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Home Management System Using Genetic Algorithm

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ABSTRACT :- Electricity usage at electricity rush hour (peak hour) may vary from each and every service area such as industrial area, commercial area and residential area. Equalizing the power consumption in industry may lead to the utilization of power in other service areas in an efficient way. Although industries have comparably lesser number of powers consuming device types than other service areas the power consumption is quite high. To meet the demands rising in the industry, shiftable loads (devices) can be redistributed equally to all the working time slots based on the average power utilization. The main objective is to minimize the power utilization during the electricity rush hour by effectively distributing the power available during off-peak hour. Evolutionary algorithm can be well adapted to problems where optimization is the core criteria. Any maximization or minimization problem can be solved efficiently using evolutionary algorithm. Hence, to obtain the optimized fitness function of load redistribution in industry Genetic Algorithm (GA). This paper proposes a way to reduce them electricity cost using Genetic Algorithm.

KEYWORDS: home energy management; real time pricing; genetic algorithm.

I. INTRODUCTION

In recent years, the public has been paying ever greater attention to problems associated with energy production and consumption. Energy-supply issues rightly constitute one of the most important issues that we face. In the absence of any viable alternative energy supply, a strategy that would result in energy savings is a legitimate goal. In this paper proposed algorithm, each user requires only the knowledge of the price of the electricity, which depends on the aggregated load of other users, instead of the load profiles of individual users. This paper presents an optimized home energy management system (OHEMS). The proposed scheme not only facilitates the integration of RES and ESS into the residential sector but also reduces the procurer's electricity bill as well as the PAR. In addition, the performance of the heuristic algorithms: genetic algorithm (GA). "Smart electricity system" has moved from conceptual to operational in the last few years. The smart grid has undergone significant innovation, with demand response, being one of the important focus areas. The principal goal of demand response is to reduce the generation cost of electricity by reducing the peak load and shifting peak hour demand to off-peak hours. Shifting electricity usage to off-peak hours is desired to allow for better utilization of the generated power, and reduce costs to both the consumers and utility companies. With the advent of advanced communication infrastructures that enable a reliable two-way communication between the energy provider and the end-users, it has become feasible for the utility company to provide the consumers with the time-dependent price of the electricity

II. PROPOSED SYSTEM ARCHITECTURE

In this paper, 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

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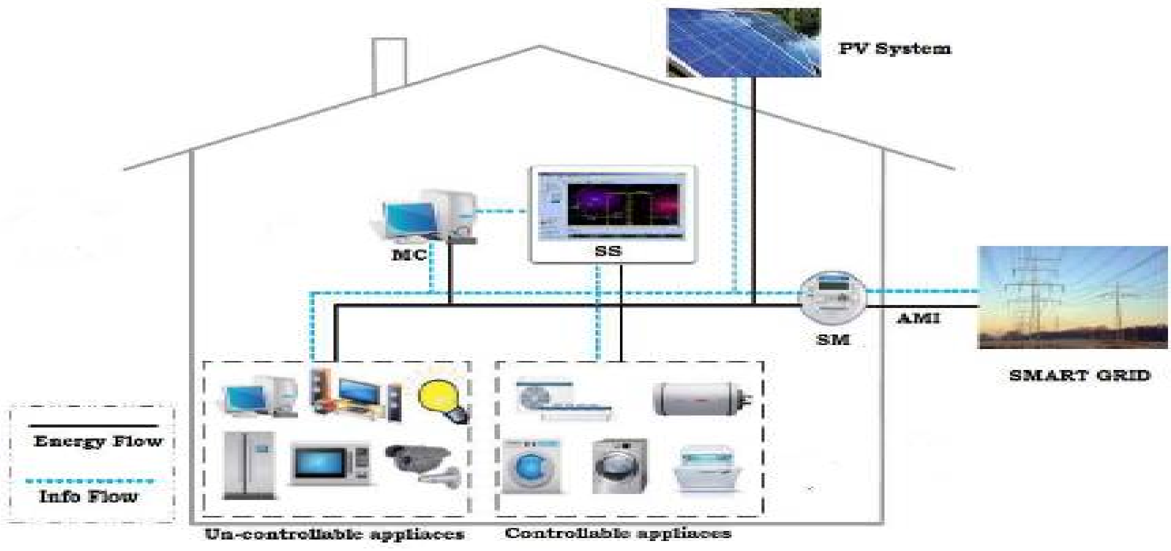
more realistic. Further, our algorithm is fully distributed, where the only information available to the users is the prices for different time-periods.

