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Active Demand Response using Shared Energy Storage

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ABSTRACT

The transformer is very costly and bulky equipment of power system. It operates for 24 hours of a day and feeds the load. Sometimes the situation may occur when the load on the transformer is suddenly increased above its own rated capacity. When this situation occurs, the transformer will be overloaded and overheated and damage the insulation of transformer resulting in interruption of supply. The best solution to avoid the overloading is to operate the number of transformers in parallel. It is same like parallel operation of transformers where the number of transformers shares the system load. In the suggested approach second transformer will share the load when the load on the first transformer will rise above its rated capacity. The main aim of the work is to provide an un-interrupted power supply to the energy consumers. By implementation of this scheme the problem of interruption of supply due to transformer overloading or overheating can be avoided.

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I. INTRODUCTION

Transformer is the very important component in the electric power transmission and distribution system. The overload problems, voltage variation and effects of heating in transformer is very common. It takes very much of time to its repair and also involves lot of expenditure. This work is done for protecting the transformer under overload condition. Overload effect causes the efficiency gets reduced and also the secondary winding gets overheated or sometimes it may be burnt winding. So, if the reducing the extra load, the transformer can be protected. So for protecting purpose another transformer is connected in parallel with the main transformer with the help of comparator and change over relay. The comparator compares the reference value and load on the first transformer. When the load exceeds above the reference value, then comparator works and then the second transformer will automatically be connected in parallel with first transformer and the second transformer share the extra load. Therefore, two transformers work efficiently under overload condition and the damage can be prevented. For various home applications, and most of commercial and industrial loads, the transmitted voltage must be steeped down to a distribution level. This may happen in phases. In sub-stations the voltage gets stepped down from transmission level (range 10-1000 volt) to the distribution level (typically less than 10,000 volts). in this operation, a secondary transformer shares the load of main transformer in the case of over load and over temperature also in overheating. A sensor circuit is designed to log the data from master transformer and if it is found to be in overload condition, immediately the secondary transformer will be connected in the parallel to the main transformer and the load is shared. Initially when switched ON the load that load will be shared by the first (main) transformer. When load has been increased on first transformer above its rated capacity then the secondary transformer (sharing) will share the load automatically. Here, for this work we used regulated 12V, 500mA power supply, and 7805 voltage regulator is used for voltage regulation. Full wave bridge rectifier is used to rectify the AC output of secondary of 230/12V step-down transformer. The concept of automatic load sharing of transformer or overload protection of transformer is done by various means like by using microprocessors, by using two transformer main and

sharing, by using GSM technology, by using voltage and current sensor, by using LCD dimply and by using relay's. Here In this operation we are used a relay and comparator IC's for automatic load sharing between main and sharing transformers. The number of transformers like 2 or 3 or 4 transformer to be operated in parallel can also be increased according to demand of a particular area. While for the number of transformers operated in parallel we must follow some conditions like same voltage ratio, same X/R ratio, same current ratio, same KVA ratings, same polarity etc.

II. LITERATURE SURVEY

1. Active Demand Response Using Shared Energy Storage for Household Energy Management
Zhimin Wang, ChenghongGu, Furong Li, Senior Member, IEEE, Philip Bale, and Hongbin Sun, Senior Member, IEEE

In a deregulated market, wholesale energy costs and distribution investment costs contribute significantly to consumers'electricity bills. However, in a low carbon electrical power system, the two cost pressure points may not be synchronous in time and space with each other. This paper develops a novel methodology for home area energy management as a key vehicle for demand response, using electricity storage devices. The aim is to enable energy storage at consumer premises to not only take advantage of lower wholesale energy prices, but also to support low voltage (LV) distribution networks for reducing network investment.

2. Microcontroller Based Automatic Load Sharing Of Transformer
Narute Nitin Hanumant, Jadhav Sanjay Balbhim, Garad Yogesh Dattatray and Shinde Krishna Narayan

In this project "AUTOMATIC LOAD SHARING OF TRANSFORMERS" we are using two transformers, one is main transformer (TF1) and the next is backup transformer (TF2). Here the load is directly connected to the secondary of the main transformer as well as backup transformer; here two transformers are connected through the relay. The transfers switch senses when utility power is interrupted, and starts up the transformer TF2 which acts as a backup transformer. If the utility power remains absent, the transfer switch disconnects the load from the utility and connects it to the Transformer TF2, restoring electricity to the load.

