Smart buildings – Buildings for tomorrow

In the near future, architecture will need to provide much more than ever before. The path from pre-industrial buildings to the state-of-the-art, high-tech constructions of our modern age took only two hundred years. Today, highly technical buildings and infrastructures are standard. However, in the intricate interplay of ventilation systems and room heating, comprehensive electronic controls and green electricity generation on the roof of the building, it is becoming increasingly important to plan your building in a networked way and equip it with electronically controlled intelligence. Smart buildings are the key to a smart city that functions holistically – in other words, the interplay of buildings and infrastructure via networked systems. And they offer the necessary space to optimally coordinate technology and human needs.

The term "smart building" refers to single-purpose buildings, i.e. office and retail properties, research, administration, production and logistics buildings in which the essential functions for building control are automated and networked with one another. Unlike in a smart home, where a task is carried out separately by sensors or chips, in a smart building they are connected to each other in and on the building in order to ensure the automation of individual functions and the interaction with the other technical applications and systems.

From energy consumer to smart, "plus-energy" building

A smart building calls for smart technology to be considered as early as the planning phase, ideally beforehand, when describing the function and defining the customer requirements. The central goal is to significantly increase the comfort and efficiency of the building compared to a conventional construction. The intelligent control of energy consumption and energy gain (for example by using the warmth input or PV systems) can increase energy efficiency to such an extent that the building itself becomes a source of energy. Self-generated electricity can then be buffered in smart energy storage or fed directly into the energy network of the city or region.

End-to-end networked data flow and comprehensive monitoring

There's no clear-cut way to differentiate what is classed as a smart building. However, the focus is always on the end-to-end flow of data between the various components: the sensors and actuators, the devices for building and system automation as well as digital IT and the connected servers. In order for intelligence, the so-called "smartness," to emerge from the hardware, from the building itself, a central program, or software, is necessary. This software always has a large number of open interfaces (API, the "Application Programming Interface") for transmitting and feeding the resulting data into the central IT. It interprets this and deduces the subsequent actions.

Digital data can be processed by central in-house servers or decentral, cloud-based systems. Depending on what the security requirements allow and what the operator desires, data protocols are exchanged for public monitoring and the improvement of automation functions, or components or entire buildings are networked with one another. In this case, the users receive access to the overall data pool in the cloud, assess the collected, structured data and use it for their central facility management in the operation of their own building.

This allows for the building performance to be analyzed and assessed, as well as for the systems involved to be continually improved.

Data analysis, assessment and optimization in the operation of the building
Because the intelligent networking of systems based on the data and information this provides to the system IT is still in the trial phase in many areas, analysis, assessment and optimization are the most important tools for establishing the smart building within our architecture landscape. The building lifecycle has a central role to play here: From the determination of requirements to the complete planning, construction and building operation, to renovation or recycling that is as pure as possible during demolition, it encompasses all phases in the life of the building. The data gained from the "as-built" model, i.e. from the planning for the handover to the building operation as well as the building operation itself , are of intrinsic importance for consideration of the complete lifecycle. This also allows a smart building to remain "intelligent" past the end of its service life: The exact qualification and quantification of the raw materials and construction products used form the basis for their reuse in another smart building with sustainable, reusable resources.

Buildings are not automatically "smart." Rather, the technical intelligence of the building emerges through the multifaceted and networking of various applications in the building itself which results in automated processes. Here's a simple example: The wind gauge sensor on the roof of an office building measures high wind speed. This information is transmitted to the central server via the connected data line and assessed by the software. The information that it's stormy doesn't trigger a direct follow-up action yet. But the home automation software recognizes the specific situation, compares the wind values with stored standard values, decides what needs to be done within the specified spectrum and raises the exterior sunscreen so that no damage can result from gusts of wind. In this case, a system component (wind sensor) is connected with another, generally independent system (exterior blinds). The resulting action (raising the sunscreen) is a result of measuring, assessing and previously defined reaction to excessive wind speed. This relatively simple technology that has been integrated into hundreds of thousands of buildings around the world for many decades by no means make a building smart. Nor does the networking of the aforementioned functions. Instead, what makes a smart building is when all of the data recorded from operation is collected, monitored and used to further optimize the operation of the building. And when this is done so comprehensively that a) the functionality is continuously improved and b) the user comfort is consistently increased.

Anonymized data doesn't allow any conclusions to be drawn about the users
Data is collected within the parameters of the applicable General Data Protection Regulation (GDPR). In addition to operational data, personal data is also constantly being collected inside a building. This begins with the registration at the entrance of an office building, continues with the controls on the elevator for reaching the right floor and doesn't stop at the door to your own office, which locks electronically and is opened by the correct access card. There are also personal settings (room temperature, ventilation system, individual lighting situation) and the chance to order and pay electronically with your own access card at the vending machine. All of this information is valuable because it records the individual user behavior and can derive personal patterns from this. However, in line with data protection, this information is all to be anonymized in such a way that the data no longer allows third parties

to draw detailed conclusions about the individual. In addition, all recorded information must be stored and managed so that unauthorized persons have no access to it and external attacks on the building infrastructure (e.g. through hacking) are prevented.

Summary

It is debatable whether the future of our built architecture lies in smart buildings alone. However, they are certainly the future of building automation. The detailed collection of operational data and the optimization of the associated processes and actions of the building technology offer many advantages for operators and users. The speed at which smart buildings will become the defining building standard for our built architecture environment depends primarily on the quality of the data collected and its low-threshold availability for everyone. Only the data analysis and targeted evaluation makes the optimization potential in a smart building visible. The steadily growing use of artificial intelligence in the building planning sector and in facility management also significantly abet this. The Internet of Things (IoT), in connection with self-learning systems and networked building technology, creates the framework for the smart buildings of our future: Green in terms of construction, operation and recycling, seamless in terms of technology usage over its entire lifetime, and comfortable and flexible to use for the people that interact with them.