

E11 Lecture 15: Game Kickoff

Profs. David Money Harris & Sarah Harris
Fall 2011

Outline

- Line Following Race Postmortem
- Game Kick-Off
- Team Dynamics

Reliable Platform

- Both of your robots on a team should be working well
 - Motors should operate consistently
 - Sensors should return consistent results
 - Reliable Gold code detection
 - FTDI download should work reliably
- If any of these aren't robust, get them working right away
 - Preferably before your lab section meets
 - Grutors available for special appointments – email them!
 - Don't succumb to the temptation to postpone!

Line Following Race

- Video!

- <http://www.youtube.com/watch?v=WPz4M6oWROA>

Line Following Race Postmortem

- What was hard?
- What worked?
- Descriptions from winning teams



Overshoot

- Feedback control systems tend to become unstable as their speed increases.
 - First manifestation is “overshoot”
 - Many robots demonstrated this, especially if you reduced your gear ratio.

Overshoot Compensation

```
void loop()
{
  int reflect;
  reflect = analogRead(4);

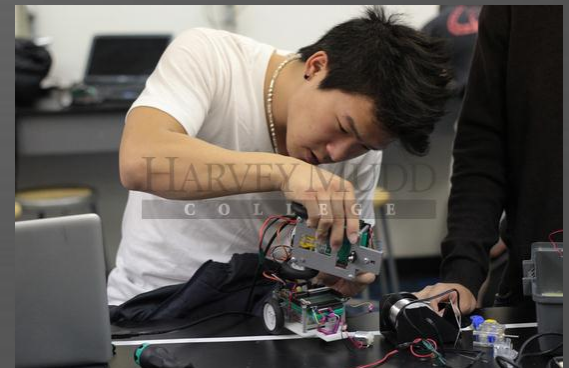
  // follow outside line
  if ((reflect-870) > random(100)) {
    setPowerLevel(130); turnL();
  }
  else if ((830-reflect) > random(100)) {
    setPowerLevel(130); turnR();
  }
  else {
    setPowerLevel(255); forward();
  }
}
```

Debug Techniques

- Printing sensor readings
 - Change to 115,000 baud to reduce disturbance to program
- Slow things down
 - Program the robot to halt when it gets in a certain condition (e.g. excess overshoot)
- Other favorite approaches?

Other Lessons

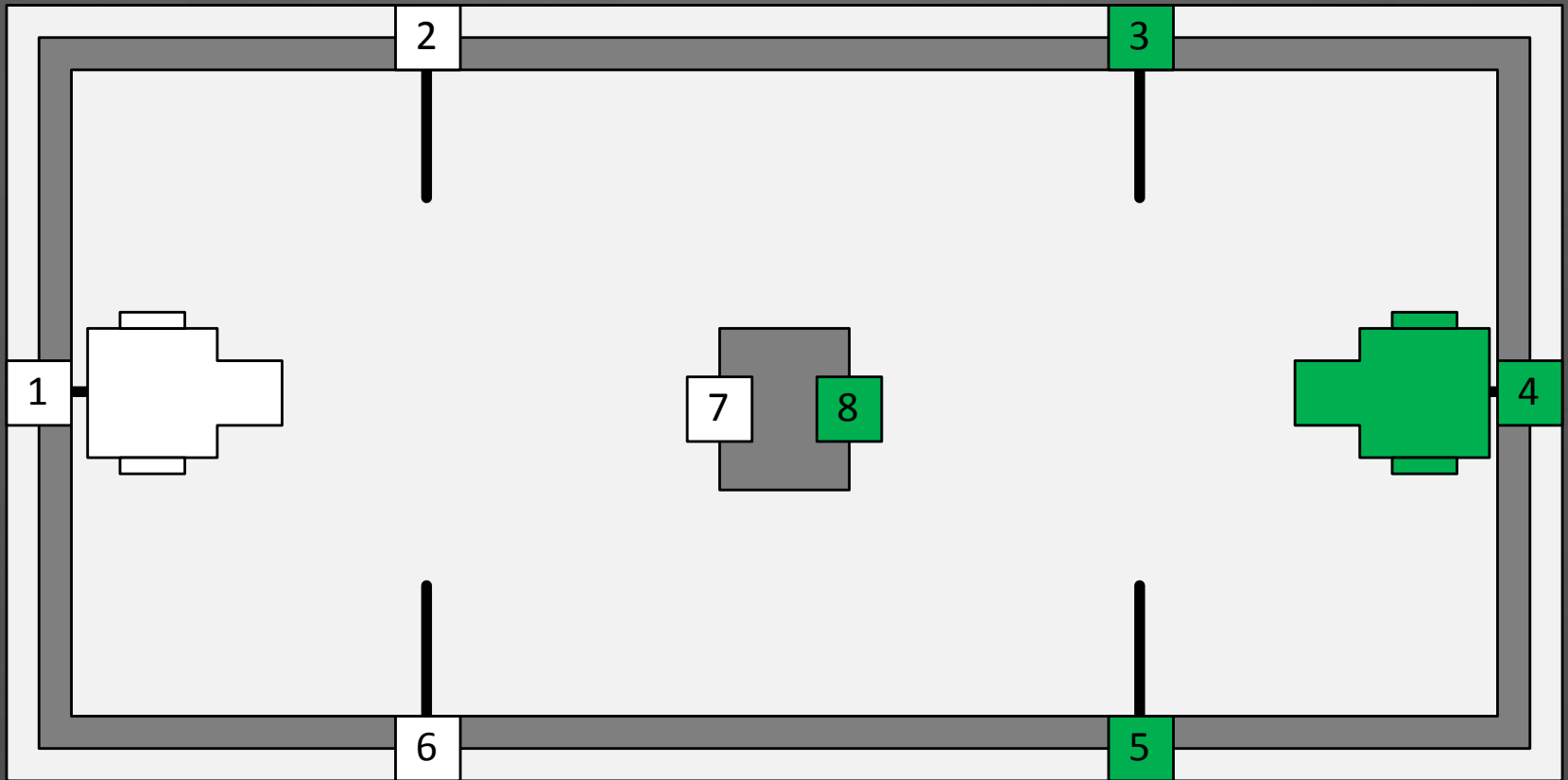
- Fully charge your battery in advance (!)
- Secure your sensors
 - Inconsistent readings may happen if sensors shift
- Test, test, test!
 - Many teams were still fixing problems when the event should have started.
 - Be sure it is working flawlessly the day before!
 - Arrive early for a final test
- Murphy's Law



