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Design and Implementation of Cable Analyser

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Abstract: This project is cable fault monitoring system, which is used to monitor the electrical problems in all three R, Y and B phases and also to locate the fault in the cable. The PC is connected to microcontroller through serial port; the microcontroller is also connected to R, Y, and B phases. From the front-end software, we check any over voltage, under voltage, over current phase-to-phase short, phase-to-neutral short has occurred. The cable tester implements the cable connectivity test by means of high- and low-level scanning. Analysing the cable various faults in single desk by identifying the problems using open circuit test/short circuit tests, sequence tests and shield grading. The above test will complete the task with duration of minimum 2 minutes and maximum 7 minutes based on the number of sockets/ports.

Keywords: **cable, electrical problems, fault monitoring.**

I. INTRODUCTION

Locating cable faults can be quite challenging even though there are a number of fault location techniques and a few tools to help with underground cable faults. Most of these issues are due to technicians not properly interpreting the test results and then selecting the wrong tool for the task at hand, and ultimately a lot of wasted time is due to taking a shortcut in the process. The challenges of locating underground faults can be significantly minimized by understanding the available equipment and techniques. Education and cable fault position knowledge will help to correct and improve the understanding of the findings and will certainly help to correct and improve the range of which equipment and technique is most appropriate for a particular task. But only a high level of awareness will correct wasted time which is afforded by taking shortcuts.

In our project we can check the cable fault's like open circuit/short circuit in the cable as well as we can check the exact location where the fault is occurred in the cable, to improve the test method and to improve the test efficiency, an easy-to-operate and portable communication cable tester is designed to test the connectivity of common interfaces (DB25, DB15, DB9) cable and visually present the test results. The main circuit is composed of power Supply circuit, time-based circuit, decoding circuit, interface and display circuit, using controller. According to a certain order, the circuit can directly display the status of various condition of each core of the cable. Algorithm pre-computes a roadmap of the environment by using a variant of the probabilistic roadmap method (PRM) and performs constrained sampling near the contact space.

II. RELATED WORK

In the earlier stage the cable testers used the multimeter to find whether the cable is good or not.,. Then after to it the equipment was arrived for large area cable testing which finds the cables fault as well as to locate the fault in the cable. In order to improve the test efficiency there are many ways to find the cables fault using the below methods.

A. THUMPING A CABLE:

A technique called condenser discharge technique or thumping a cable is one of the oldest and most popular techniques out there. The surge wave generator, creates a high voltage surge which is launched out onto the faulted cable. This energy surge will travel along the conductor of cables. If it reaches an area of dielectric breakdown or a failure in the insulating material, the transmitted energy discharges at fault through the gap and discharges all the energy through the failed insulation. All of the fault current will then return to the surge wave generator via the neutral or shield on the cable, and then safely dissipate to the earth's potential. If a several thousand-volt surge is sent into the cable, and all that energy is discharged through the gap or fault, a small explosion will result. This small explosion, buried in the ground, will cause a percussion and sound wave to travel up through the layers of earth. As a consequence, a thumping sound can be felt on the surface of the earth. To locate the defect in the underground cable, a repair crew has to walk along the surface of the ground listening for this thumping sound. Once the fault is pinpointed, the crew is digging a hole and repairing the failed cable.

