

AI for the Built Environment

Driving Business Outcomes with Applied Analytics

Why AI for IoT-enabled buildings?

AI and analytics have been in use for decades, beginning in consumer spaces such as credit scoring to guide lending practices and in retail for preference suggestions. The applications of these technologies are now common in every industry. As real-estate leaders struggle with rising energy costs, controlling budgets in difficult economic circumstances and contending with pending requirements toward carbon neutrality, AI is maturing in a wide variety of applications for the built environment that helps alleviate these key pain points.

According to analyst firm Memoori in a recent report: “The data integration, analytics and software segments will be the largest during the forecast period, growing from \$20.7 billion in 2022 to \$42.6 billion in 2028 at a CAGR of 12.8 percent. The emergence of novel AI-enabled analytics solutions, digital-twin innovations and sophisticated BIoT platform solutions are driving growth in this segment.”¹

Factors influencing the growth of AI in the built environment



Technology drivers

- Innovations in new sensors that detect a wider variety of characteristics and data points
- Improved technologies for wireless grid networks, with redundancy, reliability, and resiliency
- Advances in the collection, processing, and storage of massive quantities of building IoT data in the cloud
- Improvements in data and network security to alleviate concerns about off-prem data storage



Business drivers

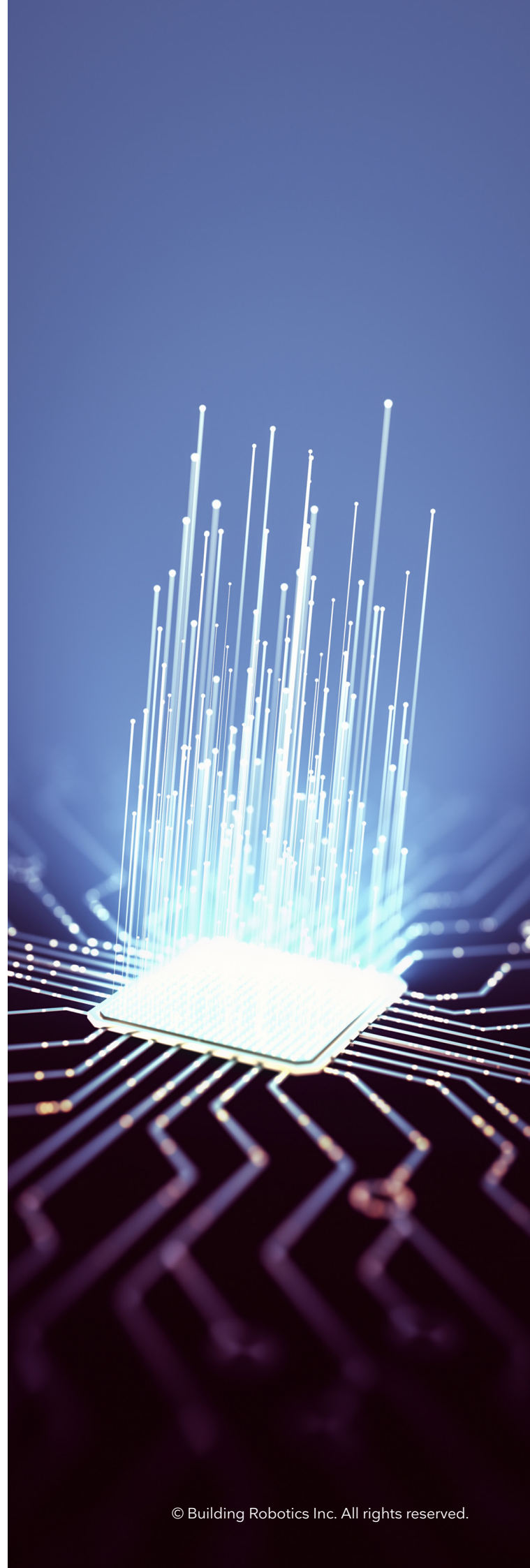
- The pending retirement of up to 50 percent of facilities managers in the next 5-7 years
- Urgency to understand space use as hybrid work has disrupted normal commercial real estate planning cycles
- Pressure to reduce operating costs related to energy use and produce operational efficiencies
- Need to create concrete plans to meet 2030 sustainability commitments

¹ Memoori: *IoT Devices in Smart Commercial Buildings 2023 to 2028*, Q2 2023.

