Automatic Fault Detection in Transmission Lines using GSM Technology

Dr. Navneet Kumar
Mr. Praveen Gupta
Mr. Manish Kumar
Mr. Yadav Brijesh
Mr. Anupam Yadav
Mr. Shivam Kumar

Rajkiya Engineering College Bijnor, India
Electrical Engineering

Abstract: The point of convergence of this paper on automatic fault detection in transmission lines by using GSM technology. The Electric Power System is divided into many sections. One of that is the transmission system, where transmission line is transfer the power from generating station to the consumer. Both methods could encounter various types of malfunctions is usually referred to as a "Fault". Fault is simply defined as a number of undesirable but unavoidable incidents can temporarily disturb the stable condition of the power system that occurs when the insulation of the system fails at any point. A smart GSM based fault detection and location system was used to adequately and accurately indicate and locate where the fault had occured. This will ensure a shorter response time for technical crew to rectify these faults and thus help save transformers and other power devices from damage and disasters. The system uses a voltage transformer, a current transformer, 8051 Microcontroller, ADC, RS-232 connector, and a GSM modem. When the fault has occurs the system automatically detects faults, analyses and classifies these faults and then, calculates the fault distance from the control room using an impedance-based algorithm method. Finally, the fault information is transmitted to the control room. In conclusion, the time required to locate a fault is drastically reduced, as the system automatically and accurately provides accurate fault location information. By using this project, we can detect the faults of three phase transmission lines one can monitor the Temperature, Voltage, Current by means of GSM modem by sending message.
Keywords: Transmission line, fault detection, GSM technology, automatic fault detection.

I. INTRODUCTION

In power transmission systems, the majority of voltage and current signal distortions are caused by faults. Faults that occur in power transmission lines can cause an interruption of power supply. The time required to locate a fault is drastically reduced, as the system automatically and accurately provides accurate fault location information. This will ensure a shorter response time for technical crew to rectify these faults and thus help save transformers from damage and disasters. A smart GSM based fault detection and location system was used to adequately and accurately indicate and locate where fault had occurred. The system uses a current transformer, a voltage transformer, PIC 16F877 Microcontroller, RS-232 connector, and a GSM modem. The system automatically detects faults, analyses and classifies these faults and then, calculates the fault distance from the control room using an impedance-based algorithm method. Finally the fault information is transmitted to the control room. The project presents design and implementation of a distributed monitoring and centralized control system. The master slave communication with the Modbus protocol is implemented. Also using wireless technology GSM, SMS is send to a responsible person on mobile. GSM module has made an attractive option for wireless communication applications. The GSM network provides reliable communication quality with nationwide coverage. Short message service (SMS) has now become the most widely used service based upon GSM standard. At the same time the decreasing cost of GSM devices such as mobile phones and the GSM SMS provides a unique address (SIM card number) to the remote control unit and commands can be transmitted in the wireless communication network.

There are many courses of faults in power transmission leading to power outages, if not properly managed.

Notable among them includes:

- Faults at the power generation station
- Damage to power transmission lines (tree falling on lines)
- Faults at the substations or parts of distribution subsystem
- Lightening

Types of transmission line faults:
Power system's faults may be categorized as shunt faults or series faults.

Single line-to-ground fault:

The most common type of shunt faults is Single Line-to-ground faults (SLG). This type of fault occurs when one conductor falls to the ground or gets into contacts with the neutral wire. It could also be the result of falling trees in a rainy storm. This type could be represented as shown in Fig 1 below.

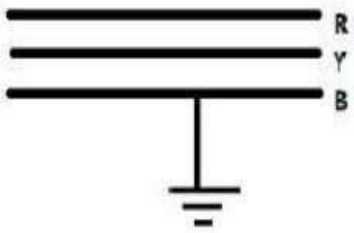

Fig 1 Single Line to ground fault

line-to-line fault:

The second most occurring type of shunt faults is the Line-to-Line fault (LL). This is said to occur when two transmission lines are short-circuited. As in the case of a large bird standing on one transmission line and touching the other, or if a tree branch happens to fall on top of two power transmission lines.

Fig 2 line to line faults

line-to-ground fault:

The third type of shunt fault is the Double Line-to-Ground fault (DLG) in figure below. This can be a result of a tree falling on two of the power lines, or other causes.

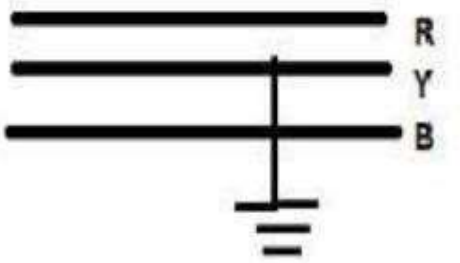

Fig 3 double line-to-ground fault

Balance three phase:

The fourth and the real type of fault is the balanced three phase, which can occur by a contact between the three power lines in many different forms.

