UNDERGROUND CABLE FAULT DETECTION SYSTEM

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ABSTRACT

The main objective of this project is to detect the faults and abnormalities occurring in underground cables using an Arduino. The basic idea behind the working of this project is ohms's law .At the feeder end ,when a DC voltage is applied, based on the location of fault in the cable ,the value of current also changes.
So in case of a short circuit fault like L-G or L-L fault the change in voltage value measured across the resistor is then fed to the in-built ADC of the Arduino. This value is processed by the Arduino and the fault is calculated in terms of distance from the base station. This value is sent to the LCD interfaced to the Arduino board and it displays exact location of the fault from the base station in kilometers for all the three phases. This project is arranged with a set of resistors which represent the length of the cable. At every known kilometer fault switches are placed to induce faults manually. Finally the fault distance can be determined.

Keyword : - *Aruduino, Underground Fault ,Resistance*

1. INTRODUCTION

An 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 or non-homogeneity that diverts the path of current or affects 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.
So underground cables are preferred in many areas specially in urban places. When it is easy to detect and correct the faults in over head 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 the exact location of the fault. This leads to dragging of the entire area to detect and correct the fault which in turn causes wastage of money and manpower. So it is necessary to know the exact location of faults in the underground cables.
Whatever the fault is, the voltage of the cable has the tendency to change abruptly whenever a fault occurs. We make use of this voltage change across the series resistors to detect the fault.

2.FAULTS IN UNDERGROUND

2.1 OPEN CIRCUIT FAULTS

These faults occur due to the failure of one or more conductors. The most common causes of these faults include joint failures of cables and overhead lines, and failure of one or more phase of circuit breaker and also due to

melting of a fuse or conductor in one or more phases. Open circuit faults are also called as series faults. These are unsymmetrical or unbalanced type of faults except three phase open fault.

2.2 SHORT CIRCUIT FAULTS

A short circuit can be defined as an abnormal connection of very low impedance between two points of different potential, whether made intentionally or accidentally. These are the most common and severe kind of faults, resulting in the flow of abnormal high currents through the equipment or transmission lines. If these faults are allowed to persist even for a short period, it leads to the extensive damage to the equipment. Short circuit faults are also called as shunt faults. These faults are caused due to the insulation failure between phase conductors or between earth and phase conductors or both. The various possible short circuit fault conditions include three phase to earth, phase to phase, single phase to earth, two phase to earth and phase to phase .In single line to ground fault, fault occurs between any one of the three lines and the ground. In double line to ground fault, fault occurs between any two of the three lines and the ground. In line to line fault, fault occurs between any two lines. When fault occurs there is an abrupt change in voltage. This change in voltage may cause serious damages to the system if not corrected in time. So immediate step of fault correction is isolation of the faulty part from the rest of the system.

3.FAULT DETECTION METHODS

3.1 ONLINE METHOD

This method utilizes and processes the sampled voltages and current to determine the fault points. Online method for underground cable are less common than overhead lines.

3.2 OFFLINE METHOD

In this method special instrument is used to test out service of cable in the field. This offline method can be divided into two methods .They are tracer method and terminal method.

3.2.1 TRACER METHOD

In this method fault point is detected by walking on the cable lines. Fault point is indicated from audible signal or electromagnetic signal. It is used to pinpoint fault location very accurately.

