Underground Cable Fault Detection Using IoT Based

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Abstract: A fault is an unexpected change of the system functionality, which causes deviation of a plant behavior from that which is specified it. The problem of detect the location of fault in transmission line has become complex and expensive which depended on the current mechanism used to detect the fault in power transmission lines approximated by the calculation of the impedance obtained from voltage and current data. The works of this is to find solution of how detected and located of fault in the transmission line Diagnosing fault source is difficult and entire cable should be taken out from the ground to check and fix faults. The project work is intended to detect the location of fault in underground cable lines from the base station in km using a microcontroller 8051. To locate a fault in the cable, the cable must be tested for faults. This prototype uses the simple concept of Ohms law. The current would vary depending upon the length of fault of the cable. In the urban areas, the electrical cables run in 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.[1] The proposed system finds the exact location of the fault. The prototype is modeled with a set of resistors representing cable length in km and fault creation is made by a set of switches at every known distance to cross check the accuracy of the same. In case of fault, the voltage across series resistors changes accordingly, which is then fed to an ADC to develop precise digital data to a programmed 8051 IC that further displays fault location in distance.

Keywords- Burned, Faults, Interfaced, Microcontroller, Ripples.

I.INTRODUCTION

In an electric power system, a fault is detected by any abnormal electric current follow. For example, a short circuit is a fault in which current bypasses the normal load. An open-circuit fault occurs if a circuit is interrupted by some failure. In three-phase systems, a fault may involve one or more phases and ground, or may occur only between phases. In a "ground fault" or "earth fault", charge flows into the earth. The prospective short circuit current of a fault can be calculated for power systems. In power systems, protective devices detect fault conditions and operate circuit breakers and other devices to limit the loss of service due to a failure. In a poly phase system, a fault may affect all phases equally which is also called symmetrical fault. If only some phases are affected, the resulting asymmetrical fault becomes more complicated to analyze because the simplifying assumption of equal current magnitude in all phases is no longer applicable. The analysis of this type of fault is often simplified by using methods such as symmetrical components. [1],[2]

A symmetric or balanced fault affects each of the three phases equally. In transmission line faults, roughly 5% are symmetric This is in contrast to an asymmetrical fault, where the three phases are not affected equally. An asymmetric or unbalanced fault does not affect each of the three phases equally Power transmission and distribution lines are the vital links that achieve the essential continuity of service of electrical power to the end users. Transmission lines connect the generating stations and load centers. Faults are caused either by insulation failures and conducting path failures. Most of the faults on transmission and distribution lines are caused by over voltage due to lighting and switching surges or by external conducting objects falling on overhead lines. Birds, tree branches may also cause faults on overhead lines. Other causes of faults on overhead lines are direct lightning strokes, aircraft, snakes, ice and snow loading, storms,

earthquakes, creepers etc. In the case of cables, transformers, generators the causes may be failure of solid insulation due to aging, heat, moisture or over voltage, accidental contact with earth.[3] The overall faults can be classified into two types:

1. Series faults 2. Shunt faults

A fault if unclear has the following effects on a power system.

- Heavy short circuit current may cause damage to equipment or any other element of the power system due to over heating or flash over and high mechanical forces set up due to heavy current.
- There may be reduction in the supply voltage of the healthy feeders, resulting in the loss of industrial loads. Short circuits may cause the unbalancing of the supply voltages and currents, there by heating rotating machines.
- There may be a loss of system stability. The faults may cause an interruption of supply to consume.

1.1. TYPES OF FAULTS IN CABLE

1.1.1. OPEN CIRCUIT FAULT:

When there is a break in the conductor of the cable, it is called open circuit fault of the cable. The open circuit fault can be checked by meager. For this purpose, the three conductors of the 3-core cable at the far end are shorted and earthed. Then resistance between each conductor and earth is measured by a meager. The meager will indicate zero resistance in the circuit of the conductor that is not broken. However, if the conductor is broken, the meager will indicate infinite resistance in its circuit.

1.1.2. SHORT CIRCUIT FAULT:

When two conductors of a multi-core cable come in electrical contact with each other due to insulation failure, it is called short-circuit fault. The two terminals of the meager are connected to any two conductors. If the meager gives zero reading, it indicates short-circuit fault between these two conductors. The same step can be repeated for other conductors taking two at a time.

