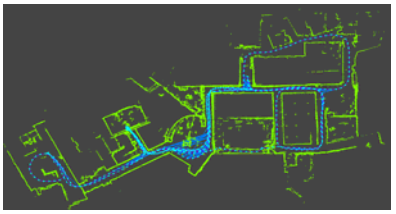
Research and Teaching Activities
Prof. Seth Teller, MIT CS & AI Laboratory
December 2011
http://rvsn.csail.mit.edu

**Collaborative Man-Portable Mapping of GPS-denied Regions**
(Joint work with Maurice Fallon, Hordur Johannsson, Jonathan Brookshire, and John Leonard at MIT, and Anthony Lapadula at MIT Lincoln Laboratory)

A wearable sensor rig and real-time distributed SLAM (simultaneous localization and mapping) algorithm enable a group of people to traverse a complex, GPS-denied region (such as a building, cave or tunnel network) and collaboratively produce a metrical-topological-semantic map representing the union of the paths explored by all participants. A hazardous-material remediation team with similar rigs could sweep quickly through a GPS-denied region of interest, marking areas or objects of interest, with outside observers using the transmitted map-in-progress to plan subsequent actions.



**Crowdsourced Indoor Location Discovery**
(Joint work with Jun-geun Park and Dorothy Curtis at MIT, and Jonathan Ledlie at Nokia Research Center Cambridge)


This project uses signal strengths of commodity wireless access points as room signatures, enabling laptops and smartphones to discover their locations. Crowd members contribute data by moving and occasionally indicating their location using a GUI.

**Autonomous Wheelchair Mobility and Manipulation for Environmental Control**
(Joint work with Matthew Walter, Sachi Hemachandra, Sudeep Pillai and Nick Roy at MIT)

As an alternative to modifying residential/health-care infrastructure to support wireless control of environmental affordances (doors, light switches, elevator call buttons), we are developing methods with which an unskilled human caregiver can demonstrate to a mobile manipulator – a power wheelchair and robot arm – how to use each affordance.

**Supervised Mobile Manipulation**
(Joint work with Julie Shah, Matthew Walter, Mike Fleder and Jon Brookshire at MIT, and Matt Antone & Yuli Friedman at BAE Systems)

This project replaces joint-level teleoperation of a remote mobile manipulator (a forklift, a PR2, a Packbot, or a wheelchair with arm and gripper) with a human-robot interface in which the human supervisor uses a multi-modal GUI to give the robot critical information about the workspace, the manipulands and their degrees of freedom and other properties, and the mobility and manipulation plan, after which the robot uses local perception and closed-loop control to execute the specified plan.

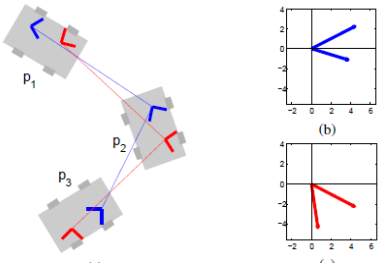
**Assisted Perception**

(Joint work with David Hayden, Yafim Landa, Jim Glass, Rob Miller, Aude Oliva, Nick Roy, and Antonio Torralba at MIT, and Carol Livermore at NEU)


Blind and low-vision people trade off safety, independence and efficiency in the conduct of most tasks of daily living. The goal of this effort is to develop a wearable device that provides situational awareness supporting independent mobility, shopping, food preparation, eating, socialization and recreation. Key capabilities include freespace and obstacle detection, object recognition, person identification, face and expression recognition, and a dialog-based interface incorporating audio, Braille and haptic display.

**Automated Extrinsic Sensor Calibration**

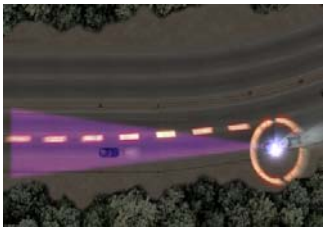
(Joint work with Jonathan Brookshire)




Applications requiring sensor fusion require the geometric transformation relating multiple sensors, e.g. lidars mounted on a robot or on a body-worn capture rig. Our algorithms recover the 3-DOF transformation (for planar, co-planar sensors) and 6-DOF transformation (for 3D, generally positioned sensors) automatically by optimizing over the calibration parameters.

**Diverting/Alerting Mechanism for Roadside Emergency Personnel**

(Joint work with Brian Wu, Rui Li, Berthold Horn, and Missy Cummings at MIT, and Matt Antone, Dan Creeden, Yuli Friedman and Rich Ivey at BAE Systems)

This project aims to reduce the incidence rate of police and other emergency personnel being killed or injured when stopped along the roadside, due to collisions caused by oncoming drivers who are impaired or inattentive. One aspect of the project focuses on developing projected visible cues to guide drivers around the stop site. The second aspect of the project focuses on developing machine vision algorithms to monitor the roadway and warn emergency personnel of oncoming drivers who appear inattentive or impaired.

**Robotics: Science and Systems (6.141J/16.405J/RSS)**

(Co-developed with Una-May O'Reilly, Nick Roy and Daniela Rus)

This 15-week junior-level introductory robotics subject covers motion planning, geometric reasoning, kinematics and dynamics, state estimation, tracking, map building, manipulation, fault diagnosis, and embedded system development. After eight weeks of structured labs, the students spend the balance of the term designing a fully autonomous mobile manipulator (arm and gripper) that can build simple structures.

**Principles and Practice of Assistive Technology (6.S196/PPAT)**

(Co-developed with Rob Miller)

This project involves teams of students who develop technology to help people with physical, perceptual and cognitive disabilities perform activities of daily living.