DETECTION OF FAULTS IN TRANSMISSION LINE SYSTEM WITH GSM

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Abstract

The efficiency of power systems is largely determined by the effectiveness of the inbuilt power equipment. Monitoring transmission lines for faults and quick isolation of the system from faults helps to improve the efficiency of the power systems reliability. Technologies such as Power line carrier communication and the use of power based communication systems have their respective demerits. In this paper we are going to design a system to provide a reliable monitoring and fault detection in transmission lines. If any fault occurs in transmission lines, it is highly difficult task to find out which type offault has occurred as well as a person should monitor all those things for every time. By chance if there is no one in a controlling room, if at that time fault occurs it causes dangerous hazard. So to avoid this we are going to implement Monitoring and alert in Electrical Transmission Lines System with GSM. By using this system we will identify which type of fault occur in transmission lines and that will be displayed on LCD. Whenever fault occurred a buzzer sound will be given as alert. For reference herein this paper we are taking Transmission lines at different Voltages and finding open circuit fault and Short Circuit fault, whenever fault occurs it can display on LCD which type of fault occurred and as well as give the alert to particular area. And we will be using GSM technology to send a message to the controller at sub-station.

***Keywords**: GSM, Raspberry Pi*

I. Introduction

In an electric power system, a fault is detected by any abnormal electric current follow. For example, a short circuitis 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 andoperate circuit breakers and other devices to limit the loss of service due to a failure. In a polyphase 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. Asymmetric 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 notaffecteach 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 causedeither 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 over head lines. Birds, tree branches may also cause faults on overhead lines. Other causes of faults on over head 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 ageing, heat, moisture or over voltage, accidental contact with earth.

Fig1:Electrical Faults

The over all 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 consumers.

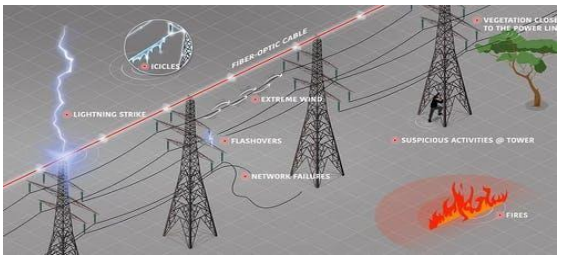

Fig2: Different aspects which cause faults in transmission lines

Classification of Developed Fault Location Methods

Generally speaking, fault location methods can be classified into two basic groups, travelling wave based schemes and impedance measurement based ones as shown in Fig 3.Travelling wave schemes can be used either with injecting a certain travelling wave from the locator position or with analyzing the generated transients due to the fault occurrence. Impedance measurement schemes are classified whether they depend on the data from one or both line ends.

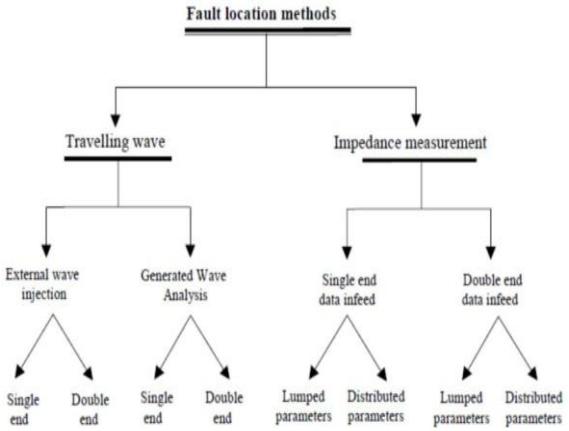

Fig3: Classification of fault location methods

Travelling Wave Based Fault Locators: Employing travelling wave phenomena for fault location purposes for both underground cables and overhead lines was reported since 1931. In1951, Lewis classified travelling wavebased schemes into different four types A, B, C and Daccording to their modes of operation using the travelling voltage waves. Types A and D dependon analyzing the resulting transients from the fault itself needing no further pulse generating circuitry. Type A is a single end one capturing the transients only at one end. It relies on the generated transients from the arcing flashover during the fault. However the assumption of getting generated transients at the line end is not always satisfied. Moreover, the arc it self may extinguish rapidly. They rely on measuring the required time for the injected pulses to go and tobe captured after reflection from the fault point. This time can be directly interpreted as a fault distance.

