IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE)
e-ISSN: 2278-1676,p-ISSN: 2320-3331,
PP 18-23
www.iosrjournals.org

Maximum Demand Control using Microcontroller AT89c51

Apurva A. Bhagwat[1], Shraddha A. Bhagwat[2], Priyanka S. Deshmukh[3], Yatin P. Bisne[4], Chandrakant L.Bhattar[5]
Student[1, 2, 3, 4.]
Asst. Professor[5]
[1, 2, 3, 4, 5]*(Electrical, Rajarambapu Institute of Technology, India)*

Abstract: *Energy more specifically electrical energy remains the most vital topic in the current condition of the developing world. In India in order to meet the growing demand of this electrical energy numbers of generating stations are set up across the countries. The improper use of electricity and lack of accessibility is a barrier in bridging the gap between the generation and ever growing demand. Many industrial organisations and various institutions draw a lot of power from the grid but fail to utilise it in an efficient and economical way. Many a times it is a case that this consumer's draw excess of power than there sanctioned demand and end up in paying high penalties to the seller. This paper considers an engineering college and its maximum demand is controlled using AT89c51 microcontroller. A prototype is designed considering the various loads of the college and a priority wise load switching is carried out by the microcontroller in order to maintain the desired maximum demand.*

Keywords: *AT89c51, Automation, Priority-wise load switching, Auto restoration, Maximum Demand control*

I. Introduction

The most flexible, un-substitutable form of energy used in the recent years is an electrical energy. Electrical energy consumption of the country is one of the main parameter to decide the development of country. It has been a critical and essential resource for all nation building activities which will develop the country and improves economy of the country. Due to this the demand of electricity is increasing day by day from domestic, commercial and Industrial sector. In recent times the life in the society has become very luxurious, that is the use of electronic goods and equipment's has increased. This has resulted in the rise of electrical power demand, whereas the production of electricity remains same. It has resulted in a very huge gap between the generation and consumption. To balance the system the conventional method is to cut the loads for long time during the peak hours i.e. load shedding. This leads to inconvenience of the consumers. Only the option left to overcome the burning problem is to use the available electrical power more effectively and efficiently.

The paper utilizes some key terminologies like maximum demand, peak load and connected load. Maximum demand is the greatest demand of the load on the Power station during a given period [3]. The load on the power station is dynamic. Uncontrolled maximum demand can affect the whole power system. There is possibility of unwanted power transmission and unwanted utilization due to uncontrolled maximum demand. Hence, it is important to control maximum demand. It can be control according to the availability of load at specific instance.

The peak load problems overcome by control over the usage of electrical loads during peak hours. This can be done by fixing the priorities to the loads with respect to time. Generally during morning and evening there are peak hours but the priority of loads during this peak hours is different so by keeping low priority load off during peak hours one can remove the burden on the supplier. Generally billing of electricity is done by using two part tariff. This is based on the number of units consumed by the consumer and maximum demand, if the consumer exceeds the maximum demand limit he has to pay penalty for that extra demand. This will increases the cost of electricity. The permanent remedy to pacify the problem partially can be achieved by controlling the usage of non-vital loads during peak hours. Microcontroller AT89c51 is used in order to control the load automatically. The extra manual switching along with the automatic switching may be provided if sometimes the non-vital loads have to be switched on during the peak hours. If the non-vital load is switched on manually during the peak hours, then the load which has more priority than the non-vital switched on load should be switched off to maintain the maximum demand limit.

In demo model, four loads (electric bulbs) are taken out of which the load bank of nine bulbs vary manually. Priority to the four loads is given according to their importance. When the load will increase beyond the set limit the low priority load will turn off automatically in order to maintain the demand in within the limit.

If the load is further increased above the set limit the next priority load will be tripped. No matter what the loading conditions are the highest priority load will remain ON. When the loading conditions are within the limit then the loads which where tripped OFF will auto restore according to reverse priority (first out last in).