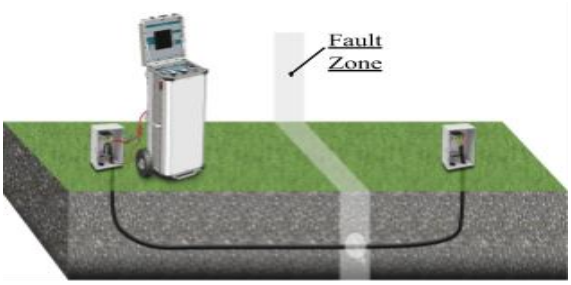

Fig.1 Capacitive discharge

B. PULSE ECHO METHOD:

A time domain reflectometer (TDR) is used to conduct the pulse echo technique, which incorporates a transmitter and a receiver. The transmitter sends a short-lived, low-voltage, high-frequency pulse to a cable. This pulse of energy travels along the surface of the cable until it encounters some type of disruption manifested in a change within the characteristic impedance of the cable; Such differences in the cable's characteristic impedance which be induced by the start of the cable, cable splices, transformers, faults etc. Depending upon the magnitude of the impedance change, either part or all of the transmitted energy reflects and travels back to the time domain reflectometer. Essentially, this technique creates an underground cable electronic or graphical roadmap showing various events along that path. The elapsed time of a transmitted pulse traveling the entire length of a cable and the pulse reflections produced by deviations from the harmonious structure of the cable are shown on a screen. These reflections are then shown in a time sequence.

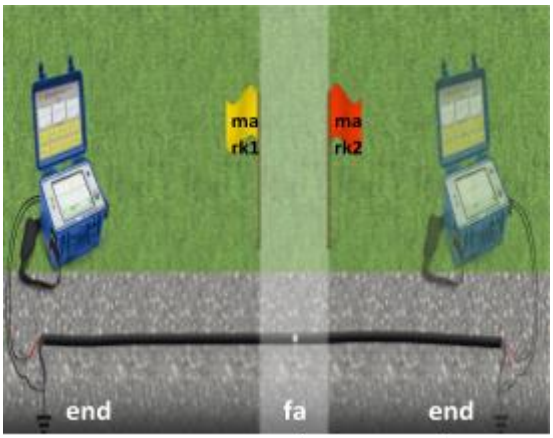

Fig.2

C. ARC REFLECTION TECHNIQUE (ARC):

The technique of Arc Reflection (ARC) combines the surge wave generator (thumper) and the pulse echo technique (TDR) for the purpose of locating high resistance shunt faults and intermittent although the pulse echo technique is a very good tool for a low voltage cable application, a problem occurs when this method is used on medium voltage electrical power cables.

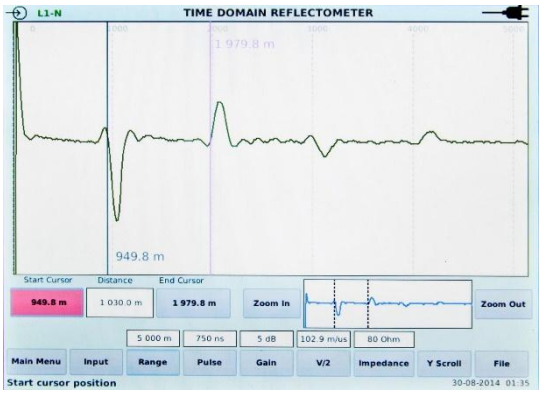

Fig.3 velocity of propagation checking

A breakdown voltage is typically required to locate ventilated trees, which basically form a hole in the insulation. The pulse echo tool by itself is very low voltage in nature. So, if the fault requires some degree of voltage breakdown, the low voltage pulse echo energy will travel straight past the fault never seeing it. The TDR will just show the reflection of energy off the terminating event or the end of the cable.

Yet, if a high voltage breakdown surge is applied at the same time that the pulse echo pulses are sent, when the fault breaks down due to the high voltage surge and the arc jumps through the faulty insulation, the pulse echo wave will reflect off that arc. For the ARC, a coupling device (a filter, or a power separation unit) is introduced into the circuit allowing the high voltage surge generator and low voltage time domain reflect meter to be combined simultaneously to the faulted cable. The function of the surge generator is simply to transmit a high voltage surge into the faulted cable. This surge momentarily reduces the resistance of the shunt fault. The pulse echo technique is applied during the time-interval of high voltage impulse.

III. PROPOSED WORK

In order to improve the test method and to improve the test efficiency, an easy-to-operate and portable communication cable tester is designed to test the connectivity of common interfaces (DB25, DB15, DB9) cable and visually present the test results.

