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Smart Buildings: Shaping Future

We Shape The Buildings; There after They Shape Us

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Abstract: Buildings that aren't "connected" are the same buildings they were decades ago. These technologies, once considered revolutionary, are steadily becoming the norm in today's premier. Buildings today are complex concatenations of structures, systems and technology. Buildings of the future must connect the various pieces in an integrated, dynamic and functional way. This vision is a building that seamlessly fulfils its mission while minimizing energy cost, supporting a robust electric grid and mitigating environmental impact. Smart buildings look beyond the building equipment within their four walls.

Keywords: Smart building, energy, technology, efficient

1. INTRODUCTION

Over time, each of the components inside a building has been developed and improved, allowing modern-day building owners to select lighting, security, heating, ventilation and air conditioning systems independently. It is not enough for a building to simply contain the systems that provide comfort, light and safety. (Building Effeciency initiative, 2011)
A smart building is so much more than brick- and-mortar, glass and steel. It's a safe secure comfortable efficient and productive place, a place that uses energy. It's more than a building, it's a living system. The term "smart building" is an emerging technology which is loosely tossed around a lot, but it generally refers to network-enabled building

management systems that help automate building operations. It provides real time energy saving and monitoring, Audio visual integration, 93% saving on lighting, Track where people are in the event of an emergency, Monitoring temperature for comfort, 40% saving on HVAC, Control on building using any smart device, Follow me mode lighting in the event on an emergency, Security integration with access control, CCTV and intruder alarm, User friendly dashboard for controlling, monitoring and reporting.

2. WHAT IS A SMART BUILDING?

At the most fundamental level, a smart building is any structure that uses automated processes to automatically control the building's operations including heating, ventilation, air conditioning, lighting, security and other systems. (Tracy, 2016). In other words, smart buildings make occupants more productive with lighting, thermal comfort, air quality, physical security, sanitation and more at lower costs and environmental impact. It uses sensors, actuators and microchips, in order to collect data and manage it according to a business' functions and services. This infrastructure helps owners, operators and facility managers improve asset reliability and performance, which reduces energy use, optimizes how space is used and minimizes the environmental impact of buildings. Smart buildings use information technology during operation to connect a variety of subsystems, which typically operate independently, so that these systems can share information to optimize total building performance. They are connected and responsive to the smart power grid, and they interact with building operators and occupants to empower them with new levels of visibility and actionable information. (Building Effeciency initiative, 2011)

3. FEATURES OF A SMART BUILDING

- **Managed Electricity Reductions**: Smart buildings helps in maintaining overall electricity consumption within sustainable levels even on the hottest summer days. By taking signals from the electricity market and altering usage in response, a smart building ensures the lowest possible energy costs and often generates revenue by selling load reductions back to the grid. Various "demand response" incentives are designed to help ensure system reliability. It can reduce usage by at least 15% of average monthly demand, or by 100 kilowatts(Doukas, Patlitzianas, Iatropoulos, & Psarras, 2007).

- **Maximized Building Security**: Smart buildings leverage network-based systems to maintain building security. There are several security providers offering wireless intrusion detection systems, allowing building managers to choose from a spectrum of mobile transmitters and motion sensors in order to automate the protection of offices, even during off-hours(Chow, 2004).
- **Smart Sensors For Lighting**: Pair networked lighting with a building energy management system for a building that can "not only switch lights on and off at optimal times and vary light levels, but also do a comparative analysis of whether the impact on HVAC energy use that results from adjusting smart windows to let in sunlight will be smaller or greater than darkening the windows and turning the lights up.
- **Controlled Appliances From Remote Locations**: For any operation with a large kitchen, network-based freezer and refrigeration sensor systems aren't just convenient — they can also reduce costs(Hetherington, 1999). Such monitoring can prevent major losses associated with spoiled or unusable product and help with overall budgeting. These systems can remotely track and report temperatures in multiple zones within a single unit. They can also monitor variables, including humidity, light, temperatures outside a unit, and a refrigerator or freezer's electricity usage. Medical facilities can similarly benefit by monitoring their cooling and freezing systems.
- **OptimizedHVAC Systems**: Advanced softwares are used to control factors such as "water flows, pump speeds and fan speeds while maintaining set temperatures." For many buildings, manually heating and cooling individual offices can account for over one-third of a building's entire water consumption(Fong, Hanby, & Chow, 2006).
- Advanced control strategies for packaged HVAC systems that customize air conditioning to the needs of the occupants using technologies such as multi-speed fans and demand control ventilation result in cost savings of 24-32% depending on the building type.

