Overview

January 9, 2006

Agenda

- Logistics
- Course Policies
- The Game
- The Kit
- Today's Assignment: OrcPad

Logistics

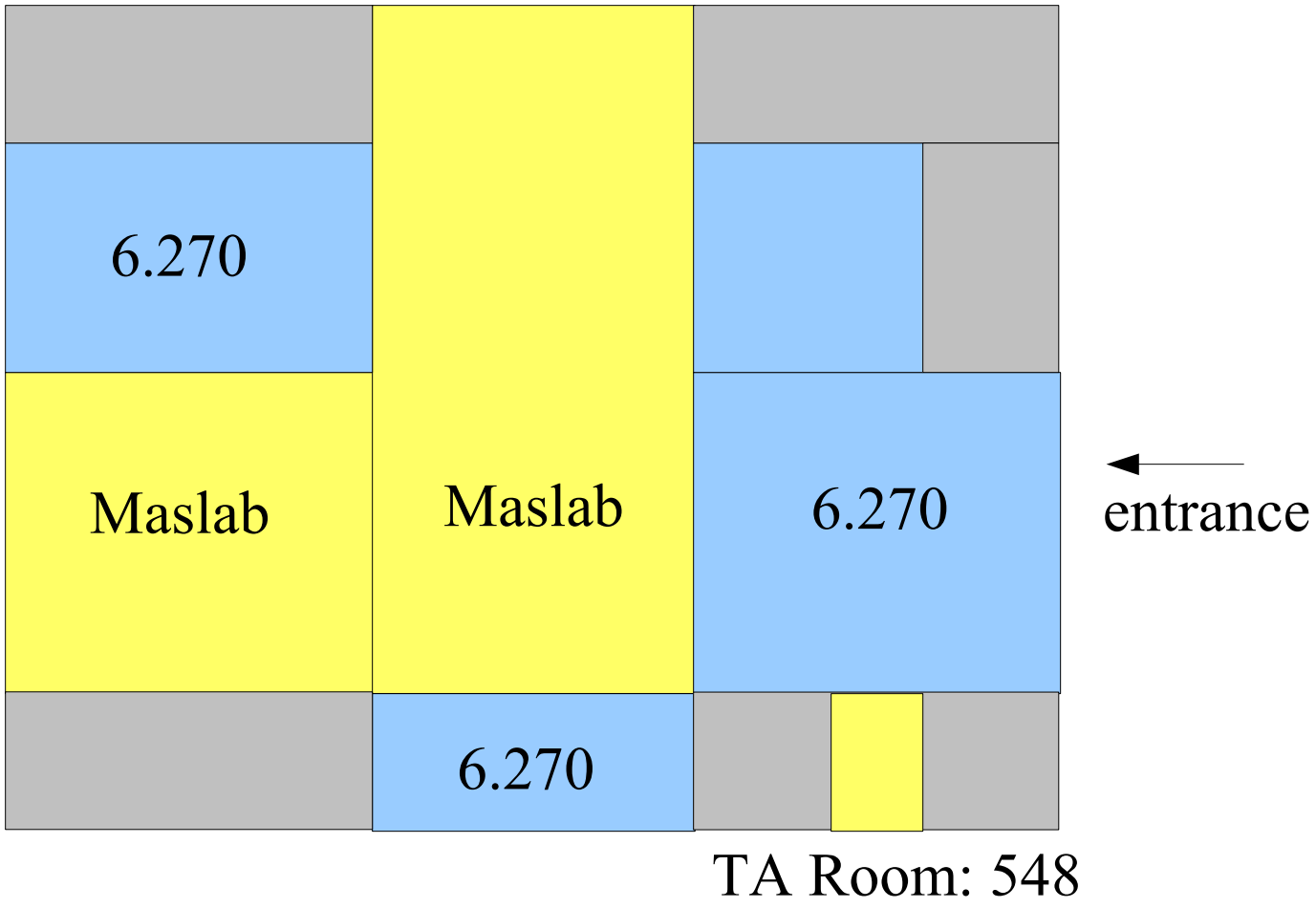
Logistics: Electronic

- Website:
  - web.mit.edu/maslab
  - 2006 section links to the wiki
  - Check the wiki multiple times daily!
- Email:
  - Staff: maslab-2006-staff
  - Teams: maslab-2006-teams
  - Finale: finale

