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Master Thesis Defense

Entitled

HOME ENERGY MANAGEMENT SYSTEM FOR DEMAND RESPONSE PURPOSES

by

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Date & Venue

03:00 PM

Thursday, 14 November 2019

Room 1164, F1 Building

Abstract

The growing demand for electricity has led to increasing the efforts to generate and satisfy the rising demand. This led to suppliers attempting to reduce consumption with the help of the users. Requests to shift unnecessary loads off the peak hours, using other sources of generators to supply the grid while offering incentives to the users has made a significant effect. Furthermore, automated solutions were implemented with the help of Home Energy Management Systems (HEMS) where the user can remotely manage household loads to reduce consumption or cost. Demand Response (DR) is process of reducing power consumption in a response to demand signals generated by the utility based on many factors such as the Time of Use (ToU) prices. Automated HEMS use load scheduling techniques to control house appliance in response to DR signals. Scheduling can be purely user dependent or fully automated with minimum effort from the user. This thesis presents a HEMS which automatically schedules appliances around the house to reduce the cost to the minimum. The main contributions in this thesis are the house controller model which models a variety of thermal loads in addition to two shiftable loads, and the optimizer which schedules the loads to reduce the cost depending on the DR signals. The controllers focus on the thermal loads since they have the biggest effect on the electricity bill, they also consider many factors ignored in similar models such as the physical properties of the room/medium, the outer temperatures, the comfort levels of the users, and the occupancy of the house during scheduling. The DR signal was the hourly electricity price; normally higher during the peak hours. Another main part of the thesis was studying multiple optimization algorithms and utilizing them to get the optimum scheduling. Results showed a significant 68% cost reduction using different metaheuristic optimization algorithms.

Keywords: Demand Response, Home Energy Management System, Optimization, Scheduling, Modelling, Grey Wolf Algorithm.