Lighting Occupancy Sensors

Introduction

Lighting accounts for approximately 30 to 50% of a building's energy consumption, and approximately 17% of the electricity consumed in the U.S. By simply turning off lights when they are not needed, energy consumed by lighting can be reduced by 45%.[1] Occupancy sensors are a great technology because they can monitor the need for lighting in a particular area. They can also be used to turn on or turn off other electrical equipment in order to save energy in other areas besides lighting.

Background

Lighting occupancy sensors are a convenient way to eliminate the forgetfulness that many people tend to over-look when it comes to turning the lights off. Lighting occupancy sensors are devices that can detect movement with-in a defined space, such as a bedroom. Only when movement is detected will these sensors light the area to which they correspond. These sensors are used most effectively in spaces that are rarely occupied, which may include: offices, warehouses, storerooms, restrooms, loading docks, corridors, stairwells, office lounges, and conference rooms.[2] Conversely, there are spaces where lighting occupancy sensors would be nearly useless; for example, high traffic areas containing steady activity. There are two types of sensors that are much most commonly used today; they are the passive infrared and ultrasonic sensors.

Infrared sensors are triggered when a warm object moves either in or out of the line of sight defined for the sensor, such as a person's body. These sensors are best used within a fifteen foot range of human activity due to potential dead spots in the room where the sensor can not be activated and because the detection becomes more difficult as an object moves further away. Ultrasonic sensors emit a very high sound frequency which is well above that of both human and animal hearing capabilities. Ultrasonic sensors are triggered when they detect changes occurring in the reflected sound surrounding the area of the room. The sound waves are then monitored to see if any changes have occurred in the reflected sound. Ultrasonic sensors can cover a much larger area and are also more sensitive then the infrared sensors. Since ultrasonic sensors are more sensitive, they are sometimes prone to being set off unnecessarily, such as by movement in the air or by an HVAC system turning on or off. The range of these occupancy sensors can be seen below in Figure 1.

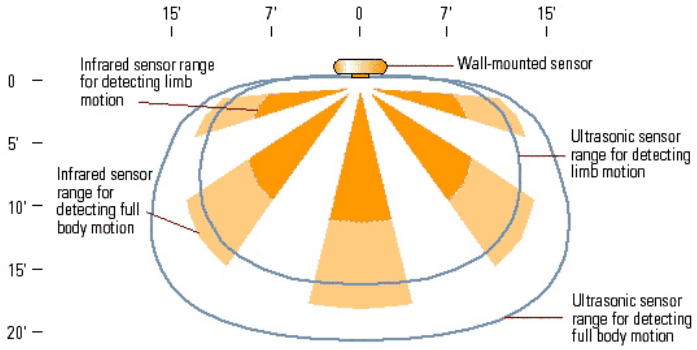

Figure 1: Occupancy Sensor Range Diagram

Lighting is the most commonly used application for occupancy sensors, but they are also extremely effective for other uses. In cafeterias and other rooms in which a large amount of people gather, occupancy sensors can be used to control ventilation fans. Since people dissipate heat, the temperature of a room can increase drastically as more and more people enter. An occupancy sensor can turn on a ventilation fan when people start to enter a room so that as more and more heat is dissipated, the room temperature doesn't increase as drastically. This is an advantage over a temperature control system, since the occupancy sensor will get a head start before the room actually starts to heat up.

Lighting occupancy sensors have been around for years now and are an inexpensive and easy way to save money on energy costs. It is important to install the right type of sensor in the right location; otherwise, they could end up wasting energy. Some typical savings have been studied and determined for various types of rooms, these savings and their respective room type are shown below in Table 1. Occupancy sensors which have been installed currently reduce the energy demand by 30 % on average. [2]

Table 1: Energy Savings per Room Type

Type of Room	Energy Savings (%)
Private office	13 to 50
Open-plan office	20 to 28
Classroom	40 to 46
Conference room	22 to 65
Restroom	30 to 90
Corridors	30 to 80
Storage area/closet	45 to 80

Rebates

The New Jersey Clean Energy Program promotes the use of occupancy sensors and offers rebates to help make them even more affordable to the public. The rebates claim that for the purchase of every wall mounted sensor, you receive $20 back per controller. For the purchase of a remote mounted sensor, you receive $35 back per controller. For the purchase of daylight dimming sensor, you receive $25 back per fixture controlled. For the purchase of occupancy controlled hi-low fluorescent controls, you receive $25 back per fixture controlled.

There are several different manufacturers of occupancy sensors. The first company is The Watt Stopper, which manufactures a complete line of energy efficient and intelligent lighting, HVAC, and office power control products. The second company is Sensor Switch Inc, which manufactures passive infrared occupancy sensors, daylight control devices, and passive dual technology sensors. The third company is Novitas Inc, which produced the first sensor for lighting control and today provides more than 2,000 large commercial, institutional, and governmental organizations with controls for lighting. These are just a few of the many occupancy sensor manufactures.[2]

Case Study

Occupancy sensors are in use throughout the world and are reducing the amount of energy being wasted. The J.N. Desmarias Library, located on the Laurentian University Campus, realized that they were wasting energy due to two main facts. Their current light fixtures were old and not efficient, and the lights were left on constantly from 7 a.m. until the library closed at 1 a.m.[3] To save energy, the old light fixtures were then replaced with new efficient fluorescent light fixtures. The next step was to monitor the use of each section of the building and shut off the lights when they were not in use. The solution to this problem pointed toward the use of occupancy sensors. Occupancy sensors were installed in all areas where the lights aren't federally required to be on. These areas include the book stacks, conference rooms, and restrooms. Seventy-four occupancy sensors were installed in total. These occupancy sensors were setup in such a way that the lights would only turn on when there was a person in a specific aisle of the library, and not just passing by. This makes the sensors that much more efficient. The installation of the occupancy sensors alone saved approximately 30% of the electric bill. This accounts for approximately 21,196 kW.

The largest amount of savings occurs in both commercial and industrial applications. This is mainly due to the fact that this is where the most amount of energy is wasted. However, there are also significant savings in residential applications. The most common occupancy sensor application in a residential area is the controlling of outdoor lights with a motion detector. When there is movement around the light, the light turns on. This helps to save energy as well as aiding in security purposes. They can also be used in rooms around a house. Have you ever waken up in the morning and find out that there are lights that have been left on all night? Occupancy sensors would be the perfect solution to this problem.

References

End Notes

[1] "Occupancy Sensors." Green Seal's Choose Green Report. Feb. 1997. Green Seals. <http://www.greenseal.org/resources/reports/CGR=Sensors.pdf>.

[2] "Lighting: Occupancy Sensors." Reliant Energy. 2003. 20 Oct. 2006

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[3] "The Watt Stopper Occupancy Sensors Reduce University Library Load by 30%." The Watt Stopper, Inc. 23 Oct. 2006 <http://www.wattstopper.com/getdoc/438>.