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Three-Phase Transmission Line Fault Detection and Its Location

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ABSTRACT

Nowadays, the per capita consumption of Electrical Energy is a parameter of any country's Development. In India, we are working on improving Transmission Line Efficiency by using semiconductor drives and information technology to increase the per capita electrical energy consumption. This paper has the proposed model for three-phase fault detection & its location. In transmission lines, there are two types of faults: (i) symmetrical fault and (ii) unsymmetrical fault. Generally, the B Phase follows the kinds of faults in transmission line

i. **Single Line to Ground Fault**
ii. **Line-to-Line Fault**
iii. **Double Line to Ground Fault**

This article used an IoT application to detect faults and their locations.

Keywords- Transmission Line Assurance, fault Detection, Overhead Transmission Lines, symmetrical faults, unsymmetrical faults.

I. INTRODUCTION

A fault in an energy gadget is any screwup that connects the point with the ordinary float of the present day. The motive of Electrical Power Derive flows is protection breakdown. The fault perhaps due to a dissention of different factors for example

i. Lighting Stoke
ii. Shower on Encasings
iii. System Disappointment
iv. Trees coming in contact with wires

Human Mistake

Concerning the examination 72% to 89% of issues are passed off in above transmission line that are the brief. There are various Transient issues which incorporate harm to protection swinging wires and brief period contact with different items. Those flows are cleared by running the circuit breaks or dissimulating the street concisely to clear the issue. The other 28% to 11% of faults in the above line are never-ending or long-length deficiencies. Long-lasting or extended-length issues took place with the guide of harmed wire, which winds up one section to ground fault or joins the two stages aggregately, passing off in an overhead line notwithstanding inside the underground link. Those deficiencies are cleared through the line and restabilised.

Types of Faults

Electrical faults in the three-stage electrical system are mainly divided into two types: short circuits and open circuits. These problems can be balanced or unbalanced errors. We should discuss these things.

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Symmetrical

Balanced faults affect all three levels and remain fixed even after an interval. Symmetric faults mostly occur at the generator terminals. An error in the system can occur due to an opposite curvature between the guides or an obstruction in the lower balancer. The even fault is divided into phase-to-phase and phase-to-earth faults in three phases.

II. UNSYMMETRICAL

A short circuit causes an asymmetrical current, i.e., a current that varies in magnitude and gradually decreases over the three periods of the electrical system, known as the asymmetric problem. It is also characterized as a fault that involves multiple steps, such as the L-G, L-L, and L-L-G faults. Asymmetry makes the system unbalanced. It is mainly divided into three types. They are

- Single Line to ground Fault (L – G).
- Line to Line Fault (L – L).
- Double Line to ground Fault (L – L – G).

III. REASON OF FAULTS

Weather conditions:

It incorporates lightning strikes, heavy downpours, heavy breezes, salt accumulation on above lines and guides, snow and ice accumulation on transmission lines, and so on. These ecological circumstances interfere with the power supply and further harm electrical establishments.

Equipment failures

Different electrical gears, such as generators, engines, transformers, reactors, exchange gadgets, and so forth, are hampered by breaking down, maturing, and protection disappointment of links and winding. These disappointments cause high current to course through the gadgets or gear, which further harms them.

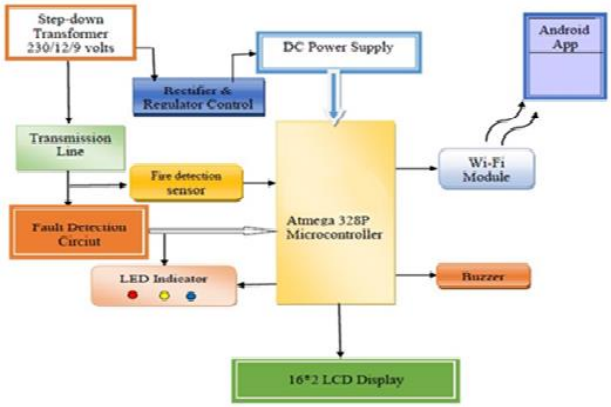
Human errors

Electrical faults are also caused by human blunders, such as choosing an ill-advised rating of gear or gadgets, failing to remember metallic or electrical leading parts subsequent to adjustment or support, changing the circuit while it is under overhauling, and so on.

Fire smoke

Air ionization caused by smoke particles surrounding overhead power lines causes arcing between lines or wires and an insulator. This bypass causes the insulators to lose their switching capacity due to high voltages.

IV. BLOCK DIAGRAM



V. WORKING PRINCIPLE

This model is utilized to recognize the fault that has happened in the transmission line.