Types of AI and their applications for buildings

In the IoT built environment, various types of AI analytics are employed to collect, process, and analyze data from interconnected devices and systems. These analytics help optimize building operations, enhance energy efficiency, and improve occupant comfort. Let's explore the different types of AI analytics used in the IoT built environment:

- 1. Descriptive analytics:** Descriptive analytics involve the analysis of historical and real-time data to provide insights into what has happened or is currently happening. In the IoT built environment, descriptive analytics are used for real-time monitoring and reporting of building parameters, such as temperature, humidity, occupancy levels, and energy consumption. This information helps facility managers and building operators gain a clear understanding of the building's current state and performance.
- 2. Diagnostic analytics:** Diagnostic analytics aim to identify the causes of specific events or anomalies detected in the building's systems. By analyzing historical data and patterns, AI algorithms can pinpoint the root causes of deviations from normal behavior. For instance, diagnostic analytics can be applied to detect and diagnose faults in HVAC systems, lighting malfunctions, or abnormal energy consumption spikes.
- 3. Predictive analytics:** Predictive analytics use historical and real-time data to make predictions about future events or conditions. In the context of the IoT built environment, predictive analytics can forecast equipment failures, energy consumption patterns, and occupant behavior. By anticipating potential issues, building managers can proactively schedule maintenance, optimize energy usage, and ensure a smooth and efficient operation of the building.





- 4. Prescriptive analytics:** Prescriptive analytics go a step beyond predictive analytics by providing actionable recommendations to improve performance and efficiency. These recommendations are based on insights gained from historical and real-time data, as well as predictive models. In the IoT built environment, prescriptive analytics can suggest optimal settings for HVAC systems, lighting schedules, and energy usage based on current conditions and predicted patterns.

- 5. Anomaly detection:** Anomaly detection is a specific AI technique used to identify deviations from normal behavior in the building's systems or operations. By continuously monitoring data streams, AI algorithms can flag unusual patterns, which may indicate equipment malfunctions, security breaches, or other issues that require attention. Anomaly detection is crucial for ensuring building safety, security, and overall performance.

- 6. Machine learning for optimization:** Machine learning algorithms are used to optimize various aspects of building management. For example, they can optimize energy consumption by adjusting HVAC settings based on weather forecasts, occupancy patterns, and energy pricing. Machine learning can also optimize scheduling for maintenance activities to minimize downtime and reduce operational costs.

- 7. Natural language processing (NLP):** NLP is employed in the IoT built environment to facilitate human-machine interactions. Voice-controlled virtual assistants can be integrated into building systems to allow occupants to control various functions, such as adjusting lighting, temperature, or requesting information about building status.



RTLS finds extensive applications across diverse industries such as manufacturing, supply chain management, hospitality, healthcare, and construction, enabling real-time tracking of assets and personnel.

BLOOMBERG, 2023

USE CASE 1

Boost accuracy of finding assets and occupant badges with AI

Situation

For a host of business processes, the inability to locate assets and occupant badges results in additional operating costs and inefficiencies. From nurses searching for IV pumps and wheelchairs to workers locating forklifts or carts on an assembly line, the ability to find assets quickly and accurately can improve productivity with bottom line results. Other use cases involve finding occupant badges, such as identification of an Alzheimer patient who has wandered from a designated ward in a health care facility. But traditional Real Time Location Systems (RTLS) have struggled with accuracy, a key to user acceptance and benefit realization.

AI solution

Traditional RTLS can yield varying accuracy levels due to factors like sensor placement, multi-path interference, and limited data processing. Enlighted's Location Intelligence addresses these challenges by harnessing existing lighting control sensors and integrating high-performance Bluetooth® Low Energy (BLE) tags and badges, resulting in a cost-effective solution. Enlighted's machine learning algorithm dynamically learns the spatial environment, achieving an impressive room-

level accuracy of 98 percent, surpassing simple triangulation methods. Enlighted's advanced AI algorithm mitigates multi-path interference caused by Bluetooth noise and adapts to changing environmental conditions, including human movements.

Result

By using existing Enlighted lighting sensor infrastructures paired with an AI approach, companies can quickly and in a cost-effective manner add highly accurate RTLS capabilities to:

1. Test various size tags and wearables on both occupant tags and assets – redesigning workflows for maximum efficiency.
2. Add new use cases everywhere the lighting sensors exist – building on savings and occupant safety.
3. Design solutions for both asset inventory tracking and personnel workflow.

[Lean more](#)





According to the recently released Caba Healthy Buildings and Indoor Environment Quality Report, 2023, “50% of employees want control over their own space to set the temperature in their workplace. The intelligent buildings sector has a stake in creating healthy buildings not only for people’s well-being, but also to help owners and operators cost-effectively meet consumer demand, comply with evolving regulatory requirements, and respond to business needs such as reducing employee absenteeism.”

BRIAN ENSIGN

CABA Board Chair of Superior Essex Communications

USE CASE 2

Occupant-led temperature control with AI

Situation

Haven't we all had the experience of entering a building in the middle of summer and being hit with a refreshing blast of cold air? After an hour or so, that cold air starts to feel too cold. Along with our colleagues, we try to locate the thermostat, search online for the facilities ticketing system, or nominate someone to track down “that facilities guy.” Meanwhile, the air conditioning keeps cranking, using valuable energy to no apparent purpose. After some time, we learn that this is just the way it is and start layering our clothes to compensate. How can facility management both save on energy costs while keeping occupant comfort in mind?

