MAXIMUM DEMAND CONTROLLER

Ajay Mendhe[1], Ashish Dhurve[2], Amit Jiwane[3], Ayush Siraskar[4], Aman Rangari[5], Ankit Dahake[6]

[1]*HOD, Department Of Electrical Engineering, PJLCOE, Nagpur, Maharashtra, India*

[2]*Student, Department Of Electrical Engineering, PJLCOE, Nagpur, Maharashtra, India*

[3]*Student, Department Of Electrical Engineering, PJLCOE, Nagpur, Maharashtra, India*

[4]*Student, Department Of Electrical Engineering, PJLCOE, Nagpur, Maharashtra, India*

[5]*Student, Department Of Electrical Engineering, PJLCOE, Nagpur, Maharashtra, India*

[6]*Student, Department Of Electrical Engineering, PJLCOE, Nagpur, Maharashtra, India*

ABSTRACT

Electrical energy is a vital for feature of any developing nation. To meet the growing demand, power generating plants of all types are being installed; though the gap between the supply and the demand is continuously increasing, due to the depletion of natural resources, hence, rise in power demand, the way to over come the flaming problem is optimal utilization of available energy sources, limiting the wastage of electrical energy which includes both technical and non technical and limiting the demand during peak hours. In this project, a
methodology is proposed to solve burning problem with load management during peak hours, in case of domestic load saiming to reduce the gap between the demand and the supply, such that both consumer and supplier get benefited simultaneously. The paper also presents the application of load controller and DSM techniques applied to domestic loads, where the power consumption can be limited during the peak hours and reliability of power can be increased by lowering the power cuts. The proposed method developed is the part of
Demand Side Management (DSM).The results are presented to show the effectiveness of the proposed method for load management.

Keyword: *Microcontroller, GSM Modem, Demand Side Management, Tariffs.*

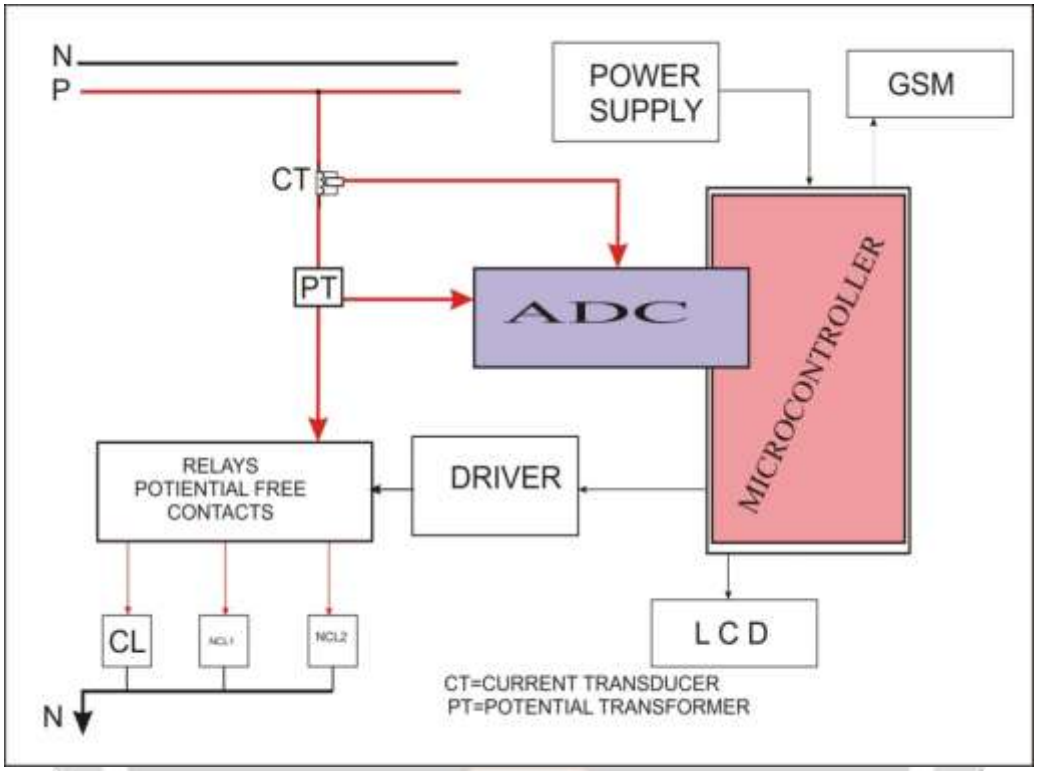
INTRODUCTION

Every electrical system needs power as the supply. Power is rated at which an amount of energy is used to accomplish the work. Electrical power is measured in kilowatts per hour (kWh), which is determined by multiplying voltage by current. In the industry, a higher power consumption than the contracted one can lead to severe penalties. Often there are power peaks produced by loads coincidence that normally do not work in a simultaneously. In order to avoid penalties, one solution would be increasing the contracted power according to the maximum registered peak, but on contrast this will force to pay a higher power than it is really needed. Another solution will be avoiding the consumption peaks through a vigilance element that advice us of the risk situation or it can disconnect certain noncritical loads such as air conditioning, compressors, lighting and fans.

