JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Microcontroller Based Cable Fault Detector Design Using GSM

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ABSTRACT

Modern Technology has profoundly transformed our world,impacting impacting almost every aspect of life from communication to health care to transportation and entertainment. In modern day there is a common problem with the electrical and electronic devices i.e Cable faults. Cable faults are common issues in electrical systems that can cause power outages, equipment damage and safety hazards. A cable fault occurs when there is damage to the insulation or conductor of an electrical cable, resulting in a loss of continuity or an unintended current path. There are three types of cable fault Open circuit fault, short circuit fault and insulation breakdown.. The objective of this project is to determine the distance of underground cable fault from the base station in kilometers and displayed over the internet. Underground cable system is a common practice followed in major urban areas. While a fault occurs for some reason, at that time the repairing process related to that particular cable is difficult due to exact unknown location of the fault in the cable. Proposed system is used to find out the exact location of the fault and to send data in graphical format to a dedicated website together with on board LCD display using a GSM module.

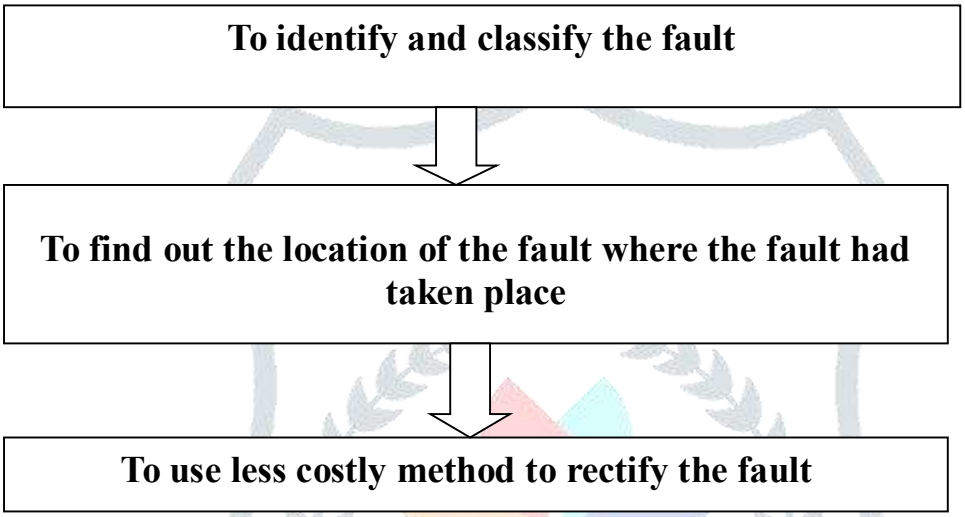
KEYWORDS: Cable Faults,loss of continuity,LCD,GSM Module,LCD.

I. INTRODUCTION

The project uses the standard theory of Ohms law, i.e., when a low DC voltage is applied at the feeder end through a series resistor (Cable lines), then the current would vary depending upon the location of the fault in the cable as the resistance is proportional to the distance. In case there is a short circuit (Line to Ground), the voltage across series resistors changes according to the resistance that changes with distance .This is then fed to an ADC to develop precise digital data which the programmed microcontroller of the 8051 family displays in kilometers.The project is assembled with a set of resistors representing the cable length in km and the fault creation is made by a set of switches at every known km to cross check the accuracy of the same. The fault occurring at a particular distance, the respective phase along with the distance is displayed on the LCD. The same information is also sent to a dedicated website over internet activated SIM with GSM, interfaced to the microcontroller. Furthermore, this project can be enhanced by using capacitor in an AC circuit to measure the

impedance which can even locate the open circuited cable, unlike the short circuited fault that uses only resistors in DC circuit as followed in the above proposed project.

