



Grid Frequency based 210MW generator load control by using PIC Microcontroller

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I. ABSTRACT

In this project, for demonstration purpose we will store system power on readings of voltage and current across the load along with the real time clock. We have proposed to use the microcontroller, external memory and ADC for the respective data acquisition of load voltage and load current.

II. INTRODUCTION

The Grid frequency controller is the tool (or) concept with which MSEB can control the power supplied to the customers. As the demand of electricity increases; at the generating stations there will be increase in the load and hence the decrease in the generating frequency can occur. To maintain the frequency in the decided range i.e. 49 to 51 Hz lot of additional resources like coil, water etc. are being used currently. If this gone out of control then MSEB will switch off the supply to the Grid and thus the Load Shedding for common man occurs. That means that as the load increases MSEB will shut the supply in the grid off and thereby for that grid no one will able to have the electricity until the load demand reaches to its nominal value. By the

time in generating stations the generation of electricity will not stop and it is only wastage. To avoid this lot of work is going on .Our present concept is a part of that. Its approach is at individuals instead of some particular area.

III. BLOCK DIAGRAM

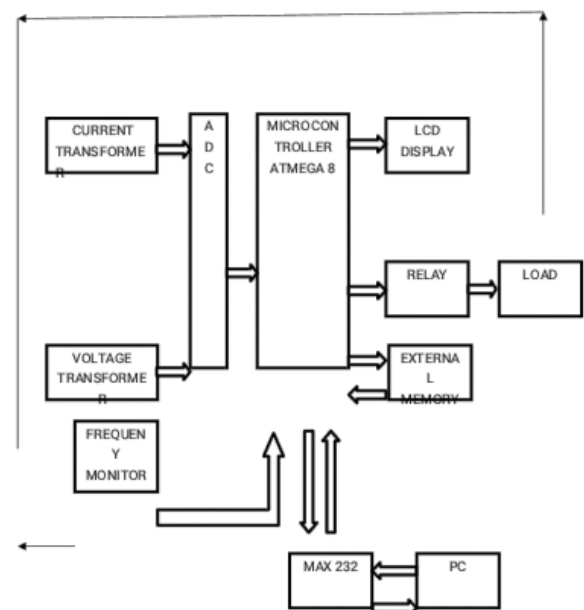


Fig.1: Block diagram

As the load demand changes inversely supply frequency can be changed. In the block diagram there are different types of equipments are connected each other.

From the load, there are three parameters taken. Which are namely as voltage, current & frequency. Those parameters should be in limit. The voltage & current are applied to the ADC for analog to digital conversion purpose. And frequency applied to comparator through microcontroller.

Therefore current transformer provides current rating & potential transformer voltage rating in the analog form to the ADC. After that, digital signal is applied to different ports of the microcontroller as per the limit of frequency; the microcontroller executed the control action to the relay. For switch OFF and switch ON the load.

If the frequency is in limit, then only load switch ON continuously. Otherwise it will cut off & which is known as load shedding from the supply side. In the Grid Frequency Controller, there are three readings taken out. Which are at the time of starting, during fault and restored. Those readings are stored in external memory. When the upload key is pressed at that time with help of MAX 232 with the TTL compatibility, reading can be display on PC. All the data can be serially transmitted over the PC by using the RS232 cable with help of DB9 connector. For monitoring purpose, the LCD display is used. This shows the current, voltage, time, frequency at the different instants. The LCD can be programmed for that indication. For the reliable operation of the circuit there are no. of capacitor, diodes are used.

IV. CIRCUIT DIAGRAM

Now days because of load increasing for some particular area, the total load demand can be increasing on generating side. This situation can be occurring due to the load increasing due to the individual consumer. That will affect the total load

demand. Therefore load shedding can be occurring. These difficulties can be overcome, by individual load shedding method. Because of that, the Frequency can be controlled by Grid Frequency controller by using microcontroller.

