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# Transmission Line Fault Detector and Safety System Using IOT

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**ABSTRACT:** The electrical power system is growing and complexity in all sectors such as generation, transmission, distribution, and load systems. The detection and location of faults on power lines is essential to the protection and maintenance of a power system. In an electrical power system, a fault current is an abnormal electric current. In this system, some device uses like sensors to sense the current (in amp) and voltage (in volt) continuously of transmission line. Our system will detect if any voltage drops or overload on transmission line, if any these types of faults occur it can detect it and trip the line by using relay. Furthermore, if there are thefts occurs on line it can be detected automatically and intimated to the authority person with location by using Internet of Things. Location of theft is essential in case of power system. Detection of fault in the transmission line has been proposing by programming Arduino UNO and Arduino MEGA. Arduino senses the change in current and voltage as per programming and provides information to LCD. The device is measures incoming and outgoing values and find abnormalities with the help of sensors. Fast monitoring can help to protect power system. This is the concept of impedance method fault detection system. This fault and detection of theft is very fast.

**KEYWORDS:** Internet Of Things, Arduino UNO, Arduino Mega

## I. INTRODUCTION

Modern electric system is growing up exponentially [1]. Electrical power transmission line is a critical link between power generation plants and distribution to all electricity users. Length of transmission line is long and there is a possibility of fault occurrence. These faults cause giant damage to expensive equipment and damage stability [2]. So, fault should monitor quickly and isolate faulty line. It is important to protect the transmission system. Sensors can take accurate measurement of an electrical parameters and transfer information to IOT. Sending information to control room in appropriate time is a difficult challenge [3]. The theft of electricity is a big problem of power system. Theft is the major concern of the transmission and distribution losses in the supply of electricity [4]. All electricity companies face this issue and losses money every year due to theft. Electricity is being stealing with bypassing. This system is utilizing to overcome this type of losses of electricity, and it is very beneficial for the authorized agency to control its revenue loss. Proposed system is uses for identifying faults, thefts and if there is any fault occurs line will trip or isolate immediately, this work is complete by relay operation. It will protect transmission line against damage. Recommended system also detect theft, if there is any taping online for electric power theft it will intimate to the authority person of control room with location by using Internet of Things (IOT) system. Detection of theft is integrating with IOT mechanism. Thus, we must take care of transmission line to reduce losses for efficient system, this proposed work, i.e., IOT based transmission line fault detection system may be the solution [5]. Most methods of fault detection and location based on measurements of electrical quantities provided by current and voltage transformers [6].

