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An Effective Distribution and Load Sharing of Transformer Automatically by using Microcontroller

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Abstract - *The transformer is a static gadget, which changes over force starting with one level then onto the next level. The primary point is to secure the transformer under over-burden condition by load sharing. Because of over-burden on transformer, the proficiency drops and windings get overheated and may get singed. Subsequently by sharing burden on transformer, the transformer is ensured. This will be finished by interfacing another transformer in equal through a miniature regulator. The miniature regulator looks at the heap on the main transformer with a reference esteem. At the point when the heap surpasses the reference esteem, the subsequent transformer will share the additional heap. Consequently, the two transformer work proficiently and harm is forestalled. Primary modules utilized here are detecting unit, control unit and miniature control. A GSM modem is additionally used to illuminate the control station about exchanging. The upsides of the task are transformer security, continuous force gracefully and hamper.*

Key Words: Control Unit, GSM Module, Microcontroller, Sensing Unit, Relay, Transformer.

1. INTRODUCTION

The quantity of transformers to be worked in equal can likewise be expanded by request of a specific region. Idea of programmed load sharing of transformer or over-burden insurance of transformer is finished by different methods like by utilizing chip, by utilizing GSM innovation, and by utilizing transfers. Among them, a transfer is utilized and comparator IC's for programmed while working the quantity of transformers in equal we need to follow a few conditions like same voltage proportion, same X/R proportion, same KVA appraisals, and same extremity and so forth for example indistinguishable transformers are working in equal. Dissemination transformers are one of the most significant gear in power framework. The solid activity of a force framework relies on the powerful working of the dissemination transformer. Accordingly checking and controlling of key boundaries like voltage, current and temperature are vital for assessing the presentation of the circulation transformer and furthermore supportive to dodge or lessen disturbance because of abrupt unforeseen disappointment. A force framework gets flawed because of the event of unwanted conditions like shortcircuits, over current, overvoltage and so forth. Transformers being one of the most noteworthy hardware in the electric force framework, needs security as an aspect of the overall framework insurance approach. In addition the expanding populace and their unavoidable requests have lead to an expanding request on electrical force. With this expanded needs, the current frameworks have gotten over-burden. The over-burdening at the customer end shows up at the transformer terminals which can influence its productivity and insurance frameworks. One of the announced harm or stumbling of the circulation transformer is because of warm over-burden.

In this, the slave transformers share the heap of ace transformer on account of over burden and over temperature conditions. A sensor circuit containing microcontroller, current transformer and so forth is intended to log the information from ace transformer and on the off chance that it is discovered to be in over-burden condition, promptly the slave transformer will be associated in the corresponding to the ace transformer and the heap is shared. The microcontroller screens the heap current and temperature of transformer and presentations the qualities on LCD .Whenever loads are added to the optional side of the transformer, the current at the auxiliary side ascent. As the heap current surpasses the appraised current rating of the transformer, the temperature of the optional winding ascents, hence the microcontroller will impart an excursion sign to the transfer, in this way turning on the slave transformers. At first when we turned ON the heap that heap will be shared by the main transformer. When burden has been expanded on first transformer over its evaluated limit then the reserve transformer (second) will share the heap consequently. Here three modules are utilized to control the heap current. The principal module is the detecting unit, which is utilized to detect the current of the heap; the subsequent module is control unit in which hand-off assumes the fundamental job, and its capacity is to change the situation concerning the control sign and last module is microcontroller. It will peruse the computerized flag and perform computations lastly gives control sign to the transfer. For checking the heap current ceaselessly, current transformer is utilized and the yield of current transformer is taken care of to microcontroller through A-D converter. Likewise for checking transformer internal heat level operational intensifiers are utilized with reasonable temperature transducer.

2. BLOCK DIAGRAM

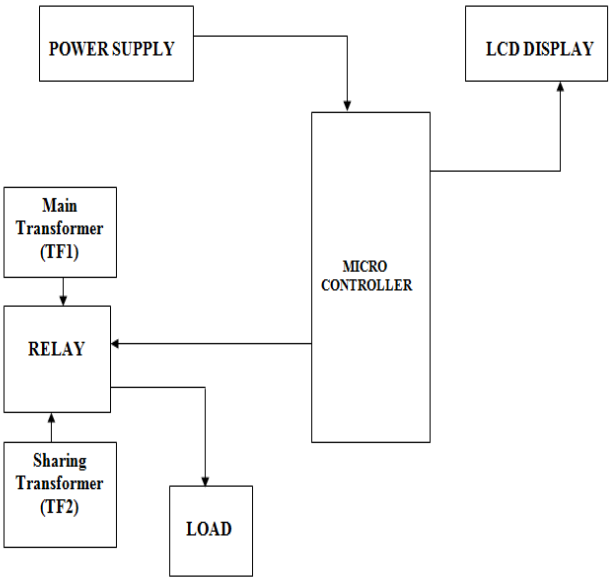

Fig. 2.1 shows the block diagram of distribution and load sharing of transformer, in this various sections are given that are described below:

2.1.1: Power Supply Section

This section is meant for supplying Power to all the sections mentioned above. It basically consists of a Transformer to step down the 230V AC to 18V AC followed by diodes. Here diodes are used to rectify the AC to DC. After rectification the obtained rippled DC is filtered using a capacitor Filter. A positive voltage regulator is used to regulate the obtained DC voltage.

