SIEMENS

Ingenuity for life

New Criteria for a New, Smart Building Era

A smart building is an active contributor to the experience and success of its stakeholders.

siemens.com/smart-buildings

New Criteria for a New, Smart Building Era

Technology enabling data capture and analysis, connectivity, monitoring and control is becoming the new baseline for smart buildings of tomorrow. Understanding what it is and where it's headed is critical.

Progress in building science, making structures better for users and their physical environment, has long been defined by advancements in the hard and the tangible: architectural design, structural integrity, building materials, mechanical components and the like.

Those priorities remain as vital as ever, but now there's a new wrinkle when it comes to creating structures that will perform to modern standards and expectations. Today, the qualities of a building's digital infrastructure, the information and operational technology network embedded in everything that enables its routine functioning, easily rivals the physical infrastructure in importance.

Digital technology, it's safe to say, has been revolutionizing buildings for some time, just as it has been upending so many aspects of the human experience over the last several decades. More controllable, better monitored and increasingly responsive, technology-aided and -enhanced buildings are delivering a better user experience and operating more efficiently.

But the future of buildings is still being written. Present now, but still very much in the process of refinement, is the smart building, one characterized by the presence of a digital infrastructure robust enough to collect and amass building operational data; provide connectivity needed to analyze, learn from it and share it; and ultimately leverage it for the benefit of the broad roster of stakeholders.

All of those capabilities are being exploited in many new buildings designated as smart. But just as there's no ceiling on human intelligence, there's yet no evidence that smart buildings are nearing their full capacity in terms of functionality. While many technologies that make building intelligence possible are now robust and capable and delivering on their promise, more advancements are possible and bear watching, just as new technologies now in their embryonic stages must be closely followed by all stakeholders. A few core technologies and technology applications, in various states of build out, should be on the radar of those interested in monitoring and evaluating smart building progress.

Data connectivity and analysis

Building self-learning, which enables high-level automation and control, relies on effective data capture, sharing and crunching. Data captured from sensors in a building's complex web of systems that keep it running must be accessible and capable of being interpreted and leveraged. Networks, in turn, are elemental to smart buildings, which are fast becoming an offshoot of the rapidly spreading and maturing Internet of Things (IoT) – an environment in which individually addressable devices communicate via the Internet using a set of commonly understood communications standards and protocols, sharing data, responding to commands and even acting autonomously.

With the rise of smart buildings, the Building Internet of Things (BIoT) is now taking shape. It aggregates data from a building's connected systems, devices and assets, which may be separate from or incorporated into a building automation system (BAS). The BIoT comprises a number of basic building blocks: sensors to capture data; actuators that use data and analytics to provide a response; network standards that allow hardwired or wireless transmission of data; application platforms that provide the language for communication; and data storage and analytics that form the brains of the system and the functionality needed for automation.

"We need to ensure that the technology installed today is future-proofed and can interact easily with other devices/control systems – this is critical for smart buildings. There is an emerging danger period where we have technology that is quickly becoming redundant."

Richard Hardy, Managing Director, BRE Global

"There has been the expectation that a digital twin model will improve the operational efficiency of a building. But in order to do so, the digital twin will need to contain both static data from the construction phase of the building and the dynamic data of the technical systems and the occupants during the operational phase.
I think the industry is only at the beginning of learning how to connect the static and dynamic data into the digital twin."

Philip Chan, Strategy Manager, Smart Infrastructure

Many elements of the BIoT are well in place, but progress is still needed in the area of meshing and merging different technologies and systems. Common standards and the availability of flexible, open architecture for data networks are vital to seamless communication.

Digital twin

Planning is essential to the development of smart buildings that end up utilizing technology effectively and working as intended and to the benefit of users. An important emerging element of the planning process is the virtual fashioning of the structure utilizing building information modeling (BIM).

One product of the process is a "digital twin," a virtual computer model of the structure that permits simulating, testing and correcting design options prior to construction. The twin simplifies coordination with multiple design and engineering disciplines, sidestepping possible design conflicts that can be costly to correct during or after construction.

In the context of designing a smart building's features, the twin would enable analysis of a structure's response to changes based on such variables as occupancy levels or different energy supply sources. The effect of, say, adding a door or window, could be analyzed in the twin in the context of different building evacuation scenarios and the impact on heating and cooling costs. Post-construction, a digital twin can incorporate live data from the building and allow ongoing comparisons with original design. Serving as a central repository for all information associated with the building the twin becomes a platform for testing and optimization of building control scenarios as needed.