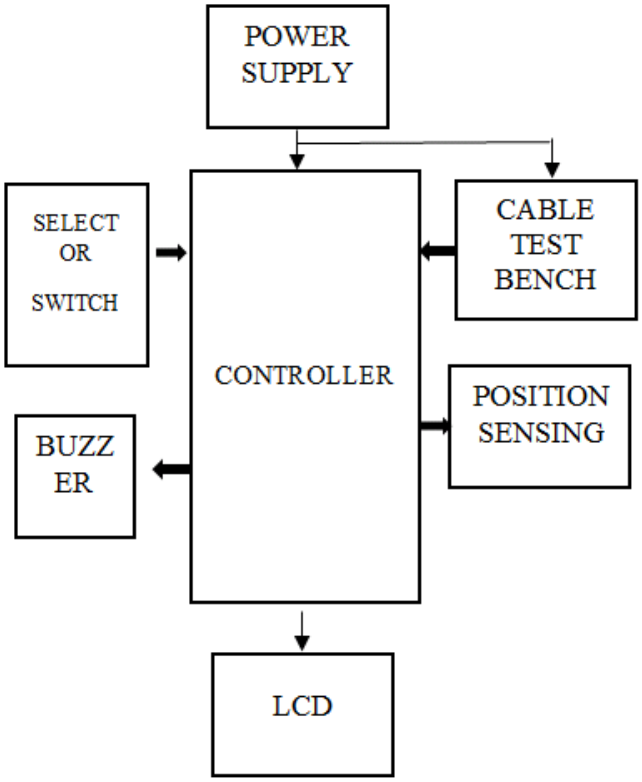

Fig.4

Analysing the cable various faults in single desk.

1. Open circuit test/short circuit

2. Sequence test

3. Shield grading

IV. HARDWARE

The system design consists of both hardware and software system. The various hardware systems are explained as follows,

A. ARDUINO UNO:

Arduino Uno is a microcontroller board based on the ATmega 328P.The current version of Arduino Uno has 14 digital I/o ports, 6analog input pins and these pins are marked as A0-A5 and has a resolution of 10bits.It allows the designers to control and sense the external electronic devices in the real world. Arduino Uno has USB ports to develop serial communication with the kit.

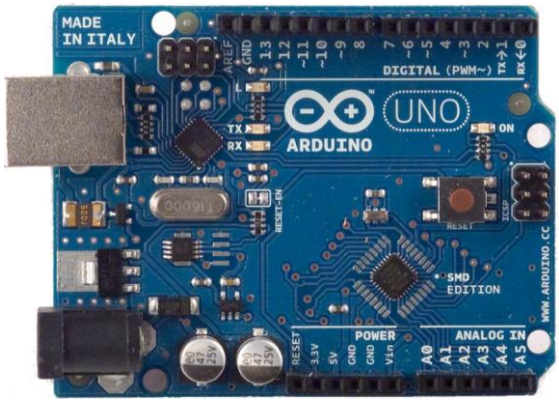

Fig.5. Arduino Uno Module

B. POWER SUPPLY (ADAPTER):

The power supply adapter used here is voltage regulator IC7812, in which we can access the 12v DC supply by giving the 230v AC in the input side .and here there are two bridge rectifiers to maintain the current volts in a specific range for the supply.

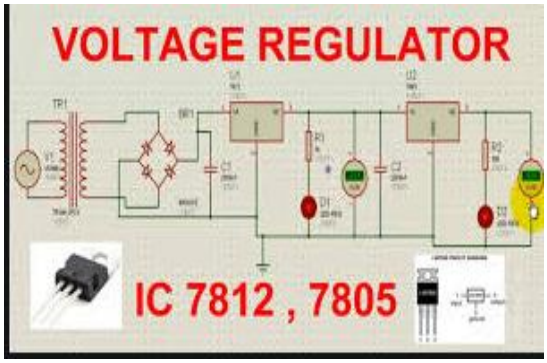

Fig.6 Power supply

C. CABLE SPECIMEN:

In this project, the cable which is used to monitor the electrical problems in all three R, Y and B phases are will be a copper isolated sheath wounded one and also to locate the fault in the cable, the specific resistance of the cable is calculated.

