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THREE PHASE TRANSMISSION LINES FAULT DETECTION

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ABSTRACT

In electricity journey the generation of transmission, distribution, utilization of electrical power is called electrical technology in power generation transmission and distribution many components are involved. So there are many types of electrical faults or faults like in transmission lines occurs in transmission system like line to line faults and line to ground fault in power system etc. In this project I will show you the prototype of three phase fault detection system. Mainly occurred in H.V transmission line our project accurately detect the distance of three phase fault from source system and display on control panel by using Arduino mega. In this project we use sensing device which is present on the line even though L-L ,L-Gnd and any unsymmetrical fault was occurred it will show on display. Arduino is a heart of our project it will detects the fault, analyses and classifies these faults and then, determined the fault distance. Then, the fault information is transmitted to the control room.

1. INTRODUCTION

Fault location and distance estimation is very important issue in power system engineering in order to clear fault quickly and restore power supply as soon as possible with minimum interruption. This is necessary for reliable operation of power equipment and satisfaction of customer These fault types are categorized into five different types of faults:

- LG faults
- LL faults
- LLG faults
- LLL faults
- LLLG faults

Faults occurrence can be easily detected with abrupt decrease in impedance of the line due to high current during fault. Next problem is its classification that is the type of fault which has occurred. Out of these five the LLL and LLLG faults are symmetrical faults and are indistinguishable. The voltage and current values change abruptly during the fault and also phase imbalance occurs. The method requires continuous inspection of the line impedance values in each phase. The phase with abrupt decrease in impedance denotes that the phase is faulty. The ground is involved in fault or not can be easily distinguished with a zero-sequence analyzer. Zero sequence current flows in case of ground fault. As the figure 1 show the transmission of the electrical system and fault occur in the line so we have design the project for fault detection, this paper proposes line impedance monitoring based fault detecting and locating algorithm.

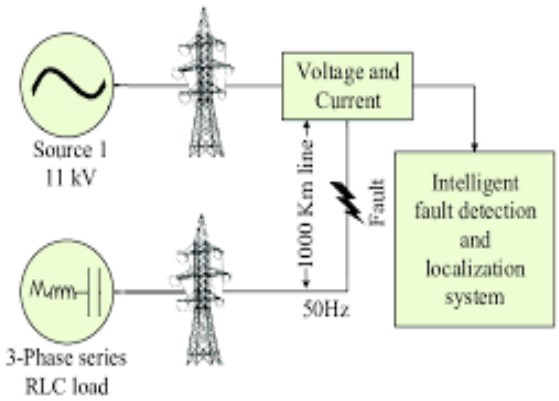

Figure 1: Simple Power System Network

2. METHODOLOGY

Here we show a prototype model or 3phase fault detection, so we make the fault line by using switches. We know that impedance of line is increases with increase in length. So, we use resistance combination in senses, for each phase

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different set of resistance is used for each phase one relay is use to isolate the load at the time of fault which give exact length of fault occur on line. The mastermind of our project is Arduino.

The DC supply is required for controlling board. Which is provided with the help of rectifier and transformer combination. Output switches is given analog pin or Arduino and display is also connected to digital output pin of Arduino. So, when we move fault it indicate of display with exact distance, and at a same time Arduino give output to lcd screen and it disconnect load from supply. This all thing happens as soon as fault is occurred in line. Due to proper program insert in Arduino on a based. It is possibly become voltage of ade pin is changes according to flowing from line and it depend upon distance of line.

3. TYPES OF FAULTS ON 3 PHASE SYSTEM

The fault in the power system is defined as the defect in the power system due to which the current is distracted from the intended path. The fault creates the abnormal condition which reduces the insulation strength between the conductors. The reduction in insulation causes excessive damage to the system. The fault in the power system is mainly categorized into the following type.

3.1 Open Circuit Fault:

These faults occur due to the failure of one or more conductors. The figure2 below illustrates the open circuit faults for two conductor open fault .The most common causes of these faults include joint failures of cables and overhead lines, and failure of one or more phase of circuit breaker and also due to melting of a fuse or conductor in one or more phases.

Open circuit faults are also called as series faults. These are unsymmetrical or unbalanced type of faults except three phase open fault.

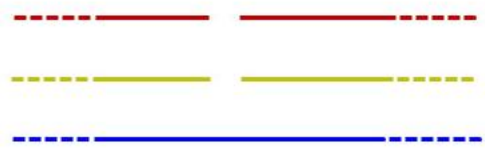

Figure 2: Open Circuit Fault

3.2 Short Circuit Faults

A short circuit can be defined as an abnormal connection of very low impedance between two points of different potential, whether made intentionally or accidentally. These are the most common and severe kind of faults, resulting in the flow of abnormal high currents through the equipment or transmission lines. If these faults are allowed to persist even for a short period, it leads to the extensive damage to the equipment.