Logistics: Lab

- Lab access: 38-500
  - Contains the shop and LA room (Room 548)
  - Staffed 12-8; opens at 10 am
  - We are sharing with 6.270, be courteous and neat!
- Lab access: 34-500
  - Open 24 hours—13579 (outer) and 10745* (inner)
- Storage
  - Each team gets a tub
  - Request lockers from equipment desk
  - Unattended valuables = loss of sensor points

Logistics: 38-500



Lab and Lecture Schedule

- Lectures Jan. 9-12, Jan. 17-18
- Enrichment Lectures
  - Jan. 20: James McLurkin
  - Jan. 20: Dinner at ITA Software
  - TBA: Leslie Kaelbling
- This week: lab after lecture until 6:30 pm
- Starting next week:
  - lab from 12 – 8+ pm weekdays,
  - 12 – 5 pm weekends

Key Dates

Checkpoint One	Jan. 11
Checkpoint Two	Jan. 13
Design Review	Jan. 18
Mock Contest Zero	Jan. 19
Mock Contest One	Jan. 26
Mock Contest Two	Jan. 30
Impounding	Feb. 2
Final Contest	Feb. 3
Clean-up day	Feb. 4

Mentors and Check-offs

- Everyone on the staff is here to help
- Everyone can witness a check-off
- Mentors keep a closer watch:
  - Teams 1-4 -- Finale
  - Teams 5-8 -- Val
  - Teams 9-12 -- Tim
  - Teams 13-15 -- Anders

Course Policies

Course Philosophy

- Maslab should be fun.
  - You will learn a lot!
  - Don't stew bitterly!
- The contest is hard.
  - Work with other teams
  - Unsportsman-like behavior will not be tolerated
- Follow the rules.
  - Keep you on track.
  - Respect your volunteer staff.

Course Policies

- 6 Units Pass/Fail
- 6 EDPs

Passing Grade

⇔ Keep kit (except computer)

⇔ Meet course requirements

Course Policy: Requirements

- Adequate effort and time invested in MASLab
- Attend mandatory meetings/events
- Majority of work in lab
- Completion of “checkpoints”
- Make daily lab entries (few sentences minimum)
- Submit final report (5-10 pages per team)
- Help tidy workshop on your team’s turn
- Help final cleanup on lab cleanup day

Course Policies: Disasters

- You are responsible for the working condition of your hardware
- If hardware breaks:
  - You're responsible for a replacement.
  - In most cases of accidental damage, Maslab will split the cost of a replacement.
  - Costs: Eden $250, Orc $150, OrcPad $50
  - Let's avoid this situation! Be careful!

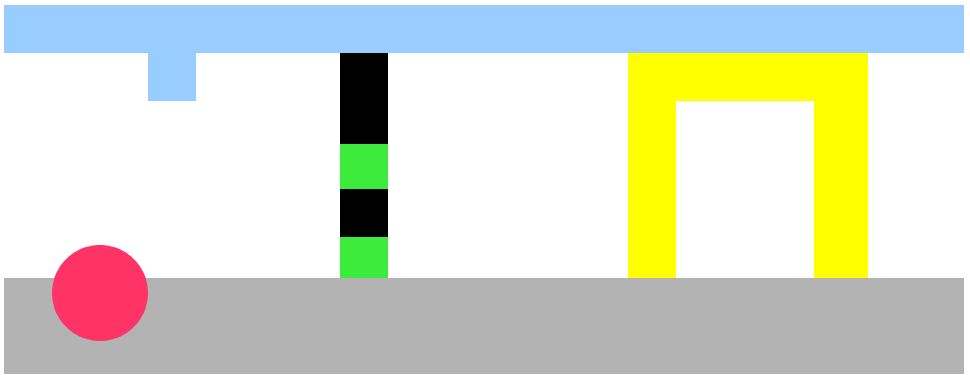
The Game

The Basics: What you know...