II. Model description

2.1 Block diagram

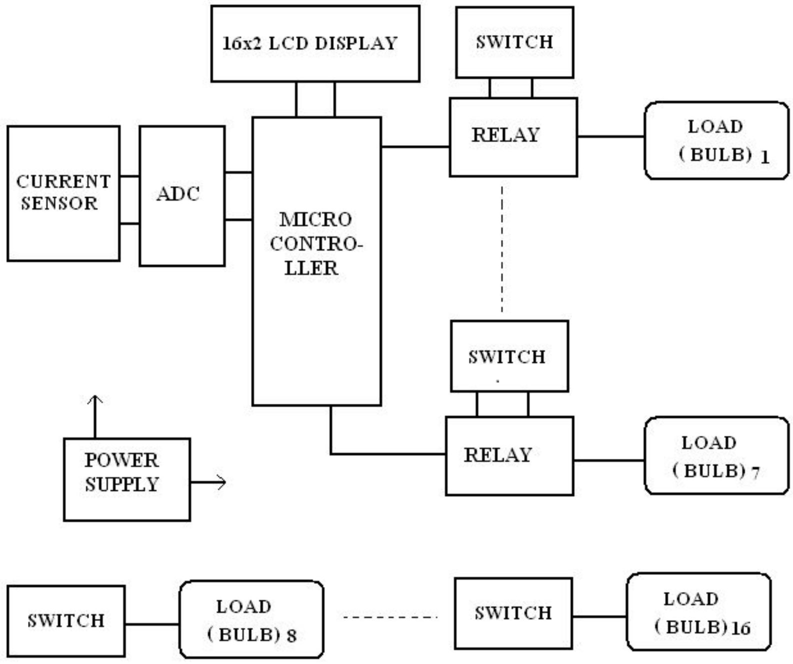

Fig. 1 block diagram

The above figure shows the block diagram of the prototype which is going to be designed. It consists of four load banks out of which load bank 1 will be altered or controlled manually. According to this switching the other loads are controlled via AT89c51 microcontroller. Load 4 is given the highest priority and therefore it remains on in every condition. Load 2 and Load 3 are controlled by the microcontroller as per the assigned priorities. Each load is a resistive load. (Incandescent bulb of 200 Watts each). The loads require a supply of 220V, 50 Hz AC supply whereas the relay driver circuit requires a 12 V DC and microcontroller (μC) requires 5 V DC. The current by the load bank is sensed by the current sensor and is given to ADC in terms of voltage and then ADC gives digital output to microcontroller as per the voltage level. Microcontroller will work according to the signal given by ADC and it will give signal to appropriate relay to trip.

Table 1: Load description

Sr. No.	**Load**	**Watt (W)**
1.	Load 1	≈ 1.8 kW
2.	Load 2	≈ 0.8 kW
3.	Load 3	≈ 0.4 kW
4.	Load 4	≈ 0.2 kW

2.2 Working

To virtualize the control of maximum demand of any organisation a prototype is designed using resistive (bulb) loads. A maximum demand of approximately 1600 Watts (1.6 kW) is set for the prototype. As the loads used in the prototype are purely resistive loads the power factor considered here is unity (1) and therefore the maximum demand in kVA is approximately equal to 1.6 kVA. To sense the load total current drawn by the loads is used as a sensing parameter. The current sensor senses the current drawn by the loads and gives a corresponding (analogue) voltage to the ADC which in turn gives corresponding digital output which is comprehended by the microcontroller and particular relay is tripped. When in the prototype the ON load is below or equal to 1.6 kVA the setup works in normal condition. As soon as the load exceeds the set demand the least priority load switches off first and again the maximum demand is checked with the corresponding current drawn. When the set limit of maximum demand is again exceeded the next least priority load trips. These loads are tripped from the load banks 2 & 3. Next, if the ON loads are within the limits the loads which were tripped off auto reclose themselves. So, a continuous monitoring of maximum demand is achieved with a provision of auto-reclose.