2.1.2: Microcontroller Section

This section forms the control unit of the whole circuit. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the circuit because it controls the devices being interfaced and communicates with the devices according to the program being written.

2.1.3: Transformer

In general, the ac line voltage present in your house wiring is not suitable for electronic circuits. Most circuits require a considerably lower voltage, while a few require higher voltages. The transformer serves to convert the ac line voltage to a voltage level more appropriate to the needs of the circuit to be powered. At the same time, the transformer provides electrical isolation between the ac line and the circuit being powered, which is an important safety consideration. However, a line transformer is generally large and heavy, and is rather expensive.

2.1.4: ADC

Analog to digital (A/D, ADC) converters are electrical circuit devices that convert continuous signals, such as voltages or currents, from the analog domain to the digital domain where the signal presented by numbers.

2.1.5: Relay

Relays are used to the Trip the transformer. A relay is an electrical switch that opens and closes under control of another electrical circuit. In the original form, the switch is operated by an electromagnet to open or close one or many sets of contacts.

3. METHODOLOGY

The two identical transformers are using which are connected in parallel through change over relay. Transformer-TF1 is a main transformer, which is called master transformer and transformer-TF2 is an auxiliary transformers which is called as slave transformers. Each transformer has its own load handling capacity. In case of a normal operation the master transformer shares the load but as the load is beyond the rated capacity of main transformer the slave transformer is connected in parallel automatically and shares the load.

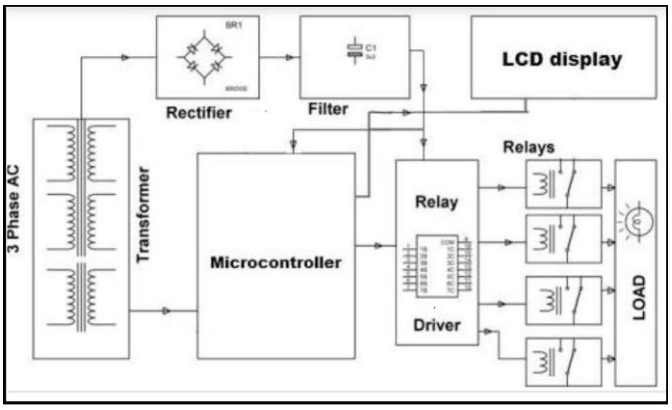

Fig. 3.1: Circuit Diagram of Load Sharing Transformer

Load switching network is provided to ON/OFF the load on the transformers which is connected to load bank. Shunt is used to distribute the current to all the sections of the circuit. Comparator is having two inputs one is from shunt and the second is from the reference voltage. Reference voltage is set by the user. Comparator (microcontroller) compares the reference voltage and system voltage continuously and the output signal is given to the relay driver circuit. Relay driver circuit consists of NPN transistor to drive the relay. Relay driver gives the signal to the changeover relay in case of overload conditions. Change over relay closes its contact when load on the master transformer is more than it's rated capacity and the transformer-T2 i.e. slave transformer is automatically connected in parallel with the main transformer and if the load is increased to such a amount that can't be handled with

the two transformers then the third transformer T3 is automatically connected in parallel with T1 & T2 and shares the load. Due to which the transformer-T1 is not overloaded and the problem like overheating, burning of winding of transformer and un-interruption of supply is gets eliminated by this arrangement.

The visual indicator contains the LED's which shows the ON/OFF status of the all transformers relay. Relay is used to on & off the transformer occurred it is connected to P2.0 microcontroller. The data pins of ADC are connected to the port 1 of microcontroller. Whatever the data in ADC from C.T (current transformer) will be converted from analog to digital and fed it to the microcontroller. Reference value is set in the preset which is continuously compared with feedback signal in the controller. Three relays are connected to controller through relay driver. The phase of transformers T1, T2 & T3 are connected to the relay contactor while the neutral is given separately from the single phase supply. 100W bulbs are used as loads which is connected to the secondary side of main transformer T1. Another n-p-n transistor of controller is used for providing the feedback signal and to make the system automatic.

3.1 Advantages

i. The load is shared by transformers is automatically.
ii. No manual errors are taking place.
iii. It prevents the main transformer from damage due to the
iv. Problems like overload and overheats.
v. Un-interrupted power supply to the consumers is supplied.

3.2: Transformer Size/Insulation Level

3.2.1: Power Transformer

Power transformer is used for the transmission purpose at heavy load, high voltage greater than 33kv and 60% efficiency. It also having big in size as compare to distribution transformer, it used in generating station and transmission substation, high insulation level.

