

Sproom

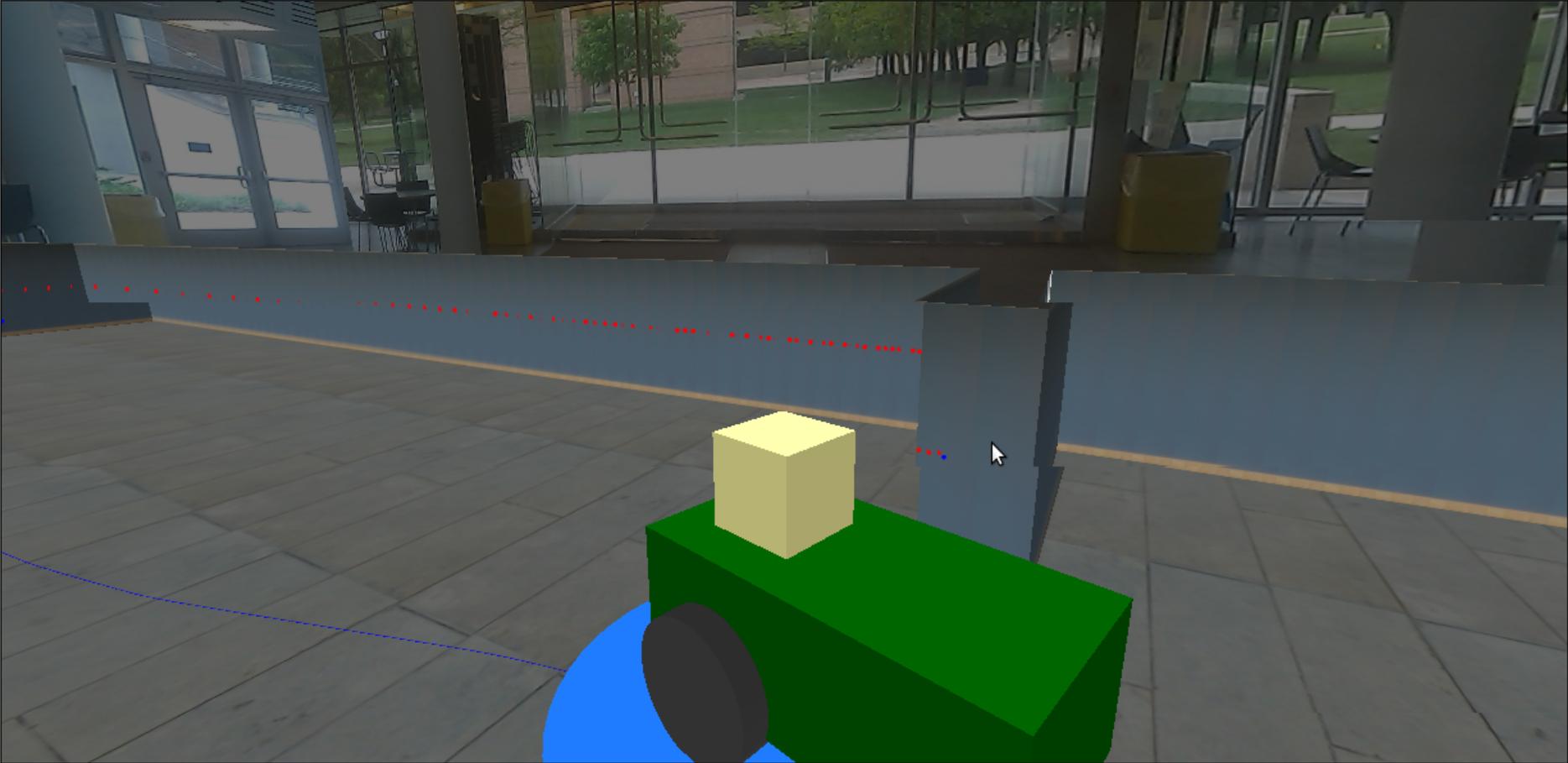
Splinter Soar Room Environment

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Motivation

- Controlling low-level robotics hardware is mostly uninteresting from a Soar perspective
 - Motor control loops, SLAM, etc.
- Sproom is a simulator that provides a more rich robotics experience than hardware permits
- Sproom mixes in real hardware when it is available