Short circuit faults are also called as shunt faults. These faults are caused due to the insulation failure between phase conductors or between earth and phase conductors or both. The figure3 showing the short circuit fault.

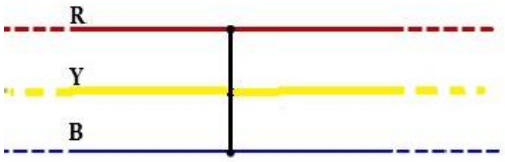

Figure 3: Short Circuit Fault

3.3 Symmetrical Fault

A symmetrical fault gives rise to symmetrical fault currents that are displaced with 120 degree each other. Symmetrical fault is also called as balanced fault. This fault occurs when all the three phases are simultaneously short circuited.

These faults rarely occur in practice as compared with unsymmetrical faults. Two kinds of symmetrical faults include line to line to line and line to line to line to ground as shown in figure4 below.

A rough occurrence of symmetrical faults is in the range of 2 to 5% of the total system faults. However, if these faults occur, they cause a very severe damage to the equipment's even though the system remains in balanced condition.

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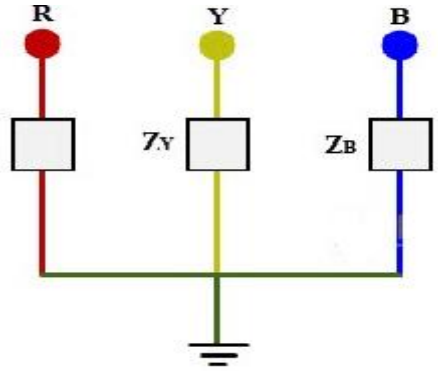

Figure 4: Symmetrical Fault

3.4 Unsymmetrical Faults

The most common faults that occur in the power system network are unsymmetrical faults. This kind of fault gives rise to unsymmetrical fault currents having different magnitudes with unequal phase displacement. These faults are also called as unbalanced faults as it causes unbalanced currents in the system. Up to the above discussion, unsymmetrical faults include both open circuit faults single- and two-phase open condition and short circuit faults.

The figure5 below shows the three types of symmetrical faults occurred due to the short circuit conditions double line to ground fault.

A single line-to-ground fault is one of the most common faults and experiences show that 70-80 percent of the faults that occur in power system are of this type. This forms a short circuit path between the line and ground. These are very less severe faults compared to other faults.

In double line to ground faults, two lines come into the contact with each other as well as with ground. These are severe faults and the occurrence these faults is about 10% when compared with total system faults.

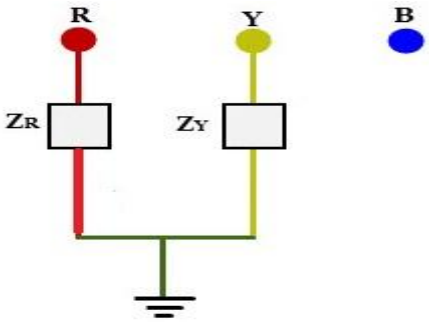

Figure 5: Unsymmetrical Faults

4. CAUSES OF ELECTRICAL FAULTS

There is a number of causes for the occurrence of a fault in the power system. Some of the possible causes of faults are and these fault are shown by pie graph in figure 6.

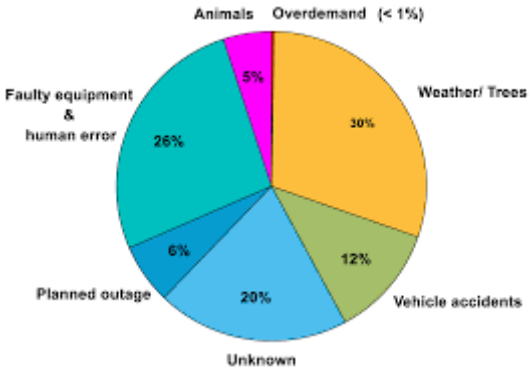

Figure 6: Graphical Analysis of Electrical Fault

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4.1 Weather conditions

It includes lighting strikes, heavy rains, heavy winds, salt deposition on overhead lines and conductors, snow and ice accumulation on transmission lines, etc. These environmental conditions interrupt the power supply and also damage electrical installations.