1.1.3. EARTH FAULT:

When the conductor of the cable comes in contact with earth, it is called earth fault or ground fault. To identify this fault, one terminal of the meager is connected to the conductor and the other terminal connected to earth. If meager indicates zero reading, it means the conductor is earthed. The same procedure is repeated for other conductors of the cable. This project is used to detect the location of fault in digital way. Locating the faulty pointing an underground cable helps to facilitate quicker repair, improve the system reliability and reduced outage period.[4]

II. INTERNET OF THINGS:

The evaluation of IOT in the electrical Power Industry transformed the way things performed in usual manner. IOT increased the use of wireless technology to connect power industry assets and infrastructure in order to lower the power consumption and cost. The applications of IOT are not limited to particular fields, but span a wide range of applications such as energy systems, homes, industries, cities, logistics, heath, agriculture and so on. Since 1881, the overall power grid system has been built up over more than 13 decades, meeting the ever-increasing demand for energy. Power grids are now been considered to be one of the vital components of infrastructure on which the modern society depends. There is an increasing need of a centralized management solution for more reliable, scalable, and manageable operations while also being cost effective, secure, and inter-operable. In addition, the solution should enable power providers and utilities to perform effective demand forecasting and energy planning to address the growing need for uninterrupted quality power. [5],[6]

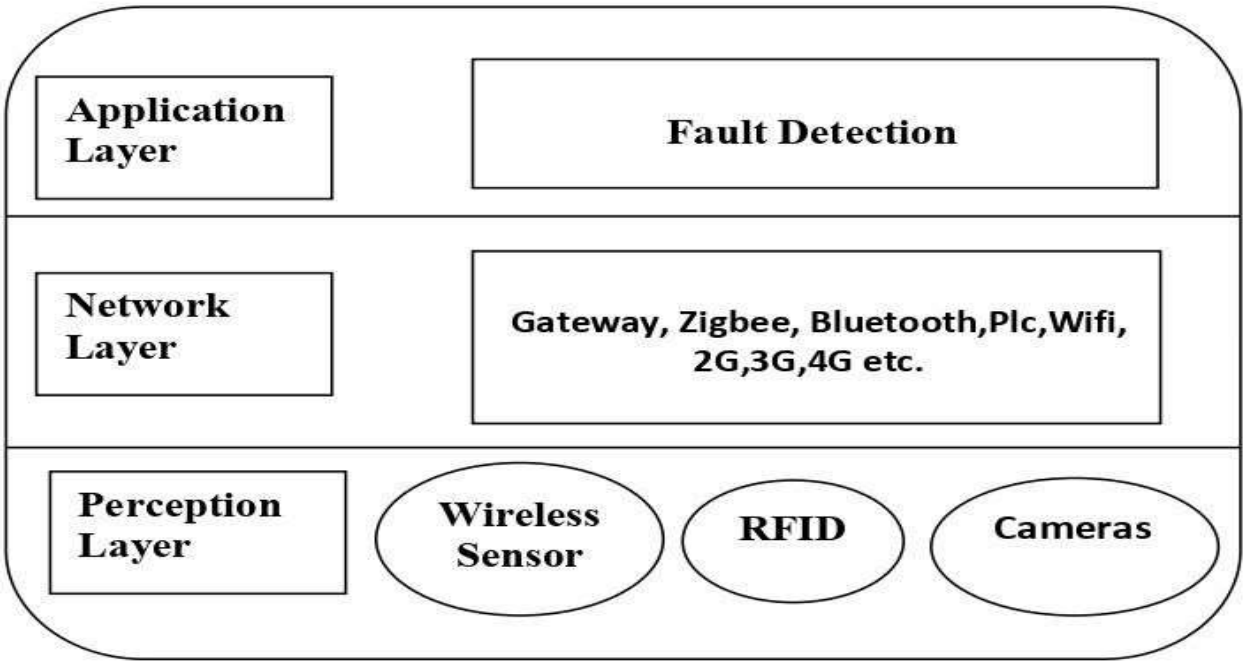


Figure 1 Architecture of IOT

III. METHODOLOGY

The proposed system is an IOT enabled underground cable fault detection system. The basic principle behind the system is Ohms law. When fault occurs in the cable, the voltage varies which is used to calculate the fault distance. The system consists of Wi-Fi module, Micro-controller, and Real-Time Clock. The block diagram of the fault detection system is shown in the Figure 2.