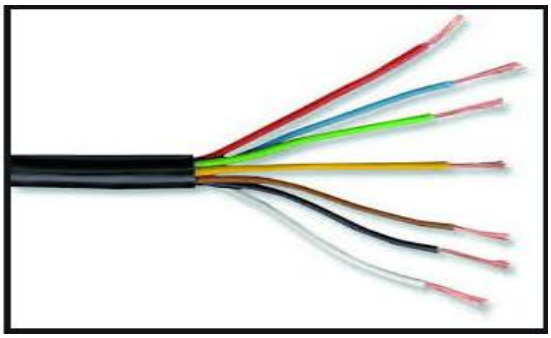

Fig.7

D. LCD DISPLAY

It is an electronic display module. The 16*2 LCD display is a basic module which can display 16*2 alphanumeric dot matrix display and can display 224 different characters and symbols. Contrast of the display can be adjusted with the help of potentiometer to be connected across VEE pin. It has low power consumption than LED's.

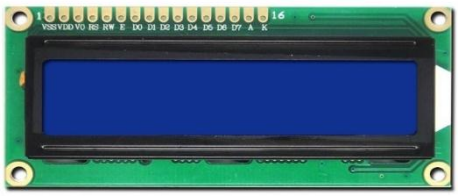

Fig.8. 16x2 LCD display

V. SOFTWARE

Arduino is a open source prototyping platform which helps the users to create communication between electronic objects. The open source IDE (Integrated Development Environment) makes it easy to write the code and upload it to the board. Almost all Arduino modules are compatible with this software and is easy to download and install and start compiling the code instantly. The main code known as sketch is created on a IDE platform which will generate a HEX file when compiled and which when transferred and uploaded in the controller on the board and the result is observed.

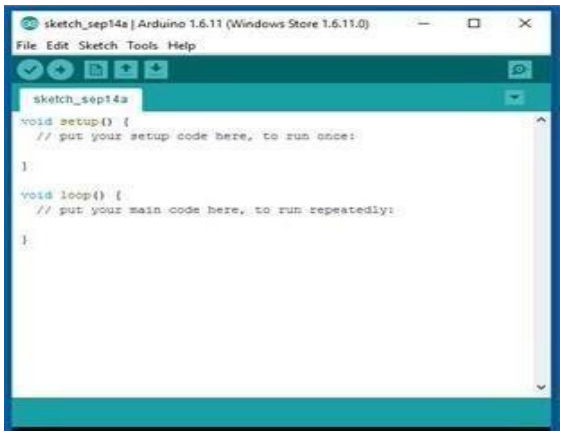

Fig.9. Arduino IDE

VI. FUTURE SCOPE

In future, this cable testing method is used to find a many number of cables in a huge dense area by connecting two or three kit deepened upon the count of cables the kits are connected with AI(artificial intelligence) to a common host and to link it with the CAN(Control Area Network) in order to check a large scale sector in a single time with less complexity from our front end software. By this there is many advantages in future for cable monitoring engineers as well as in quality control department of any cable manufacturing industry.

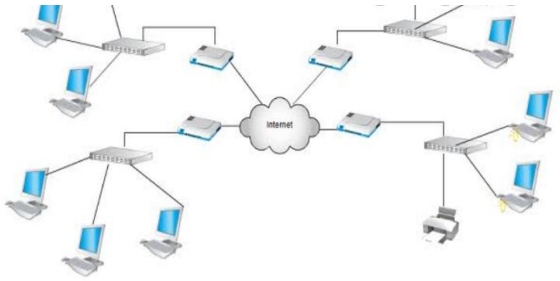

Fig.10

VII. RESULTS AND DISCUSSIONS

In this project we have developed a front-end system for cable testers to check the cable whether it has a fault in it and is there is a fault it will locate the exact location where the interception occurs. Our proposed system has the following results:

1. Analysing the cable various faults in single desk.

2. The tests like Open circuit test/short circuit test, Sequence test and Shield grading 3. The health status of the cable is checked and will be displayed in the LCD display.

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