- You'll build and program a robot
- Robots use **vision** (as well as range finders and other sensors) to locate and transport targets.
- The playing field is **unknown**
  - Where are obstacles?
  - Where are targets?
  - What is the shape of the playing field?
- The robot functions **autonomously**

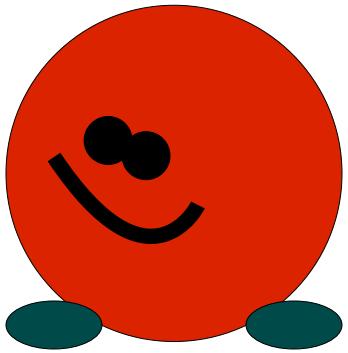
Playing Field

- Blue line on top of white walls with pseudo-randomly spaced tick marks
- Yellow border around mouse holes
- 4-bit vertical green and black bar codes on walls
- Red balls
- Powerball



Scoring – Red Balls

- 5 minute scoring round
- Score by:
  - 6 pts – first red ball in a mouse hole
  - 4 pts – second red ball in same mouse hole
  - 2 pts – any additional red balls in same mouse hole
  - 1 pt – porch in front of mouse hole
  - 1 pt – possession



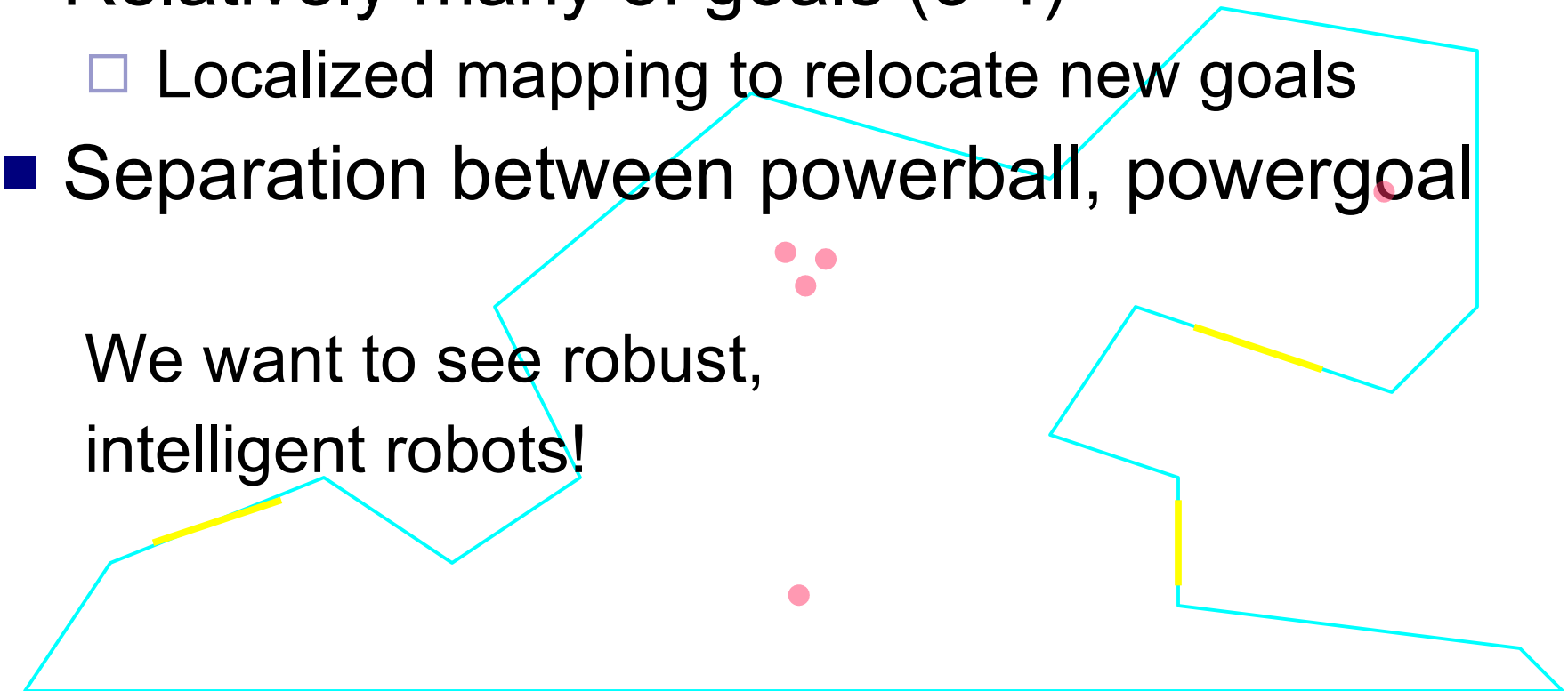
Scoring – Power Ball

- The power ball will be green
- The power goal will have a specified bar code beside it
- Score by taking the power ball to the power goal as fast as possible:
  - Very fast – 12 pts
  - Fast – 8 pts
  - Slow – 4 pts
- Power score independent of red ball score

Objectives... be prepared for

- Relatively few targets (10-12)
  - Efficient exploration strategy
- Relatively many of goals (3-4)
  - Localized mapping to relocate new goals
- Separation between powerball, powergoal

We want to see robust, intelligent robots!



Contest Preview: Prizes!

- More of an ***exhibition*** than a ***competition***
