Capabilities and limitations of commercially available wireless indoor environment sensors

The number of wireless, indoor environment monitoring devices are increasing with the improving measurement technology. This development enables the possibility of deploying many of these sensors in buildings to improve the indoor environment control. Wireless sensors could possibly replace the wired sensors that are integrated in Building Management Systems (BMS) or could be used to develop a remote commissioning process for smaller buildings (those typically without BMS). Yet, if these sensors will be used for commissioning and diagnosing the building operation, it is crucial to determine their measurement capabilities and limitations.

Within the scope of this study, a thorough analysis of the commercially available wireless indoor environment sensors was made and six sensors from different manufacturers were chosen. These sensors were tested in a climate chamber under strictly controlled temperature and CO₂ concentrations (temperatures of 16, 20, 25 and 30 °C, 60.8, 68, 77, 86 °F and CO₂ concentrations of 400, 800, 1200, 1600 and 1930 ppm, resulting in 20 combinations). Three identical sensors for each of the six selected sensor types were tested. Additionally, the effects of the calibration temperature on the accuracy of the CO₂ measurements, and the effects of different humidity levels on the CO₂ measurements were examined. The measurements of temperature, relative humidity and the CO₂ concentrations from these sensors were compared to reference instruments to quantify the deviations from the actual conditions in the climate chamber. Determining the capabilities and limitations of wireless indoor environment sensors (quantification of the deviations from the actual conditions) enables studying the effects of each of these sensors on the HVAC system operation, energy use and indoor environment, if the measurements from one of these sensors were used as inputs to the HVAC system. These effects will be reported in another study using a case study building.

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