3 PHASE FAULT DETECTION USING AUTO RECLOSING

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Abstract—Big role of electrical power network is the continuity of service. The electrical substations which supply the power to the consumers can have failures due to some faults which can be temporary or permanent. These faults lead to substantial damage to the power system equipment. This gave idea to investigate power system protection it's to improve reliability by focusing on fault detection

Index Terms—Arduino, Contactor, Relay, Voltage Transformer

I. INTRODUCTION:

In any power system most required parameter is continuity of power supply to load and reliability of system. In power system there are many chances of occurrence of faults which can be transient or permanent.

Definition of transient fault: Transient faults are errors that occur because of some temporary condition such as network connectivity issues or service unavailability. Typically, if you retry the operation that resulted in a transient error a short time later, you find that the error has disappeared.

Definition of Permanent fault: Permanent faults are errors that continue to exist until faulty component is repaired or cause of fault is removed. This project is made to detect faults like LG (Line to Ground), LL (Line to Line) in the power systems. In power system 85 percent faults are of temporary fault type which exists only for few cycles and then it get cleared by interrupting supply only for short time.

II. COMPONENT:

We had a great discussion on how the arduino works in the project in last chapter, now it's time to gather a deep brief.

Knowledge about all the other component of the project that are

1. Arduino
2. Relay
3. Contactor
4. Voltage transformer

1. Arduino:

The Arduino environment has been designed to be easy to use for beginners who have no software or electronics experience. With Arduino, you can build objects that can respond to and/or control light, sound, touch, and movement. Arduino has been used to create an amazing variety of things, including musical instruments, robots, light sculptures, games, interactive furniture, and even interactive clothing.

Figure 1: Arduino

2. Relay

The relay is an electromagnetic device which can operate on sensing the parameter for which it has been designed. A simple electromagnetic relay consists of a coil of wire wrapped around a soft iron core, an iron yoke which provides a low reluctance path for magnetic flux, a movable iron armature, and one or more sets of contacts (there are two in the relay pictured). The armature is hinged to the yoke and mechanically linked to one or more sets of moving contacts. It is held in place by a spring so that when the relay is de-energised there in the air gap. A contact in the relay pictured is closed, and the other set is open.
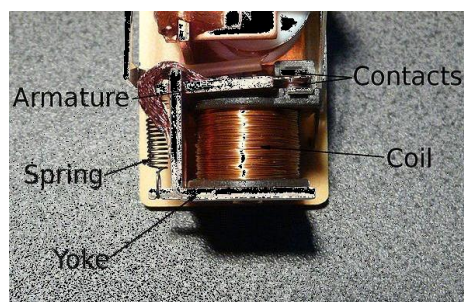

Figure 2: Relay

3. Contactor

A contactor is an electrically controlled switch used for switching a power circuit, similar to a relay except with higher current ratings. A contactor is controlled by a circuit which has a much lower power level than the switched circuit. Contactors come in many forms with varying capacities and features. Unlike a circuit breaker, a contactor is not intended to interrupt a short circuit current. Contactors range from those having a breaking current of several amperes to thousands of amperes and 24 V DC to many kilovolts. The physical size of contactors ranges from a device small enough to pick up with one hand, to large devices approximately a meter (yard) on a side. Contactors are used to control electric motor s, lighting, heating, capacitor banks, thermal evaporators, and other electrical loads.

Figure 3: Contactor

4. Voltage Transformer

Voltage transformer (VTs) is known as potential transformer (PTs). It's used to reduce the power system voltages to lower values and to provide isolation between the high voltage power network and the relays and other instruments connected to their secondaries. The voltage ratings of the secondary windings of the VTs have been standardized, so that a degree of interchangeability among relays and meters of different manufacturers can be achieved. The voltage transformer should be able to provide voltage signals to the relays which are faithful reproductions of the primary voltages. [7]

Figure 4: Voltage Transformer

III. BLOCK DIAGRAM

As shown in block diagram, PT will step down the voltage. The output of PT is given to input pins of Arduino. Arduino compares the input value with some pre-set reference value and if the input value is greater than the reference value then it will give output signal to auxiliary relay, so if any fault occurs on the line the value of current increases which is detected by arduino and it will trip the contactor through auxiliary relay. Arduino will again reclose the contactor after a 3second delay. And it will again check the condition at input of Arduino. If fault is of temporary type then it would be cleared in one tripping period. But if fault is semi-permanent type then fault would not be removed so Arduino will again trip the contactor and after 3 second delay it will again reclose it to check if fault is removed or not. If fault is permanent then it won't be removed so it will trip the contactor permanently.
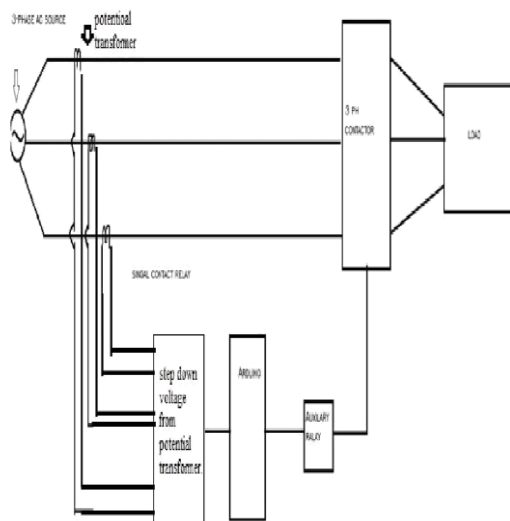

Figure 5: Block Diagram

IV. FAULT ANALYSIS:

Faults are classified into two parts, Active and Passive Fault.

❖ **Active Fault:**

When current is passing from one phase to another phase or phase to ground is known as active fault. This fault must be cleared as quickly as possible otherwise its damages to the conductor or line or the equipment.

❖ **Passive Fault**

Passive faults are stressing the system beyond its design and long duration fault which ultimately results in active fault.

❑ **Types of Fault on a Three Phase System**
1. Faults occurred on a three phase
2. Phase-to-earth fault
3. Phase-to-phase fault
4. Phase-to-phase-to-earth fault
5. Three phase fault
6. Three phase-to-earth fault

❑ **Advantages**
- Safety Equipment
- Work complete time To Time
- More Efficiency
- Reduce losses
- More reliable

❑ **Application**
- Sub Station
- Transformer
- Transmission Lines

CONCLUSION

In the project various faults have been simulated 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 back to the supply to the load immediately called as temporary trip while long duration shall result in permanent trip.

ACKNOWLEDGMENT

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