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Fault Detection, Classification and Location using GPS System

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Abstract – *The Electric Power System is divided into many different sections. One of which is the transmission system, where power is transmitted from generating stations and substations via transmission lines into consumers[1].Failure is critical issue in this essential service. The location of the fault must be identified for recovery from failure[2]. The fault location detection and real time monitoring has been a goal of power system engineers, since the creation of distribution and transmission systems. Quick fault detection can help protect the equipment by allowing the disconnection of faulted lines before any significant damage of the equipment. The accurate fault location can help utility personnel remove persistent of the faults and locate the areas where the faults regularly occur, thus reducing the occurrence of fault and minimize the time of power outages[3] In this paper, internet of thing(IOT) based fault detection and location system was used to adequately and accurately indicates and locates the exact spot using GPS system where fault had occurred. This will ensure a shorter response time for technical crew to rectify these faults and thus help expensive equipment from damage When a fault gets created in a cable line, this is sensed by the sensor and the microcontroller detects the fault from cable line data and display this data over LCD display; it transfers this data over internet to display online. Also the data is transfer to internet for real time monitoring.*

Key Words: Fault location, Internet thing Technology (IOT), Fault detection, GPS system

1. INTRODUCTION

For the past fifty years, electric power systems have rapidly grown. This has resulted in a large increase of the number of lines in operation and their total length. Transmission of electricity through overhead transmission lines is a widely used method for power transmission from one location to another[2]. In Electrical Power Systems mostly the distortions of current and voltage are caused by faults. Fault that occur in power transmission lines can cause an interruption of power supply[1]. The restoration can be expedited if the location of the fault is either known or can be estimated with reasonable accuracy. Detecting and locating fault in power line is very essential for healthy operation of power system. In electrical power line fault often occur many times making the power system unreliable. Speedy and precise fault location plays an important role in accelerating system restoration, reducing outage time and significantly improving system reliability. Though there is human effort involved in fault detection, technology assisted solutions can save time and resources[2].

Losses in distribution system are much higher than losses in transmission side and also fault are more frequent in distribution side. In distribution system most of the losses are caused by fault and theft. The system uses a current transformer, Microcontroller, ESP8266 modem, GPS module. In this system the focus is on single phase to ground fault in power line. When single phase to ground fault occurs, it becomes significant to detect fault quickly and accuracy. It becomes challenging for the power company to detect and repair the fault as quickly as possible. Protection systems are designed to identify the location of faults and isolate only the faulted section in order not to damage the whole equipment in power system.

2. SYSTEM ANALYSIS

Existing System

In practical electricity, people use the trial and error method to detect the fault location (Line to line fault / line to ground fault) of a distribution line. They feed supply at the single end at a time by dividing that transmission line into two parts and check the fault up to that section. These processes go on until they find the fault area. After checking if they found anything, then it is ok to go forward. This process is done from both ends and they sort out the exact location.

Proposed Solution

The aim of this paper is finding the exact location of the fault. In the proposed concept with the use of wireless network exact location of fault can be diagnosed. There by providing optimum operation of electric power. The objective of this project is to provide with a simple way to detect the fault and show the exact location of occurred fault which will ultimately lead to optimum operation of the whole system and to improve the reliability of distribution network. The aim is to detect the fault in the distribution line and intimate to the server about the fault location. To detect the accurate fault in the distribution lines, the sensor is used. The sensors sense the power characteristics of the transmission line.

Advantages of Proposed System

- Reduced human effort
- Detects accurate fault location
- Time saving and faster maintenance
- Can be used for both underground and overhead cable