3.2.2: Iron Loss and Copper Losses

Power transformers are used in Transmission network so they do not directly connect to the consumers, so load fluctuations are very less. These are loaded fully during 24 hours a day, so Cu losses and Fe losses takes place thought day the specific weight is very less.

3.2.3: Distribution Transformer

The distribution transformer is use for the distribution of electrical energy at low voltage as less than 33 KV in industrial purpose and 440 volt-220V in domestic purpose. It works at low efficiency at 50-70%, small size, easy in installation having low magnetic losses and it is not always fully loaded.

3.3: Conditions for Parallel Operation of Transformer

When two or more transformers run in parallel, they must satisfy the following conditions for satisfactory performance.

3.3.1: Voltage Ratio or Turns Ratio

If the transformer connected in parallel have voltage ratio different than this will not good condition for system. Due to the different voltage ratio induced EMF generated at the secondary side will be different. Which cause circulating current flows in the loop which are formed by the secondary windings under no-load condition .The value of this circulating current is much higher than no load current. So chances of damage the winding of transformer. Circulating current cause the losses and damage the insulation of the winding. So the voltage ratio should be proper manner to achieve better parallel operation of transformer.

3.3.2: Same Polarity

Polarity of all transformers that run in parallel should be the same otherwise huge circulating current that flows in the transformer but no load will be fed from these transformers. Polarity of transformer means the direction of induced EMF in secondary. If the directions of induced secondary EMF in two transformers are opposite to each other when same input power is fed to both of the transformers, the transformers are said to be in opposite polarity. If the directions of induced secondary EMF in two transformers are same when same input power is fed to the both of the transformers, the transformers are said to be in same polarity.

3.3.3: Same Phase Sequence

The voltage between two phases is called line voltages. In this case the phase sequence of line voltages of main transformer and auxiliary transformer which are connected parallel with main transformer must be identical for parallel operation in case of three-phase transformers. If the phase sequence is not same, in every cycle each pair of phases will get short-circuited.

3.3.4: Same Impedance Ratio

We know the relation of current with impedance. Current is inversely proportional to the impedance. If we

consider two transformers which has different per unit impedance. One transformer have less impedance will draw more current and which has more per unit impedance will draw less current. This leads unequal load sharing. This is not beneficial. Due to this condition, the transformers will not share the load according to their kVA ratings. In that case, it can be corrected by inserting proper amount of resistance or reactance or both in series with either primary or secondary circuits of the transformers where the impedance is below the value required to fulfill this condition.

4. CONCLUSION

It is reasoned that on the off chance that heap on one transformer is expands, at that point the transfer will detect the adjustment in current and microcontroller works and slave transformers comes consequently in activity to share the heap. For working three transformers in corresponding to share the heap consequently with the assistance of progress over transfer and hand-off driver circuit and furthermore to shield the transformers from over-burdening and accordingly giving a continuous force flexibly to the clients.

REFERENCES

1. B. Singh, S. S. Murthy and S. Gupta, “Analysis and implementation of an electronics load controller for a self excited induce”,IEE Proc.-Gener. Transm.Distrib, Vol. 151, No. 1, January2004.

2. Has-san Monsef, PouryaSahmsi, “Effective On-line Parameters for Transformer Monitoring and Protection on Northern American Power Symposium (NAPS), pp 1-5, Sep2010, Volume: 04 Issue: 05 | May-2017.

3. J. Liang, T. C. Green, G. Weiss, and Q. C. Zhong, “Evaluation of repetitive control for power quality improvement of distributed generatio”, in Proc. 2002 IEEE Power Electronics Specialists Conference, Cairns, Qld., Australia, vol. 4, pp. 1803- 1808, June2002.

4. Laknapuram Sai Vani. Assistant professor, Dept.of EEE LIMAT, Andhra Pradesh “Distribution and load sharing of Transformer Automatically by Using Microcontroller”, International Research journal of Engineering and technology volume 04 Issue: 05 may-2017.

5. PiotrBiczel, AndrzejJasiński and JacekLachecki ,“Power Electronics Devices in modern power systems’’, IEEE Euro on 2007, Warsaw, Poland, September 9-12, 2007.

6. SenOuyang and Jianhua Wang, “A new morphology method for enhancing power quality monitoring system”, International Journal of Electrical Power & Energy Systems Vol. 29, No. 2, pp. 121-128, February2007.

7. S.M Bashi, N. Mariun and A.rafa (2007) ,“Power Transformer protection using microcontroller based relay”, Journal of applied science, 7(12), pp.1602-1607. Volume: 0Issue: 05 | May-2017.

8. Xiaoyang, Wu Guanging, Zhang Guangehun, Tan Yong-dong ,“A Transformer Online Monitoring and Diagnosis Em-bedded System Based on TCP/IP and Pub/Sub New Technology on Properties and Applications of Dielectric Materials”, vol1, pp467-470,June2003. Volume: 04 Issue: 05 | May-2017.