



ABMNext

**SENSOR TECHNOLOGY & IMPROVED
OPERATIONAL OUTCOMES**

Introduction

Sensor technology is one of the more promising technologies impacting the facility management industry. This position paper is intended to help you understand both what sensor technology is and what the most promising use cases are today. At the end of this paper, you will understand how sensor technology can be used to drive a better experience for you and your facility occupants.



PART 1:

Background Around Sensor Technology

WHAT IS SENSOR TECHNOLOGY?

Sensor technology is a broad category of technology that uses sensors to track and transmit data. Within the facility management space, this generally refers to the use of motion sensors to capture and track information around facility usage. Other forms of sensor technology include (but are not limited to):

- **People counters** (counts individuals entering a space)
- **Indoor air quality sensors** (track KPIs like humidity and temperature)
- **Contact sensors** (used to track when doors are open)
- **Asset sensors** (for tracking usage of physical assets and equipment)
- **Vibration sensors** (to track hard-asset performance)

It is important to keep in mind that sensor technology is a type of IoT (Internet of Things) technology. This means that it is a type of technology that can transmit and capture data without human involvement. Generally, when people refer to IoT, they are likely thinking about sensor technology.

However, every IoT implementation has a few key layers. They are:

The hardware or device

This is what is used to capture data. Generally, this is a sensor. It can also refer to other “smart” devices such as telematic trackers or smart badges.

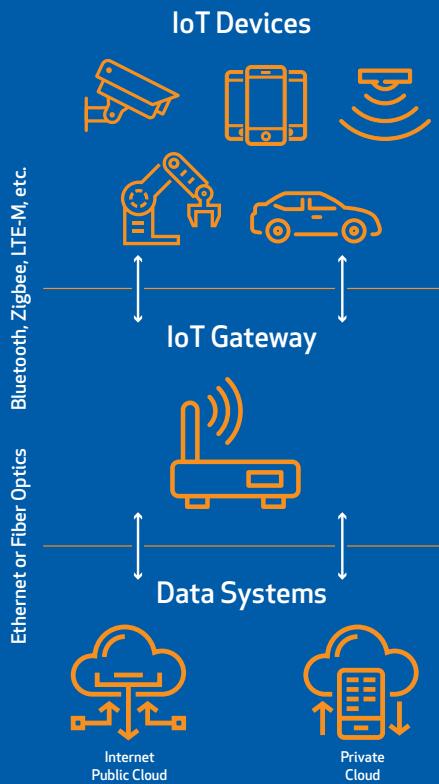
The gateway

The gateway refers to the way in which the data is connected and transmitted from the end device to the cloud. When used in a facility, the IoT gateway must be installed near the sensor or device.

The data systems

The data system refers to the end-cloud where the data is transmitted to. This is where we can ultimately pull reporting and analytics from.

Remembering that sensor technologies are a form IoT is important, as it underscores that the value from using the technology is the data that is captured.



WHAT IS THE ADVANTAGE OF USING SENSOR TECHNOLOGY?

Sensor technology allows you to capture real-time data for any item this is tagged or being tracked. This, if actioned against, can lead to better facility management.

Today, we generally see sensor technology being used to track specific, isolated use cases. The most common application is tracking space usage, which is frequently leveraged for a specific area (e.g., restrooms). As this information is captured, patterns of usage can be used to drive better outcomes for end users.

In the future, we anticipate that usage will become more prevalent and integrated. This will be an evolution, as connecting disparate pieces of information from different types of sensors will present challenges. However, over time this will enable a more holistic, data-based method to manage facilities.



WHAT CHALLENGES EXIST WITH IMPLEMENTATION?

Though sensor technology can greatly increase the amount of data we have about a space, there are challenges around implementation.

Data Translation and Start-Up Time

The first is due to the nature of IoT technologies—it requires connectivity to a gateway and ultimately, the end cloud. This connectivity, albeit only a one-time set-up, can take considerable time. Additionally, the data that comes from a sensor is also generally unusable without translation. For example, an occupancy sensor may produce a binary series of zeros and ones instead of indicating the space was occupied or unoccupied. Data translation is required to turn a signal from the sensor to readable information. When considering the time to configure, translate, and tune the data connections, the set-up time can be extensive.

Identifying the Use Case

The second challenge appears once the data is translated and readable. While there is often great anticipation around the data, there is no real value in a simple output of the data captured. The value stems from using the data to form analytics and actionable insights. Given the vast realm of use cases for sensor technology, it can be challenging to align on the prioritized data use case or to focus the analysis.

Long-Term Maintenance

Long-term viability must be considered, as IoT technologies are not often compatible with one another and require maintenance. The volume of sensors is a key consideration, as this will also increase the amount of time that must be dedicated to replacing batteries, checking errors, or rewiring the sensors.



WHAT ARE THE KEYS FOR SUCCESSFUL IMPLEMENTATION?

