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Protection of Transformer

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ABSTRACT

The main intention of this project is to design a microcontroller based system that can be used in power transformer protection. The system checks the operating parameters of the transformer i.e. current and reports the quantity that is flowing through the transformer. The system is designed such that it is able to detect currents above the normal operating level and isolate the power transformer from the distribution line. This isolation process is to ensure that the transformer is safe from any excess current levels that can make it to overheat thus get damaged. It gives a solution to the need to reduce cost of maintenance and ensure that supply of electricity to consumers is not interrupted for long periods taken while repairing or replacing destroyed transformers.

Keywords : GPR,SFR,ADC, PIC16F690.

I. INTRODUCTION

In the design of electrical power transmission and distribution system, there are various factors that need to be considered in the quest to satisfy the needs of electricity consumers. Electrical power systems experience faults at various times due to various reasons. These faults must be foreseen and safety precautions applied to the power system. The power systems engineer must include in his design, safety measures in order to avert any destructive occurrences that the system may undergo at any given time. Power system protection is very essential and necessary for a dependable electrical power supply. It ensures that the system is protected from itself and that the consumer is also safe as he benefits from the electrical power supply. An electrical power system consists of various components such as generators, switches, transmission cables, transformers, capacitor banks among other components. It cannot therefore operate without an effective protective device to keep these components safe and the system stable.

Faults in a power system refer to the undesired conditions that occur in the electrical power system. These conditions may include short circuit, over current, overvoltage, high temperatures among others. It is clear that over time, there has been an increase in human population, economic growth and technological advancement. This has continuously made the demand for electrical power to go high because as technology, induction takes place in the second conductor.

Transformer theory and application is based on the principle where magnetic field in one coil causes voltage induction into another coil. Sizes of transformers vary according to their applications from the tiny ones used in microphones to the ones weighing hundreds of tones used system grid. Transformers are used in electronic appliances and in electrical power networks. Transformers are therefore very important in transmission, distribution and consumption of electrical power.

The main aim of power system protection scheme is to switch off a section that is faulty in the system from the remaining live system. This ensures that the remaining portion is able to function satisfactorily locking out chances of damage that may be caused by fault current.

A circuit breaker closes automatically as a result of trip signals it receives from the relay whenever a fault is detected. The basic philosophy of a power protection system is that system faults cannot be prevented from

flowing in the system but can be stopped from spreading in the system.

II. METHODOLOGY

1. Block diagram

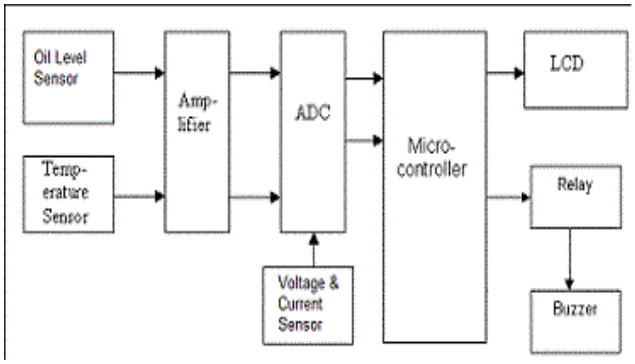

Figure 1. Block diagram of protection system

Current Sensor

This is a device that detects electric AC or DC current flowing in a conductor and gives out a corresponding signal (analogue voltage/current/digital pulse). The detected signal can be used for various purposes like measuring the amount of current in the conductor, controlling of another device etc.

Relay

A relay is an electrically operated switch. It uses electromagnetic force to close or open contact. The relay employed in this project can be operated as normally closed or normally open. For this system, the normally closed mode was used. The relay circuit is illustrated in figure. The relay was used to de-energize the contactor coil in case of a fault thus isolating the transformer from the system.

Transformer

A transformer is an electrical device that transfers electrical energy between two or more circuits through electromagnetic induction. A varying current in one coil of the transformer produces a varying magnetic field, which in turn induces a voltage in a second coil. Power can be transferred between the two coils through the magnetic field, without a metallic connection between the two circuits. Faraday's law of induction discovered in 1831 described this effect. Transformers are used to increase or decrease the alternating voltages in electric power applications.

III. RESULT

The figure below shows the outcome when the transformer is operating under normal conditions. The LCD is operating normally and the green LED blinks to show that the system is responding accordingly. A 20KΩ variable resistor has been used as the load. Varying the resistor signifies the varying load connected to a transformer. The current reading on the LCD changes as the resistor is varied up to the preset fault point. The normal operation condition operates as expected and as depicted in the simulation.

IV. CONCLUSION

The main objective if this project has been to design and implement a system that uses a microcontroller to protect a power transformer. This objective was achieved as the system works effectively. As the current circulating in the transformer coil varies, the LCD displays the readings. The relay is able to operate and isolate the transformer in case of an over current fault. The relay is the main switching element in the system. When energized, it opens its contacts and de-energizes the contactor thus isolating the transformer to safety in case of adverse current conditions. The other peripheral devices act as means of sending warning messages in case a fault occurs. This system if put to use in power transformer protection can serve the purpose with greater advantages than the analogue over current relay. Its ability to automatically reclose the circuit after the fault is cleared warrants the system usability in remote areas that may be too far for an operator to reach easily and reconnect the transformer back to the supply line. The admirable fact about it is the accuracy with which it closes and recloses during either normal operation or fault occurrence. Every customer desires to optimize the usage of a gadget yet at a low cost. The cost of implementing the system is relatively cheap as the components used are few and can be cheaply found in the market. The microcontroller can be used to drive multiple relays using the same program. The only thing that needs to be done is free more ports for multiple input and outputs. This will allow for more variables from different transformers and multiple outputs to different

relays. Owing to the fact that transformers are very important components of the electrical power system, their safety is paramount. Over current phenomenon can cause damage to transformers. Damage to a transformer puts interrupts electrical supply to consumers. Blackouts cause economic derailment and disorients consumers' work schedule. This explains why this system is needed and can help mitigate the effects of fault in a transformer.

V. REFERENCES

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