Fig 4 Balanced Three Phase fault

II. PROPOSED METHOD FOR DETECTION AND LOCATION OF FAULT

Considerable research has been carried out in the area of fault diagnosis methods, particularly to radial distribution systems. These methods uses various algorithmic approaches, where the fault location is iteratively calculated by updating the fault current.

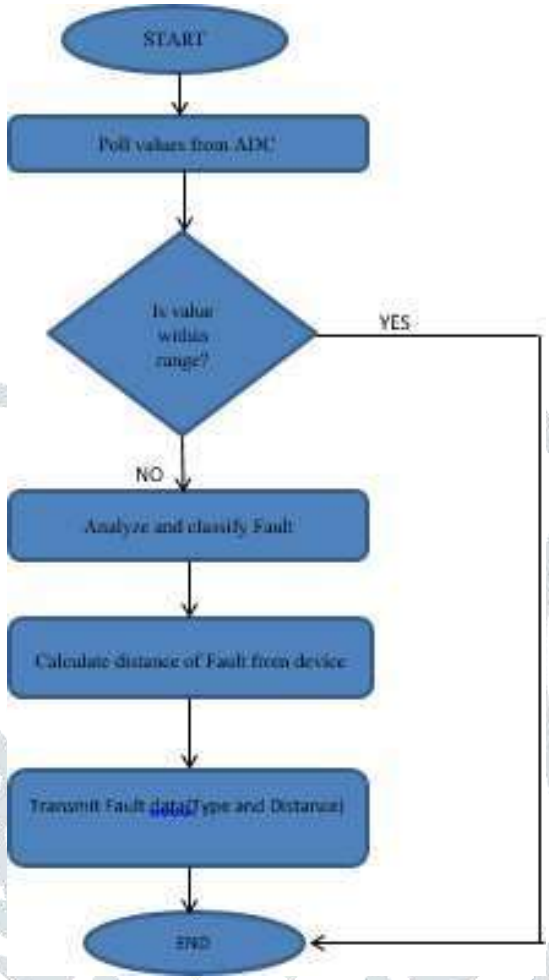

Fig. 5 Flowchart of the Proposed Approach

1. Impedance And Fundamental Frequency Component Based Methods
2. High Frequency Components and Travelling Wave Based Methods
3. Knowledge-Based Method
4. Artificial Intelligence (AI) and Statistical Analysis Based Methods
5. Distributed Device Based Methods
6. Hybrid Methods

Impedance and Fundamental Frequency Component Based Methods

The distance of fault from the primary distribution bus is estimated by impedance based method. Voltage and current values measured at one end or both ends of the line are required in this method. The method uses mathematical equations to estimate the fault location. Suggested a technique that used the fundamental frequency voltages and currents measured at a line terminal before and during the fault. The fault location technique was described by considering a single-phase-to-ground fault on a radial system. Nevertheless, they still considered the line to be fully transposed, and was only good for line-to-ground faults. The proposed method that was based on measurements provided by Intelligent Electronic Devices (IEDs) with built-in oscillography function. This is installed only at the substation level and on a database that stores information about the network topology and its electrical parameters. In particular, on 12kV networks application of the method was a problem.

III. CONSTRUCTION AND WORKING

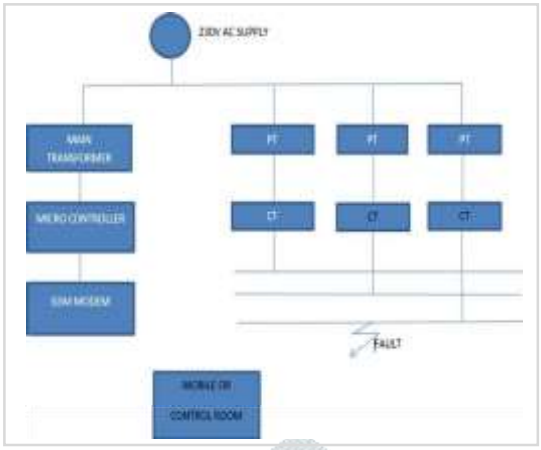

Fig. 6 Block Diagram of the Proposed Approach

Working

The set up or field device consists of 3 major components, instrument transformer (CT and VT), GSM modem and microcontroller. The primaries of the CT and VT which are connected to the line sense the corresponding current and voltage values of the system and feed the output to the ADC of the microcontroller which converts the signal to a digital form in order to be processed by the CPU of the microcontroller.

