

Design of Underground Cable Fault Detection Using IoT

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Abstract— This paper introduces associate underground fault location model of cable using Arduino and IoT (Internet Of Things) module, used for remote indication to diminish power outages and significant loss of profit by sending data to control room therefore the field engineer can resolve the difficulty of a particular fault location. In underground system, incidence of fault is rare and is hard to seek out the precise position of fault to overcome this drawback, we have a tendency to come up with the concept given in paper. The main aim is to diagnose the electrical circuit and three phase contact faults distance from base-station in kilometers. This prototype is assembled with a set of resistors showing length of cable in kilometers and a set of switches are used to create fault at every known kilometer to determine the accuracy and results concerning fault readings, is displayed on a alphanumeric display connected with the Arduino UNO board. This project is useful in reducing the cost, production losses by saving the time and efforts for partition of faults and up the facility accessibility to customers through an enhancement of overall efficiency of power nets.

Keywords— Internet of things (IoT), arduino, fault location , distance, kilometer.

I. INTRODUCTION

The main function of the electrical power system transmission line is to transfer electricity from the generation unit to the users. We prefer underground cable rather than overhead for the transmission because the underground cable aren't affected by any atmospheric condition like lightning, high speed winds, earthquake, snow ,frost etc. But when a fault is occur at underground cable, it's difficult to search out the location of the fault to clear the fault before it increases the damage to the power system. So we are going to move to detect the precise location of fault. Now the globe become digitalized therefore the project is meant to detect the location of fault in digital way[1]. The underground cable system is a lot of common practice followed in several urban areas. While fault happens for a some reason, at that time the repairing process associated with that specific cable is difficult because of not knowing the precise location of cable fault. Fault in cable is represented as follows- Any defect and inconsistency, Caused by breaking of conductor & failure of insulation, Weakness or non-homogeneity that affect performance of cable, Current is diverted from the intended part.

II. PROBLEM STATEMENT

Power supply companies are sometimes forced to use underground power transmission and distribution lines instead of their overhead counterparts. This is often mostly for safety and neatness reasons. One in all the foremost challenges related to underground power cables is that the difficulty in locating the particular point of fault and consequently prolonged 'out of service' time. Currently there's no perfect fault location system for underground power line and this introduces a problem to fault location within the marine and also the expected underground distribution lines. The method of fault detection, location and fixing appears rather more difficult and time consuming in underground systems as compared to overhead systems solely because the utility company currently lacks a correct fault location technique. This project has geared toward designing and building an accurate and affordable system of underground cable fault detection and site.

III. BLOCK DIAGRAM

The Power Grid System consists of basic blocks mainly the Resistors, Arduino, Relay, 12V & 5V DC supply, Buzzer, Switches, LCD Display, WiFi module, Cloud, Interface block. This is diagrammatically shown in figure 1.