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 NP-hard. Therefore, we employ a greedy iterative algorithm to find the sub-optimal 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.

Controller Appliances	Un-controllable Appliances
Washing machine	Personal Computer
Air conditional	Security Cameras
Clothes Dryer	Microwave Oven
Water Heater	Refrigerator



GA BASED ALGORITHM

The appliances scheduling problem as formulated in Section IV is solved by using GA. Although, appliance scheduling problem is solved by different classical optimization techniques such as LP, ILP, MILP, OSR, dynamic programming, but these techniques can not handle large number appliances
and face a lot of difficulties in convergence. Moreover, most of the classical techniques do not have the global perspective and often converge at the local optimum solution.

In contrast, evolutionary algorithms, for example, GA give alternative methods to solve complex problems and outperforms the classical techniques in most of the cases. The GA is an iterative optimization technique, rather than working on a single solution, GA deals with different possible solutions in each iteration. Therefore, we use GA to design our smart scheduler (SS). It the beginning of each day, when the presume gets the grid signals SS generates an

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optimized energy consumption pattern for all appliances. GA begins it search with randomly initialized binary coded chromosomes. The chromosomes pattern of GA represent the ON=OFF state of appliances, and the length of chromosomes show the number of appliances.

Length of chromosomes= N

Where,

N is the number of household appliances.

Once a population is created, the fitness function of each possible solution is evaluated according to the objective function of the optimization problem. In this case, the fitness of each population is evaluated. Then, a new population is generated by applying the natural genetic operators such as selection, crossover, and mutation. The working principle of GA is shown in Fig. 2. In each iteration new population is produced through crossover and mutation. In this work, a single point mutation and binary crossover are used. The rate of convergence of GA is directly proportional to crossover rate, and the optimal solution is inversely proportional to the mutation rate. A tournament based selection is used to form a new population from existing one. Elitism is used to remember and transform best solution from one generation to next one.

