

Three Phase Transmission Line Fault Detection using IOT

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Abstract—

The transmission lines are an essential component of the power system network. However, they are prone to various flaws and as a result, their losses are significantly higher than those of other power system components. These issues are so hard to fix that a complete cable replacement is necessary. In order to better serve consumers with power, numerous studies have been conducted using new technology. The ESP 8266 (microcontroller) is used in this project to identify transmission line defects from the base station. The ESP 8266 Wifi-Module is used to trace the fault location and, as a result, display the fault type on the 16*2 LCD interfaced with the ESP8266. In accordance with this, the relay linked to the ESP8266 disconnects the relevant line load. The fault location is indicated in distance. Using a Wi-Fi module, the IOT is used to display the data online. Faults like L-G, LL-G, and ground fault are identified and the corresponding data is shown.

Keywords— Transmission Line, ESP 8266 controller, Fault Detection, IOT, Android App.

I. INTRODUCTION

It is well known that sudden variations in voltage and current at the point of a fault in an overhead transmission line system result in high frequency. Traveling waves are electromagnetic impulses that move away from the fault point and along the transmission line in both directions.[1] The electrical grid is extremely enraged by a variety of extreme natural and man-made occurrences. It may doubtfully have an impact on the grid's overall stability and performance. due to the low fault impedance. During the fault, the fault current is comparatively high. Power is redirected toward the fault, causing the voltage in the adjacent zone to become imbalanced and the supply to be disrupted.[2] It is critical to discover faults as soon as possible, which is why a kit is being developed utilizing a microprocessor to speed up the procedure. The uniform distribution of the transmission line's conductor resistance and inductance along its length.[2]

In general, lengthy lines are better suited for traveling wave fault location techniques. Transmission lines for power, operating at 50 Hz and spanning over 80 kilometers, are thought to possess the characteristics of both voltage and current waves that propagate along the line at a limited speed. There have been reports of traveling wave techniques for locating transmission line faults for a long time. The subsequent advances use the traveling wave transients produced by the fault to generate high speed digital recording technologies. At present, the electrical power infrastructure is increasingly susceptible to various natural and malevolent physical occurrences,

hence impacting the grid's stability. A certain parameter is going to be impacted. As a result, it will soon be necessary to outfit the antiquated transmission line infrastructure with a high performance data communication network that can handle operational demands in the future, such as real-time recording and control, which are essential for the integration of smart grid technology. This technique necessitates real-time monitoring.[3]

To identify the problematic areas of their transmission lines, a lot of electric power transmission firms have mostly relied on circuit indications. The precise location of these faults remains difficult to determine, though.

The technical team and patrol teams still need to physically patrol and inspect the devices for extended periods of time in order to find problematic sections of their transmission lines, even though fault indicator technology has made it possible to locate permanent defects in a flexible manner.[4] Many of these concerns are addressed by wireless sensor-based transmission line monitoring, including real-time structural awareness, quicker fault localization, precise fault diagnosis by distinguishing electrical from mechanical faults, cost savings from condition-based maintenance as opposed to periodic maintenance, etc.[5] Strict specifications like quick transmission of massive amounts of extremely trustworthy data are identified by their implementations. The creation of a dependable, affordable network infrastructure with quick reaction times is essential to the success of these appeals. Confidential data, including control information and the condition of the transmission line at any given time, needs to be transferred between the transmission grid and the network. An affordable foundation for creating a real-time data transmission network is offered by this research. Sensors are installed in a variety of power network components to allow real-time monitoring of the power system status.[5]

II. LITERATURE SURVEY

“Three Phase Fault Analysis with Auto Reclosing Mechanism”, Vinesh Gamit, Vivek Karode, Karan Mistry
Various faults have been Simulated to develop an automatic tripping mechanism for the three phase supply system while temporary fault and permanent faults occur. Here timer 555 has been used with relay for the fault analysis. Short duration fault back to the supply to the load immediately called as temporary trip while long duration shall result in permanent trip.

