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Transformer Automatic Load Sharing With Current Sharing and Sms Support

Mr. Kharat Sushant Baban, Mr. Landage Pavan Shivaji, Mr.Salunke Rohit Kalyan, Mr. Kale SagarPopat

Under the guidance of*Prof. K. N. Kazi*

Student, Department Of Electrical Engineering, S. B. Patil College Of Engineering Indapur,Asst, Prof, Department Of Electrical Engineering Indapur, S. B. Patil College Of Engineering Indapur.

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ABSTRACT- The development of any country depends upon a large extent on availability and usage of electricity. In normal we used to control the industrial equipment by manual operation. It is overcome by a new mode of communication which is used to control all those equipment through load sharing mechanism by a single message from anywhere. The main aim of this project is to protect the failing or damage of transformers having applied more load on it to share these with another backup supply using GSM technology. The purpose of this project is to provide a secured environment for the transformers from overloads which are distributing power to certain regions by sharing these overloads with another parallel supply.

I. INTRODUCTION

Transformer is a static device which converts energy at one voltage level to another voltage level. It is an electrically isolated inductively coupled device which changes voltage level without change in frequency. Transformer transfers ac voltage from one electrical circuit to another by the principle of mutual induction. Distribution transformers are one of the most important equipment in power system and are also known as the heart of the power system. The reliable operation of a power system depends upon the effective functioning of the distribution transformer. Therefore monitoring and controlling of key parameters like voltage and current are necessary for evaluating the performance of the distribution transformer. Thus it helps in avoiding or reducing the disruption due to the sudden unexpected failure. Transformers being one of the most significant equipment in 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 at the 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.

To eliminate the damaging of transformers due to overloading from consumer end, it involves the control against over current tripping of distribution transformer. Rise in operating temperature of the transformer due to overloading has an influence on ageing of transformers. The accelerated aging is one of the main consequences of overloading power transformers. Thus load limitations must be implemented to operate the transformers within safe limits. Moreover on overloading the transformers voltage regulation may increase and power factor drops. The project is all about protecting the transformer under overload condition. This can be done by connecting another transformer in parallel through a microcontroller and a relay which shares the excess load of the first transformer. The transformers are switched alternatively to avoid thermal overloading. Therefore, two transformers work efficiently under overload condition and damage can be prevented. If there is a further increase in load beyond the capacity of two transformers there will be a priority based load shedding of consumers which will provide un-interrupted power supply for the hospitals, industries etc.

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II. OBJECTIVES

- The main aim of the project is transformer sharing whenever load is increased for certain value and also sending this change in information to the respective authority via SMS by using GSM modem.
- Load sharing provides sufficient protection to distribution transformer under overloaded conditions. Due to overload on transformer, the efficiency drops and windings get overheated and may burn. By sharing a load current on transformer for each phase the transformer was protected. Therefore, the objective of this study was to protect transformers from overloaded conditions by sharingthe load.
- The objective of this project is to protect the domestic supply and power transformer from over load power.
- The main aim of the project is to protect the transformer under overload condition by sharing load with a standby transformer and to provide un-interrupted power supply to the consumers. The GSM sends messages to the concerned authority whenever the load is shared between the parallel transformers.

