

Evaluating the Performance Characteristics of Occupancy Sensors

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Introduction

As part of the National Lighting Product Information Program (NLPIP), the Lighting Research Center is collecting technical performance data from occupancy sensor manufacturers, and is performing spot-check tests on certain performance characteristics of the sensors. Most manufacturers publish occupancy sensor performance data by describing the field of view, sensing range, and coverage area of their products; however, as the sensitivity of the sensor is changed, the coverage area and the ability of the sensor to maintain detection may change as well. This poster reports our preliminary findings, and the methods for testing these effects.

Methodology

Most sensors respond to three types of movement: large body movement such as walking, medium body movement such as moving an arm, and small body movement such as moving wrists, hands and fingers. We evaluated the performance of an infrared wall switch sensor for each of these movements at 100%, 50%, and 10% sensitivity settings.

A 22' x 20' room was used to perform the tests. A 2' x 2' grid was marked on the floor and used for mapping body movements in the room. The sensor was mounted on a cart at an approximate switch height and was positioned at the center of the north wall. The sensor was wired to a 100 watt A-lamp to satisfy the minimum incandescent load required for operation. Figure 1 illustrates the set-up.

The sensor sounded an audible signal shortly before it turned off the lights. If the sensor detected motion, the incandescent lamp remained on and the audible signal ended. If the sensor did not detect motion, the light went off.

A walk test was used to test the ability of the sensor to detect large body movements, moving an arm sideways and up and down was used to test for the ability of the sensor to detect medium movements, and hand tasks such as turning pages and writing were used for testing the ability of the sensor to detect small body movements. For

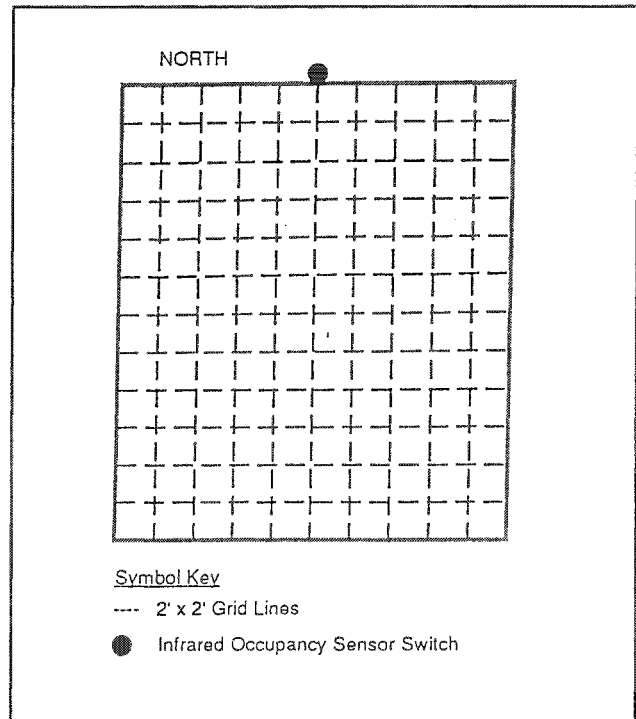


Figure 1. Spot Check Set Up Floor Plan. 1 Block = 4 Square Feet

each of the movement types, a person was located at a specific grid point in the room, and the sensor was activated. The person moved when the audible signal sounded. The detection response was documented on the grid plan.

Iso-sensitivity contours were generated for the three body motion conditions for each sensitivity setting. The isosensitivity plot shows the maintained detection contour and graphically depicts the coverage area for each body movement.

Results

Figures 2, 3, 4, 5, and 6 illustrate the iso-sensitivity plots for each body movement at 100%, 50%, and 10% sensitivity settings respectively.

