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# Measuring overall thermal comfort to balance energy use in sports facilities

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## Abstract

A study for the development of a monitoring methodology that includes thermal comfort in a smart metering system for sports facilities is presented. The scope of this system is to obtain meaningful information on how energy is used in relation to the level of comfort perceived, so as to allow fully informed management operations. The main problem to be addressed is the accurate quantitative measurement of the thermal comfort inside indoor sports areas (e.g. swimming pools, fitness rooms, etc.), which in this work is estimated through the *PMV* (Predicted Mean Vote) index. The paper describes what needs to be dynamically measured, which parameters are required, which critical uncertainty factors may arise and how to estimate the indicators. A sensitivity and uncertainty analysis for the *PMV* measurement in this specific application is performed to develop a simplified approach. The results obtained from the measurement campaigns made in two different sports areas are presented to validate the approach. Finally, a simulation of swimming pool data is used to preliminarily demonstrate the feasibility and effectiveness of the global monitoring system proposed.

*Keywords:* Comfort measurement, PMV, Energy monitoring, Sensitivity analysis, Uncertainty, Sport buildings, Swimming pool, Gym

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