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Underground Cable Fault Detector

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***Abstract*: The objective of this project is to determine the distance of underground cable fault from base station in Meters or kilometers. The underground cable system is a common practice followed in many urban areas and metropolitan cities. While a fault occurs for some reason, at that time the repairing process related to that particular cable is difficult due to not knowing the exact location of the cable fault. The proposed system is to find the exact distance of the fault.**

The project uses the standard concept of Ohms law i.e., when a low voltage DC is applied at the feeder end through a series resistor (Cable lines), then current would vary depending upon the location of fault in the cable. In case there is a short circuit (Line to Ground, Line to Line, Line to Line to Line), the voltage across series resistors changes accordingly, which is then fed to an ADC to develop precise digital data which the programmed microcontroller of 89s52 family would display in Meters or kilometers. The project is assembled with a set of resistors representing cable length in Meters or kilometers and fault creation is made by a set of switches at every known Meter or kilometers to cross check the accuracy of the same. The fault occurring at a particular distance and the respective phase is displayed on a LCD interfaced to the microcontroller. Further this project can be enhanced by only the short circuited fault using resistors in DC circuit.

***Keywords*: Underground cable fault location, Fault detection.**

1. Introduction

Till the last decade the cables are made to place on overhead and currently a day's mostly uses land cables. There are some techniques in overhead cables like phaser gauge system which is able to identifying the accurate location of faults and its types. The underground cables are essential in some places particularly in cities, Air ports and defense services. We can't easily identify the faults in underground cables. This project deals with Arduino microcontroller, resistor circuit, fault switches, LCD and buzzer. This system operates capably. Many times faults happen because of construction works and other reasons. When fault happen it is difficult to hollow out cables because of not knowing the correct fault location. In the recent years the development of the fault analysis has been developed with the signal processing algorithms and results in transient study base techniques.

2. Literature review

Dhekale. P. M., Bhise. S. S., Deokate. N. R., Suryawanshi. R. R. (2015) In this project we have knowing the different types of faults and fault location methods fault in cable can be classified in two groups

1. Open circuit fault-This type of fault is caused by break in conducting path.
2. Short circuit fault – Further short circuit fault can be classified into two types.

a) Symmetrical fault- In this all three phases are short circuited.
b) Unsymmetrical fault – In this fault magnitude of current is not equal and not displaced 120 degree.

Fault Location Method – It is classified into following methods.

1. Online method: This method utilizes and processes the sampled voltages and current to determine the fault points.
2. Offline method- In this method special instrument is used to test out service of cable in the field. There are two types of offline method

a) Tracer method- In this method fault point is detected by walking on cable lines.
b) Terminal method- It is a technique used to detect fault location of cable from one or both end without tracing.

B.Y.V.N.R swamy, D. Rama Krishna, Ch. Purna chandu, K. Venkatesh, A. Sasidhar reddy, in this project they are using bridge rectifier. This voltage moves to voltage regulator unit. The regulator maintains an unvarying voltage. This voltage is sufficient the resistor circuit to work. The project underground cable fault detection has been planned and tested. Using well sophisticated IC's and with the help of emergent technology the project has been effectively implemented. In this project they have assume the open circuit fault locations.

Abhay Sharma, Akash Mathur, Rajat Gupta, Ranjeet singh, Mansi singh, in this project system they are uses a 16F887 micro controller and a rectified DC supply. Here the project uses a capacitance method. When the current is flow through to the wire than the electromagnetic field is induced which is sense by a Darlington pair i.e. it removes an unwanted noise than it will be filtered and then pass through a voltage regulator gives a constantly 5v supply and then embedded IC is used to represent a fault. A transmission line is a specialized cable

design to carry alternating current of radio frequency. That is, current with a frequency high enough that their wave nature must be taken into account.

A. *Problem statement*

If fault is occurred in underground cable than it's difficult to identify the fault, this is a main problem present in now days. In order to find out such as underground fault. We design underground ground cable fault detector which find out the fault very easily.

3. Block diagram

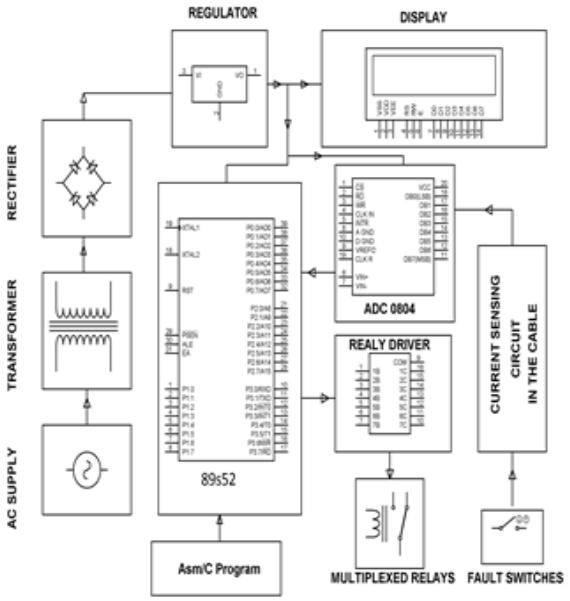

Fig. 1. Block diagram

4. Working

The 230V AC supply is first stepped down to 12V AC using a step-down transformer. This is then converted to DC using a bridge rectifier. The AC ripples are filtered out by using a capacitor and given to the input pin of voltage regulator 7805.At output pin of this regulator, we get a constant 5V DC which is used for Microcontroller and other ICs in this project. This project works on ohm's law. The feeder is fed through a resistor by a DC supply and as per the fault occurrence, the current through this resistor changes. Now depending upon this change in resistance the voltage across the resistance also changes. This change in voltage is fed to the microcontroller through ADC which converts this voltage signal to a readable form to the microcontroller. The microcontroller is coded to read various data given by ADC and give the signal to LCD for displaying consonant distances.

