

The RSS I Course Challenge

RSS Lecture 12

Wednesday, 16 March 2011

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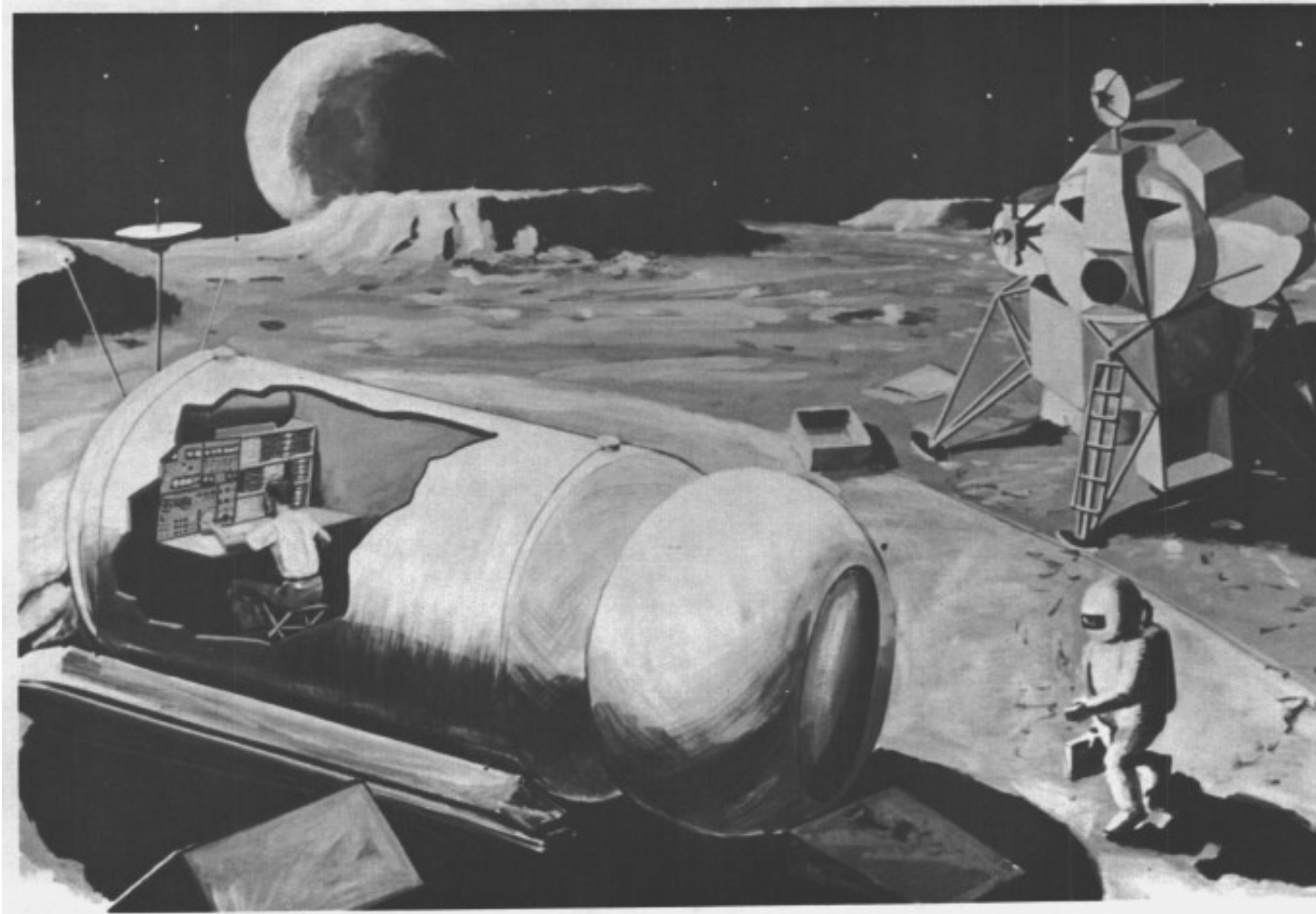
6.141
**Robotics: Science
and Systems**

Final Challenge

Overview

- RSS I “grand challenge” scenario, subtasks
- What you are provided
- Schedule through end of term
- Graded challenge milestones
- Question & answer session

