The RSS I Course Challenge

RSS Lecture 13

Wednesday, 21 March 2012

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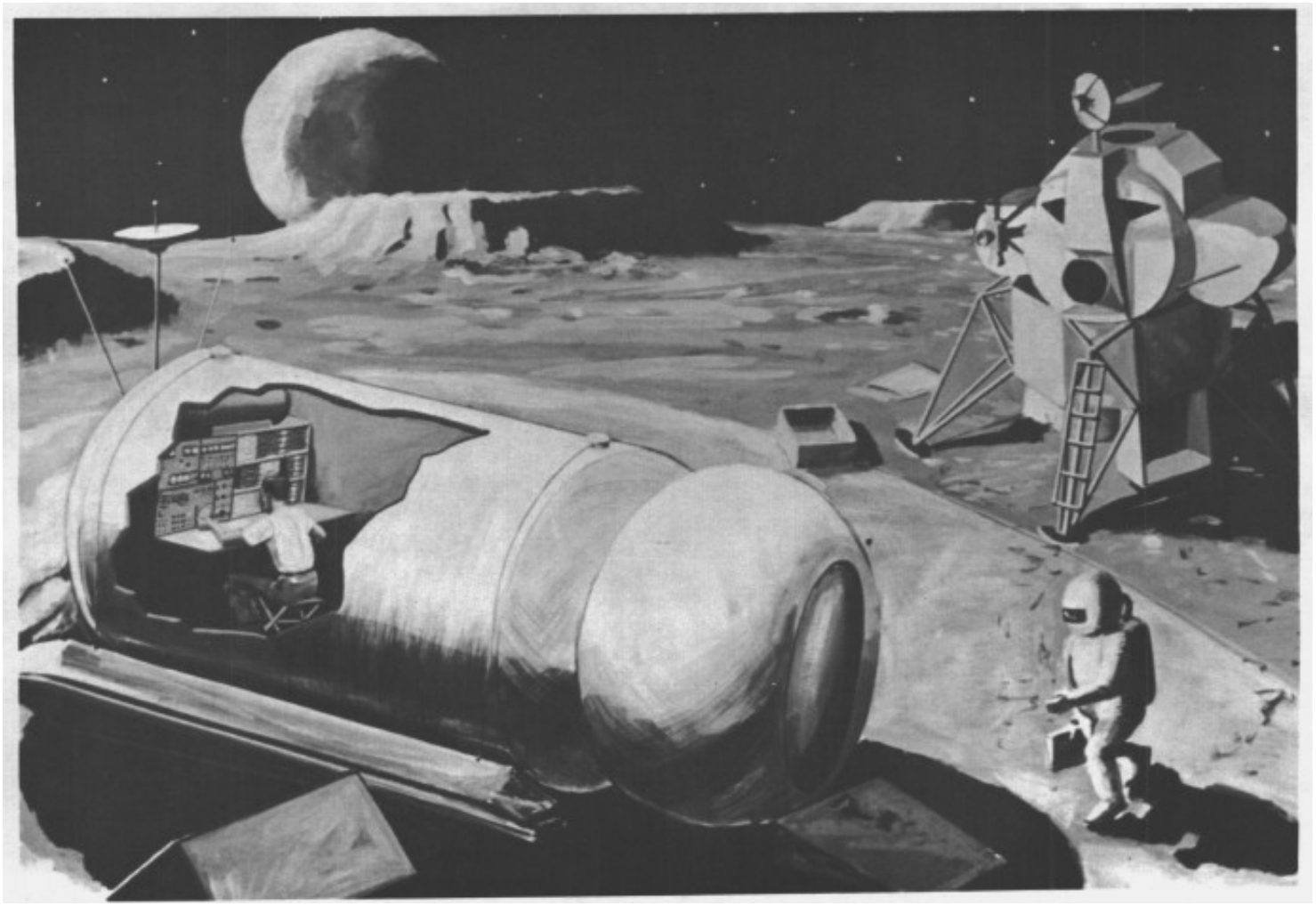
6.141
Robotics: Science and Systems