To be as successful as possible, implementation planning should take into account the following:

- The use cases for how the technology and the data captured will be used. Installation and the system design should be planned accordingly.
- Being intentional where IoT is deployed, especially given the maintenance required.
- A plan to interpret and normalize the data output.

A strong facility management partner, such as ABM, can assist with these planning discussions as well as operationalizing the data to drive tangible benefits.

PART 2:

Optimizing Sensor Technology Usage

WHAT ARE THE MOST PROMISING USE CASES FOR SENSOR TECHNOLOGY?

As mentioned, one of the biggest challenges is simply deciding how to use the data being captured from sensors. The range of possibilities is vast, so it can be difficult to align on a set of viable, high-value use cases. ABM has performed pilots to help sort through this challenge.

In the technology's current maturity, the most viable usage for sensor technology is leveraging occupancy data to drive more effective servicing based on the space utilization. Put most simply, you can be equipped with insights around how your space is currently being used and serviced. We can help you understand options around optimizing these two factors, ultimately driving improved end-user experiences.

To enable this, sensors should be placed in common areas with high-traffic usage such as restrooms, break rooms, and conference rooms. There is diminishing value with installations beyond these areas.

However, the future of facility management will involve holistic, integrated views of what is occurring throughout the facility with multiple layers of data. This could include data around HVAC, parking, facility equipment, and more. While not viable in the current state, it is critical to understand that sensor technology and IoT overall will be more prevalent and embedded in facility management in the future.



HOW IS THIS OPERATIONALIZED? WHAT DOES IT LOOK LIKE IN PRACTICE?

To align servicing with facility usage there are two methods of operationalizing. The simplest method is to develop patterns of facility usage and to align static servicing schedules to these facility patterns. For instance, data collected around restrooms could highlight that the restrooms have high usage around 11:00 a.m., 2:00 p.m., and 4:30 p.m. The schedule for servicing could be adjusted and optimized for this pattern of usage.

Another option is to develop thresholds or rules around when servicing should be performed based on occupancy data. This means that real-time alerts to service a space can be generated. A common example is setting a limit for the number of individuals that should use a restroom between servicing.

Aligning real-time usage to servicing, rather than patterns of usage over time, enables more control over the end-user experience. It accounts for the variation that occurs day-to-day that causes margins of error in the established patterns.

1 Sensor technology captures your occupancy levels and pushes cleaning priorities to our service professionals.



2 After cleaning, the service professional will scan a QR code to log task completion, providing real-time visibility to clients.



3 ABM Smart Routing will inform the team member of their next task and destination. High-priority tasks or new work requests will modify the task order as needed.



4 Information is pushed to displays throughout the space, informing occupants when the space was last serviced.



While both approaches are viable and beneficial, it is best practice to leverage threshold alerts for servicing the space during occupied hours. The day-to-day variation in exact timing of usage is often significant enough that establishing schedules based on patterns of usage is less effective. Put more simply, establishing patterns of usage cannot account for natural variations. Leveraging alerts during occupied hours allows you to control the end-user experience more effectively.



However, servicing during unoccupied periods cannot leverage thresholds or rules, as alerts are only generated as the space is occupied. As such, it is best practice to establish patterns of usage from when the space is occupied, which can inform how the facility is serviced while unoccupied. Though still important to periodically review patterns, highly-used spaces throughout the facility tend to be consistent. This means that servicing of the space during its unoccupied period can have a schedule that is fine-tuned periodically but static on a day-to-day basis.

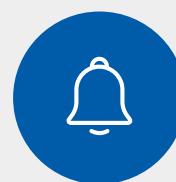


It's best practice to establish patterns of usage throughout the day or usage period to inform how the facility is serviced while unoccupied. Though still important to periodically review patterns, highly-used spaces throughout the facility tend to be consistent.

WHAT DOES IMPLEMENTATION LOOK LIKE?

Implementing this program first requires establishing a baseline for current usage of the space. Thus, after installation, it is best to establish a 30-day base-lining period where current patterns of usage can be established. For instance, how does the volume of usage between servicing fluctuate throughout the day?

Once these patterns are established, it is important to have a discussion around the desired end-user experience. The more pristine the space should be for end users, the lower the usage should be in-between servicing. This decision will influence the changes in scheduling and/or the thresholds used for alerts.



Install, configure, and tune devices

- Install devices throughout the floor
- Configure cloud connection
- Test and tune sensors until accurate data capture

Establish a baseline for the space

- Undergo a baseline data-gathering period to understand current occupancy and servicing levels
- Document trends around usage and occupancy between servicing

Select desired thresholds

- Collaborate on the appropriate thresholds for the space based on desired end-user experience or efficiency goals
- Adjust SOW as appropriate

Implement alert mechanism

- Introduce alert mechanism
- Monitor KPIs to ensure desired change in occupancy normalization is achieved
- Adjust thresholds as needed



ARE THERE STRATEGIES TO MAKE THIS MORE EFFECTIVE?

