ISSN XXXX XXXX © 2018 IJESC

Research Article Volume 8 Issue No.3

IOT Based Underground Cable Fault Detector

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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

The objective of this project is to determine the distance of underground cable fault from base station in kilometers. The underground cable system is a common practice followed in manyurban 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 microcontroller of 8051 family would display in kilometers. 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.

Fault can be classified as two groups:
Fault in cable can be classified in two groups:
1) Open circuit fault: Open circuit faults are better than short circuit fault, because when this fault occurs current flows through cable becomes zero. This type of fault is caused by break in conducting path. Such faults occur when one or more phase conductors break.
2) Short circuit fault: Further short circuit fault can be categorized in
two types:
a) Symmetrical fault: Three-phase fault is called symmetrical fault. In this all three phases are short circuited.
b) Unsymmetrical fault: In this fault magnitude of current is not equal¬ displaced by 120 degree.
Fault location method: Fault location methods can be classified as:
1)Online method: This method utilize process the sampled voltages& current to determine the fault points. Online method for underground cable is less than overhead lines.
2) Offline method: In this method special instrument is used to test out service of cable in the field. There are two offline methods as following
a) Tracer method: In this method fault point is detected by walking on the cable lines. Fault point is indicated from audible signal or electromagnetic signal .It is used to pinpoint fault location very accurately.
Example:
1) Tracing current method
2) Sheath coil method
b) Terminal method: It is a technique used to detect fault location of cable from one or both ends without tracing. This method use to locate general area of fault, to expedite tracing on buried cable.
Example:1) Murray loop method
2) Impulse current method

II. ABOUT OF IOT TECHNOLOGY

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

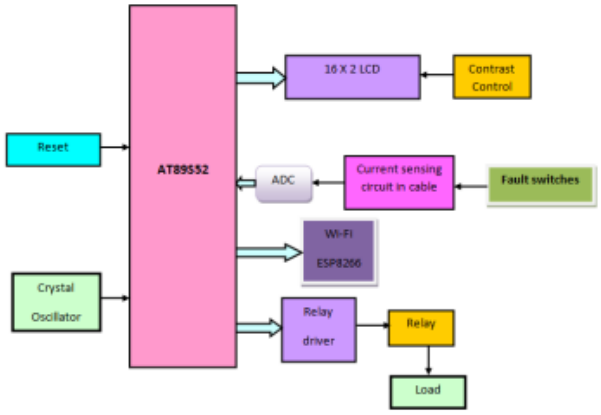
industry assets and infrastructure in order to lower the power consumption and cost. The applications of IoT are not limited to particular fields, but span a wide range of applications such as energy systems, homes, industries, cities, logistics, heath, agriculture and so on. Since 1881, the overall 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. It is essential to provide uninterrupted power without outages or losses. It is quiet hard to digest the fact that power generated is not equal to the power consumed at the end point due to various losses. It is even harder to imagine the after effects without power for a minute. Power outages occur as result of short circuits. This is a costly event as it influences the industrial production, commercial activities and consumer lifestyle. Government & independent power providers are continuously exploring solutions to ensure good power quality, maximize grid uptime, reduce power consumption, increase the efficiency of grid operations and eradicate outages, power loss & theft. Most importantly, the solution should provide a real-time visibility to customers on every penny paid for their energy. There is an increasing need of a centralized management solution for more reliable, scalable, and manageable operations while also being cost effective, secure, and interoperable. 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]. The goal of IoT is not just only connecting things such as machines, devices and appliances, but also allowing the things to communicate, exchanging control data and other necessary information while executing applications. It consists of IoT devices that have unique identities and are capable of performing remote sensing, monitoring and actuating tasks. These devices are capable of interacting with one another directly or indirectly. Data collection is performed locally or remotely via centralized servers or cloud based applications. These devices may be data collection devices to which various sensors are attached such as temperature, humidity, light, etc., or they may be data actuating devices to which actuators are connected, such as relays.

III. SYSTEM DESIGN

This system design with following component:

1.Atmega Microcontroller
2.LCD Display
3. Relay Driver
4. WiFi Module
5. Transformer

4. BLOCK DIAGRAM



1. MICROCONTROLLER

Microcontroller is a programmable device. We are using 32 pin microcontroller as for our requirement. In these the 11 pin for LCD, 14 pin for ADC5 pin switches and 2 pin for Wi-Fi. Microcontroller is on chip true microcomputer Intel 8051 family each most popular microcontroller producing is world market. It has 64KB external data memory, 64KB program memory and 256 byte internal data memory. It increases reliability. Hardware is less because of single chip microcontroller it has small time to execution therefore speed is high Microcontroller is a programmable device microcontroller has a CPU in addition to a fixed amount of RAM/ ROM,I/O port. The fixed amount of on chip ROM,RAM and number of IO ports in microcontroller makes them ideal for many applications in which cost and space are critical.

2. LCD DISPLAY LCD

is finding wide spread use replacing LEDs because of the following reasons: The ability to display numbers ,characters and graphics .This is in contrast to LEDs, which are limited to numbers and a few characters. In contrast, the LED must be refreshed by the CPU to keep displaying the data

3. RELAY DRIVER

Relay are switches that open and close circuit electromechanically or electronically. Relays are control one electrical circuit by using opening and closing contact in another circuit when a relay contact is normally open, (NO) there is open contact (OC) when the relay is not energized.

4. WiFi MODULE

The ESP8266 WIFI module is self contained SOC with integrated tcp/tp protocol stack that can give any microcontroller access to your wifi network. The ESP8266 each capable of either hosting or application or off loading or wifi networking function from another application processor.

5. TRANSFORMER

Transformer is static device is transfer electrical energy from one circuit to other circuit with change voltage and current without in change frequency. in this step-down transformer is use. Usually, DC voltages are required to operate various electronic equipment. And this voltages are 5v,9v and 12v.but this voltage cannot be obtained directly. Thus AC input available at the main supply.i.e. 230v is to be brought down the required voltage level. This done by transformer. Principle of transformer is according to faraday law of electromagnetic induction.

III. IMPLEMENTATION

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, Microcontroller, and Real-Time Clock. The block diagram of the fault detection system is shown in the Figure .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 microcontroller and based on the voltage the fault distance is located.

IV.CONCLUSION

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 microcontroller and ESP8266 Wi - Fi module in a webpage. The benefits of accurate location of fault are fast repair to revive back the power system, it improves the system performance, and it reduces the operating expense and the time to locate the faults in the field.

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