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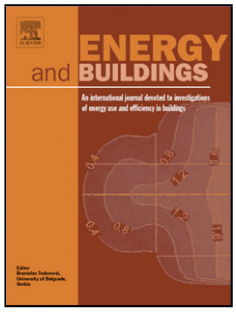

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Occupancy Measurement In Commercial Office Buildings For Demand-Driven Control Applications- A Survey And Detection System Evaluation.

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Abstract

Commercial office buildings represent the largest in floor area in most developed countries and utilize substantial amount of energy in the provision of building services to satisfy occupants' comfort needs. This makes office buildings a target for occupant-driven demand control measures, which have been demonstrated as having huge potential to improve energy efficiency. The application of occupant-driven demand control measures in buildings, most especially in the control of thermal, visual and indoor air quality providing systems, which account for over 30% of the energy consumed in a typical office building is however hampered due to the lack of comprehensive fine-grained occupancy information. Given that comprehensive fine-grained occupancy information improves the performance of demand-driven measures, this paper presents a review of common existing systems utilized in buildings for occupancy detection. Furthermore, experimental results from the performance evaluation of chair sensors in an office building for providing fine-grained occupancy information for demand-driven control applications are presented.

Keywords: *Building occupancy; energy efficiency; demand-driven control*

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1. Introduction

1.1. Building energy consumption

The built environment is currently a major consumer of non-renewable fossil energy, accounting for more than one-third of the total final energy consumed in both OECD (Organization for Economic Cooperation and Development) and non-OECD countries [1-4]. Due to continued economic and population growth in OECD and non-OECD countries respectively, it is anticipated that the built environment in the near decade would be the main energy consuming sector [3]. Within the built environment, commercial office buildings are the largest in floor space and energy use in most countries [5]. In the Netherlands for instance, it is estimated that there are around 78,000 office buildings and the energy use per square meter is almost double that of households [2]. Overall, both the electricity use and gas consumption of buildings are increasing slightly, despite targets set by various governments, which anticipates 20% reduction in energy use by the year 2020 [6,7].

In commercial office buildings, Lighting, Heating, Ventilation and Air -Conditioning systems (L-HVAC) are the main energy consumers, together accounting for about 70% of the total energy consumed in a typical office building [4-9]. Over the years, numerous occupancy detection systems have been developed for use in demand-

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