DOWNLOAD PDF INTELLIGENT BUILDING SYSTEMS

Chapter 1 : Intelligent Buildings | Automate, Communicate and Integrate

IntelligentBuildings provides smart building consulting and managed services for organizations in commercial, corporate, campus and government real estate.

Internet of Things collection Specifically, the Internet of Things IoT is already having a significant impact on the CRE industry, helping companies move beyond a focus on cost reduction. IoT applications aim to grow margins and enable features such as dramatically more efficient building operations, enhanced tenant relationships, and new revenue generation opportunities. While consumer IoT devices have drawn most press attention, it is enterprise-level adoption of the technology that will likely have the bigger impact on industry. Indeed, the CRE industry is perhaps uniquely positioned to implement the technology, using IoT-enabled building management systems BMS to make building performance more efficient and also use sensor-generated data to enhance building user experience. For instance, sensors in shopping malls can help owners connect directly and offer services to end customers. This would lead to building relationships with customers as well as strengthening tenant engagement. What is the IoT? Conceptually, the IoT implies physical objects being able to utilize the Internet backbone to communicate data about their condition, position, or other attributes. With the cost of sensors, data storage, and connectivity all falling, 4 we expect more CRE firms to move forward in adopting IoT applications. In fact, sensor deployment in the sector is likely to grow at a compound annual growth rate of Using such sensors, the IoT promises to turn any object into a source of information about that object and its environment. This creates both a new way to differentiate products and services and a new source of value that can be managed in its own right. In the CRE context, the value created from the information generated by IoT-enabled buildings has the potential to widen the lens on value creation beyond location through a level of efficiency and effectiveness that could distinguish buildings within a marketplace from a desirability and profitability standpoint. An act is monitored by a sensor that creates information, that information passes through a network so that it can be communicated, and standardsâ€”be they technical, legal, regulatory, or socialâ€”allow that information to be aggregated across time and space. Augmented intelligence is a generic term meant to capture all manner of analytical support, collectively used to analyze information. The loop is completed via augmented behavior technologies that either enable automated action or shape human decisions in a manner leading to improved action. In the CRE context, different types of sensors that track features such as motion, pressure, light, temperature, and flow create a vast amount of data around building operations and the environment. This information passes through a network such that various parts of the BMS communicate with each other and the vast set of structured and unstructured data can be aggregated on a real-time basis at a building, portfolio, and even metropolitan level. The aggregated information can be analyzed using different tools to develop descriptive, prescriptive, and predictive insights for building operations teams both landlords and tenants. The loop is completed when the BMS demonstrates augmented behavior in the form of increased automated actions related to monitoring and tracking, among other things, or influencing human decisions for both the landlord and tenant. The amount of value created by information passing through the loop is a function of the value drivers identified in the middle. Falling into three generic categoriesâ€”magnitude, risk, and timeâ€—the specific drivers listed are not exhaustive but only illustrative. Different applications will benefit from an emphasis on different drivers. The uses of the IoT: Far beyond motion-sensor lighting For CRE executives who have long looked to automate building maintenance activities, all the IoT hype may sound inflated: Is this just a new buzzword for old practices? But it may not be. Yes, CRE companies have been installing sensors and automating activities for some time, primarily aiming to realize the benefits of low-hanging fruit such as cost savings and operational efficiency through improved energy management and reduced personnel costs. Figure 4 depicts approaches to developing a connected BMS, each progressively more connected and integrated than its predecessor. Typically, CRE owners install BMS on a piecemeal basis to automate individual tasks such as elevator or lighting control; 5 not surprisingly, owners then must collect and aggregate data from various places see figure 4. Realizing the limitations of individual BMS, more mature CRE companies have begun using partially integrated BMS, 6 combining automation of a few activities with a common focus, such as energy management systems. Compared with individual BMS, these systems are more integrated, require less manual intervention, and enable faster decision making. More importantly, CRE owners use these systems to enhance tenant and end-client experience through sustainability initiatives including to support LEED and other green building certification standards , open Wi-Fi access, and so forth. It can leverage one infrastructure to operate all building management solutions and require minimal to no manual involvement. Internet protocol or IP-enabled devices can facilitate intelligent decision making by automating point decisions and enhancing strategic insights; this allows data to automatically flow all the way around the Information Value Loop without manual interaction, enabling quick action on the data and creating new value for CRE companies. The way in which IoT-generated information creates value represents a fundamental shift for CRE companies. In creating value through information generated by connected systems, IoT applications can not only improve efficiency but provide new opportunities for differentiation and even new revenue. Where the value is: Leveraging IoT data Given the current focus on costs and margins, CRE companies may be predisposed to seek to improve margins first through tried-and-true methods of cost savings and operational efficiency, rather than connectivity. But IoT applications offer more possibilities to build upon those efficiencies, enabling CRE companies to use data generated through connected systems to differentiate their services and identify new revenue opportunities. Creating value through efficiency With BMS already firmly established in the CRE sector, it