Innovative Journal for Opportunities and Development in Science &Technology,
Volume 3,Issue 4, May.2023
Paper Id: – IJ2022V3I4 -30A-E,
ISSN 2582-6026

AUTOMATIC LOAD SHARING OF TRANSFORMER USING MICROCONTROLER

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ABSTRACT:- The transformer is a static device, which converts power from one level to another level. The aim of the projectis to protect the transformer under overload condition by load sharing. Due to overload on transformer, the efficiency drops and windings get overheated and may get burnt. Thus by sharing load on transformer, the transformer is protected. This will be done by connecting another transformer in parallel by means of a micro-controller.
The first transformer's load is compared to a reference value by the microcontroller.
The second transformer will share the additional load when the load is greater than the reference value.As a result, the two transformers operate effectively and are protected from harm.The load currents in this project are controlled by three modules.The first module serves as a sensing unit to measure the load's current, while the second module serves as a control unit.The microcontroller unit, which is the final module, will read the analogue signal, carry out certain calculations, and then send a control signal to a relay.The control station is also informed about switching via a GSM modem.

KEYWORDS: Transformer Overload, Microcontroller, Uninterrupted Power Supply.

I. INTRODUCTION

Transformers are static devices that transform energy from one voltage level to another.
It is an inductively connected device that changes voltage level without changing frequency and is electrically isolated.The mutual induction principle is used by transformers to transmit ac voltage from one electrical circuit to another.One of the most crucial pieces of equipment in a power system, distribution transformers are also referred to as the power system's heart.The distribution transformer's efficient operation is essential to a power system's dependability.In order to assess the functioning of the distribution transformer, it is therefore required to monitor and manage important parameters like voltage and current.Thus, it aids in preventing or lessening the disruption brought on by an unexpected, sudden breakdown. the Transformers the electric power system, needs protection as a part of the general system protection approach.Moreover the increasing population and their unavoidable demands have led to an increasing demand on electrical power. With this increased needs, the existing systems have become overloaded. The overloading atthe consumer end appears at the transformer terminals which can affect its efficiency and protection systems. Due to overload on the transformer, the efficiency drops and the windings gets over heated and may get burnt.It takes a lot of time to repair and involves a lot of expenditure. Transformers are

occasionally loaded beyond nameplate ratings because of existing possible contingencies on the transmission lines, any failure or fault in power systems, or economic considerations. One of the reported damage or tripping of the distribution transformer is due to thermal overload.

II. RELATED WORK

In the power system transformers may be loaded beyond their nameplate ratings due to a fault or some emergency conditions. This type of overloading can cause either short term failures or long term failures. Increase in hot spot temperature would also lead to the accelerated ageing of the transformers resulting in transformer overload. So in order to keep the body temperature of the transformer within its nameplate rating, the transformer must be loaded efficiently in a controlled manner.

Our system aims at load sharing of transformers and priority based load shedding. The procedure of load sharing is summarised below.

1. Loads are supplied from a single transformer under normal condition and a standby transformer is connected in parallel through a circuit breaker.
2. A current transformer measures the load current continuously and feeds it to the controller by converting it to a corresponding D.C value in order to compare with the reference value set by the user.
3. Whenever the load current exceeds reference value, the controller sends a high signal to the relay which energises the relay coil. The relay coil thus sends a tripping signal to the circuit breaker of the standby transformer.
4. Thus the load is shared by the transformers equally as the transformers are identical. The current transformer still measures the load current and compares it with the reference value.
5. Whenever the load current falls below reference value one transformer is shut down and this is done in an alternative manner to avoid thermal overloading.
6. If the load value increases further beyond the capacity of two transformers, load will be cut-off from the main supply based on the priority level set by the user. This is done to provide un-interrupted power supply to higher priority loads.
7. Each of the process is informed to the controller by a GSM and the load parameters are continuously displayed in the LCD.

This algorithm is followed whenever the transformer is working and the program is executed in a loop function so that the algorithm repeats itself.

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III. BLOCK DIAGRAM

Figure 3.1 shows the block diagram of automatic load sharing of transformers using microcontroller. Thevarious components in the system are described below.

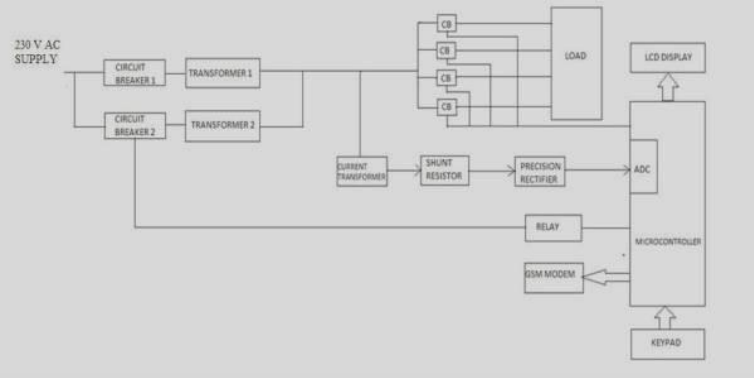

Fig 1. Block Diagram

In the block diagram circuit breakers are used to make and break the connections to the transformers. A relayis used to send a tripping signal to the circuit breakers and they are energised on receiving a signal from the microcontroller. The current transformer is used for measurement purpose.

Circuit breaker

A circuit breaker is used to isolate the faulty point of the power system in case of abnormal conditions such as faults. It is a protective device which energizes and de-energizes a circuit and provides over-current protection. Circuit breakers operate on receiving a signal from relay.

