HVAC Energy Savings and IEQ for Occupancy-Based Control by Side-by-Side Experimental Study

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Abstract

Building sensing technologies have evolved rapidly in the last two decades in aid of monitoring building environment and energy system performance. A series of occupancy sensing systems were developed to track the occupant behavior in the indoor space. Occupancy-based building system control is defined as a control method that adjusts the building system operation schedules and setpoints based on the measured occupant behavior and has been identified as a smart building control strategy that can improve building energy efficiency as well as occupant comfort. Some studies demonstrated energy-saving potential and comfort-maintaining capability from occupancy-based control (OBC). This study adopted a first-of-its-kind side-by-side experimental approach to quantify the performance of the occupancy-based Heating, Ventilation, and Air-Conditioning (HVAC) system control in commercial buildings. Three state-of-the-art occupancy sensing technologies were integrated into the real-time HVAC system control in this study. Their detection accuracy and its effectiveness on energy-saving and thermal comfort were analyzed. It was found that the OBC can maintain good thermal comfort and perceived indoor air quality with a satisfaction ratio greater than 80%. Although the daily energy-saving by OBC varied with occupancy sensor accuracy and outdoor environment conditions, the weekly averaged HVAC energy saving was between 17-24%.

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