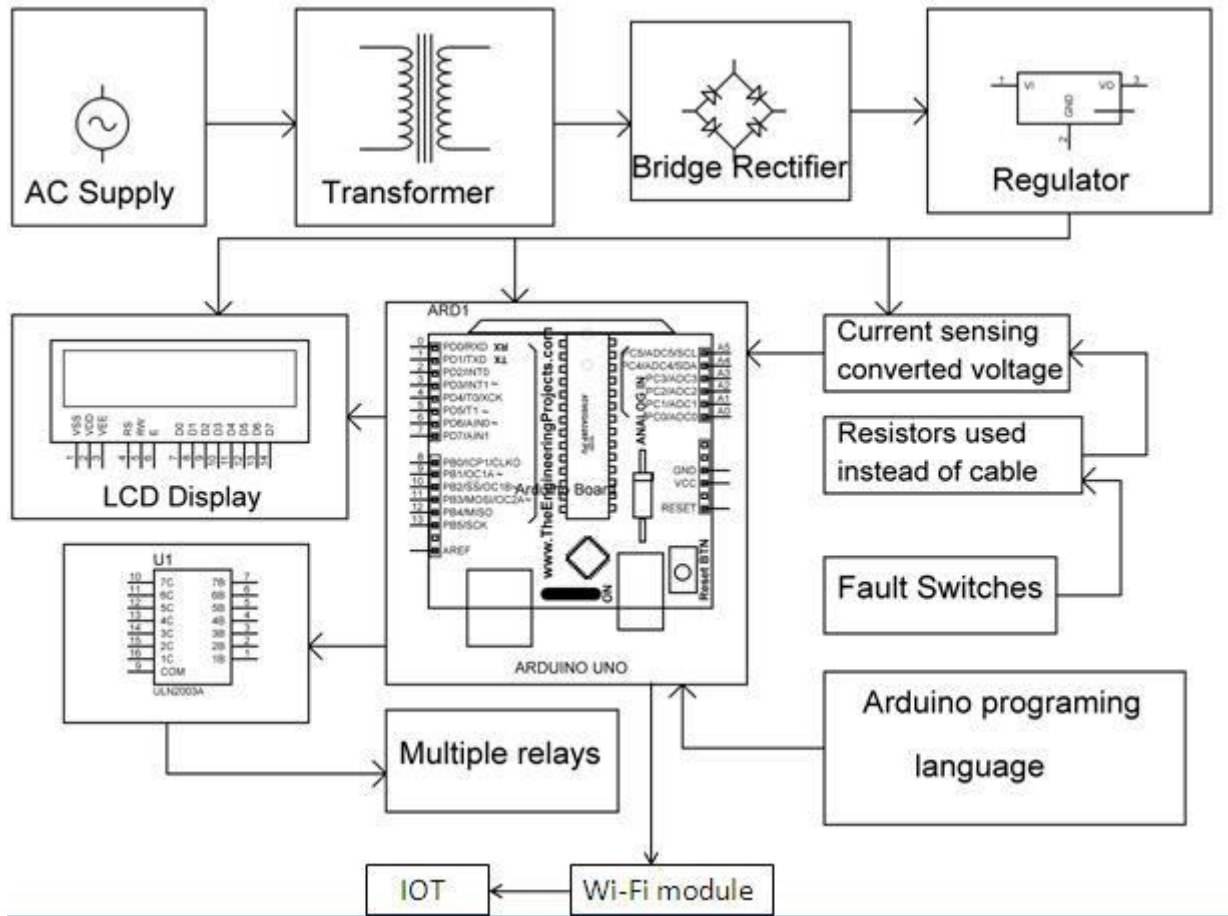


Fig 1: LINE TO GROUND AND LINE TO LINE FAULT DETECTION OVER IOT

The development of the nation's power sector provides one of the most important input especially in moderately developing nations. In India the consumption of electricity is increasing at a much faster rate. Therefore, a need has aroused to generate, transmit & distribute electric power in the most economical way. Electrical power systems are divided into generation, transmission & distribution. Losses in the distribution system are much higher than losses in transmission side and also faults are more frequent in distribution side. In the distribution system most of the losses are caused by fault and theft. In this project the focus is on a three phase, fault in the power line. When a phase to phase or phase to ground fault occurs, it becomes significant to detect fault quickly using IoT. We also try to detect fire faults and Over current faults in the system. It becomes challenging for the power company to detect and repair the fault as quickly as possible. Protection systems are designed to identify the location of faults by SMS and IoT means by saying the transformer location number and Isolate only the faulted section in order not to damage the whole equipment in the power system. In the proposed concept with the use of wireless sensor networks the location of fault can be diagnosed. There by providing optimum operation of electric power. The objective of this project is to provide a simple way to detect the fault and show it on IOT as well as by SMS the fault which will ultimately lead to optimum operation of the whole system and to improve the reliability of the distribution network. Sending this information to the control centre in a cost efficient and appropriate time is a critical challenge to be addressed in order to build an intelligent smart grid.