Impedance Measurement Based Fault Locators: These schemes provide another alternativefor the fault location estimation problem. A line to ground fault occurred on phase A at point F through a resistance RF at a distance x from the locator position. The fault current IF is comprised from two components IFs and IFr flowing from sending and receiving ends respectively. The essential task of the fault location algorithm is to estimate the fault distance x as a function of the total line impedance Z_L using the sending end measurements (for single end algorithms) or both end measurements (for double end algorithms) with the most possible accuracy.

II. Block Diagram

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.

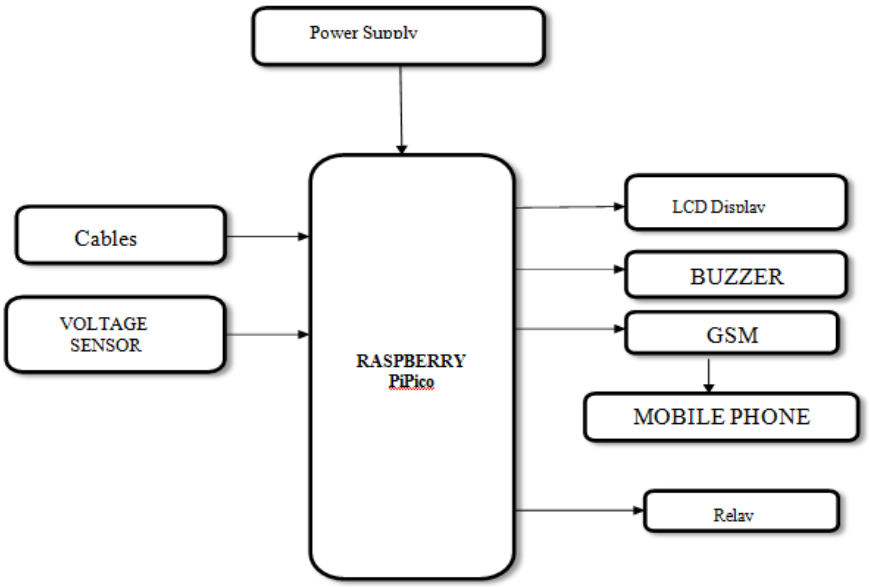

Fig4: Block Diagram of Monitoring and Alert in Transmission Lines with GSM

III. Working

The block diagram of Monitoring and Alter in Transmission Lines with GSM is based on GSM technology is shown in figure 4. It contains the power supply section, GSM, Raspberry PiPico, Voltage Sensor, Buzzer and LCD display. The GSM board has a valid SIM card with a sufficient recharge amount to make outgoing messages. The circuit powered by +5v DC.

Raspberry Pi Pico: In our system we are using raspberry pi pico. It acts as the major controller unit of the system. Input from voltage sensor is given to this unit on which it process according to the programming and gives output as a message to mobile phone by using GSM technology.

Power supply : 7805 is a voltage regulator integrated circuit. It is a member of 7805 series of fixed linear voltage regulator ICs. The voltage source in a circuit may have fluctuations and would not give the fixed voltage output. The voltage regulator IC maintains the output voltage at a constant value. 7805 provides +5V regulated power supply. Capacitors of suitable values can be connected at input and output pins depending up on the respective voltage levels.

Voltage Sensor : In our project we are using voltage sensor to read or sense the voltage level values in transmission lines. The continuously sensed voltage values by voltage sensor from transmission lines are given as the main input to the raspberry pi pico microcontroller.

GSM MODEM**:** GSM technology is used in this system to send the message to the controller at control room whenever the fault occurs in transmission lines. The message contains the details about the type of fault occurred, transmission pole numbers at which the fault occurred. It is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone.

Liquid Crystal Display: LCD is interfaced with I2C modem in order to

reduce the circuit connections or circuitry with power supply and microcontroller. It is the display unit of the system that displays appropriate messages based on the scenario**.** The most commonly used Character based LCDs are based on Hitachi's HD44780 controller or other which are compatible with HD44580. LCD consists of LCD driver/controller that is used to interface LCD and microcontroller.

Buzzer: In our project we are using a buzzer to give an alerting sound whenever the fault has occurred. Here we used a piezo type buzzer, a piezo buzzer is an electric device used to produce atone. These lightweight and simply-constructed buzzers are inexpensive yet reliable and come in a range of sizes and frequencies to meet the needs of nearly any application.