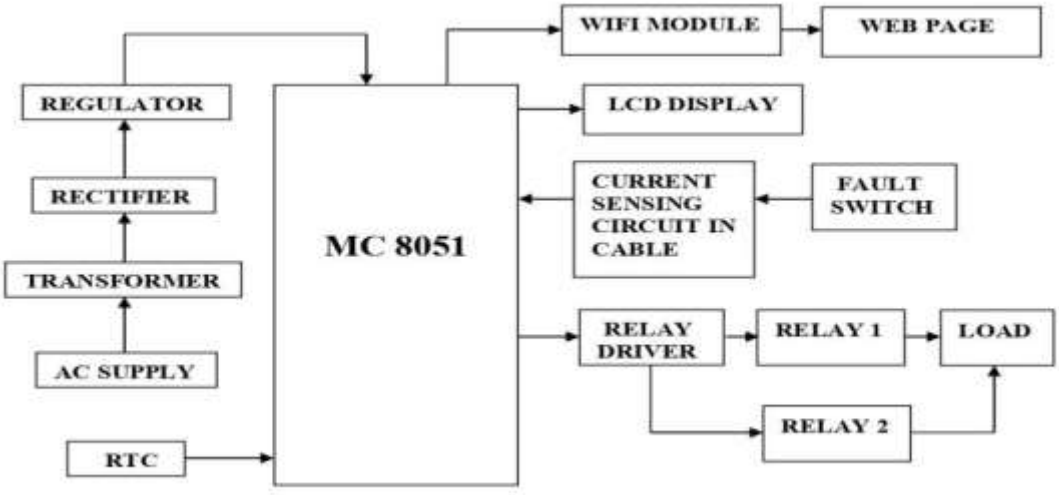


Figure 2 Block Diagram of Fault Detection system

The power supply is provided using step-down transformer, rectifier, and regulator. The current sensing circuit of the cable provides the magnitude of voltage drop across the resistors to the micro-controller and based on the voltage the fault distance is located. [7],[8]

IV.FLOWCHART

The flow chart of the logic behind the fault detecting system is given in Figure 3. The input and output ports of Microcontroller, LCD display, RTC and Wi-Fi module of the system are configured and initialized. When fault occurs (switch is pressed), the fault distance, time and phase are displayed corresponding to that fault. The above fault information will be displayed in the web-page using Wi-Fi modules