1. Dedicate team members to space while occupied.

If using alerts to align servicing to real-time facility usage, it is critical to align ABM team members to the space. If the space is large and team members are routing throughout the entire facility, the alerts will become inefficient as the team members will need to route back to the alert location. As such, it is important to localize team members to given floors or spaces if the facility is large.

2. Incorporate status displays to provide visibility to end-users.

The extra steps being taken to provide an enhanced end-user experience will be evident as team members use the space. However, this can be coupled with increased transparency around servicing and occupancy to end users through mounted displays. Many sensor technology vendors also sell displays that can be hung outside rooms, allowing for visibility around either how many team members are already in the space or transparency around the last time the space was serviced. This is an important consideration to keep in mind when selecting a sensor technology vendor.

3. Modify conference room scheduling to allow for servicing.

If conference rooms are included in the facility layout, they often present a challenge for servicing during the day. Popular conference rooms are often used back-to-back, which means that there is no gap in usage for servicing. The desired end-user experience, thus, cannot be controlled. To fix this, it is important to either:

- **Limit scheduling of meetings** to 25 or 55 minutes, allowing small blocks of time for servicing between usage.
- **Add blocks for servicing during the day.** These blocks should be optimized based on facility usage and rotated throughout the day as to not impact end user experience. Only a few conference rooms should be taken offline at once and these times should correlate with patterns of usage.
- **Integrate rules or logic into the conference room scheduler** so that blocks for servicing are added after a given number of reservations.



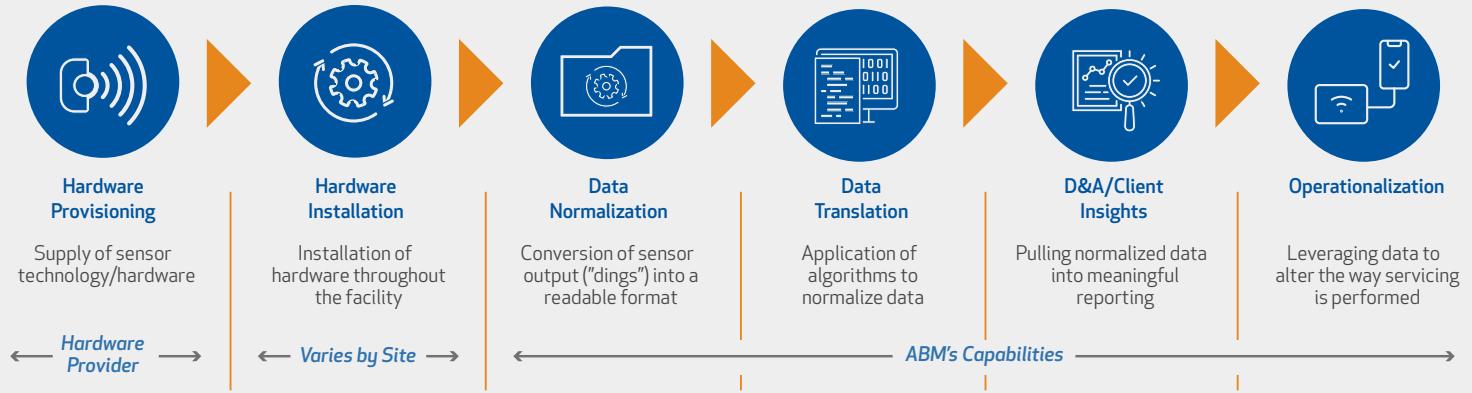
HOW CAN ABM HELP?

ABM can support you with the implementation of sensor technology within your space. More specifically, we can assist with the data configuration, normalization, interpretation, and operationalization.

Put more simply, we can assist with connecting the data gateway to the end cloud, along with making the data that is produced readable, pulling insights from the data, and identifying ways to operationalize the insights.

ABM can leverage the data from sensors and pull it into a readable format. We then take the data, pull out patterns of usage, and establish alerts to make the data actionable.

This capability is agnostic of the sensor technology vendor. We have already established integrations with several sensor providers, and we can work with sensors that are already established in the client space.



WHAT YOU GET WITH ABM



Expertise on how to leverage sensor tech



Analytics around space utilization



Ability to operationalize the data



ABM's sensor technology expertise offers actionable analytics around space utilization and the ability to interpret that data to real-world operational improvements.

To learn more, visit ABM.com or call 866.624.1520.

ABOUT ABM

ABM (NYSE: ABM) is a leading provider of facility services in the United States and various international locations. ABM's comprehensive capabilities include janitorial, electrical & lighting, energy solutions, facilities engineering, HVAC & mechanical, landscape & turf, mission critical solutions, and parking, provided through stand-alone or integrated solutions. ABM provides custom facility solutions in urban, suburban and rural areas to properties of all sizes — from schools and commercial buildings to hospitals, data centers, manufacturing plants and airports. ABM Industries Incorporated, which operates through its subsidiaries, was founded in 1909. For more information, visit ABM.com.



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