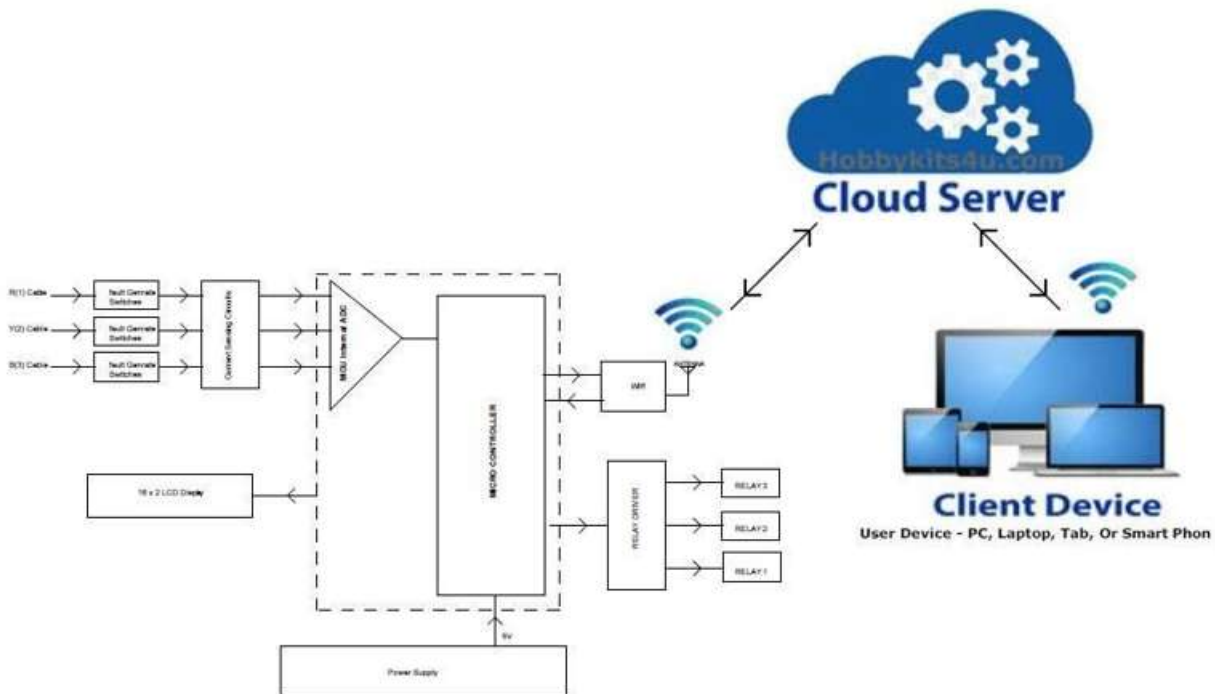


FIGURE 1: Block Diagram Underground Cable Fault Detection By Using Iot

IV. CIRCUIT DIAGRAM

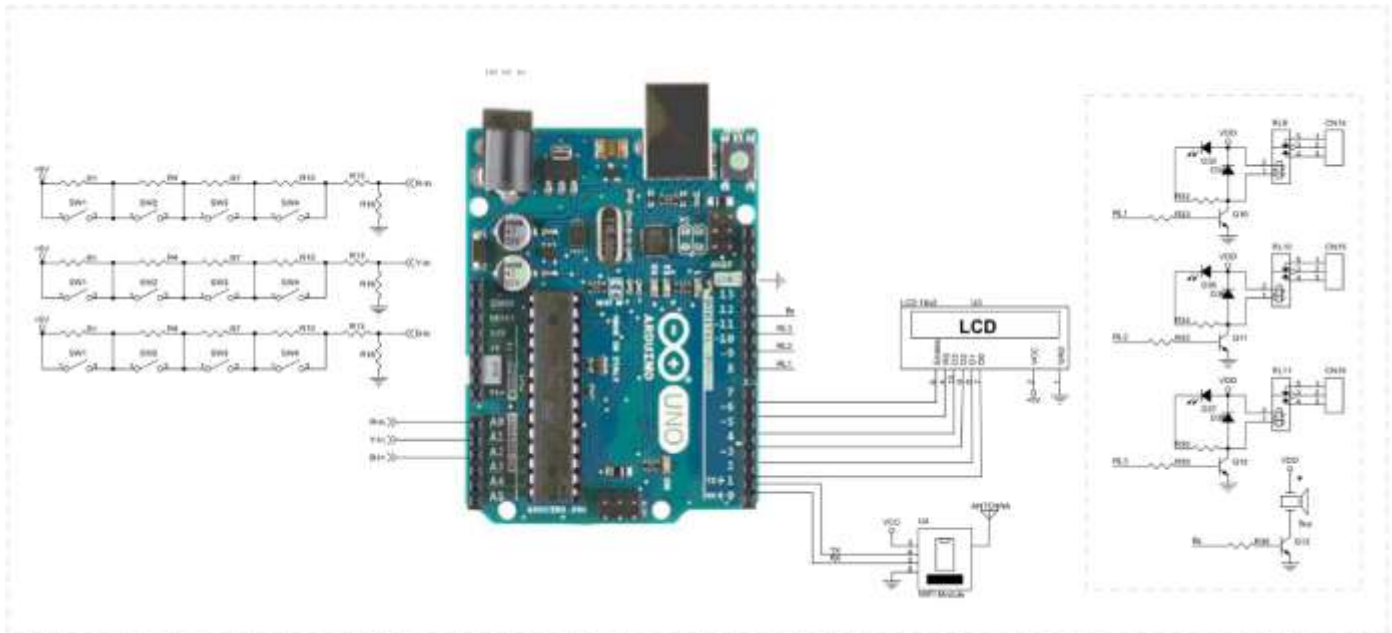


FIGURE 2: Circuit Diagram Underground Cable Fault Detection By Using Iot

V. WORKING

The project depends on the 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 just in case there's a short circuit of LL or LG etc. The series resistor voltage drop changes accordingly which is then fed to an ADC to develop exact digital data which the programmed microcontroller would display the identical in kilometers. The project is assembled with a group of resistors representing cable length in kilometers and fault creation is created by a group of switches at every known kilometer to cross check the accuracy of the same. Within the cable part we use a set of resistor along with switches. Current sensing part are used as fault creators to point the fault at each location. This part senses the change in current by sensing the voltage drop.

After that there is a controlling part which consists of analog to digital converter that receives signal from this current sensing circuit and converts this signal into digital signal and send it to the microcontroller. The microcontroller also a component of the controlling units and makes a necessary calculation regarding the distance of the fault. The microcontroller also drives a relay driver which successively controls the switching of a set of relays for correct connection of the cable at each phase. In the display section it consists of 16x2 LCD display interfaced to the microcontroller which shows the data related to status of the cable of each phase and the distance of the cable at that phase, in case of any fault.

VI. COMPONENTS DESCRIPTION

4.1 Arduino UNO

The Arduino Uno is a microcontroller board based on the ATmega328. ATmega-328 is basically an (AVR) Advanced Virtual RISC micro-controller. It has 20 digital I/O pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs), a 16 MHz crystal oscillator, a USB port, a power jack, an in-circuit system programming (ICSP) header,

and a reset button. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) so as to load new code onto the board you can simply use a USB cable.

4.2 Power Supply

The power supply circuit. It's supported three terminal voltage regulators, which give the specified regulated +5V and unregulated +12V. Power is delivered initially from standard 12V AC/DC adapter or 12V , 800ma Transformer.

4.3 ESP8266 (WI-FI Module)



