

# Three Phase Overhead Transmission Line Fault Detection and Analysis Using IoT

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## ABSTRACT

The Electric power system is split up into many different sections. One of which is that the transmission mechanism, in which electricity is transmitted from generating stations and substations through transmission lines into consumers. Both methods could various types of malfunctions is usually mentioned as a "Fault" Fault is described as a number of undesirable however unavoidable incidents can temporarily disturb the stable condition of the facility system that happens when the insulation of the system fails at any point. Furthermore, if a conducting object comes in contact with a bare power conductor, a short circuit, or fault. The causes of faults are, lightning stroke, human error, wind damage, trees falling or vines plants across transmission lines, aircraft crash on transmission line, birds shorting lines or vandalism. During this study, the causes and effects of faults within the overhead transmission lines were the most target of the research. Variety of the varied causes of faults and a few detection methods are going to be discussed. These faults cause substantial damage to the power system equipment. In India it's normal, the faults might be LG (Line to Ground), LL (Line to Line), 3L (Three lines) within the availability systems and these faults in three phase supply can affect the power plant.

**KEYWORD:** Three Phase Faults, Node MCU, Transmission line, Line to Line fault, Line to Ground fault, IOT based

## I. INTRODUCTION

The aim of this project is to find out the location of line to ground and line to line fault from base station using an Arduino board over IOT. In case of failure for any reason, the exact location of the cable or tower is not known and therefore the repair process related to that particular cable becomes difficult. The system is to find the location of the fault. Just in case there's a short circuit (Line to Ground/ Line to Line), the voltage across series resistors changes accordingly, which is then fed to inbuilt ADC of Arduino board to elope precise digital data for display in kilometers.

Fault occurring in power systems might result in losing their stability. Stability proposition is charged in an important component in energy management and planning of power systems (1). Moreover, during the start-up period of the motor, it draws a large current from the system, resulting in a voltage drop of the system and impairs the normal operation of others. There are fault transits on most overhead lines. A transient fault, such as an insulator flashover, is a fault which is cleared by the immediate tripping of one or more circuit breakers to isolate the fault, and which does not recur when the line is too energized. Faults are less transient (close to 80% range), distribution voltage is more transient and higher near 90% range, sub-transmission and transmission voltage. Lightning stroke is the most common fault on transmission line, partially resulting from insulator flashover from the high transient voltages induced by the lightning stroke other

foreign objects. Thus, transient faults can be cleared by momentarily de-energizing the line, in order to allow the fault to clear.

This breakdown can be caused by many different factors such as :

- ☐ Lightning stroke
- ☐ Spray on Insulators
- ☐ Trees coming in contact with wires
- ☐ Equipment Failure
- ☐ Human Errors

The project is assembled with a group of resistors representing cable's length in KM's and fault creation is formed by a group of switches at every known KM to cross check the accuracy of a similar. The fault occurring at a specific distance and therefore the respective phase is displayed on a LCD interfaced to the Arduino board and also message is displayed on IOT page.

## THREE-PHASE POWER SYSTEM:

The three-phase electric power system is a common method of alternating-current electric power generation, transmission, and distribution. It is a type of polyphase system and is the most common method used by electrical grids worldwide to

possible faults are swinging wires and temporary contact with

transfer power. A 3-phase device is normally more good value than an equivalent unmarried-segment or two-phase machine at the equal line to ground voltage as it uses much less conductor material to transmit electrical power. The three-section device became independently invented through Galileo Ferraris, Mikhail Dolivo Dobrowolski, Jonas Windstorm, and Nikola Tesla in the late Eighteen Eighties.

### Types of Faults:

### A) Symmetric and Asymmetric Fault

- Symmetric Faults

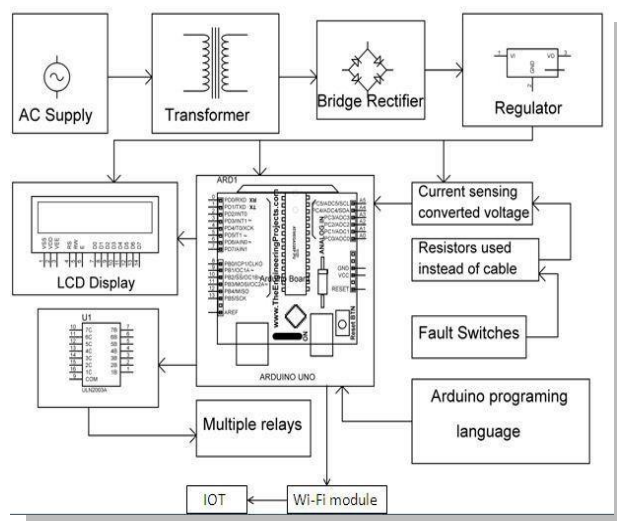
Symmetric Faults are very intense faults and arise from time to time inside the electricity structures. There are of two types of fault Line-to-Line-to-Line-to-Ground (L-L-L-G) and three strains (L-L-L). The prevalence of those faults is simply 25% in electricity systems.