II. THE OBJECTIVE OF THE PROJECT



III. LITERATURE REVIEW

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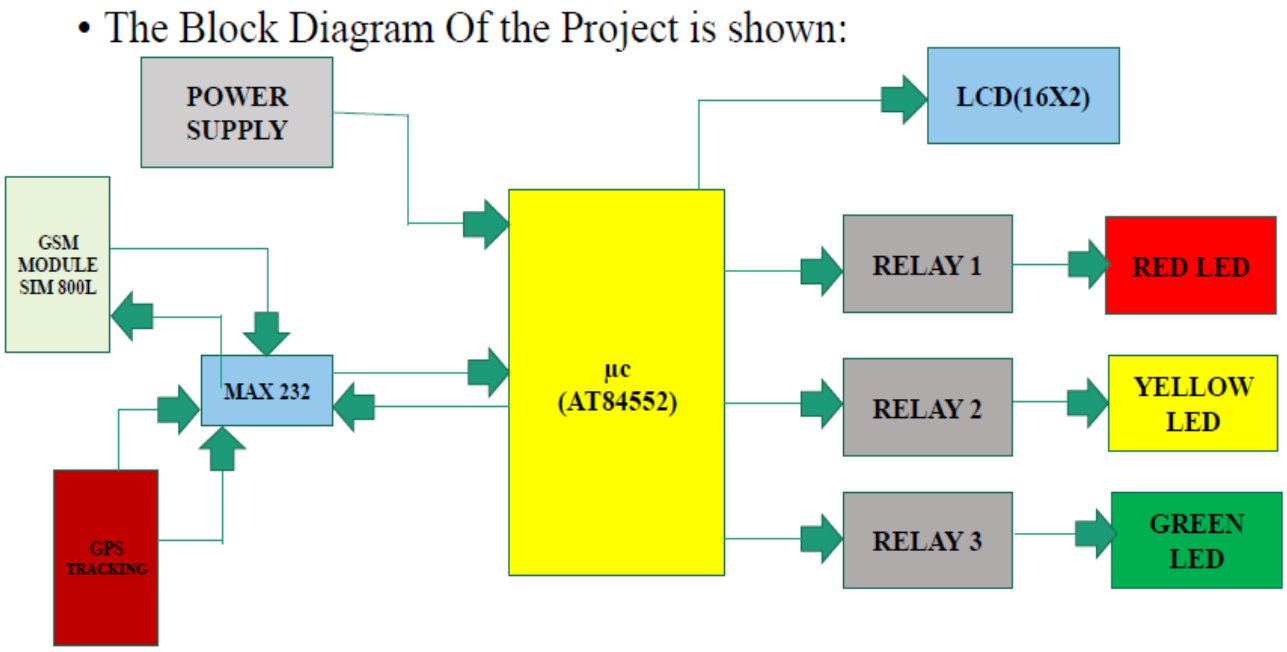
IV. WORKING

The project is assembled with a set of resistors representing the cable length in km and the fault creation is made by a set of switches at every known km to cross check the accuracy of the same. The fault occurring at a particular distance, the respective phase along with the distance is displayed on the LCD. The same information is also sent to a dedicated website over internet activated SIM with GSM, interfaced to the microcontroller.The project uses the standard theory of Ohms law, i.e., when a low DC voltage is applied at the feeder end through a series resistor (Cable lines),then the current would vary depending upon the location of the fault in the cable as the resistance is proportional to the distance. In case there is a short circuit (Line to Ground), the voltage across series resistors changes according to the resistance that changes with distance .This is then fed to an ADC to develop precise digital data which the programmed microcontroller of the 8051 family displays in kilometres.