is perhaps no surprise that many of the initial uses of IoT technology help CRE companies by increasing efficiency through enhanced building performance and better portfolio and liquidity management. Enhanced building performance IoT-enabled BMS can be used to reduce energy use, repair and maintenance, and administrative costs. For instance, property owners can use the data collected by motion and occupancy sensors at a building level to regulate air-conditioning and lighting in real time, thereby reducing energy costs and optimizing the internal environment for its intended purpose. CRE companies can also offer clear value to tenants, since the system could lead to lower energy bills. Real-time monitoring can bolster internal security, and specialized weather sensors provide advance warnings of adverse weather events. Better portfolio risk management and liquidity Enhanced tracking and monitoring at a building and portfolio level, along with use of portfolio analytics, can result in lower asset risk, more granular valuations, and enhanced portfolio management capabilities. For example, tracking the flow of people can enable CRE owners to analyze occupant behavior and space usage patterns, while acknowledging privacy limitations. This information may help them identify excess capacity and develop action plans for peak hours, ultimately resulting in more efficient portfolio management. Several tech startups are automating brokerage and leasing tasks and activities, openly sharing CRE pricing and valuation information, lowering barriers between potential tenants and CRE owners. Potential buyers could see not only static data about price and valuation but also real-time area data about traffic, crime, or other real-world factors that impact property values. For real estate investment trusts REITs in particular, this development would improve their ability to understand and profile risks on an individual asset basis, opening the opportunity to sell or swap assets to rebalance portfolios. Conversely, it may also empower tenants to have more informed negotiations at rent review. Creating value through differentiation With the amount of connectivity and data generated by IoT-enabled buildings, CRE owners have an opportunity to differentiate themselves by using the information to identify unmet consumer demands, provide more sophisticated services to their tenants and transform tenant and user experience, and contribute to the broader ecosystem. By offering services their competitors as yet lack, CRE companies using IoT applications in this way could charge premium prices and improve margins. In fact, tenants will likely soon come to expect IoT features, meaning that a building lacking them may trade at a discount. Some of these opportunities include: Focus on employee and occupant health and productivity Service innovation to tenants Benefits to the broader ecosystem Focus on employee and occupant health and productivity The potential impact of IoT applications is hardly limited to machinesâ€”it can also track and help to improve employee and occupant health and productivity. In addition to enabling predictive maintenance, wearables such as smart glasses can combine IoT technology with augmented reality to provide prompt information and guidance to workers in the field, particularly during the construction stage. Combining BMS-captured environmental data temperature and air quality with movement data from motion sensors and other sources could allow CRE companies to understand the optimal ventilation and temperature levels for a specific day. Service innovation to tenants Fierce competition and changing patterns in consumption and work are forcing companies in many sectors to reevaluate their CRE space usage as they look for innovative ways to cut costs and derive value. Many companies now continuously resize their CRE requirements to adapt to lower demand for physical space. The retail sector is a classic example of this trend, as online sales growth is eroding demand for physical stores: Analysts expect 50 percent of American malls to close by CRE owners can use IoT data to create differentiation right from the development stage. For example, AirSage, a location-based service provider, collects real-time location data for billions of mobile devices each day. These are just a few examples. To help illustrate the wide variety of possible IoT uses in differentiating CRE companies, the interactive graphic shows a number of examples broken down by property type. Connected buildings can drive meticulous tracking of information on sustainability initiatives related to energy, water, and waste management and boost efforts to reduce the impact of climate change. Further, sustainability analytics can help CRE companies decrease their carbon footprint, have more sustainable properties in their portfolio, and eventually differentiate themselves in the marketplace. In the case of energy, increased IoT adoption can imply more detailed and real-time monitoring of all devices that consume energy in a building and better connectivity with the smart grids. This essentially means that companies can combine, analyze, and present insights from the large sets of data in a manner that tenants or other stakeholders can purchase and augment their actions and behavior. As an example, data on people moving within a building can potentially be sold to advertisers or urban planners to help them in their decision making. In another example, retail real estate owners can capture and analyze end-customer demography, purchase, and movement data and sell it to their tenants. CRE companies can likely sell building performance information to institutional investors to allow them to make informed investment decisions. Companies can combine, analyze, and present insights from the large sets of data in a manner that tenants or other stakeholders can purchase and augment their actions and behavior. How to maximize IoT value? IoT technology offers many potential benefits, but its implementation largely remains in its infancy. A bottleneck is characteristically seen as a bad thingâ€”a limiting factor in an otherwise smooth, even flow 22 â€"but in the value loop, it is also an opportunity for the company that removes that bottleneck, because in creating new value for all, the company can capture a large part of that value for itself. The bottleneck in any flow is going to depend on what is flowing and under what circumstances. Therefore, much as we see IoT technology creating three categories of new value in CRE, there is a different bottleneck in each case, as well as cybersecurity and privacy issues that cut across all, as table 2 illustrates: Bottlenecks and key challenges to value capture Value to CRE.

