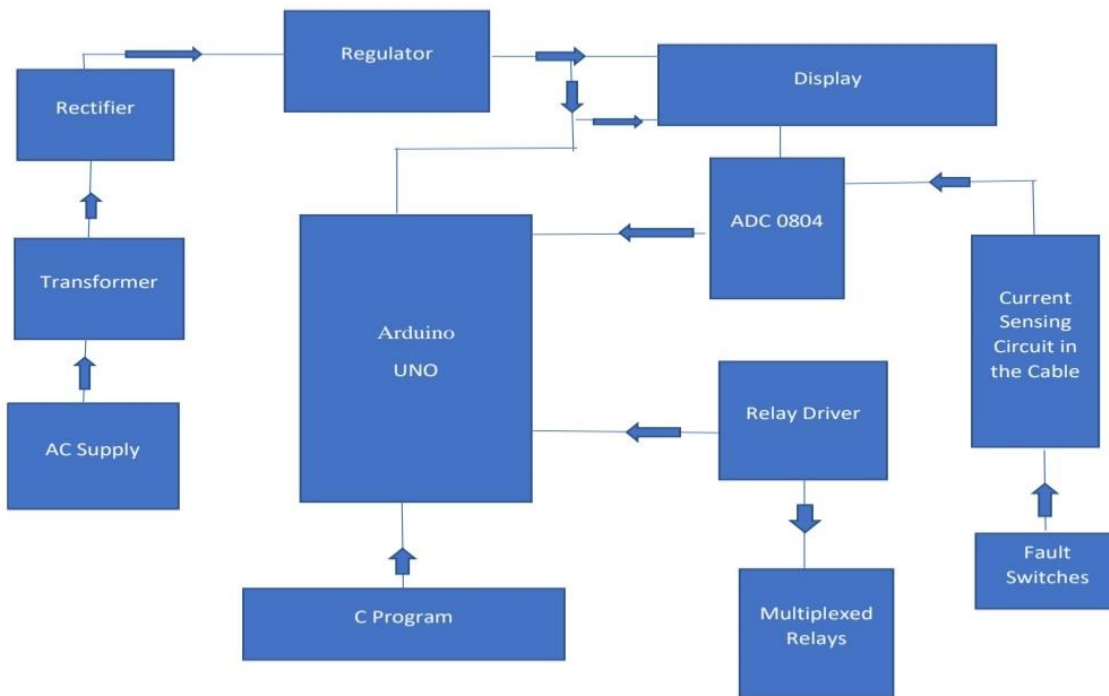


Fig. [1] Block Diagram of UCFD

### 6. COMPONENTS

#### 6.1 POWER SUPPLY

The strength deliver circuit includes step down transformer that's 230v step right all the way down to 12v. In this circuit 4 diodes are used to shape bridge rectifier which provides pulsating dc voltage after which fed to capacitor clear out the output voltage from rectifier is fed to clear out out to dispose of any a.c. additives given after rectification. The filtered DC voltage is given to regulator to provide 12v steady DC voltage.

#### 6.2 RECTIFIER

The output from the transformer is fed to the rectifier. It converts A.C. into pulsating D.C. The rectifier can be a 1/2 of wave or a complete wave rectifier. In this undertaking, a bridge rectifier is used due to its deserves like right stability. The circuit has 4 diodes related to shape a bridge. A rectifier is an electrical tool that converts alternating present day (AC), which periodically reverses direction, to direct

present day (DC), which flows in best one direction. The method is referred to as rectification. Rectifiers have many makes use of, however are frequently determined serving as additives of DC materials and high-voltage direct present day strength transmission systems. Rectification can also additionally serve in roles aside from to generate direct present day to be used as a supply of strength.

#### 6.3 LCD DISPLAY

Liquid crystal display are interfacing to microcontroller 8051. Most commonly LCD used are 16\*2 and 20\*2 display. In 16\*2 display means 16 represents column and 2 represents rows. LCDs are available to display arbitrary images or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

#### 6.4 VOLTAGE REGULATOR

A voltage regulator is an electrical regulator designed to mechanically preserve a steady voltage level. In this undertaking, strength deliver of 5V and 12V are required. In order to gain those voltage levels, 7805 and 7812 voltage regulators are to be used. The first variety seventy eight represents advantageous deliver and the numbers 05, 12 constitute the specified output voltage levels. The L78xx collection of 3 terminal advantageous regulators is to be had.

