Abstract

Motaz M Amer

Power Consumption Optimization Based on Controlled Demand for Smart Home Structure

Energy is a major expense for most of the customers, naturally each home would be interested in minimizing the utility bill. But there is a need for tools to be suitable for both customers and utility, first for customers to understand what is driving their monthly energy spend and overcome complexity of managing energy effectively. On other hand for electrical companies to ensure stability on the grid, electricity supply and demand must remain in balance in real time. Traditionally utilities have called upon peaking power plants to increase power generation to meet rising demand. As a solution Demand Side Management (DSM), which includes energy efficiency and Demand Response (DR), works from the other side of the equation instead of adding more generation to the system, it pushes energy users to reduce consumption. This thesis proposes a concept of power consumption optimization in smart homes based on demand side management that reposes on using Home Energy Management System (HEMS) that is able to control home appliances. The advantage of the concept is optimizing power consumption without reducing the users living comfort. An adaptive mechanism for smart home energy management system which composed of algorithms that govern the use of different types of loads in order of pre-Selected priority in smart home is proposed. In addition a method for the optimization of the power generated from a Hybrid Renewable Energy Systems (HRES) in order to achieve the load demand. Particle Swarm Optimization Technique (PSO) is used as optimization searching algorithm due to its advantages over other techniques for reducing the Levelized Cost of Energy (LCE) with an acceptable range of the production taking into consideration the losses between production and demand sides. The problem is defined and the objective function is introduced taking into consideration fitness values sensitivity in particle swarm process. The algorithm structure was built using MATLAB software and Arduino 1.0.5 Software. This work achieves the purpose of reducing electricity expense and clipping the Peak-toAverage Ratio (PAR). The experimental setup for the smart meter implementing HEMS is built relying on the Arduino Mega 2560 board as a main controller and a web application of URL http://www.smarthome-em.com to interface with the proposed smart meter using the Arduino WIFI Shield.