Three Phase Fault Analysis and Detection in Transmission Line based on IoT

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Abstract: **There are numerous sections to the electric power system. One of these is the transmission system, which transports power from generating stations to substations and then to customers via transmission lines. Malfunctions are commonly referred to as 'Faults'. A fault is simply described as a series of unpleasant and unavoidable events that might momentarily disrupt the power system's stable condition when the insulation breaks at any point. Lightning, Trees falling on transmission lines, Automobiles or Aircraft colliding with transmission towers and Birds shorting lines are all causes of faults. The causes and effects of defects, as well as several fault detection technologies, will be examined in this paper. The power system equipment is severely damaged as a result of these problems. The faults in the supply systems might be L-G (Line to Ground), L-L (Line to Line), or L-L-L (Three Lines), and these three phase faults could influence the power system's supply system**.

Key Words: L-G, L-L, L-L-L, faults, transmission line.

1. INTRODUCTION

Transmission lines account for 85-87 percent of problems in the power system network [1]. Whenever a fault develops in an above power transmission system, large variations in power supply achieve a large-pulses defined as wave propagation, they spread up the power line in both directions far from the fault point.

The power generation system is aggravated by a variety of environmental and physical phenomena, that can have a substantial effect on grid speed and reliability [2]. The defect has a very low impedance. Throughout the faulty, overall leakage current is quite strong. The power supply to the nearby zone is disrupted as The electrical current is deflected to the defect. It's vital to pinpoint the issue as quickly as possible. [3]. Finding subterranean faults is extremely challenging [4]. To speed up the process, a prototype is being created utilising a microcontroller. The resistive and inductive of the power distribution conductors are spread fairly along its path. Long-line fault locators, such as travelling wave fault locators, are usually more appropriate. To identify faulty powerlines, certain electrical transmission corporations have totally depended on network signals. However, pinpointing the specific position of these flaws remains a challenge. Several of these issues are addressed by a wireless sensor-based transmission line monitoring system, such as real-time structural awareness, speedier problem localisation, precise fault detection by separating electrical from mechanical failures, cost savings from management that is situation instead of regular, and etc. These solutions highlight strong needs, such as the transmission of massive amounts of highly trustworthy data in a short amount of time. The creation of a reduced, dependable system design with a quick reaction time is important to the achievement with this approach. The network should be capable of to send and receive sensitive information, such as transmission line status and control data. Transmission network grid. A reduced foundation for building a real transmitting data system is proposed in this paper. Devices are deployed in different electricity power line to provide real-time monitoring of the platform's state.

These sensors can collect a lot of data while monitoring fine-grained electrical or physical properties. The cost-effective and timely transmission of this data to the control centre is a significant challenge that must be overcome in order to build an intelligent system.

The Internet of Things (IoT) is a network of devices, analogue, mechanical, and digital equipment, products, animals, and people with Unique Identifiers (UIDs) that may transfer data via a network without involving humans or computers [5]. The (Internet - of - things) is a network of interconnected objects that can collect and communicate data [6]. A vast number of smart phones and Io-T (Internet of Things) devices would generate large volumes of data traffic in 5G, ranging from a few bytes to many terabytes. [7]. The Internet of Things (IOT), which allows autonomous objects to use the Internet to exchange data, has sparked a lot of interest in Machine to Machine communication. This paper describes the design and implementation of real-time transformer monitoring and defect detection, as well as the recording of critical dispersion transformer operation indicators such as load current, voltage, transformer oil, and ambient temperatures and humidity. They must keep an eye on it at all times. By utilizing this project, they can reduce working efforts and boost precision, stability, and efficiency. Sensors are used in this project to sense the key parameters of equipment such as voltage and current (over voltage, under voltage, and over current). This sensed data is transferred to a microcontroller, which checks parameter limits and then sends the data to a computer. [8]

One of the most important components of an electrical power system is distribution transformers. A transformer is a device that is constantly working to improve the transmission system's efficiency. The current paper proposes using IOT to conduct continuous online monitoring of distribution transformers (Internet Of Things). The Internet of Things brings previously unconnected objects together. Things that were previously inaccessible have now become accessible as a result of it. Over-Voltage, Over-Current, Increased Temperature, Oil-Level, Humidity, and Other Faults Can Affect The Transformer. All of these faults are constantly monitored by the Arduino, which sends the health information of the device on a regular basis.

The Wi-Fi Module Allows You To Transform. An Android application can access this data from anywhere in the world. As a result, the upkeep of [15]. Step down transformer, Arduino Mega 2560, voltage sensor current sensor ACS712, 5V Relay, 16*2 LCD Display, and Wi-Fi model are all included in this model.