- Awards
  - 1st place
  - Maslab Engineering Award for cool ideas or clever implementations
  - At least one award for cosmetics

Sponsors

- ITA Software
- Google
- Ray and Maria Stata Innovation Fund
- MIT EECS
  - iRobot
  - Analog Devices
  - ClickAutomation
  - Altera
  - Digikey
  - CrystalFontz
  - IPCAmerica
  - CablesUnlimited
  - American Power Conversion

The Kit

- We supply basic parts
  - Enough to build a complete robot.
  - Motors, wheels, computer, sensors…
- You supply “extras”
  - Better motors, custom-made widgets, unique/unusual sensors
  - Subject to spending limit ($100 per team)
  - Non-passive components require staff thumbs-up

Sensor Budget

- ~30 pts, subject to staff approval and availability

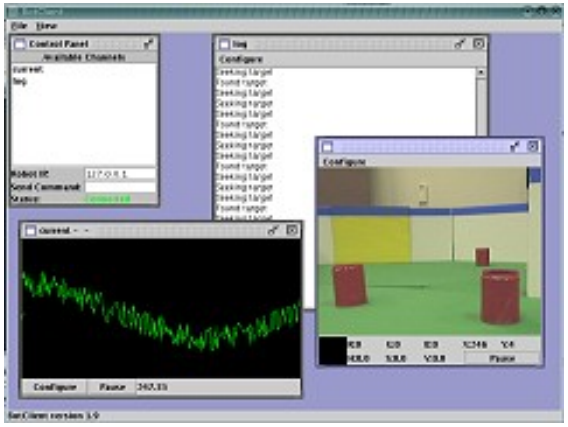
Item	Value
Extra drive motor	9
Ultrasound	7
Gyro	5
Servo	5
Optical Encoder	4
IR (long range)	4
IR (short range)	4
Whisker switch	2
Solenoid	2
Moment buttons	1
Photodiodes, etc.	1

Building Tips

- Mechanical
  - Maslab has limited tools
  - Feel free to use other shops
- Software
  - Many conceptual parts
  - Outputs hard to observe without care, so…

Building Tips

- Write modular code
- Focus on behaviors (go straight, turn, etc.)
- Design for test:
  - iterate between coding, compiling, and tests
  - automate tasks (calibration)
  - test on static images
  - use bot-client, orcspy



Updates, bugs, advice

- maslab.jar updates at boot
- firmware updates as needed
- Problems? Suggestions? Let us know!