3. TECHNIQUE OF FAULT DETECTION AND LOCATION

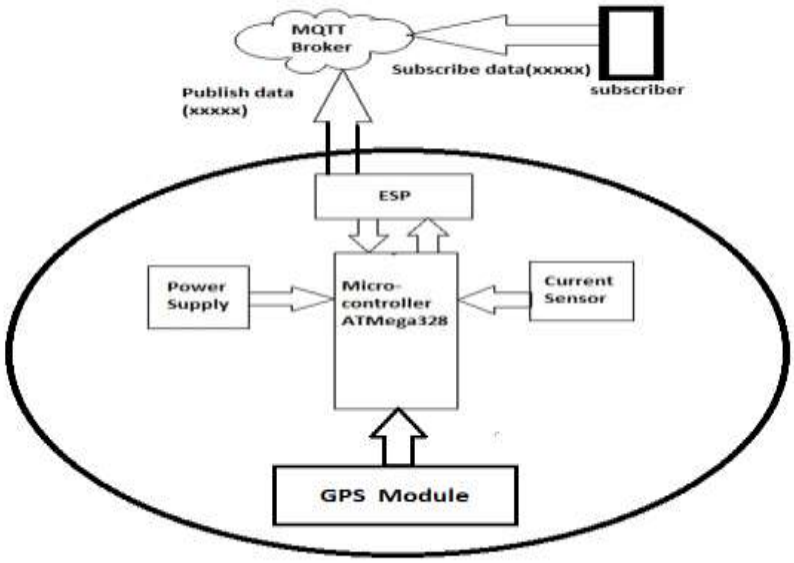

Fig-1: Technique of fault detection and location

Description

The system consists four major components current transformer (CT) or current sensor, ESP8266 Module, microcontroller and for finding location GPS used as shown in Fig-1. The CT which is connected to the main line cable sense the current value of the system and feed the output to the ADC (analog to digital converter). ADC convert the analog signal to digital signal or form in order to be processed by the microcontroller. Microcontroller contain a set of programming codes which have been stored in the EEPROM which enable it to finding fault based on the current values. Based on the program the microcontroller compares this value to see they are within the required range. If the current value is out of range as compared to the reference it gives an indication of a fault. The fault information will be display in the webpage using GSM module. Also, the value of current is continuously display on the webpage.

4. TECHNOLOGY OVERVIEW

Internet of Things

It is expected that more than 50 billion objects would have been connected with the power of the Internet by year 2020. This includes not only smart devices like cell phones and tablets, but also coffee makers, washing machines, jet engines, stereo headphones, light lamps, digital wearable devices and almost everything with a sensor on it. This huge network of myriad objects is better known as the Internet of Things (IOT). The Internet of Things (IOT) is a virtual network where every object, whether a person or an animal, everything is assigned and recognized by a unique address (Technically known as IP address) and has an amazing ability to transfer and receive data over a network without any sort of communication between human-to-computer or human-to-human. It allows objects to be sensed and controlled across the sphere, crafting great opportunities to connect with the physical world into computer-based systems, and resulting in enhanced adeptness, accuracy

and economic benefit. 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.

MQTT (Message Queue Telemetry Transport)

MQTT stands for Message Queue Telemetry Transport. As its name suggests, it's a protocol for transporting messages between two points. This protocol is so lightweight that it can be supported by some of the smallest measuring and monitoring devices, and it can transmit data over far reaching, sometimes intermittent networks. MQTT is designed to overcome the challenges of connecting the rapidly expanding physical world of sensors, actuators, phones, and tablets with established software processing technologies. These principles also turn out to make this protocol ideal for the emerging M2M or IOT world of connected devices where bandwidth and battery power are at a premium.

5. HARDWARE DESCRIPTION

The most common set of requirements defined by any operating system or software application is the physical computer resources, also known as hardware. The list of hardware required for this paper are given below:

Transformer

Transformer is static device which transfer electrical energy from one circuit to other circuit with change in voltage or current without change in frequency. In this step-down transformer is used. Usually, DC voltages are required to operate various electronic equipment and these voltages are 5V, 9V or 12V.

Rectifier

A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. The process is known as rectification.

Capacitors

A capacitor is a passive two-terminal electrical component that stores electrical energy in an electric field. It is a device used to store an electric charge, consisting of one or more pairs of conductors separated by an insulator.

LCD Display

LCD (Liquid Crystal Display) is the technology used for displays in notebook and other smaller computers. Like light-emitting diode (LED) and gas-plasma technologies, LCDs allow displays to be much thinner than cathode ray tube (CRT) technology. LCD is an Alphabetic Display. It means that it can display Alphabets, Numbers as well as special symbols. Thus, LCD is a user-friendly display device which can be used for displaying various messages.

AT mega AVR Series MICROCONTROLLER

AVR was one of the first microcontroller families to use on-chip flash memory for program storage. A microcontroller is a small computer on a single integrated circuit. A microcontroller contains one or more CPUs (pro along with memory and programmable input/output peripherals.)

ESP8266 MODEM

ESP8266 MODEM is a class of wireless MODEM devices that are designed for communication of a computer with cloud network. It has a 64 KB boot ROM, 32 KB instruction RAM, and 80 KB user data RAM. Also they have IMEI (International Mobile Equipment Identity) number similar to mobile phones for their identification.

Current Sensor/Current transformer

30 AMP. Current transformer Features of this current transformer is to designed and developed as per European Standards IEC: 62053-21 / IS: 13779. It is PC Housing for better insulation and environmental protection. And Variants available in Self Wire (Flying Leads) or PCB Mounting Type CT.

6. SOFTWARE DESCRIPTION

EAGAL

EAGLE is a scriptable electronic design automation (EDA) application with schematic capture, printed circuit board (PCB) layout, auto-router and computer aided manufacturing (CAM) features. EAGLE stands for easily applicable Graphical layout editor and is developed by CadSoft computer GmbH. The company was acquired by Autodesk inc.in2006.

Arduino Programming Language

Arduino Software (IDE): The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and others open-source software.

7. CONCLUSION

This paper presented the designed IOT based transmission line monitoring and indication of fault in system. The implemented system design mainly concentrates on the distribution system. The project has continuous monitoring system integrating the IOT technology and the microcontroller technology. The system continuously monitors current value of the system. The proposed system can minimize the time to locate the fault and reduce manpower.

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