III. BLOCK DIAGRAM

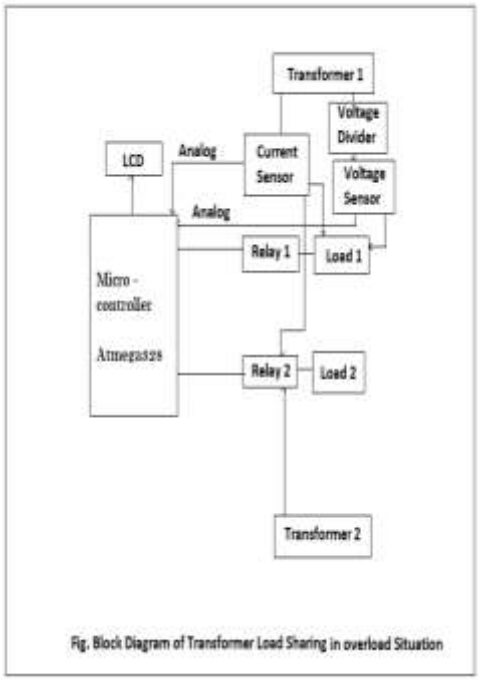


Fig. Block Diagram of Transformer Load Sharing in overload Situation

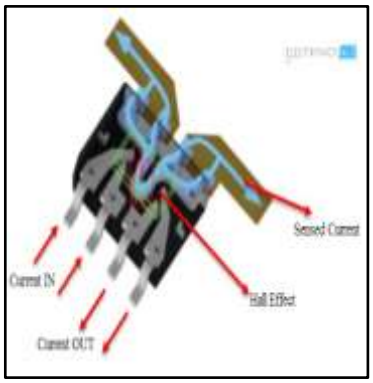
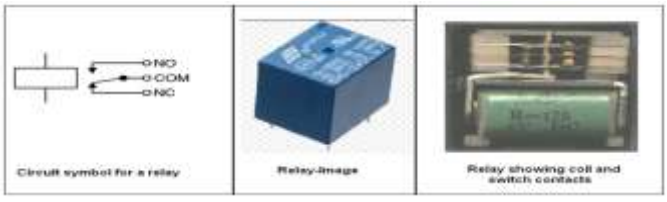


Figure shows the block diagram of automatic load sharing of transformers with current sensing and SMS support. The various components in the system are described below. In the block diagram circuit breakers are used to make and break the connections to the transformers. A relay is used to send a tripping signal to the circuit breakers and they are energized on receiving a signal from the microcontroller. The current transformer is used for measurement purpose.

Relay

A relay is an **electrically operated switch**. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are **double throw** (**changeover**) switches.



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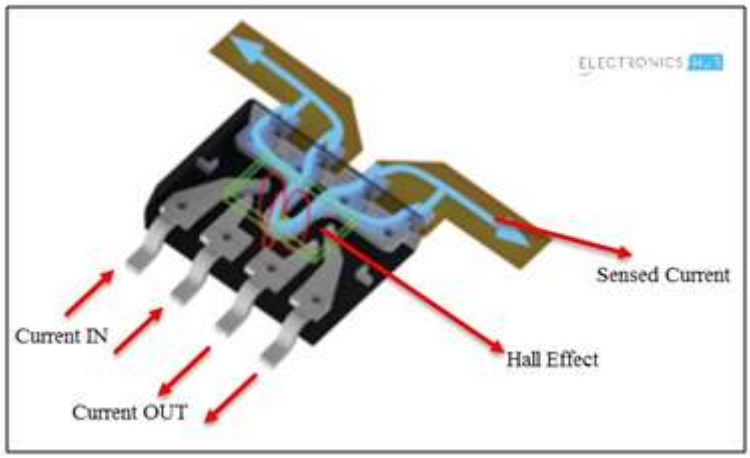
Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits the link is magnetic and mechanical.

The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) cannot provide this current and atransistor is usually used to amplify the small IC current to the larger value required for the relay coil. The maximum output current for the popular 555timer IC is 200mA so these devices can supply relay coils directly Without specificationsRelays are usually SPDT or DPDT but they can have many more sets of switch contacts, for example relays with 4 sets of changeover contacts are readily available.

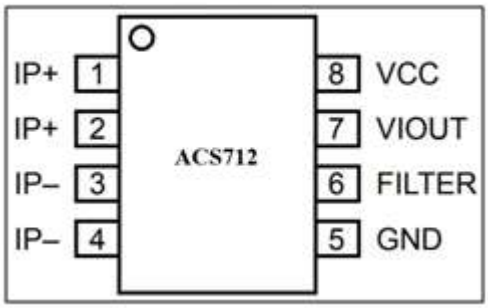
Current Sensors

Low-noise analog signal path

- Device bandwidth is set via the new FILTER pin
- 5µs output rise time in response to step input current
- 80 kHz bandwidth
- Total output error 1.5% at TA = 25°C
- Small footprint, low-profile SOIC8 package
- 1.2mΩ internal conductor resistance
- 2.1 k VRMS minimum isolation voltage from pins 1-4 to pins 5-8
- 5.0 V, single supply operation
- 66 to 185 mV/A output sensitivity
- Output voltage proportional to AC or DC currents
- Factory-trimmed for accuracy
- Extermly stable output offset voltage
- Nearly zero magnetic hysteresis
- Ratio metric output from supply voltage



IC is available in an 8-lead SOIC package and the following image shows its pin diagram.



