

Sigma Institute of Engineering, Ajwa-Nimeta Road, Vadodara, Gujarat, India



Differential Current Protection of Transformer using Arduino with Voice Alert

Patel Afzal¹, Patel Jigar², Tadvi Raj³, Khuman Abhishek⁴, Mr. Ketan Bariya⁵

¹B.E student, Electrical Engineering, Sigma Institute of Engineering, Vadodara ²B.E student, Electrical Engineering, Sigma Institute of Engineering, Vadodara ³B.E student, Electrical Engineering, Sigma Institute of Engineering, Vadodara ⁴B.E student, Electrical Engineering, Sigma Institute of Engineering, Vadodara ⁵ Asst prof, Electrical Engineering, Sigma Institute of Engineering, Vadodara

Abstract- The main purpose of this project is to establish a differential protection of transformer and this is to be done using arduino as brain, the current sensor measure current entering and leaving the transformer and arduino decides when to disconnect the transformer according to the basis of difference of current.

Keywords-Transformers, Differential Current Protection, Arduino Board, Current Transformer.

I. INTRODUCTION

The faults of transformer in electrical power system are common problem. The faults occurs on the transformer is mainly divided into two types external fault and internal fault, external fault are cleared by the relay system outside the transformer within the shortest possible time to avoid any danger to the transformer due to these faults. The Protection for internal faults in such type of transformer is to be provided by using differential protection scheme. Differential protection scheme are mainly used for protection against phase to phase faults and phase to earth faults. The differential protection used for power transformers is based on merz-prize circulating current principle. Differential protection is not only limited to transformer but it is also used for protection of utilities like generators, synchronous motor and bus bars.

II. DIFFERENTIAL CURRENT PROTECTION



Figure 1.Differential Current Protection of Transformer [3]

During the external(normal load condition) condition, the current entering and leaving in the protected winding(equipment) will be same in magnitude and phase relation, Therefore instantaneous values of CT secondary currents will be same at all instants. This obviously, means that the current through relay will be zero and the relay will not operate. During internal fault condition the currents entering and leaving in the protected winding will not be in same magnitude and phase relation. Therefore the CT secondary currents are disturbed. Hence, the differential or spill current will through the relay. If this current is higher than the set value of the relay, relay will operate and isolate the protected equipment from the system.

III. ARDUINO

Arduino is hardware and software company, Arduino is similar to microcontrollers. These systems provide sets of digital and analog input/output (I/O) pins that can connected to various board and other circuits. The boards most feature of serial communication interfaces, including Universal Serial Bus (USB) on some models, and also loading programs from computers. For programming the microcontrollers, the arduino project provides an integrated development environment (IDE) based on a programming language name like: C and C++. Also ardiuno provide another feature of a low cost, easily available, not effect to environment, this is the Main aim to choose arduino another feature is that it is the portable USB connected.



Figure 2. Arduino UNO Board [5]

IV. CIRCUIT DIAGRAM



Figure 3. Circuit Diagram in Proteus Design Suite

V. WORKING

Arduino is the main component in this circuit. Above figure shows the circuit diagram of the differential protection of transformer using arduino with voice announcement. Here arduino is used to compare the currents on both primary and secondary. Two rectifier circuits are used in this circuit to convert the AC voltage into DC voltage for the use of arduino. Current transformers also provided one on primary and another on secondary to tap the currents on both sides and to give proportionate voltage to the rectifier circuits. Output of the arduino is connected to the relay. The relay here is 12V DC 1-phase relay. Relay is used to initiate the voice circuit which gives voice alert.

Under normal operating conditions currents on primary and secondary are same. So, the proportionate voltages generated by the current transformers on primary and secondary are same. These two voltages will give to the arduino. The proportionate voltages generated by current transformers are rectified by the rectifiers in the circuit. Under normal operating conditions these two voltages will be same in magnitude and difference is zero. So, the arduino gives no signal to the relay.

Whenever extra load or an internal fault occur in transformer the currents seen by the CT on primary and secondary differs by same amount. As a result voltage sensed by the arduino from primary and secondary differs. As there is a difference in the voltage sensed by the arduino i.e., difference is not zero. Arduino give a signal to the relay according predefined program. As and when the relay is activated by the arduino the relay will activates the voice announcement circuit. The voice circuit will give output predefined voice as a alert to the operator. After three consecutive voice alerts Arduino will give trip signal to the relay board and which is connected in series with the supply will open its contacts thus the supply to the hardware setup will be disconnected.

VI. SOFTWARE



Figure 4.Flow Chart of Arduino Programming

ARDUINO PIN	ASSIGNED	FOR FU	NCTIONS.

sensorPin1 = $\overline{A0}$;

sensorPin2 = A1;

x'merPin = 13;

buzzerPin=12;

VII. PROTEUS SIMULATION

6.1 Simulation While Both Currents Are Same:-



Figure 5. Simulation While Both Currents Same

Figure shows the Proteus simulation of Differential Current Protection of transformer using Arduino with voice alert, when the both currents are same the lamp which is connected to transformer is ON. We can say this is normal working condition of transformer

6.2 Simulation While Both Currents Are Different:-



Figure 6. Simulation While Both Currents are Different

Figure shows the Proteus simulation of Differential Current Protection of transformer using Arduino with voice alert, when the value of both currents is different to each other the BUZZER is ON. We can say this is Abnormal working condition of transformer.

VIII. HARDWARE IMPLEMNTATION

List of Components Used For This Project

- 1. Current Transformers
- 2. Potential Transformer
- 3. Capacitor
- 4. Diode (1N4733A)
- 5. OP Amplifier (LM358)
- 6. Relay
- 7. Resistors
- 8. Transistor (BC547)
- 9. Buzzer



Figure 7. Hardware of the Project

VII. CONCLUSION

From this project we have concluded that when internal fault occurs and the value of both currents are different the relay gets operated and the voice circuit gives voice alert by the sense of arduino, so we come to know about abnormal working condition of transformer. Therefore by using Differential protection scheme, transformer is protected from faults with the use of Arduino operating an electromagnetic relay.

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