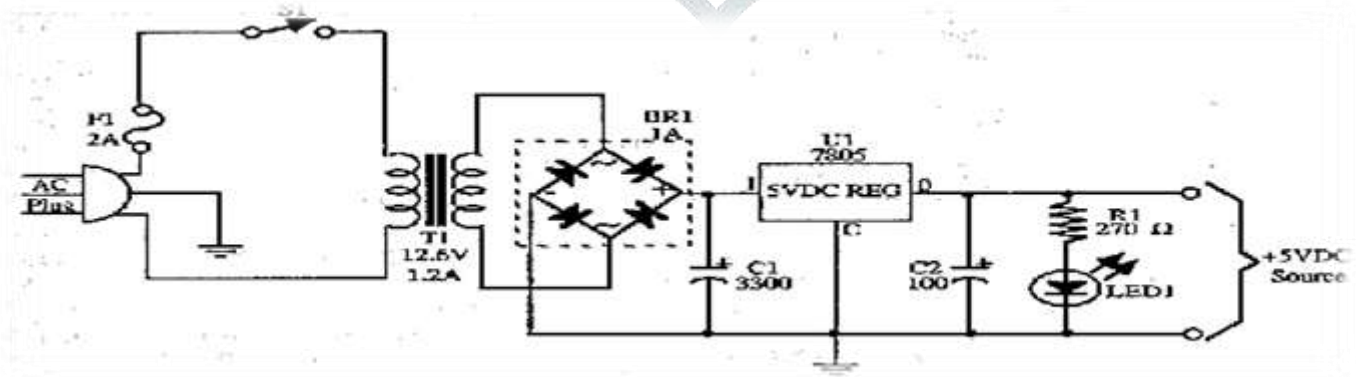
V. BLOCK DIAGRAM



VI. MODULES OF THE PROJECT

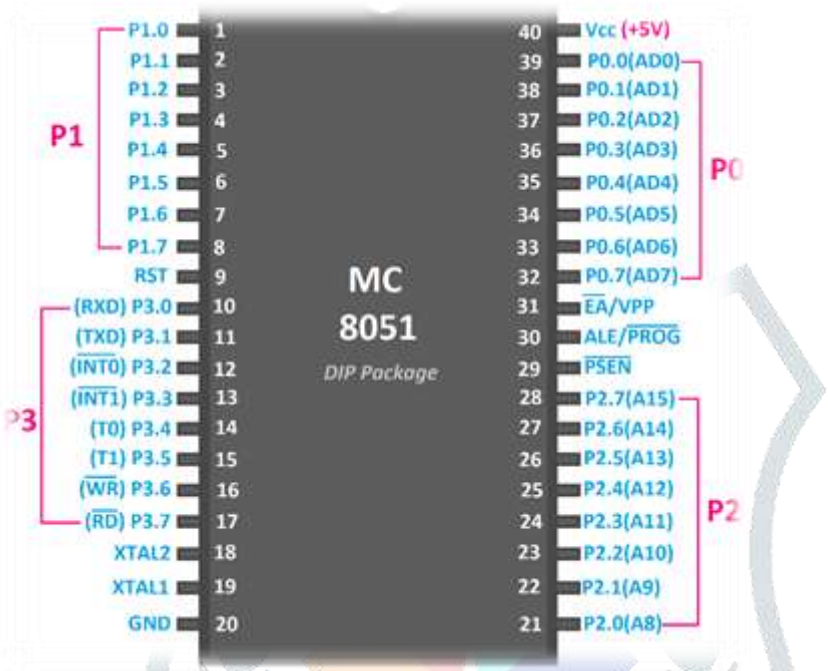
POWER SUPPLY

The strength deliver circuit includes step down transformer that's 230v step right all the way down to 12v. In this circuit 4 diodes are used to shape bridge rectifier which provides pulsating dc voltage after which fed to capacitor clear out the output voltage from rectifier is fed to clear out to dispose of any a.c. additives gift even after rectification. The filtered DC voltage is given to regulator to provide 12v steady DC voltage.



MICRO-CONTROLLER

8051 is one of the first most popular microcontroller also known as MCS-51. It was introduced by Intel in the year 1981. Initially it came out as N-type metal-oxide-semiconductor (NMOS) based microcontroller, but later versions were based on complementary metal-oxide-semiconductor(CMOS) technology. These microcontrollers were named as 80C51, where C in the name tells that it is based on CMOS technology. It is an 8-bit microcontroller which means data bus is of 8-bits. Therefore, it can process 8-bits at a time. It is used in wide variety of embedded systems like robotics, remote controls, automotive industry, telecom applications, power tools etc.

