

# Lessons Learned - Implementing Occupancy Sensors In Labs: Smart Labs Toolkit

As a nationally acknowledged leader in science training, Emory College has tons of laboratories throughout their campus. To assist integrate sustainable greatest practices into laboratory operations and management, Emory established a Green Labs program. By way of this program, particular person labs can receive completely different levels of certification and earn recognition for making sustainable decisions. Beyond the Green Labs program, Emory's engineering staff constantly seems for opportunities to implement greatest practices in current and future labs. One greatest apply is the deployment of occupancy sensors. For a laboratory setting, occupancy sensors will help management ventilation and lighting. Sufficient laboratory ventilation is essential towards providing a safe and comfy environment whereas mitigating publicity to hazardous contaminants. Emory is in Atlanta, Georgia where energy rates are very affordable when compared with the remainder of the country. However, Atlanta's climate tends to require more energy to treat exterior air than the rest of the country. When operated appropriately, occupancy sensors can not only save power however, if tied into the HVAC they'll save on heating and cooling as nicely. In the example above Emory

was in a position to solely do three quarters of the labs within the constructing. Emory is running the air changes at 6 occupied and a couple of unoccupied with estimated yearly financial savings slightly over \$50,000/yr. There are numerous types of occupancy sensors and extra applied sciences are emerging. Currently, the two most typical varieties of occupancy sensors are passive infrared (PIR) and ultrasonic. Infrared sensors detect temperature adjustments in rooms, while ultrasonic sensors use excessive frequency sound to detect movement. Twin-know-how sensors use both methods to determine a rooms occupancy. There are a number of issues to occupancy sensor placement and quantity. While lighting could be controlled by a bench in a big lab, the HVAC (heating, ventilation, and air conditioning) cannot. It is crucial to find out lab boundaries based off the HVAC stress boundaries as well because the width of the occupancy sensor's beam and range. For their pilot, Emory selected a 5-yr-outdated constructing that was not performing as anticipated despite being new and having undergone commissioning. The constructing's original development had dual-technology sensors as loosely depicted in determine 1. The orange triangles assist present the sensor's path, vary, and unfold. As Emory's workers analyzed the info factors for the occupancy sensors, they observed that the data was not reflecting the constructing occupancy ranges. In commissioning, most consultants check the inputs to the HVAC system from the occupancy sensors by controlling them by way of the constructing automation system. This test demonstrates that the HVAC will react accordingly if it gets a signal, however, it doesn't take a look at the occupancy sensors in an precise operational setting. Therefore, when the constructing was commissioned the truth that the sensors by no means went off was not detected. The building layout added another level of complexity when making certain that solely occupied areas where being picked up by the sensors. Working with the manufacturer, employees discovered that air noise from the lab was being picked by the sensor's ultrasonic operate, making the sensor stay on indefinitely. Even with <https://observablehq.com/@motionsensor?tab=profile> at the bottom setting, the unit wouldn't swap to unoccupied. To resolve this challenge, the sensors had been reprogrammed, removing the ultrasonic function and adding in new detection timeframes. In determine 2, you possibly can see the various sensor testing that occurred over the course of several months. Figure 2: occupancy sensor testing. The subsequent situation that Emory had to deal with was the range for each occupancy sensor. Since the sensors were inside the utmost detection vary, Emory looked at the set up angle. When putting in a sensor, it's essential to get the detection angle correct so that it may well precisely detect occupancy ranges within the projected coverage range. Primarily based on Emory's expertise, they seen that for the sensor to adequately detect a researcher's motion, you need to be effectively inside two thirds of the beam vary and spread. Every sensor's settings had been set to high sensitivity and to remain on for 30-minutes after the final recorded motion. It is very important be aware about how often you're calibrating these sensors. The lack of confidence within the occupants in the course of the calibration and false positives can lead to them or your Environmental Health and Safety Office requesting them to be removed. Finally, to compound points, the deluxe mannequin was utilizing AI program to attempt to determine when somebody was just walking by way of and turning the lights on/off faster than the programmed on/off times. This caused lights to flicker off at inopportune times when the researchers were working. Unfortunately, the AI program could not be faraway from Emory's

model. Emory's solution was to once more work straight with the manufacturer to exchange the existing bench sensors and add further ones per Determine 3. The brand new sensors had been all PIR without AI, set to the very best sensitivity and 30 min on occasions. With this setup, Emory has all however eliminated the false positive and unfavorable detections. In the week shown in figure 4 you may see that there are still a few false detections occurring. A few of these have been confirmed to be the cleansing crew or repairs but some are nonetheless a mystery. Emory suspects it to be the heat generated from some lab gear resembling ultra-low freezers, glasswashers or autoclaves.

1. Design the lab with occupancy in mind.
1. HVAC methods in process rooms ought to be unbiased of the principle labs so they are not held on as a result of other areas.
2. Consider Specifying situation testing of the lighting sensors and the HVAC response.
3. Consider Specifying traits of every occupancy area to be submitted by the commissioning agent showing they work.
4. Sooner or later, occupancy sensors ought to be commissioned in actual conditions whereas preserving in thoughts occupied vs.

1. Lighting can be turned off by bench but, if just one person is in an open lab, the lab HVAC should stay at a protected degree.
2. "Daisy chaining" lights can save money but, when a sensor stops working it makes discovering the sensor for troubleshooting way more advanced. Consider more circuits in a big lab to lower the number of sensors per circuit.

1. Emory recommends utilizing PIR only sensors.
2. Set the sensor installation angle for maximum detection.
3. Ensure the work area is inside 50-75% of most vary to ensure they will detect a researcher working at the bench.
4. Make sure the work space is within 50-70% of the beam width for maximum detection.
5. Set the minimal on instances to ASHRAE tips or longer.
6. Set the unit sensitivity to max to ensure you detect the researcher.

1. Development the areas and set alarms if they're on at odd hours or extended intervals. This may help you discover bad sensors.
2. Trending also can assist determine financial savings for the next undertaking justification.