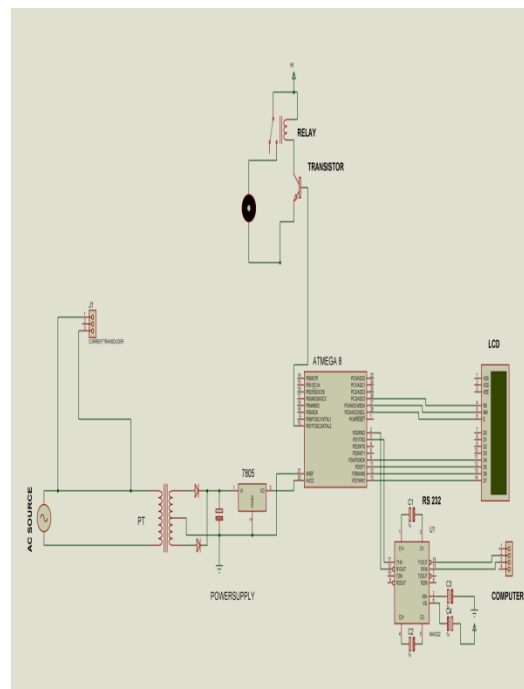


Fig.2: Circuit diagram

This is the effective frequency control method. In the grid frequency controller frequency can be controlled with the help of microcontroller. There are number of equipments use in this control method.

This is one of the important control actions in the powersystem. There are four main section of grid frequency controller using microcontroller.

- a) Input section
- b) Converter section
- c) Control section
- d) Output section

A. INPUT SECTION

In input section, the supply can be given to the circuit. We are giving the AC voltage at the input side. At that point we are connected the step down transformer, which gives the 12 V ac output. This voltage is applied across the full wave bridge rectifier. Which convert the ac voltage to dc voltage.

The second input is current transformer. That step down current can be converted into voltage signal. The third one is frequency, which is load frequency. This frequency can be given to the comparator (LM 211) for zero crossing detectors and for ripple free operation.

B. CONVERTER SECTION

In converter section, analog to digital converter (ADC 0808) is used. This is having 28 pins. In which 11, 13 pins is used for VCC and ground purposes and the analog input is connected. The output of input section of voltage signal is connected to IN0 & IN1. There are 7 pins for input. We are using only two pins hence other pins are kept open. For channel selection there are 3 pins available in ADC ie. A0, A1, A2. These pins are connected to reference, port 3.2/INT1 & port 3.4/T0 respectively. The output of the ADC is in digital form which is connected to the microcontroller. This only reads digital signal.

C. CONTROL SECTION

In the control section, with the help of microcontroller, the control action executed through relay. The timer & memory also use for control section. A microcontroller having 40 pins in control circuit, microcontroller 89V51 is used. This is from 8051 family. This has various features for controlling point of view. The microcontroller having 4 ports, in which port 2 is use for input, this input is output of the ADC. The port 0 is used for the output of microcontroller. And port 3 is use for

various functions for e.g. Interrupt, Timer, Transmit, Receive, Read & Write etc. The XTAL1 & XTAL2 points are used for crystal oscillator purpose. The main operation the microcontroller is to monitor & control. The program can be downloaded in the microcontroller for different purposes like control operation. In this program, the frequency limit is 47 to 53 Hz is installed. As the load frequency crosses this limit, then load shut down from the supply. This is individual load shedding.

As the load frequency crosses this limit, microcontroller sends the control action to the relay. Relay gets the control signal in 0&1 form. For that purpose sugar cube relay utilized. In which transistor act as switch. When microcontroller sends the signal to the base, that time because of VCC controller side is always high. Therefore there is no potential difference & coil cannot energize. Because of that load is kept in operated with supply side. When there is 1 at the base reverse control action take place & coil energized.

The load will be open. The external memory is used to store the reading of current, voltage & frequency at the different time. There are starting, during fault & after restored the supply like three reading are stored in memory

The real time clock is used to show the actual time for the continuous operation of time even the kit is off for that battery arrangement is used. This is continuously supply to timer. This all come in controlling action.

D. OUTPUT SECTION

The output monitoring is by using the LCD. When upload key is press, after that by using DB9 port we can see the all the readings on the PC for monitoring purpose LCD (16*2) module used. From the port 2 of microcontroller input is given to the LCD. On the LCD screen, current, voltage, frequency, time can be display. This all function of

LCD done with help of programming. The output can be seen on the PC with the help of upload key.

V. EXISTING SYSTEM

In present situation when there is increase (or) decrease in load which affect the behavior of the generator. The Indian appliances designed to operate at 50 Hz.

If this not maintained they will damage drawing high current. In case of faults or high loads, the following steps take place. Power delivered by the generator increases as the power input is constant (mechanically). The kinetic energy stored in rotor as speed decreases frequency tends to of all. So in order to maintain the frequency, the extra load (or) fault has to be isolated from which under frequency relay are used. They work automatically. When grid frequency falls below the limit, it senses & trip electrical equipments or generator in case of Thermal power station.