3. GSM Based Automatic Substation Load Shedding And Sharing Using Programmable Switching Control S.R.Balan, P.Sivanesan1, ananthakannan92@gmail.Com

Aim of This Project Is Designed to Control substation load shedding and sharing using a programmable switching control by automatically. In this project we demonstrate the working of this simple operation using a Microcontroller. The development of this application requires the configuration of the program through GSM module. In substation, there are many tasks like certain loads need to be switched on/off in specific time intervals. In this, the loads can be operated in three modes: Set mode, Auto mode and Manual mode.

III. PROPOSED SYSTEM

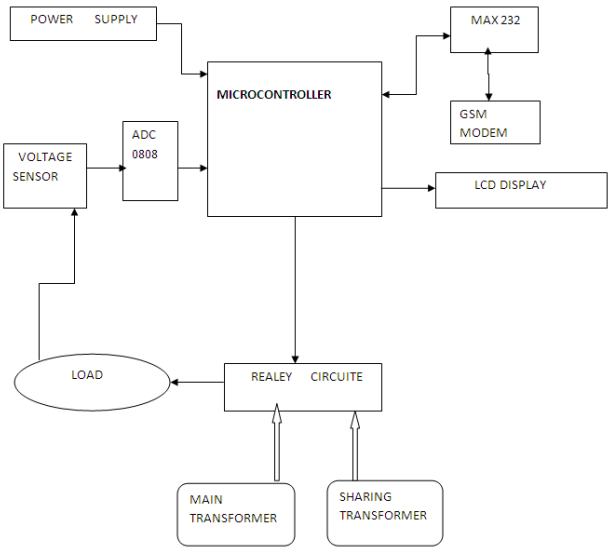

Fig. 1.Block diagram of Load Sharing of Transformer

TRANSFORMER-
Transformer is used for distributing power up to certain region. That should be constantly distributing power up to certain extent of applying load on it. But whenever, the load will exceed the limit the transformer will be fails in transferring of main supply to the load.
In this project, we are using two transformers instead of one transformer. Whenever applying the more loads on main supply (transformer) exceeding the particular limit then it will not broke down but the excess load must be shared by another transformer. Therefore, no failure of transformers will occurs.

RELEY-
here two transformers use for sharing of power when exceeding the loads. These two transformers are connected with the relay which is controlled by the micro-controller. With the help of the micro-controller controlling this sharing of power by using of relay. The relays will trips to another transformer upon exceeding the limit of load.

ADC-
The ADC is an analog to digital converter which converts the analog current value to the digital value. This information is passed to the micro-controller and then the micro-controller checks the instruction and send it to the GSM.

LCD DISPLY-
When micro-controller check instruction and forward to GSM and the GSM modem immediately send SMS to the mobiles and this will be displayed as load status on the LCD display.
POWER SUPPLY-here we use 7805 regulated power supply.

APPLICATIONS:

- Industrial areas
- Used in substation
- Shopping malls
- This system can be implemented in industries.

ADVANTAGES:

a) This project can be operated anywhere in the world and also small as well as large applications.
b) Feedback of the devices being operated is present.
c) Low cost design.
d) power consumption is low & Real time monitoring
e) Device is efficiently works.

This system can be used to monitoring and controlling the home application.

Electrical substation

IV.CONCLUSION

Project is mainly used to operate the devices like fans, lights, motors etc. a GSM based mobile phone. The system has a micro-controller, LCD display, GSM modem, temperature, voltage sensors and the devices to be operated through the Relay which are connected to the micro controller and trip the circuit. The micro controller is programmed in such a way that if a particular fixed format of SMS is sent to GSM modem from mobile phone, which is fed as input to the micro controller which operates the particular devices. A return feedback message will be sent to the mobile from GSM modem. The temperature at the place where devices are being operated can be known. In future this project use in several applications by adding additional components to this project like in solar system, wind system etc. This project can be extended by using GPRS technology, which helps in sending the monitored and controlled data to any place in the world. The temperature controlling systems like coolant can also use in places where temperature level should be maintained. By connecting wireless camera in industries, etc. it can be see the entire equipment's from personal computer only by using GPRS and GPS technology.

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[3]. GSM Based Automatic Substation Load Shedding AndSharing Using Programmable Switching Control S.R.Balan,P.Sivanesan1,R.Ramprakash2,vB.Ananthakannan 3, K.Mithin Subash4 Kit ,Ananthakannan92@Gmail.Com

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