Build a Shelter on Mars



Goodyear STEM (Stay-Time Extension Module) concept, 1979

Build a Shelter on Mars

- Robot parachutes into a remote, crudely-mapped environment such as Mars
- Materials, fiducials delivered as well; robot must prepare space for later-arriving humans
- Some materials delivered accurately to planned locations; other materials go awry
- Robot must move around to explore and familiarize itself with its new space
- After capturing a rough map, the robot selects a spot for constructing a shelter
- Robot then collects materials, transports them to the shelter site, and builds shelter

Challenge sub-tasks

- **Plan and Navigate:**
 - Form motion plans around mapped, unmapped obstacles
 - Navigate from known start location to construction site
 - Optional: motion planning from unknown start location
- **Identify Construction Site:**
 - Define site location a priori, or have robot choose it online
- **Find Objects:**
 - Detect objects of known types at known locations
 - Detect objects at unknown locations, identify object types
- **Gather and (Optionally) Store Objects:**
 - Collect blocks on, under, or in robot body
- **Transport Objects:**
 - Convey blocks to selected construction site
- **Construction:**
 - Create a simple structure of your choice (e.g. group, row, open wall, closed wall, multi-story wall) at construction site
- **Optional:**
 - Any technical aspect of the challenge that you wish to focus on

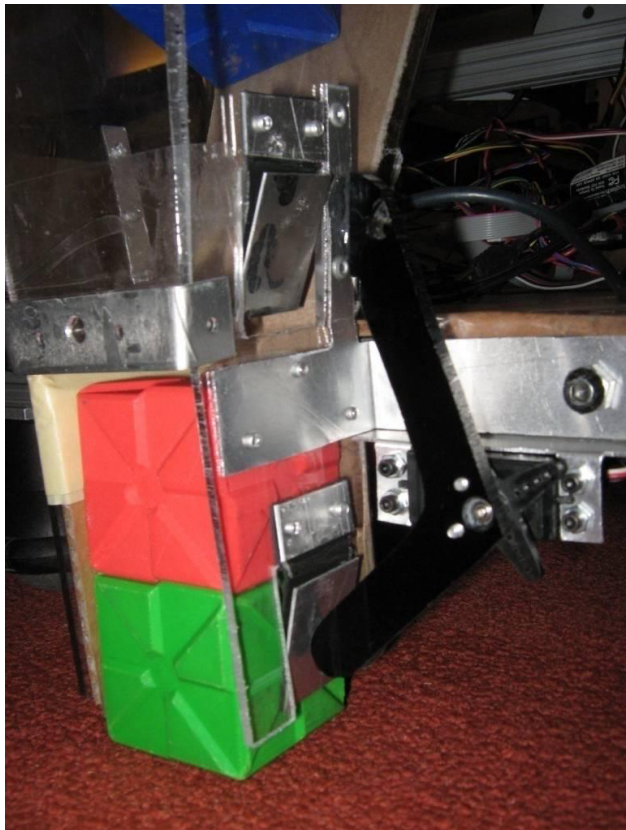
What you are provided

- Hardware and Tool Access
- Approximate map of challenge area
- Fiducial locations, color coding
- Rules / constraints