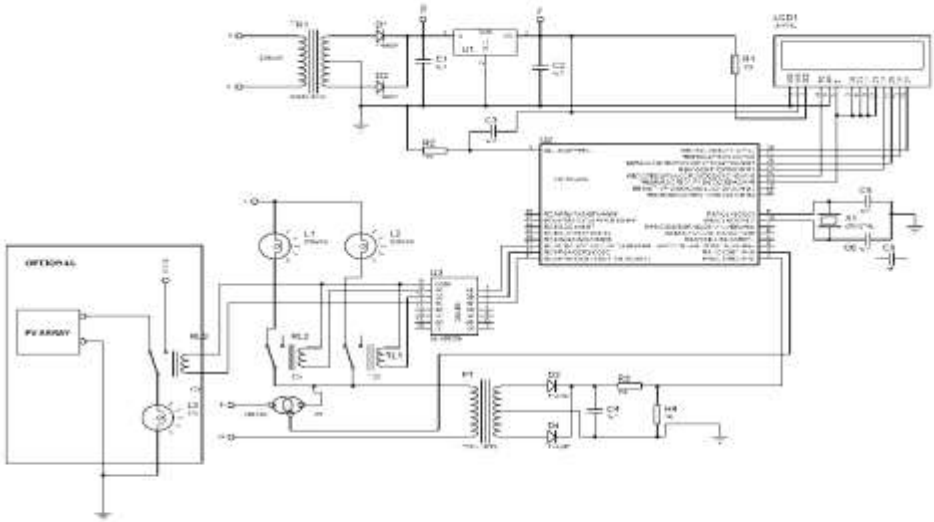
Maximum demand refers to the maximum amount of electrical energy that is being consumed at a given time. It is measured in kilowatts per hours, which is a measurement of total electricity used for a period of time. A 1000 watt electrical load used for one hour consumes one kilowatt per hour (kWh). There are two items used to show the way the maximum demand works which are the Total Time of Measurement (T1) and the Periodic time for integration (tp). These differ from metering company to other or from country to country. Let say that T1= 8 hours and that T1 has been divided into 1 hour intervals. That makes 8 × 1/8= 1 hour intervals or periods of measurement. Then, during every 1 hour, the hardware measures the maximum power utilization and records it. Each time this is measured, for every interval of 1 hour ,thereafter, the maximum power utilization value is record until the 8 hours are elapsed. Then the highest value of all these periods is recorded and displayed. The separate register for 1 hours interval are zeroed and the process repeats. At the end of the 8 hours, the maximum demand register is read and billed then the register is

zeroed to start a new 8 hours billing period. The purpose of controlling the demand is, not to exceed the contracted maximum demand limit. One way to do this is to shed non-critical loads. There are possible loads to be disconnected such as lights, compressors, air conditioners, pumps, fans and extractors, packaging machinery.

BLOCK DIAGRAM



CIRCUIT DIAGRAM



PROPOSED SYSTEM

In the above circuit a step down power transformer is used to convert a 220v AC to 12v AC. As the requirement of all the control circuit is of DCv, hence a rectifier and filter circuit is used which convert a 12v AC to a Pure 12v Dc with the help of diode D1 & D2 with Capacitor C1.
Controller circuit requires a constant 5v for its operation, and available DC voltage is of 12 v hence a regulator IC 7805 is used, which gives a constant 5vdc in its output irrespective of any in volage fluctuation between 6vdc to 28vdc. A capacitor C2 is used as a storage capacitor to protect a complete circuit against a fractional reset due to loading on 5vdc bus in case of all the components in operative modes.
Inside a microcontroller there are various operations are performs and all the executions requires a clock pulse. for generation of clock pulse a crystal oscillator with a suppressor capacitor is used. Suppressor capacitor maintains the 50% duty cycle of a frequency generated by oscillator i.e capacitor c3 and c4 maintains the Ton and Toff time of the clock pulses.

