Visualizing a Control Strategy for Estimating Electricity Consumption

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ABSTRACT
This paper investigates the potential of applying different control measures on low power and high power appliances with the goal of evolving efficiency in electricity consumption. The research involves carrying out simulations on their power consumption readings to set up a control system. The study discovers savings on all appliances under study to be 12.8% Kw, not minding occupancy rate of the building. Air-conditioners have the greatest impact of a 6% Kw contribution on savings. This would lead to a substantial contribution when converted to pricing rates. The results from the study indicate that control measures should be extended to peak periods and power saving measures extended to more appliances.

Keywords
Control measures, efficiency, simulation, occupancy rate, savings.

1. INTRODUCTION
This research proposes a control strategy to estimate electricity consumption which can be used to improve efficiency in electricity usage. Due to the importance of having an efficient electricity consumption system, various studies have addressed the issue of finding a solution to this problem. This varies from the use of sensors, which regulates and control electric usage, to the efficient allocation and scheduling of electric power supply [1]. A previous research derives a speed control strategy to improve operations of renewable source of electricity by promoting manufacture of wind turbines [2]. It is based on the Newton's method, which is a numerical technique.

A paper introducing the use of a smart meter, comprising of an energy consumption controller (ECC) is used to determine whether electricity prices would fluctuate if users shift their energy consumption schedule of high load household appliances to off-peak hours to reduce energy expenses [3]. In the analysis, Heating Ventilation and Air conditioning (HVAC) systems are investigated. These are considered to be high power appliances. Efficiency in electricity consumption was applied to control of Heating Ventilation and Air conditioning systems (HVAC) because of their large energy footprint, [4]. This involves building a mathematical model of the temperature dynamics of the room, and combining this model with statistical methods allows us to compute the heating load due to occupants and equipment using only a single temperature sensor. A paper [5] introducing a load shedding algorithm to maximize efficiency under certain requirements was presented. It employs an algorithm with penalty function method (PFM) and the simplex method (SM) compiled by C++. This algorithm leads to rapid computation speed.

Past research of determining efficiency in electricity consumption is mainly based on control of high power appliances; it does not consider control of low power electrical appliances. The current research seeks to investigate if it is possible to obtain better performance level when controls of low power appliances are considered, together with high power electrical appliances. This research work will implement a control strategy for computing electricity consumption with the goal to minimize electricity wastages in the system and ultimately the costs. This will take into account energy consumption for each electrical appliance, varying time intervals for each appliance, which are used for decision making.

2. METHODOLOGY
The methodology developed in this research involves electricity consumption based on real electricity consumption measurements which are collected from individual appliances through the use of installed power meter connected to electricity grid in the Faculty of Computer Science and Information Technology building, Universiti Malaysia Sarawak where data in this research study is collected from. The study models electricity consumption in order to find out control effects of

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