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Automatic Load Sharing of Distribution Transformer for Over Load Protection

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Abstract: ***The main aim of this paper is to indicate the methods we are using to reduce the faults in the transformer and we are also able to protect the transformer. A transformer is a constant device that transfers electrical power from one circuit to another with the desired change in voltage and current at a constant frequency. But when it overloads the condition causes abnormality, which can cause serious problems in the future. To avoid such a situation when there is a high load on the main transformer, we use other standby transformers that provide loads, which are switched on automatically by the Arduino. This will lead to efficient loading of both transformers. When the load is normal, both transformers can be switched to alternate loads. This will avoid the thermal loads of the transformer. Also, this arrangement will provide a proper maintenance facility for both the transformers. The transformer is the most expensive and bulky piece of equipment in an electrical system. It operates 24 hours a day and feeds the load. The situation can sometimes occur when the load of the transformer suddenly increases beyond its rated capacity. When this condition occurs, the transformer will be overloaded, overheating and damaging the insulation of the transformer, resulting in clogging. The best solution to avoid overloads is to run the number of transformers in parallel. This is as same as the parallel operation performed by the transformers, where the number of transformers shares the system load. In the recommended approach, the load of the first transformer will share loads of the second transformer when it rises above its rated capacity. The main objective of this paper is to provide an uninterrupted power supply to the consumers and also to protect the transformer from overload condition. By implementing this scheme the transformer can avoid supply interruption due to high load or high heat.***

Keywords: Transformer, Uninterrupted Power supply, Overload condition, Arduino

1. Introduction

Transformer is a constant device which is used for the purpose of sharing the electrical power from one circuit to another circuit with the required change in voltage and current at a constant frequency level. When we comparing with other devices transformer is the only one equipment in the power system which operates at higher efficiency at the full load condition level. But in some abnormal cases occur at overloading conditions, which may also affect the transformer efficiency, because of increased heating and increased losses. So it is very essential component to transfer this load to other transformer or to replace the transformer with higher rating. This technique is not possible economically so the first technique in this system is practically used to supply the load efficiently. So we are using the first technique to supply the load efficiently and also reliably. To execute this requirement there is only one method present in manual approach. In this way another transformer is connected manually during the heavy load condition occurs.

But practically manual approach is not efficient method. So we are using Arduino to make the switching of transformer automatically. Arduino is an automation based microcontroller device which will automatically switch the transformer when the overloading condition or abnormal conditions happen in the power system. Thus, this will result in efficient working of both the transformers in the system. Also, when the load is at constant condition both the transformers are able to switched on into the circuit alternately. This situation will avoid continuous heating of only one transformer. This practical setup offers proper maintenance facility for both the transformers. All this advantages will make the entire system very efficient.

2. Proposed Methodology

The proposed methodology of the system is mentioned in the above flow chart diagram. It shows that load is shared equally during overload conditions by using Arduino and another transformer is connected in parallel with the circuit breaker circuit and relay. The current transformer is used to measures the load current and it gives the information to the Arduino. The reference value of the load current or the highest limit is set by the user and also the highest order level of the load is also provided by user. As we all know about the during peak hours, there is huge increase in load demand, we are not able to maintain the condition by using only one transformer. During this overload condition, when the demand of the load is increases the reference value, then the Arduino will send a control signal message to energize the relay coil. Thus, another transformer are connected parallel and we are sharing the load equally since the both the transformers are of same rating level. Then, all the loads are shared equally and we are able to achieve more efficiency and by also providing an uninterrupted power supply in the system. The transformer load current or maximum value are displayed in the LCD display and also the switching status of the transformer are also shown. When the load condition is normal, the master transformer is sharing the load and slave transformer is in off condition. When the load condition comes to overload that compared value is greater than the reference value the slave transformer comes into picture. When the load conditions come into normal state the slave transformer will be in the off state automatically with the help of Arduino.

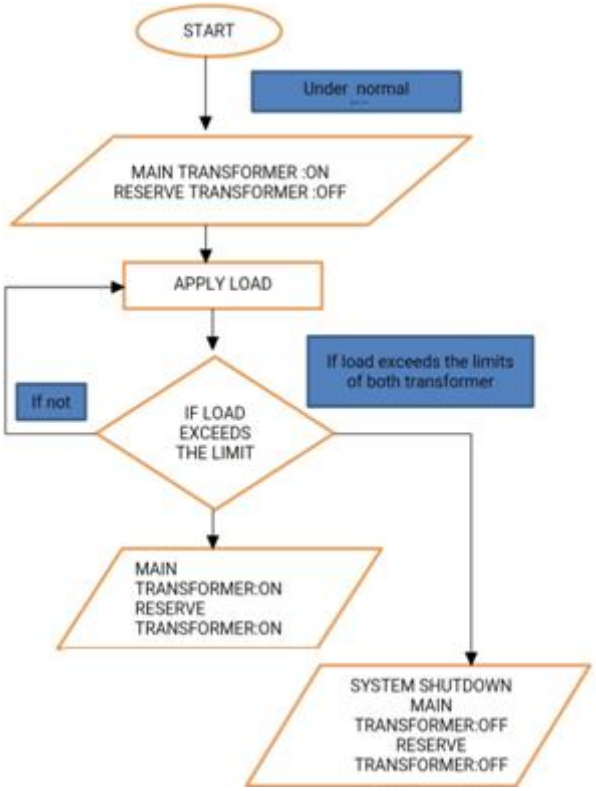

Figure 2.1: Working Flowchart Diagram

3. Applications

There are two conditions present in the transformer parameters:

- **Under Normal Conditions:**

In this proposed system we are using two transformers namely master transformer and the slave transformer. In case of normal condition, the master transformer is able to feed the load, while the slave transformer is in OFF state. This can be done with the help of sensors and Arduino, current transformers. First the circuit breaker is connected with primary transformer that is master transformer and also sensor circuit is connected contains current transformer which measures the load current and pass the signal to Arduino. Then the Arduino will energize the relay coil according to compared value, if the reference value is greater than compared value then only one transformer will feed the load and the status of the system is displayed in the LCD display.