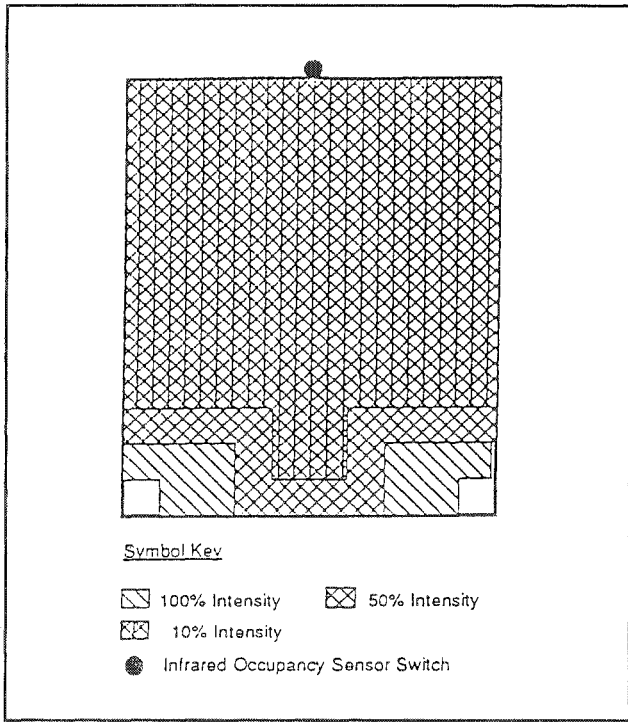


Figure 2. Walk Test Iso-Sensitivity Plot North/South Direction. 1 Block = 4 Square Feet

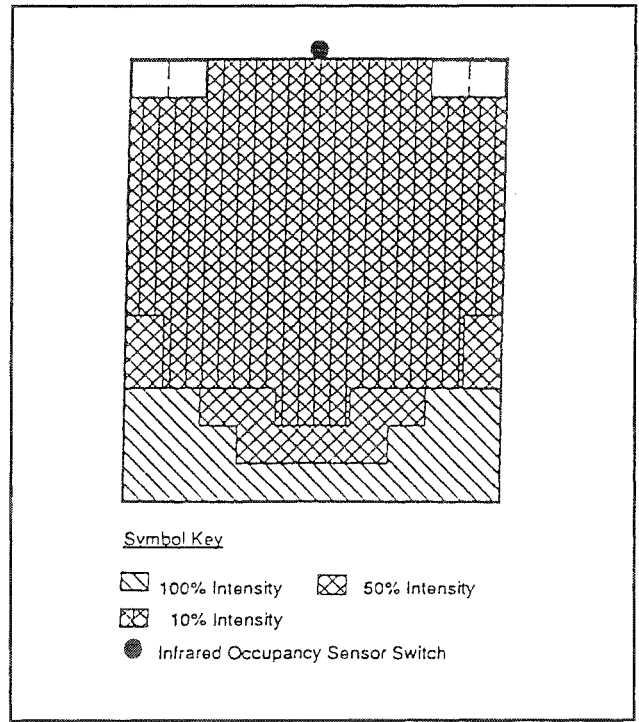


Figure 4. Arm Motion Iso-Sensitivity Plot U/Down Direction. 1 Block = 4 Square Feet

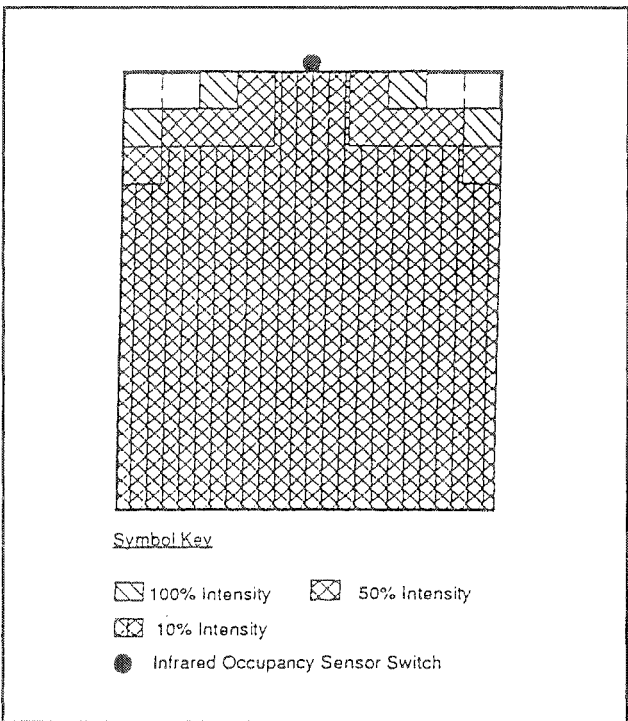


Figure 3. Walk Test Iso-Sensitivity Plot East/West Direction. 1 Block = 4 Square Feet

