A Biased Load Manager Home Energy Management System for Low-cost Residential Building Low-income Occupants

Chukwuka G. Monyei, 1Aderemi O. Adewumi, 3Daniel Akinyele, 4Olubayo M. Babatunde, 2Michael O. Obolo and 5Joshua C. Onunwor

1Applied Artificial Intelligence Research Unit, School of Mathematics, Statistics and Computer Science, University of KwaZulu-Natal, Westville Campus, Private Bag X54001, Durban 4000, South Africa
2Gidia Oaks Centre for Energy Research, Lagos, Nigeria
3Elizade University, Ilara-Mokin, Ondo State, Nigeria
4Department of Electrical and Electronics Engineering, University of Lagos, Nigeria
5Department of Electrical and Electronics Engineering, Covenant University, Ota, Ogun State, Nigeria
6Corresponding author
chiejinamonyei@gmail.com, adewumia@ukzn.ac.za, daniel.akinyele@elizadeuniversity.edu.ng, olubayobabatunde@gmail.com, michaeldammy@ymail.com, joshuaonunwor@yahoo.com

Abstract
This research paper presents the development of a biased load manager home energy management system for low-cost residential building occupants. As a smart grid framework, the proposed load manager coordinates the operation of the inverter system of a low cost residential apartment consisting of rooftop solar photovoltaic panels, converter and battery, and provides a platform for discriminating residential loads into on-grid and off-grid supply classes while maximizing solar irradiance for optimum battery charging and improving consumer comfort from base levels. Modelled in a Matlab simulation environment, the system incorporates a converter system for maximum power point tracking using a hopping algorithm, with a dedicated mechanism for smart dispatch of specified loads to meet the users’ comfort based on the priority ranking of the loads. Results obtained indicate a 34% reduction in electricity cost, 26% reduction in carbon emissions and a 4% increase in comfort level for the photovoltaic/battery/utility option compared to the utility only option. The results further show that cost is a major factor affecting the users’ comfort and not necessarily dispatch of appliances to meet energy needs. The research can be useful for encouraging the adoption of the photovoltaic/battery/utility option by low/middle income energy users in developing countries.

Keywords: - low-cost residential buildings, BLM-HEMS, hopping algorithm, consumer comfort, return on investment, carbon footprint

Highlights
- Presents a load manager for low-income residential homes.
- Evaluates the contribution of the load manager in improving household comfort.
- Evaluates associated reduction in carbon emissions and electricity cost.
- Discusses and presents solution to the challenge of adopting the load manager.

1.0 Introduction
Energy (electricity) access is still a major problem for over 800 million people in sub-Saharan Africa (SSA) and South Asia. In Nigeria, over 80 million people are still without
دریافت فوری متن کامل مقاله

امکان دانلود نسخه تمام متن مقالات انگلیسی
امکان دانلود نسخه ترجمه شده مقالات
پذیرش سفارش ترجمه تخصصی
امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
امکان دانلود رایگان ۲ صفحه اول هر مقاله
امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
دانلود فوری مقاله پس از پرداخت آنلاین
پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات