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3-Phase transmission line monitoring and fault detection system

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Abstract
This paper presents a thorough analysis of the techniques for fault localization, classification, and detection in three-phase transmission lines and distribution systems. Although the three subjects are closely connected, the writers make an effort to describe them independently so that readers will have a clearer comprehension of the ideas without confusion. One of the most extensively used engineering structures for moving large amounts of power from one part of a nation to the other is a system of transmission lines. The lines are more susceptible to various atmospheric disasters because of their proliferation over various topographies and geographic areas, which more frequently results in line faults. The defective line must be removed as soon as possible in order to prevent excessive bulk power loss through the faulty point and to quickly restore system stability, which will allow regular power flow operation to continue. Researchers have developed a number of approaches for creating enhanced power system protection algorithms that might be used to instantly fix defects when they occurred. This article includes a succinct but thorough analysis of the many strategies used by several researchers to create efficient fault diagnostic systems, highlighting both the benefits and drawbacks of each method. This succinct and thorough literature review will aid researchers in selecting the best methods for various transmission line fault investigation goals.

Keywords: Three-phase transmission lines and distribution systems, bulk power loss, fault diagnostic systems

Introduction
The most fundamental task in the assurance of the power system is to protect transmission cables from exposed deficit in this case. Overhead line faults are a rare occurrence that can be caused by climatic factors, human error, smoke from burning objects, faulty hardware (such as transformers and pivoting machines), and other factors. These problems result in hardware damage, incursion of electric streams, and even the passage of humans, birds, and other living things. These problems pose a threat to the reliability of the power supply. Fault is only an uncommon circumstance. This study compares transmission system flaws with human illnesses to make it easier to grasp. Similar to this, if a system experiences an abnormal state, the system quantities (voltage, current, phase angle, etc.) surpass their threshold levels; this is referred to as a fault.

Classification of faults
No fault
In this situation, Firstly the current comes from the power source, the relays close the circuit and the power is transmitted to the load (bulbs) through the transmission line, then the current sensor starts to take the readings and display it to the LCD display after 5 seconds. Hence shows the values same as the pickup current.

Single line to ground fault (SLG)
In this situation, the current in the ground wire is greater than the pickup current. So, the buzzer alarms, the relays isolate the transmission line fault through the current sensor to the LCD display. After 5 seconds, the LCD display shows the type of fault, at which line and the distance of fault location in the transmission line.

Line to line fault (Ll)
In this situation, the current in the line 1 and the current in line 2 is greater than the pickup

current. So, the buzzer alarms, the relays isolate the transmission line fault through the current sensor to the LCD display. After 5 seconds, the LCD display shows the type of fault, at which line and the distance of fault location in the transmission line.

Double line to ground fault: (LLG)

In this situation, the current in the line 1, the current in line 2 and the current in ground wire is greater than the pickup current. So, the buzzer alarms, the relays isolate the transmission line fault through the current sensor to the LCD display. After 5 seconds, the LCD display shows the type of fault, at which line and the distance of fault location in the transmission line.

Catriple Phase Fault: (LLL)

In this situation, the current in the line 1, the current in line 2 and the current in line 3 is greater than the pickup current. So, the buzzer alarms, the relays isolate the transmission line fault through the current sensor to the LCD display. After 5 seconds, the LCD display shows the type of fault, at which line and the distance of fault location in the transmission line.

