"IMPLEMENTATION OF PRECISE KILOMETER CALCULATION BY UNDERGROUND CABLE FAULT DETECTOR"

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ABSTRACT: *This paper proposes fault location model for underground power cable using microcontroller. The aim of this project is to determine the distance of underground cable fault from base station in kilometers. This project uses 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 voltage converter and a microcontroller is used to make the necessary calculations so that the fault distance is displayed on the LCD display.*

Keywords: Underground cable, fault location, fault detection, location methods, microcontroller

1. INTRODUCTION

Last two 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.

2. RELATED WORK

Dhekale P.M et. al. [1] proposed fault location model for underground power cable using microcontroller. The aim of this project is to determine the distance of underground cable fault from base station in kilometers. This project uses 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 voltage converter and a microcontroller is used to make the necessary calculations so that the fault distance is displayed on the LCD display.

DhivyaDharani e t. al. [2] proposed the prototype uses the simple concept of OHMs law. The current would vary depending upon the length of fault of the cable. This prototype is assembled with a set of resistors representing cable length in Kilo meters and fault creation is made by a set of switches at every known Kilo meters (km's) to crosscheck the accuracy of the same. The fault occurring at what distance and which phase is displayed on a 16X2 LCD interfaced with the microcontroller. The program is burned into ROM of microcontroller. The power supply consists of a step down transformer 230/12V, which steps down the voltage to 12V AC. This is converted to DC using a Bridge rectifier. The ripples are removed using a capacitive filter and it is then regulated to +5V using a voltage regulator 7805 which is required for the operation of the microcontroller and other components.

Jitendra Pal Singh et. al. [3] proposed the underground cable fault distance locator is done by using microcontroller. The target of this project is to work out the gap of underground cable fault through base station in kilometers. It uses the straight forward conception of ohm's law, voltage drop can vary counting on the length of fault in cable, since the current varies. A group of resistors are used to represent the length of cable in kilometers and a dc voltage is fed at one end and the fault is detected the change in voltage using analog to voltage converter. The fault occurring at what distance is shown on LCD which is interfaced with the microcontroller that is used to make the necessary calculations.

SwapnilGaikwadet. al. [4] design prototype model that based on the simple concept of OHMs law. The current would vary depending upon the length of fault of the cable. This prototype is assembled with a set of resistors representing cable length in Kilo meters and fault creation is made by a set of switches at every known Kilo meters (km's) to cross check the accuracy of the same. The fault occurring at what distance and which phase is displayed on a 16X2 LCD interfaced with the microcontroller. The program is burned into ROM of microcontroller. The power supply consists of a step down transformer 230/12V, which steps down the voltage to 12V AC. This is converted to DC using a Bridge rectifier. The ripples are removed using a capacitive filter and it is then regulated to +5V using a voltage regulator 7805 which is required for the operation of the microcontroller and other components.

A. Ngaopitakkulet. al [5] proposed the technique for detecting faults in underground distribution system. Discrete Wavelet Transform (DWT) based on traveling wave is employed in order to detect the high frequency components and to identify fault locations in the underground distribution system. The first peak time obtained from the faulty bus is employed for calculating the distance of fault from sending end. The validity of the proposed technique is tested with various fault inception angles, fault locations and faulty phases. The result is found that the proposed technique provides satisfactory result and will be very useful in the development of power systems protection scheme.

3. PROBLEM STATEMENT

- 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 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 KMs and fault creation is made by a set of switches at every known KM to cross check the accuracy of the same.

