PIR Sensor Modeling and Simulation Using COMSOL Multiphysics® and Its Ray Optics Module

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Abstract

PIR (Passive Infrared) sensor is the most widely used motion sensor for occupancy detection in building automation applications. Normally, only the binary information indicating presence or absence is used. However, an advanced analysis of the PIR sensor analog signal can results in more detailed information about the source of detection. Using machine learning methods the detection can be classified to be either a human or a non-human origin. It may be able to define the speed of the source and approximate distance between source and the sensor and to decide, whether the signal originates from a single person or from multiple people. In this study, a simulation model for PIR sensor optics is developed. Time dependent simulation results in the analog signal waveform of PIR sensor. It is possible to model PIR sensor electronics by using AC/DC Module and its electrical circuit interface. LiveLink™ for MATLAB® provides the powerful mathematics tools of MATLAB® for collaborative use with COMSOL Multiphysics®. FFT and wavelet transforms (CWT) will reveal more information on the source.