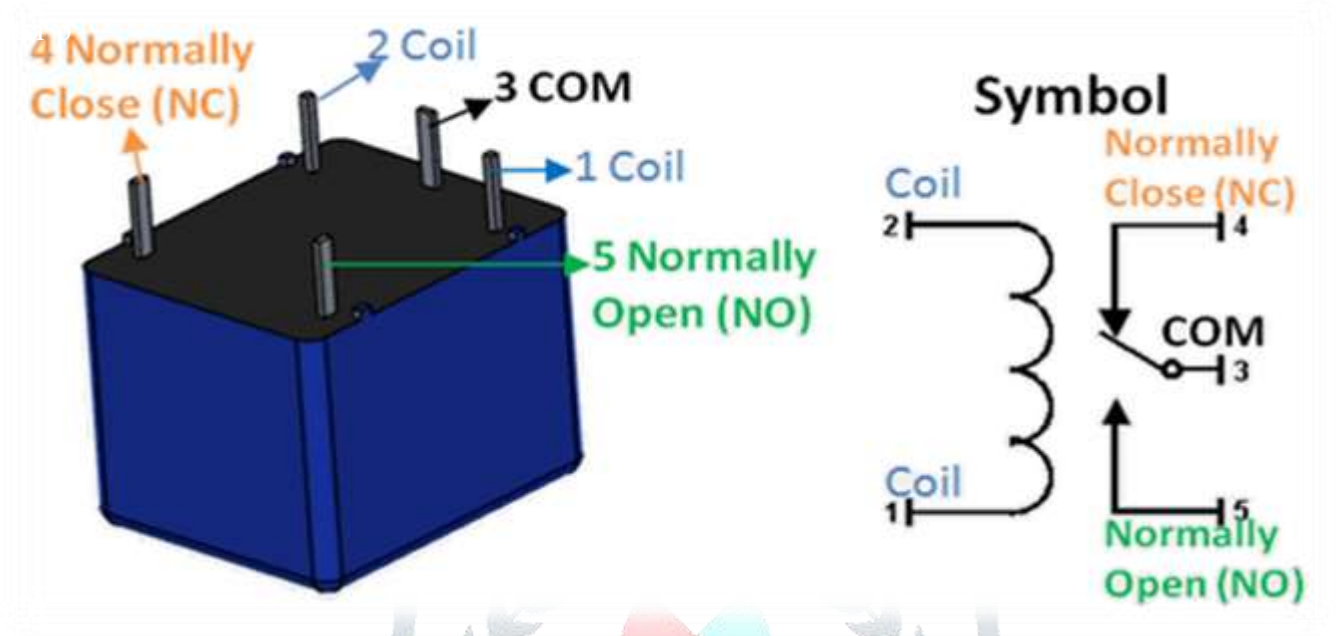


LCD

To display the numbers, alphabets and special characters an LCD module with 16x2 alphanumeric types is used. Using the higher bit data lines of LCD pins such as pin 11,12,13 and 14 are interfaced to digital pins of Microcontroller such as pin 8,9,10 in 4 bit mode as shown in the below figure. RS and E pins of LCD are connected to pin 12 and 13. To perform the write operation on LCD the read/write pin is connected to ground.

RELAYS

A relay is an electrically operated switch used to isolate one electrical circuit from another. In its simplest form, a relay consists of a coil used as an electromagnet to open and close switch contacts. Since the two circuits are isolated from one another, a lower voltage circuit can be used to trip a relay, which will control a separate circuit that requires a higher voltage or amperage. Relays can be found in early telephone exchange equipment, in industrial control circuits, in car audio systems.to mobiles



LIGHT EMITTING DIODE (LED)

A light-emitting diode (LED) is a semiconductor diode that emits incoherent narrow spectrum light when electrically biased in the forward direction of the pn-junction, as in the common LED circuit. This effect is a form Of electroluminescence.

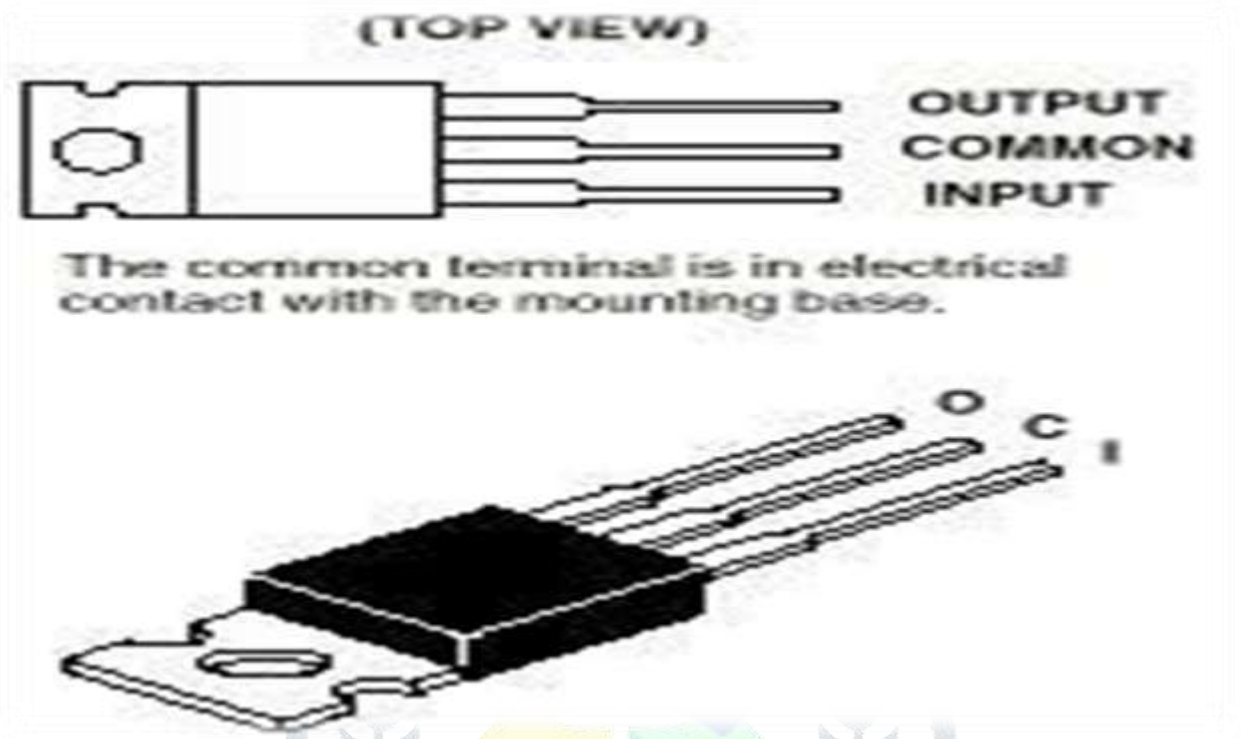
While sending a message in the form of bits such as 1,the data is sent to the receiver side correspondingly the LED glows representing when we send 8 as a data the LED gets off.