Camera Place Object

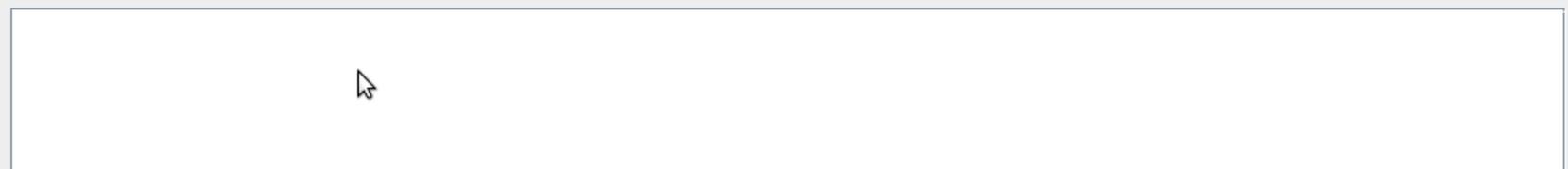
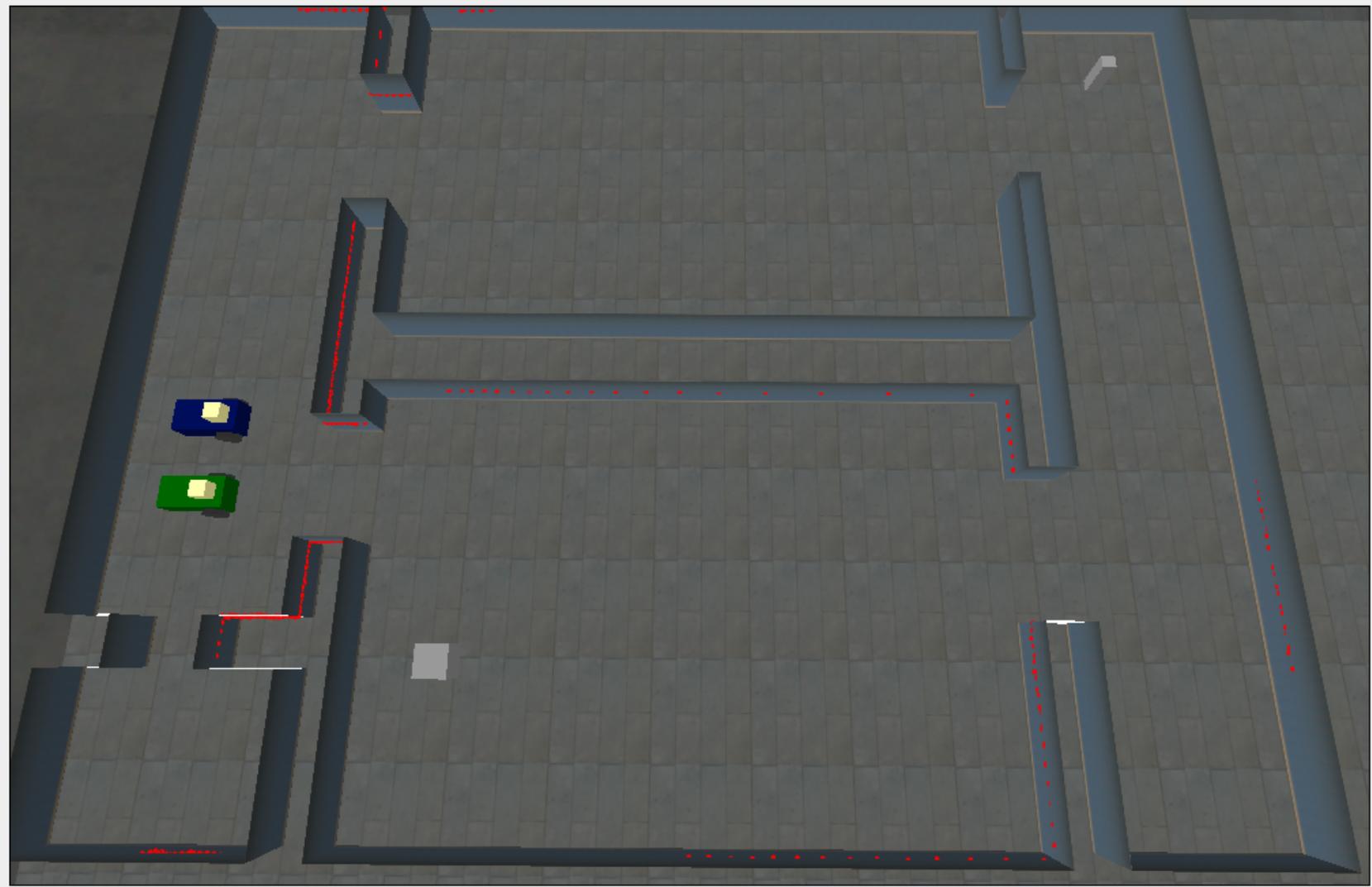


