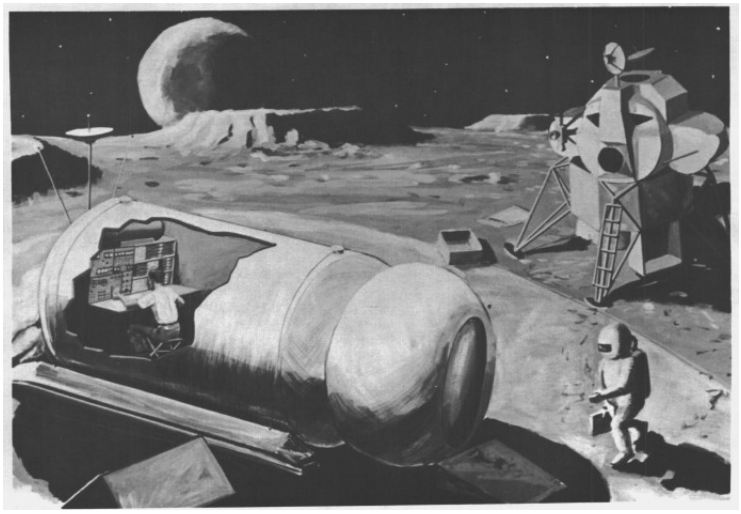
The RSS Course Challenge

RSS Lecture 11
Wednesday, 13 March 2013
Prof. Seth Teller

Overview

- Historical context
- RSS Challenge scenario, requirements
- What you are provided
- Schedule through end of term
- Graded challenge milestones
- Q&A

Build a Shelter on Mars



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

Build a Shelter on Mars

- Prior delivery of *materials*, at planned & unplanned locations; some destroyed
- Coordinates of *fiducials* established (via satellite) throughout environment
- Robot is then deposited within arena
  - Can assume known or unknown location
- Robot must then:
  - Move itself within the environment
  - Identify and collect available materials
  - Transport them to a suitable site
  - Arrange simple shelter or structure there

Challenge sub-tasks

- **Plan and Navigate**:
  - Navigate, starting from known location (team places robot)
  - Optional: handle unknown start location (staff places robot)
  - Form motion plans around mapped, unmapped obstacles
- **Identify Construction Site**:
  - Define site location *a priori*, or have robot choose it online
- **Find Objects**:
  - Detect objects of known types at expected locations
  - Detect objects at unknown locations, identify object types
- **Gather and (Optionally) Store Objects**:
  - Collect blocks on, under, or within robot body
- **Transport Objects:**
  - Convey blocks to construction site (all, serially, in groups)
- **Construction**:
  - Create a simple structure of your choice (e.g. group, row, open/closed wall, stack, multi-story wall) at construction site
- **Optional:**
  - *Any* technical aspect on which your team wishes to focus

What you are provided

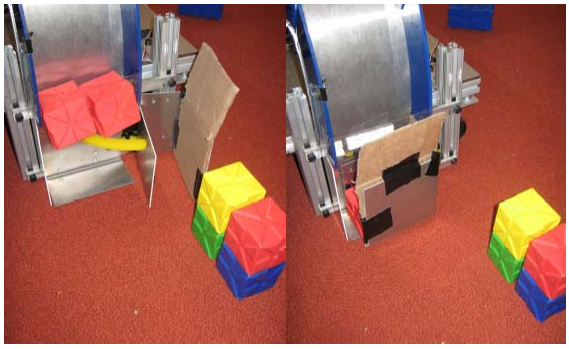
- Robot through lab 7 and other parts
- ROS source, staff solution code
- Map of challenge environment, blocks
- Fiducial locations, color coding
- Rules / constraints

What you are provided

- Materials
  - Standard RSS microbot, sensors, etc.
  - Delrin, Lexan, sheet metal, plywood etc.
  - Any parts needed from RSS, EECS stockroom
  - $50 budget for outside components (use MIT's tax-free number, save receipts)
  - **Absolutely no cardboard or duct tape** (decorative or cosmetic cardboard is OK)
- Shop access
- An approximate map of challenge area
- Fiducial locations, color coding
- Rules / constraints