“Three Phase Fault Analysis with Auto Reset for Temporary Fault and Trip for Permanent Fault”, Sathish Bakanagari¹, A. Mahesh Kumar², M. Cheenya

This project is designed in the form of Hardware for three single phase transformers 230v to 12V of output for to develop an automatic tripping mechanism for the three phase supply system while temporary fault and permanent fault occurs. Here we used 555 times with relay for the fault is temporary or permanent. Short duration fault returns the supply to the load immediately called as temporary trip while long duration shall result in permanent trip. The concept in the future can be extended to developing a mechanism to send message to the authorities via SMS by interfacing a GSM modem.

“An Overview on Detection of Temporary Fault and Permanent Fault for 3 Phase Load”, Abhay Lodhe¹, Ashish Tandekar², Mayur Rokade³, Vaibhav Dhurve⁴, Pratiksha Sakhare⁵, Ajay Wagdhare⁶, Harshal Bhopche⁷, Dr. Chandrashekhar Hiwarkar
To Maintain reliability in Power System it is important to protect the 3 phase devices like inductive, resistive, etc against various faults occurring in it. This fault should be identified and analysed

quickly for their remedies. The Project Aim is to develop an Automatic Tripping mechanism for the three-phase system. In the case of a temporary fault, the output of the project resets automatically within second. While in event of Permanent fault condition the permanent Trip. Due to these faults, the power system may suffer from considerable damage. This can lead to disturbance in power supply and may cause a standstill to various industries linked to the system. In a three phase power system, these faults are classified as LG (Line to Ground), LL (Line to Line), 3L (Three lines). This system can overcome such problem which by sensing the fault automatically and disconnects the system from the supply so that large scale damage to the system equipment can be avoided. The system automatically differentiates between a temporary disturbance and a permanent fault and appropriately cuts the supply for a short duration or long respectively. The purpose of this project is also to send the information to the mobile by using Global system for Mobile Communication (GSM) technology.

III. OBJECTIVE

Three phase supply system failures can impact the power system. These faults might be LG (Line to Ground), LL (Line to Line), or 3L (Three lines) in the supply systems. To solve this issue, a system that can detect these faults and immediately cut off the supply is constructed to prevent significant damage to the control gears in the grid sub-stations.

The project's goal is to create a three-phase supply system's autonomous tripping mechanism. When a short fault occurs, the project output automatically resets after a brief interruption; when a permanent fault occurs, it remains in the tripped state.

With the use of IOT, we can quickly identify phase fault in this project. In addition, we can quickly detect faults when they occur, which gives the system backup protection.

By determining or providing a graphical or pictorial representation of the faults and the actual position of the faults, IOT addresses this issue.

IV. MOTIVATION

There is an increased risk of malfunction when electrical networks, machinery, and equipment are operating. This kind of failure is undesirable because it can alter the electrical network's characteristic impedance value and disrupt the power system's regular operation. An insulation flashover-related fault that needs to be tripped right away is referred to as temporary. As a result of the malfunction, this system makes sure that the remaining equipment is safe.

V. PROPOSED SYSTEM

To meet the problems of the modern world, all systems are automated. Automated systems now days are more accurate, dependable, flexible, and require less human intervention. All fields favor automated control systems as a result of this requirement. Automated systems performance is good, especially in the electronics industry. Absence of any one of the phases is an often encountered issue with three phase supplies. For this reason, the three single phase supplies (R- \emptyset , Y- \emptyset , and B- \emptyset) that we are using in this project are meant to provide a constant load. When one of the three phases runs out, the others are prepared to supply the single phase load, and the LCD is ready to show which phase is operational.

