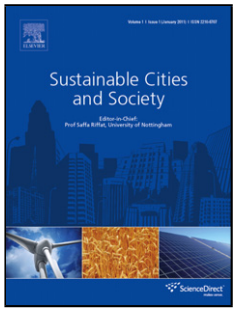

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Multi-Granular Electricity Consumer Load Profiling for Smart Homes using a Scalable Big Data Algorithm

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Smart meter technology in smart homes provides real-time information to customers through devices such as in-home displays and web portals, and provide half-hourly consumption data to electricity distributors and retailers. Such data enables the profiling of consumers making it possible to understand different life styles and electricity usage behaviours to provide customised electricity billing. To obtain the anticipated benefit from such highly granular and high frequency data, it is essential to have big data technologies which can process such volumes of data in near real time. The research described in this paper focus on addressing the key requirements of large volume data processing and making use of the highly granular nature of the data. Adapting a new scalable algorithm introduced by the authors for big data processing, this work demonstrates the practicality of processing large volumes of data at multiple levels of granularity. The faster processing capacity makes it possible to continuously analyse consumption data at frequent intervals as they are collected and at a highly granular level thus providing a practical solution as a smart home application. The advantages of the technique are demonstrated using electricity consumption data for 10,000 households for a year from an Australian electricity retailer.

Abstract

With rising electricity prices, there is a need to give consumers greater control over their energy consumption. It is anticipated that such informed consumers in control of their consumption patterns will contribute to reduced energy usage and thus a sustainable environment. Smart meter technology in smart homes provides real-time information to customers through devices such as in-home displays and web portals, and provide half-hourly consumption data to electricity distributors and retailers. Such data enables the profiling of consumers making it possible to understand different life styles and electricity usage behaviours to provide customised electricity billing. To obtain the anticipated benefit from such highly granular and high frequency data, it is essential to have big data technologies which can process such volumes of data in near real time. The research described in this paper focus on addressing the key requirements of large volume data processing and making use of the highly granular nature of the data. Adapting a new scalable algorithm introduced by the authors for big data processing, this work demonstrates the practicality of processing large volumes of data at multiple levels of granularity. The faster processing capacity makes it possible to continuously analyse consumption data at frequent intervals as they are collected and at a highly granular level thus providing a practical solution as a smart home application. The advantages of the technique is demonstrated using electricity consumption data for 10,000 households for a year from an Australian electricity retailer.

1. Introduction

Improving energy efficiency is arguably the most cost-effective way of reducing greenhouse gas emissions. Energy efficiency also brings numerous economic and social benefits. Data on energy supply and end-use are also a prerequisite for developing policies and initiating a change towards increased sustainability. Despite the large increase in the use of electricity in the residential sector and