TRANSMISSION LINE MULTIPLE FAULT DETECTION: A REVIEW AND AN APPROACH

Arti Sanganwar¹, Kapil Chalkhure², Shivani Jijankar³, Anand Dhore⁴, Prof. Vikramsingh R. Parihar⁵

¹,²,³,⁴ U.G Students, Department of Electrical Engineering, PRMCEAM, Badnera-Amravati
⁵Assistant Professor, Department of Electrical Engineering, PRMCEAM, Badnera-Amravati

Abstract

This paper presents an overview and an approach of Transmission Line Multiple Fault Detection. In this paper, after a brief introduction, the focus is on literature review wherein we have studied 15 papers related to the topic and have successfully analyzed them. On the basis of the literature review, we have proposed a system offering rigid, reliable and robust communications like GSM technology instead of many communication techniques used earlier. This increases swiftness of communication with distance independency. This technology saves human life from this electrical hazard by providing the fault detection and stops the electricity to the damaged line and also conveys the message to the electricity board to clear the fault.

Index Terms: transmission line, fault detection, GSM technology, automatic fault detection

I. INTRODUCTION

This paper represents the Line Protection on the applications of fault detection technology. This addresses the detection of those abnormal conditions where a conductor breaks and does not contact either another conductor or a grounded element. Detection of fault on line is done by automation. Automation of system has become the demand of the day. In fact most of the system are impossible to be controlled by human being. As fault analysis became important requirements of the electric power system to become more accurate. The need of automatic fault clearance became a necessity. There are combinations of a circuit breaker and a relay protection system in a typical fault cleaning system. The main parts in protection system are wiring, transducers, auxiliary power supply, switches, circuit breakers, relays and the operating coil of the circuit breaker. Earlier fault is automatically cleared by electromagnetic relays. The electrical quantity, which is voltage or a current, was transformed to a mechanical force which operated the relay when a preset threshold was exceeded. But now a days the solid state relays are developed so that the operation can be performed easily and accurately.

Power devices act as imperfect loads, generate a distorted waveform which contains harmonics and interference component of waveform. These harmonics can result problems ranging from telephone transmission interference to degradation of conductors and insulating material in devices and transformers.

Therefore, it is important to investigation of the total effect of these harmonics impact. The addition of all harmonics component in a device is known as total harmonic distortion (THD). Electrical fault is the deviation of voltages and currents from normal values or states of input signal. In normal operating conditions, power system equipment or lines carry nominal voltages and currents which results in an
accurate and good operation of the system. The faults are mainly two types of faults:

1. Symmetrical faults
2. Unsymmetrical faults

1. Symmetric fault
A symmetric or balanced fault as name indicate affects each of the three phases equally. Transmission line faults normally, 5% are symmetric.

There are of two types namely
• line to line to line to ground (L-L-L-G)
• line to line to line (L-L-L).

2. Asymmetric fault
An asymmetric or unbalanced fault which does not affect each of the three phases. Common types of asymmetric faults, and their cause

There are mainly three types namely
• Line to ground (L-G)
• Line to line (L-L) and
• Double line to ground (LL-G) faults

TYPES OF FAULT DETECTION
The fault occurring in the power lines and cable can be classified into four main categories: short circuit in the cable or transmission line, short circuit to earth, high resistance to earth and open circuit. Four method that are mostly used in detecting fault location is described as follow

1. A frame
2. Thumper
3. Time domain reflectometer (TDR)
4. Bridge method

This survey includes the relevant fault models, failure effects or manifestations, fault injection techniques used in developing and validating the safety system, requirements for failure diagnosis, and finally the actual failure diagnosis methods themselves. The development of the algorithm for detecting the faults on the transmission lines has been progressed, especially in recent years.

