NSF CPS Large Proposal 0931843: Abstract

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The objective of this research is to develop a theory of "ActionWebs", that is, networked embedded sensor-rich systems, which can be tasked to coordinate multiple decision-makers. The approach is to first identify models of ActionWebs using stochastic hybrid systems, an interlinking of continuous dynamical physical models with discrete state representations of interconnection and computation. Second, algorithms will be designed for tasking individual sensors, based on information objectives for the entire system. Third, algorithms for ActionWebs will be developed using multi-objective control methods for meeting safety and efficiency objectives. Two grand challenge applications for this research are in Intelligent Buildings for optimal heating, ventilation, air conditioning, and lighting based on occupant behavior and external environment; and Air Traffic Control for mobile vehicle platforms with sensor suites for environmental sensing to enable safe, convenient, and energy-efficient routing.

The intellectual merit of this research stems from a conceptual shift of ActionWebs away from *passive* information gathering to an *action-orientation*. This involves: modeling of ActionWebs using stochastic hybrid systems; taskable, multi-modal, and mobile sensor webs; and multi-scale action-perception hierarchies.

The broader impact of the research is in two grand challenge national problems, namely, energy-efficient air transportation, and energy-efficient, high productivity buildings, and will tackle social, privacy, economic, and usability issues. Integrated with the research is a program of coursework development in networked embedded systems, across stovepipes in EECS, Aero-Astro, Civil, and Mechanical Engineering departments. Outreach objectives include new course design at San Jose State University, and recruiting more women researchers.