- **Advanced building energy management systems:** The automated fault detection and diagnostics of newer systems help reduce downtime and O&M costs, adding to the energy savings from simply optimizing equipment set points and setting timers. Advanced BEMS packages on their own can save anywhere from 13-66% on energy, depending on whether the packages have detection and diagnostics, historical analysis and predictive capabilities. (Barendrecht, 2017)

- **Other smart building components**: Smart windows that lighten or darken depending on sunlight intensity are recommended, as they can help reduce the HVAC and lighting loads and reduce glare. A study by the Lawrence Berkeley National Laboratory cited in

the ACEEE report described savings of 19-26% on cooling and 48-67% on lighting if smart windows are implemented.

Additional savings may be possible by using advanced power strips to reduce plug loads; smart ceiling fans that help regulate the thermostat, destination dispatch controls for elevators, and televisions, refrigerators, and dishwashers that interact with the grid to assist with peak load management. An additional savings of roughly 10% is feasible with controls like these, the researchers note. (How Smart Buildings Save Energy, 2015)

4. ENERGY EFFICIENCY OF SMART BUILDINGS

A utility on the smart grid may be programmed to read the weather forecast, and anticipate a temperature increase that will result in increased demand the following afternoon. A smart building could control the temperature by activating an internal demand-reduction mode and thereby reducing its load. (Building Effeciency initiative, 2011)

Consider an example, a 220,000-square-foot office building operating around the clock used 2,200 tons of cooling power. When it switched to a network-based HVAC system that automatically calculated the best ways to heat, cool and ventilate based on the time of day, the building saved 364,921 gallons (1381376.25liters) of water per year. Through the use of automated HVAC systems that continuously “maximize performance of the whole system. (Barendrecht, 2017)

It can make the use of optimal start/stop, which allows the building automation system to learn when it should bring the air conditioning system online for a particular zone in the building. Another feature is electrical loads that are grouped into categories from critical to high priority to non-essential.

Intelligent efficiency measures applied to just 35% of eligible commercial floor area in buildings with 50,000 or more square feet could save upwards of 50 terawatt-hours by 2030, assuming a conservative savings estimate of 20%(Barendrecht, 2017).

It reduces operating costs, saves you money, and makes a smaller environmental footprint. Best of all an intelligent building creates a positive experience for everyone who steps inside the building customers, employees, tenants and visitors. For example, sensors know that a car has arrived and turn on exterior lights to enhance safety, security and peace of mind.

For instance, the office building's access control system recognizes the employee and the security system is integrated with the lighting system, which turns on hallway and ambient workspace lights along the user's path. It even turns on task lighting in the cubicle. The employee never has to touch a switch and the HVAC system knows that the employee has arrived from the swipe of the badge so it automatically adjusts the airflow and temperature in the area based on preferences he/she has selected. If anyone wants to change the temperature, they can use the nearest wall module, their computer or even their smartphone, thanks to improvements in user interface technology.

Smart building systems make sure that the meeting room is set to the right comfort settings for the number of people that show up for a scheduled meeting and that lights come on when they arrive. Natural lighting, fresh outdoor air and optimum temperature and humidity levels can improve people's health and reduce absenteeism. These things also affect employee and customer satisfaction and even improve productivity.

Intelligent buildings are equipped with systems that harvest day light and supplemented automatically with artificial light to create ideal conditions. They also continuously monitored temperature humidity air quality and fresh air levels making adjustments to create the best possible indoor environment while also saving energy around-the-clock. Smart buildings are more efficient, they use less energy, they cost less to operate, they're safer - more secure and create fewer carbon emissions and they deliver levels of performance worthy of LEED certification and Energy Star recognition(European Environment Agency, 2004).

Behind the scenes, building owners and operator rely on various sophisticated systems; all programmed to work together to create intelligent building capabilities that were in conceivable just a few years ago. For instance smart building systems can automatically access weather forecasts and plan for the next day by preheating or pre cooling the building during off-peak hours to save money. Hot, cold, or rain or shine, the system automatically manages energy use throughout the day to shift demand and take advantage of the best utility rates.

Advanced reporting capabilities make it easier than ever for building managers to track progress monitor energy use by area, identify new conservation opportunities, and validate system benefits and document compliance. Today's best building systems are extremely dependable thanks to predictive technologies and performance-based maintenance strategies. If a problem ever does occur, night or day today's intelligent service capabilities make it possible to address many alarms remotely.

5. CONCLUSION

The smart building is at the centre of this vision, providing not just the roof overhead, but also the information infrastructure to make possible a truly intelligent world.

Of course, smart building technology is only as effective as the building's own internet connectivity. What is important to remember is that many smart building features are extraordinarily sophisticated and interconnected. Oftentimes, the smart features themselves require additional infrastructure, like high-speed fibre connections, diverse access points, and specific riser configurations — all-important considerations when seeking new smart building. Reaching the vision smart building requires adding intelligence from the beginning of design phase through to the end of the building's useful life.

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