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"Gheorghe Asachi" Technical University of Iasi, Romania

MEASURING METABOLIC RATE TO IMPROVE COMFORT MANAGEMENT IN BUILDINGS

Andrea Calvaresi, Marco Arnesano*, Filippo Pietroni, Gian Marco Revel

Università Politecnica delle Marche, Department of Industrial Engineering and Mathematical Science, Ancona, Italy

Abstract

Indoor environment significantly affects occupants' health and productivity. However, in smart buildings and cities, it can be improved thanks to the implementation of innovative ICT systems and services. Thermal comfort is one of the most complex aspects to be considered to enhance occupants' well-being, because of the relevant role played by subjective parameters (physiological, psychological and cultural) in its evaluation. This challenge can be tackled by integrating wearable devices into the monitoring framework. Thus, this paper presents an innovative methodology to measure metabolic rate (M) based on wearable devices, which can be used to apply Fanger's comfort model. This model makes use of both environmental and physiological quantities to calculate the PMV (Predicted Mean Vote) index. The former can be easily acquired through standard sensors, on the contrary, providing a good evaluation of the physiological variables of the model (i.e. metabolic rate and clothing insulation) is more difficult. In the proposed methodology, a wearable multi-parametric device has been adopted to measure data from occupants and calculate the metabolic rate. Different sets of physiological data have been investigated to derive the optimal set providing the most accurate metabolic rate. Results from laboratory tests are presented, considering activities ranging from sedentary (1 met) to more active ones (4 met). Finally, a virtual test bench has been developed to simulate a building where the methodology proposed is used to control the indoor air temperature by means of a PMV-based set-point calculation. The methodology has then been compared to traditional approaches with constant *M*.

Key words: metabolic rate, smart buildings, thermal comfort, wearable sensors

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* Author to whom all correspondence should be addressed: e-mail: m.arnesano@univpm.it; Phone: +39 0712204508; Fax: +39 071 2204801