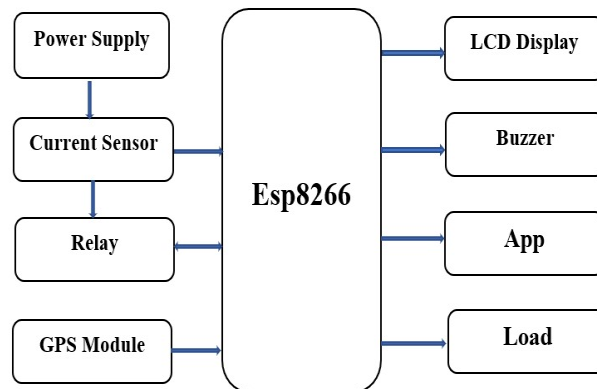


FIG 1. BLOCK DIAGRAM

Three phase supply system failures can impact the power system. These faults might be LG (Line to Ground), LL (Line to Line), or 3L (Three lines) in the supply systems. To solve this issue, a system that can detect these faults and immediately cut off the supply is constructed to prevent significant damage to the control gears in the grid sub-stations. Using a block diagram and fundamental components, we gather the components and assemble the circuit in the process. We are currently developing software to run or create a complete program to create a complete model.

VI. OPERATION

Operation of three phase transmission line fault detection system:

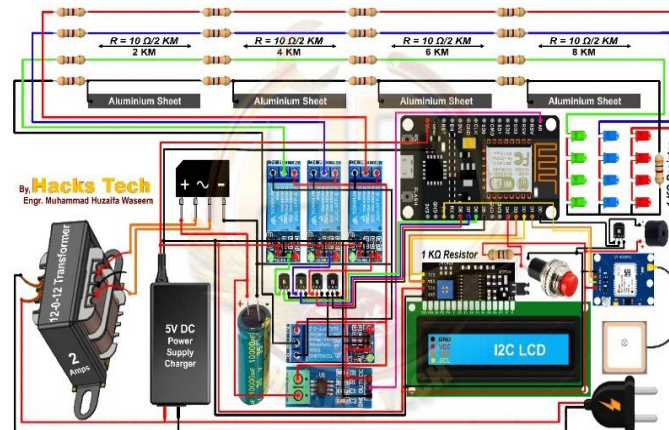


FIG.2 CIRCUIT DIAGRAM

The current sensors continuously monitor the current on each of the three phases. If a fault occurs, the current on one or more phases will deviate from normal levels. The ESP8266 detects the abnormal current and triggers the relay to open. This isolates the faulty section of the transmission line from the rest of the power system. The ESP8266 can also send a notification to the app, indicating the location of the fault (via GPS) and other relevant information. The LCD display and buzzer provide local indication of the fault. Fault detection systems like these play an important role in protecting power transmission lines from damage. By quickly isolating faults, they can

help to minimize downtime and prevent cascading failures.

VII. RESULT

By utilizing individual three push switches as the system supply side, we were able to assess the three phase system defect from the functioning model of our experiment. When a fault occurs, the project detects it and reports the information on the LCD board.

In the event of a momentary malfunction, it temporarily trips the circuit before reestablishing the connection. On the other hand, it trips it permanently in the event of a permanent fault.

The three single phase supplies (R-Ø, Y-Ø, and B-Ø) that we are using in this project are meant to provide a constant load. When one of the three phases runs out, the others are prepared to supply the single phase load, and the LCD is ready to show which phase is operational. Three phase supply system failures can impact the power system. These faults might be LG (Line to Ground), LL (Line to Line), or 3L (Three lines) in the supply.