## II. SURVEY

The reference study stressed the significance of using an impedance-based computation method to pinpoint a transmission line fault. Line parameter changes affect the results. This is demonstrated by analysing genuine defects using the two popular methodologies. The most popular fault location techniques are contrasted, and their relative drawbacks and benefits are discussed here. The users can choose the most precise approach with ease. Because two end methods are less sensitive to faults than one end methods, they are stronger than one end methods. [1]

This study found that reliable fault detection and classification are essential for effective power distribution to various sites. The precise protection of transmission lines is ensured by active circuit breaker tripping, and the tripping action of circuit breakers is dependent on the current and voltage waveforms during the fault. The usage of Discrete Wavelet Transform (DWT) for study of current waveforms during fault is highlighted. For the purpose of identifying and categorising defects on a transmission line network, discrete wavelet analysis was evaluated. Classification of flaws had been done based on energy level percentage

It is discussed how to employ wireless sensors to detect faults in power lines, such as phase-to-phase, short-circuit, and primarily line-to-ground faults, for more dependable and effective system functioning. In this concept, the power line is separated into WNS (wireless sensor network) nodes that may detect the power line's fault condition, show it to the operator, and send an SMS to the service engineer via a GSM modem. This concept effectively and thoroughly investigates the asymmetrical faults that develop in power lines. The PIC 16F877A microcontroller, which is attached to the current sensor in a Wireless Sensor Network (WNS), transforms the analogue measured current value into digital form and then communicates the data to the primary first node via transceiver. principles determined by a PIC 16F877A microcontroller are transmitted GSM technology is used to transmit data to a control panel or substation so that quick action can be taken.. [2]

The system examined a variety of defect kinds for monitoring purposes. The limit for each error can be set by the NodeMCU when it is communicated to a web page via a Wi-Fi module. The system notifies the authority's cell phone if any parameter exceeds its limit. By contrasting the calculated values obtained from a theoretical equation with the actual measured findings, the overhead transmission line monitoring system is evaluated. In order to increase the system's viability and utility, it might also collaborate with an IoT system. The Wi-Fi module transmits and receives data from the numerous sensors, which are then saved in a database. The power company could be informed companies to increase transmission line safety or act as a resource in the power dispatch centre. Every bit of information from overhead broadcast is recorded hour by hour. Every time a gearbox line issue arises, it takes time and costs substantially more to fix it. Additionally, there is a risk to life. Here, the application of IOT to transmission lines will aid in enhancing transmission line maintenance and monitoring. A quick fix shortens the time it takes to find the problem in the field and brings the system back up. For real-time monitoring, the system can be tested outdoors. The main energy expense is accounted for by IOT services on scattered placed devices. Combining different services is one approach to reduce energy costs. minimise the bandwidth usage on a device to conserve computation and communication power. Therefore, it is crucial, economical, and efficient to use IOT for transmission line monitoring.. [3]

In the study titled IOT based fault monitoring system, a cost-optimized framework for designing a real-time data transmission network is described. Sensors are installed in a number of the power network's components to track the power system's status in real time. These sensors produce a lot of data and are able to take precise measurements of a wide range of electrical or physical properties. Building an intelligent smart grid requires addressing the fundamental challenge of promptly and cost-effectively delivering this information to the control centre. A key component of sensor-based transmission line monitoring is network design because of the massive scale, extensive topography, unusual topology, and crucial timing requirements. mechanical issues, cost savings brought by by the extensive scale, broad geography, unusual topography, and pressing schedule needs. mechanical issues, cost savings from condition-based maintenance as opposed to routine maintenance, etc. Applications like analysing mechanical status and dynamic transmission line ratings make use of sensor networks. Sensors are installed in a number of the power network's components to track the power system's status in real time. With the intention of installing cellular transceivers on each tower, the hierarchical model proposes an extremely expensive option. Although such a network can deliver incredibly low latency data transmission, the significant installation and subscription expenses make this concept very inefficient.. [4]

To ensure safety, reduce equipment damage, and preserve power system stability, the primary purpose of the protection system is to quickly clear faults from the power system. Understanding system faults, their identification, and safe isolation of the defective equipment are necessary for the protection of power systems. A basic electrical load evaluation and an inventory of all the necessary electrical loads can give an indication of how much power the system must generate. Situations involving power fluctuation, such as the maximum/minimum voltage obtained from the a.c. supply mains, are also taken into account. [5]

This paper explains the GSM-based fault detection approach. An accurate location of the fault occurring in the transmission line (latitude and longitude) will be sent via GPS coupled to a GSM-based fault detection system. The

system can be correctly programmed to determine the distance between the fault and the substation. When the threshold is bridged, the GSM modem is used to transmit and receive the fault and position.