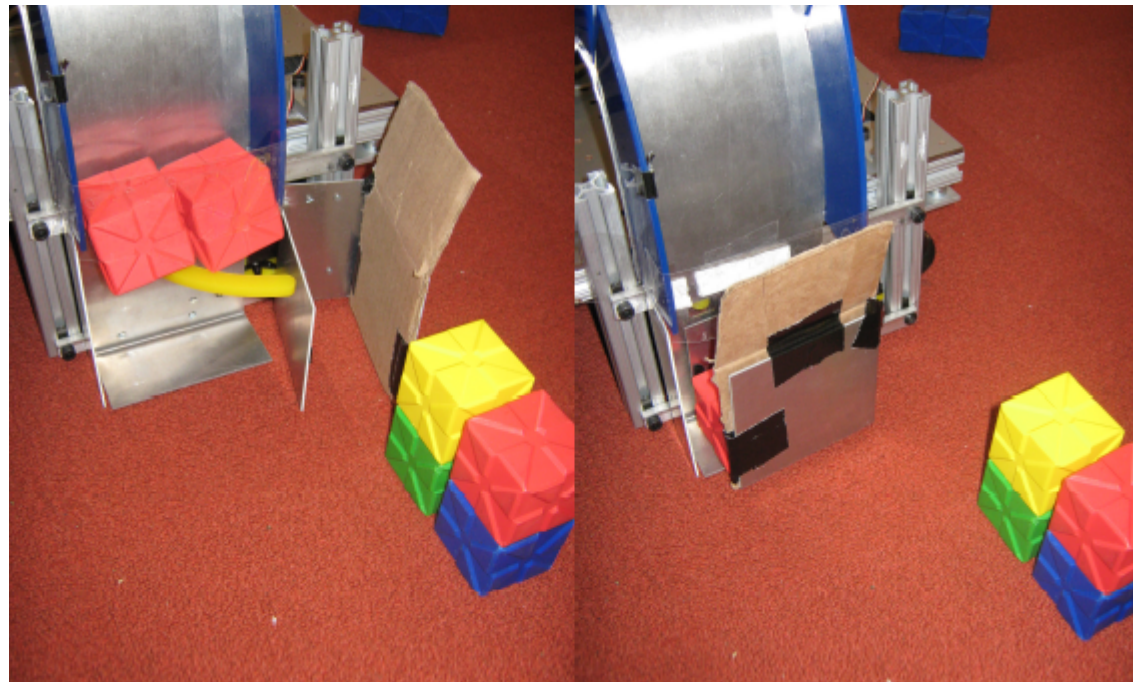
What you are provided

- Hardware and Tool Access
 - Standard RSS microbot, sensors, etc.
 - Delrin, Lexan, sheet metal, plywood etc.
 - Any other parts needed from RSS, EECS stock
 - \$50 budget for outside components
(use MIT's tax-free number, save receipts)
 - Access to shop, waterjet cutter, 3D printer, ...
 - **Absolutely no** cardboard or duct tape
(decorative or cosmetic cardboard is OK)
- An approximate map of challenge area
- Fiducial locations, color coding
- Rules / constraints

