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United Arab Emirates University

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Entitled

*DESIGN AND IMPLEMENTATION OF WIRELESS SMART HOME ENERGY MANAGEMENT
SYSTEM USING RULE-BASED CONTROLLER*

by

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Abstract

Most residential units still rely on conventional energy supplied by utilities despite the continuous growth of renewable energy resources, such as solar and wind energy systems in power distribution networks. Utilities often use time-of-use energy pricing, which increases the interest of energy consumers, such as those in commercial and residential buildings, in reducing their energy usage. Thus, this work demonstrates the design and implementation of a home energy management (HEM) system that can automatically control home appliances to reduce daily energy and electricity bill. The system consists of multiple smart sockets that can read the power consumption of an attached appliance and actuate its on/off commands. It also consists of several other supporting instruments that provide information to the main controller. The smart sockets and supporting instruments in the system wirelessly provide the necessary data to a central controller. Then, the system analyzes the data gathered from these devices to generate control commands that operate the devices attached to the smart sockets. Control actions rely on a developed online rule-based HEM scheme. The rules of the algorithm are designed such that the lifestyle of the user is preserved while the energy consumption and daily energy cost of the controlled appliances are reduced. Experimental results show that the central controller can effectively receive data and control multiple devices from up to 18 m away without loss of data on the basis of a scheduled user program code. Moreover, online adaptation of the HEM scheme confirms significant reductions in the total daily energy consumption and daily electricity bill of 23.5 kWh and \$2.898, respectively. Therefore, the proposed HEM system can be remarkably useful for home owners with high daily energy consumption.

Keywords: Home energy management, Zigbee, Smart socket, Power monitoring, appliance smart scheduling.