World Academy of Science, Engineering and Technology
International Journal of Civil and Architectural Engineering
Vol:19, No:10, 2025

Modeling and Analysis Of Occupant Behavior On Heating And Air Conditioning Systems In A Higher Education And Vocational Training Building In A Mediterranean Climate

Authors : Abderrahmane Soufi

Abstract : The building sector is the largest consumer of energy in France, accounting for 44% of French consumption. To reduce energy consumption and improve energy efficiency, France implemented an energy transition law targeting 40% energy savings by 2030 in the tertiary building sector. Building simulation tools are used to predict the energy performance of buildings but the reliability of these tools is hampered by discrepancies between the real and simulated energy performance of a building. This performance gap lies in the simplified assumptions of certain factors, such as the behavior of occupants on air conditioning and heating, which is considered deterministic when setting a fixed operating schedule and a fixed interior comfort temperature. However, the behavior of occupants on air conditioning and heating is stochastic, diverse, and complex because it can be affected by many factors. Probabilistic models are an alternative to deterministic models. These models are usually derived from statistical data and express occupant behavior by assuming a probabilistic relationship to one or more variables. In the literature, logistic regression has been used to model the behavior of occupants with regard to heating and air conditioning systems by considering univariate logistic models in residential buildings; however, few studies have developed multivariate models for higher education and vocational training buildings in a Mediterranean climate. Therefore, in this study, occupant behavior on heating and air conditioning systems was modeled using logistic regression. Occupant behavior related to the turn-on heating and air conditioning systems was studied through experimental measurements collected over a period of one year (June 2023–June 2024) in three classrooms occupied by several groups of students in engineering schools and professional training. Instrumentation was provided to collect indoor temperature and indoor relative humidity in 10-min intervals. Furthermore, the state of the heating/air conditioning system (off or on) and the set point were determined. The outdoor air temperature, relative humidity, and wind speed were collected as weather data. The number of occupants, age, and sex were also considered. Logistic regression was used for modeling an occupant turning on the heating and air conditioning systems. The results yielded a proposed model that can be used in building simulation tools to predict the energy performance of teaching buildings. Based on the first months (summer and early autumn) of the investigations, the results illustrate that the occupant behavior of the air conditioning systems is affected by the indoor relative humidity and temperature in June, July, and August and by the indoor relative humidity, temperature, and number of occupants in September and October. Occupant behavior was analyzed monthly, and univariate and multivariate models were developed.

Keywords : occupant behavior, logistic regression, behavior model, mediterranean climate, air conditioning, heating
Conference Title : ICBSM 2025 : International Conference on Building Simulation and Modeling
Conference Location : Dubrovnik, Croatia
Conference Dates : October 04-05, 2025