CM3 BUILDING SOLUTIONS

a member of DAIKIN group

How Smart Room Sensors Achieve Greater Energy Efficiency & Initiate Foundational Building Automation

Historically, building automation has felt out of reach for individual schools and small buildings, due to operational and financial constraints. However, the introduction of the smart room sensor gives smaller facilities the same opportunities to pursue energy efficiency and achieve sustainability goals as larger organizations.

INTRODUCTION

One of the greatest challenges for organizations is how to contain energy costs. According to the US Environmental Protection Agency and US Department of Energy, up to 20% of lighting and 30% of energy is wasted in schools and commercial buildings. At a cost of $1.47 - $2.10 per sq ft., this is $40K - $60K annually for a 30,000 sq. ft. building.

The leading cause of this waste is the unoccupied room. Research from UC Davis found that nearly 25% of a building's electricity is consumed during vacant periods. While spaces are often controlled with basic thermostat schedules, this approach does not account for schedules that vary from day-to-day or seasonally.

The traditional method for addressing these energy waste problems has been costly. Older buildings may try to implement a Building Automation System (BAS) with central reporting and management via remote room environment control. While this is an effective approach in new construction, traditional building automation does not deploy easily nor inexpensively within existing infrastructure. Therefore, implementing BAS in an existing school or business setting is often both cost prohibitive and operationally complex.

CREATING ENERGY INTELLIGENCE

The most basic room control system is the simple thermostat, while in recent years, a more advanced technology– the smart room sensor– has emerged.

Smart room sensors directly reduce energy costs, often by as much as 30%.

Like thermostats, smart room sensors can be easily programmed to maintain room temperature according to a schedule. They can be configured and adjusted (with limits) at the individual room level, because they look like a normal thermostat.

Smart room sensors also introduce an entire range of new intelligent capabilities, such as auto and AI-driven scheduling and occupancy sensing, that directly reduce energy costs, often by as much as 30%.

LOWER RETROFIT COSTS

Smart room sensors also have wireless capabilities which means the sensors can be easily and inexpensively retrofitted to existing buildings. This minimizes installation time and costs because wiring does not have to be run through ceilings or walls.

Sensors come equipped with a choice of settings, therefore they are easy to customize, which further simplifies the installation.

PROACTIVE FACILITIES MANAGEMENT

Smart room sensors can be easily cost-justified as stand-alone technology, but their benefits can be further expanded. Via wireless capabilities and open protocols, they can be the phased, step-in solution to a fully networked and integrated BAS– a benefit that grows exponentially.

A full BAS provides intelligent, holistic management to room and environmental control, allowing facilities managers to optimize equipment performance, reduce energy waste, and save money. The system gathers data from the various sensors and controllers from one building or many, and provides alerts, alarms, and visualizations, and aggregates reporting for facility and business managers.

	Occupancy Sensor	Lighting Controls	CO_2 Ventilation Controls
Function	Detect motion using infrared, ultrasonic, or microwave technology and adjust heating or cooling based on room usage, overriding standard settings.	Room controllers use schedules and/or occupancy sensors to control lighting.	CO2 sensors in room controllers optimize ventilation, improving air quality and cutting energy costs by limiting costly outside air intake.
Savings	Each 1° change saves 5% on HVAC; a 6° shift cuts costs by 30%.	Turning off lights in empty rooms can cut lighting costs by up to 20%.	Smarter fan use saves energy; better air quality boosts performance.

A PHASED APPROACH

Whatever solution is implemented, facilities should create a path for future enhancements to leverage investment and achieve maximum ROI. The selected room sensors should be able to migrate to new buildings and have the capability to be networked and scaled to include BAS applications for management and analytics.

Wireless capability, in particular, lends itself to staged deployments, since new nodes, sensors, actuators and controllers can be easily added to an existing network. Some buildings begin with only a single zone under automated control—as a proof of concept, to measure results before proceeding further, or to fit within budget constraints—and then expand from there.

Stage 1: Identify the school, building, or room with the most need. Install smart room sensors in the identified building for proof of concept and ROI measurement.

Stage 2: Expand to other buildings or the rest of the school district.