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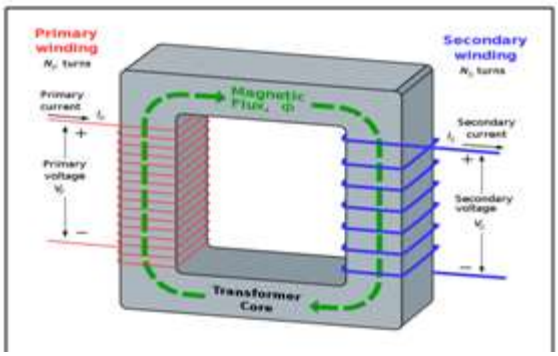
Transformer

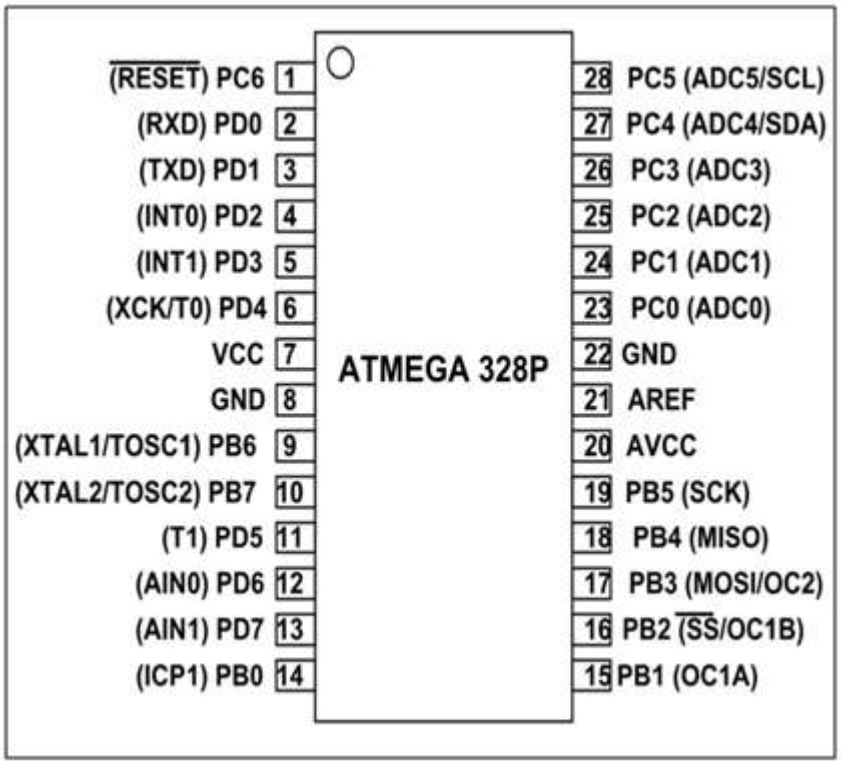


A transformer is an electrical device that transfers electrical energy between two or more circuits through electromagnetic induction Transformers convert AC voltage from one level to another level with a little loss of power. A transformer operates on the principals of "electromagnetic induction", in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

The transformer is a static device, which converts power from one level to another level. 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.

Micro-controller

The microcontroller is used to compare the load current with reference value. Atmega328 is the controller used for this purpose and it also provides a provision for GSM module and in built ADC.



GSM Modem

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. Here the purpose of GSM modem is to send the monitoring parameters values and faults of transformer to authorized person's number in control room. It is a class of wireless modem

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devices that is designed for communication of a computer with the GSM and GPRS network. It requires a SIM card to send the message.