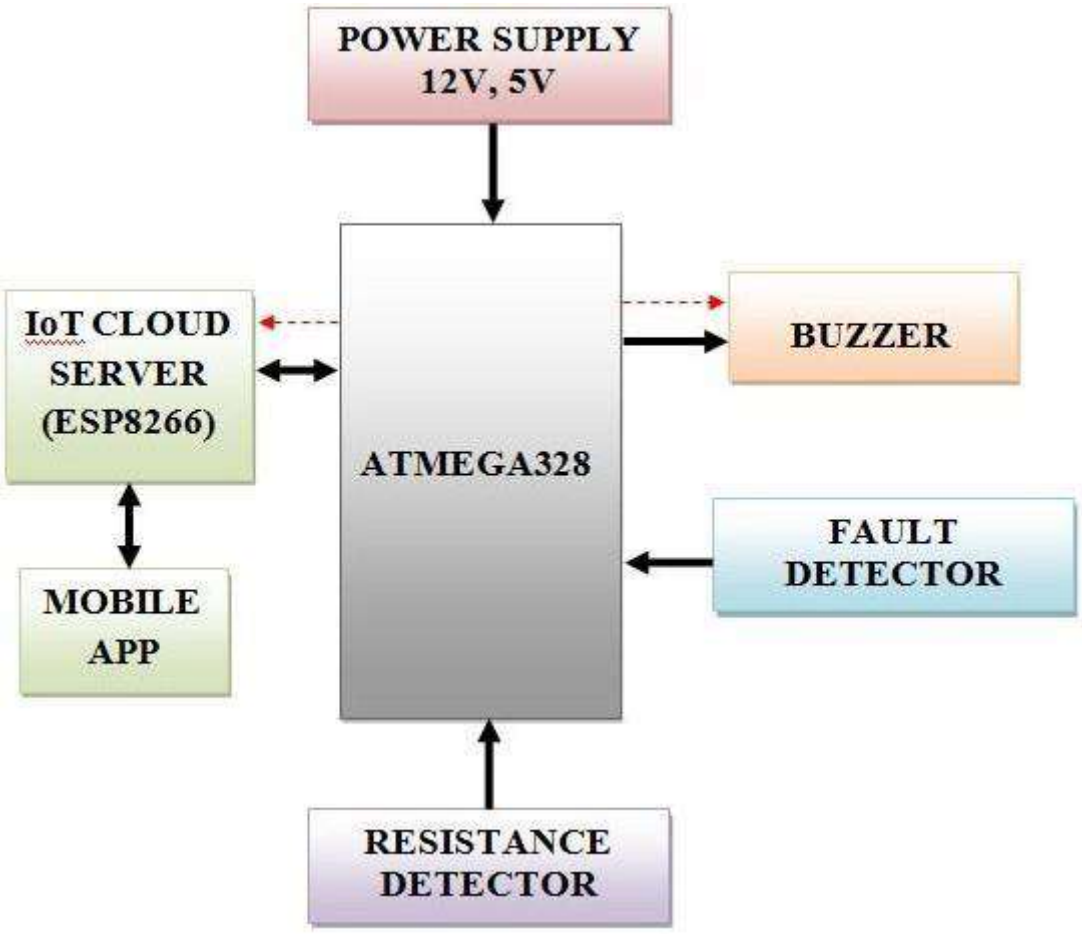
3.2.2 TERMINAL METHOD

It is a technique used to detect fault location of cable from one or both ends without tracing. This method use to locate general area of fault, to expedite tracing on buried cable.

4.PROPOSED SYSTEM

The circuit consists of a power supply, 4 line display, Arduino and resistance measurement circuit. To induce faults manually in the kit ,fault switches are used. About 12 fault switches are used which are arranged in three rows with each row having 4 switches .The 3 rows represent the 3 phases namely R,Y and B. The fault switches have 2 positions-No fault position(NF) and fault position(F).Main component of the underground cable fault detection circuit is low value resistance measurement. It is constructed using a constant current source of 100mAmps. It can measure very low value resistance as the cables have around 0.01 Ohm/meter resistance. For 10meter cable resistance becomes 0.1 Ohm. This circuit can measure resistance up 50 Ohm, Maximum cable length it can check up to 4 kilometers.

So starting from the reference point 4 sets of resistances are placed in series. These 4 sets of resistances represent the three phases and the neutral. Short circuit faults, Symmetrical and unsymmetrical faults can be determined by this method. This project uses three set of resistances in series (ie)R10-R11-R12-R12,R17-R16-R14R21,R20-R19-R18-R25 one for each phase. Each series resistor represents the resistance of the underground cable for a particular distance and so here four resistances in series represent 1-4kms.Value of each resistance is 10kΩ.