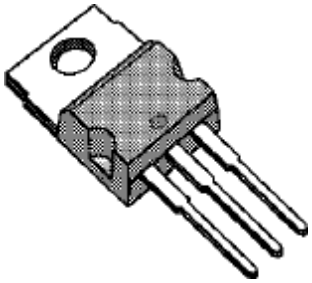
Initially microcontroller requires to reset, because lot of garbage data will reside inside a RAM memory after switching OFF the Power supply, which disturbs the execution start point of microcontroller if we switch ON the power, hence a microcontroller initially needs a reset pulse at its reset pin. Reset pulse means a HIGH to LOW transient of pulse. Generating a HIGH to LOW transient in above circuit with the help of capacitor c3 and r2, which are connected in Differentiating mode. Initially a capacitor is discharged due to which a low resistive path is form to flow a 5v through a capacitor, and the same capacitor is connected in series with the resistance, which help to charge the capacitor, after some time capacitor gets charged and forms a high impedance state between 5v and reset pin which results a Reset pins voltage falls to 0v.
Microcontroller works on constant 5v and it is obvious that it gives a maximum 5v in its output ports. The port capability of a microcontroller is of 5vd and max of 20mAmp only, whereas in above circuit I use a 12v relay to switch ON/OFF the various load. To drive a 12v relay with the help of microcontroller it is necessary to increase the 5v signals coming from a microcontroller to a 12v. For increasing a voltage a driver IC ULN2003 is used. Inside a driver IC there are 7 Darlington Pair of transistors are used as a switch.
CT and PT is used to measure a electrical Current and Voltage across a load to calculate a power. As the output of CT and PT is not constant i.e analog and the analog signals cannot be measured by microcontroller, it is compulsory to convert the analog signals to a digital format and fed to the microcontroller. For conversion of this a ADC(Analog to Digital Converter) is used. ADC of 10 Bit is already available inside the microcontroller.

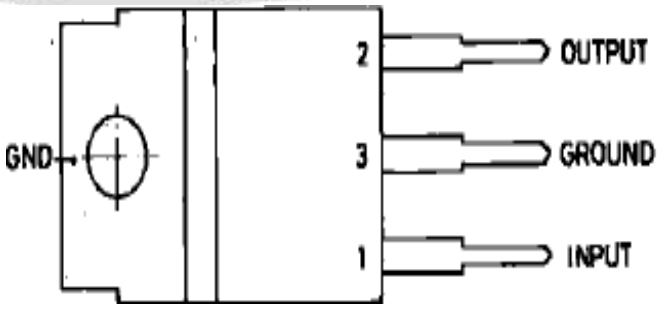
1) The Full Wave Rectifier(12VAC to 12VDC)

A **Full Wave Rectifier** is a circuit, which converts an ac voltage into a pulsating dc voltage using both half cycles of the applied ac voltage. It uses two diodes of which one conducts during one half cycle while the other conducts during the other half cycle of the applied.

2) Voltage Regulator (12VDC to 5VDC)

A **voltage regulator** is designed to automatically maintain a constant voltage level, where they stabilize the DC voltages used by the processor and other elements.



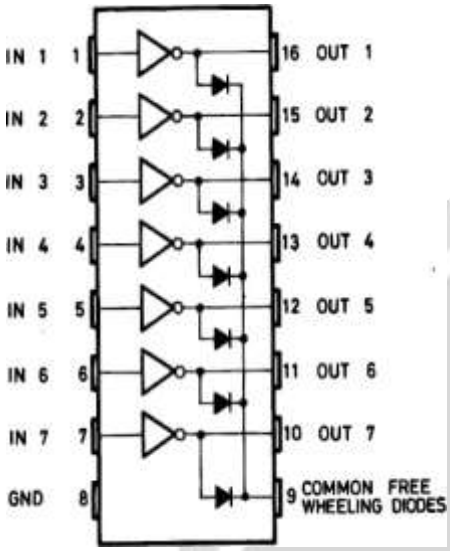


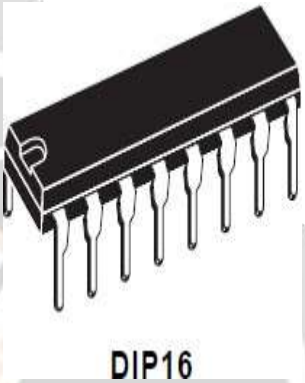
3) ADC

An ADC may also provide an isolated measurement such as an electronic device that converts an input analog voltage or current to a digital number proportional to the magnitude of the voltage or current. Typically the digital output will be a two's complement binary number that is proportional to the input.

