

Intuitious TechNote: Occupancy Sensor Technologies, February 2010

Motion sensors have been in widespread use within security systems for decades. Recent advancements in the core technologies have led to higher accuracy and reliability, smaller size and reduced power consumption. There are now hundreds of devices on the market from dozens of manufacturers based on several different technologies. In general, these devices are all good, but it remains important to select the best technology and device for each application. By example, an intruder detection system takes a one-shot reading and has a very low tolerance for false positives, whereas an occupancy based energy conservation system uses timers, logic and multiple readings to determine human occupancy.

The most popular technologies are Passive InfraRed (PIR), Ultrasonic and MicroWave (MW). Some manufacturers offer dual sensor devices with PIR as the primary and either Ultrasonic or MicroWave as a secondary sensor. A brief overview of these technologies follows:

Passive Infrared (PIR) sensors react to the infrared heat energy emitted by humans. PIR sensors are passive devices that only detect radiation; they do not emit it. This characteristic is ideal for wireless battery powered sensors and other low power applications such as solar and energy harvesting devices. PIR sensors are designed for maximum sensitivity to objects that emit heat energy at a wavelength of 10 microns. This is the peak wavelength of the heat energy emitted by humans.

Ultrasonic sensors activate a quartz crystal that emits ultrasonic sound waves at frequencies above human sensitivity, typically at 30 to 40 kHz. When there is movement within the detection area, the waves are disrupted, which triggers the sensor. These sensors continuously emit these waves and may result in minor noise in hearing aids.

Microwave (MW) motion detectors use microwave signals to emit frequencies that bounce off of the surrounding area; similar to a police radar gun. When an intruder passes the field of a microwave sensor, he disrupts the frequency, which sets off the sensor's alarm.

Detector Comparisons

All three technologies offer very similar characteristics in terms of overall performance and all rely on line-of-sight, so care must be taken to ensure optimal location within the sensing area. Ultrasonic and microwave sensors are typically more expensive, but provide a larger coverage area than PIR detectors. However, increased sensitivity means that ultrasonic and microwave sensors are more susceptible to false triggering due to any movement in the space. For example, unless carefully calibrated, ultrasonic sensors will react to non-occupant movement such as breezes from open windows or HVAC systems. Passive Infrared sensors consume far less power since no energy is emitted from the device, whereas Ultrasonic and Microwave technologies continuously emit high frequency sound and microwave pulses.

Dual-Sensor Devices

Many manufacturers now offer dual-sensor devices that pair PIR technology with either ultrasonic or microwave technology to maximize accuracy, primarily for intruder detection applications. PIR draws less energy than ultrasonic and microwave detection, so many devices are calibrated so that when the

PIR sensor is tripped, it powers up and activates the secondary sensor technology. If the latter also picks up an intruder, then the alarm is triggered.

Occupancy Detection for Energy Conservation Systems

Each technology and the combination of these technologies have advantages and disadvantages that make it more suitable for some applications than others. There are two primary applications for these technologies; Motion Sensors and Occupancy Sensors.

A **Motion Sensor** is a device that detects motion, usually for the purpose of alerting a security system or turning on a surveillance camera. This is a one-shot event and dual sensor technologies are ideal for this purpose since a false-positive can have detrimental effects.

An **Occupancy Sensor** is a device that utilizes motion sensor technologies that are optimized for human detection and applies some intelligent logic to maintain the state of an area as either occupied or vacant.

Intuitous utilizes PIR technology within all its occupancy sensors including both wired and wireless remote sensors and the wired family of controllers with integrated sensors. The PIR sensor component is designed and built for Intuitous by a leading manufacturer with over 25 years experience specializing in the motion detector field.

Unlike security sensors which are typically wall mounted and aimed at doors and windows, Intuitous occupancy sensors provide a 360 degree detection range from a discrete ceiling mounted enclosure. This configuration along with integrated timers and logic provides for optimal management of occupancy state within an energy conservation system.