Cyber-security

Connected devices are the foundation of smart buildings, and little could be accomplished without them. But their presence also poses a security risk that technology must be capable of addressing.

An Internet of Things configuration offers multiple points of entry for potential hacking. That exposes both building information and operational technology systems. With critical building systems networked to allow remote management and monitoring, and both IT and OT communicating with each other, a cross contamination risk is real.

To limit the security threat potential, smart building technologies must address both physical and cyber-security risk. On one-layer, physical building access must be monitored with occupancy monitoring and control systems for anomalies that could indicate a cyber-attack. On another, digital networks must be safeguarded with firewalls and data encryption. Thirdly, system integrity must be ensured with individual systems and terminals protected from access by unauthorized individual as well as unauthorized changes.

In short, the trend to extensive building digitalization, and increased reliance on it, can be a double-edge sword when it comes to security. Utilizing the full range of security features a smart building system offers can limit the potential for a cyber-attack that could put building operations and users at risk.

Space management

Gaining a better understanding of exactly how occupants use a building is a central component of the smart building approach. Data captured through sensors is the foundation of being able to program a building's operational system so it aligns with usage patterns and responds appropriately to needs. Tracking and logging user movements, monitoring building area occupancy levels and trends, and providing real-time information to occupants, smart building technology helps improve space utilization to the benefit of both users and the building's energy requirements.

Space under-utilization is one of the biggest inefficiency problems buildings present. Some research suggests that traditional assigned-desk configurations in office buildings leave those desks unused up to half the day, and that meeting rooms and other shared areas are often empty as well. That means significant areas of a building, for significant periods of time, are likely being lit and heated/cooled when no one is present.

Activity-based working (ABW) approaches have consequently begun to blossom. They move workers away from a single desk and toward a setup where workers can congregate in more defined, but less restrictive workspaces. The approach offers more flexibility and potentially reduces the need to extend power and a working environment across large areas of a building.

The smart building configuration could go a long way to making that more feasible for more employers. With real-time monitoring of desk and room occupancy via sensors embedded in desk or lighting systems,

"The Corporate Real Estate industry will increasingly engage with occupiers to understand space needs better and clever optimized use of space will be a major future factor. Space will become more activity based with overall reduced area and higher utilization. Ongoing monitoring of space use will allow these learnings to constantly improve."

Ruairi Revell, Sustainability Advisor Real Estate, Standard Life Investments

workers alone or in groups could quickly locate available work areas tailored to their needs. The information would be accessible via mobile phones or live CCTV video feeds analyzed by facial recognition software.

Occupancy detection is destined to become a central feature of smart buildings as efforts to improve space utilization advance. By extension, building users stand to benefit through enhanced productivity and better overall interaction with the building environment.

Predictive operation and maintenance

Providing an integrated platform for all elements of building management, digitization can transform the approach to operation and maintenance. Typically, the current approach involves reliance on a mix of control and management systems. That's long been achieved with an expert operations staff capable of managing troubleshooting, inspection, repair and replacement as needed. But even top-notch building operations and maintenance staff often must make guesses about the source of system problems and the timing of service cycles and replacement; actual performance data has played a limited role in decision-making.

In a smart building configuration, sophisticated sensoring technology enables deep monitoring of building physical plant operations that can supplement knowledge and expertise held in human hands. With digitalization, system performance can be monitored and tracked; servicing and maintenance needs can be predicted and planned; and costs can be better compared and estimated based on multiple variables. They can include the age and service record of plant and equipment; its level of usage and how critical it is to building functions; and the investment needed to repair or replace.

The result is more efficient and cost-effective system maintenance and movement toward a predictive or "just-in-time" approach to maintenance. That means less unplanned downtime or outages, with necessary replacement or repair optimally scheduled. Additionally, money is saved by reducing unneeded or premature parts replacements and by minimizing the impact on building operations.

Energy needed to run building systems also can be better managed with smart building technology. In some buildings energy management has become completely digitalized, with facilities managers able to review and optimize the building's energy performance using a mix of real-time and historical data to adjust or upgrade equipment such as the HVAC system. Facilities managers are thus able to adopt a more strategic stance informed by data provided by new technologies aimed at improving facility performance.

Monitoring and control

Reduced energy consumption in smart buildings is a savings opportunity not only with respect to money, but the environment. Reduction of a building's energy footprint translates to reduced energy production, much of which is still dependent on burning of carbon dioxide-emitting fossil fuels. The smart building, equipped with technology that closely monitors and controls energy consumption based on needs and resources, is well-situated to become another type of structure increasingly sought after: the green building.

