FAULT DETECTION IN TRANSMISSION LINE USING IOT

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Abstract-Electrical power is transmitted from the generation plant to end-users at distant locations through the transmission line. These lines are exposed to various environmental conditions and faults may occur causing power interruption to end-users, damage to the power system. Fault location detection has been the main objective of power system engineers in transmission and distribution systems. Identification of fault source is a tedious task fast fault detection can help to protect the equipment before any significant damage to the equipment.The transmission line runs hundreds of kilometers, if any fault occurred in between transmission lines so it is hard to locate immediately and it is exhausting work to locate them. The exact fault location can help the serviceman remove persistent faults and locate the areas where the faults occur regularly, thus reducing the occurrence of faults and minimizing the time of power outages. The paper is intended to detect the location of the fault in the transmission line using IoT and the same is transmitted to the control center, an engineer through the GSM technology in the form of an SMS alert. The project used MATLAB Simulink to simulate generally occurring faults and detect them. Simulation results show that the proposed algorithm gives satisfactory results and will be very useful in the development of a power system protection scheme.

KEYWORDS:- IOT, MATLAB Simulink, GSM, Fault Location.

Introduction :

As years pass by, the world population has increased drastically. It has contributed to the increasing need for electrical energy. Providing sufficient and uninterrupted power supply to the consumers is the main objective of a power system. The power system is classified into power generation, transmission and distribution. A transmission network is considered to be one of the vital parts of the power system, as it connects the supply and the demand. Unfortunately, unavoidable faults could occur due to factors such as lightning, storm, and other natural disasters which is uncontrollable by human beings.

The loss in transmission and distribution networks is considered to be very high, compared to other parts of the power system. The transmission line fault is mainly classified into balanced and unbalanced fault. The balanced fault in transmission lines is the three-phase fault, Single phase to ground.

- Single line to a ground fault – 70-80%
- Line-to-line to ground fault – 10-17%
- Line-to-Line fault -8-10%
- Three-phase fault -3%

Many electric power transmission companies have primarily relied on circuit indicators to detect faulty sections of their transmission lines. Even though the sensors, breakers, and other communication line are used the system look bulkier costly, and time-consuming for fault location and clearance. However, there are still challenges in detecting the exact location of these faults.

Literature Survey

In the current scenario, increased emphasis has been placed on power equipment reliability. In particular, facing deregulation and increasing competition, many utilities are looking for ways to generate and transmit power in more economical and reliable ways. The health of equipment constituting the substation is critical to assuring the supply of power

In recent years a range of monitoring and diagnosis devices have become available that provide continuous, real-time condition monitoring and analysis of substation equipment. The effective use of on-line monitoring and diagnosis has potential to provide significant benefits for substation owners, technical personnel, and even utility consumers.

The maintenance of electrical power equipment has been time-based. Maintenance crews would inspect the equipment at set intervals based on its age and performance history. As can be expected, this leaves room for many catastrophic failures of improperly or untimely diagnosed equipment. The cost in disruption of business could far outweigh the savings in maintenance costs. On the other hand, too-frequent maintenance can be very costly and unnecessary. Because of the cost of scheduled and unscheduled maintenance, especially at remote sites, new approaches using on-line monitoring and analysis systems of the substation equipment may be more reliable and cost-effective.

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There are various fault occurred in 3 phased devices which causes damaged to the operating parts if they are not diagnosed at quick time. It is thus important to monitor devices continuously. Real-time and Online monitoring is the solution for continuously observing the health. In this model we will monitor various faults like, under voltage, Over voltage, Unbalance voltage, Single phasing and also we detect the distance at which the fault occurred and protect them against any abnormal conditions, same will be send in term of SMS using a GSM module.

In addition to this we also give a provision for automatic restoration(reset) after fault may get OK, which result less human interactions. For monitoring and control purpose we are used a PIC microcontroller 18f25k22, Potential transformer (PT), Regulator, Relay, LCD. The key benefits of this model includes:- - Early detection and possible prevention of equipment failure, especially catastrophic failure. - Long-term data acquisition and understanding about equipment performance. - Automatically assessing electrical equipment condition. - Resulting in reducing maintenance time and labour, and reducing maintenance costs associated with any failure.