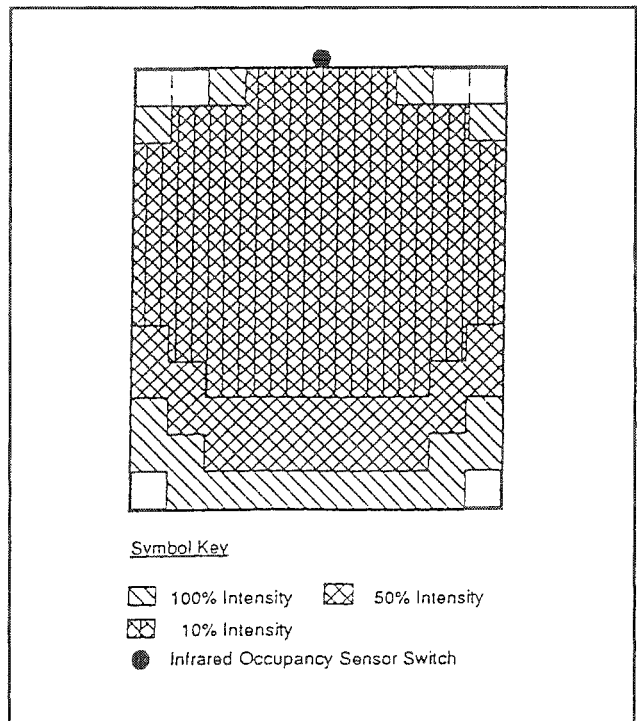


Figure 5. Arm Motion Iso-Sensitivity Plot Side to Side Direction. 1 Block = 4 Square Feet

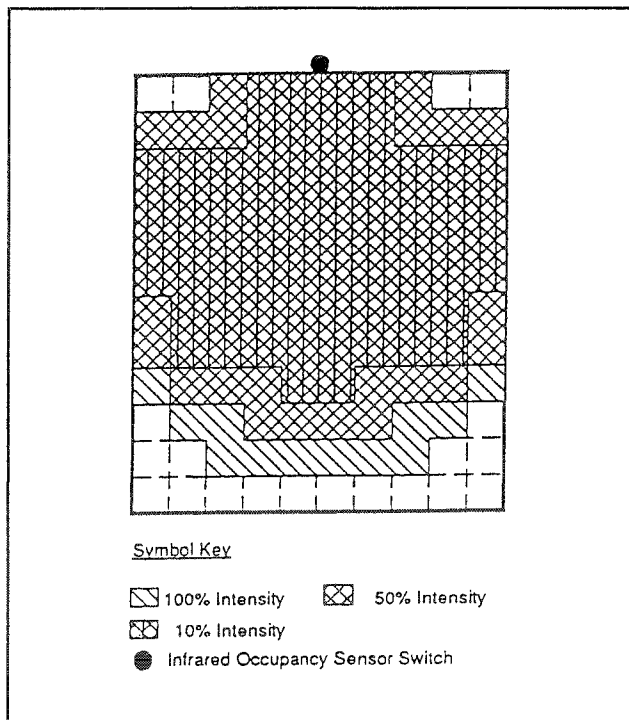


Figure 6. Small Hand Motion Iso-Sensitivity Plot.
1 Block = 4 Square Feet

Conclusions

The iso-sensitivity plots for the three body motions show that the sensor was most reliable for detecting the walking motion, and that for each body movement the coverage area always decreased when the sensitivity was reduced. Table 1 summarizes the coverage area reductions.

These results show that changing the sensitivity of the wall switch sensor affected the coverage area and the ability of the sensor to maintain detection in the space for all three body movements. Manufacturers should consider publishing this information to help customers minimize inappropriate applications of this type of product.

Acknowledgements

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Table 1. Percent Coverage Area Reductions for Each Movement

Movement	Coverage Area Reduction Between Sensitivities		
	100%-50%	100%-10%	50%-10%
Walking North/South	7%	22%	18%
Walking East/West	2%	13%	12%
Arm Movement Up/Down	17%	37%	23%
Arm Movement Side to Side	9%	21%	13%
Wrist Movement	12%	34%	25%