- SIM900 is designed with a very powerful single-chip processor integrating AMR926EJ-S core
- Quad - band GSM/GPRS module with a size of 24mmx24mmx3mm
- SMT type suit for customer application
- An embedded Powerful TCP/IP protocol stackBased upon mature and field-proven platform, backed up by our support
- service, from definition to design and production

LCD Display

LCD modules are very commonly used in most embedded projects, the reason being its cheap price, availability and programmer friendly. Most of us would have come across these displays in our day to day life, either at PCO's or calculators. The appearance and the pin outs have already been visualized above now let us get a bit technical.

16×2 LCD is named so because; it has 16 Columns and 2 Rows. There are a lot of combinations available like, 8×1, 8×2, 10×2, 16×1, etc. but the most used one is the 16×2 LCD. So, it will have (16×2=32) 32 characters in total and each character will be made of 5×8 Pixel Dots. A Single character with all its Pixels is shown in the below picture.

PCB

PCB means printed circuit board PCB is one of the most important elements in any electronic system. They accomplish the interconnection the between component mounted on them in particular manner PCB consist of conductive circuit pattern which is applied to one or both sided of an insulating base copper is most widely used for conductor material. Aluminum nickel, silver, brass is used for same special application.

The thickness of conducting material depends upon the current carrying capacity of circuit. Thus a thicker conductor layer will have mare current carrying capacity once the PCB is manufactured the current carrying capacity is depends on which of conductor track.

Circuit Diagram

The circuit diagram consists of two transformers of which only one transformer is working under normal load condition. Each transformer is connected with a relay and the loads are connected to the secondary coil of the transformer. 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 get 12V and 5V DC from the 230V mains by a full wave bridge rectifier. A 7805 regulator ensures a regulated 5V supply to the LCD and controller. Here five inductive loads are connected to the transformer each provided with an individual relay. A current transformer continuously measures the load current of the transformer and feeds to the controller. The current transformer is connected to a zener diode in order to measure quick response. Under normal working condition relay 1 is latched and supply passes to the load through a manual switch and a relay contact. Normally the relay will be latched initially and on receiving a low signal from microcontroller the relay will be de-energized and becomes open thus interrupting the supply. The controller is programmed in such a way to send a low signal to relay when the transformers are overloaded. Thus the load cannot be operated even if the manual switch is closed. At the same time the GSM sends a message to the control room about the transformer operation. Here as the fifth load is switched on both the transformers are overloaded and in order to maintain the supply priority based load shedding is also included Whenever the load decreases and reaches a normal level, transformers are switched alternatively to avoid thermal overloading. The main advantage of this type of switching is that, it allows the transformer to cool by natural methods thus increasing its lifespan.

Connections

The controller used is ATmega328 which is 8 bit controller and has 20 I/O pins of which there are 14 digital I/O pins and 6 analog pins. The keypad is configured as rows and columns of which either row or column is set as input. Thus the controller reads the value by matrix arrangement. Crystal oscillator is connected to pin no. 9 and 10 of the controller which generates clock signals. Digital pins PD0 to PD7 are configured as output and all the output devices like LCD and GSM are interfaced to this port. The row pins of the keypad and the relay is connected to the port B while the column pins of keypad and CT is connected to port C of the controller. All the loads are connected to the port B through a relay which is supplied with a 12V supply. Relay contacts are shown named as RLY 1, RLY 2, and RLY 3. Of these two relay

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contacts corresponds to two transformers and the third relay corresponds to priority based load shedding. A crystal oscillator is used to generate clock signals to the controller. It is also possible to use internal oscillator of the controller unless the ADC pins are used. A CT is connected to ADC pin 5 of the controller and a variable resistor is used to vary the value of CT. A GSM is connected to digital pins 0 and 1for communication purpose. In order to view the message displayed by GSM, a virtual terminal is used. A 4x3 keypad is used to set the maximum load limit and the LCD gives a visual indication of CT value and maximum load limit. For LCD display four bits of address lines are connected to the controller. RESET pin is connected to the power supply so that the controller works continuously. The controller can be reset by applying a logical low signal to RESET pin. Relays are connected with transistors which act as switches. Whenever a high signal is applied to the base of the transistor, the transistor act as a closed switch and energizes the coil of the relay which in turn latches the relay contactors. A freewheeling diode or a flywheel diode is connected across the relay coil to protect the collector terminal of transistor from the back EMF of the relay coil.