Chapter 2 : Intelligent Building Automation Systems, Inc.

An intelligent building management system is a single platform that controls and integrates building management systems into a unified whole over an IP network. Building owners today face a number of challenges, as they search for ways to.

Building management system The term building automation system, loosely used, refers to any electrical control system that is used to control a buildings heating, ventilation and air conditioning HVAC system. Modern BAS can also control indoor and outdoor lighting as well as security, fire alarms, and basically everything else that is electrical in the building. Modern systems rely on standards-based multi-protocol heterogeneous networking such as that specified in the IEEE These accommodate typically only IP-based networking but can make use of any existing wiring, and also integrate powerline networking over AC circuits, power over Ethernet low-power DC circuits, high-bandwidth wireless networks such as LTE and IEEE Proprietary hardware dominates the controller market. Each company has controllers for specific applications. Some are designed with limited controls and no interoperability, such as simple packaged roof top units for HVAC. Software will typically not integrate well with packages from other vendors. Current systems provide interoperability at the application level, allowing users to mix-and-match devices from different manufacturers, and to provide integration with other compatible building control systems. These typically rely on SNMP , long used for this same purpose to integrate diverse computer networking devices into one coherent network. Types of inputs and outputs[edit] Sensors[edit] Analog inputs are used to read a variable measurement. Examples are temperature , humidity and pressure sensors which could be thermistor , 4â€”20 mA , 0â€”10 volt or platinum resistance thermometer resistance temperature detector , or wireless sensors. A digital input indicates if a device is turned on or not - however it was detected. Digital inputs could also be pulse type inputs counting the frequency of pulses over a given period of time. An example is a turbine flow meter transmitting rotation data as a frequency of pulses to an input. Nonintrusive load monitoring [5] is software relying on digital sensors and algorithms to discover appliance or other loads from electrical or magnetic characteristics of the circuit. It is however detecting the event by an analog means. These are extremely cost-effective in operation and useful not only for identification but to detect start-up transients , line or equipment faults, etc. Another example is a variable frequency drive ramping up a motor slowly to avoid a hard start. Digital outputs are used to open and close relays and switches as well as drive a load upon command. An example would be to turn on the parking lot lights when a photocell indicates it is dark outside. Digital outputs could also be pulse type outputs emitting a frequency of pulses over a given period of time. An example is an energy meter calculating kWh and emitting a frequency of pulses accordingly. Controller[edit] Controllers are essentially small, purpose-built computers with input and output capabilities. These controllers come in a range of sizes and capabilities to control devices commonly found in buildings, and to control sub-networks of controllers. Inputs allow a controller to read temperature, humidity, pressure, current flow, air flow, and other essential factors. The outputs allow the controller to send command and control signals to slave devices, and to other parts of the system. Inputs and outputs can be either digital or analog. Digital outputs are also sometimes called discrete depending on manufacturer. Controllers used for building automation can be grouped in three categories: However an additional device can also exist in order to integrate third-party systems e. The installer typically selects one of the available pre-programmed personalities best suited to the device to be controlled, and does not have to create new control logic. Occupancy[edit] Occupancy is one of two or more operating modes for a building automation system. Unoccupied, Morning Warmup, and Night-time Setback are other common modes. Occupancy is usually based on time of day schedules. In Occupancy mode, the BAS aims to provides a comfortable climate and adequate lighting, often with zone-based control so that users on one side of a building have a different thermostat or a different system, or sub system than users on the opposite side. A temperature sensor in the zone provides feedback to the controller, so it can deliver heating or cooling as needed. If enabled, morning warmup MWU mode occurs prior to occupancy. This is also referred to as optimized start. An override is a manually initiated command to the BAS. For example, many wall-mounted temperature sensors will have a push-button that forces the system into Occupancy mode for a set number of minutes. Where present, web interfaces allow users to remotely initiate an override on the BAS. Some buildings rely on occupancy sensors to activate lighting or climate conditioning. Given the potential for long lead times before a space becomes sufficiently cool or warm, climate conditioning is not often initiated directly by an occupancy sensor. Lighting[edit] Lighting can be turned on, off, or dimmed with a building automation or lighting control system based on time of day, or on occupancy sensor, photosensors and timers. A photocell placed outside a building can sense darkness, and the time of day, and modulate lights in outer offices and the parking lot. Lighting is also a good candidate for demand response , with many control systems providing the ability to dim or turn off lights to take advantage of DR incentives and savings. Lamps