Transformers are the most expensive piece of equipment in the substation, and therefore, preventing transformer failures is the key to greatly reducing the cost and increasing the reliability of providing the needed electrical energy. The development has being made to make the transmission system to be more reliable. So in the earlier days the data was being manually monitored, do to which it has become more time consuming and error loaded.

Then comes the GSM techinique which has become more effective then the manual one but in our project the implementation is to send the data via internet which very fast. In short the easy parameter monitoring will allow reducing the man power requirement at the substation area. This parameter monitoring system will be done around the clock throughout the year. The overall efficiency of the substation will increase as its maintenance plan is reduced.

METHEDOLOGY

The proposed system is an IoT- enabled fault detection system. It uses the voltage from the network to identify the fault location. Node-MCU is used to analyze the data and transmit the information very quickly.

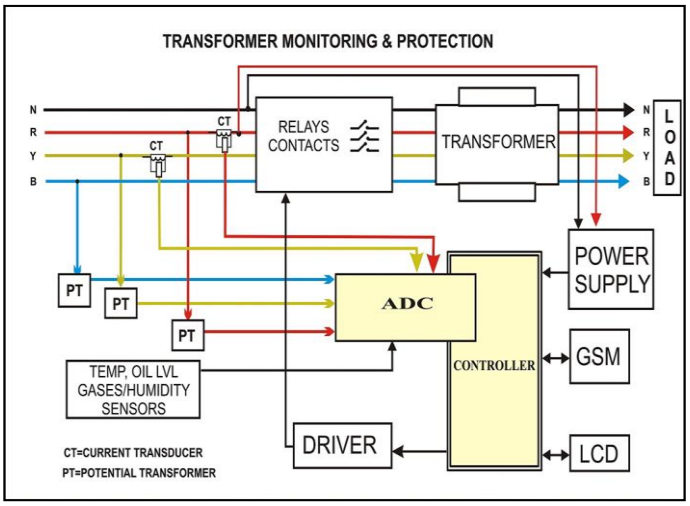

Fig 1. Block Diagram

The paper proposes a very simple, fast efficient, and cost-effective approach to identify the fault location in the transmission network. The proposed system uses the concept of ohms law. Based on the program coded, it senses the voltage drop in the fault line where it compares with the predefined value for fault condition and sends information to the control center.

Working

In case of fault such as unbalanced voltage under voltage, overvoltage, etc. The fault is being analyzed by microcontroller programming and the signal is being sent to the driver relay to disconnect the contractor and isolate the substation.

The power transformer is used to step down the voltage of 230V single phase to 12V. The 12V supply is being rectified to 12V by using the full-wave rectifier.

The rectified supply is regulated to 5V. This 5V of supply is needed for the working of the microcontroller and the various equipped sensors.

The P.T and the current transformer are energized by the line conductors.

The LCD is used to display the monitored parameters on the station substation itself.

The GSM module is used to send SMS to engineers and upload

Internet Of Things

- The internet of things is a system that is connected between the device, analog, mechanical and digital machines that are provided with unique identifiers and the ability to send data over a network without requiring human-to-human or human-to-computer interaction.

- The internet of things is simply defined as "A network of internetconnected objects able to collect and transfer data. IoT is a concept of connecting any device with an ON and OFF switch to the internet and then giving an appropriate output.

