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ESP32 Based Underground Cable Fault Detector Using IOT

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ABSTRACT - Underground cables are prone to a wide variety of faults due to underground conditions, wear and tear, rodents etc. Diagnosing fault source is difficult and entire cable should be taken out from the ground to check and fix faults. The paper work is intended to detect the fault in underground cable lines from the base station to another substation using a Microcontroller. To locate a fault in the cable, the cable must be tested for faults and fault creation is made by a set of switches at every known distance between two substations. In case of fault, the voltage drops and changes accordingly, which is then fed to a programmed microcontroller IC that further displays on IOT fault. IOT is used to display the information over Internet using the Wi-Fi module ESP32. A webpage is created using HTML coding and the information about occurrence of fault is displayed in a webpage or also can use android application for same. For the real worldwide operated voltage distribution lines underground cables have been used from many years. In order to reduce the sensitivity of distribution networks to environmental influences underground voltage cables are highly used. Underground cables have been widely used in power distribution networks due to the advantages of underground connection. Underground cable system is a common practice followed in urban areas. While a fault occurs due to many reasons in the cable, at a time of removing or repairing process, there is difficulty in locating also nearby location of the fault. The system proposed in this project is used to find out the sub area location of the fault and display it to the dedicated application over internet using Wi-Fi module.

KEYWORDS: HTML, IoT, Microcontroller, Wi-Fi Module.

I. INTRODUCTION

Power supply networks are growing continuously and their reliability getting more important than ever. The complexity of the whole network comprises numerous components that can fail and interrupt the power supply for end user. For most of the worldwide operated low voltage and medium voltage distribution lines, underground cables have been used for many decades. Underground high voltage cables are used more and more because they are not influenced by weather conditions, heavy rain, storm, snow and pollution. Even though the Cable manufacturing technology is improving steadily, there are still influences which may cause cable to fail during test and operation. A cable in good condition and installed correctly can last a lifetime of about 30 years. However, cables can be easily damaged by incorrect installation or poorly executed jointing, while subsequent third-party damage by civil works such as trenching or curb edging. Fault in cable is represented as any defect and inconsistency, caused by breaking of conductor and failure of insulation and weakness or non-homogeneity that affects performance of cable. Bundle of electrical conductors used for carrying electricity is called as a cable. An underground cable generally has one or more conductors covered with suitable insulation and a protective cover. Commonly used materials for insulation are varnished cambric or impregnated paper. Fault in a cable can be any defect that can break the path of the performance of the cable. So it is necessary to correct the fault. Power transmission can be done in both overhead as well as in underground cables. But unlike underground cables the overhead cables have the drawback of being easily prone to the effects of rainfall, snow, thunder, lightning etc. This requires cables with reliability, increased safety, ruggedness and greater service. Underground cables are preferred in many areas especially in urban places. When it is easy to detect and correct the faults in overhead line by mere observation, it is not possible to do so in an underground cable. As they



are buried deep in the soil it is not easy to detect the abnormalities in them. Even when a fault is found to be present it is very difficult to detect fault. This leads to debugging of the entire area to detect fault between two sub section unit, which in turn causes wastage of money and manpower.

II. OBJECTIVE

The objective is to determine the cable fault and its location using IOT and microcontroller board. In the present scenario when a fault occurs, detecting fault source is difficult and entire line has to be dug in order to check entire line and fix faults. The main objective is to detect the fault nearby location to reduce the time. So, it avoids the difficulty in digging the entire line. The basic idea is to read the voltage using sub unit from different place. Hence it will detect the fault with help of sub unit. In this implementation we are using 3 sub units in transmission line and with help of switch we are creating transmission line. Once any fault occurs, from that point the next sub unit will not able to update status. So fault will be from that point to next sub unit. We will able to see the status of all unit in a common IOT app from anywhere around the World.