- **Under Abnormal Conditions:**

In this proposed system we are using two transformers namely master transformer and the slave transformer. In case of abnormal condition, the master transformer is not able to feed the load, so we are switching the slave transformer is in ON state. This can be done with the help of sensors and Arduino, current transformers. First the circuit breaker is connected with primary transformer that is master transformer and also sensor circuit is connected contains current. Transformer which measures the load current and pass the signal to Arduino, then the Arduino will energize the relay coil according to compared value, if the reference value is less than compared value then both the transformers will feed the load and the status of the system is displayed in the LCD display. To provide an uninterrupted power supply under an overload condition. To increase the efficiency of the transformer. To protect a transformer under an abnormal conditions.

4. Results and Discussion

4.1 Hardware Implementation:

We have done the prototype model of this project. First we have fully studied our project idea and referred some literatures related to our project. And analysed some important information related to our project. Then we got an idea to do our project in prototype model. Firstly, we have designed the block diagram of our project, then we understand the project components requirements which is most important thing in any project. Because without the components part there is nothing to do the project. We have used the hardware components such as transformer, Arduino, LCD display, Voltage regulator IC, Relay, Dc motor as a load, Potentiometer, Resistor, capacitor, push button, Diodes. Secondly, we have done the coding part in the Arduino board using the Arduino software.

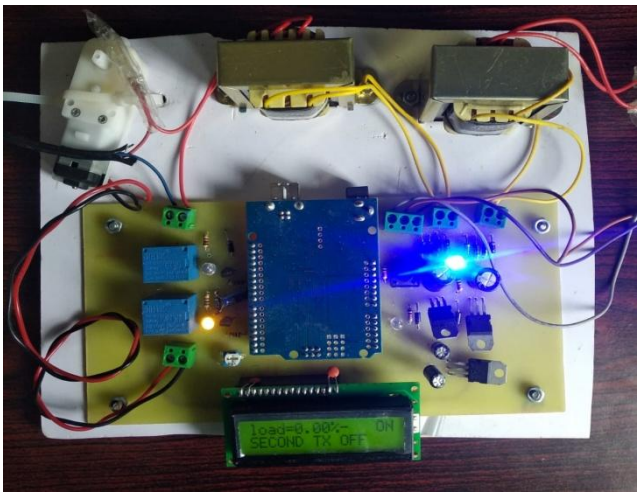

Figure 4.1: Prototype of project showing the master transformer is ON

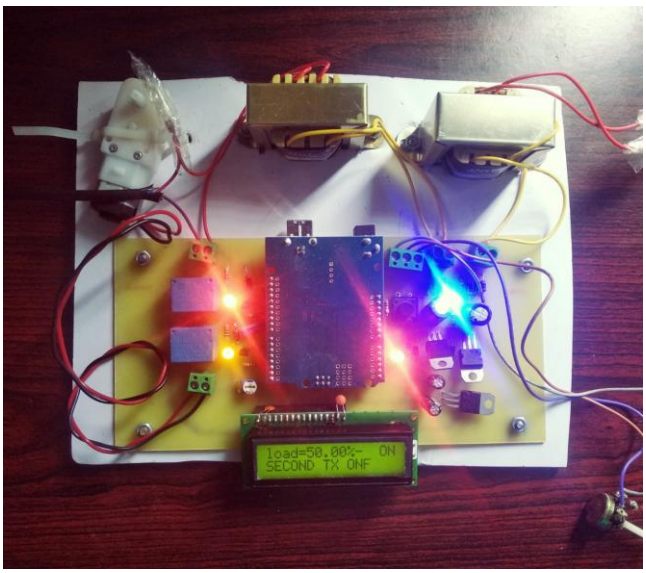

Figure 4.2: Prototype of project showing that slave transformer is ON

Thus, we can see that the two above figures we can easily understand that our project is able to switch automatically during overload or an abnormal condition. The load percentage can be adjusted by the potentiometer device in the system. Thus, we are concluding our project is able to indicate the transformer switching status and the load percentage in the LCD display and also in a LED. In the first and second figure we can see a major difference ,first figure load percentage is zero ,however in the second figure we can see that the load percentage is increased to fifty percentage and also led 1 is blinking in a first figure and both the led are blinking in a second figure. By doing this project we can automate the transformer switching under overload condition or any abnormal condition. By this we can achieve the maximum efficiency of the system and also we able to protect the transformer and we can provide an uninterrupted power supply.

5. Conclusion

By designing an automatic load sharing transformer using the Arduino we have concluded that the transformer is the most important as we all know Equipment in the electrical system, so its safety is very important. This paper the transformer is about the importance of load distribution, so that power can be changed seamlessly. We noticed that if the load on a transformer increases, the relay is off Sensing the change of current and activating the microcontroller and other transformers operate automatically to share the load and when the relay senses the change in current and then again as the load decreases. The load is distributed and redistributed back to the single main transformer.

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