(0) seek -> operator: PICTURE block
(1) seek -> operator: saw block at (3 -2), height: short , shape: sphere , color: blue , smell: burn
(2) seek -> operator: PICTURE block
(3) seek -> operator: saw block at (12 6.400000095367432), height: short , shape: cube , color: green , smell: sulfur
(4) civ -> operator: PICTURE block
(5) civ -> operator: saw block at (12 6.400000095367432), height: short , shape: cube , color: green , smell: sulfur

seek



Camera Place Object

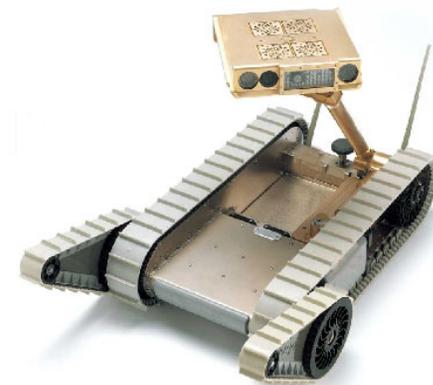
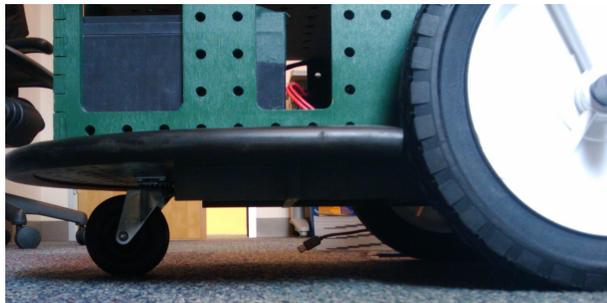


