Implementation of IOT to Detect and Display Underground Cable Fault

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ABSTRACT **- This paper 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 followed in major areas in Metro cities. While a fault occurs for some reason, at that time the fixing process related to that particular cable is difficult due to exact unknown location of the fault in the cable. This IOT Technology is used to find out the exact location of the fault and to send data in graphical format to our website using an IOT module at the same time it display on the LCD screen. This paper 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.**

Keywords: **Microcontroller, Relays, ADC, Underground cable Fault and 230v power supply**.

I INTRODUCTION

In the urban areas, the electrical cable runs underground instead of overhead lines. Whenever the fault occurs in underground cable it is difficult to detect the exact location of the fault for process of repairing that particular cable. The proposed system detects the exact location of the fault and by the means of IOT it's serially communicated towards server. Since problem that occurs in underground cable is a big problem till now. As it is very difficult to find the exact location or faulty location manually, which suddenly affects the efficiency of the cable wire due to losses occurred. Till now many techniques had already been implemented in order to detect fault in cable wire. But the problem came up is how to detect fault in cable wire when it is under grounded, and how to access or retrieve those data related to faulty location whenever it is required. In order to fill those gaps, we proposed the system which detects the exact location of the fault and through the means of IOT it's serially communicated towards server. Through previous researches many techniques came up which were useful to overcome the problem up to some extent. In one of the paper by K.Hasan, et.al. says that-failure and degrading of air craft wiring is a big concern which could further lead to fire and smoke because of arcing .But the proposed technique based on TDR ,in which train of pulses are generated in order to detect the fault[2].

Till now electrosurgical being a one of the major problem for the researchers in one of the paper proposed Robert.d.Gross,a et.al. says that a problem of an electrosurgical grounding which lead to a severe burn was reduced at some extent through a technique proposed of electrosurgical grounding pad which consist of a temperature sensor and alarm .With the help of temperature sensor faulty location is being caught before it started producing burn, on the other hand alarm detect the faulty location with problem and alerts the operator in a control room about the burn[3].

The problems and the techniques we discussed above were the best way of dealing with the problem only when we consider inorder to alert the personnel, what if along with the alerting about the faulty location if we maintain proper data about that location and the fault and serially communicating the data towards the server from where the information can be retrieved through IOT (Internet of things).When we talk about the term IOT it is the best way of mitigating any problem as through this all object become interconnected and smart. Through previous researches we made a conclusion that when we are talking about underground fault it really becomes a tough job so in our proposed system we are using current sensor that has to be placed along with the underground cable which after detecting fault will serially communicate the data towards the server with the help of Wi-Fi modem from where information can be retrieved through IOT.

II INTRODUCTION TO EMBEDDED SYSTEM

An embedded system is a system which is going to do a predefined specified task is the embedded system and is even defined as combination of both software and hardware. A general-purpose definition of embedded systems is that they are devices used to control, monitor or assist the operation of equipment, machinery or plant. "Embedded" reflects the fact that they are an integral part of the system. At the other extreme a general-purpose computer may be used to control the operation of a large complex processing plant, and its presence will be obvious. All embedded systems are including computers or microprocessors. Some of these computers are however very simple systems as compared with a personal computer.

III SYSTEM DESCRIPTION

The main concept of this project is to find the distance of underground cable fault from the base station in kilometers. In many urban areas, cable fault is a common problem. When a fault occurs due to some reason, the process of fault tracking without knowing the location related to that particular cable is very difficult. The proposed system is designed to track the exact location of the fault occurred in the cable. This project uses Ohms Law concept, when a low voltage DC is applied to the feeder end through a series resistor, then the current would differ based on the location of fault occurred in the cable. In case is there any short circuit occurred from line to ground, then the voltage across series resistor alters accordingly, then it is fed to an analog to digital converter to develop exact data, which the preprogrammed ATMEL AT89S52 microcontroller will display in kilometers.

The proposed system is designed with a set of resistors to signifying the length of a cable in kilometers, and the fault creation is designed with a set of switches at every known kilometer (KM) to cross check the exactness of the same. The fault happening at a specific distance and the particular phase is displayed on an LCD interfaced to the microcontroller ATMEL AT89S52.