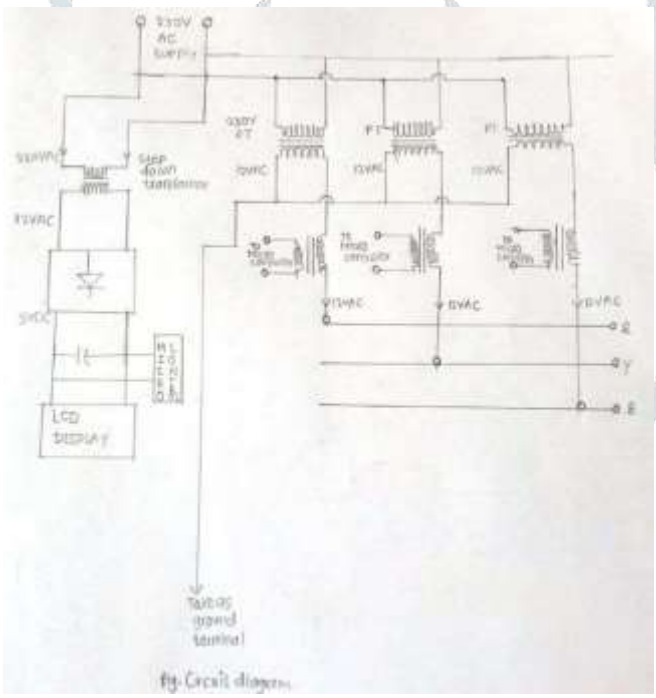

Fig. 7 Circuit Diagram of the Proposed Approach

The microcontroller serves as the central point of the set up. It contains a set of programming codes which have been stored in the EEPROM which enables it to classify the fault type based on the voltage and current values. Based on the program, the microcontroller compares these values to see whether they are within the range required. If the voltage and current values are out of range as compared to the reference, it gives an indication of a fault. The microcontroller also calculates the fault distance, relative to the device based on an impedance-based algorithm and then relays this information to the modem for transmission. In summary, the microcontroller classifies, calculates the fault distance and relays the information to the modem for transmission via the serial communication interface (SCI) which serves as an interface between the microcontroller and the modem. The RS-232 serves as the connector between the
microcontroller's serial communication port and the modem. The device is placed in the boundary of the sectionalized regions in the transmission system and the location of the fault is calculated relative to the position of the device. The unique identity of the SIM card in the GSM modem is used as an address for the device.

IV. RESULT

The analysis of fault detection and location system of transmission line. Whether it is any type of fault that can be detected and located. When fault get occurs on the transmission line the signal is send to the control room or mobile phone through a GSM modem. The message receive on the mobile that is the fault between pole 1 and 2 and the fault which is symmetrical or unsymmetrical like L-G The signal that appears on the control room or mobile phone is the L*G or any other type of fault occurred on transmission line.