4. ANALYSIS AND DESIGN

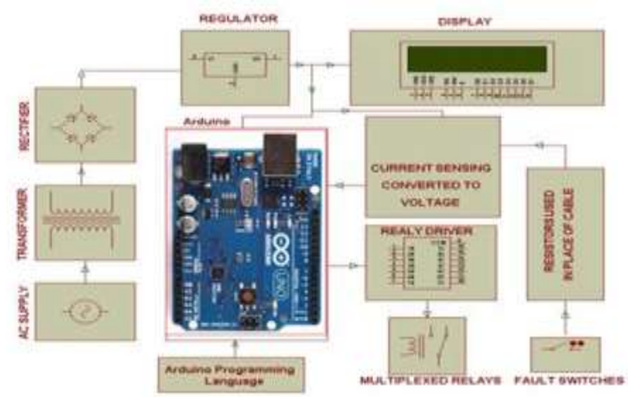

Figure 1: Block diagram

5. IMPLEMENTATION DETAILS

5.1 Power Supply

The circuit uses standard power supply comprising of a step-down transformer from 230Vto 12V and 4 diodes forming a bridge rectifier that delivers pulsating dc which is then filtered by an electrolytic capacitor of about 470µF to 1000µF. The filtered dc being unregulated, IC LM7805 is used to get 5V DC constant at its pin no 3 irrespective of input DC varying from 7V to 15V. The input dc shall be varying in the event of input ac at 230volts section varies from 160V to 270V in the ratio of the transformer primary voltage V1 to secondary voltage V2 governed by the formula V1/V2=N1/N2. As N1/N2 i.e. no. of turns in the primary to the no. of turns in the secondary remains unchanged V2 is directly proportional to V1.Thus if the transformer delivers 12V at 220V input it will give 8.72V at 160V.Similarly at 270V it will give 14.72V.Thus the dc voltage at the input of the regulator changes from about 8V to 15V because of A.C voltage variation from 160V to 270V the regulator output will remain constant at 5V.

The regulated 5V DC is further filtered by a small electrolytic capacitor of 10µF for any noise so generated by the circuit. One LED is connected of this 5V point in series with a current limiting resistor of 330Ω to the ground i.e., negative voltage to indicate 5V power supply availability. The unregulated 12V point is used for other applications as and when required.

5.2 Atmega 328 Microcontroller

The high-performance Microchip 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. By executing powerful instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed.

5.3 Reset

Pin no 9 is provided with a reset arrangement by a combination of an electrolytic capacitor and a register forming RC time constant. At the time of switch on, the capacitor gets charged, and it behaves as a full short circuit from the positive to the pin number 9. After the capacitor gets fully charged the current stops flowing and pin number 9 goes low which is pulled down by a 10k resistor to the ground. This arrangement of reset at pin 9 going high initially and then to logic 0 i.e., low helps the program execution to start from the beginning. In absence of this the program execution could have taken place arbitrarily anywhere from the program cycle. A pushbutton switch is connected across the capacitor so that at any given time as desired it can be pressed such that it discharges the capacitor and while released the capacitor starts charging again and then pin number 9 goes to high and then back to low, to enable the program execution from the beginning. This operation of high to low of the reset pin takes place in fraction of a second as decided by the time constant R and C.

For example: A 10µF capacitor and a 10 kΩ resistor would render a 100ms time to pin number 9 from logic high to low, there after the pin number 9 remains low.

5.4 External Access (EA)

Pin no 31 of 40 pin 8051 microcontroller termed as EA is required to be connected to 5V for accessing the program form the on-chip program memory. If it is connected to ground then the controller accesses the program from external memory. However as we are using the internal memory it is always connected to +5V.

6. SNAPSHOT OF DESIGN

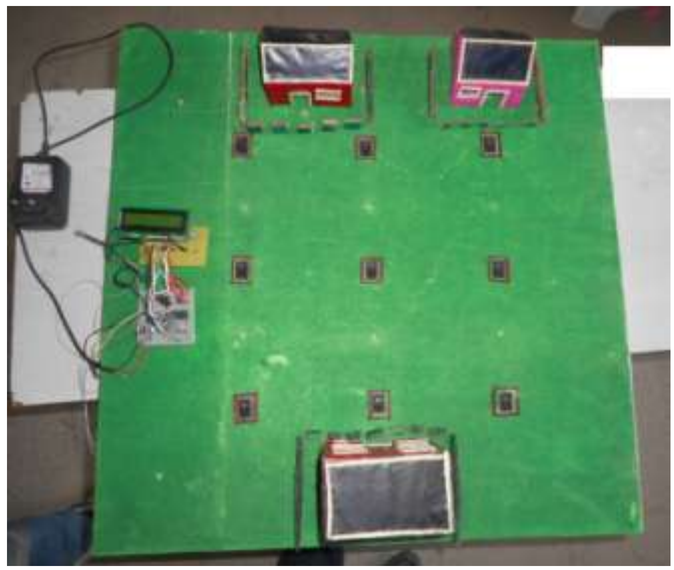

Figure 2: Model Design

Figure 2 shows the designed model of underground fault detection which is based on microcontroller.

7. FUTURE SCOPE

Nowadays, the fault location and state estimation for underground distribution networks are very challenging. This work may help in some degree to encourage further analytical and practical studies in the fields of fault location and state estimation for real underground distribution systems.

8. LIMITATION

1. Implementation cost is high.

2. Resistance of line has to be measured per kilometer before installation.

9. CONCLUSION

In this paper proposed a very effective method for precise kilometer calculation of underground cable fault. This is advanced technology for fault detection of underground cable; it has lots of scopes in future, very beneficial for new generation.

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