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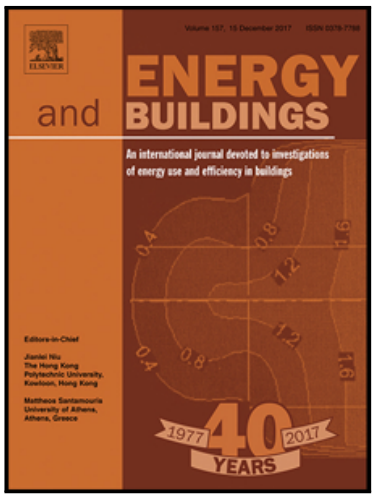

Extracting Typical Occupancy Data of Different Buildings from Mobile Positioning Data

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ACCEPTED MANUSCRIPT

Extracting Typical Occupancy Data of Different Buildings from Mobile Positioning Data

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Occupancy is one of the main factors affecting building energy consumption. The occupancy data, which refer to the occupancy number in this paper, has been widely used in the building simulation field. However, due to the stochastic nature of occupant behavior, it is hard to predict and measure how many people stay in a given building. The rapid development of mobile Internet technology provides an efficient and convenient option for occupancy detection. This paper proposes a concept of Typical Occupancy Data (TOD), which are extracted from real-time occupancy data collected by mobile devices. K-means algorithm is employed to generate the TOD data through cluster analysis. An energy performance model of an office building is used as a case study to demonstrate the effectiveness of the TOD data.

[Key words] Typical occupancy data, Mobile device, Building energy simulation

1 Introduction

Occupancy is one of the main factors affecting building energy consumption and it is also a main source of uncertainty in building energy simulation and prediction [1, 2]. Due to the stochastic nature and privacy issue of occupancy, it is not easy to characterize occupancy in the buildings. Both the presence of occupants and their interactions with building are often simplified by some predefined schedules in current simulation programs [3], which is mainly acquired from building standards or design manuals of different countries and organizations, as shown in Fig. 1. According to the ASHRAE Standard 90.1-2013, schedules shall be determined by the designer and approved by the rating authority [4]. The user's manual provide occupancy schedules for different building types from ASHRAE standard 90.1-1989 when actual schedule is unknown [5], where occupancy factors vary on weekdays, Saturdays and Sundays. Supported by the U.S. Department of Energy (DOE) Building Energy Codes Program, Pacific Northwest National Laboratory (PNNL) made enhanced prototype building models for 16 commercial building types in 17 American climate locations with modified schedules [6]. However, actual occupancy schedules are more complicated than those in the model. Not all the schedules can be simply divided into weekdays and weekends, and not all the occupancy schedules are same for the same building type. Thus, discrepancies may exist between standard

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