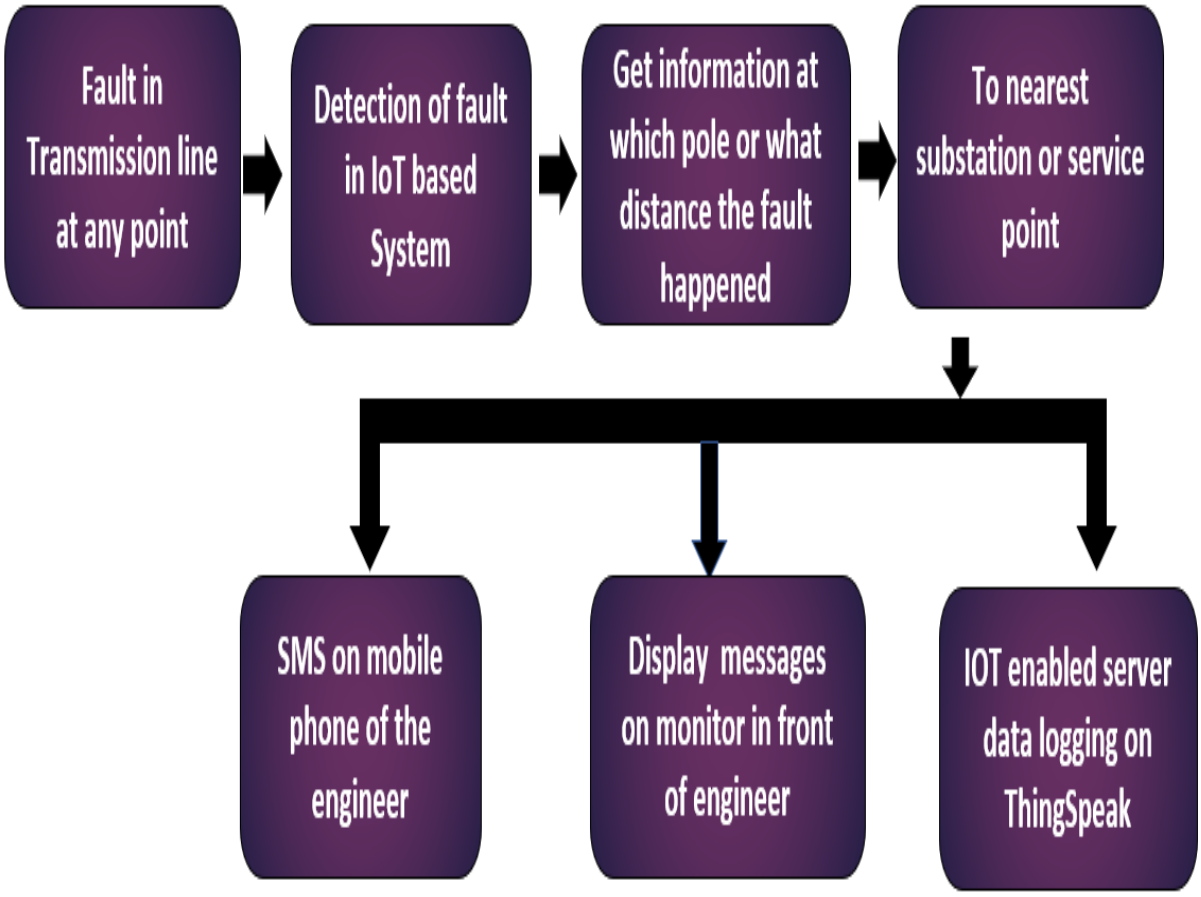

Fig 2. Flow Diagram of Proposed System

This project on transmission line fault detection and classification is done by using the symmetrical component analysis of a three-phase transmission line. The fault on transmission causes unbalances in the system which can be observed from the voltage and current values on the three phases during the fault. The fault is being analyzed by microcontroller programming and the signal is being sent to the driver relay to disconnect.

Components List :

- Power Transformer
- Centre Trapped Transformer
- Regulator
- Driver IC ULN203
- Microcontroller PIC16F886-8 Bit
- LCD Module
- Relay
- GSM Module