- Asymmetric Fault

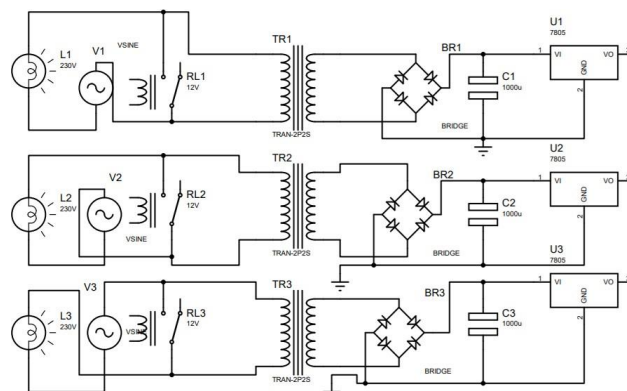
These are very not unusual as they arise way greater time than symmetric faults and are less intense than former faults. These mainly constitute of line to floor which is the maximum common fault (65-70%), line to line (5-10%) and double line to ground (15-20%) faults. Inline to floor fault, a conductor makes contact with earth or floor. A line to line fault takes place while conductors make contacts with every different specifically at the same time as swinging of lines due to winds. Whilst two conductors make contact with floor then it a double line to ground faults.

### B) Type of Faults on a Three Phase System

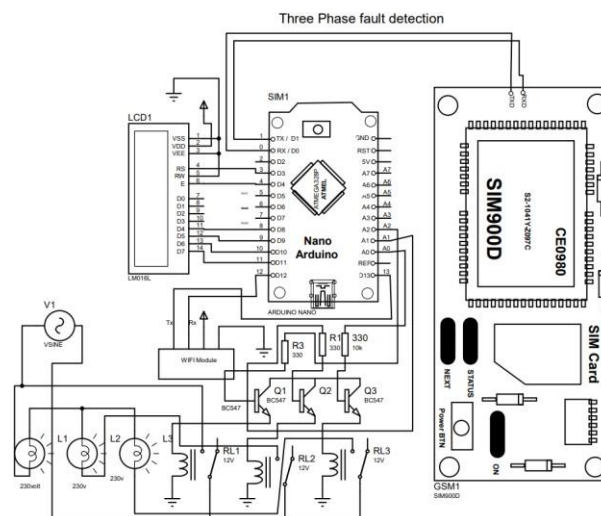
- A. L-to-G Fault (Line to Ground)
- B. L-to-L Fault (Line to Line)
- C. L-to-L-to-G Fault (Two lines to Ground)
- D. 3Line Fault (Three Phase)
- E. 3L-to-G Fault (Three Phase to Ground)



**DC POWER SUPPLY:**



### ARDUINO UNO:



**BLOCK DIAGRAM:**

**COMPONENTS USED:**

- **POWER TRANSFORMER**

That is a device that is used to convert power from one alternating contemporary (AC) voltage to another alternating current (AC) voltage with less lack of electricity. There are two types of transformers: -

-Step-up transformers that increase voltage.

-Step-down transformers that decrease voltage.

- **VOLTAGE REGULATOR (LM7805):**

It provides several fixed output voltages The LM7805 is an outputs +5 volts. It is a 3-pin IC; input pin for accepting incoming DC voltage, ground pin for establishing the ground for the regulator, and output pin that supplies the positive 5 volts

- **RELAYS:**

A relay is an operated switch that helps to protect the system from damage by detecting and isolating faults on transmission and distribution lines by opening and shutting of breaker.

- **LCD (Liquid Crystal Display):**

An Interface IC is used for the hectic task to handle with Assist of MCU. The IC is to get a function of the data from the MCU and process to display meaningful information onto the LCD screen.

The liquid crystal display is normally utilized in different embedded projects because of its low cost, quick access and adaptability to get programmed.

There's a kind of liquid display that has sixteen columns and two rows so it's called 16 x 2 LCD modules.

LCD is also available in several arrangements like (8 x 1), (10 x 2), (16 x 1), but the 16 x 2 liquid crystal is generally utilized in embedded projects.

- **Features of LCD**

1. Its function voltages are from 4 volts to 5volts.
2. It uses one milliampere current for operation.
3. In this LCD, we work alphabets and numbers.
4. There are rows each has 16 characters.
5. Every character of this LCD screen has 5 x 8 or 40 pixels.
6. It works on both 4 and 8 bits mode.

7. It monitor backlight is two colour green and blue.

- **(IOT) INTERNET OF THINGS:**

The Internet of things (IoT) provides an easy and secure connection for sending and retrieving data in real-time. This platform supports interactive, real-time data visualization that permits developers to increase the platform for personal customization when desired. It exists to empower the data from the device.

- **ARDUINO UNO**

The Arduino UNO is a microcontroller board supported the ATmega 328 (datasheet). It has 14 digital input/output pins (of which 6 are often used as PWM outputs), 6-analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller, simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. The UNO differs from all preceding boards in this it doesn't use the FTDI USB-to serial driver chip. Instead, it features the ATmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to serial converter.

- **Working principle**

The project uses one step-down transformer for handling the entire circuit under low voltage conditions of 12V only to test the 3-phase fault analysis. The primaries of one transformer are connected to a 3-phase supply in a star configuration, while the secondary of the same is also connected in a star configuration. The output of the transformer is rectified and filtered and is given to 3 relay coils. Fault switches, each one is connected across the relay coil, meant to create a fault condition either at star i.e. LL. Fault and 31. fault, LED'S are connected at their output to indicate their status. The Microcontroller is used which converts the analog value of the voltage to a digital one which is displayed on a 16x2 LCD screen. If the fault is created by means of any fault switches the digital value shown on the LCD screen will fluctuate abnormally giving the fault location. If the fault is cleared within the specified time period, then it will be a temporary fault if it is not then there will be at a permanent trip. This relay is meant for disconnecting the load to indicate fault conditions

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