broadcast

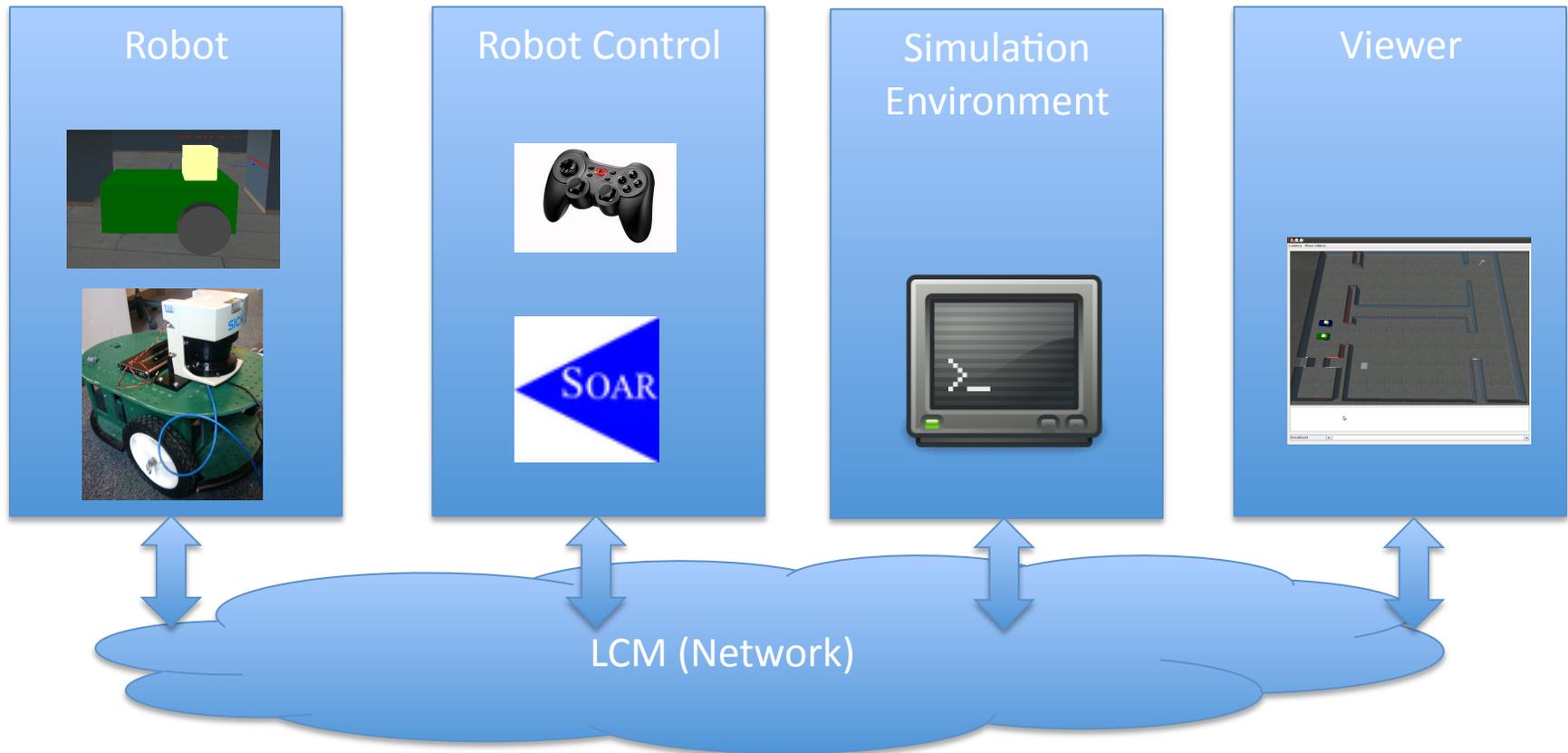


Usage

- Simulator only
 - Splinter robot simulated
- Simulator plus hardware (mixed real/virtual)
 - Splinter hardware: complete
 - iRobot PackBot support coming June 1



Sproom System Overview



Robot

- Simulated hardware:
 - Odometry (pose estimation)
 - Laser range finder
 - Differential drive motors (left, right throttle)
 - Object detection
 - Object manipulation (defuse, pickup, drop)
- Real hardware (Splinter with Orc board):
 - Odometry (pose estimation)
 - Laser range finder
 - Differential drive motors (left, right throttle)
- iRobot PackBot support coming in June

Robot Control

- Issues commands to control the robots
 - Can also control other aspects of the simulation during debugging
- Soar interface (9.3 or trunk), multiple agents
- Debugging tools for agent/robot development
 - Gamepad
 - Intuitive, useful controls for the bots and simulation
 - Web
 - When specific values are necessary (e.g. tuning controllers)
 - Viewer interface
 - Robots can be dragged around when they are fully simulated
 - Objects can be added/removed/manipulated
 - Messaging system
- Merges laser data from real and virtual environments

Simulation Environment & Viewer

- Supports many robots, holds shared state
- Manages data model for virtual hardware
 - Robot motion physics, uncertainty, collisions
 - Simulated laser range data
 - Location, detection, and state of virtual objects
 - Messaging and inter-robot communication
- Viewer: 3D state observation
 - Simulation control

LCM

<http://lcm.googlecode.com>

- LCM is a fast, efficient UDP multicast communication system
 - “Lightweight Communications and Marshalling”
- Model: Publish/Subscribe
- Simple logging and playback
- Easy to add modules
- Scales well, proven

Running Simulator

- Sproom Java program includes everything
 - Simulator, virtual robots, viewer interface, web interface, optional gamepad interface, spawns Soar debuggers
- Demo

Running Mixed Real/Virtual

- On each mobile robot:
 - Splinter hardware (Orc board)
 - SICK laser range finder hardware
 - Interface for this currently requires Linux
 - Laptop process: Java splinter
 - Subscribes to drive commands, publishes pose
 - Laptop process: sick
 - Publishes laser data
- Simulation/control computer:
 - Sproom process as before (simulator only) but with simulated robot disabled
 - Still generates simulated sick laser data based on real pose data
- Demo video

Agent I/O

<http://code.google.com/p/soar/wiki/Sproom>

Input

- Configuration (geometry, units, limits, etc.)
- Area descriptions
 - Walls
 - Gateways
 - Waypoints
- Objects (virtual)
 - Properties
- Laser range data
- Messages

Output

- Drive commands
 - Throttle, velocity, heading
- Effector commands (virtual)
 - Pick-up, drop, defuse, etc.
- Waypoints
 - Navigation assistance
- Communication
- Configuration

Nuggets

- Successful migration from simulation to real hardware
- Almost completely cross platform
- iRobot PackBot-ready

- Endless simulation possibilities

Coal

- Needs polish, tools
- Localization
- Mapping

- Many simulated sensor capabilities not grounded in reality

How to get Sproom

- Runs on Windows, Linux, OS X
- Install Java, get Soar 9.3.0
- Contact me
 - voigtjr@gmail.com
- Will be available for download soon
 - Simulator usable without any hardware
- Many thanks to Miller Tinkerhess