Working with circuit diagram

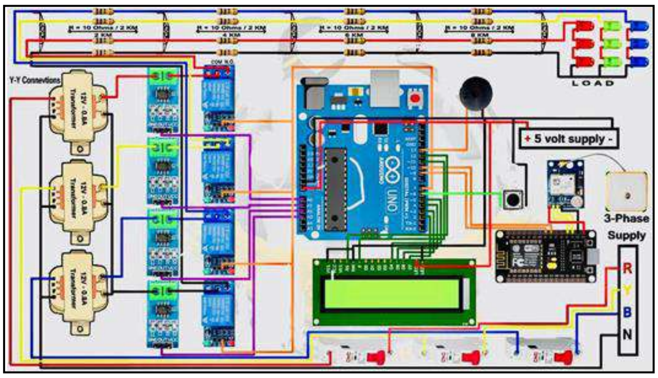


Fig 1: Circuit Diafram

Working

The project uses 4 numbers step-down transformers for handling the entire circuit under low voltage conditions of 12v only to test the 3 phase fault analysis. The primaries of transformers are connected to a 3 phase supply in star configuration, while the secondary of the same is also connected in star configuration. The other set of transformers with its primary connected in star to 3 phase have their secondaries connected in Delta configuration. The outputs of all the transformers are rectified and filtered individually and are given to 6 relay coils. 6 push buttons, every button connected across the relay coil is meant to create a fault condition either at star i.e. LL Fault or 3L Fault. The NC contacts of all the relays are made parallel while all the common points are grounded. The parallel connected points of NC are given to pin2 through a resistor R5 to a 555 timer

i.e. wired in monostable mode. The output of the same timer is connected to the reset pin 4 of another 555 timer wired in a stable mode. LEDs are connected at their output to indicate their status. The output of the U3 555 timer from pin3 is given to an Op-amp LM358 through wire 11 and d12 to the non-inverting input pin3, while a potential divider RV2 keeps the inverting input at fixed voltage. The voltage at pin2 coming from the RV2 (potential divider) is held such that it is higher than the voltage at pin3 of the Op-amp used as a comparator. As a result, pin1develops zero logic that fails to operate the relay through the driver transistor Q1. This relay Q1 is 3CO relay i.e., it disconnects the load to indicate fault condition.

Components used

Step-down Transformers

220 AC to 12v dc power supply is the most used and common circuit. There are so many applications of AC to DC converter Project. The 220v to 12v dc power supply is built to convert AC input to 12-volt DC output. The ac to dc converter project is useful for fixed DC applications like DC motors, pumps, Chargers and many other applications. Here we are going to discuss what is a dc power supply and circuit for power supply for 12 volt output.

Fig 2: Step-down Transformers

Arduino Uno R3

The Arduino Uno R3 is an open-source hardware computing platform. It uses the ATmega328 microcontroller. The board also incorporates the ATmega16u2 to act as a onboard USB to serial converter. The Arduino Uno R3 can be used to develop applications that operate in a standalone or connected environment.

Fig 3: Arduino Uno R3

Resistors 5V 10A

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses.

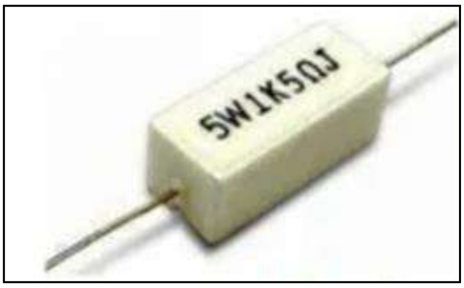


Fig 4: Resistors 5V 10A

Relays 5V DC

A 5V relay is an electrically operated switch that is activated by a low-voltage control signal. It consists of a coil, a set of contacts, and a spring-loaded armature, and is designed to switch electrical circuits on and off.