- This model utilizes an ATMEG328p microcontroller, Push Switches, Showing LEDs, and an LCD. It is also collected with a bunch of resistors and links, and a set of switches is utilized to make the weakness in the model.
- A 230V AC supply is taken care of through a stage-down transformer, which gives 12 V AC yield, which is to an AC-DC Power Modulator, where it changes AC voltage into DC voltage utilizing a Full-Wave Rectifier circuit. A 7805

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voltage controller is utilized to control the voltage yield voltage to 5V, as the miniature regulator needs a 5V power supply.

- Through a miniature regulator, there is only one 5V power yield pin and single ground. The fundamental challenge is that the model needs to drive different parts, i.e., LCD, Wi-Fi module, bell, and fire sensor. A Power Expansion PCB has been presented in the module to settle this issue. It has numerous power pins that can be utilized for a large number of purposes. In short, Power expansion, PCB fills in as Power augmentation. Demonstrating LEDs are given in the circuit, which shows the situation with transmission lines at the point when a fault happens. At the point when any issue in any specific line happens, that's what that drove addressing line switches off.
- ESP8266 Wi-Fi Module is associated with the microcontroller through its sequential correspondence ports, i.e., RXD and TXD pins.
- The model includes three-stage down transformers to handle the transmission line. These transformers convert 230V AC to 12V AC, which is additionally fed to the Press button PCB, where three scaffold rectifiers switch this 5V AC over completely to 5V DC. These Push buttons are associated with simple input pins on the microcontroller.
- The press buttons show/recreate the issues in the framework. Different buttons are apportioned for different purposes, and each button is mindful of various issues. There are six press buttons, three of which are DPDT buttons, and three of them are Material switches. DPDT buttons are used to show stage-to-stage flaws, and material switches are used to detect stage-to-ground faults.

Advantages

- ✓ Safety Equipment
- ✓ Work from time to Time
- ✓ More Efficiency
- ✓ Reduce Losses
- ✓ More Reliable

VI. COMPONENT USED

Wi-Fi module

ESP8266 is a 3V Wi-Fi module known for its Web of Things applications. Its most extreme working Voltage is 3.6V, and it's vital to note. You should know how to control it, how to sequentially interface it with Arduino securely, how to ping, and numerous other things. You ought to utilize programming like Circuito.io, Tinker Lowlife, and Fritzing to recreate and work with the board securely. You ought to likewise utilize a Rationale Level Regulator to use with the ESP8266 module.

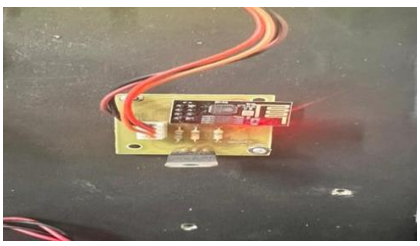

Figure 1: 3V Wi-Fi module

Step Down Transformer

A transformer intended to reduce the voltage from key to optional is known as a stage down transformer. This transformer takes contribution of 230 volts AC and diminishes the voltage to 12 volts/9 volts AC. In complete four stage down-transformers are utilized in which 3 are utilized as transmission line parts (230V/9V) and one is utilized to give DC supply (230V/12V).

Figure 2: Step Down Transformer

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Internet of Things (IOT)

The Internet of Things (IOT) permits clients to send and get information continuously in a straightforward and secure way. This stage permits designers to expand the stage for private customization by permitting intelligent, ongoing information perception. Its motivation is to engage information from gadgets.

Push Switches

These are the switches which are utilized to mimic the deficiencies in framework. Two kinds of switches are utilized i.e., DPDT press button and material switches. At the point when these buttons/switches are squeezed, shortcoming is started in the framework as the associations are finished in such manner. DBDT switches produce line deficiencies and material flaws produce line-ground faults.

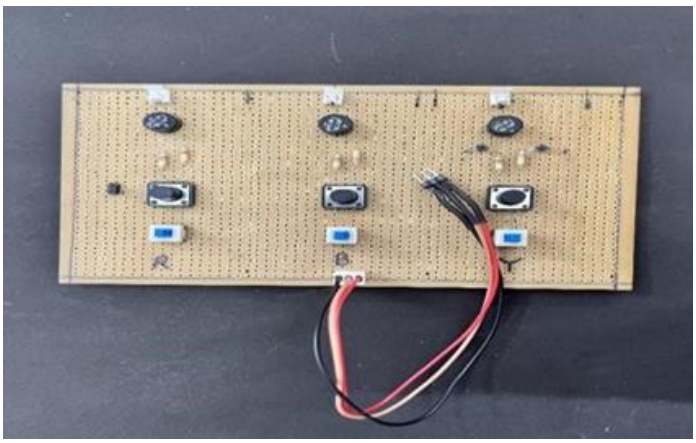

Figure 3: Push Switches

LCD (Liquid Crystal Display)

A Connection point IC is utilized to handle troublesome errands that the MCU can't handle. The IC is responsible for taking orders and information from the MCU and processing them so significant data can be shown on the LCD screen.