III. Controller

The prototype has microcontroller AT89c51 at its heart for the complete control actions and various switching controls. It is suitable and compatible for the MCS-51 products. It is a low power but a high-performance CMOS 8-bit microcomputer with a flash reprogrammable memory of 4K Bytes. A programmable and erasable read only memory (PEROM) is provided with an endurance of thousand write/erase cycles. It comes with 128 x 8-bit internal RAM, two 16-bit Timers/Counters and 32 programmable I//O lines. [4]

2.3 Pin description

Vcc – Supply Voltage
GND – Ground
PORT 0 & PORT 2 – Used for communication with LCD display.
PORT 1 – Used for outputs and given to respective relays.
PORT 3 – Used as input pins in which the output from the ADC acts as the input.
RST – To reset the microcontroller.
ALE/$\overline{\text{PROG}}$ – Address Latch Enable kept high to access data and program from internal memory.
$\overline{\text{EA}}$/Vpp – External Access Enable. Pin connected to GND for fetching code from external memory locations and connected to Vcc for executing internal programs. Pin also gets +12 V which is the program enabling voltage.
XTAL 1 – Input to inverting oscillator amplifier and internal clock operating circuit.
XTAL 2 – Output from inverting oscillator amplifier.
$\overline{\text{PSEN}}$ – Program Store Enable refers to read strobe to an external program memory.

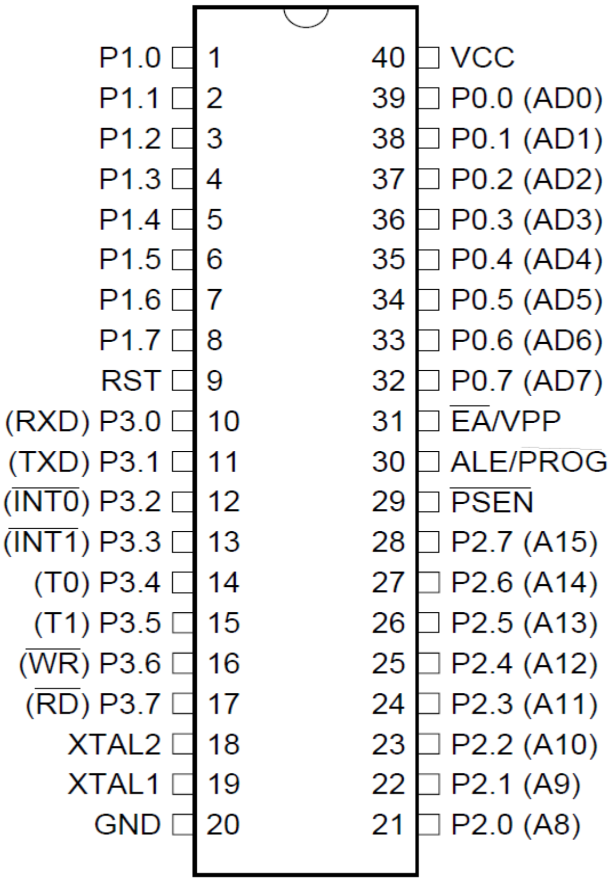

Fig. 2 AT89c51 pin configuration.