IV WORKING PRINCIPLE

To detect the fault we are implementing the method of voltage drop through resistance network. When a particular media is grounded at different location it provides us different level of analog signal(voltage).The analog signal has to be convert into digital form so that it can be represent with numerical value. To interface the 0804 total 11 I/O pins are required. The 8I/O pin to transfer digital data from ADC to microcontroller, one I/O pin for RD, one I/O pin for WR and one I/O pin for interrupt. When we ask the ADC to convert a analog signal to digital it assume a specific amount of time i.e we can get actual result only after 100% conversion. The INTR pin solve the problem for us. The program executing the microcontroller continuously monitors the interrupt pin and read the data from port 2 only after 100%conversion. The program executing in the microcontroller is responsible for converting the ADC value to resistance value and the resistance value is converted into distance of fault. We are using a single channel ADC. Hence a changeover circuit is necessary to monitor a specific line at a specific time. To do so we have create 3 way exchanger switch with the help of switching transistor SPDT electromagnetic relay and fly diode to protect from reverse current. The 3 relays are driven by relay driver circuit based on 2N2222 from Philips. The base of the transistors are connected to pin number 15, 16& 17 i.e P3.5, P3.6 & P3.7. As 8051 cannot gives us effective high, it is not possible to

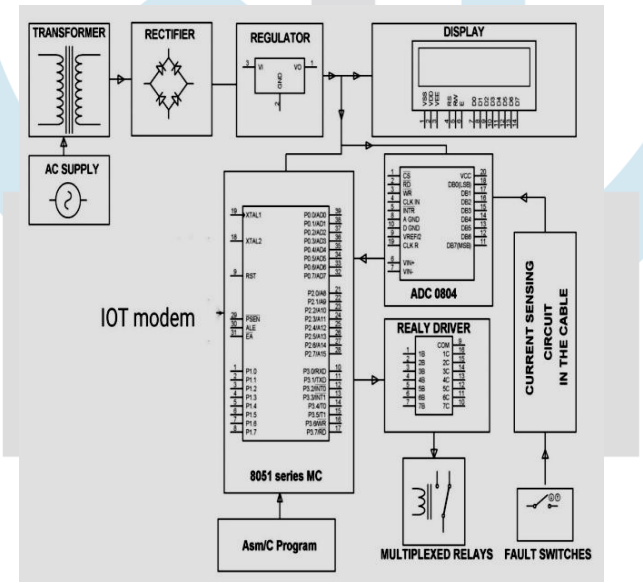

Fig.1**:** Block Dig. of implementation of iot to detect and display underground cable fault

activate the driver without external pull up. Hence 4.7K pull resistance is connected across base and Vcc. When there is no presence of effective high voltage, the internal resistance between emitter and collector are high and it will not allow to flow current. But when the base have a effective high positive voltage the internal resistance between emitter and collector drops and current flows from collector to emitter. One terminal of the relay coil is connected with the collector of the transistor and other terminals of coils are connected with +12V. As we are using electromagnetic relay. The transistor will be affected by reverse current which will effect the driver circuit. As to protect the reverse current a rectified diode IN4007 is connected parallel to the relay coil as fly diode. The program executed in the microcontroller is controlling the relay driver circuit in specific sequence to connect with the specific ground cable and to read the ADC value, to get the information about prospective fault.

V MICROCONTROLLER

Microprocessors and microcontrollers are widely used in embedded systems products. Microcontroller is a programmable device. A microcontroller has a CPU in addition to a fixed amount of RAM, ROM, I/O ports and a timer embedded all on a single chip. The fixed amount of on-chip ROM, RAM and number of I/O ports in microcontrollers makes them ideal for many applications in which cost and space are critical.The Intel 8052 is Harvard architecture, single chip microcontroller (µC) which was developed by Intel in 1980 for use in embedded systems. It was popular in the 1980s and early 1990s, but today it has largely been superseded by a vast range of enhanced devices with 8052-compatible processor cores that are manufactured by more than 20 independent manufacturers including Atmel, Infineon Technologies and Maxim Integrated Products.8052 is an 8-bit processor, meaning that the CPU can work on only 8 bits of data at a time. Data larger than 8 bits has to be broken into 8-bit pieces to be processed by the CPU. 8052 is available in different memory types such as UV-EPROM, Flash and NV-RAM.The present project is implemented on KeiluVision. In order to program the device, proload tool has been used to burn the program onto the microcontroller. The features, pin description of the microcontroller and the software tools used are discussed in the following sections.