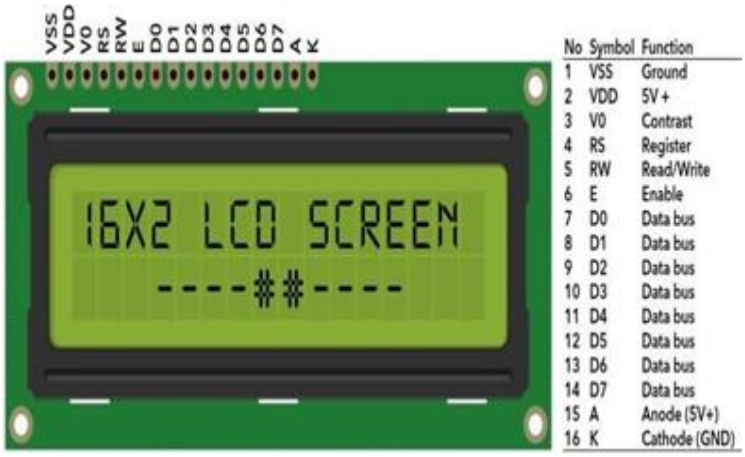

Figure 4: Liquid Crystal Display

ATMEGA328 Microcontroller

ATmega328 is a High-level Virtual RISC (AVR) microcontroller. It upholds 8-digit information handling. ATmega-328 has 32KB inner glimmer memory.

ATmega328 has 1KB Electrically Erasable Programmable Perused Just Memory (EEPROM). This property shows on the off chance that the electric inventory provided to the miniature regulator is eliminated, even it can store the information and can furnish results subsequent to furnishing it with the electric stock. Besides, ATmega-328 has 2KB Static Arbitrary Access Memory (SRAM). Different qualities will be figured out later. ATMEGA 328 has a few unique elements which make it the most famous gadget in the present market. These features involve state of the art RISC plan, incredible execution, low power usage, real clock counter having separate oscillator, 6 PWM pins, programmable Successive USART, programming lock for programming security, throughput up to 20 MIPS, etc. Further insights regarding ATMEGA 328 will be given later in this part.

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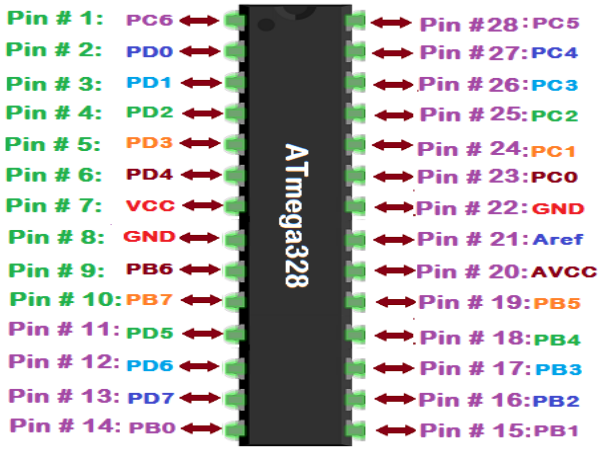

Figure 5: ATMEGA328 Microcontroller

AC-DC Power Modulator

Power modulator changes over AC supply to fixed DC. It comprises of scaffold rectifier circuit, voltage controller (7809) circuit. It takes 12 volts AC input from transformer and converts it into 9 volts fixed swell free DC supply.

Figure 6: Power modulator

Buzzer

A sound flagging gadget like a beeper or ringer might be electromechanical piezoelectric or mechanical sort. The primary capability of this is to change the sign from sound over completely to sound. By and large, it is muscled through DC voltage and utilized in clocks, alert gadgets, printers, cautions, PCs, and so forth. In view of the different plans, it can create various sounds like caution, music, ringer and alarm.

Figure 7: Buzzer

VII. CONCLUSION

The short circuit fault is located at a particular distance in the transmission line to correct the shortcoming effectively. With the assistance of Arduino, the work naturally shows the stage, distance, and season of the issue event. Quicker fix of the power framework, further developed framework execution, lower working expenses, and more limited opportunity to find issues in the field are benefits of exact fault area.

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AUTHOR PROFILE

Shailesh Kumar Maurya completed his B.Tech. in Electrical Engineering from M.G. Institute of Management and Technology, Lucknow, in 2023. His Diploma was completed from Town Polytechnic, Ballia, in 2016 – 2019, respectively.