Photosensor-based lighting control is a common method for daylight harvesting in buildings. However, the use of photosensors to control interior lighting is nontrivial. A photosensor signal greatly depends on the position of the sensor relative to room surfaces and daylight apertures (e.g. windows), as well as on room surface material properties. Various problems associated with calibration and commissioning contribute to the fact that photosensor-based systems have seen limited application and have traditionally faced market barriers.

While occupancy sensors are generally reliable in their performance, under certain circumstances they do not function well. Quiet activities such as reading or working at desk may not be detected, causing the lights to turn off, much to the annoyance of the occupants. The sensor can also pick false alarms by detecting movement outside the room and thus turning the lights on for no reason.

An image sensor can be thought of a combination of a cluster of photosensors. Unlike photosensors, they do not give us a single electrical signal, but luminance as well as color information simultaneously at thousands of points within the space. Not only that, a sequence of images can give us information on occupancy within the room. Thanks to the tremendous growth and development in CMOS technology, today digital imaging is pervading every sphere of our life, providing us with cost-effective and innovative solutions. This is the motivation behind this proof-of-concept research on the application of digital imaging in lighting control.

The Cam-Sensor 2 project has demonstrated a proof-of-concept lighting control and occupancy sensor that is robust to major contributions of outside lighting entering the room as well as to stationary room occupants – the occupant never has the lights turned out on them. This work has demonstrated in the early stages that approximately a 50% cost savings over conventional occupancy only sensing can be obtained while maintaining a target light level over the course of an entire day.

This work has led to a major proposal submitted to the California Energy Commission through their EISG program.
Target and measured illuminance near a define region-of-interest in the controlled room over a 16 hour period.

Occupancy sensing detection; Green pixels indicate objects that exhibited movement since the last gathered frame.
Regions-of-interest used for lighting control calibration. The illuminance at each location is kept as close to a constant target level as possible throughout the day and night.