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Review on IOT based Transmission Line Fault Detection

Amol Hatwar[1], Chetan Shende[2], Anshika Kolhe[3], Mrs. Vedanti Hardas[4]
Department of Electrical Engineering K.D.K. College of Engineering Nagpur.

Abstract: The electrical system is made up of numerous unique parts. One of these is the transmission system, which involves sending electricity from substations and substations to consumers along power lines. This paper provides a review of the research being done for Internet of Things-based transmission line fault detection.

I. INTRODUCTION

A. About Transmission Line Faults

Transmission lines are used to move electricity from generating units to distant load centres. Faults may develop on these gearbox lines as a result of lightning, incorrect operation, overload, short circuits, human error, malfunctioning equipment, and ageing. When a defect develops, the voltage of the affected phase drops, and large currents flow that, if not stopped right once, might burn out the components. The faults in transmission lines powered by a three-phase power source are, in decreasing order of frequency of occurrence:

1) *Single-phase-to-ground faults (L-G):* Single Line-to-Ground Faults (SLG) are the most prevalent form of fault. One conductor touching the ground or making contact with the neutral wire will result in this kind of fault. It might also be the result of trees collapsing during a rainstorm.
2) *Phase-to-phase faults (L-L):* The Line-to-Line fault (LL) is the second most frequent form of fault. Two transmission lines are said to short-circuit when this happens. For example, if a huge bird were to perch on one transmission wire while touching another, or if a tree branch were to fall on top of two electricity transmission lines..
3) *Double-phase-to-ground faults (L-L-G):* The Double Line-to-Ground fault (DLG) in the graphic below represents the third type of fault. This might be due to a tree falling on two power lines, among other things.
4) *Three-phase fault (3-ɸ):* Balanced three phases, which can result from a contact between the three power lines in a variety of ways, are the fourth and most serious type of fault. This calls for very quick diagnosis and correction of transmission network faults. A high performance data communication network that meets future operational requirements like real-time monitoring and control required for smart grid integration must also be installed in order to sustain the outdated transmission line infrastructure.

B. What is IOT?

The internet of things, or IOT, is a network that connects smart devices that use embedded systems, like processors, sensors, and communication hardware, to gather, and act on data they gather from their environments. The idea behind IOT is to connect any device with an ON/OFF switch to the internet and then provide the necessary output.

C. Use of IOT in Fault Detection

When a line malfunctions, the IOT base Transmission fault detection system can identify the issue and shut off power to the affected area until the operator can validate the issue and shut off the entire line. The R, Y, and B Phases lines are monitored sequentially by the system for line faults. As soon as a fault is found, the system sends a notification to the line monitoring station along with details about the faulty line and the length of the broken line. Additionally, the system has the ability to transmit line voltage to the monitoring station.

II. LITERATURE 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. [1]

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. CONCLUSION

Compared to the conventional method of fault detection in transmission lines, IoT-based transmission line fault detection offers a quicker and more efficient solution. In any season, the fault may be accurately located, as well as its position. A number of issues can be addressed by wireless sensor-based monitoring of transmission lines, but the effectiveness of these applications depends on the creation of cost-effective, dependable, and responsive network architecture.

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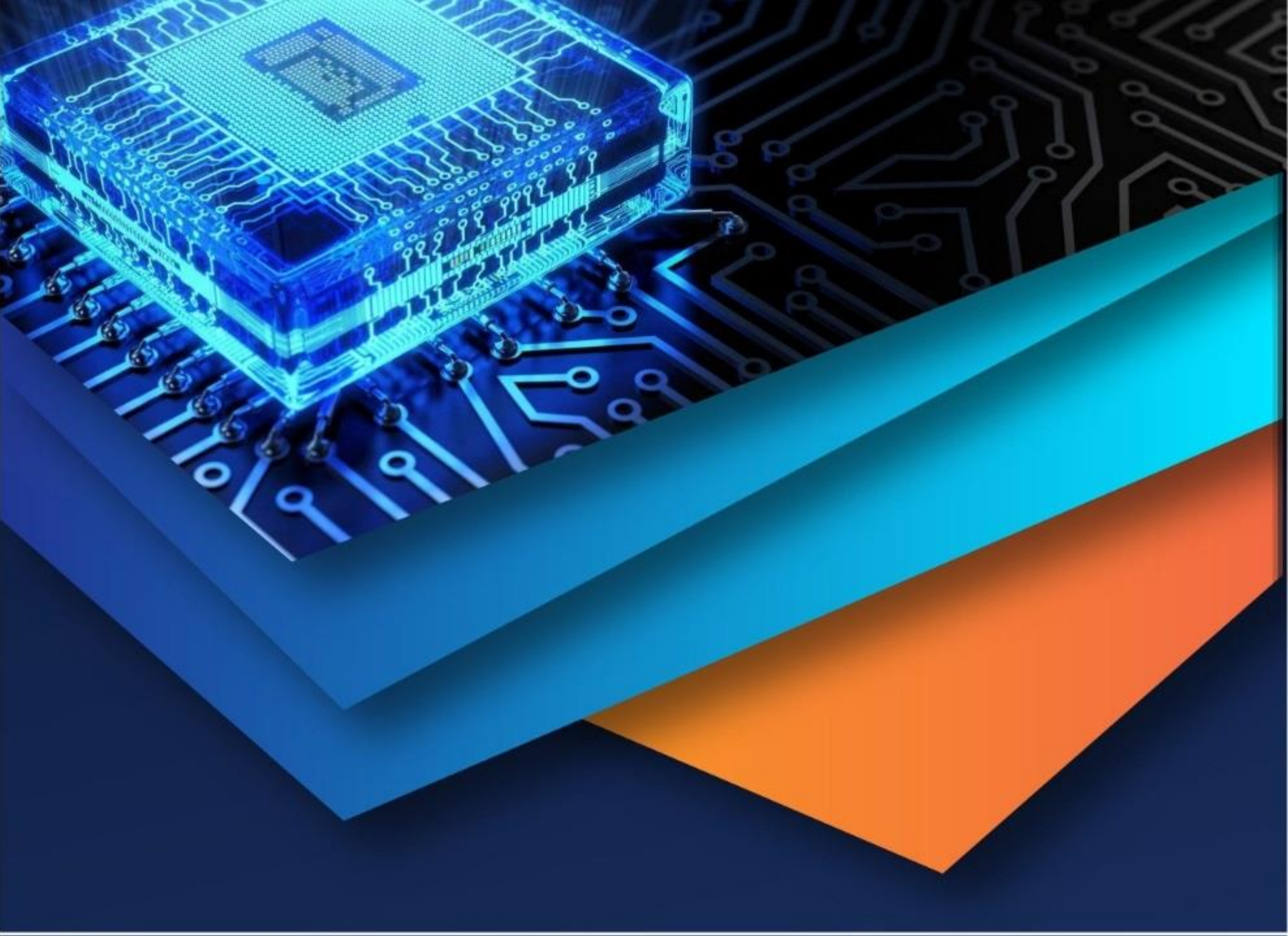

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