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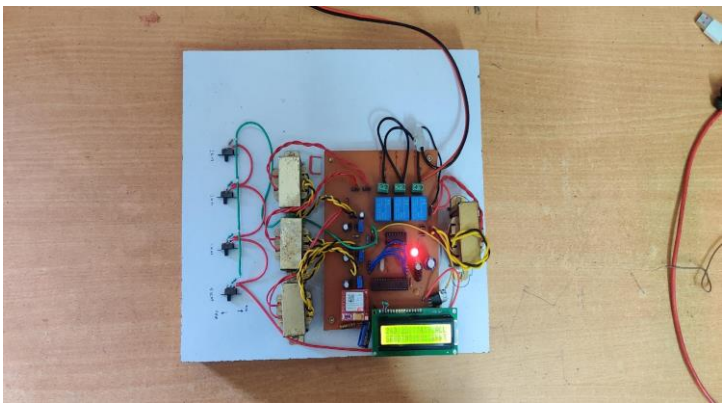
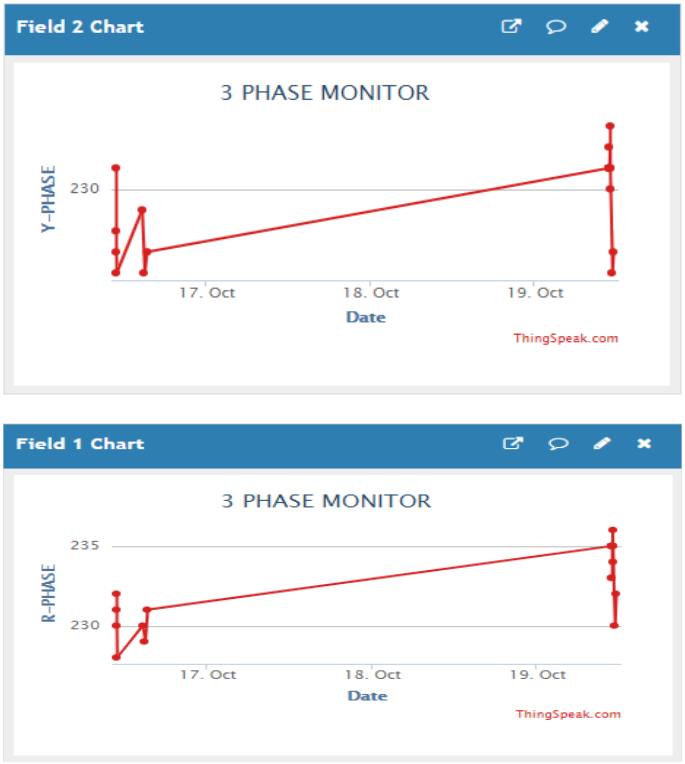
Thingspeak

- Thingspeak is an IOT analytics platform service that allows you to aggregate, visualize, and analyze live data streams in the cloud.
- You can send to thingspeak from your devices, create instant visualization of live data, and send alerts.
- It can be used to store previous data uploaded on the server for future analysis.

Result



Thingspeak ServerOutput



SMS RECEIVED

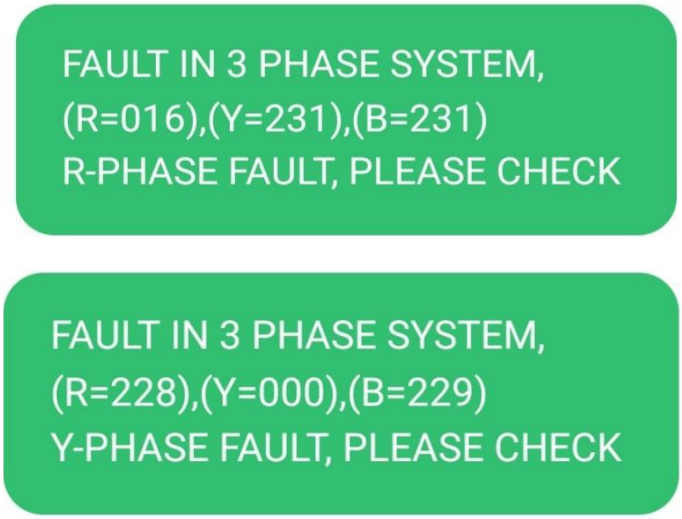


Fig 3. Working model

Conclusion

IoT-based transmission line fault motoring system is proposed. Fault in the transmission line is manually introduced for demonstration. Here in this project, we have designed a GSM-based transmission line monitoring and indication system that sends information of the same to the control room, engineer via SMS. This paper concludes that the GSM technology used for the fault detection of three-phase lines through calls and messages is provided to the In-charge Technicians of a particular faulty location.

The message of fault location will be sent to all In-charge technicians at the same time by the internal programming of the microcontroller connected to the GSM module. The benefits of the system are i. Reduce the time to locate the fault in the field. ii. Fast Repair to revive back the power system. iii. Improves the performance of the system. iv. Reduce the operating expense.

Future Scope

This can be used for Underground Line Fault Detection. Data Logging

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