IV. FUTURE SCOPE

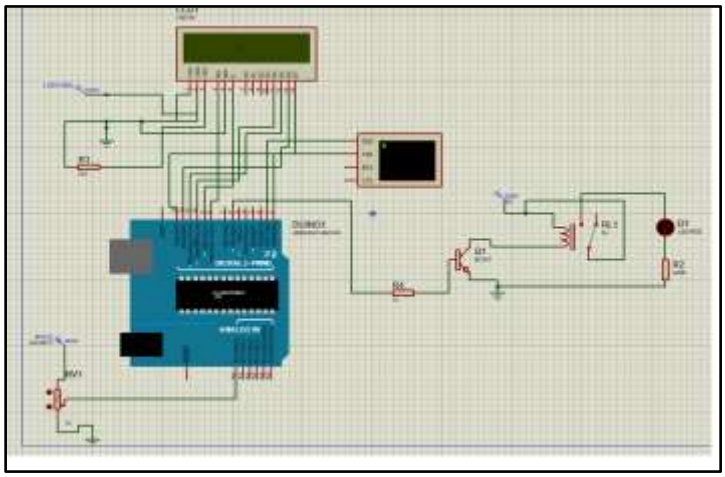
- GSM-(Global system for mobile communication)

-GSM is globally accepted standard for digital cellular communication
- Frequency range 900MHZ to 1990 MHZ.
-PIC micro-controller sends actual load value to the authority via SMS by using GSM
- In our project we are using only transmitter to transmit the data
-In our project we are not yet get the required frequency GSM.

V. RESULT

Normally electrical power transformer gives the supremeefficiency at full capacity. If we run numbers of transformers in parallel, we can swap on only those transformers which will give the total demand by running nearer to its full capacity rating for that time.

When load boost we can switch no one by one other transformer connected in parallel to accomplish the total exaction. In this way we can run the system with maximum efficiency.



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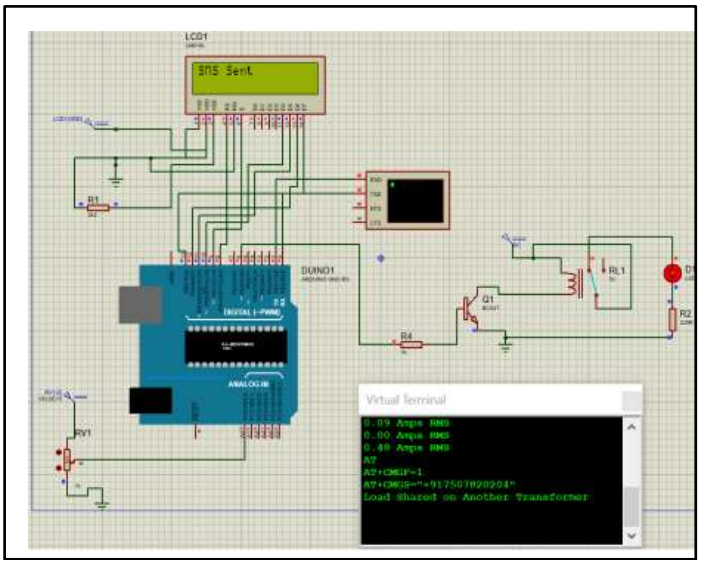

VI. CONCLUSION

After the implementation of the design, various tests were carried out and achieved its design and construction purpose. The system worked according to specification by monitoring overloads and over-current. With this project we can avoid the breakage or failure of transformers from overloads by converting these overloads to other section of transformer. So, that transformer can constantly distribute power to the required regions here by changing over to the active energy supply. This automatic electronic system operates without human intervention hence the sluggishness of manual operation is eliminated and demand will be completed without interruptionandbreakage.

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