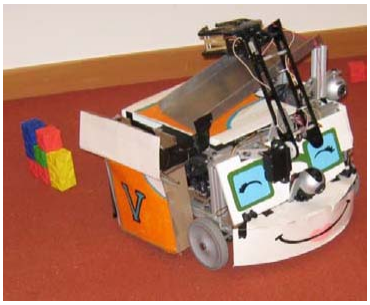
Examples from Past Years

Block marshalling, servo-controlled release mechanism

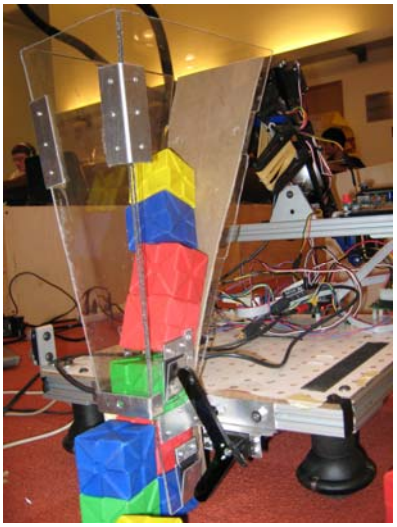


Alternative design from another team

Examples from Past Years



Block marshaller



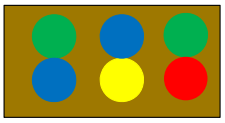
Funneling mechanism

What you are provided

- Materials
- Shop access
- An approximate map of challenge area
  - Global coordinate frame
  - Polyline perimeter of operation area
  - Mapped obstacles (some will be unmapped)
  - Mapped blocks (some will be unmapped)
  - Fiducials
  - Start location (optional)
- 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
  - Coordinates and radius of each ball
  - Use 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 called
  - Team has 2 minutes to stage and launch bot
  - Bot must run autonomously for 10 minutes
  - Bot can't make destructive/irreversible changes
  - Walls will not move (much) if bot hits them
  - Each team should *narrate* its own bot's run
- External sensors, code?

Challenge Schedule 2013

- **This Friday 15 March:**
  - Forum on expectations for team-written challenge proposal
  - Challenge Design Document *outline* (CDO) assigned
- **Next Friday 22 March:**
  - Challenge Document *outlines* due in Forum (one per team)
- **Wednesday 3 April:**
  - CDOs returned with comments
- **Friday 5 April:**
  - Forum: From CDO to CDD; CDD assigned
  - (Lab 7 due Monday Apr. 8th, no briefing; **Challenge begins**)
- **Wednesday 17 April**:
  - CDDs due; Team check-ins in Wed Forum; Milestones in lab
- **Wednesday 24 April:**
  - CDD feedback distributed
- **M 22 Apr, W 24 Apr, M 29 Apr, & W 1 May:**
  - Graded Challenge milestones (in lab)
- **Monday 6 May**:
  - Timed and graded challenge **dry runs**
- **Wednesday 8 May**:
  - Timed and graded challenge **final runs**

Graded Challenge Milestones

- **As specified in team-written Challenge proposal**
  - Will be graded by staff
- **Wednesday 17 April:**
  - Ungraded Challenge milestones (in lab)
- **Monday 22 April:**
  - Graded challenge milestones (in lab)
- **Wednesday 24 May:**
  - Graded challenge milestones (in lab)
- **Monday 29 April:**
  - Graded challenge milestones (in lab)
- **Wednesday 1 May**:
  - Graded challenge milestones (in lab)
- **Monday 6 May**
  - Timed Challenge dry runs (in lab)
- **Wednesday 6 May**:
  - Final timed and graded Challenge runs
  - Briefings by each team of entire class (no slides)

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)

Questions?