BLOCK DIAGRAM

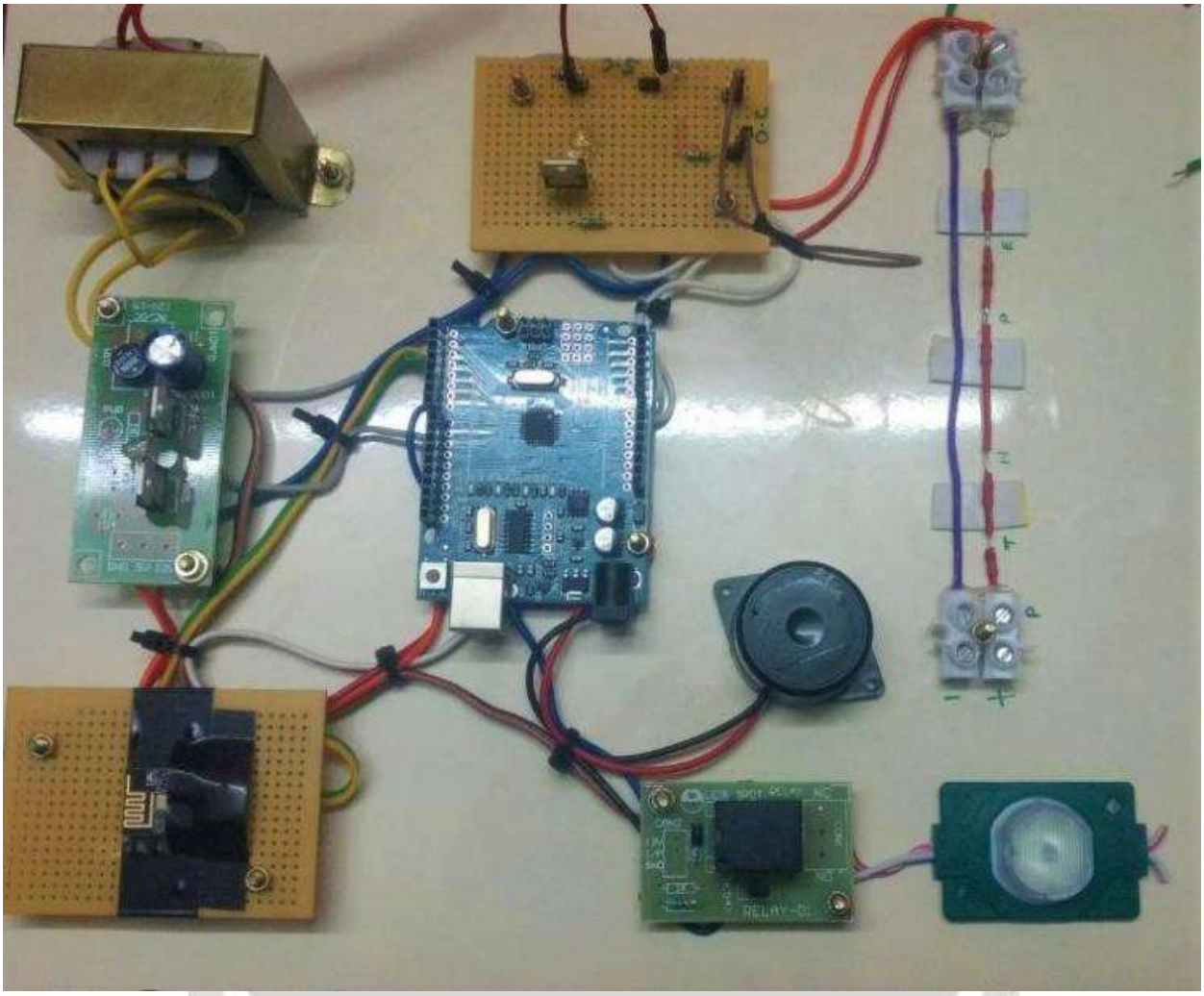


Fig -1: HARDWARE KIT

6.ADVANTAGES

 Less maintenance
 It has higher efficiency
 Less fault occur in underground cable
 This method is applicable to all types of cable ranging from 1kv to 500kv
 It can detect other types of cable fault such as Short circuit fault, cable cuts, Resistive fault, Sheath faults, Water trees, Partial discharges.

7. CONCLUSIONS

Thus the project on Underground cable fault detection using Arduino was done and the distance of the fault from the base station in kilometers was displayed for the three individual phases R,Y and B. Circuit can be tested with different resistor values to simulate various fault conditions In this project faults upto a distance of 4km can be

detected. When the fault switches are operated to fault condition then the phase corresponding to that particular switch is considered as the faulty phase. So the faulty section can easily be located.

8. REFERENCES

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