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Implementation of a Novel Home Energy Management System (HEMS) Architecture with Solar Photovoltaic System as Supplementary Source

Mohammad Shakeri¹, Mohsen Shayestegan¹, S.M. Salim Reza¹, Iskandar Yahya¹, Badariah Bais¹, Md. Akhtaruzzaman², Kamaruzzaman Sopian, Nowshad Amin¹,²,³*

¹ Department of Electrical, Electronic and Systems Engineering, Faculty of Engineering and Built Environment, The National University of Malaysia, 43600 Bangi, Selangor, Malaysia
² Solar Energy Research Institute, The National University of Malaysia, 43600 Bangi, Selangor, Malaysia
³ College of Engineering, Universiti Tenaga Nasional (@The National Energy University), Jalan IKRAM-UNITEN, 43000 Kajang, Selangor, MALAYSIA

*Corresponding author: nowshad@ukm.edu.my
Phone: +60193296750, Fax: +60389118359

Abstract

This study investigates a novel control algorithm for the home energy management system (HEMS) to monitor and schedule the electrical appliances to apply in any conventional houses. This is to reduce the electricity consumption and consequently electricity cost in places with time-of-use (TOU) pricing model. A hardware implementation is executed in a testbed house premise using in-house built control system, smart plugs as well as PV system as the supplementary source. In this system architecture, the overall consumption of the electrical appliances that run on the grid is limited by the algorithm and kept under the certain value that is fixed depending on the total consumption of the building and the capacity of the battery. If the predefined limit is crossed, the new appliances are shifted to run on battery instead of shifting to other time, and thereby human comfort is less violated. In the worst case scenario, where the electrical appliances are assumed to consume the maximum amount of electricity, a prototype implementation of the proposed algorithm achieves up to 15% of electricity cost reduction and ensures the minimum sacrifice in dweller’s comfort.

Keywords: Smart Grid; Demand Response; Home Energy Management Systems (HEMS); Smart Appliance; Storage Device; Renewable Energy.
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