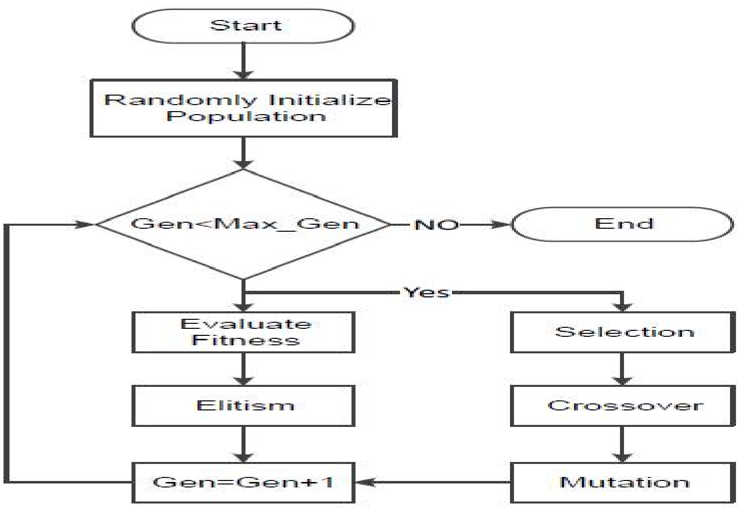

Fig: - Working Principal of Genetic Algorithm

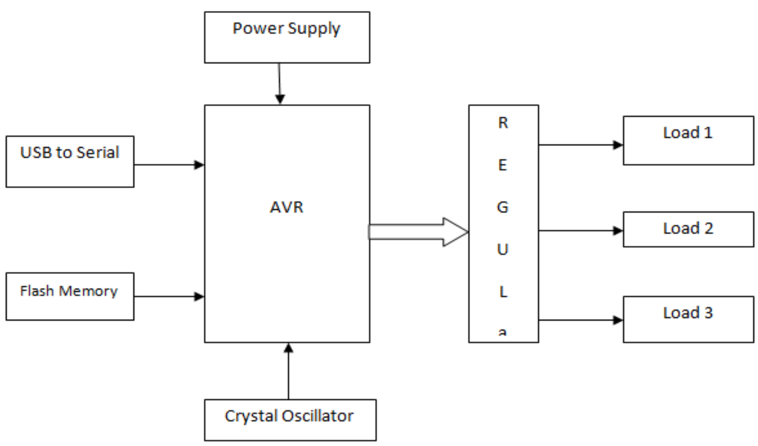

Fig: - Working Architecture Of efficient Load Controller

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III.SIMULATION RESULT

In this section, simulation results of the proposed OHEMS are presented. In the proposed scheme, the integration of RES and ESS, as well as the performance of algorithms GA is evaluated via two stages simulations. In the first case, the integration of RES and ESS into the residential sector are evaluated in terms of energy consumption pattern, and electricity bill as well as PAR reduction. While in the second case, the same performance metrics (energy consumption pattern, and electricity bill as well as PAR minimization) are used to evaluate the effectiveness of GA . The Device shows the consumption of power step by step.

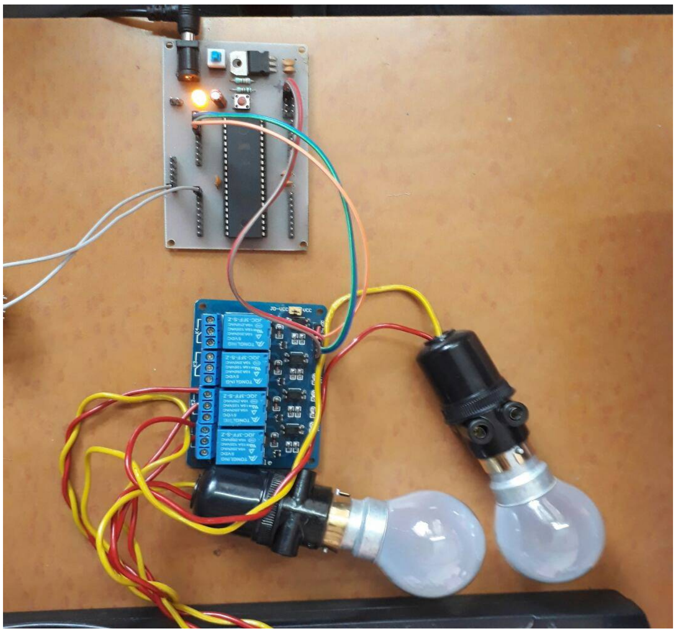

Fig: - Hardware Part of GA Based controller and Uncontrolled

IV. CONCLUSION

In this paper, we proposed an RHEMS to facilitate the integration of RESs in the residential sector and to reduce the electricity bill as well as peak formation. First, the objective function is mathematically formulated and then evaluated by using GA-based scheduling in a dynamic pricing environment.
Simulations results show that the scheduling of household appliances and estimated renewable energy in response to dynamic pricing signal significantly reduce the electricity cost and PAR. Moreover, the proposed RHEMS achieve a favorable tradeoff between the user comfort and cost reduction. In future, we are interested in forecasting and integration of energy storage system in residential sector to increase the benefits from RESs.

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