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"Detection of Short Circuit Fault in Underground Cable using Microcontroller"

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Abstract: The objective of this project is to detect short circuit faults in underground cables using Advance Microcontrollers. The underground cable system is a common practice followed in many urban areas. 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 type of fault. The proposed system is to find the fault in the underground cables. Underground cables has been broadly applied in electricity distribution networks due to the advantages of underground connection, regarding extra secure than overhead traces in horrific weather, much less liable to damage by storms or lightning, much less expensive for shorter distance, environment-pleasant. But, the risks of underground cables need to also be stated, including eight to fifteen instances which shows extra luxurious than equal overhead traces, less energy switching capability, more at risk of permanent damage following a flash-over, and tough to locate fault. Faults in underground cables can be commonly categorized as two classes: incipient faults and everlasting faults. Commonly, incipient faults in electricity cables are gradually resulted from the getting old technique, wherein the localized deterioration in insulations exists. Electric overstress in conjunction with mechanical deficiency, adverse environmental circumstance and chemical pollutants, can reason the irreparable and irreversible damages in insulations. The associated strategies posted in journals and proceedings are reviewed, summarized and compared inside the subsequent subsections.

Keywords: PIC16F877, LCD, Underground cable.

I INTRODUCTION

The main feature of the electric transmission and distribution systems is to transport electric energy from the generation unit to the customers. Usually, while fault occurs on transmission traces, detecting fault is important for strength machine on the way to clean fault before it will increase the damage to the electricity gadget despite the fact that the underground cable system provides better reliability than the overhead line device, it's miles difficult to seek out the fault area. The call for dependable service has caused the improvement of technique of finding faults. During the direction of recent years, the development of the fault diagnosis has been improved with the programs of signal processing techniques and outcomes in brief based strategies. It's been found that the wavelet transform is capable of investigating the temporary signals generated in strength system.

II.TYPES OF FAULT

The maximum common forms of fault that occur in underground cables are,
1. Open circuit fault.
2. Short circuit fault.
3. Earth fault.

1. Open circuit fault

When there is damage in the conductor of a cable, it is known as open-circuit fault. The open-circuit fault can be checked by amegger. For this cause, the three conductors of the 3 centre cable at a ways end are shorted and earthed. Then resistance between every conductors and earth is measured by using a megger. The megger will imply zero resistances in the circuit of the conductor that is not broken however if a conductor is damaged the megger will simplyan endless resistance.

2. Short circuit fault

When two conductors of a multi core cable are available in electrical contact with each other due to insulation failure, it's known as short-circuit fault. Megger can additionally be used to check this fault. For this the two terminals of a megger are linked to any conductors. If the megger gives a zero reading it indicates short-circuit fault among these conductors.

3. Earth fault

When the conductor of a cable comes in contact with earth, it is called earth fault or floor fault. To perceive this fault, one terminal of the megger is hooked up to the Conductor and the alternative terminal related to the earth.
If the megger shows zero reading, it method the conductor is earthed. The equal system is repeated for other conductors of the cable.

III. WORKING PRINCIPLE

OHM's law is the primary operating precept used to discover the short circuit fault in underground cables buried deep in the earth. A DC voltage is applied on the feeder stop through a series resistor, depending upon the length of fault of the cable modern varies. The voltage drop throughout the series resistor adjustments consequently, this voltage drop is used in dedication of fault location.

IV. WORKING

In this project we used concept of OHMs law where a low DC voltage is applied at the feeder end through a series resistor. The current will vary and it depends upon the length of fault of the cable in case there is short circuit fault like LL,LLG etc. The series resistor voltage drop changes accordingly which is then fed to an ADC to develop precise digital data which the programmed microcontroller would display the same in Kilo meters. This project is arranged with a set of resistors showing the cable length in KMs and fault is created with the help of set of switches at every known KM to cross check the accuracy of the process.

This is an underground cable fault distance locator model using microcontroller. It is classified in four parts –DC power supply part, cable part, controlling part, display part. DC power supply consists of ac supply of 230v step down using transformer. Bridge rectifier converts ac signal to dc & regulator is used to produce constant dc voltage. The cable part is denoted by set of resistors along with switches. Current sensing part of cable it represents the set of resistors &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. Next is controlling part which consists of analog to digital convertor which receives input from the current sensing circuit, converts this voltage into digital signal and feeds the microcontroller with the signal. The microcontroller is nothing but part of control unit and makes necessary calculations regarding the distance of the fault. The microcontroller drives a relay driver which in turn controls the switching of a set of relays for proper connection of the cable at each phase. The part consists of the LCD display interfaced with 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 display.

A.7805 Voltage Regulator:

KIA7805 represents a voltage regulator integrated circuit consisting of a complex network of resistances & diodes. It is a member of 78xx series of fixed linear voltage regulator ICs. The voltage source in the circuit may have fluctuations. So it will not produce the fixed output voltage. The xx in 78xx indicate it gives the fixed positive voltage. Here we used 7805 which provides +5V regulated power supply. Capacitors are connected accordingly in parallel to
Fix the voltage fluctuations.