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

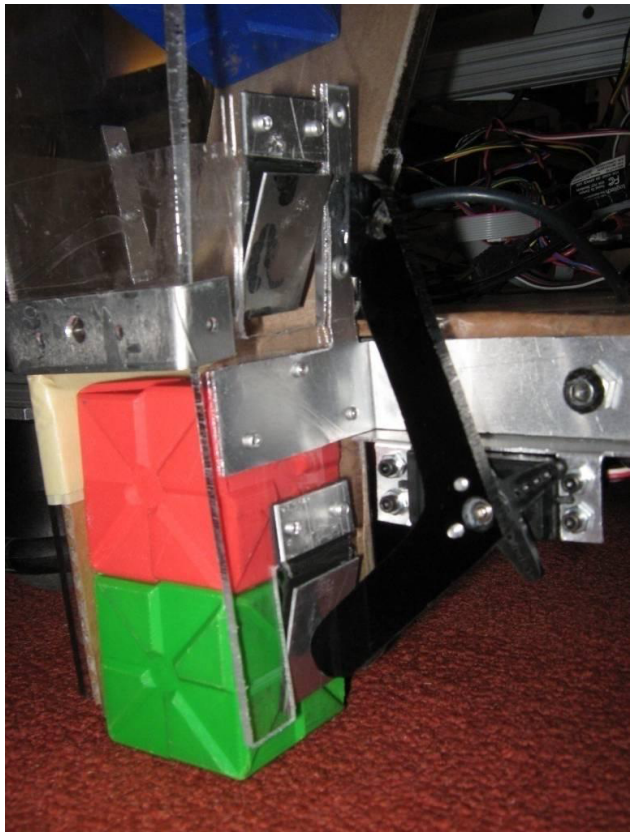
What you are provided

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

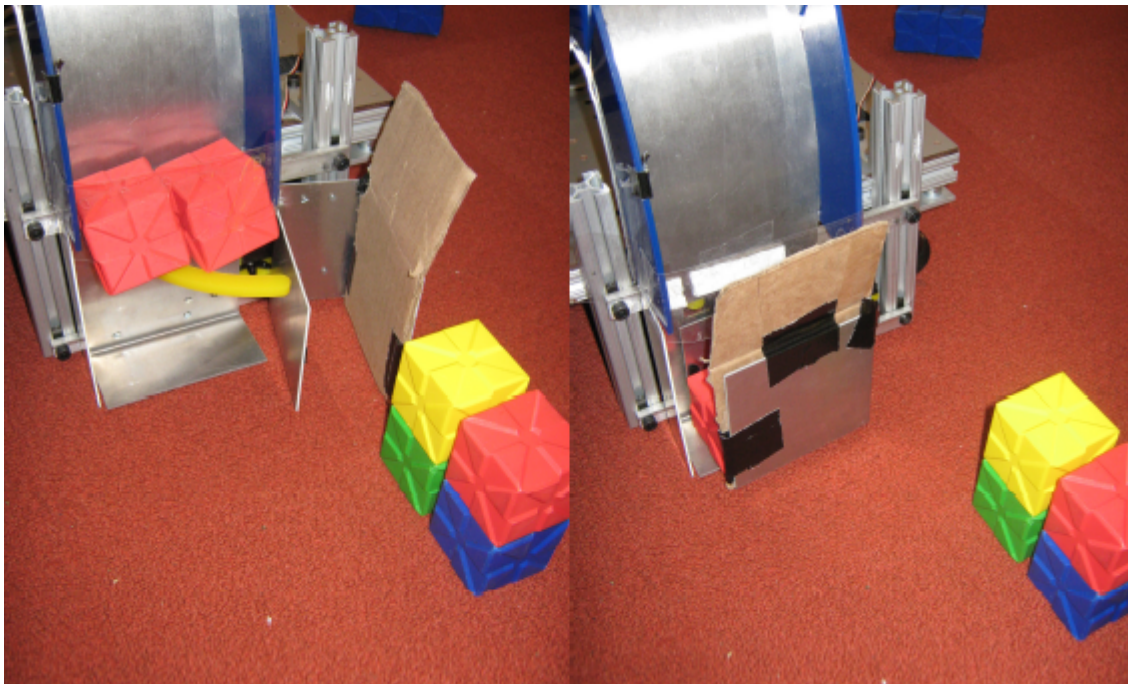
What you are provided

- Hardware and Tool Access
  - RSS robot, sensors, etc.
  - Delrin, Lexan, sheet metal, plywood etc.
  - Supplies 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