GSM

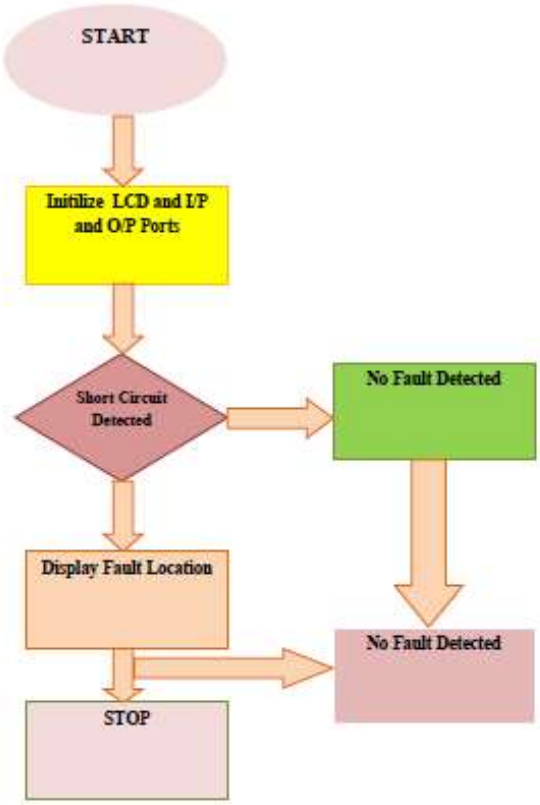
GSM (Global System for Mobile Communications, originally Groupe Special Mobile), is a standard developed by the European Telecommunications Standards Institute (ETSI).It was created to describe the protocols for second-generation (2G) digital cellular networks used by mobile phones and is now the default global standard for mobile communications – with over 90% market share, operating in over 219 countries and territories.

IC 7805

7805 is an integrated three-terminal positive fixed linear voltage regulator. It supports an input voltage of 10 volts to 35 volts and output voltage of 5 volts. It has a current rating of 1 amp although lower current models are available. Its output voltage is fixed at 5.0V. The 7805 also has a built-in current limiter as a safety feature. 7805 is manufactured by many companies, including National Semiconductors and Fairchild Semiconductors



