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Smart Home Energy Management System Using Least Square Regression Analysis

Shiru Mohammed Abdullahi[1], Kolo Jonathan Gana[1], Simon, Apeh[2], Ajao Lukman Adewale[1*], Agajo James[1], Nuhu Bello K[1]
[1]Department of Computer Engineering, Federal University of Technology, Minna, Nigeria
[2]Department of Computer Engineering, University of Benin, Nigeria

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***Corresponding author**
Ajao Lukman Adewale

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Abstract: Smart home is a residence with several electrical and electronic appliances that are capable of communicating with each other and can be controlled remotely from any room in the home or from any location in the world. Easy control of home appliances/devices and energy management has been the main goal that leads to the invention of smart homes. However, most of the systems developed for these homes are either complex or could not manage energy wastage efficiently which incurring more electricity bills cost. In this work, an intelligent home energy management system that is based on Least Square Regression (LSR) analysis is presented. The system is trained based on the historical data of occupant's interaction with the appliances over a period of time. It monitors and computes the power consumption of home user over a period of time. This system takes decision and controlled the output using LSR based on what it learnt by alerting the home user on condition of accept or reject response through Android GUI Apps. The system performance evaluation based on the frequency prediction which is given as 0.77 RMSE, the activation time prediction is given as 127.89 seconds RMSE which is slightly above 2 minutes with a regression coefficient of (R=0.999988). The RMSE of 257.90 seconds for activation of duration prediction with regression coefficient analysis of (R= 0.989071).

Keywords: Android, Communication, Electricity bills, Electronic appliances, Energy management, Intelligent, Least square regression, Smart home.

INTRODUCTION

Smart homes are homes where different appliances, machines and other energy consumers are connected in one network which is controlled according to inhabitants' needs and behaviors, outdoor climate and other parameters. Smart home refers to home where information and communication technology (ICT) can anticipate and respond to the needs of occupants, in order to enhance their comfort, convenience, security and entertainment [1, 2]. Described smart home as a home-like environment that possesses ambient intelligence and automatic control capable of increasing occupant's comfort, convenience and luxury. Since the primary objectives of a smart homes are to increase home automation, facilitate energy management, and reduce environmental emissions. This is possible due to the advancement of wide variety of sensors and high processors technologies using service modules based on any short-range technologies such as Wi-Fi, ZigBee, Z-wave among others [3-5].

In literatures [6-8] revealed that, smart home systems is grouped into six primary categories which include: security and access control systems; lighting, window and appliance control systems; home appliances; audio-visual and entertainment systems; healthcare and assisted living systems and energy management systems.

Energy management is a term that integrates both power control and power management, with an emphasis on total energy conservation rather than just the efficiency of a specific system component in a smart home. Smart home energy management system refers to the application of supervisory control and data acquisition with energy management systems, including the generation, the transmission and distribution systems of the electrical network. Smart home energy management system deals with the real-time monitoring and arranging of various home appliances, based on user's preferences via intelligent ambient systems controlled by a human–machine interface.