#### 6.5 ARDUINO

Arduino is an open-supply platform used for constructing electronics projects. Arduino includes each a bodily programmable circuit board (frequently known as a microcontroller) and a bit of software, or IDE (Integrated Development Environment) that runs in your laptop, used to jot down and add laptop code to the bodily board. The Arduino platform has grown to be pretty famous with humans simply beginning out with electronics, and for right reason. Unlike maximum preceding programmable circuit boards, the Arduino does not want a separate piece of hardware (known as a programmer) which will load new code onto the board – you could absolutely use a USB cable. Additionally, the Arduino IDE makes use of a simplified model of C++, making it simpler to learn how to program. Finally, Arduino gives a fashionable shape element that breaks out the capabilities of the micro-controller right into an extra on hand package.

#### 6.6 RELAY

Relay is sensing tool which senses the fault and sends an experience sign to circuit breaker to isolate the defective segment. A relay is an automated tool by which an electrical circuit is not directly managed and is ruled with the aid of using extra trade within the equal or some other electric circuit. There are numerous forms of relay: Numerical relay, Static relay and electromagnetic relay. Relays are housed in panel within the manage room. Here 3 mini strength relays are used every for one of the 3 levels. The relays periodically test the 3 phases and ship the sign to the Arduino controller. The score of every of the relays is set 12V.

#### 6.7 RELAY DRIVER IC

Driver Circuit is used to reinforce or extend indicators from microcontrollers to manipulate strength switches in semiconductor devices. Driver circuits take capabilities that encompass keeping apart the manage circuit and the strength circuit, detecting malfunctions, storing and reporting screw ups to the manage gadget, serving as a precaution in opposition to failure, reading sensor indicators and growing auxiliary voltages. In this undertaking, ULN2003 is used because the relay motive force circuit. It is an untegrated circuit which capabilities because the relay motive force and boosts up the deliver going to the relay.

#### 7. CIRCUIT DIAGRAM

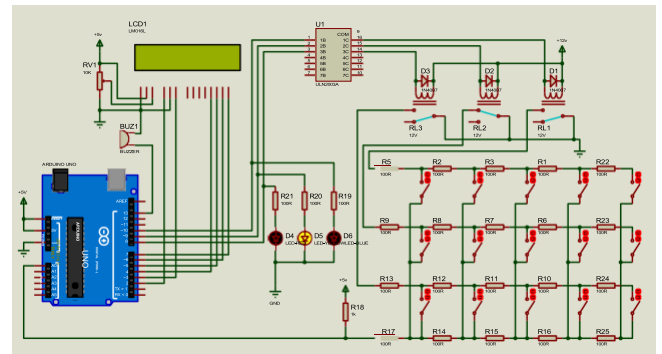


Fig. [2] CKT Diagram of UCFD

#### 8. WORKING

The circuit includes a strength deliver, 4 line show, Arduino and resistance size circuit. To set off faults manually within the kit, fault switches are used. About sixteen fault switches are used which might be organized in four rows with every row having five switches. The three rows constitute the three levels particularly R, Y and B. The fault switches have 2 positions - No fault position (NF) and fault position (F). Main factor of the underground cable fault detection circuit is low fee resistance size. It is built the use of a steady present day supply of 100mAmps. It can degree very low fee resistance because the cables have round zero.01 Ohm/meter resistance. For 10 meter cable resistance turns into zero.1 Ohm. This circuit can degree resistance up to 50 Ohm. Maximum cable duration it is able to take a look at as much as five kilometers. So beginning from the reference factor five units of resistances are located in collection. These five units of resistances constitute the 3 locations and the neutral. Short circuit faults, Symmetrical and unsymmetrical faults may be decided with the aid of using this technique. Each collection resistor represents the resistance of the underground cable for a selected distance and so right here five resistances in collection constitute 1-5 kms. Value of every resistance is 10kΩ. One relay for every segment R, Y and B 3 relays are used and the not unusual place factors of the relays are grounded and the NO factors are related to the inputs of R17, R21 and R26 and being the 3 segment cable input. As deliver wanted for the relays is better than that of the Arduino, Relay motive force is used to reinforce the deliver and offer it to the relays. A 230V AC deliver is carried out to the transformer from wherein it's far stepped right all the way down to 12V AC. From the transformer the alternating present day receives transformed into direct present day while it passes thru a Bridge wave rectifier. The 12V DC then is going to the voltage regulator wherein it receives transformed from 12V DC to 5V DC. Voltage regulator is used additionally converts the variable Dc deliver into steady DC deliver. This 5V DC is used to deliver strength to the Arduino and

the LCD. Power deliver to the LCD is given from the voltage regulator. When fault is caused with the aid of using running any of the sixteen switches, they impose situations like LG (Line To Ground), LL (Line To Line), LLG (Line To Line Ground) fault as in line with the transfer operation. As a end result of the fault, there's a extraed in voltage fee. This voltage fee measured throughout the resistance is fed to the ADC of the Arduino. Using this fee, the Arduino computes the gap. Finally the gap of the fault from the bottom station is displayed in kilometers