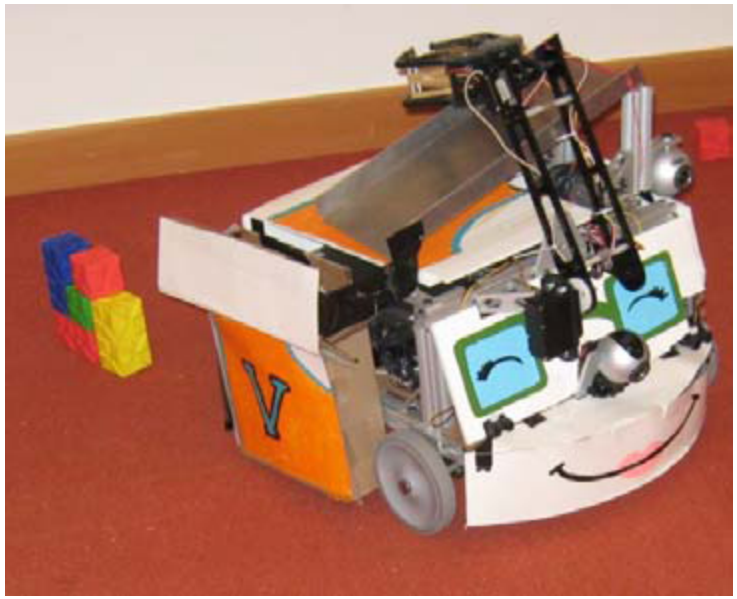


Block marshalling, servo-controlled release mechanism

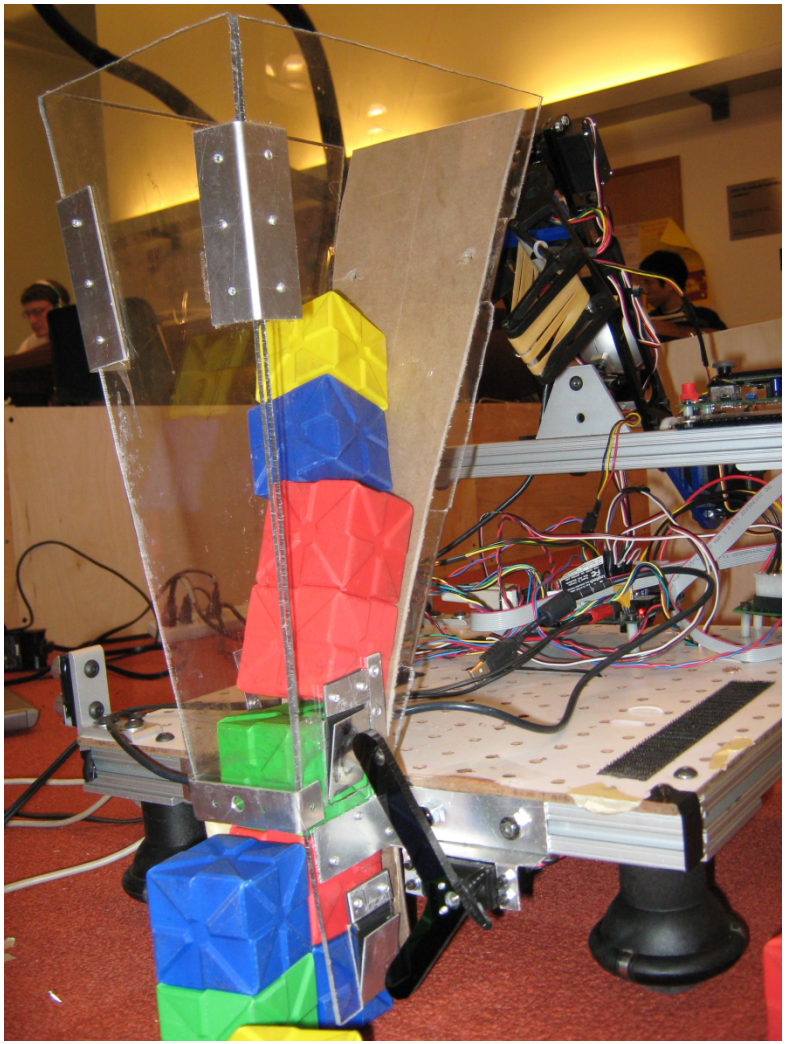


Alternative design from another team

Examples from Past Years



Block marshaller



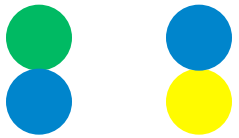
Funneling mechanism

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
  - Teams must be ready to run when their turn
  - Robot runs for 10 minutes
  - Robot can’t make destructive changes to env.
  - Walls should not move (much) if robot hits them

Challenge Schedule 2012

- **This Fri:**
  - CI-M lecture on expectations for team-written challenge proposal
- **Fri 7 April:**
  - Team-written draft challenge proposals due
- **Wed 11 April:**
  - Challenge project begins
- **Wed 9 April, Mon 11 April**
  - Challenge design briefings to staff (dry runs in lab, 4 teams each day)
- **Fri 13 April**
  - CI-M feedback on draft challenge proposals returned by today
- **Wed 18 April, Mon April 23:**
  - In-class design review presentations
- **Wed 20 April**:
  - Revised team-written challenge proposals due
- **M 30 Apr, W 2 May (Hardware Freeze), M 7 May, W 9 May:**
  - Graded Challenge milestones (in lab)
- **Fri 11 May starting at 1pm**:
  - Timed and judged challenge runs
- **Sun 13 May**:
  - Last chance run

Graded Challenge Milestones

- **As specified in team-written Challenge proposal**
  - Will be graded by staff
- **Monday 30 Apr:**
  - Graded challenge milestones (in lab)
- **Wednesday 2 May:**
  - Graded challenge milestones (in lab)
- **Monday 7 May:**
  - Graded challenge milestones (in lab)
- **Wednesday 9 May:**
  - Graded challenge milestones (in lab)
- **Friday 11 May**:
  - Timed challenge runs
- **Sunday 13 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)