While any of the 2 switches are operated they impose conditions like the line to ground (LG), line to line (LL), and line to line to line (3L) fault as per the switch operation. Any NO point while driven to GND through the common contact point of the relay develops a current flow through R1 & any of the cables by the fault switch depending on the created fault. Thus the voltage drop at the analog to digital (ADC) pin varies depending on the current flow which is inversely proportional to the resistance value representing the length of cable in meters.

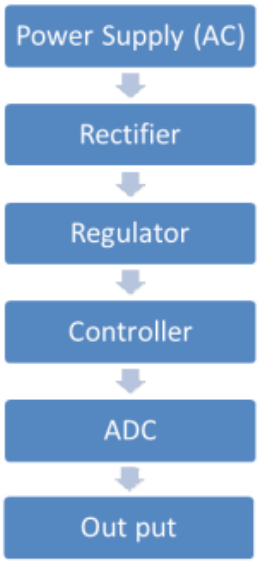

Fig. 2. Flowchart

A. *Components used*

1. 89s52 Microcontroller,
2. PCB Board
3. LCD
4. Crystal
5. ADC0804
6. Relays
7. Relay Driver IC
8. Transformer
9. Diodes
10. Voltage Regulator
11. Resistors
12. Capacitors
13. LEDs
14. Voltage Regulator 7805

B. *Power supply*

The power supply circuit consists of step down transformer which is 230v step down to 5v. In this circuit 4diodes are used to form bridge rectifier which delivers pulsating dc voltage & then fed to capacitor filter the output voltage from rectifier is fed to filter to eliminate any A.C. components present even after rectification. The filtered DC voltage is given to regulator to produce 5v constant DC voltage.

C. *LCD*

Liquid crystal display are interfacing to microcontroller 8051.Most commonly LCD used are

16*2 &20*2 display. In 16*2 display means 16 represents column & 2 represents rows. These displays are mainly

preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc. The operating voltage of this LCD is 4.7V-5.3V. Every character can be built with a 5×8 pixel box.

D. Voltage regulator

A voltage regulator is an electrical regulator designed to automatically maintain a constant voltage level. In this project, power supply of 5V and 12V are required. In order to obtain these voltage levels, 7805 and 7812 voltage regulators are to be used. The first number 78 represents positive supply and the numbers 05, 12 represent the required output voltage levels. The L78xx series of three-terminal positive regulators

Electronic voltage regulators are found in devices such as computer power supplies where they stabilize the DC voltages used by the processor and other elements. In automobile alternators and central power station generator plants, voltage regulators control the output of the plant. In an electric system, voltage regulators may be installed at a substation or along distribution lines so that all customers receive steady voltage independent of how much power is drawn from the line.

E. Transformer

This block comprises a step down transformer whose secondary voltage is less than its primary voltage. It is designed to reduce the voltage from the Primary winding to the secondary winding. This kind of transformer "steps down" the voltage applied to it. Here the voltage rating 230V to 5V is used.

F. Full wave bridge rectifier

This block consists of full wave bridge rectifier to convert variable AC voltage to variable DC by the usage of 4 diodes connected in bridge form. They are also referred as graetz circuit or graetz bridge.

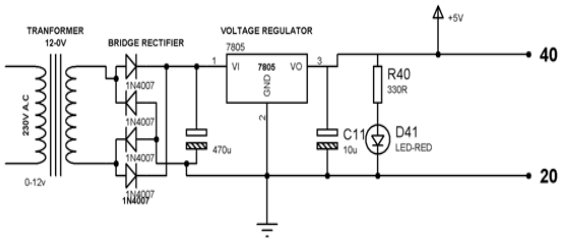

Fig. 3. Full wave bridge rectifier

G. ADC 0804

ADC0804 is a converts the input analog voltage to digital output. It is a standalone analog to digital converter. It is provide more flexibility, consumes less power, provides output in multiple formats and are smaller in size. Previously ADC were used with intelligent (smart) hardware/microcontroller etc. because microcontrollers didn't have built in analog to digital converts. There are also other predecessor and successors of the same family ADC0801/ADC0802/ ADC0803/ADC0804/ADC0805/ADC0808.

5. Facilities and requirements

1) Computer with software like Kiel 5, Proteus, Flash magic software.
2) Microcontroller IC burning kits.
3) Internet & online journals.

6. Applications

- Multiple DIY Projects.
- Very good choice if you are learning Atmel.
- Projects requiring Multiple I/O interfaces and communications.
- Replacement for Arduino Module.
- Ideal for more advanced level A/D applications in automotive, industrial, appliances and consumer applications.

7. Results and Conclusion

Resistance	Distance(meter)
R_1	230m
R_2	420m
R_3	1420m

In this project, the exact location of short circuit fault in the underground cable from feeder end is detected in meter by using a microcontroller. For this, we use the concept of OHM's law to determine the distance at which fault is present.

8. Future scope

Further this project can be enhanced by using capacitor in an ac circuit to measure the impedance which can even locate the open circuited cable, unlike the short circuited fault only using resistors in DC circuit. The current project is able to find short circuit fault conditions. So by use of capacitors the open circuit fault and be analyzed and rectified easily. Fewer Fires Improved Property Values: Improved aesthetics removal of unsightly poles and wires, enhanced tree canopies.

Acknowledgment

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References

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