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Peak Time Load Management in Domestic Sector

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Abstract: ***The electricity demand is increasing day by day and leads do increase in generation and power transmission. India consumes about 3.4% of world energy consumption. The energy demand has grown at the average of 3.6% per annum over the past 30 years. Usually the demand for the electricity increases abruptly during peak hours. So it is necessary to monitor the loads during peak hours in order to provide energy sufficiently. The government has taken steps to reduce power consumption in industrial sector. Demand reduction can also possible in domestic sector. This Paper presents a load management model for domestic houses. Every house has a maximum demand limit for essential loads. During peak hours, if the consumer consumes power more than the preset limit,, based on the priority of load the power supply to the load will be turned off automatically and by using the cloud, the data can be visualized and analyzed. The power consumption during peak time is updated in cloud using NODEMCU and Thingspeak. The information can also be used for load forecasting***

Keywords: Demand, Essential and Non-essential loads, Load Management, Peak Hour

I. INTRODUCTION

In the report of central electricity authority of India, during the year 2017-18, the peak load met was 160,752 MW with a deficiency of 3,314 MW against 169,130 MW expected load. In the report of Load Generation Balance 2018, India's Central Electricity Authority predicted that energy surplus and peak surplus to be 4.6% and 2.5%. India ranks the 3rd largest energy producer as well as 3rd largest energy consumer. Considering global world power consumption , India consumes only 3.4% power of world consumption. Considering last 30 years of electricity report of India, demand increases constantly 3.6% per annum. By 2030, the total power demand for electricity in India is estimated to cross 950000 MW. As per the report of central electricity of India, total energy produced in India is about 2,05,163.47MW per day. In this, around nearly 18% of power lost during Transmission and Distribution losses which are about 36929.42MW. Comparing to normal hours, during peak time the Transmission and Distribution losses gets increased gradually. The power of 14771.76 MW is lost during peak time. The estimated losses about 40% of the losses are happened around 5PM to 11PM (i.e) during peak hours. The increase in annual electricity demand is due to the rapid growth of industrial sector and rapid growth of buildings and houses which consumes power more than their sanctioned power limit from the Electricity Board. So, power demand problem arises during peak hours. During Peak hours, if any consumer consumes power above their load limits, other consumers too get affected due to low voltage problems.

S.Ashok, Rangan Banerjee [2001] briefed the classification of loads for industry based on fixed time and controllable load.[1]

R. Rajarajeswari, D. Suchitra, J. Vijay Krishna and Joydeep Das Gupta [2019] briefed the scheduling of user devices based on the priority. They also analyzed that the load during peak hour is reduced and cost as well.[2]

Onur Ayan and Belgin Turkay[2018] has classified the domestic loads based on the shiftable and non shiftable loads. They have also listed the various appliances in the house hold and their priority order .[3]

II. LOAD MANAGEMENT

In order to overcome power demand during peak time, the load should be moved from peak hours to non-peak hours. The domestic loads are classified into essential and non-essential loads. Essential loads are the loads which will be required to meet the basic needs of the house. Some of the essential loads are Flash lights, fans, telephone power, fire alarm systems etc. Non essential loads are the loads which can be operated after specific time interval. Some of the non essential loads are Air conditioner, Water heater, Dryer, Pump, etc

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III. PROPOSED LOAD SCHEDULING MODEL

Every consumer needs to mention the Maximum Current Limit (ML) or Maximum Demand for their houses while applying for the new connection. If consumer consumes above the maximum demand of their house, it will affect other consumers by several problems like low voltage problem.
This proposed model is to make consumers to get maximum demand properly and to reduce peak time power consumption by shifting peak time loads to non-peak time by segregating the loads into essential and non-essential loads.

This proposed model consists of two sections, one is for existing houses and other is for newly constructed houses