Kit details: Hardware Overview

- Orc Board (the larger board)
  - provides hardware resources—interface between compute and sensors, motors
- Orc Pad (the smaller board)
  - joystick and lcd
  - draw images on to it
  - log text messages
  - start robot without wireless

Kit details: batteries

- One 12 V lead-acid battery
  - may trade or borrow a different size (and different amp-hours: 2, 5, or 7)
  - ALWAYS fused
- 13.8 V DC regulator
  - if both battery and regulator are plugged in, the battery is recharged

Kit details: Software

- Java documentation at Sun's website
- Maslab goodies on maslab website
- All documentation linked from the wiki

Kit details: orcd

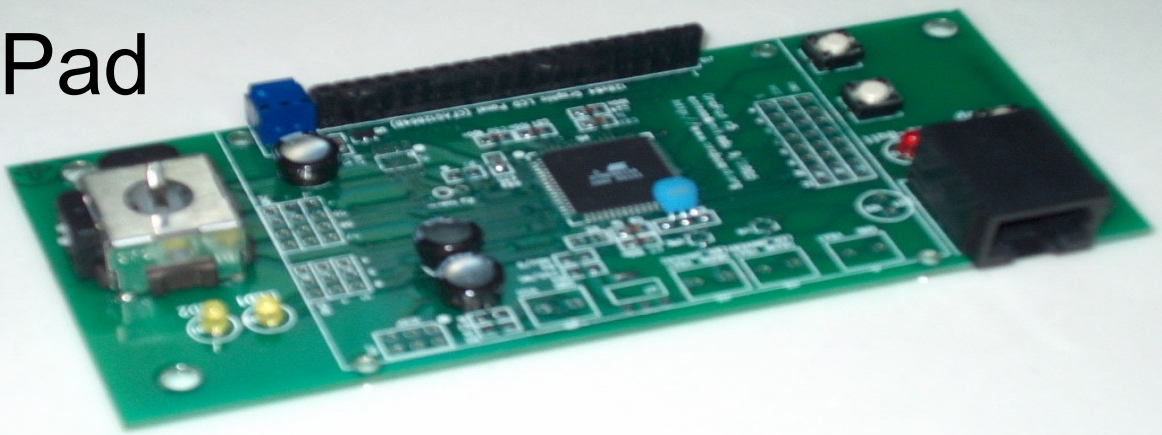
- Persistent service on the eden that
  - implements low-level usb port handling
  - Arbitrates between client applications
  - Provides shell capability (Eden's IP address, run/execute arbitrary programs)
- We provide the binary. You never need to compile/write anything
  - Except maybe /etc/orcd.conf

Kit Details: Maslab APIs

- Maslab.camera—get frames from camera
- Maslab.orc—implements Orc API
  - analog digital orcpad
  - lcd motor lcd console
  - servo soar
- Maslab.telemetry—data logging, visualization, debugging
- Maslab.util—helper classes

