

# Abstract: Energy-Driven Occupant Behaviour Sensing

Samuel C.B. Wong

August 3, 2020

Building energy and comfort management based on occupant behaviour pattern detection requires large-scale sensor deployment to discern the number of occupants, their distribution, and perhaps activity level. However, the notion of numerous sensors in households and workspaces collecting rich sets of data, such as images and audio, raises privacy concerns. Moreover, the maintenance of such deployments, for example periodic battery replacement or manual data collection, means that such systems are impractical. A pervasive, self-powered, wireless sensing system, which enables true deploy-and-forget scenarios is required. This class of systems are powered from energy harvesters, such as solar cells or RF rectennas, and collect sparse amount of data opportunistically as energy becomes available. As a bulky battery is no longer required in these devices, non-intrusive form factors, such as stamp size devices attached to windows or flexible circuits embedded in fabrics can be considered. Due to the limited capability of these systems however, the sensed parameters are typically sparse accelerometer data, infrared readings, etc. as opposed to images or audio streams. While appealing from a privacy point of view, meeting application requirements under such constrains is a substantial challenge. Furthermore, the design of robust self-powered sensing system that require zero maintenance is non-trivial. This presentation is on the challenges in realising such systems and the state of the art research efforts in this domain. Results from case studies illustrating the use of such systems for occupant behaviour monitoring is also presented thus demonstrating the feasibility of this approach.