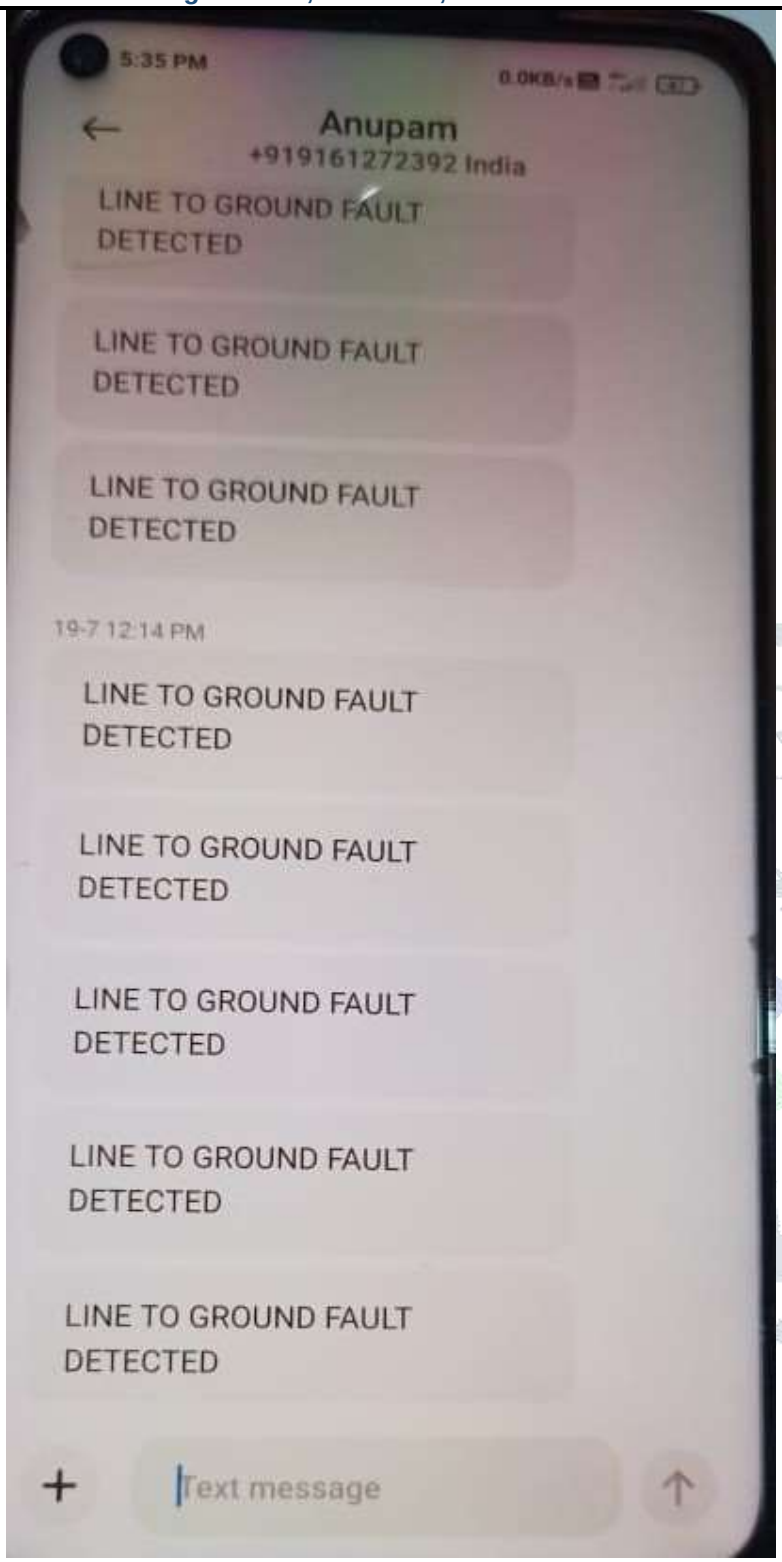

Fig.7 Result

V. CONCLUSION

Here, in this project we have designed a GSM based transmission line monitoring and indication system that sends information of the same to control room via SMS. The implemented system design mainly concentrates on the distribution system. It provides the way to detect the faults such as wastage of energy and power theft. The system continuously monitors various parameters of the system. It also helps to detect the fault at the appropriate time and hence avoids illegal use of electricity. Automatic monitoring, analyzing and recording is done on the PC screen through hyper terminal. The project has continuous monitoring system integrating the GSM communication technology and the microcontroller technology. It also represents the hardware architecture and the software flow. The implementation of the system will save large amount of electricity and thereby electricity will be available for more number of consumers in a highly populated country such as India.

REFERENCES

[1] Ing. Komi Agbesi, Felix Attuquaye Okai . AUTOMATIC FAULT DETECTION AND LOCATION IN POWER TRANSMISSION LINES USING GSM TECHNOLOGY. Vol.no.5 issue 01 ,January 2016

[2] S.Leelakrishnan, V.Ganesharavinth, K.Kalpana, P.Sivaranjani, S.Vijaykumar . Distribution Side Fault Detection and Disconnection Using GSM. Vol. 6, Issue 3, March 2017

[3] Chandra shekar. P .Transmission Line Fault Detection & Indication through GSM .ISSN (Online): 2347 - 2812, Volume-2, Issue -5, 2014 .

[4] Mr. Nilesh S.Wani, Dr. R. P. Singh . TRANSMISSION LINE FAULTS DETECTION- A REVIEW. Volume 7, Issue 2, March-April, 2016

[5] prof. m. s. sujatha, dr. m vijaykumar. on-line monitoring and analysis of faults in transmission and distribution lines using gsm technique. 30th November 2011. Vol. 33 No.2 © 2005 - 2011 JATIT & LLS. All rights reserved.

[6] R. N. Patel, Mamta Patel ,Fault Detection and Classification on a Transmission Line using Wavelet Multi Resolution Analysis and Neural Network . International Journal of Computer Applications (0975 – 8887) Volume 47– No.22, June 2012

[7] Sushil Chavhan, Vaibhav Barsagade, Abhijit Dutta, Shubhangi Thakre . Fault Detection in Power Line Using Wireless

[8] By MD Asaduzzaman Nur, Jahidul Islam, Md. Golam Mostofa & M oshiul Alam Chowdhury . Transmission Line Fault Detection Using Android Application

[9] Preethi Manivannan , Prof. Manik Hapse , Fast and Accurate Fault Detection in Transmission Line using Wavelet Transform . Volume 2 | Issue 11 | April 2016. Sensor Network . Volume 3, Issue 3, March 2015. (IIJEE)