These several decision algorithms have different solutions and techniques. Transmission and distribution lines are vital links between generating units and consumers. They are exposed to atmosphere, hence chances of occurrence of fault in transmission line is very high, which has to be immediately taken care of in order to minimize damage caused by it. In this paper discrete wavelet transform of voltage signals at the two ends of the transmission lines have been analyzed. Transient energies of detail information for two consecutive data windows at fault are used for analysis. Four-layer feed forward back propagation neural networks are designed to classify and locate the fault at different single line to ground fault conditions. It is done by automation. Automation of system has become the demand of the day. In fact most of the system are impossible to be controlled by human being. The main objective of the project is to design and fabricate an automated control system for automatic power grid control. Detection of fault done through micro controller and with the help of LED we can analyze the fault. The whole process is centralized around micro controller and relays. Here GSM module is used for information. Advances in digital technology have enabled practical solutions for the detection of a high percentage of these previously undetectable faults.

The organisation of the paper is as follows: Section 2 focuses on the literature review work I which we have mainly focused on the concept used by the authors, their performance evaluation parameters and the claims by the concerned authors. On the basis of the literature review, it is found that the GSM based approach has maximum potential and thus, we have discussed it in the Section 3 followed by the conclusion in Section 4.

## II. LITERATURE REVIEW

<table>
<thead>
<tr>
<th>Sr no</th>
<th>Ref. no, authors, years.</th>
<th>Concept use</th>
<th>Performance evaluation parameter</th>
<th>Claim by concerned authors.</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Ing. Komiagbesi, Felixatu Quayeo Kai. (1 Jan 2016)</td>
<td>Smart GSM based fault detection and location system was used to adequately and accurately indicate &amp; locate</td>
<td>None</td>
<td>It will also allow operators such as GRIDco to correctly detect &amp; locate faulted segment on their transmission line &amp; therefore</td>
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<td></td>
<td>Author(s)</td>
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<td>2</td>
<td>S. Leelakrishnan1, V.Ganesharavi, K.Kalpana3, P.Sivaranjani4, S.Vijaykumar</td>
<td>We introduce a system which will disconnect the power line from the transformer automatically without the manual work of line operator. Fault current and voltage waveform at 300 km &amp; 50 km. By using this system to get the exact faulty phase under abnormal condition has been happened. No other person can reclose the breaker before they finished their work. It is effective in providing safety to the working staff. It is money saving. It can be easily installed.</td>
<td>Chandra Shekar p. (May 2014)</td>
<td></td>
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<td>No.</td>
<td>Authors</td>
<td>Description</td>
<td>Keywords</td>
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<td>8.</td>
<td>MD. Asaduzzaman Nur, Jahidul Islam, Md. Golam Mostofa &amp; Moshiul Alam Chowdhury</td>
<td>This system is to monitor the distribution line due to the constraints such as overvoltage, under voltage, SLG, DLG faults.</td>
<td>Voltage and current waveform</td>
<td>This system is a reliable technique for monitoring and controlling the electric distribution system. For Short distance data transmission Bluetooth technology is a reliable and robust one.</td>
</tr>
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<td>9.</td>
<td>Preethi Manivannan Prof. Manik Hapse</td>
<td>The system is depending on a carringpairing positive sequence voltage magnitude for specified &amp; positive sequence current, phase different angle for each interconnected line between two area on the network.</td>
<td>Most high-impedance faults can be detected using harmonic current phase-angle analysis and localized by using reclose sectionalization technology.</td>
<td></td>
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<tr>
<td>10.</td>
<td>P.A.Gulbhile1, J.R.Rana2, B.T.Deshmukh3</td>
<td>The sensed signals are given to microcontroller for detection &amp; classification of faults. Simultaneously mobile communication technique i.e. GSM is used to send message to responsible person or displayed on PC screen</td>
<td>None</td>
<td>phase parameters are sensed continuously &amp; during the occurrence of any series and shunt fault (here in paper S-L-G, L-L, L-L-G, open conductor fault) on the three phase line, the type of fault is detected by microcontroller. Protective devices placed on sending end and receiving end works during occurrence of fault (specially short circuit fault). Respective message sending or displaying on PC screen takes place</td>
</tr>
<tr>
<td>11.</td>
<td>Bhanuprakash M. E1, Arun. C2, Akhil Satheesh3 (march 2017)</td>
<td>This project mainly focuses on the section of power line that connects the transformer with customers. This is done by placing individual units on certain points of the power line which consists of set of voltage and current sensors. Using sensor values, the system checks whether there is any fault is present on the line or not</td>
<td>None</td>
<td>The fault can easily be detected, identified and located using this arrangement. This system can help the authorities to maintain the power line easily and can avoid line fault induced accidents up to a limit</td>
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<td>12.</td>
<td>Okokpujie Kennedy1, Amuta Elizabeth 2, Okonigene Robert3, Samuel John4</td>
<td>Whenever fault occurred the data acquired were transmitted to the utility mobile phone as SMS via the GSM wireless network</td>
<td>Voltage value</td>
<td>With this system, power transmission fault can be detected and isolated at the shortest possible time.</td>
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<td>13.</td>
<td>K.</td>
<td>This paper presents a</td>
<td>Time (sec), All possible fault scenarios were</td>
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<td>Authors</td>
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<td>Exclusion Time</td>
<td>Notes</td>
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<td>Nareshkumar, Member, IEEE, M. A. Choudhry, Senior Member, IEEE, J. Lai, A. Feliachi</td>
<td>Multi-agent system model for fault detection and reconfiguration based on graph theory and mathematical programming</td>
<td>Test time required to locate a fault by automatically providing accurate fault location information</td>
<td>The results obtained are promising and it shows a very good start in the direction of MAS application in power distribution system.</td>
<td></td>
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<tr>
<td>Devanand Samuel S, Bashyam</td>
<td>The system automatically detects faults, analyses and classifies these faults and then, calculates the fault distance from the control room</td>
<td>None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neeta D. Sonawane, prof. devidas D. Dighe</td>
<td>Represent under voltage &amp; over current fault detection using GSM modem.</td>
<td>None</td>
<td>For protection of that device this system can be used the choice of a device for fault consideration, best suited to particular field condition is not only a technical issue but also economical one.</td>
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### III. Possible Approach

