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skoleklima.dk – A platform to monitor air quality and thermal comfort in classrooms, developed for teachers and students

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Figure 1 Qualitative evaluation of the CO₂ concentration (left) in some classrooms of a school, and related time series visualization (right) for a working day, from the skoleklima.dk platform.

Smart devices help us solving many complex tasks in an optimal way. In homes for instance, they can run our heating, ventilation and air conditioning systems (HVAC). Within the Smart Cities Accelerator project, among other goals, we aim to apply simple and cost effective smart solutions to get the best reachable indoor climate and thermal comfort at lowest energy cost, in real schools (located around the greater Copenhagen area, and the municipalities of Malmö and Lund in Sweden). Indoor air quality and thermal comfort are essential for a salubrious working and learning environment. We all well know that good thermal comfort conditions and a proper ventilation of the indoor environment lead to less sick leaves. Furthermore, we also know that a poor ventilated classroom exposes both teachers and scholars to high concentrations of volatile organic compounds (VOC) and CO₂. Some VOC can have both short and long terms effects on our health, hence their presence in the air should be minimize. Moreover, levels of CO₂ concentration above 1000 ppm negatively affect the performance of both scholars and teachers.

Over 100 classrooms located in three different schools of the Høje Taastrup Municipality have been equipped with wireless sensors. At time of writing, we collect air temperature, air relative humidity, noise level and CO₂ concentration at 5 minutes intervals. The air temperature and the relative humidity help us evaluating the thermal comfort in each classroom. Moreover, since only human beings (and eventually plants) emit CO₂ in classrooms, monitoring the CO₂ concentration allow us to estimate the air exchange rate of the room. We hence gain fundamental information about how to run optimally the HVAC system. Within the project, we will increase the number of sensors (including also heat meters) and add smart actuators (e.g. thermostatic valves) to get a better control over the HVAC, hence over the indoor climate and over the energy use. The platform skoleklima.dk offers scholars and teachers the opportunity to visualize own classrooms' data, and get a key for a qualitative interpretation of those measurements. We also provide them advices on how to address problems (e.g. when and how to optimally ventilate). In addition, through skoleklima.dk, scholars can run experiments to understand the physics behind the HVAC system and the indoor climate. Furthermore, skoleklima.dk offers the possibility to exchange information related to the indoor climate and the HVAC system between teachers, and between teachers and buildings' managers.