IV. Flowchart

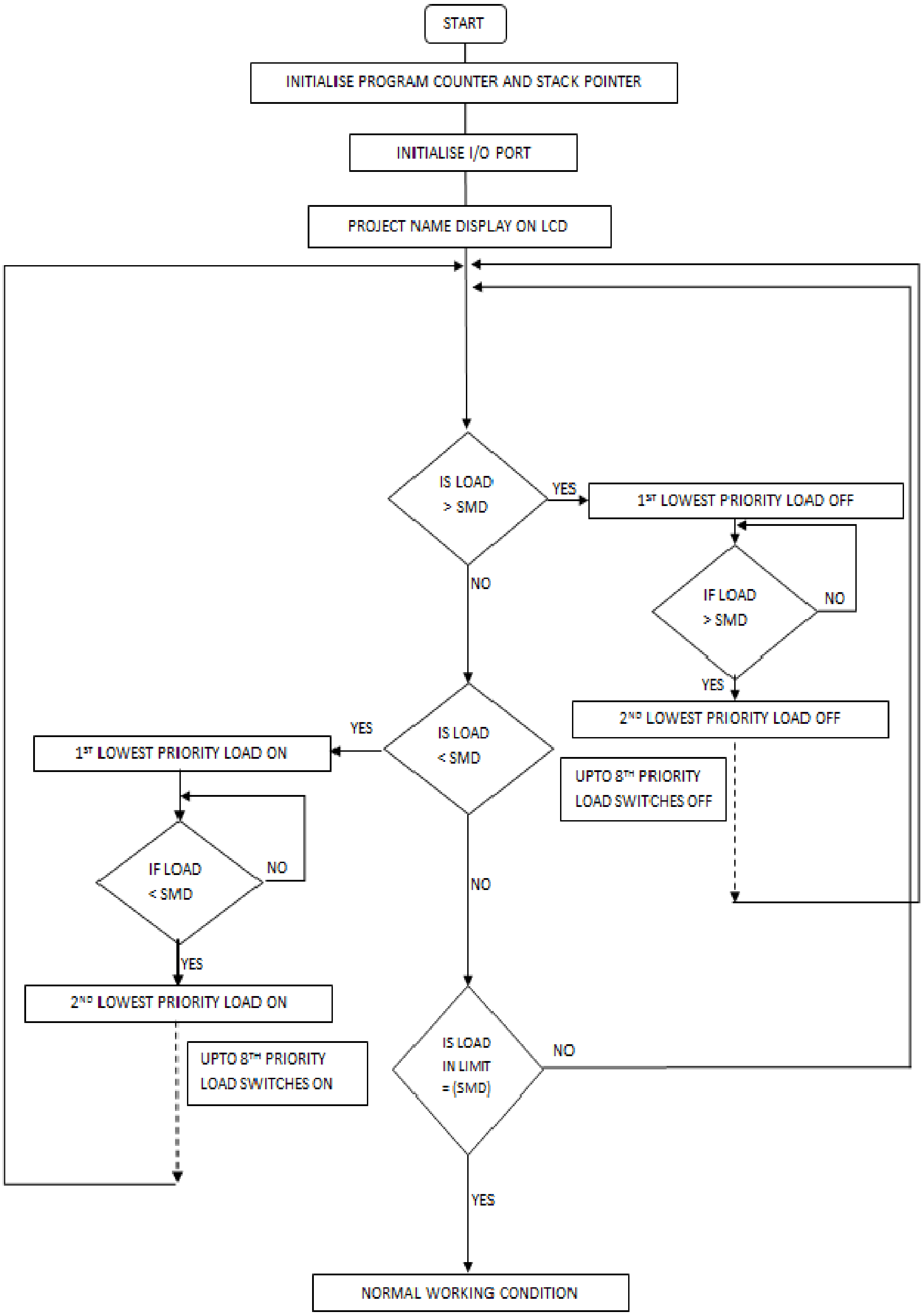

Fig. 3 Flowchart

The flowchart shows the step involved during the execution of program in the microcontroller as well as the switching of the loads. The prototype is based on the above algorithm designed.