Set up consist of 3 major components, instrument transformer (CT & PT), GSM modem & microcontroller. The primary winding of CT & PT are connected to the line to sense the corresponding current & voltage value of the system & feed the output the ADC of the microcontroller. The ADC is inbuilt in the microcontroller. It converts analog signal to digital signal in order to be processed by the CPU of the microcontroller. The microcontroller contains a set of programming codes which have been stored in memory which enable it to classify the fault type based on the voltage and current values.

Based on the program, the microcontroller compares this value to see whether they are within the range required. If the voltage and current values are out of range as compare to the reference, it gives an indication of 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 sectionalised regions in the transmission system.

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![Fig. 1; Block Diagram of Multiple Fault Detection](image-url)
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.

**The GSM Modem**

A modem (modulator-demodulator) is a device that modulates an analog carrier signal to encode digital information, and also demodulates such a carrier signal to decode the transmitted information. The goal is to produce a signal that can be transmitted easily and decoded to reproduce the original digital data. The GSM Modem comes with a serial interface through which the modem can be controlled using attention (AT) command interface. An antenna and a power adapter are provided. The basic segregation or working of the modem is as follows: [15]

- Voice calls
- Short Message Service (SMS)
- GSM Data calls
- General Packet Radio Services (GPRS)

**Advantages**

1. This system reduced man efforts.
2. Saves time
3. Operates efficiently without human interface.
4. Quick operation

**Disadvantages**

1. Absence of mobile network this system is not give information about faults & its location.

**IV. CONCLUSION**

In this paper we studied a GSM based transmission line multiple fault detection system that send information to electricity board via SMS. From the previous discussion we conclude that, system will provide a reduction in the time. Hence, phase parameters are sensed continuously & during the occurrence of any series and shunt fault (here in paper S-L-G, L-L, L-L-G, open conductor fault) on the three phase line, the type of fault is detected by microcontroller. Protective devices placed on sending end and receiving end works during occurrence of fault (especially short circuit fault). Respective message sending or displaying on PC screen takes place.

**REFERENCES**


[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.