The sensing unit includes the sensors for sensing current, voltage, frequency, and temperature in order to help gather electrical parameters and make the corresponding signals available for the PIC to process. This system's benefit is that it provides precise details regarding the type of line fault that occurred, such as L, G, L, etc. The system asserts that it is more adaptable than the current conventional system. [6]

### III. METHODS

Actual working Designed work divided in two parts. One part is called the “Slave system” and the other part is called the “Master system”. In the actual system there will be many slave systems in a particular area but a single Master system that will control all the slaves. All the systems will be mounted on each of the electricity distribution pole. The master system will be located at the central pole and slaves will be on the surrounding poles. The purpose of the slave is to monitor the current flow on the transmission line for that particular pole. We will use the current sensors for this. It will measure the current flow on the transmission line in two parts, one is incoming current to the pole and the other is outgoing current from the pole. Both the currents values may be different as there may be authorized electrical connection going to a consumer from that pole. Another task of the slave is to transmit those current values to the Master system over a wireless RF link. For this purpose, we are going to use RF trans-receiver modules. The master system will also measure the incoming and outgoing current on the master pole. It will also collect the current values coming from all the slaves over the RF links and also monitors voltage of all three phases (R, Y, B). The master system will arrange all those current values in a sequence in which the actually current flows through each of the current sensors. The main task of the master is to find out difference between outgoing current of each pole and the incoming current consecutively next pole for every phase wire. Like this it will detect the leakage/theft of the power in the transmission line. A IoT modem can be used to send the message to the area supervisor of that particular area using the WIFI system. This data can be viewed on the website by anyone. There will be 6 CTs on each pole in total, 3 for incoming current measurement of each phase (R Y B) and 3 for outgoing current measurement.

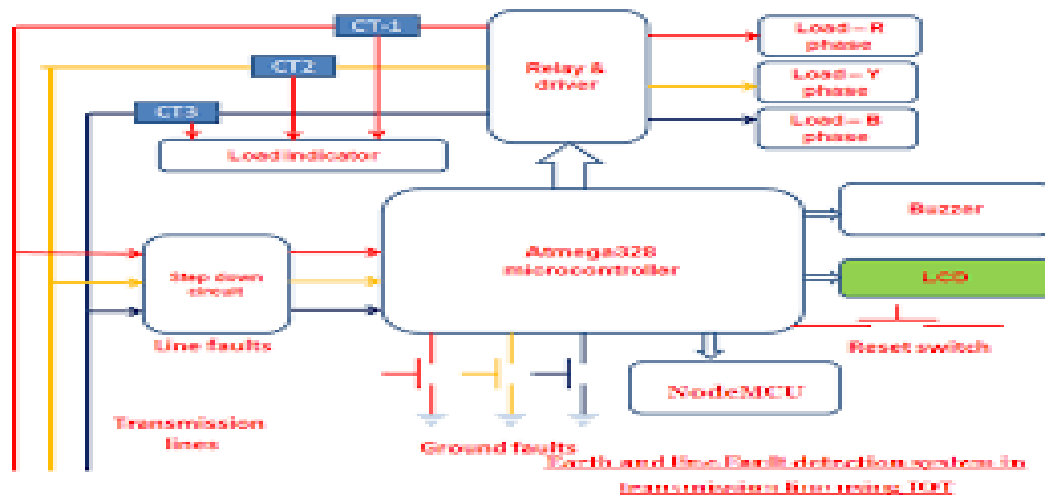


Fig 2: Methods

The data will be stored online on a cloud server w.r.t data and time and the fault type. The system we are using in the project is Node MCU-based controller which is a wi-fi 2.4GHz microcontroller and programmed for the same. For SMS GSM module is used. For the demo transmission line, we use a 12V AC transformer and we show its output as overhead lines and provide to the load via current sensor. As shown in the diagram, Node MCU is an ESP32 controller having inbuilt Wi-fi to connect to the internet. The 3 phases we connect fault relays which are triggered when the line is shorted with ground/ neutral or line to line short. Current sensor Use to detect the load current fault. As soon as anyone phase shorted the signal goes to Node MCU and SMS is sent to the concerned person via GSM. Also we can see the status of each phase online using an IP address on the web browser.