III. BLOCK DIAGRAM

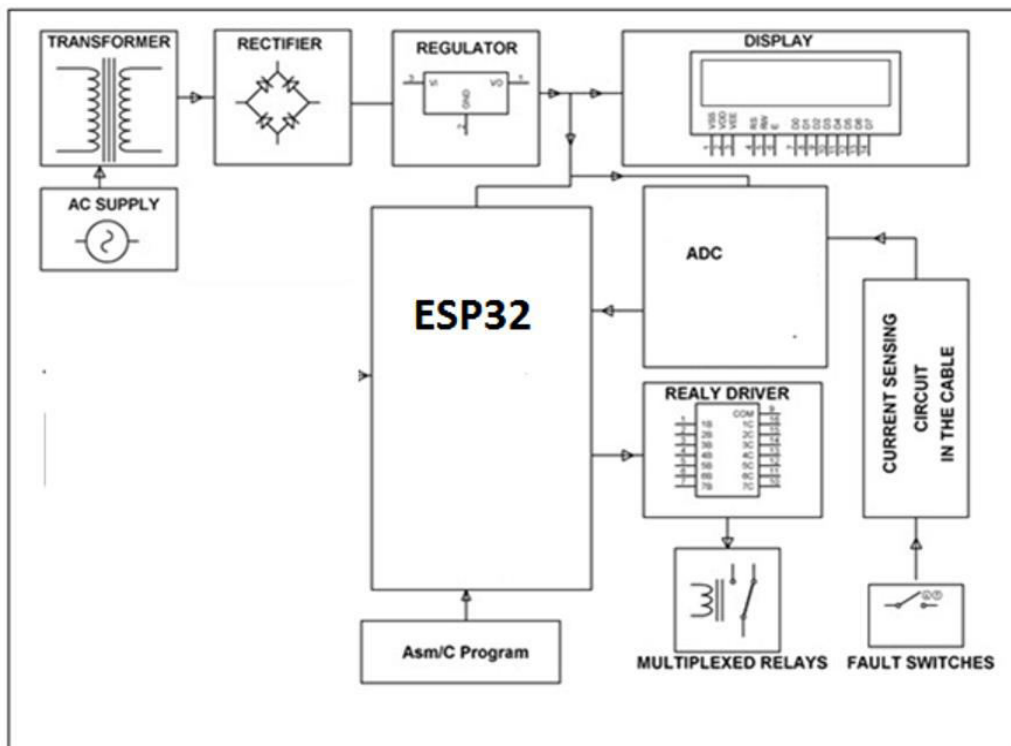


Figure 1: Block Diagram of Proposed system

IV. PROPOSED SYSTEM

The four parts of the model include – DC power supply, cable, controlling, display parts. DC power supply consist of AC supply of 230V step down using transformer, the bridge rectifier converts AC signal to DC and regulator is used to produce constant DC voltage. The cable part consists of set of resistors and switches. Current sensing part of cable is represented as set of resistors and switches are used as fault creators to indicate the fault at each location. This part senses the change in current by sensing the voltage drop. The controlling part consists of analog to digital convertor that receives input from the current sensing circuit, converts this voltage into digital signal and feeds the microcontroller with the signal. The display part consists of the LCD display interfaced to the microcontroller which shows the status of the cable of each phase and the distance of the cable at the particular phase, in case of any fault.

Working Of Fault Location Device

The ESP32 microcontroller is used which consume low power and gives high performance. It is a CMOS 8bit microcontroller with 8K bytes of programmable Flash memory. Three relays are used for each phase and the common points of the relays are grounded and the Normally Open points of the relay are connected to the inputs of Resistors. Since, the three phase cable input as supply needed for the relays is higher than that of the ESP32 Board, relay driver is used to boost the supply and provide it to the relays. A 230V AC supply is applied to the transformer from where it is stepped down to 12V AC. From the transformer the alternating current gets converted into direct current when it passes through a bridge rectifier. The 12V DC then goes to the voltage regulator where it gets converted from 12V DC to 5V DC. Regulated 5V DC is used for supplying power to the Esp32 and LCD. When fault is induced by operating any of the switches (to F position), they impose conditions like LG, LL, LLG fault as per the switch operation. As a result of the fault, there is a change in voltage value. This voltage value measured across the resistance and is fed to the ADC of the ESP32 Module. Using this value, the ESP32 computes the distance. Finally the distance of the fault from the base station is displayed in kilometer. It is used remotely by using the web page creating by using html. The device has been successfully tested in the laboratory. It is planned to test the device in actual site conditions in the future.

V. METHODOLOGY

4.1 Power Supply Section A power supply circuit is a very basic circuit in learning electronics. The power supply which we will design here is very basic and it is a linear technology based design which will go through each design step. The design of any circuit begins with a well-made general block diagram. It helps to design the sections of the circuit individually and then at the end put them together to have a complete circuit which is ready for use.