Following figures shows the result of simulation

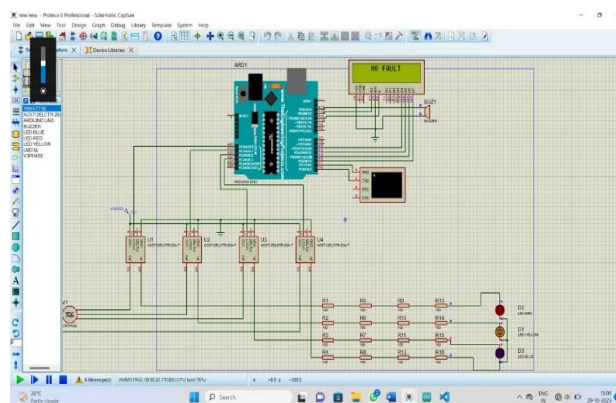


FIG.3 RESULT WITH NO FAULT

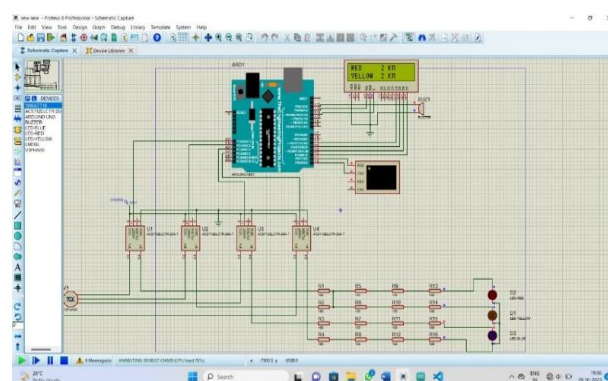


FIG.4 RESULT WITH FAULT IN 2KM DISTANCE

Android App Fault detection result:

Android App: Develop an Android app that communicates with the ESP8266 over Wi-Fi. The app can display real-time data from the system and allow the user to monitor the transmission line status remotely. It can also send commands to the ESP8266 to control the system, such as resetting the relay fault location. User can see the location of occurred fault remotely

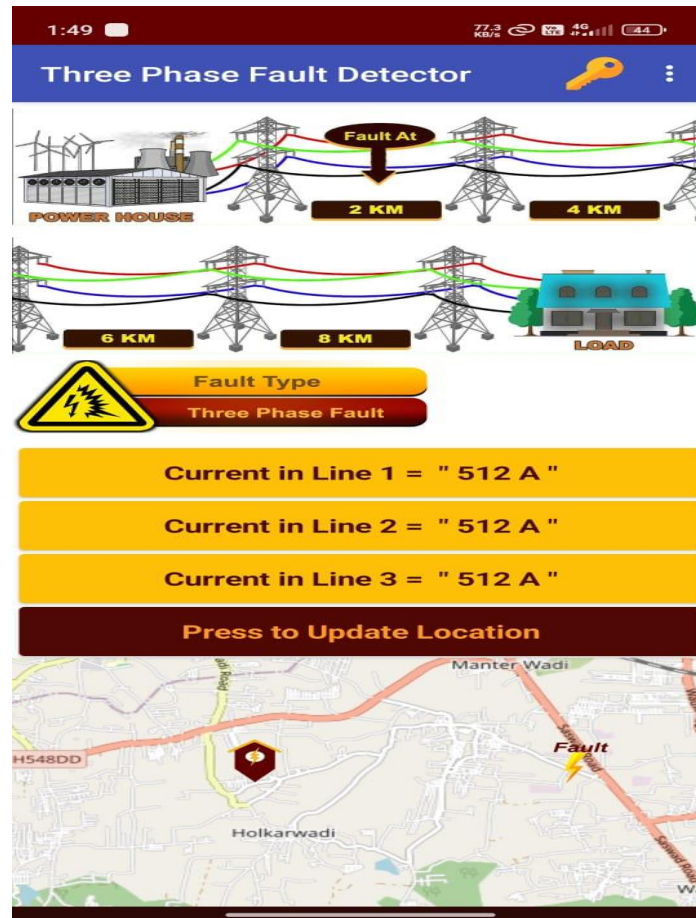


FIG.5 ANDRIOD APP RESULTH WITH 2KM FAULT

VIII. CONCLUSION

In this research, a concept utilizing an ESP8266 and Internet of Things software to address consumer issues is proposed. The model can quickly identify the kind of error and provide an efficient solution. The prototype model is accurate and fast, and it helps prevent transmission line issues in the future. Taken as a whole, this model offers an effective fault detection system that can help the power business and customers alike.

IX. FUTURE SCOPE

In this research. Future advancements in IoT technology will enhance accuracy and reliability, reducing false alarms. Predictive maintenance will utilize machine learning to anticipate faults before they occur. Remote monitoring and control capabilities will improve response times during faults. Integration with smart grid technologies will automate responses, enhancing efficiency. Overall, IoT-based fault detection will drive innovation, making power grids more reliable, efficient, and sustainable.

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