Relay: In our project we used relay as a circuit breaker, whenever the fault is detected the relay is activated and the power supply to the transmission lines is blocked by it to prevent the further loss and as an immediate action after fault detection. As we all know relay could be a device that is employed to supply association between 2 or a lot of points or device in response to the sign applied.

Fig5: Module of Monitoring and Alert in transmission Lines system with GSM

IV. RESULTS

This monitoring and alert in transmission lines with GSM system basically provide us the information about the fault detection and type of faults, it will continuously monitor the transmission lines and alert us whenever the faults occur. The transmission lines which are connected to the micro controller are continuously monitored whenever the fault has occurred the micro controller detected the fault. The voltage sensor along with a potentiometer is used to show the voltage differences in the transmission lines when a fault occurs if the sensed voltage values are not comparable with the prefixed values then it means that a fault has occurred. If the voltage values are above prefixed standard value then it is a high voltage fault otherwise it is low voltage fault. The type of the fault along with differed voltage values are displayed on LCD. The GSM interfaced with the microcontroller has send the message to controller at submission as an alert and contain the details about the type of fault and the differed voltage values in transmission lines after the occurrence of the fault.

The transmission lines through the transmission poles undergone the faults as line-line and line-ground when two transmission lines are short circuited and open circuited. When L-L fault has occurred the voltage values got increased and it is indicated on the LCD as high voltage and a message had send to the substation as LINE-LINE FAULT OCCURED, when L-G fault has occurred the voltage values got decreased and it is indicated on the LCD as low voltage and amessage had send to the substation as LINE-GROUND FAULT OCCURED, the voltage sensed by the voltage sensor is above 7V then high voltage is displayed on LCD with differed voltage value and a message had send to substation as HIGH VOLTAGE DETECTED, the voltage sensed by the voltage sensor is below 4V

then low voltage is displayed on LCD with differed voltage value. If the voltage value is in between 4V & 7V then normal voltage is displayed on LCD with normal voltage values.

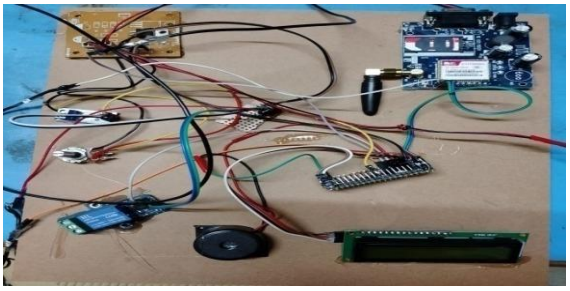

Fig 6: Hardware part of the Module

Fig7: Message sent to mobile phone through GSM

Fig8: L-L fault displayed on LCD

Fig9: L-G fault is displayed on LCD

Fig10: Low voltage is displayed on LCD

Fig11: High voltage is displayed on LCD

Fig12: Normal voltage is displayed on LCD

V. Conclusion and Future Scope

Conclusion

In this paper, we implemented and tested the fault detection system in the transmission lines by using many components like (microcontroller, voltage sensor, GSM, LCD) all these components work together to perform the detection of fault and type of fault. If any fault occurs in transmission lines, it is highly difficult task to find out which type of fault has occurred as well as a person should monitor all those things for every time i.e., nothing but a person should be present in the control room for monitoring these things. By chance if there is no one in a controlling room, if at that time fault occurs it causes dangerous hazard. So to avoid this we implemented Monitoring and alerting Electrical Transmission Lines System with GSM. By using this system we identified which type of fault has occurred in transmission lines and that is displayed on LCD. Whenever fault the occurred a buzzer sound had given as an alert. For reference here in this paper we have taken Transmission lines at different

Voltages and found L-L fault and L-G fault, whenever fault occurs it is displayed on LCD which type of fault occurred and as well as given the alert to particular area. And we used GSM technology to send a message to the controller at sub-station.

Future scope

By using this system we will be getting the information about the type of the fault and differed voltage values. But we don't know the exact position or location of the poles at which fault has occurred. This problem can be overcome by using GPS (Global Positioning System) we can exactly point out the location of poles. The purpose of this system is to send a quick message to the service provider authority as soon as there is fault in transmission line. In future we can have a GPS (global positioning system) attached to it so that it would be send exact location of fault occurs in transmission line in terms of longitude and latitude. In future we can use appropriate programming for finding distance of fault from substation.

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