A Novel Method of Home Energy Management System Using Microcontroller for Increasing Load Factor

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Abstract— The development of any country depends to a large extent on availability and usage of electricity. Conservation of electricity has now become a vital element of economic growth giving benefit to state's exchequer and this conservation is more essential due to the concern for fast depletion of non-renewable sources of energy in the country.
The main aim of this paper is to construct a control system that can manage (turn on/off and control speed) various common home appliances like Heater, Fan, Air Conditioner etc of domestic load at instantaneous time. The potential transformer is used to measure voltage and a current transducer is used to measure a current flow through load, further it communicates with microcontroller using one analog to digital converter.

Keywords— *Advanced metering infrastructure, appliance scheduling, demand response, distributed optimization, time-dependent pricing, Walrasian equilibrium, welfare theorem* I.

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I. INTRODUCTION

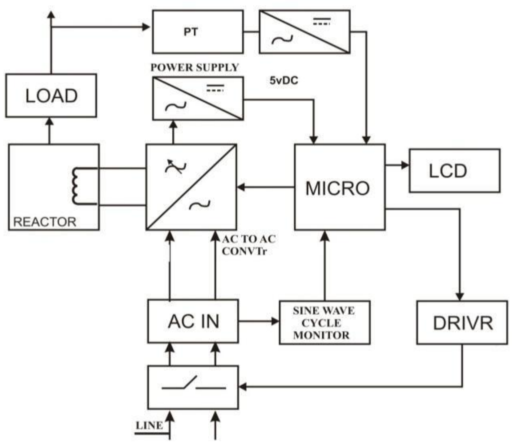
In this work, we propose a distributed energy scheduling algorithm as a demand response for the smart grid. We use day ahead pricing scheme, where the price of the electricity for the day is determined on the previous day. We then find optimal operating times for the electric appliances and their corresponding energy consumptions by minimizing the overall cost of operation. Our approach is different from the related work in four main aspects: i) we jointly optimize both the start time and the energy consumption for each appliance of the user; ii) we bill all the users based on their time dependent use of electricity; iii) we enforce realistic constraints on the operation of the appliances by categorizing them into two different classes; iv) we let the energy consumption vary in a discrete manner, which is more realistic. Further, our algorithm is fully distributed, where the only information available to the users is the prices for different time periods.

Using this price, each user will find his energy consumption schedule. Since we allow the energy consumption to vary in a discrete fashion, the corresponding optimization problem will be NPhard. Therefore, we employ a greedy iterative algorithm to find the suboptimal energy consumption schedule of each user. In each iteration, all the users will communicate their energy consumption schedule to the utility company. The utility company will then adjust the price depending on the overall system load and broadcast the price to all the users. The users will then update their energy consumption based on the new price. These iterations continue until convergence. We use numerical simulations to show that the proposed algorithm will result in lower cost for the consumers, higher profit for the utility companies, lower peak load, and lower load variance. The rest of this work is organized as follows.

II. System Model:

Power Manager work on the principle of Phase angle controlling method. Power savers work on straightening this unstable electric current to provide a smooth and constant output. The fluctuation in voltage is unpredictable and cannot be controlled. However, the power savers utilize current fluctuation to provide a usable power by acting like a filter and allowing only smooth and constant current to pass through the circuit. Power savers use capacitors for this purpose. When there is a surge of current in the circuit.In this project model we reduced down the voltage across the load upto a certain limit until current starts increases. As most of the devices can work on 190 vAC, our project gradually decreases the voltage and measures the current, whenever it observes that the current increases, the power electronics circuit will stop decreasing the voltage.Use of power electronics reduces the mechanical arching and fast reaction time.