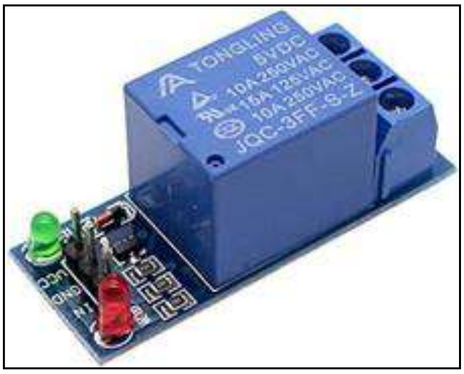
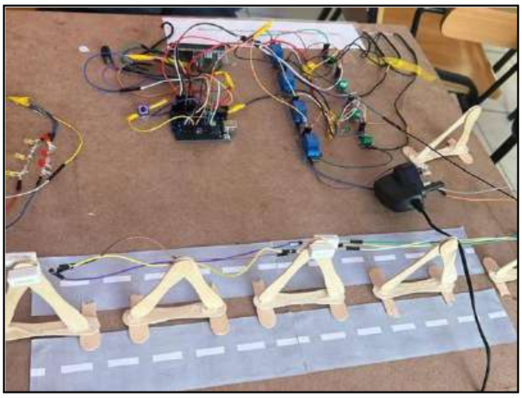


Fig 5: Relays 5V DC

Result and Discussion

In no fault situation, Firstly the current comes from the power source, the relays close the circuit, and the power is transmitted to the load (bulbs) through the transmission line, then the current sensor starts to take the readings and display it to the LCD display after 5 seconds. Hence shows the values same as the pickup current. (Here pickup current means the value of the current after which is considered to be as fault current, the relay will open and isolate). In SLG situation, the current in the ground wire is greater than the pickup current. So, After 5 seconds, the LCD display shows the type of fault, at which line and the distance of fault location in the transmission line. In LL situation, the current in the line 1 and the current in line 2 is greater than the pickup current. So, the buzzer alarms, the relays isolate the transmission line fault through the current sensor to the LCD display. After 5 seconds, the LCD display shows the type of fault, at which line and the distance of fault location in the transmission line.



Formulas Used

The resistance of the conductor can be called as.

$$R = \frac{\rho l}{A}$$

Where,
R = Resistance.
ρ = Rho is a property of any conductive material that is constant for the conductors.
L = Length of the conductors.
A = Cross-sectional area of the conductors.

By changing the length of the conductor (L), the resistance (R) will also change.

$$R \propto l$$

Hence the resistance (R) is directly proportional to the length of the conductor (L).

According to OHM'S Law

$$I = \frac{V}{R}$$

Here,
I = Current.
V = Voltage.
R = Resistance.

- Here voltage (V) of the transmission line is constant. So,

$$I \propto \frac{1}{R}$$

Hence the current (I) is inversely proportional to the resistance (R) of the transmission line.
Where the resistance (R) of the transmission line is changed due to the change of length (L) in transmission line. According to their fault location, then the fault current will also be changed.

Conclusion

The methods for fault detection, classification, and localization in transmission lines and distribution systems are reviewed in this work. A number of techniques are explained, and detailed presentations of example works are made. We first provide a general overview of the methods used for feature extraction, which serves as the starting point for additional defect detection activities, before explaining the specific methods utilized in the three sections. when picking both the feature extraction strategies and the derived features. As the methods for feature extraction are heavily reliant on the detection approaches, fault detection is given on top of them. However, certain interesting details and fresh concepts for defect identification are offered. The literature on defect detection time is briefly summarized as well. We primarily present several machine learning techniques that have been heavily developed by academics for the fault classification problem.

References

1. Akagi H, Watanabe HE, Aredes M. Instantaneous power theory and applications to power conditioning, Wiley-IEEE Press, 2007, 43-105.

2. Gamit V, Karode V, Mistry K, Parmar P, Chaudhari A. Fault Analysis on Three Phase System by Auto Reclosing Mechanism, IJRET: International Journal of Research in Engineering and Technolog, 2015, 4(5).
3. Morey MS, Ghodmare A, Khomane V, Singh A, Dawande J, Ali Iqbal Shaikh S. Microcontroller Based Three Phase Fault Analysis for Temporary and Permanent Fault, International Research Journal of Engineering (IRJET), 2015, 2(1).
4. Jambulingam V, Power System Stability Improvement under Three Phase Faults using Static Synchronous Compensator, International Journal of Research in Engineering and Technology, 2014, 3(7).