2. METHODOLOGY

2.1 Proposed System

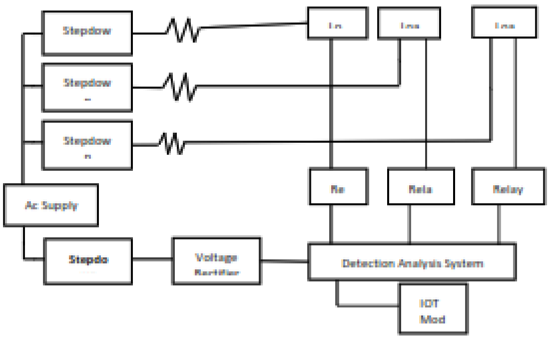

Fig 1: Block Diagram

This model consists of four step down transformers, each with a 230v input signal and a 12v output signal. One of the transformers is connected to a voltage rectifier, which rectifies the voltage from 12v to 5v of DC supply, which is necessary for the detecting system.

Voltage sensor, Current sensor, and Arduino mega2560 make up the detection system. Voltage sensor that detects and measures voltage and generates a voltage signal that is proportionate to the detected voltage in analogue form. Current sensor that detects current that is proportionate to the detected current and generates an analogue signal. A voltage and current sensor I/P signal is sent to an Arduino Mega 2560 using analogue pins to generate an O/P in digital form, which produces two outputs: one is hardware that is connected to 5v relays for switching, and the other is software. From there, a lamp is connected as a load, which is connected to the transformer via the transmission line. It is in a regular state if three lamps are turned on. If the lamp is turned off or fluctuates, it is in an abnormal state, and the system becomes unbalanced.

Fig.2: Working model

The Arduino Mega2560 receives electricity in the form of analogue energy, which is converted to digital by the microcontroller. The Arduino Mega 2560 is incorporated into the microcontroller. The Arduino mega 2560 pin is connected to both current sensor pins. For serial connection, the Wi-Fi module is connected to the TX and Rx pins. Three switches are used to manually perform a short circuit. Switch 1 connects phases A and B, whereas Switch 2 connects phase A to ground and Switch 3 connects phase B to ground. The centre tapped step down transformer produces two phases of output after the main supply is turned on, and the L-L fault is manually created by activating Switch 1 ON. Phases A and B are short-circuited when Switch 1 is turned on, causing overcurrent to flow. When the current sensor detects an overcurrent, the current sensor sends signals to the microcontroller, which translates the signal from analogue to digital and displays the Wi-Fi signal. The current values of I 1 and I 2 are displayed, together with the fault type (L-L or L-G). The microcontroller sends a signal to the ESP826601 Wi-Fi module. Wi-Fi module can be used to link a microcontroller to a network. There are up to nine GPIOs available. Wi-Fi is a wireless local area networking technology that uses IEEE 802.11 specifications to connect devices. There are numerous Wi-Fi features that make using a wireless network more convenient and straightforward. Wi-Fi Technology is a wireless local area network that is similar to Ethernet but without the wires. Wi-Fi technology can connect two or more devices for a variety of reasons, including data sharing. To connect to the internet or construct a network, no wires are required. IEEE 802.11-based Wi-Fi. Currently, millions of people are taking advantage of this built-in feature and fantastic wireless technology. The information is kept on the server and a signal is delivered to the receiver, who can inspect the fault using a URL, when the microcontroller transmits a signal to the Wi-Fi module. A 16*2 LCD display is connected to another Arduino O/P, which shows the position, distance, and type of trouble that occurred during the Wi-Fi connection. A voltage regulator is utilised to provide power. Without them Regulators have an inherent influence.

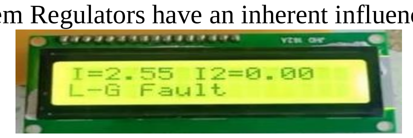

Fig 3:Line to ground Fault displayed on LCD and system result

Faults were manufactured using switches and CT connected to each phase in this example project. When the switch connecting phase A and ground is turned on, a fault result can be seen in fig 3.

3. CONCLUSION

Maintenance of remote locations such as BTS (mobile tower) can be handled efficiently and effectively using ATmega2560 and cutting-edge technology such as IoT communication. This system is very sophisticated in terms of fault protection and sending alert signals to the user for the power generator. It is a very reliable and effective system. With the help of a specific adjustable variable pot, we can monitor and detect faults in this system. As a result, we can adjust the settings to suit our needs. Without requiring human interaction, the system provides effective monitoring and protection of the power generator based on its oil level, oil quality, temperature, and operating voltage.

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