In this work, we present SCOPES, a distributed Smart Camera Object Position Estimation sensor network System that provides maps of distribution of people in indoors environments. Each node in the system is comprised of a Cyclops camera that performs local detection and processing of the visual information and a Tmote Sky sensor node, which provides multipath communication. SCOPES uses local adaptive techniques that enables intelligent duty-cycling between the active sensing and the information processing tasks performed at each node. The system switches between the fast and simple background subtraction algorithms for object detection, to the more computationally intensive object grouping algorithms for estimating the number and direction of travel of multiple persons in the local field of view.

By aggregating meta-information generated by each node, SCOPES is able to minimize the total data transmitted in the network and still be able to generate an accurate density estimation map of the coverage area. Using analysis, simulation and experimentation, we show that the system is able to provide a small global error estimate of the spatio-temporal distribution of people in indoors environments despite the absence of continuous sensing when doing local information processing and sparse coverage. In the work, we show the results of people density estimation, power consumption, memory usage, latency and detection probability on a real system deployment at the University of California, Merced.

**Performance Evaluation**

- Performance of the system is determined by its ability to effectively monitor the target area for movement of individuals.
- Key metric is Failure Detection Probability.
- Increase in the number of memory banks allows the sensor to process more data at a time which on an average should increase the probability of detection.
- Average error per section depends upon factors like the presence of external illumination.
- Provide a sample map of the transition of individuals inside different sections of a building from our deployment.

**Conclusion**

We showed that SCOPES is able to provide a small global error estimate of the spatio-temporal distribution of people in indoors environments despite the absence of continuous sensing when doing local information processing and sparse coverage, under severe resource constraints.