VI. PROPOSED SYSTEM

The operation of the relay can be based on the definite time principle, on the rate of frequency change principle, (or) on combination of these two principles. In generation protection application the relay protects the generator & prime mover against hazardous over speeding or under speed. The relay can also be used from the network in the event of fault.

In substation under frequency (or) over frequency relay are installed. When there is any fault i.e. increase (or) decrease in frequency due to the load, the relay senses the fault and trips the circuit immediately and comes to ON position when the frequency comes to normal condition i.e. 50 Hz. During tripping the load shedding of that area is done till it comes to normal condition

VII. ELEMENTS USED

(i) PIC (16F877)

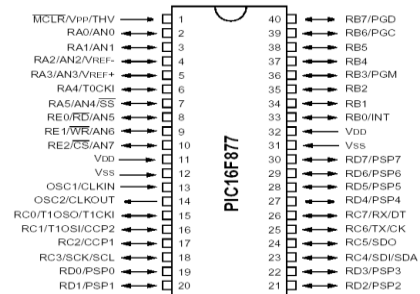


Fig.3: PIC (16F877)

. Various microcontrollers offer different kinds of memories. EEPROM, EPROM, FLASH etc. are some of the memories of which FLASH is the most recently developed Technology that is used in pic16F877 is flash technology, so that data is retained even when the power is switched off. Easy Programming and Erasing are other features of PIC 16F877.

(ii) 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.



Fig.4: Relay

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.

(iii) MAX 232

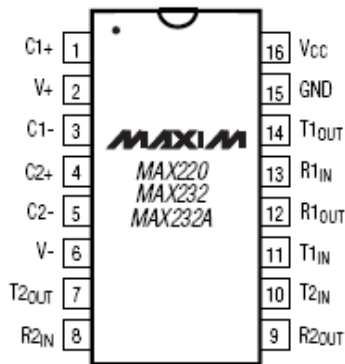


Fig.5 Pin diagram of MAX 232

The MAX220–MAX249 family of line drivers/receivers is intended for all EIA/TIA-232E and V.28/V.24 communications interfaces, particularly applications where ±12V is not available. These parts are especially useful in battery-powered systems, since their low-power shutdown mode reduces power dissipation to less than 5μW.

(iv) LIQUID - CRYSTAL DISPLAY

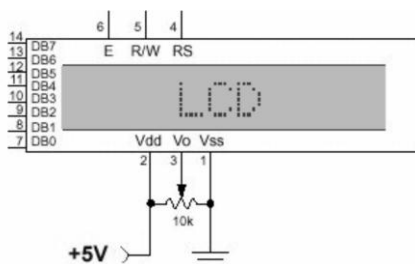


Fig.6 LCD

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical

device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as present words, digits, and 7-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

(v) SOFTWARE

The AVR is a modified Harvard architecture 8-bit RISC single chip microcontroller which was developed by Atmel in 1996.



Fig.7 Code vision AVR

The AVR is a modified Harvard architecture 8-bit RISC single chip microcontroller which was developed by Atmel in 1996. The AVR was one of the first microcontroller families to use on-chip flash memory for program storage, as opposed to one-time programmable ROM, EPROM, or EEPROM used by other microcontrollers at the time.

RESULT

Thus the prototype device that stores system power on readings of voltage and current is successfully created with the real time clock. To achieve this microcontroller, external memory and ADC has been used. Hence this prototype can be

used to monitor and control voltage, current and temperature and displays values throughout the process for user interference. It is secure, reliable and wastage at generation and production side can be avoided.

V.CONCLUSION

In this paper we have presented a design of a system based on microcontroller that is used to monitor and control the voltage, current and temperature. The proposed system which has been designed to monitor the transformer's essential parameters continuously monitors the parameters throughout its operation. If the microcontroller recognizes any increase in the level of voltage, current or temperature values the unit has been made shutdown in order to prevent it from further damages.

The system not only controls the transformer in the substation by shutting it down, but also displays the values throughout the process for user's reference. This claims that the proposed design of the system makes more robust against some key power quality issues which makes the voltage, current or temperature to peak. Hence more secure, reliable and efficient by means of the proposed system.

With the help of this installation in individual area of high load users (end user) we can avoid the conventional way of complete load shading to that area and the individual load shading can be done. This will not harm the rest users as only the user who is having maximum load will be cut for some time from the supply until he minimizes the load on his side and rest will be unaffected. This will avoid wastage at both the generation side and also to production side.

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