4.2 Equipment failures

Various electrical equipment like generators, motors, transformers, reactors, switching devices, etc. causes short circuit faults due to malfunctioning, ageing, insulation failure of cables and winding. These failures result in high current to flow through the devices or equipment which further damages it.

4.3 Human errors

Electrical faults are also caused due to human errors such as selecting improper rating of equipment or devices, forgetting metallic or electrical conducting parts after servicing or maintenance, switching the circuit while it is under servicing, etc.

4.4 Smoke of fires

Ionization of air, due to smoke particles, surrounding the overhead lines results in spark between the lines or between conductors to insulator. This flashover causes insulators to lose their insulting capacity due to high voltages.

4.5 Snake and Birds

Snakes are major reliability concerns in both substations and underground systems. They can squeeze through very small openings, can climb almost anything, and have the length to easily span phase conductors.

Birds are the most common cause of animal faults on both transmission system and air insulated substation. Different types of bird cause different type of the problem woodpecker holes in the wood with their beaks as they search for insects . this does not harm trees but can cause devasting damage to the utility poles. Birds use electrical equipment to rest on or to search for prey. They can be electrocuted by bridging conductor with their wings and their excrement can contaminate insulators.

5 OBJECTIVES OF THE PROJECT

This project is aimed to design reduce the outage time due to faults and provide a higher level of service continuity to the customer side and to maintain system stability.

6 HARDWARE COMPONENTS

In this project the various hardwires that are used for the proper operation of the project are as follows:

6.1 Transformer

Transformer are the device that transfers electric energy from one alternating-current circuit to one or more other circuits, either increasing or reducing the voltage. Transformers are employed for widely varying purposes; e.g., to reduce the voltage of conventional power circuits to operate low-voltage devices, such as doorbells and toy electric trains, and to raise the voltage from electric generators so that electric power can be transmitted over

6.2 Voltage Regulator

A voltage regulator is a component of the power supply unit that ensures a steady constant voltage supply through all operational conditions. It regulates voltage during power fluctuations and variations in loads. A voltage regulator usually takes in higher input voltage and emits a lower, more stable output voltage.

A voltage regulator is designed to automatically maintain a constant voltage level. It may be a simple feed-forward design or may include negative feedback control loops. It may use an electromechanical mechanism, or electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages.

6.3 Diode

Diodes are used to convert AC into DC these are used as half wave rectifier or full wave rectifier. Three points must he kept in mind while using any type of diode. Diodes of number IN4001, IN4002, IN4003, IN4004, IN4005, IN4006 and IN4007 have maximum reverse bias voltage capacity of 50V and maximum forward current capacity of 1 Amp.

6.4 Arduino Uno

Arduino Uno is a microcontroller board based on the ATmega328P, It has 14 digital input/output pins out of which 6 can be used as PWM outputs, 6 analog inputs, a 16 MHz quartz crystal, 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 a AC-to-DC adapter or battery to get started pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable.[4] It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts.

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6.5 LED Display

LED Display (light-emitting diode display) is a screen display technology that uses a panel of LEDs as the light source. Currently, a large number of electronic devices, both small and large, use LED display as a screen and as an interaction medium between the user and the system. Modern electronic devices such as mobile phones, TVs, tablets, computer monitors, laptops screens, etc., use a LED display to display their output.

7 RESULTS ANALYSIS

Different voltage unbalance such as Line to Line, Line to Ground, and Three Lines has been observed. These faults are carried out by closing the fault switch in Simulink model. These faults are taken temporary as well as permanent.

7.1 Line to Ground Faults

X-axis shows Time and Y-axis shows three system Voltage, Current and Fault current between two contacts of Circuit Breaker. From the Figure 7, it is shown that fault occurs in one line at a time 0.2 second and it is cleared at 0.4 second. It is a Temporary fault which is cleared by auto reset.

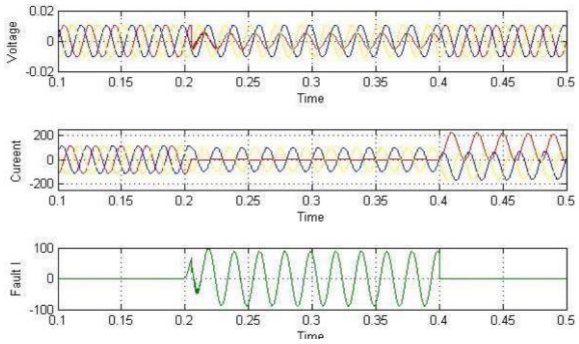

Figure7: Temporary Line to Ground Fault

From figure 8 it's clear that the line to ground fault is permanent, it's not cleared at a time instant of 0.4 second. Hence, its permanent fault and line will shut down.