The smart technology that enables improved operational efficiency and energy savings positions enables the smart building to be more environmentally friendly and sustainable. Buildings increasingly designed to have on-site renewable energy to supplement or even replace grid-supplied energy are edging toward "zero energy

"Digitalization hits all the sustainability elements. It can provide efficiency improvements through optimization way beyond the current building management system (BMS) capability. It will also be key for improving health and well-being, and occupiers will soon want to know about internal air quality, driving landlords to monitor and improve air quality levels."

Ruairi Revell, Sustainability Advisor Real Estate, Standard Life Investments

building" status, which is likely to become the next meaningful marker for a new generation of buildings.

The sustainable building model has long revolved around a building materials and equipment approach that ties energy reduction to better physical infrastructure design. That remains important, but the other emerging dimension relates to better building systems management. A more proactive and ongoing effort to discover areas of energy waste in operations, using smart technology, may prove equally consequential. Improvements acquired through digitalization could translate into a new target for building energy savings and reduction of the environmental footprint.

Partnering for a smarter future

Experts are emerging to help building stakeholders move ahead more confidently toward a smart building future. One of the undisputed leaders is Siemens, a company with a rich history in understanding buildings and developing technologies to improve their efficiency and utility. Present at the dawn of the smart building era, Siemens continues to solidify its position in the space and accelerate efforts to craft a portfolio of solutions to help building owners and developers design and execute a strategy.

Through its Siemens Smart Infrastructure unit, the company is laser focused on balancing the thirst for advanced building technology with the practical, achievable needs of building stakeholders. It understands that while technology, and data specifically, is the centerpiece of a smart building the value comes from knowing its power – and its limitations.

Recent investments have driven Siemens Smart Infrastructure deeper into its smart building commitment, ones that reflect the company's vision and understanding of the need to develop a portfolio of vertically integrated solutions. Acquisition of Building Robotics and its Comfy building occupant

"We have reached the tobacco moment of climate change, and people are starting to take action against companies and organizations. Pension funds have a duty to look at the long term and therefore responsibility to manage this risk. Digitalization can help with demonstrating this risk management."

Tatiana Bosteels, Director, RPI & Sustainability, Hermes Investment Management

app; Enlighted, a provider of sensor and building analytics tools; and J2 Innovations, a building automation and operating system vendor, put more leading-edge technology into Siemens' hands and give it the breadth of expertise demanded of leading smart building solutions providers.

That's certain to become more important as demand for smart buildings grows and the range and depth of enabling technology expands. Stakeholders dizzied by the options – as well as the stakes themselves – will increasingly look to capable partners to guide them through the maze and grasp the full promise of next-generation buildings.

The challenge of delivering on that is sure to grow in complexity. Buildings of tomorrow will be called to account on numerous fronts, from enhancing the user experience to reducing energy usage and the environmental footprint to controlling costs of operation. Today, we have not only smart buildings, but also green buildings, zero-energy buildings and people-friendly WELL buildings, all reflecting a range of demands that buildings become better and a growing confidence that they indeed can. But it won't happen by throwing technology at buildings, chasing bells and whistles down blind alleys in the hope that more equals better.

Instead, it will demand taking a step back, assessing needs first and then moving ahead deploying the digital tools that will truly transform buildings and their role in the built environment.

Conclusion

Mass digitalization is clearly a game changer for buildings – from how they're initially conceived and designed, to how they're built and ultimately utilized. The possibilities for using digital technology to create a broadly defined, across-the-board better building stakeholder experience are only beginning to be understood and appreciated, more so with the help of those with proven expertise in configuring smart buildings that perform.

On paper, both new and modernized buildings will likely have far more native intelligence than their analog predecessors. The trick for these smart buildings, though, just as it is for the book-smart human, will come in translating that capability to the real world. Indeed, the challenge that confronts all would-be smart building developers is mistaking the presence of raw capabilities for the ability to achieve clear, meaningful results. But those are attainable when human intelligence and know-how intersects with smart digital technologies. In the end, that's what will produce buildings that truly work – for people – in the demanding 21st century.

Published by
Siemens Switzerland Ltd.

Smart Infrastructure
Global Headquarters
Theilerstrasse 1a
6300 Zug
Switzerland
Tel +41 58 724 24 24

For the U.S. published by
Siemens Industry Inc.

100 Technology Drive
Alpharetta, GA 30005
United States

Article no. SI_0183_EN (Status 11/2019)