with DALI ballasts are fully dimmable. This can save money by using less chilled or heated water not all AHUs use chilled or hot water circuits. To optimize energy efficiency while maintaining healthy indoor air quality IAQ , demand control or controlled ventilation DCV adjusts the amount of outside air based on measured levels of occupancy. Analog or digital temperature sensors may be placed in the space or room, the return and supply air ducts , and sometimes the external air. Actuators are placed on the hot and chilled water valves, the outside air and return air dampers. The supply fan and return if applicable is started and stopped based on either time of day, temperatures, building pressures or a combination. Constant volume air-handling units[edit] The less efficient type of air-handler is a "constant volume air handling unit," or CAV. The fans in CAVs do not have variable-speed controls. They heat or cool the spaces by opening or closing chilled or hot water valves that feed their internal heat exchangers. Generally one CAV serves several spaces. A VAV air handler can change the pressure to the VAV boxes by changing the speed of a fan or blower with a variable frequency drive or less efficiently by moving inlet guide vanes to a fixed-speed fan. The amount of air is determined by the needs of the spaces served by the VAV boxes. Each VAV box supply air to a small space, like an office. Each box has a damper that is opened or closed based on how much heating or cooling is required in its space. The more boxes are open, the more air is required, and a greater amount of air is supplied by the VAV air-handling unit. Some VAV boxes also have hot water valves and an internal heat exchanger. The valves for hot and cold water are opened or closed based on the heat demand for the spaces it is supplying. These heated VAV boxes are sometimes used on the perimeter only and the interior zones are cooling only. This adjustment reduces the cooling, heating, and fan energy consumption. In this system, the interior zones operate as in a VAV system. The outer zones differ in that the heating is supplied by a heating fan in a central location usually with a heating coil fed by the building boiler. The heated air is ducted to the exterior dual duct mixing boxes and dampers controlled by the zone thermostat calling for either cooled or heated air as needed. Central plant[edit] A central plant is needed to supply the air-handling units with water. It may supply a chilled water system , hot water system and a condenser water system , as well as transformers and auxiliary power unit for emergency power. If well managed, these can often help each other. The chilled water system will have chiller s and pumps. Analog temperature sensors measure the chilled water supply and return lines. The chiller s are sequenced on and off to chill the chilled water supply. A chiller is a refrigeration unit designed to produce cool chilled water for space cooling purposes. The chilled water is then circulated to one or more cooling coils located in air handling units, fan-coils, or induction units. Chilled water distribution is not constrained by the foot separation limit that applies to DX systems, thus chilled water-based cooling systems are typically used in larger buildings. Capacity control in a chilled water system is usually achieved through modulation of water flow through the coils; thus, multiple coils may be served from a single chiller without compromising control of any individual unit. Chillers may operate on either the vapor compression principle or the absorption principle. Vapor compression chillers may utilize reciprocating, centrifugal, screw, or rotary compressor configurations. Reciprocating chillers are commonly used for capacities below tons; centrifugal chillers are normally used to provide higher capacities; rotary and screw chillers are less commonly used, but are not rare. Heat rejection from a chiller may be by way of an air-cooled condenser or a cooling tower both discussed below. Vapor compression chillers may be bundled with an air-cooled condenser to provide a packaged chiller, which would be installed outside of the building envelope. Vapor compression chillers may also be designed to be installed separate from the condensing unit; normally such a chiller would be installed in an enclosed central plant space. Absorption chillers are designed to be installed separate from the condensing unit. Condenser water system[edit] Cooling towers and pumps are used to supply cool condenser water to the chillers. Because the condenser water supply to the chillers has to be constant, variable speed drives are commonly used on the cooling tower fans to control temperature. Proper cooling tower temperature assures the proper refrigerant head pressure in the chiller. The cooling tower set point used depends upon the refrigerant being used. Analog temperature sensors measure the condenser water supply and return lines. The hot water system will have a boiler s and pumps. Analog temperature sensors are placed in the hot water supply and return lines. Some type of mixing valve is usually used to control the heating water loop temperature. The boiler s and pumps are sequenced on and off to maintain supply. A variable frequency drive functions by modulating the frequency of the electricity provided to the motor that it powers. In the USA, the electrical grid uses a frequency of 60 Hertz or 60 cycles per second. Variable frequency drives are able to decrease the output and energy consumption of motors by lowering the frequency of the electricity provided to the motor, however the relationship between motor output and energy consumption is not a linear one. For example, because the variable frequency drive needs power itself to communicate with the building automation system, run its cooling fan, etc.