VII. FLOW CHART



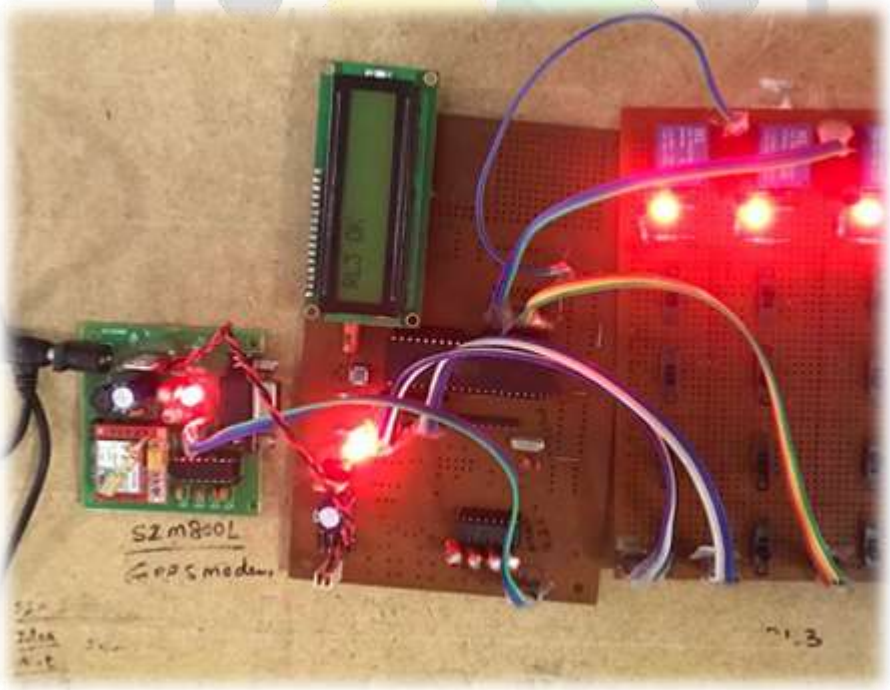
VIII. RESULT

The project entitled " Microcontroller BasedUnderground cable fault detector using GPRS" Here we use 800L SIM GPRS ,so we are enabling GPRS internet here we are using SIM card whose phone number is used in the project .With the help of thids SIM card we can calculate the latitude and the longitude of cell phone tower.

The circuit consists of a power supply, 4 line display, arduino and resistance measurement circuit. To induce faults manually in the kit, fault switches are used. About 12 fault switches are used which are arranged in three rows with each row having 4 switches. The 3 rows represent the 3 phases namely R,Y and B. The fault switches have 2 positions-No fault position(NF) and fault position(F).Main component of the underground

cable fault detection circuit is low value resistance measurement. It is constructed using a constant current source of 100mAmps. It can measure very low value resistance as the cables have around 0.01 Ohm/meter resistance. For 10meter cable resistance becomes 0.1 Ohm. This circuit can measure resistance up 50 Ohm, Maximum cable length it can check up to 4 kilometres. • So starting from the reference point 3 sets of resistances are placed in series. These 3 sets of resistances represent the three phases and the neutral. Short circuit faults, Symmetrical and unsymmetrical faults can be determined by this method. This project uses three set of resistances in series (ie)R10R11-R12- R12,R17-R16-R14R21,R20-R19-R18-R25 one for each phase Each series resistor represents the resistance of the underground cable for a particular distance and so here four resistances in series represent 1-3kms.Value of each resistance is 10kΩ. • One relay for each phase R,Y and B as three relays are used and the common points of the relays are grounded and the NO points are connected to the inputs of R17,R21 and R25 and being the three phase cable input. As supply needed for the relays is higher than that of the arduino, Relay driver is used to boost the supply and provide it to the relays. A 230V AC supply is applied to the transformer from where it is stepped down to 12V AC From the transformer the alternating current gets converted into direct current when it passes through a Bridge wave rectifier .The 12V DC then goes to the voltage regulator where it gets converted from 12V DC to 5V DC Voltage regulator is used also converts the variable Dc supply into constant DC supply.

This 5V DC is used to supply power to the arduino and the LCD Power supply to the LCD is given from the voltage regulator. • When fault is induced by operating any of the 12 switches (to F position),they impose conditions like LG,LL,LLG fault as per the switch operation. As a result of the fault, there is a change in voltage value. This voltage value measured across the resistance is fed to the ADC of the Microcontroller. Using this value, the Microcontrollercomputes the distance. Finally the distance of the fault from the location is obtained.



