AUTOMATIC UNDERGROUND CABLE FAULT DETECTION WITH SMS ALERT

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Abstract *- The main objective of this project is, any distribution network is likely to get faults, on and off the supplier as well as user. Majorly a supply line can be affected by conditions of over voltage and over current, and also under voltage condition. During the event of any fault, the event goes unreported for long length of time. Manual reporting can lead to long interruption. To overcome this problem, a system is developed that will detect the changes in voltage and current guidelines, and using a micro controller based circuit. The faults can be classified based on comparison between the values received from rated guidelines of the distribution side power lines. Whenever the preset dividing line is crossed, the micro controller instantly initiates a message to the area lineman and the control station stating the exact street location where fault is happening. The real purpose of detecting fault in real time is to protect the transformer at the earliest.*

Key Words: Microcontroller, Underground, Cable, LCD

1. INTRODUCTION

A 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 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 the exact location of the fault. This leads to dugging 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.

2 .FAULTS IN UNDERGROUND CABLES

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 open circuit fault.

2.2.Shortcircuitfaults

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.

3.3. 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.

3.4. 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. BLOCK DIAGRAM

The project uses the simple concept of Ohm's 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 KM's. The project is assembled with a set of resistors representing cable length in KMs and 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 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 consist 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.It is fault occur in relay will be open ,to current flow in open condition .To send a message using GSM Modem in mobile phone.Indimate alarm to faulty section .

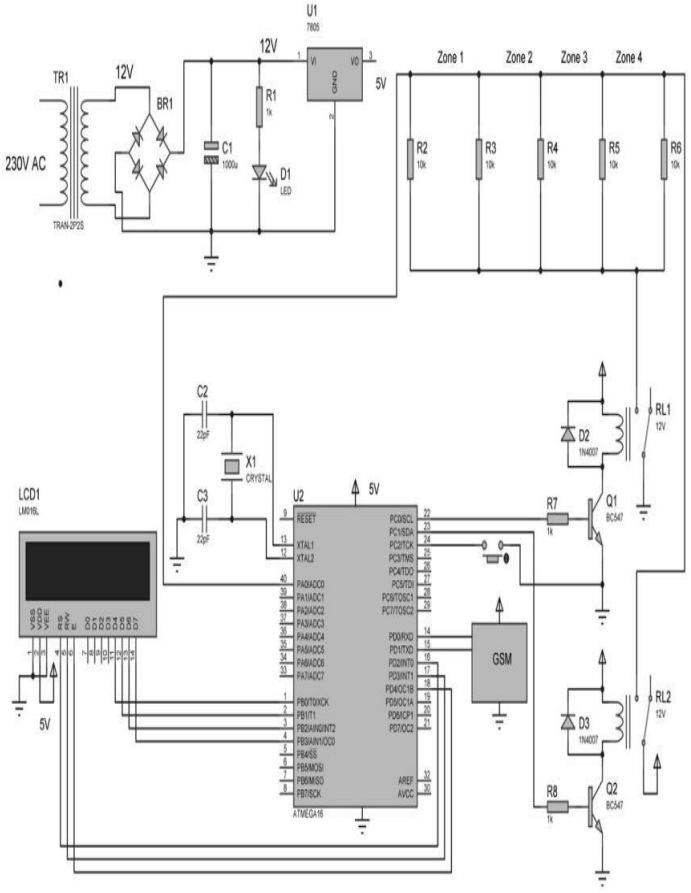

Fig : circuit diagram

4.1 Rectifier

The output from the transformer is fed to the rectifier. It converts A.C. into pulsating D.C. The rectifier may be a half wave or a full wave rectifier. In this project, a bridge rectifier is used because of its merits like good stability .The circuit has four diodes connected to form a bridge. A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. The process is known as rectification. Rectifiers have many uses, but are often found serving as components of DC supplies and high-voltage direct current power transmission systems. Rectification may serve in roles other than to generate direct current for use as a source of power.

4.2. 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 and then fed to capacitor filter the output voltage from rectifier is fed to filter to eliminate any AC components present even after rectification. The filtered DC voltage is given to regulator to produce 12v constant DC voltage.

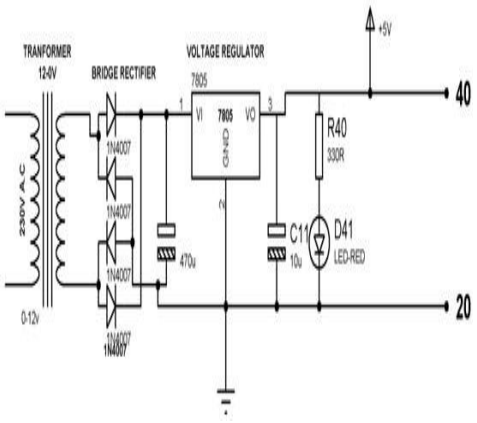

Fig: power supply diagram

4.3.AT MEGA 16 Microcontroller.

AT Mega 16 micro controller is an 8 bit high performance micro controller from the Atmel's Mega AVR family. At mega16 micro controller is a 16 bit 40 pin micro controller based on enhanced RISC(Reduced instruction set computing) architecture with 131 powerful instruction.AT mega 16 micro controller can be worked on a maximum frequency 16 MHZ. The micro controller is an input supply is given to the voltage regulator also drives a solid state relay driver which in turn controls the relays for proper connection of the Underground cable(feeder) resistor at each phase connection to each zone. It is fault occur in relay will be open ,to current flow in open condition. To Intimate alarm to faulty section. Automatic displayed in cable fault at a distance in LCD display displayed in substation. To send a message using micro controller through GSM Modem in mobile phone.

4.4 LCD Display

Liquid crystal display are interfacing to micro controller 8051.Most commonly LCD used are 16*2 and20*2 display. In 16*2 display means 16 represents column and 2 represents rows. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

4.5. 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.

4.6.Relay

Relay is sensing device which senses the fault and sends a trip signal to circuit breaker to isolate the faulty section. A relay is an automatic device by means of which an electrical circuit is indirectly controlled and is governed by change in the same or another electrical circuit. There are various types of relay: Numerical relay, Static relay and electromagnetic relay. Relay are housed in panel in the control room. Here three mini power relays are used each for one of the three phases. The relays periodically scan the three phases and send the signal to the AT Mega16 Microcontroller controller. The rating of each of the relays is about 12V.

4.7.Transformer

Transformer is static device which transfer electrical energy from one circuit to another circuit with change in voltage or current without change in frequency .in this step down transformer is used. Usually DC voltage are required to operate various electronic equipment and this voltage are 5v ,9v or 12v.but this voltage cannot be obtained directly . Thus the AC input available at the main supply. i.e. 230v is to be brought down the required voltage level. This is done by transformer.

5. ADVANTAGES

1. It has higher efficiency

2. Less fault occur in underground cable

3. This method is applicable to all types of cablerangiefrom1kvto500kv

4. It can detect other types of cable fault such as Short circuit fault, cable cuts, Resistive fault, Sheath faults, Water trees, Partial discharge.

6. RESULT

Thus the underground cable fault using AT Mega 16 Microcontroller was identified in the underground cable from feeder end in a km. To measure the particular distance and location an individual resister is connected between zones. Solid State relay is a sensing device it will work in a particular location of cable and intimate the fault to microcontroller and distance of fault is displayed in the LCD display.

7. CONCLUISION

Thus the project on Underground cable fault detection using AT Mega 16 Micro controller was done. We have proposed a low cost solution to enhance the fault detection of underground cable. It is secure, robust and power consuming. It can be used to all types of cables so as to avoid fault occurring in the underground cables.

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