Transformers

A transformer is an electrical device that transfers electrical energy between two or more circuits through electromagnetic induction Transformers convert AC voltage from one level to another level with a little loss of power. A transformer operates on the principals of “electromagnetic induction”, in the form of mutual induction. The transformer used here is a step-down transformer so that it can be directly fed to the measuringdevices by rectification.

3.1 Operating principle

Only one transformer is functioning to supply the loads in the proposed system.A circuit breaker a nd relay are used to parallel-connect a standby transformer.

The load current is continually measured by the current transformer and fed to the microcontroller 's ADC ports.The user enters the reference value or the maximum load limit, and the user or the relevant authority also sets the load's priority level.During peak hours, there is an increase in load demand, and a single transformer would not be able to supply the entire load.When the load dema nd in this situation surpasses the reference value, the microcontroller will give a control signal to energize the relay coil. Thus the standby transformer will be connected in parallel and will share the load equally since the transformers are of the same ratings. Thus all the loads are fed efficiently providing un-interrupted power supply. The GSM modem will send a message to the control room about the load sharing and a display will be shown in the LCD display. When the load increases further to a value

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IV. CIRCUIT DIAGRAM

The circuit diagram of the proposed system is shown in figure 5.1. Here two transformers share 5 loadswhich can be controlled independently.

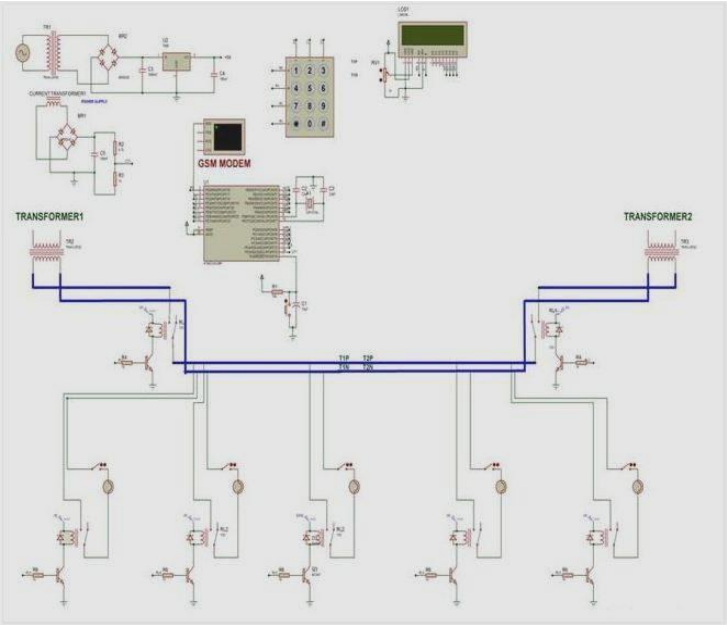

Fig 2- Circuit Diagram of Automatic Load Sharing of Transformers using Microcontroller

Circuit Diagram Description

The circuit diagram consists of two transformers of which only one transformer is working under normal loadcondition. Each transformer is connected with a relay and the loads are connected to the secondary coil of thetransformer. Transformers work only when the relays are latched. The transformer used here is step down transformer which converts 230V to 12V. The controller and LCD require a DC operating voltage of 5V while the relay and GSM operate at a DC voltage ranging from 9V to12V. A power supply circuit is provided to get12V and 5V DC from the 230V mains by a full wave bridge rectifier. A 7805 regulator ensures a regulated 5Vsupply to the LCD and controller. Here five inductive loads are connected to the transformer each provided with an individual relay.

V. EXPERIMENTAL RESULTS

- Hardware implementation of the Automatic Load Sharing of Transformers using Microcontroller wasdeveloped using Atmega328 microcontroller.
- Simulation was done in PROTEUS ver. 7.7 and the output was verified.
- Priority based load shedding provided un-interrupted power supply to certain loads like hospitals
- load is shared by the transformers equally since the transformers were of same rating
- The message sent by the GSM was viewed by a Virtual terminal in PROTEUS as shown below.

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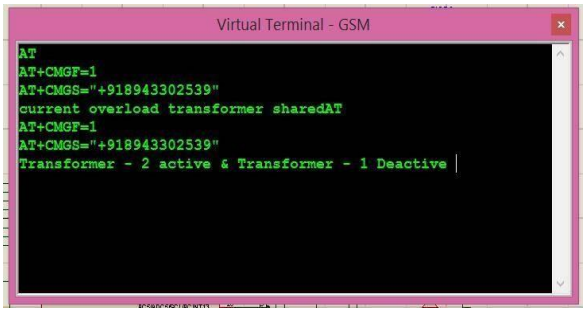

Fig 3- Virtual Terminal of a GSM

VI. CONCLUSION

One of the most common and expensive pieces of equipment in the transmission and distribution system is the transformer.It is referred to as the power system's beating centre.The transformer needs to be protected and maintained because of its high cost.Each transformer's load may increase as result of the daily increase in load demand and the need to satisfy it with the current transformers.

One of the finest ways to deal with this is by connecting transformers in parallel. In this project of Automatic Load Sharing of Transformers Using Microcontroller, a technology is implemented to share the load on the transformers. This provides un- interrupted power supply and avoids blackout in particular areas where there is varying loads. With the advancement of communication technology, now it is possible to receive overload condition of transformer through GSM to the control room.

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