Chapter 3 : Practical Machine Learning | Building Intelligent Systems

Intelligent Building Automation Systems, Inc. specializes in design, development, integration, programming, and service of building automation systems. Our mission is to provide unparalleled expertise and service for your building automation system.

Chapter 4 : Intelligent Buildings: Optimizing Environmental and System Performance

To realize these advantages, it is key to integrate your new and existing building management systems, solutions, technologies and business processes into one platform. The result will be more efficient performance, simplified operations and more affordable growth through reduced energy and operating costs.

Chapter 5 : Intelligent Building Systems in Miami | Intelligent Building Examples

Intelligent building systems, network, communications and security systems for a , square foot headquarters building and a , square foot office building at a separate location. The headquarters also includes a , square foot parking deck.

Chapter 6 : Building automation - Wikipedia

Indeed, the CRE industry is perhaps uniquely positioned to implement the technology, using IoT-enabled building management systems (BMS) to make building performance more efficient and also use sensor-generated data to enhance building user experience.

Chapter 7 : Intelligent Buildings | Convergentz

The Building Management System (BMS) and the practice of building automation in the age of IP, IoT, advanced analytics and blog.quintoapp.com intelligent and integrated building management systems evolution and solution overview.

Chapter 8 : Intelligent Building System - Solution | chint global

Building automation is an example of a distributed control system - the computer networking of electronic devices *designed to monitor and control the mechanical, security, fire and flood safety, lighting (especially emergency lighting), HVAC and humidity control and ventilation systems in a building.*

Chapter 9 : Intelligent Building Systems - Newcomb & Boyd

Building Intelligent Systems is about connecting users to machine learning so they benefit each other. Learn how here.