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Data analytics for occupancy pattern learning to reduce the energy consumption of HVAC systems in office buildings

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Highlights

- Development of data analytics-based methodology for enhancing building energy management
- Occupants' displacement in buildings driven by pattern recognition analysis
- Implementation of an occupancy-based HVAC system operation schedule
- Assessment of energy saving through calibrated energy simulation model

Abstract

In the last few years, the collecting and processing of occupancy data have become emerging issues since they can affect, either directly or indirectly, several energy operations in buildings. The application of data analytics-based methods makes it possible to exploit the potentialities of occupancy related knowledge to enhance the energy management in buildings. A methodology, aimed at implementing an occupancy-based HVAC system operation schedule, is presented in this article. The process is based on the convenience of displacing groups of occupants with similar occupancy patterns to the same thermal zone. An optimisation of the stop schedule of an HVAC system has been investigated, considering a typical week's occupancy patterns. The methodology was used to analyse the Zaanstad Town Hall (The Netherlands), considering anonymous occupancy data for a monitoring period of four months. The resulting optimised schedule was tested, through an energy simulation approach, considering a model calibrated with real energy consumption data. The savings related to the energy consumption of the HVAC system, as a result of the implementation of the strategy, in comparison to an occupancy-independent operation schedule amounted to 14%. The proposed process can be generalized and drive energy managers in evaluating optimised occupancy-based HVAC system operation schedules.