

# Press release

Graz, October 14<sup>th</sup>, 2021

## Artificial Intelligence Provides Comfort in Office Buildings

- **Researchers develop virtual sensor that measures and predicts comfort**
- **Comfort prediction opens up new opportunities for increasing energy efficiency**
- **Simulation results provide added value for planning specialists and Building Information Modeling (BIM)**

Too warm, too cold, too drafty. The indoor climate has a major influence on how comfortable people feel in rooms and on how productively they work. So far and despite advancing digitalization in building technology, comfort in office spaces hasn't been adequately addressed. On the one hand, building management focuses on energy efficiency and the associated cost savings. On the other hand, building technology does not record all of the parameters required to determine comfort since the number of sensors used and physical variables that can be measured are limited. Direct user surveys are time-consuming and often fail due to the lack of feedback. In the future, this could be remedied via virtual sensors, leading to significant improvements.

### Virtual sensor measures what cannot be measured directly

Within the COMFORT project (Comfort Orientated and Management Focused Operation of Room condiTions) funded by the FFG, a team of building technology experts, construction engineers, simulation experts and data scientists has recently developed a virtual sensor to measure comfort using data-driven AI models and simulation models.

Since comfort cannot be measured directly – meaning there is no comfort sensor that can be purchased as a component - experts resorted to a smart combination of hardware and software: influencing factors, such as temperature and mass flow, are obtained from the existing building management system and systematically combined with additional measured values, such as the opening of windows and the air flow, of a recently developed, wireless sensor network. It consists of about 40 nodes, each equipped with several sensors, measuring similar parameters as the building management system, but instead of one measuring point per room, there are ten or more. In addition, meteorological data is included in the database.

During the simulation, the building's entire energy consumption due to heating or cooling is simulated. In addition, the temperature and the air flow can be simulated in any random point inside the building. By merging various data sources into a homogeneous database, the big data principle is applied.

“All this data creates the basis of the novel combination of AI and simulation models, enabling both methods to optimally unfold their respective strengths. AI methods, for example, are well suited for predicting long-term warming during the summer months, while a simulation can precisely

determine short-term fluctuations in air flow. The results of AI methods and simulation together feed the virtual sensor, which derives a comfort value based on that,” explained Heimo Gursch, Project Manager at Know-Center.

### **Proof via a Practical Test**

The virtual sensor was tested for its practicality in the test boxes at the Technical University of Graz and on campus of LogicData in Deutschlandsberg. It appeared that determining a more precise comfort level allows to identify margins for energetic improvements. An energy flow analysis, for example, showed that the air exchange rate in one of the test rooms was too high. In this case, the energy consumption of the ventilation was reduced by a lower air exchange without diminishing the comfort.

### **Future Integration with Building Information Modeling (BIM)**

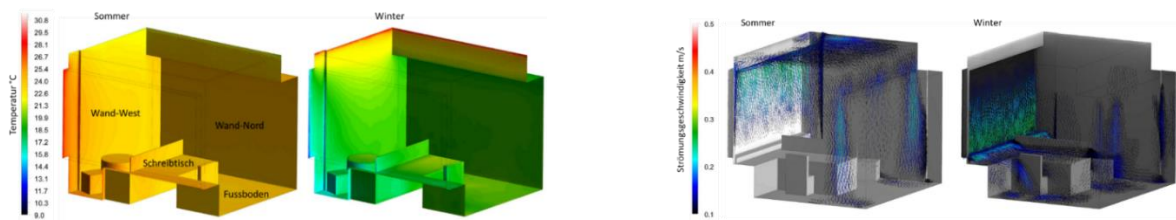
BIM is a concept for digital planning of buildings and managing them after construction. The same information that is stored in the BIM is required to create simulation models. So far, however, there are no software tools to convert the information from BIM automatically and fully into simulation models. Most of the information must be transferred manually and in the event of changes in BIM adapted anew. Within the project, a catalog of requirements was created on how the exchange between BIM and the simulation models can be automated in the future. An automated exchange offers added value for planning specialists and BIM managers since they can use simulation results for comfort and energy efficiency assessments in the early planning stages.

The following institutions were involved in the COMFORT project: Know-Center, Silicon Austria Labs, Salzburg University of Applied Sciences, the Institute for Thermal Technology of Graz University of Technology, EAM Systems GmbH, EU DT Energie- u. Umweltdaten Treuhand GmbH, Thomas Lorenz ZT GmbH, IKK Engineering GmbH, LOGICDATA, Central Institute for Meteorology and Geodynamics.

### **Caption including credits**



Wireless sensor nodes record physically measurable influences on comfort in the room, such as temperature, humidity, window opening, etc., and supplement the building management system’s data base. ©Know-Center



Simulations predict temperatures and air flows. The simulation data is aggregated together with the sensor data, data from the building's control system and meteorological data in a homogeneous database and feed the virtual sensor.

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### About Know-Center

Know-Center is one of Europe's leading research centers for Data-Driven business and AI. Since 2001, well-known companies have been supported in using data as a success factor for their business. The center successfully handles numerous projects and contract research at EU and national level as an integral part of the European research landscape. The K1 Competence Center, which is funded by COMET, is the leading training center for data scientists in Austria and furthermore offers a range of AI training and consulting services to companies. The majority shareholder of Know-Center is Graz University of Technology, a major contributor to domestic AI research, whose institutes handle numerous projects together with Know-Center. In 2020, Know-Center was the only Austrian center to receive the iSpace Gold Award by the Big Data Value Association, which to date has only been awarded nine times throughout the entire EU. <https://www.know-center.at>