A. For Existing Houses

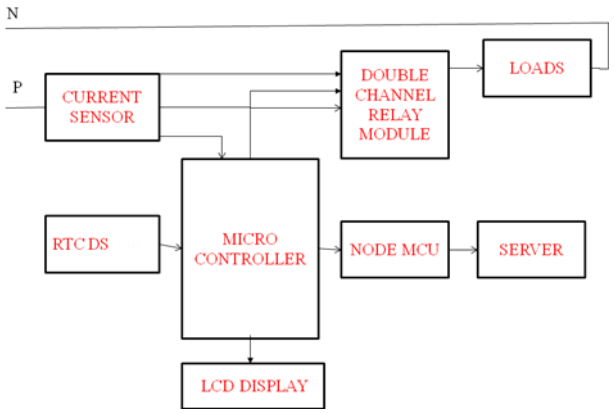

Figure 1: Block Diagram for existing Houses

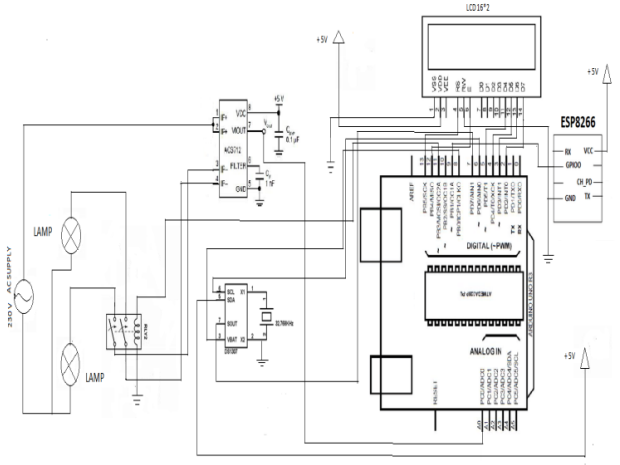

Figure 2: Circuit Diagram for existing Houses

For existing wired houses, we may not able to separate essential and non-essential load lines. The consumer uses above their specified load limit during peak hour, then all the essential and non essential loads will be turned off. Current sensor is used to sense the current and it sends the value to microcontroller. Microcontroller compares the set value and actual value. The current value exceeds the maximum limit, microcontroller send the command signal to relay to trip all the loads. Real time clock is used to turn on the project during peak hours. By implementing this method for existing wired houses, the power consumption above the essential load limit during Peak time can be turned off. Thus the power consumed by non essential loads can be shifted from peak hour to non peak hour. The power drawn by the consumer is displayed in the LCD. Node MCU transfers the data about the time of violation of limit to the server.

B. For Newly Wired Houses

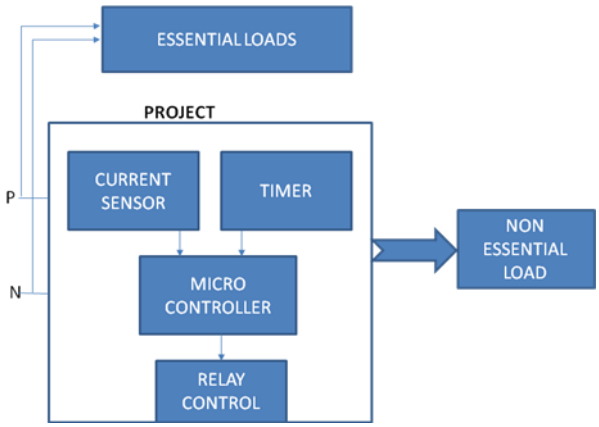

Figure 3: Block Diagram for New Houses

For Newly wiring houses, separate wiring should be done for essential and non essential loads. With the help of real time clock, the microcontroller switches off all the non essential loads automatically during peak hours.
Thus, the power consumed by the non essential loads will be changed from peak hours to non peak hours.

IV. CLASSIFICATION OF LOADS

The loads in the houses can be classified based on the priority.

Table 1: Classification of various loads

Low Essential Loads	Medium Essential Loads	High Essential Loads
Water heater	Computer	Lamp loads
Electric iron box	Refrigerator	Fan loads
Television	Mixer	Mobile phone charger
Decoration lamps	Grinder	
Washing machine	Water purifier	
Air cooler	Water Pumps	
Air conditioner		
Radio		
UPS		

V. RESULT AND DISCUSSION

The table shows the power rating of the appliances generally used in the houses.

Table 2: Rating of the appliances in house hold

Appliances	Type of load	Power (W)	No of quantities
Refrigerator	Non Essential	200	1
Television	Non Essential	150	1
Computer	Non Essential	150	1
Lamps	Essential	20	6
Air-Conditioner	Non Essential	1500	1

Washing Machine	Non Essential	500	1
Fan	Essential	75	3

The power consumed during Peak hour and non peak hour is also displayed at consumer point so that the consumer will be aware of their individual power consumption

Figure 4: Power Consumption Display

The power consumed by the individual houses can be updated in the server. The information can also be used to determine the future load and its corresponding losses

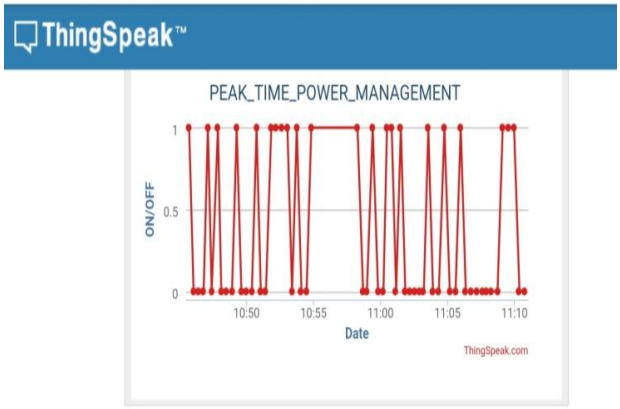

Figure 5: ON/OFF Time of load details in server

VI. CONCLUSION

By adopting the above proposed model, the power of approximately 2500W can be shifted to non peak hour in every house, thereby peak hour demand and losses in the peak hour also reduced.

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