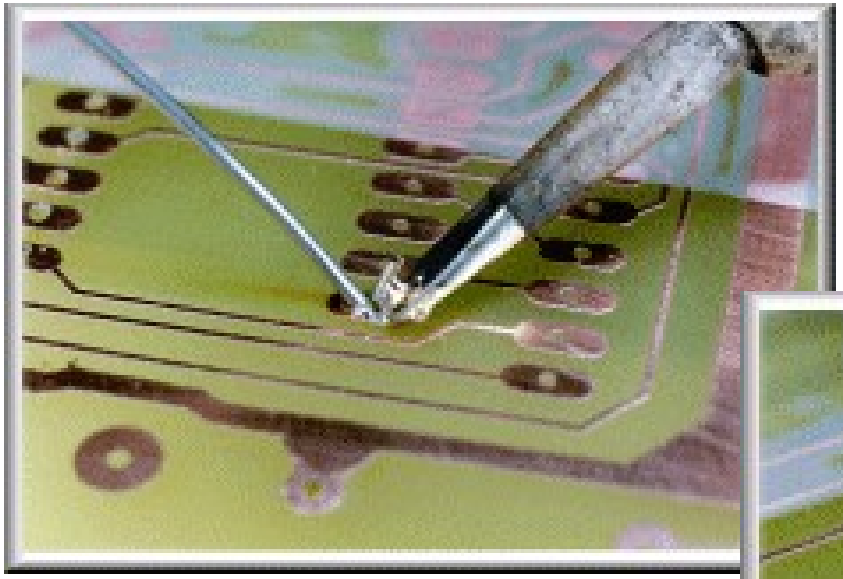
Today's Objectives: OrcPad

- Assemble OrcPad
- Step-by-step instructions included

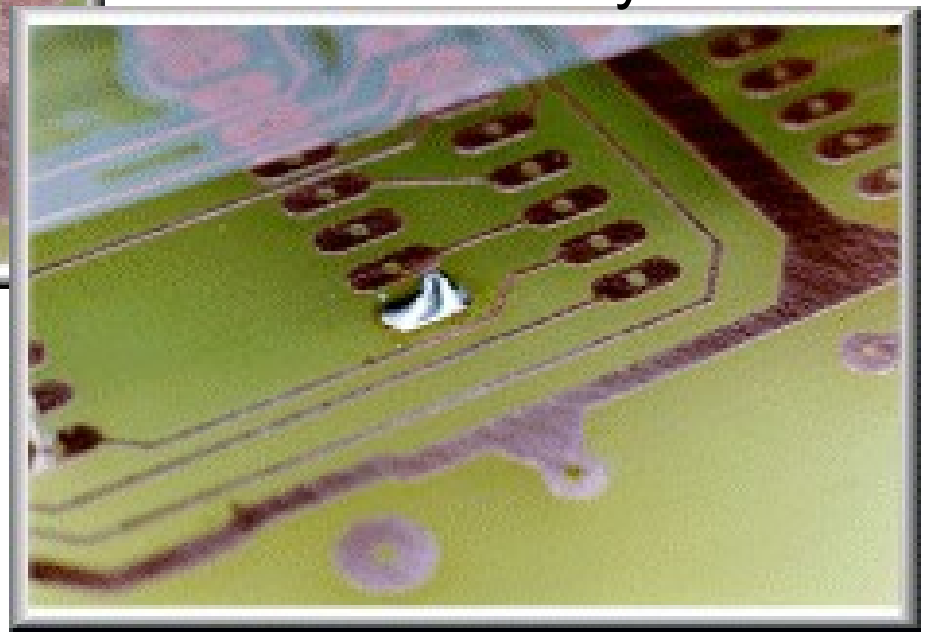


- After soldering kit, check with a staffer:
  - Get LCD, program chip to finish
  - Get suggestions on your soldering technique (this is a class, after all :)

Soldering technique



- Heat both parts of the joint
- Don’t paint with solder!
- Avoid oxidation–the joint should be shiny.



http://www.epemag.wimborne.co.uk/solderpix.htm

More on Soldering:

- Use the lowest heat that will work (about 650 F)
- Keep iron tip clean and shiny. Store with solder on it. Never “sharpen” tip.
- Minimize heating time (avoids oxidation, damaging sensitive components)
  - Contact shouldn’t be more than 2-3 seconds
  - Let components cool for a few seconds

Today’s Objectives, con't

- Software
  - Write a hello world for your Eden
  - Print a hello world to the orc pad
- Pegbot
  - Slap it together!
  - Get something moving!

And if you're done early...

- Staff and equipment are limited, so please be patient! Everyone will get a turn.
- Other things to do:
  - make your battery cable
  - inspect orc board for missing/poor joints
  - play with the playing field
  - take pictures of the playing field
  - extend tutorial code
  - brainstorm contest strategies