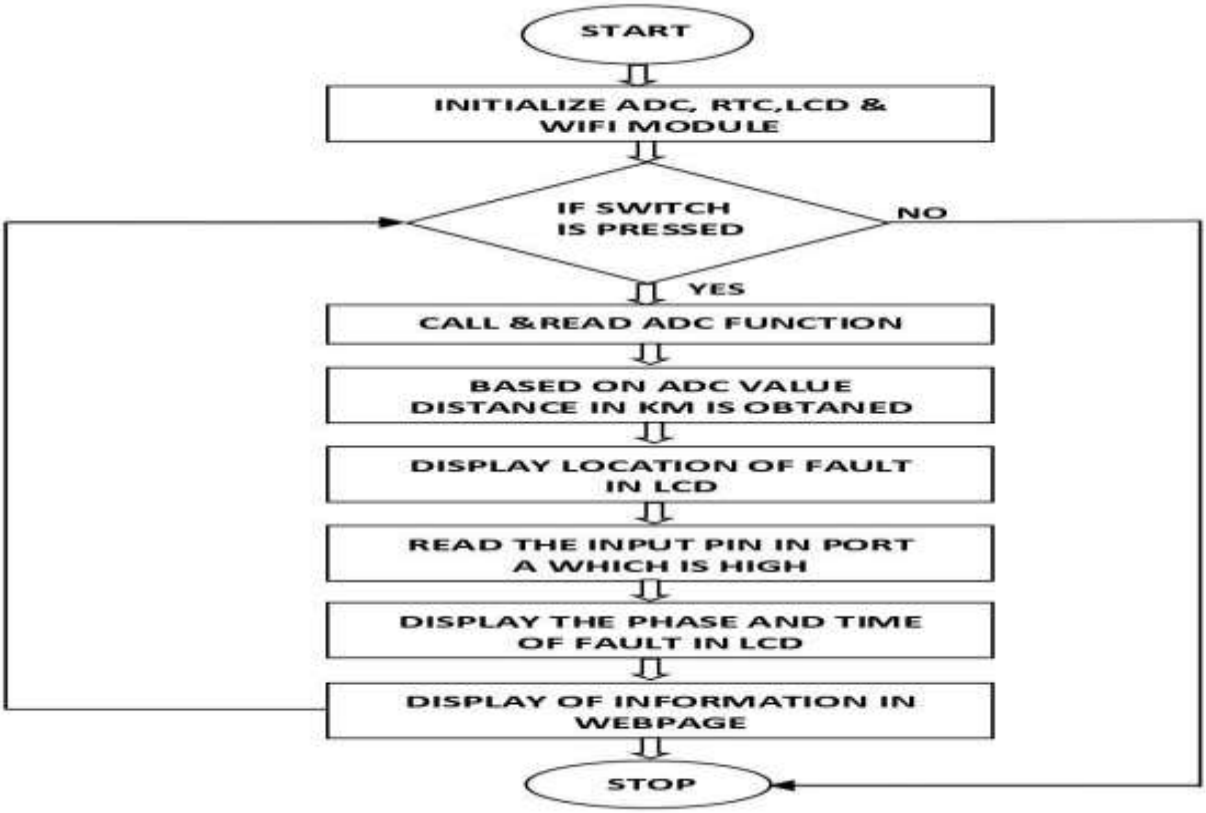
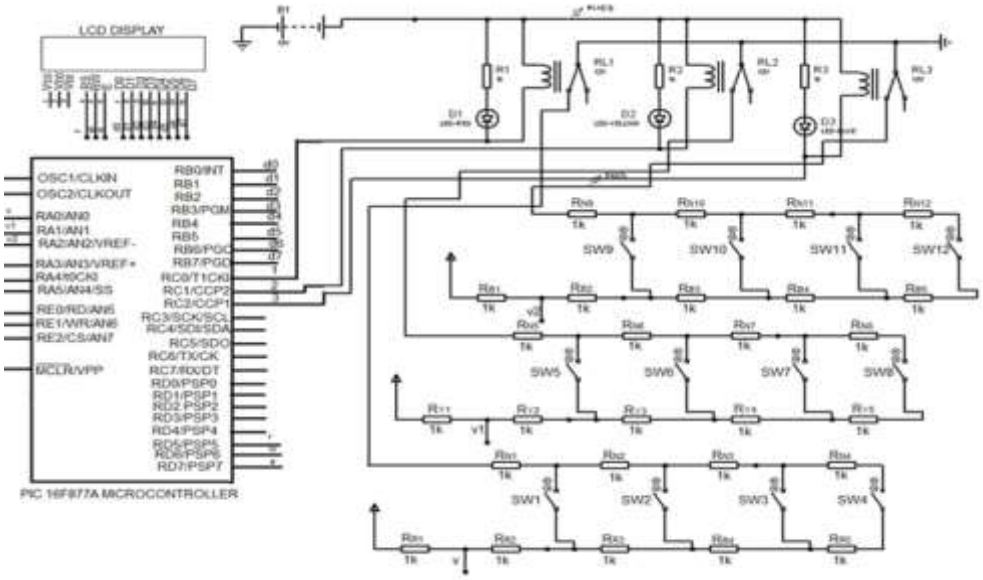


Figure 3 Flowchart



S.No.	Switch	Analog	Fault	ADC
1.	SW1	3.33V	1km	682
2.	SW2	3.99V	2km	818
3.	SW3	4.28V	4km	876
4.	SW4	4.9V	8km	909