B. PIC16F877 Microcontroller

This powerful (200 nanosecond instruction execution) yet easy-to-program (only 35 single word instructions) CMOS FLASH-based 8-bit microcontroller packs Microchip's powerful PIC® architecture into an 40- or 44-pin package and is upwards compatible with the PIC16C5X, PIC12CXXX and PIC16C7X devices. PIC16F877 contains 256 bytes of EEPROM data memory, 8 channels of 10-bit Analog-to-Digital (A/D) converter, 2 additional timers, 2 capture/compare/PWM functions, the synchronous serial port can be configured as either 3-wire Serial Peripheral Interface (SPI™) or the 2-wire Inter-Integrated Circuit (I²C™) bus.All of these features make it ideal for more advanced level A/D applications in automotive, industrial, appliances and consumer applications.

C. Liquid Crystal Display:

Liquid crystal shows (Liquid Crystal display) show display screen is a digital display module and discover a big sort of programs. A 16x2 LCD show is quite simple module and could be very commonly used in diverse gadgets and circuits those modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are fee-effective; without issues programmable; have no trouble of showing particular & even custom characters (not like in seven segments), animations and so on.

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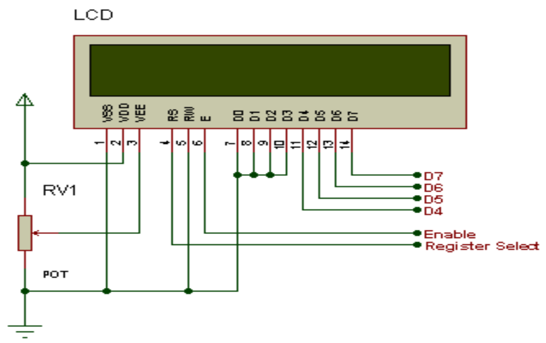

Fig.3 LCD

A LCD (Liquid Crystal Display) screen is an electronic show module and locate an extensive variety of uses. These modules are favoured more than seven portions and other multi fragment LEDs. The reasons being: LCDs are prudent; effectively programmable; have no impediment of showing exceptional and even custom characters (not at all like in seven portions), movements et cetera.

A 16x2 LCD implies it can show 16 characters for each line and there are 2 such lines. In this LCD each character is shown in 5x7 pixel grid. This LCD has two registers, in particular, Command and Data. A summon is a guideline given to LCD to do a predefined undertaking like instating it, clearing its screen, setting the cursor position, controlling showcase and so forth. The information enlist stores the information to be shown on the LCD.

D. Resistors

In our project model resistances are being represented as underground cables buried deep inside the earth. While representing three phases (R Y B) we have used six resistances per phase, connected in parallel connection in order to create and detect short circuit & open circuited faults. The parallel network comprises of 1, 4.7 & 10 kilo ohm resistances to represent various load points across each phase.

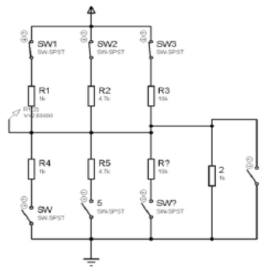

Fig.1 Resistor Network to Represent Underground Cables across Each Phase

ADVANTAGES

- Less maintenance
- It has higher efficiency
- Less fault occur in underground cable
- Improved public safety

V. RESULT

The fault arrival is made by means of a hard and fast of switches. The relays are managed with the aid of a relay motive force IC, which is used to test the cable line. The 16x2 LCD display related to the microcontroller is used to display the information In case of a brief circuit (Line to floor), the voltage throughout the series resistors changes consequently.

Fig. 2Working of Fault Detection Model

VI. CONCLUSION

The Based on the study of wavelet transform and analysis of superimposed components, two schemes have been proposed to detect and classify the incipient faults in underground distribution cables. The following design goals have been achieved -

- It can be easy implemented in exixting digital relays
- High detection and classification
- Dead zone is comparatively less
- It can be customised for different CT locations.
- Different transformers can be easily used with it.
- Real time detection.

This wavelet-based scheme has the following advantages in terms of the detecting error and accuracy-

- Achieving higher detection accuracy, especially for high impedance incipient fault.
- Detecting and classifying the different fault type;
- Detecting and classifying the other transient such as cold load pickup and capacitor switching.
- Eliminating noise from signals

The superimposed components-based scheme is particularly designed to detect SLG incipientfaults. It has following advantages in terms of the configuration and simplicity.

- Performing simple and less computation;
- Setting fewer threshold
- Implementing by easily upgrading firmware.

The wavelet-based scheme can obtain the low rate of missing detection and zero rate of false alarm in the presence of the various noise levels, fault conditions, transient types and system configurations. The superimposed components-based scheme is capable of achieving the zero rates of false alarm and misclassification.

VII. FUTURE SCOPE

For underground distribution networks fault location and state estimation isvery challenging. This work may help in some degree to support further analytical and practical studies in the fields of fault location and state calculation for real underground distribution systems.

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