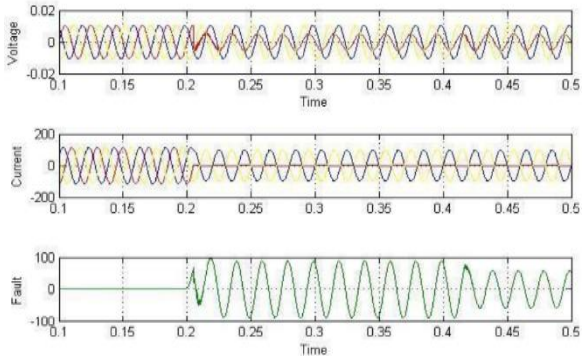

Figure8: Permanent Line to Ground Fault

7.2 Line to Line Faults

In this, line-line-ground fault has been shown and from the waveform, it Can be shown in Figure 9 that it's temporary.

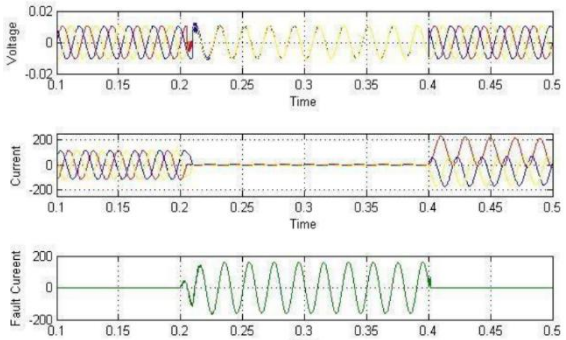

Figure9: Temporary Line-Line-Line-Ground Fault

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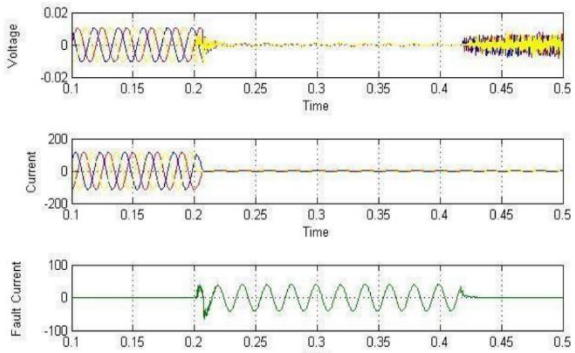

Figure10: Permanent line-line-line- ground fault

8 CONCLUSION

Various faults have been created to develop an automatic tripping mechanism for the three phase supply system while temporary fault and permanent faults occur. Here timer 555 has been used with relay for the fault analysis. Short duration fault returns the supply to the load immediately called as temporary trip while long duration shall result in permanent trip. Also we adjust the time duration for permanent fault by adjusting capacitors charging periods. Whenever any type of fault: LG temporary/permanent or LL temporary / permanent occurs message regarding faults is displayed on LCD and also message is sent to the concerned.

9 ADVANTAGES AND DISADVANTAGES

The various advantages and disadvantages we found while making this project are as follows:

- This invention will accurately identify hazardous faults requiring line de-energization, and also accurately discriminates, or distinguishes, a hazardous fault from other events for which the line should remain energized.
- The invention encompasses such a load analysis system which minimizes unnecessary power service interruptions and outages.
- By using this system, the secondary arc current can be abruptly reduced.
- If any fault occurs due to natural calamities, then this invention will not able to overcome the fault.

10 APPLICATIONS

- Substation
- Transformer
- Drives & Relay
- Transmission Line

11 FUTURE SCOPE

The future implications of the project are very great considering the amount of time and resources it saves. The project we have undertaken can be used as a reference or as a base for realizing a protection scheme to be implemented in other transmission lines of higher level. Also the current system can be made to work with conventional SCADA or other Communication Services like GSM to operate remotely.

12 REFERENCE

[1] Vines Gamit, Vivek Karode, Karan Mistry and Pankaj Parmar, “Faults Analysis on Three Phase System by Auto Reclosing”

[2] Y.G Paithankar and S.R Bhide,” Fundamentals of Power System Protection”, Prentice-Hall of India Private Limited, New Delhi, 2003

[3] Cause of power system failures
https://electrical-engineering-portal.com/11-major-causes-of-power-system-failures

[4] Type of Faults in Electrical system
https://www.electronicshub.org/types-of-faults-in-electrical-power-system

[5] https://en.wikipedia.org/wiki/ Transformer

[6] https://en.wikipedia.org/wiki/Arduino