AI solution

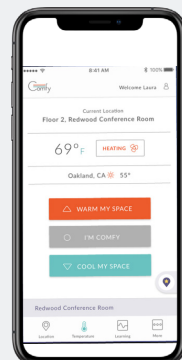
Various solutions have been attempted to correct this very common issue. However, Enlighted has devised an ingenious combination of a mobile “voting” app combined with AI learning models that continuously evaluate occupant preferences and integrate with back-end HVAC systems that save energy while giving environmental control back to the occupants. A side benefit is a reduction in the number of facilities calls, further providing operational savings.

² CareerBuilder: [CareerBuilder Survey](#), 2018.

Result

Using an AI-driven solutions, occupants can “vote” for their temperature preferences. The outcome of the method is:

1. Lower energy costs as heating and cooling is moderated to align with actual needs, reducing wasteful energy use.
2. Reduced facilities costs as users can make their own requests rather than logging tickets.
3. Improved employee satisfaction with temperature aligned to their needs with the feeling of control.



46%

of employees want control over their own space to set the temperature in their workplace.²



Our technology teams worked closely to identify the pain points of our customers and designed a solution that offers valued outcomes using voice understanding integrated with an AI-driven RTLS solution.

MANUEL ZIMMERLI
Global Account Manager, AWS

USE CASE 3

AI natural language control for busy workers

Situation

Healthcare organizations worldwide are experiencing difficulties with talent acquisition and staffing to meet ever growing needs since the pandemic. Add to this the proliferation of IT systems that require human interfaces and it makes for an overburdened situation for those caring for patients every day. Given the speed at which nurses and doctors must respond to patient needs, what's needed is proven automation that provides real help for busy hands.

AI solution

Enlighted has collaborated with AWS to leverage the natural language processing capabilities of the Alexa solution as an adjunct to Enlighted's AI-driven RTLS solution. With this capability, busy healthcare professions, when identified via their wearable badge, can voice command: "Where is the closest wheelchair?" or "Notify pickup that the patient from room 211 requires transportation."

Result

By linking natural language understanding of AWS's Alexa with badge identification (and associated access control) technologies from Enlighted, healthcare providers can:

1. Free caregiver hands to focus on what's most important for patients.
2. Improve patient experiences with more care time available.
3. Implement an AI-driven location logic for an 80 percent faster time to locate and asset using voice control. [Learn more](#)



AI as a driver of sustainability

AI's ability to drive positive outcomes for sustainability in building is primarily delivered through the ability to collect, analyze, and derive insights and suggested actions from the vast quantities of IoT building data now being collected. The recent proliferation of data gathering sensors of all types – occupancy, temperature, air quality, people counting, humidity, and others – means that the case for AI for sustainability buildings is just beginning to be explored. However, there are active installation of analytics in buildings, demonstrating real outcomes for facility managers focused on their Environmental, Social, and Governance (ESG) goals.

Case for leveraging AI to reduce carbon emissions in buildings

- Predicting space allocations to manage overall building energy consumption more sustainably
- Use of AI models that work with occupant input to reduce energy use in the built environment
- Analysis of vast quantities of energy usage data with precision to uncover patterns, reveal relevant insights, and understand ESG performance for proactive adjustments
- Use of predictive analytics in Asset Performance Management (APM) to ensure building energy systems are performing at optimal capacities
- Integration of building digital twins that can track, measure, and suggest actions toward lowering carbon emissions

The role of AI in sustainable infrastructure

In this white paper, Reuters examines how Siemens, owner of Enlighted and Europe's largest industrial manufacturing company, is approaching the role of AI for building sustainability. [Read paper](#)



By enriching applications with AI-driven algorithms, such as forecasting or anomaly detection, insights are generated automatically and presented clearly.

DR. PAUL BAUMANN

Global Head of Product Management

Data Analytics at Siemens Digital Buildings



Enlighted and Siemens – Leaders in IoT Building AI

By combining different types of AI analytics, fed from time-series building data, the IoT built environment can become a more intelligent and efficient ecosystem, providing benefits such as energy savings, improved occupant comfort, and predictive maintenance, ultimately leading to sustainable and smart buildings.

Enlighted, as part of Siemens Xcelerator program, is positioned to bring new AI innovations to fruition. The Enlighted Lighting Solution, which includes a dense sensor network, blankets buildings with a sensing infrastructure that continuously collects data for intelligent lighting and HVAC control. A wireless grid network delivers vast quantities of both building and occupant behavior data to the cloud for AI processing.

As a provider of IoT data and applications and as a partner to companies working on AI analytic applications, Enlighted is at the forefront of new analytic breakthroughs for building systems.

[Learn more](#) about Enlighted AI capabilities.

[Learn more](#) about Siemens AI capabilities.



Enlighted

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Turn Everyday Spaces into Extraordinary Places

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