The four main sub blocks are: Transformer, Rectifier Circuit, Filter and Regulator

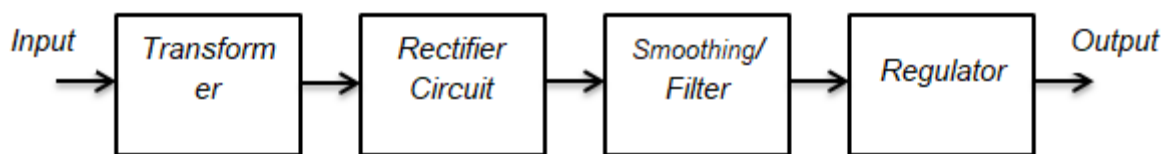


Fig -2: Block Diagram of Power Supply Section

4.2 Input Transformer A transformer is a device that is used to step up or step down the AC voltages level, keeping the input and out power the same. AC coming to your home has the voltage level of 220/120 V. We need the input transformer to step down the incoming AC to our required lower-level which is close to 5V (AC). This lower level is further used by other blocks to get the required 5V DC. Since we are using the main supply voltage which is too dangerous. We must never touch any of the terminals with bare hands or with bad instruments and must have a good and decent non-contact voltage tester and use it to always be sure of which line is the live wire coming to the transformer.

4.3 Rectifier Circuit A rectifier circuit is the combination of diodes arranged in such a manner that converts AC into DC voltage. The transformer still didn't step down the voltage to 5V DC. The stepped-down voltage is still AC and need to convert it into DC for a good rectifier circuit. Without the rectifier circuit, it is not possible to have the required output 5V DC voltage

4.4 Filter A capacitor filter is used when we need to convert a pulsating DC into pure or to remove distortion from signal. Nothing is ideal in practical electronics. The rectifier circuit converts the incoming AC to DC but it does not make it a pure DC. The output of the rectifier is pulsating and is called pulsating DC. This pulsating DC is not considered good to power up sensitive devices. The rectified DC is not very clean and has ripples and the job of the filter is to filter out these ripples and to make the voltage compatible for regulation. A rule of thumb is DC voltage must have less than 10 percent ripples to be regulated perfectly. The best filter in our case is the capacitor and the capacitor is used to charge the storing device. Actually it can be best used as a filter. It is the most inexpensive filter for our basic 5V power supply design.

4.5 Regulator A regulator is the integrated circuit used to give a constant output voltage regardless of input voltage changes. Voltage regulation is very important because we do not need a change in output voltage when the load



changes. An output voltage independent of the load is always required. The regulator IC not just makes the output voltage independent of varying loads, but also from line voltage changes.

