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Design & Implementation Of Fault Identification In Underground Cables Using IOT

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Abstract - *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 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 Technology is used to find out the exact location of the fault and to send data in graphical format to our website using a GSM module at the same time it display on the LCD screen.*

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.

Key Words: Microcontroller, Relays, ADC, Underground cable Fault and 230v power supply.

1.INTRODUCTION To IoT *(Size 11 , cambria font)*

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.

1.1 Introduction To Embedded System

An Embedded System is a combination of computer hardware and software, and perhaps additional mechanical or other parts, designed to perform a specific function.

An embedded system is not a computer system that is used primarily for processing, not a software system on PC or UNIX, not a traditional business or scientific application. High-end embedded & lower end embedded systems. High-end embedded system - Generally 32, 64 Bit Controllers used with OS. Examples Personal Digital Assistant and Mobile phones etc .Lower end embedded systems - Generally 8,16 Bit Controllers used with an minimal operating systems and hardware layout designed for the specific purpose. Examples Small controllers and devices in our everyday life like Washing Machine, Microwave Ovens, where they are embedded in.

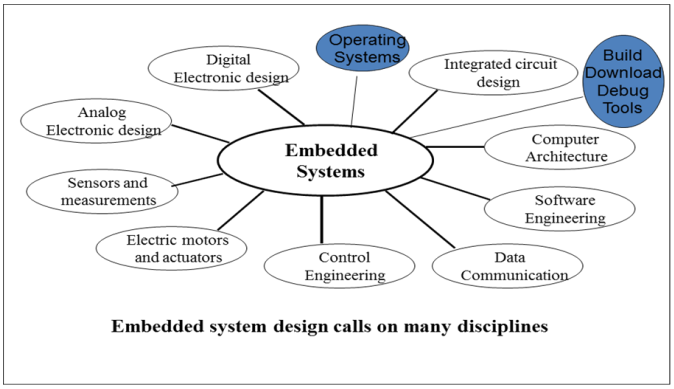

Fig.01: System Design Calls.

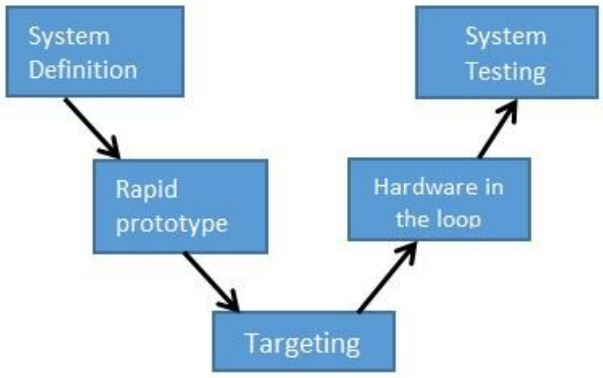

Fig.02: Embedded System Design Cycle ("V" Diagram)

1.2 Characteristics of Embedded System

- An embedded system is any computer system hidden inside a product other than a computer.
  - Response–Our system may need to react to events quickly
  - Throughput – Our system may need to handle a lot of data in a short period of time.
  - Debugability–Without a screen or a keyboard, finding out what the software is doing wrong (other than not working) is a troublesome problem
  - Memory space – Memory is limited on embedded systems, and you must make the software and the data fit into whatever memory exists
  - Testability–Setting up equipment to test embedded software can be difficult
  - Program installation – you will need special tools to get your software into embedded systems
  - Reliability – embedded systems must be able to handle any situation without human intervention
  - Power consumption – Portable systems must run on battery power, and the software in these systems must conserve power
  - Processor hogs – computing that requires large amounts of CPU time can complicate the response problem
  - Cost – Reducing the cost of the hardware is a concern in many embedded system projects; software often operates on hardware that is barely adequate for the job.

Embedded systems have a microprocessor/ microcontroller and a memory. Some have a serial port or a network connection. They usually do not have keyboards, screens or disk drives.

2. DESIGN OF THE SYSTEM

The project uses the- 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. At the same time the same information is also sent to a dedicated website/url over internet with the help of data enable activated SIM with GSM, which is interfaced to the microcontroller.