III. Block Diagram:



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IV. Description of Operation:

For any inductive load power saver is used to reduce starting current using capacitor bank. Supply is given to the hall current sensor. Current sensor gives signal to A to D converter. To drive A to D converter microcontroller itself clock frequency generator is used. Then signal is supplied to microcontroller which is the heart of the system. Microcontroller gives signal to driver circuit (ULN2003) and this driver circuit is used to operate relay.The heart of this circuit is microcontroller(89s52) is used to control all components. The basic need of micro-controller is +5v dc supply, reset circuit and clock oscillation frequency. Power supply circuit is used to convert 250v AC to 5v and 12 v DC supply. Automatic power factor correction method is used to control power factor at unity with varying firing angle of a TRIAC. Here CT and PT are connected to A/D converter which converts analog data in digital format and gives to micro-

controller as a close loop feedback, further microcontroller gives signal to ULN2003 driver circuit which is used to drive relays, also it gives a gate triggering signal to the TRIAC. As TRIAC works on high voltage i.e on 220 vAC, and there may be chances of short circuit which results damages to the

low power devices like Microcontroller and driver circuit finally all the parameers like viltage across load and current flow through load is display on LCD . As we can't connect relay unit directly with micro-controller because microcontroller works on 5VDC and operating current requires to drive the relay is of 80mA, and driver IC converts a 5 vdc signal to 12V, hence ULN2003 is connected to micro-controller and receive signals from it and operates relay. Here we use PCF8591 8-bit A/D convertor for convert analog data to digital data. Zero-crossing detector circuit is fromed by a transistor T1 and T2, which reads/converts every zero crossing of sine wave from positive to negative half cycle and vise-vesa

V. PROBLEM FORMULATION

Installation of new generating units, especially thermal power plants, to meet ever increasing demand of electricity has threatened our environmental sustainability along with the increasing cost of electricity. This steep increase in demand of electricity has posed a serious challenge to electricity distribution systems and most of utility companies have to follow a trend of load shedding; is the art of managing the load demand by shedding it in critical situations where demand is increased than total generation to avoid system failure or major breakdown. Common practice is to trip feeders originating from a substation. Integration of renewable energy resources and application of efficient load management schemes will avoid the blackout caused by the conventional load shedding. Load management.

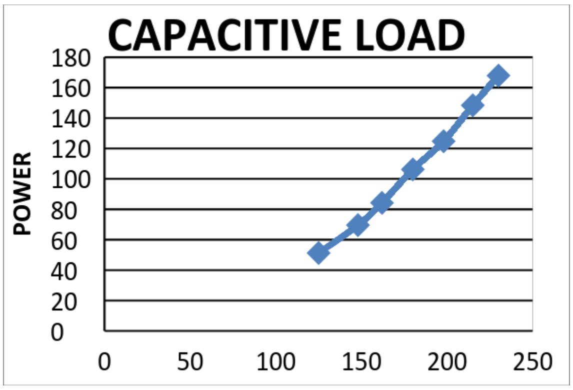
VI. OBJECTIVES

The primary objectives of this study can be summarized as follows.

1. Jointly optimize both the start time and the energy consumption for each appliance of the user.
2. Bill all the users based on their time dependent use of electricity.
3. Enforce realistic constraints on the operation of the appliances by categorizing them into two different classes.
4. The energy consumption vary in a discrete manner, which is more realistic. Further, our algorithm is fully distributed, where the only information available to the users is the prices for different time periods.

VI. .Result:

CAPACITIVE LOAD						
VOLTAGE	CURRENT		POWER		TOTAL CURRENT	TOTAL POWER
	MIN	MAX	MIN	MAX		
230	0.73	0.73	167.9	167.9	0.73	167.9
215	0.69	0.69	148.4	148.35	0.69	148.35
198	0.63	0.63	124.7	124.74	0.63	124.74
180	0.59	0.59	106.2	106.2	0.59	106.2
162	0.52	0.52	84.24	84.24	0.52	84.24
148	0.47	0.47	69.56	69.56	0.47	69.56
125	0.41	0.41	51.25	51.25	0.41	51.25



VII. Conclusion:

In this paper, we propose appliance scheduling as a demand response scheme for a smart grid. Unlike the earlier approaches that either select an optimal start time or an optimal energy consumption, our model finds a joint solution by considering all the appliances to be operating in specific modes. Such model in is also realistic, since it is easier to design appliances that can switch between various modes depending on the energy consumption. We select the optimal price that the utility company has to charge to be proportional to the generation cost. We then propose a distributed framework, where each user independently minimizes his own cost using a greedy approximation.

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