V. Results

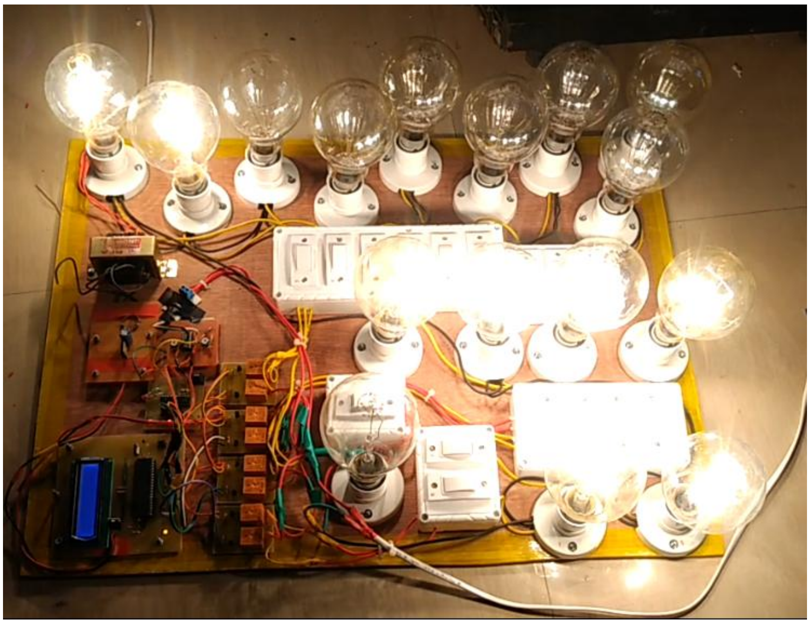

Fig. 4 Showing normal condition i.e. the load is within the set limit so that all load remains ON.

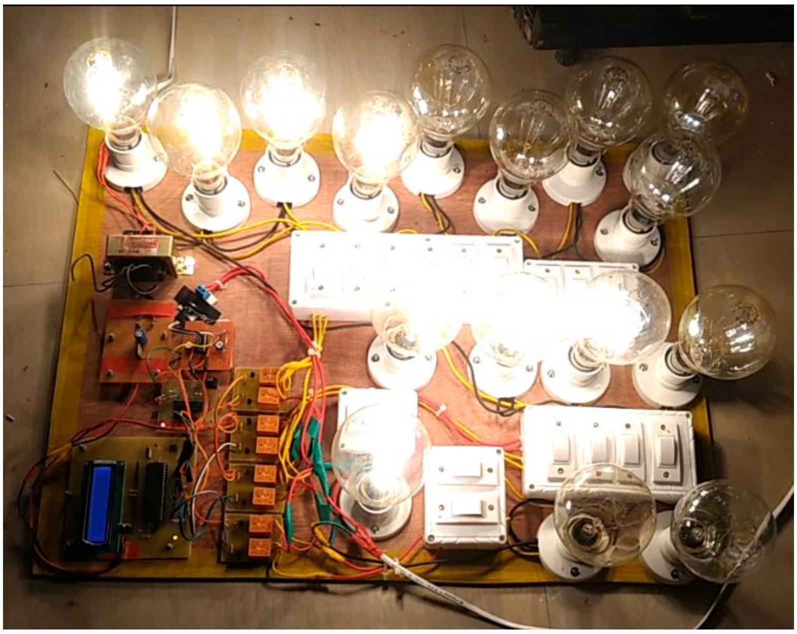

Fig. 5 Shows load is increased so that in order to limit the maximum demand low priority load tripped (Bulbs in last row).

VI. Conclusion

Electrical energy consumption of the country is one of the main parameter to decide the development of country. The peak load problems overcome by control over the usage of electrical loads during peak hours. Auto reclose is provided to loads in order to switch on the loads after the peak period. With the help of this prototype, we are able to eliminate the penalty paid by engineering college due to overconsumption of energy. It reduces the overload on the power stations during peak hours which lead to stability of power system. Also we will make this very flexible according to the any condition. We will provide both automatic and manual mode to it to avoid any inconvenience.

References

[1]. B. T. Ramakrishna Rao, Anand Daga, K.V.V.Srinivasa Rao, M.NaveenKumar, B.Ajay Kumar, AUTOMATION OF MAXIMUM LOAD CONTROL USING 8051-MICROCONTROLLER in 2014 IOSR Journal of Engineering (IOSRJEN).

[2]. Mousam Sharma, Anup Mishra, Nagendra Tripathi and Abhishek Verma, MICROCONTROLLER BASED MAXIMUM DEMAND INDICATOR AND CONTROLLER FOR EFFICIENT POWER MANAGEMENT in 2013 International Journal of Electrical and Electronics Engineering and Telecommunications.

[3]. Ravi Babu P & V.P Sree Divya, MAXIMUM DEMAND LIMITER FOR RELIABLE SUPPLY BY REDUCING THE POWER CUTS TO DOMESTIC LOADS in 2013 International Conference on Power, Energy and Control (ICPEC).

[4]. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. Mckinlay, The 8051 Microcontroller and Embedded System (PEARSON EDUCATION).