FIGURE 3:ESP8266 WiFi module

It is a low cost chip with TCP/IP stack and microcontroller. In our project main importance role of wifi is it performs IOT operation. The simple device is connected from microcontroller to send the information wireless.

4.4 LCD Display



FIGURE 4: 2*16 LCD Display

LCD (Liquid Crystal Display) is the technology used for displays in notebook, TV & other appliances. Like LED and gas-plasma technologies, LCDs allow displays to be much thinner than cathode ray tube (CRT) technology. It displays the Energy Meter reading units and balance. A 16X2 LCD is connected with microcontroller at 7,8,9,10,11 and 12 pins to display the reading of varied sensors.

4.5 Relay

Single pole double throw (SPDT) relay is connected to port RBO of the micro controller through a driver transistor (Q1). The relay requires 12 V at a current of around 100 mA , which cannot provided by the micro controller. So the driver transistor is added. A relay is an electrical switch that uses an electromagnet to maneuver the switch from the off to on position rather than a moving the switch. It takes relatively alittle amount of power to turn on a relay but the relay can control something that pulls far more power.



FIGURE 5: Relay

VII. ADVANTAGES

1. IOT web based application.
2. Three way cable testing
3. Control and monitoring from anywhere.
4. Wifi based wireless interface.
5. Special softwares are not required for diagnosis.
6. Advanced sensing.

VIII. DISADVANTAGES

1. Arduino requires 5V dc.
2. Relay requires 12V dc.
3. Initial cost is high.

IX. CONCLUSION

The short circuit fault at a specific distance within the underground cable is found to rectify the fault efficiently using simple concepts of Ohms law. The work automatically displays the phase, distance and time of occurrence of fault with the assistance of Arduino MCU and ESP8266 Wi-Fi module in an exceedingly webpage. The benefits of accurate location of fault are fast repair to revive back the power system, it improves the system performance, it reduce the disbursal and therefore the time to locate the faults within the sector.

X. FUTURE SCOPE

In this project we detect only the location of short circuit fault in underground cable line. The work can be extended for open circuit fault and double Line to Ground Fault (LLG). The open circuit fault can be detected employing a capacitor in ac circuit which measures the change in impedance and calculate the distance of fault.

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