First Lecture

January 3, 2005

Agenda

- Introducing the Staff
- Logistics—website, wiki, rooms, calendar
- Course Policies and Philosophy
- Contest Preview
  - The Game
  - The Kit
- Today's Objectives
  - ORC API preview
  - Assembling the ORC Pad
  - Pegbot

The MASLab Staff

- Undergrads and grads like you!
  - Program — Finale
  - Technical — Yuran
  - Software — Tim
  - Mechanical — Aaron
  - Hardware — Dany
  - ORC — Ed

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 -- Yuran
  - Teams 9-12 -- Aaron
  - Teams 13-15 -- Tim

Sponsors

- MIT Course 6
- Cypress
- Advance Circuits
- Globtek
- iRobot
- Analog Devices
- Hankscraft Motors
- Acroname
- Digikey

Logistics

- Storage Options
  - Take it with you—tubs provided
  - Locker or storage closet (we're working on it)
  - Unattended valuables = loss of sensor points

Lab and Lecture Schedule

- Lectures Jan. 3-7, Jan. 10 and Jan. 12
- Enrichment Lectures to be scheduled
- This week: lab after lecture until 6:30 pm
- Starting next week:
  - lab from 12 – 8+ pm weekdays,
  - 12 – 5 pm weekends
- Java Tutorial: tomorrow night!!
  - 7-9pm

Key Dates

Checkpoint One	Jan. 7
Design Review	Jan. 12
Checkpoint Two	Jan. 14
Mock Contest One	Jan. 20
Mock Contest Two	Jan. 25
Impounding	Jan. 27
Final Contest	Jan. 28
Clean-up day	Jan. 29

Course Philosophy

- Maslab should be fun!
- You will learn a lot!
- Why all 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

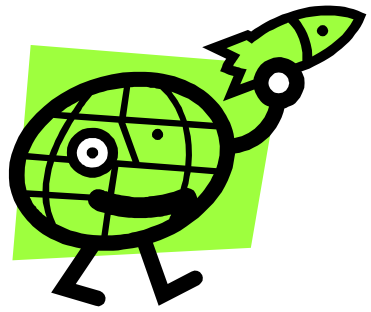
- Adequate effort and time invested in MASLab
- Attend mandatory meetings/events
- Majority of work in lab
- Completion of “checkpoints”
- Make daily lab entries (few sentences minimum)
- Submit final report (5-10 pages per team)
- Help tidy workshop on your team’s turn
- Help final cleanup on lab cleanup 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 $40
  - Let's avoid this situation! Be careful!

Contest Preview: The Basics

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



Contest Preview: The Rules

- 3 minute scoring round
- Optional 3 minute exploring pre-round
- Targets are red wooden balls
- Score by:
  - 5 pts – field goal over mouse hole
  - 3 pts – through mouse hole
  - 1 pt – porch in front of mouse hole
  - 1 pt – possession

Contest Preview: The 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

Contest Preview: Prizes!

- More of an ***exhibition*** than a ***competition***
  - It's a hard problem. Work together!
  - You'll do better if you work with other teams.
- Awards
  - 1st place
  - *MASLab Engineering Award* and other staff picks for cool ideas or clever implementations
  - *At least* one award for cosmetics

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) and non-passive components to staff thumbs-up

Sensor Budget

- ~30 pts, subject to staff approval and availability

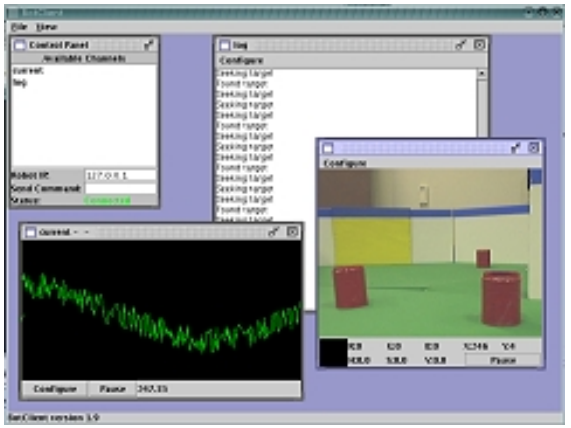
Item	Value
Extra drive motor	9
Ultrasound	7
IR (long range)	6
Servo	5
Gyro	5
Optical Encoder	4
IR (short range)	4
Whisker switch	2
Solenoid	2
Moment buttons	1
Photodiodes, etc.	1

Building Tips

- Mechanical: machine shop access is *very* useful!
  - MASLab tools limited, imprecise
- 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 the debug clients



Updates, bugs, advice

- maslab.jar updates at boot
- firmware updates as needed
- Problems? Suggestions? Let us know!
  - Don’t stew bitterly
  - Your advice is very welcome

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

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

Example

```
import maslab.orc.*;
    import maslab.util.*;

    import java.io.*;

    public class hello
    {

        public static void main(String[] args)
        {
            Orc o;
            try {
                o=new Orc();
            } catch (IOException ex) {
                System.out.println("Could not create orc!");
                return;
            }

            o.lcdConsoleHome();
            o.lcdConsoleWrite("Hello, world\n\n");
            o.lcdConsoleWrite("Press a key...");
            o.padButtonsGet();
        }
    }
```

Today's Objectives: OrcPad

- Assemble OrcPad
- Step-by-step instructions included
- After soldering kit, check with a staffer:
  - Make sure it's right—get LCD, chip to finish
  - Get suggestions on your soldering technique (this is a class, after all :)

Today's Objectives: Soldering

- Soldering is non-trivial, especially surface mount components
- Goals: good physical connection; electrical and thermal connectivity
- Technique: heat both parts of joint first. (Don't paint with solder!) Avoid oxidation – the joint should be shiny.

Diagrams

Image removed due to copyright considerations.

To see this image, go to:

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

Tips for Surface Mount

- Put a dab of solder on one of the pads
- Slide the device right next to the solder. Remelt the solder and slide the component in place.
- Solder second pad.
- Use all left pads/right pads for the dabs when components are next to each other.

Surface Mount

Image removed due to copyright considerations.

To see this image, go to:
http://www.geocities.com/vk3em/smtguide/websmt.html

Today's Objectives

- Gryo sensor – solder the board
- Orcboard – add 3x2 header for gyro
- Software
  - Write a hello world for your Eden
  - Print a hello world to the orc pad
- Pegbot
  - Slap it together!
  - Get something moving!

More objectives

- 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