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GSM TECHNIQUE USED FOR UNDERGROUND CABLE FAULT DETECTOR AND DISTANCE LOCATOR

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Abstract:

The aim of this project is to determine the distance of underground cable fault from base station in kilometers and by using 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 a analog to digital converter and a microcontroller is used to make the necessary calculations so that the fault distance is displayed on the LCD display.

Key Words: Underground Cable, Fault Location, Fault Detection, Location Methods, Murray Loop Method & Impulse Current Method

Introduction:

Till last decades cables were made to lay overhead& currently it is lay to underground cable which is superior to earlier method. Because the underground cable are not affected by any adverse weather condition such as storm, snow, heavy rainfall as well as pollution. But when any fault occur in cable, then it is difficult to locate fault. So we will move to find the exact location of fault. Now the world is become digitalized so the project is intended to detect the location of fault in digital way. The underground cable system is more

Common practice followed in many urban areas. While 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 cable fault. Fault in cable is represented as: any defect, Inconsistency, Weakness or non-homogeneity that affects performance of cable. Current is diverted from the intended path. Caused by breaking of conductor& failure of insulation

Fault in cable can be classified in two groups: 1) Open circuit fault: Open circuit faults are better than short circuit fault, because when these fault occurs current flows through cable becomes zero. This type of fault is caused by break in conducting path. Such faults occur when one or more phase conductors break. 2) Short circuit fault: Further short circuit fault can be categorized in two types: a) symmetrical fault: Three-phase fault is called symmetrical fault. In this all three phases are short circuited. b) Unsymmetrical fault: In this fault magnitude of current is not equal not displaced by 120 degree.

Fault Location Methods:

Fault location methods can be classified as:

1. Online method: This method utilizes process the sampled voltages& current to determine the fault points. Online method for underground cable is less than overhead lines.

2. Offline method: In this method special instrument is used to test out service of cable in the field. There are two offline methods as following
3. 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.

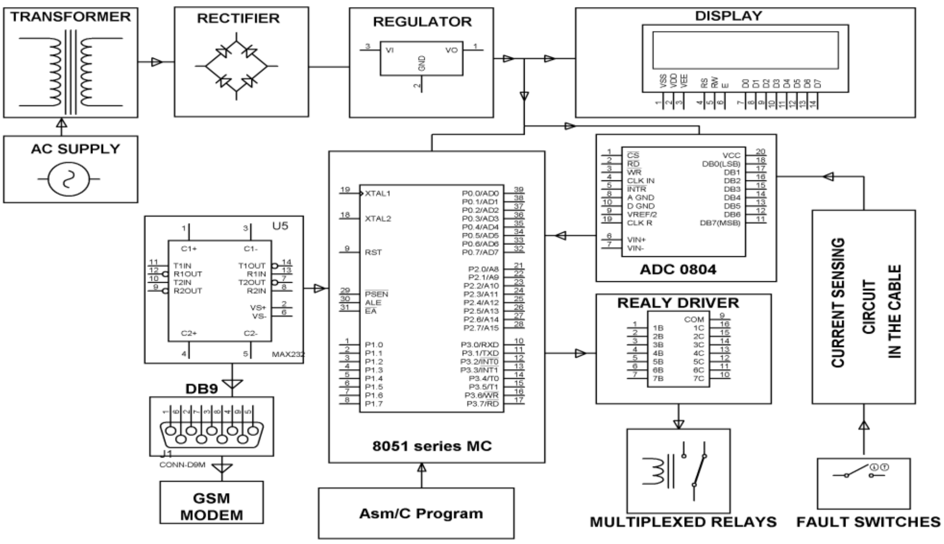
Example:

1. Tracing current method
2. Sheath coil method

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.

Example: 1) Murray Loop Method 2) Impulse Current Method

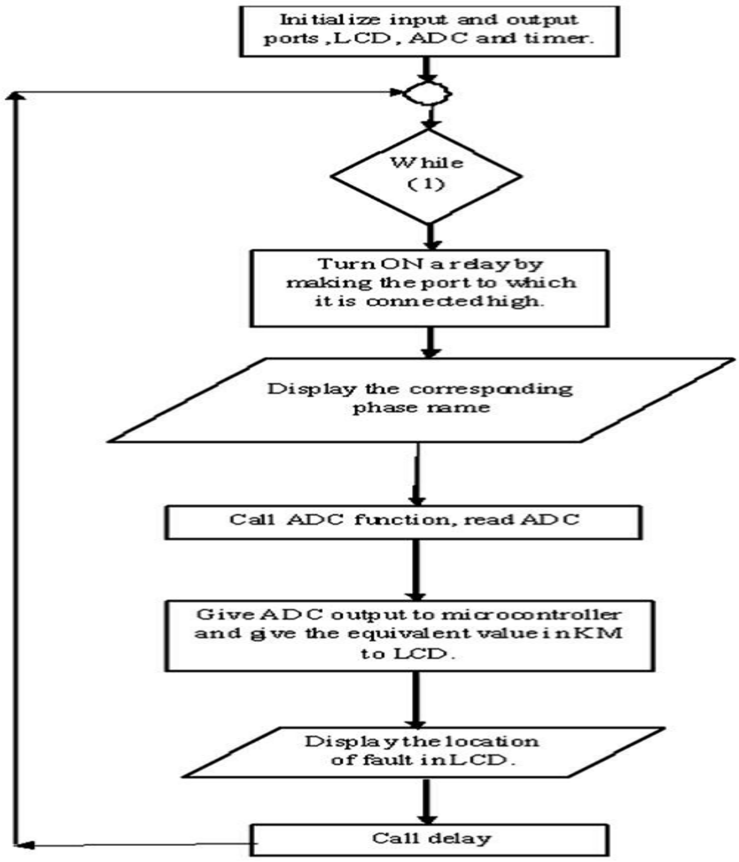
Block Diagram:



The project uses the simple concept of OHMs law where a low DC voltage is applied at the feeder end through a series resistor. The current would vary depending upon the length of fault of the cable in case there is a short circuit of LL or 3L or LG 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. The project is assembled with a set of resistors representing cable length in KM sand fault creation is made by a set of switches at every known KM to cross check the accuracy of the same.