Examples from Past Years

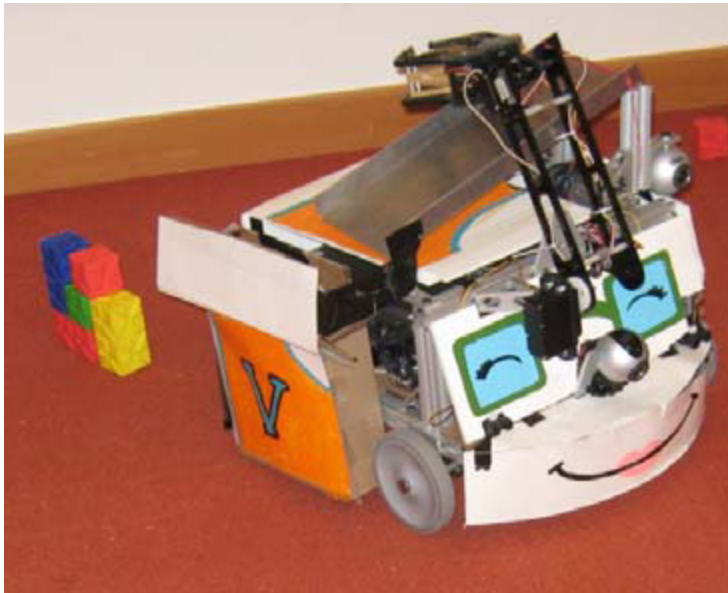


Block marshalling, servo-controlled release mechanism

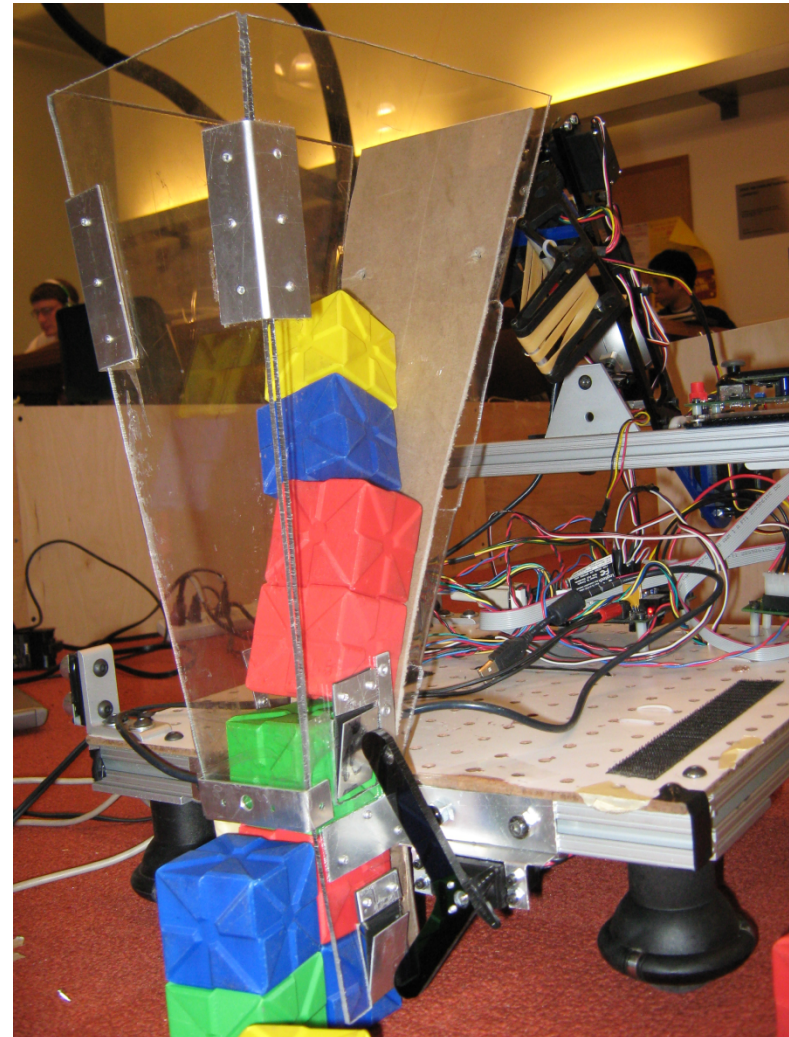


Alternative design from another team

Examples from Past Years



Block marshaller





Funneling mechanism

What you are provided

- Hardware and Tool access
- An approximate map of challenge area
 - Polyline perimeter of operation area
 - Mapped and unmapped obstacles
 - Mapped and unmapped blocks
- Fiducial locations, color coding
- Rules / constraints

What you are provided

- Hardware
- An approximate map of challenge area
- Fiducial locations, color coding
 - Two vertically-stacked colored balls 
 - Use any blob detector from visual servo lab 
- Rules / constraints

What you are provided

- Hardware
- An approximate map of challenge area
- Fiducial locations, color coding
- Rules / constraints
 - Team must be ready to run when your turn
 - Bot must be staged, left to run for 10 minutes
 - Bot can't make destructive/irreversible changes
 - Walls will not move (much) if bot hits them

Challenge Schedule 2011

- **This Friday:**
 - CI-M lecture on expectations for team-written challenge proposal
- **Friday 1 April:**
 - Team-written draft challenge proposals due
- **Monday 4 April, Wednesday 6 April**
 - Challenge design briefings to staff (dry runs in lab, 4 teams each day)
 - Challenge project begins in lab on April 6
- **Friday 8 April**
 - CI-M feedback on draft challenge proposals returned by today
- **Monday 11 April, Wednesday April 13:**
 - In-class design review presentations
- **Wednesday 20 April:**
 - Revised team-written challenge proposals due
- **M 25 Apr, W 27 Apr (Architecture Freeze), M 2 May, W 4 May:**
 - Graded Challenge milestones (in lab)
- **Friday 4 May starting at 1pm:**
 - Timed and judged challenge runs
- **Sunday 6 May:**
 - Last chance run

Graded Challenge Milestones

- **As specified in team-written Challenge proposal**
 - Will be graded by staff
- **Monday 24 Apr:**
 - Graded challenge milestones (in lab)
- **Wednesday 27 Apr:**
 - Graded challenge milestones (in lab)
- **Monday 2 May:**
 - Graded challenge milestones (in lab)
- **Wednesday 4 May:**
 - Graded challenge milestones (in lab)
- **Friday 6 May:**
 - Timed challenge runs
- **Sunday 8 May:**
 - Last chance challenge runs

Team huddle

- Come up with several questions
- We'll discuss until end of today's meeting
- Submit remainder to rss-help
 - We'll post responses to wiki (Challenge FAQ)