Picture representation of the Project with LCD,GSM and GPRS

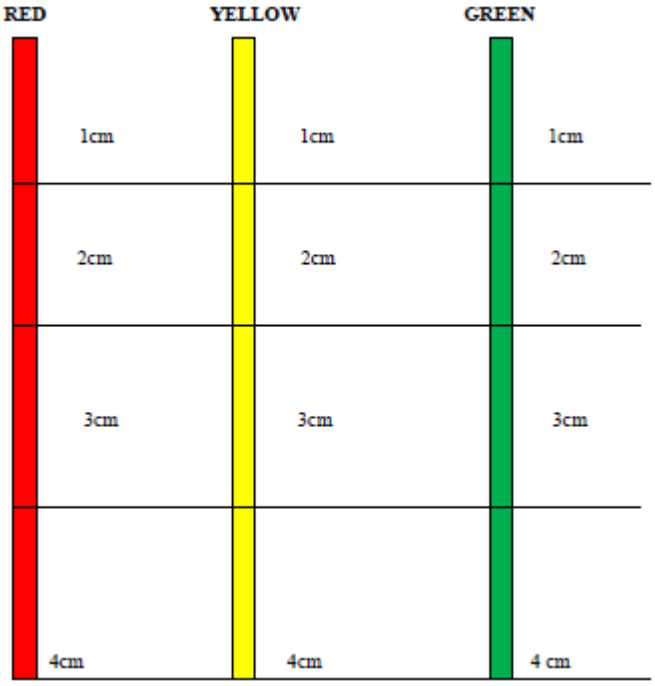
CABLES	DISTANCE (in Km)	FAULT	LOCATION OF FAULT	FAULT RECTIFIED
Red	1 cm	X	----------	----------
Yellow	1cm	X	----------	----------
Green	1cm	X	----------	----------
Red	2cm	X	----------	----------
Yellow	2cm	X	----------	----------
Green	2cm	X	----------	----------
Red	3cm	X	----------	----------
Yellow	3cm	X	----------	----------
Green	3cm	X	----------	----------
Red	4cm	X	----------	----------
Yellow	4cm	X	----------	----------
Green	4cm	X	----------	----------

Table showing no fault

CABLES	DISTANCE (in Km)	FAULT
Red	1 cm	X
Yellow	1cm	X
Green	1cm	X
Red	2cm	X
Yellow	2cm	√
Green	2cm	√
Red	3cm	√
Yellow	3cm	√
Green	3cm	√
Red	4cm	√
Yellow	4cm	X
Green	4cm	X

Table showing Fault

7.3 Diagramatic Representation of the Cable faults that took place in wire.



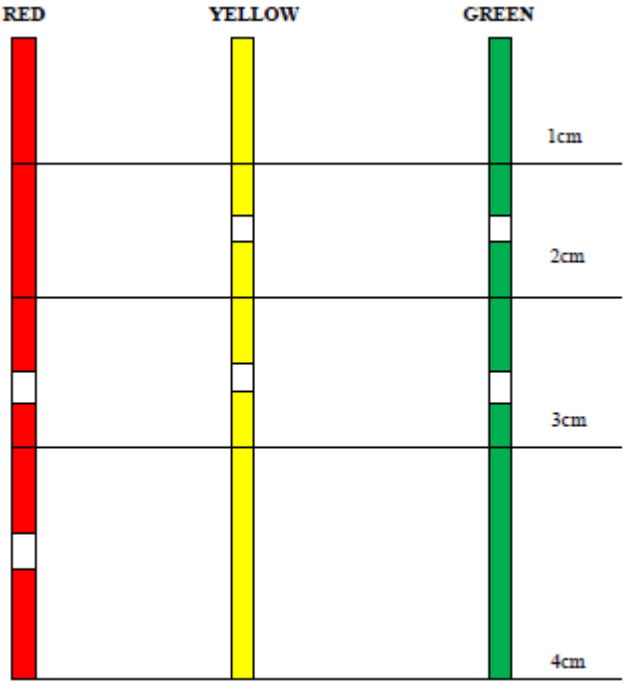


Fig.2.5 (b)Diagram showing Cable faults occurred in the in the cable

Received data of the fault through GSM and GPRS Module

IX. ADVANTAGES

- It has a low voltage drop.
- Low Maintanence.
- Low chances of fault occuring.
- Very suitable in the urban areas.
- Where overhead transmission lines are not easy to install.

X. DISADVANTAGES

- include higher initial costs,
- difficulty in locating faults,
- potential for more extensive repair work when faults occur.
- The inability to visually inspect the cables makes fault detection challenging, requiring specialized equipment and techniques.
- Additionally, underground systems can be susceptible to insulation failures and may require more complex protection schemes

XI. FUTURE SCOPE AND CONCLUSION

In this project we detect the precise area of cable fault with inside the cable insulation from feeder head to km with the aid of using Microcontroller. In future aspect we can make this type of model with more alteration for providing us exact location and information regarding the faut in case of long transmission lines. This model can be used by different Electricity companies or boards.

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