Table 1. Mapping Table for Fault Identification

V. HARDWARE

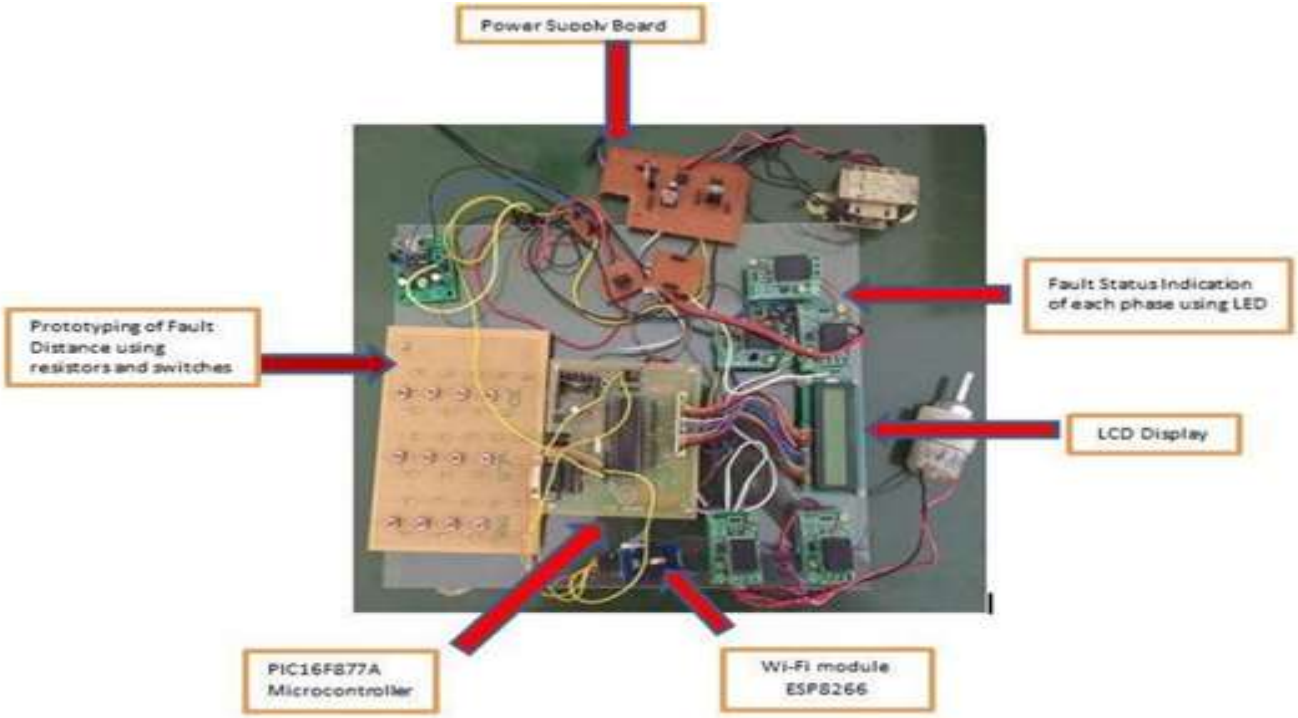


Figure 7. Hardware Setup of the System

HARDWARE		
Problem Affected in R Phase in Time 12:04:35PM		
Phase	**Relay switch Over ring**	**Distance (in km)**
R Phase	**R2**	**8km**
Y Phase	**R**	**0km**
B Phase	**R**	**0km**

Table 2 Fault Display Message in the Webpage

VI. COMPONENTS REQURIED

- Wi-Fi module
- Microcontroller
- LCD
- Real- Time Clock
- Fault Switches etc.

VII. RESULT ANDCONCLUSION

Determine the distance of underground cable fault from base station in kilometers. The underground cable system is a common practice followed in many urban areas. While a fault occurs for some reason, at that time the repairing process related to that particular cable is difficult due to not knowing the exact location of the cable fault. The proposed system is to find the exact location of the fault. The project uses the standard

concept of Ohms law i.e., when a low DC voltage is applied at the feeder end through a series resistor (Cable lines), then current would vary depending upon the location of fault in the cable. In case there is a short circuit (Line to Ground), the voltage across series resistors changes accordingly, which is then fed to an ADC to develop precise digital data which the programmed micro-controller of 8051 family would display in kilometers.

The project is assembled with a set of resistors representing cable length in KM's and 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 and the respective phase is displayed on an LCD interfaced to the micro-controller. The short circuit fault at a particular distance in the underground cable is located 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 help of IC8051 and ESP8266Wi - Fi module in a web-page. The benefits of accurate location of fault are fast repair to revive back the power system, it improves the system performance, it reduces the operating expense and the time to locate the faults in the field.

VIII. ACKNOWLEDGMENT

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