9. FLOWCHART

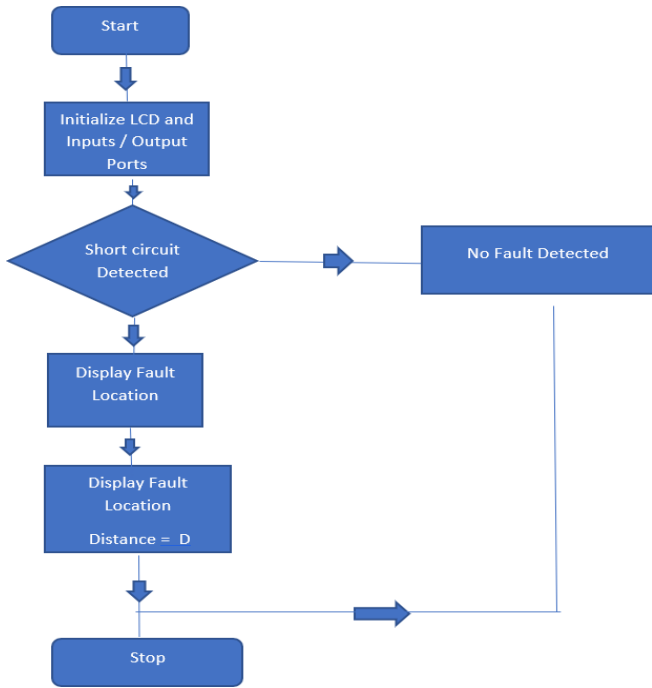


Fig. [3] Flowchart of UCFD

10. PROPOSED ALGORITHM

- Step 1:- Initialize the ports, declare timer ,ADC, LCD functions.
- Step 2:- Begin an countless loop; turn on relay1 by making pin0.0 high.
- Step 3:- Display “R:” at the starting of firstline in LCD.
- Step 4:- Call ADC function, depending uponADC output, displays the fault position.
- Step 5:- Call delay.
- Step 6:- Repeat steps 3 to 5 for other twophases.

11. RESULT

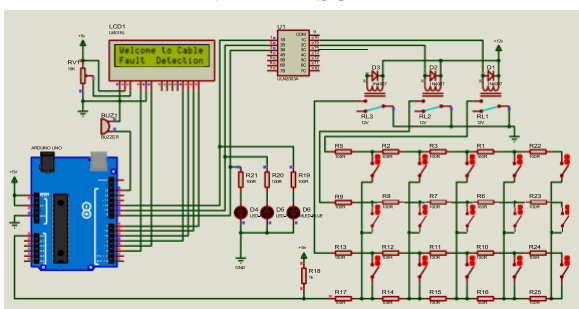


Fig. [4] Output CKT Diagram.

circuit and accordingly degree the open circuitfault.

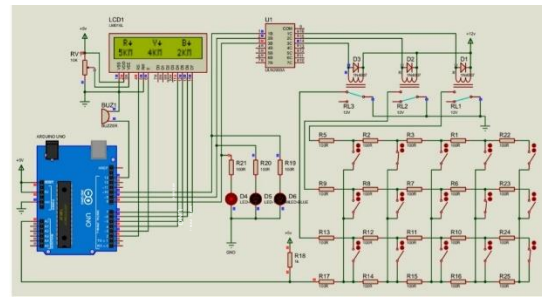


Fig. [5] Detect The Fault.

The above Fig shows output of Underground Cable Fault Detection. When the switch is closed in any wire (R, Y, B), Then which wire faulty is detected and display on LCD in KM. That is above Fig.[5] show R-5KM, Y-4KM, B-2KM.

12. ADVANTAGES

- Less maintenance.
- It has better efficiency.
- Less fault arise in underground cable.
- This technique is relevant to all forms of cable starting from 1 km To five km.
- It can locate different forms of cable fault inclusive of cable fault, cable cuts.

13. CONCLUSION

Thus the project on Underground cable fault detection the use of Arduino became completed and the gap of the fault from the bottom station in kilometers became displayed for the 3 person levels R, Y and B. Circuit may be examined with exclusive resistor values. In this project faults as much as a distance of 5km may be detected. When the fault switches are operated to fault circumstance then the segment similar to that unique transfer is taken into consideration because the defective segment. So the defective segment can effortlessly be located.

14. FUTURE SCOPE

In this project we detect the precise area of cable fault within the underground cable from feeder lead to km with the aid of using the use of Arduino. In future, this undertaking maybe carried out to calculate the impedance with the aid of using the use of a capacitor in an AC

15. REFERENCES

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