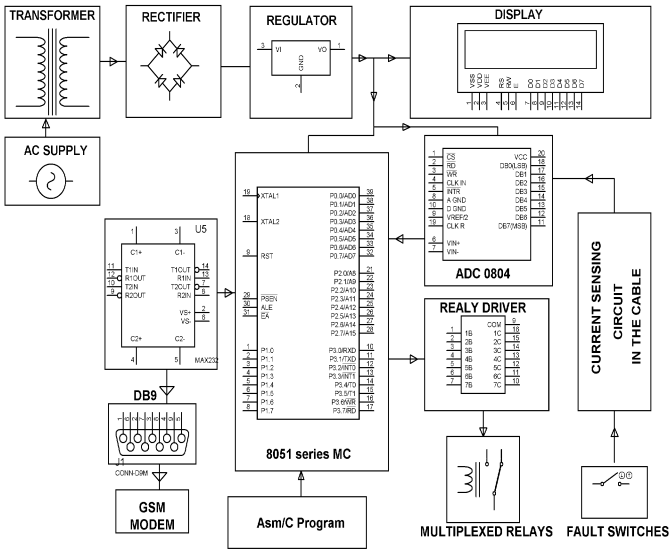

Fig.03: Block Dig. Of Design & Implementation of Fault Identification In Underground Cable Using IOT.

2.1 Microcontroller 8015 :

The Intel 8051 is an 8-bit microcontroller which means that most available operations are limited to 8 bits. There are 3 basic "sizes" of the 8051: Short, Standard, and Extended. The Short and Standard chips are often available in DIP (dual in-line package) form, but the Extended 8051 models often have a different form factor, and are not "drop-in compatible". All these things are called 8051 because they can all be programmed using 8051 assembly language, and they all share certain features (although the different models all have their own special features).

Some of the features that have made the 8051 popular are:

- 4 KB on chip program memory.
- 128 bytes on chip data memory(RAM)[32 bank reg + 16 bit addressable reg + 80 general purpose reg]
- 4 reg banks.
- 128 user defined software flags.
- 8-bit data bus
- 16-bit address bus
- 16 bit timers (usually 2, but may have more, or less).
- 3 internal and 2 external interrupts.
- Bit as well as byte addressable RAM area of 16 bytes.
- Four 8-bit ports, (short models have two 8-bit ports).
- 16-bit program counter and data pointer.
- 1 Microsecond instruction cycle with 12 MHz Crystal.

8051 models may also have a number of special, model-specific features, such as UART, ADC, Op_Amps, etc... it is a very powerful micro controller.

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 this Technology.

The major proposed building blocks of this project are:

- LCD to display the meter readings.
- Display on the dedicated website/url.
- Microcontroller based control system with regulated power supply.
- Digital/ Conventional Energy Meter interfacing with microcontroller.
- GSM Modem using RS232 serial communication for remote communication.

2.2Analog 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).

2.3 Product Specification:

- Operating Frequency:-Quad Band 850/900/1800/1900 MHz
- Operating voltage:- 230 VAC, 50 Hz
- Output Notification :- LCD Display
- Antenna:- Wired antenna
- Serial connectivity:-DB9 female connector
- Power (Max.):-2 W
- SIM card type:-standard card
- GSM range indication:-LED indication
- Max. Baud rate :- For GSM operation -9600 bits/sec
- TCP /IP stack access via AT commands.

2.4 PRACTICAL RESULT:

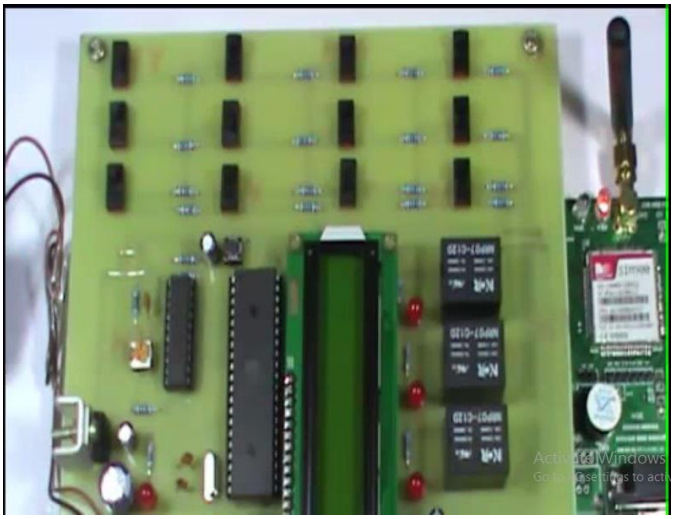

Fig.04: Testing Microcontroller & GSM Modem.