VI ANALOG TO DIGITAL CONVERTER

An analog-to-digital converter (ADC) is a system that converts an analog signal, such as a sound picked up by a microphone or light entering a digital camera, into a digital signal. An ADC may also provide an isolated measurement such as an electronic device that converts an input analog voltage or current to a digital number proportional to the magnitude of the voltage or current.

Typically the digital output is a two's complement binary number that is proportional to the input, but there are other possibilities. There are several ADC architectures. Due to the complexity and the need for precisely matched components, all but the most specialized ADCs are implemented as integrated circuits (ICs).

VII INTRODUCTION TO IOT

British entrepreneur Kevin Ashton coined the term in 1999 while working at Auto -ID Labs (originally called Auto-ID centers, referring to a global network of objects connected to radio, or RFID). Typically, IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine (M2M) communications and covers a variety of protocols, domains, and applications. The interconnection of these embedded devices (including smart objects), is expected to usher in automation in nearly all fields, while also enabling advanced applications like a smart grid, and expanding to the areas such as smart cities.The internet of things (IoT) is the network of physical devices, vehicles, buildings and other items— embedded with electronics, software, sensors, and network connectivity that enables these objects to collect and exchange data. In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IoT as "the infrastructure of the information society." The IoT allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit; when IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, homes, intelligent and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure. The expansion of Internet-connected automation into a plethora of new application areas, IoT is also expected to generate large amounts of data from diverse locations, with the consequent necessity for quick aggregation of the data, and an increase in the need to index, store, and process such data more effectively. IoT is one of the platforms of today's Smart City, and Smart Energy Management Systems.

VIII RESULTS

Thebelow Fig.2shows the fault occuring in underground cables. it is displayed on LCD screen as well as send to the dedicated website/url as follows. In that particular website we could view the graphical analysis of the faults in underground cables.

Fig. 2 Graphical Representation of fault in underground cables

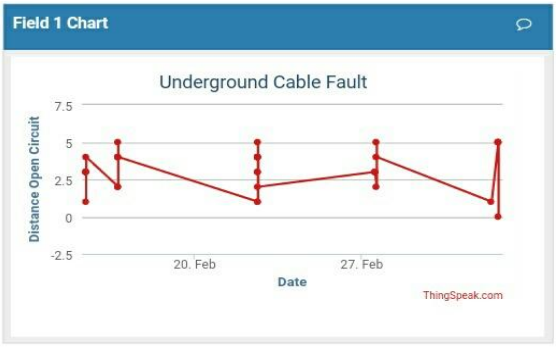

Fig.3 Graphical representation of open circuit faults

In the above Fig.3 Field1 chart shows the graphical representation of the open circuit fault in underground cables, it shows on the LCD Display as well as sending like this on website/url. In case there is a open circuit occurs,the voltage across the series resistors changes according to the resistance that changes with the distance. Then fed to an ADC to implement precise digital data which the programmed microcontroller displays in kilometers and dedicated website/url.

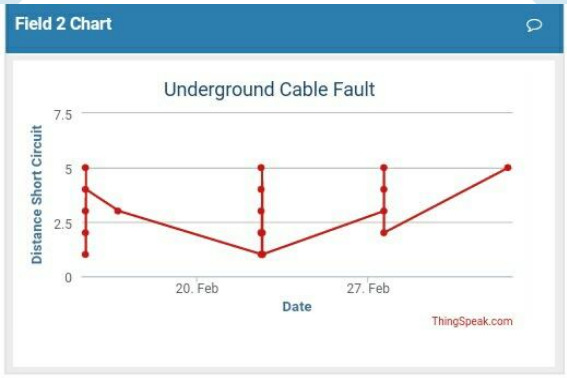

Fig.4 Graphical representation of short circuit faults

From Fig.4Field2 chart shows the graphical representation of the short circuit fault in underground cables, it shows on the LCD Display as well as sending like this on website/url. In case there is a short circuit occurs ,the voltage across the series resistors changes according to the resistance that changes with the distance. Then fed to an ADC to implement precise digital data which the programmed microcontroller displays in kilometers and dedicated website/url.

IX CONCLUSION

This paper determined the distance of underground cable fault from the base station in kilometers and displayed over the internet using the standard theory of Ohms law. The fault occurring at a particular distance is displayed on the LCD. The same information is also sent to a dedicated website over internet (IOT) interfaced to the microcontroller.

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