#### IV. RESULT ANALYSIS

Relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations. A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protective relays". Magnetic latching relays require one pulse of coil power to move their contacts in one direction, and another, redirected pulse to move them back.

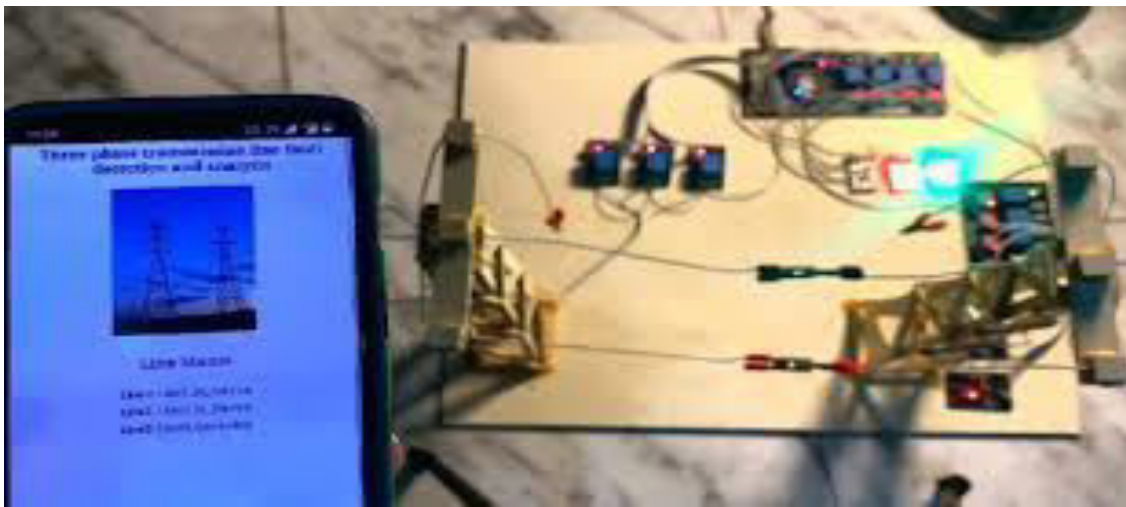


Fig 3: Line Fault Result analysis

Repeated pulses from the same input have no effect. Magnetic latching relays are useful in applications where interrupted power should not be able to transition the contacts. When the coil is energized with direct current, a diode is often placed across the coil to dissipate the energy from the collapsing magnetic field at deactivation, which would otherwise generate a voltage spike dangerous to semiconductor circuit components. Such diodes were not widely used before the application of transistors as relay drivers, but soon became ubiquitous as early germanium transistors were easily destroyed by this surge. Some automotive relays include a diode inside the relay case. If the relay is driving a large, or especially a reactive load, there may be a similar problem of surge currents around the relay output contacts. In this case a snubber circuit (a capacitor and resistor in series) across the contacts may absorb the surge. Suitably rated capacitors and the associated resistor are sold as a single packaged component for this commonplace use.

#### V. CONCLUSION

Here monitor the fault in transmission lines which is done on the basis of Node MCU Wifi Module. Here projected an IoT based model for recognition of fault in the transmission line. This technique is also given that a very fast speed of operation, which is very essential for the continuity and stability of power quality. Fault in the transmission line is manually introduced for the purpose of demonstration. The fault is transmitted to the control center using Wi-Fi module. The method proposed now provides us a cheap and highly reliable way to locate the faults in the three phase transmission lines and also supports data storage.

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