The above Fig. Shows the Proper Testing of microcontroller & GSM modem.

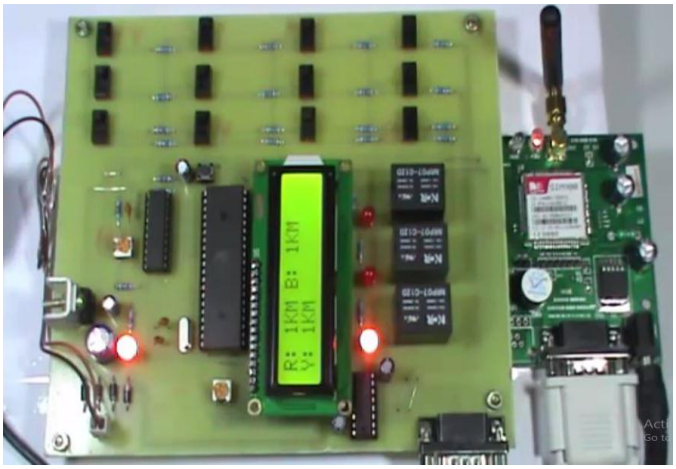

Fig.05: Fault Occurs in R, B, Y Lines At 1Km.

The Fig.03. Shows the fault occurs in R, B, Y Cables 1 kilometers. It is display on the LCD screen as well as send to the dedicated website/url. As follows:

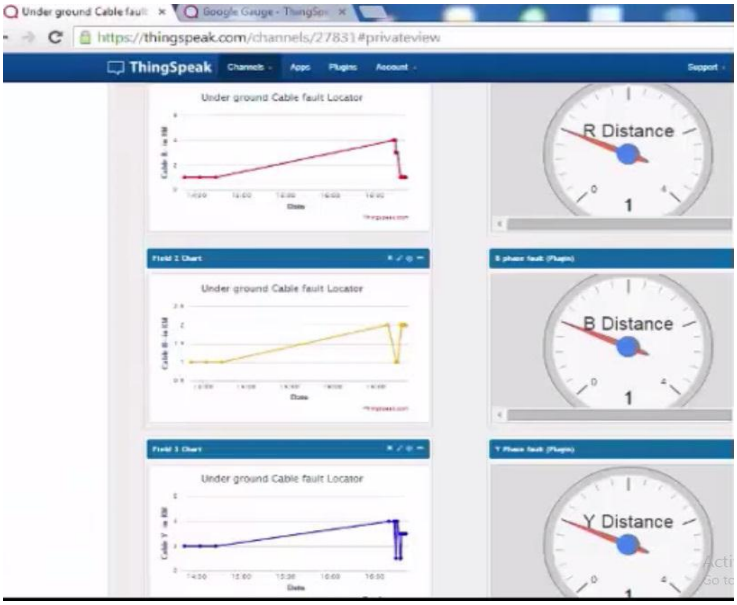

Fig.06: Graphical Representation of 1 Km Fault in R, B, Y cables.

In the above Fig. it shows the graphical representation of the 1 Km fault in R, B, Y cables, it shows on LCD Display as well as sending like this on website/url.
In case there is a short circuit (Line to Ground), the voltage across series resistors changes according to the resistance that changes with distance .Then fed to an ADC to implement precise digital data which the programmed microcontroller displays in kilometers & Dedicated website/url.

3.CONCLUSION:

This project 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, the respective phase along with the distance is displayed on the LCD. The same information is also sent to a dedicated website over internet (IOT) activated SIM with GSM, interfaced to the microcontroller.

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