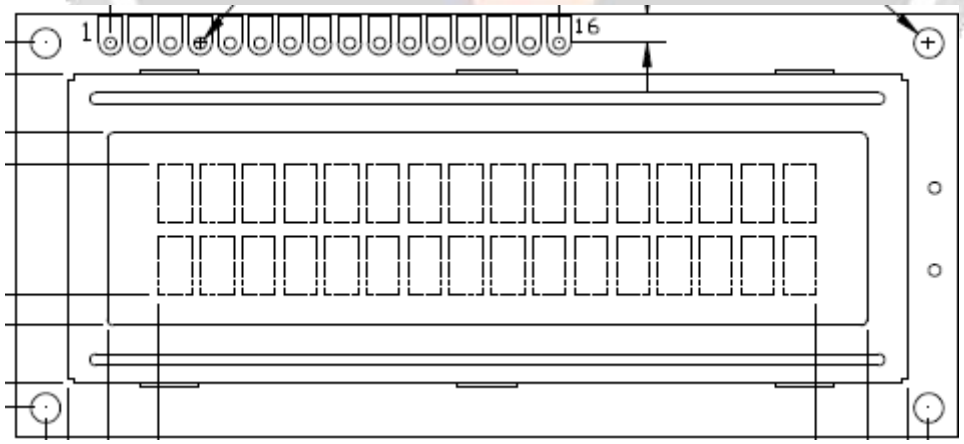
4) DRIVER

A Microcontroller digital logic output pin supplies only 10mA of current. External devices such as high-power relays can require >100mA and they need more voltages. In order to control such devices which use high DC current, a transistor-based driver circuit is used to amplify current to the required levels. If the voltage and current levels are in perfect range, the transistor acts like a high-current switch controlled by the lower current digital logic signal.

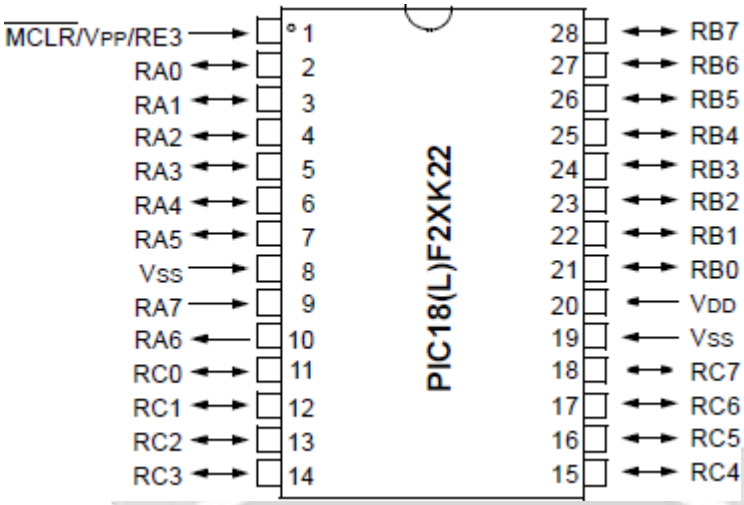




5) LCD :LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications.



6) MICROCONTROLLER:



APPLICATIONS

1. Process Control Industries
2. Main Incomers in Substations
3. Hospitals
4. Hotels
5. Corporate Offices
6. Educational Institutes
7. Small Single phase MD Controllers and be used for domestic purposes also.

ADVANTAGES OF MD CONTROLLER

1. Better Utilization of available Power
2. Avoid Penalty, Disconnection
3. Improved Load Factor
4. True RMS measurement
5. Auto scaling from kVA to MVA
6. Predictive control method adopted to optimize demand control
7. Field programmable CT & PT ratios
8. Demand profile generation for setting realistic demand targets
9. Records peak demands with date & time
10. Time of the day (TOD) facility
11. Integration time selectable : 15/30 minutes (optional)
12. Communication interface to PC (optional)

13. Multi Control outputs for better control
14. The device has no or negligible running costs It is economical to install

APPLICATIONS

- Process Control Industries
- Main Incomers in Substations
- Hospitals
- Hotels
- Corporate Offices
- Educational Institutes
- Small Single phase MD Controllers and be used for domestic purposes also.

FUTURE SCOPE

- Primarily the Controller can be interfaced with the computer and the Maximum Demand can be monitored through the SCADA system itself.
- The Controller can be made foolproof by using GSM technology.

REFERENCES

I. Mehta, V.K. Principles of Power System. New Delhi.: S.Chand & Company Ltd. 2005.

II. Alexender, C., Sadiku, M. Fundamental of Electric Circuit. New York.: McGraw-Hill Companies. Inc. 2009.

III. Maximum demand, http://www.measurlogic.com

IV. C programming, http://www.wordiq.com

V. Electric meter, http://bluestarmeters.com

VI. Electric power, http://brebru.com/

VII. Visual basic, http://www.answers.com

VIII. Demand, http://www.rlshields.com