This is proposed model of underground cable fault distance locator using microcontroller. It is classified in four parts DC power supply part, cable part, controlling part, display part. DC power supply part consist of ac supply of 230v is 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 represented as 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 also forms part of the controlling unit and makes necessary calculations regarding the distance of the fault. The microcontroller also 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 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.

Algorithm & Flow Chart:



Algorithm:

Step1: Initialize the ports, declare timer, ADC, LCD functions.
Step2: Begin an infinite loop; turn on relay 1 by making pin 0.0 high.
Step3: Display "R:" at the starting of first line in LCD.
Step4: Call ADC Function, depending upon ADC output, displays the fault position.
Step5: Call delay.
Step6: Repeat steps 3 to 5 for other two phases.

Power Supply:

The power supply circuit consists of step down transformer which is 230v step down to 12v.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 12v constant DC voltage. Transform change in usually, 5V, 9V o mains transform Diodes connected to form a bridge. The ac input voltage is applied to the diagonally opposite ends of the bridge. The load resistance is connected between the other two ends of the bridge.

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.

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 is available

Relay:

Relay is sensing device which senses the fault &send a trip signal to circuit breaker to isolate the faulty section. A relay is automatic device by means of which an electrical circuit is indirectly controlled &is governed by change in the same or another electrical circuit. There are various types of relay: Numerical relay, Static relay & electromagnetic relay. Relay is housed in panel in the control room.

Discussion on Application of Artificial Intelligence for Fault Location:

The application of artificial networks for fault location on OHL has been discussed by many authors—some work is also published on hybrid systems. No authors have, 2.2 Current Fault Location Methods 15 however, dealt with fault location problems on cross bonded cables. Because the artificial network learns by example (supervised learning) it should, however, be possible to develop such a method using the methods already proposed. The problem is the extensive amount of data needed for training and to ensure that the models used to create the training data are good and reliable. None of the algorithms proposed in the literature are verified in real-life and if the models used to train the artificial networks are oversimplified, good results can be obtained when verifying the algorithm against the same model, but the results will not be useable in real life. How well the most advanced simulation models predict real fault behaviour on cross bonded cable systems must be examined before any final recommendation regarding artificial intelligence methods can be made.

Discussion on State of the Art:

The state of the art analysis conducted shows that fault location on cross bonded cables is not a field which is studied in detail. Only few publications are available when considering both impedance and travelling wave-based methods. The publications which are available are centred on very short lines where the lines in the Danish grid will be considerable longer. The use of artificial intelligence for fault location is a relatively new area of research and is mainly focused on OHL systems. Furthermore, not much research that studies the special conditions for cross bonded cable system under faulted conditions is published. Conclusions This paper proposes and discusses extended impedance based fault location formulation for underground distribution systems. The formulation uses as input data, local voltages and currents, measured at one terminal (substation) and is developed for single line-to-ground and three-phase faults. A capacitive current compensation procedure is proposed to consider underground cable's typical characteristic. Furthermore, the fault location scheme is suitable for grounded generic balanced or unbalanced distribution systems with laterals branches and intermediate loads.

Test results demonstrate an accurate and robust fault location technique. The method performance is independent of the fault resistance and distance values. System topology, regarding the existence of lateral branches, may affect the fault distance estimate accuracy level. However, even in the worst simulated test conditions, the formulation obtained encouraging results. The comparison with a recently published [4] impedance-based fault location technique demonstrates the accuracy improvements obtained by the proposed extension. Since recently proposed impedance-based [3–5] fault location formulations for PDS do not consider line's capacitance, its application on underground feeders produces very inaccurate results. According to obtained test results, this inaccuracy is dependant and proportional to the fault resistance value.

The proposed formulation based on underground feeder's capacitive current compensation overcomes this limitation. The formulation provides accurate fault distance estimates, and is suitable even in higher fault resistance values conditions. Finally, the application of the proposed fault location formulation in real underground distribution feeders can be easily implemented and may reduce the maintenance crew intervention time, enhancing system's restoration.

Conclusion:

This paper proposes and discusses and extended impedance based fault location formulation for underground distribution systems. The formulation uses as input data, local voltages and currents, measured at one terminal (substation) and is developed for single line-to-ground and three-phase faults. A capacitive current compensation procedure is proposed to consider underground cable's typical characteristic. Furthermore, the fault location scheme is suitable for grounded generic balanced or unbalanced distribution systems with laterals branches and intermediate loads.

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Future Scope:

In this project we detect only the location of short circuit fault in underground cable line, but we also detect the location of open circuit fault, to detect the open circuit fault capacitor is used in ac circuit which measure the change in impedance & calculate the distance of fault.

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