Stage 3: Add networking and building management if not already available.

Stage 2 could be done in a few months or a few years, depending on an organization's size and budget. This kind of staged approach allows an organization to use incremental ROI to help pay for each new stage. Eventually, all buildings can be folded into a centralized BAS for maximum benefit and ROI.

Cost-Effective, Streamlined Deployment

A wireless integrated room controller can be installed in an existing facility in 30 minutes by a single electrician. This means that even for hundreds of rooms, the installation cost is a fraction of the cost of a traditional BAS install.

The main expense will be the integration of the controllers themselves, which will depend on the set of features chosen, the vendor and type of product selected, the size of the purchase, and the geographic location. In general, today's integrated room controllers cost little more than an average residential electronic thermostat.

Key Technology Driving Energy Efficiency

Dynamic HVAC Optimization

AI-driven logic optimizes energy use through advanced modeling. Unlike traditional systems with fixed schedules, today's smart sensors dynamically adapt to changing conditions using self-regulating setpoints. The algorithm continuously analyzes factors such as occupancy patterns, indoor temperatures, outdoor weather, and humidity to make real-time adjustments to HVAC settings.

Occupancy Detection

Today's passive infrared motion sensor capabilities enable advanced occupancy sensing for automatic energy savings during both occupied and unoccupied periods. Sensitivity is adjustable, with a detection range up to 25 feet.

Scalable Capabilities

Today's smart room sensors allow for many disparate inputs and outputs with universal I/O support. This provides coverage for virtually every energy efficiency application.

IMPLEMENTATION TIPS

- Understand facility and team needs and goals. Evaluate wireless choices in the context of your business goals and budget.
- Understand how products should be connected–whether products will leverage a building's existing Wi-Fi or dedicated network.
- Choose vendors and contractors that offer a choice. Work with providers that offer a wide range of product and technology choices.
- Look for vendors that offer distributed intelligence in their products. This will improve network performance and reliability, and eliminate the bottleneck that can result from a single point of control.
- Ensure that you use open-standard protocols to enable cross-vendor interoperability to avoid being locked into a single vendor.
- Discuss scalability and whether you can implement building control in a phased approach, to address budgeting and operational considerations.

ARTIFICIAL INTELLIGENCE IN BUILDING AUTOMATION

The future of building energy management is shifting as it begins to employ AI for analytics. Existing BAS's generate and store a lot of their data from connected equipment. Many buildings already have a centralized system for monitoring and control that contains trend logs, event logs, alarm logs, and occupancy schedules. This information can be used as a starting point for implementing AI in your Building Automation System.

Edge computing means that data storage and computing are brought closer to the user, at the edge of the network, rather than on the cloud. Edge-based AI processes historical temperature data, occupancy patterns, and environmental conditions in real-time, enabling dynamic adjustments that maximize energy efficiency and occupant comfort. The integration of AI transforms a simple HVAC room controller into a smart, self-regulating system that continuously learns and adapts to user preferences, delivering optimized indoor environments without the need for constant manual intervention.

1. **Measure**
   Gather temp and humidity data.
2. **Assess**
   Conditions based on weather, thermal comfort model.
3. **Predict**
   Ideal temperature path based on environmental conditions.
4. **Control**
   Set temperature and humidity levels per redictive algorithm.
5. **Learn**
   Feedback loop optimizes predictions and refines internal thermal model.

BENEFITS OF BAS

- Monitoring of systems in a continuous, real-time fashion.
- Real-time alarm management and alerts.
- Pre-cooling or pre-heating to an "occupied" set point when it's known a room will soon be occupied.
- Identification of trends that signal equipment in need of repair or inefficient energy use.
- Building analytics to understand and manage long-term energy use.
- Central or remote management of multiple buildings and building systems.
- Efficient use of manual labor as technicians may troubleshoot a problem before going on site.
- Standardization of an open energy management platform that eases future integration.
- Expandable to support growth and adapt to future needs.

At CM3, we specialize in providing comprehensive building automation solutions. The solutions we deliver are end-to-end and turnkey– from system engineering and installation to preventive maintenance and customer training.