V. FLOW CHART

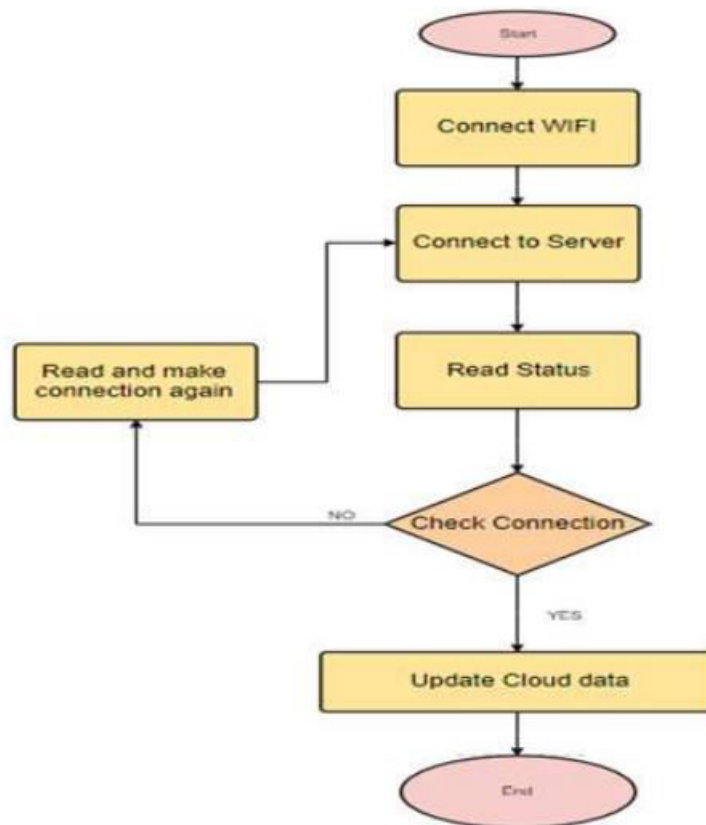


Fig: Flow chart of working process

For the real worldwide operated voltage distribution lines underground cables have been used from many years. In order to reduce the sensitivity of distribution networks to environmental influences underground voltage cables are highly used. Underground cables have been widely used in power distribution networks due to the advantages of underground connection. Underground cable system is a common practice followed in urban areas. While a fault occurs due to many reasons in the cable, at a time of removing or repairing process, there is difficulty in locating also nearby location of the fault. The system proposed in this project is used to find out the sub area of the fault and display it to the application over internet using Wi-Fi module. Power supply networks are growing continuously and their reliability getting more important than ever. The complexity of the whole network comprises numerous components that can fail and interrupt the power supply for end user. For most of the worldwide operated low voltage and medium voltage distribution lines, underground cables have been used for many decades. Underground high voltage cables are used more and more because they are not influenced by weather conditions, heavy rain, storm, snow and pollution. Even though the cable manufacturing technology is improving steadily, there are still influences which may cause cable to fail during test and operation. A cable in good condition and installed correctly can last a lifetime of about 30 years. However cables can be easily damaged by incorrect installation or poorly executed jointing, while subsequent third party damage by civil works such as trenching or curb.

Main supply will apply to step down transformer which results in decrease in power. The power will be applied to rectifier bridge for the conversion of ac to dc. The signal passes through the filter and then it will be passed through the voltage sensor (voltage divider or voltage regulator). The microcontroller checks the status and the information are sent to the cloud.



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VI. ADVANTAGES AND APPLICATIONS

7.1 ADVANTAGES

- Detects accurate fault sub location
- Reduced human effort
- Less software requirements
- Easy installation and maintenance
- Low-cost sensors and equipment
- Real-time monitoring and alerts
- Remote access and control Accurate fault detection

7.2 APPLICATIONS

- Monitoring Fault in underground cable line
- Monitoring Fault in Industrial line
- Monitoring Fault in Residential line

VII. RESULTS

The work automatically updates the status of every substation on IOT. The time of occurrence of fault is determined with the help of ESP32 module in a webpage or web application. The system helps to quickly repair the fault and to revive back the power system.

VIII. CONCLUSION

The work automatically sends data to cloud about fault with the help of ESP32 module in a webpage or IOT application. Underground high voltage cables are used more and more because they are not influenced by weather conditions, heavy rain, storm, snow and pollution. However, cables can be easily damaged by incorrect installation or poorly executed jointing, while subsequent third-party damage by civil works such as trenching or curb edging. Fault in a cable can be any defect that can break the path of the performance of the cable. So it is necessary to correct the fault. Underground cables are preferred in many areas especially in urban places. With the help of this system, we can get to know the location of the fault in the cable which are buried under ground. Therefore, this system does not lead to debugging of the entire area to detect the fault. Hence, the expenditure and manpower gets reduced. The benefits of fault are fast repair to revive back the power system and improves the system performance. It reduces the operating expense and the time to detect the faults in the field. The ESP32 microcontroller works based on the output of power supply status. The IOT module is vital due to which it can quickly update the status on IOT and many substation which can be done through common app of IOT

REFERENCES

- [1] Kunal Yogeshkumar Parikh, Brajesh Kumar and Vijay Raval, "GSM Based Underground Cable Fault Distance Locator", International Journal for Scientific Research & Development (IJSRD), Vol 6, Issue 4, 2018, pp 1174- 1176.
- [2] B.Y.V.N. R Swamy, D. Rama krishna, CH. Purna chandu, K.Venkatesh and A. Sasidhar Reddy, "Underground Cable Fault Detection", International Journal for Research in Applied Science & Engineering Technology (IJRASET), IC Value: 45.98, SJ Impact Factor: 6.887, Vol 6, Issue 3, March 2018, pp 3060-3064.
- [3] Summi Thomas, A.Vimenthani and Kaleeswari, "Automatic underground cable fault locator using GSM", International Journal of Advanced Research Trends in Engineering and Technology (IJARTET), Vol 4, Issue 19, April 2017, pp 260-265. [4] Abhay Sharma, Akash Mathur and Rajat Gupta, "Underground Cable Fault Distance Locator", IJAREEIE, Vol. 6, Issue 4, April 2017, pp 1260-1264.



|| Volume 12, Issue 4, April 2023 ||

| DOI:10.15680/IJIRSET.2023.1204054 |

- [5] Faizan Mohammad Yakub and Dinesh Rojatkar, "Arduino Cable Fault Detector A Survey", Vol 4, Issue 1, January 2017 JETIR, pp 2349-5162.
- [6] Akash Jagtap, Jayesh Patil and Bhushan Patil, "Arduino based Underground Cable Fault Detection", IJREAM, Vol 3, Issue 4, May 2017, pp 88-92



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