Game Kickoff

- Moonbase Epsilon
- Green Industries and White Incorporated
- Vying for the universe's largest reserve of epsilonium
 - For making very small things!

Moonbase Map



Scoring

- Two minute round to claim as many beacons as possible
 - Perimeter beacons worth 1 point each
 - Center beacons worth 2.4 points
- After 2 minutes, sudden death begins
- Robots in danger of damaging the field, the opponent, or themselves may be removed at the discretion of the ref

Physical Modification

- Your robot must have at least one physical modification
 - New sensor
 - New actuator
 - Improved mechanical design (max 7" from corner to corner)
 - Be creative (!)
 - Changing gear ratio doesn't suffice
- You must make a plausible case why the physical modification will improve performance
 - Not simply a cosmetic or silly change
- Must be operational by the scrimmage (11/7)
 - Order parts this week!

Resources

- You may spend a maximum of \$40
- Your team may print one modified chassis
 - Beyond that, you must pay the standard rate of \$10/in³
- Machine shop
 - Only use the machines where you are qualified
 - Always have proctor supervision
- 24/7 Lab access
 - Never work alone in the lab
 - Always keep the door open

Milestones

- **10/25:** **Game Kickoff**
- **11/7:** **Scrimmage**
 - In lecture. Physical mod ready. Demo your operational bot capable of claiming at least one beacon.
- **11/21:** **Final Competition (5:30-7 pm, Galileo McAlister)**
 - Invite your friends and family! No lecture/lab this week.
- **12/6-8:** **Final Presentations**
 - In lab section
- **12/8:** **Final Report**

Teamwork

- Most complex problems today are solved by teams
 - Too hard for a single person
 - Complementary skill sets
- You will get extensive teamwork experience at HMC
 - Starting in E11
 - Engineering curriculum
 - Cornerstone: E4
 - Laboratory: E8o
 - Many project-based labs and classes
 - Capstone: Clinic

Team Dynamics

- Forming
- Storming
- Norming
- Performing

Team Issues

- Leadership and decision making
 - How will you resolve disagreements?
 - Plan a mechanism for dispute resolution before you have problems.
- Division of labor
 - Many ways to partition the problem
 - Each team member should become the expert for some part
 - But stay informed about your partner's work
- Pair programming

Design Process

- **Conceptual Design**
 - Brainstorm wildly; no criticizing ideas initially
 - Record the ideas
 - Systematically compare alternatives and choose the best
- **Detail Design**
- **Cyclical nature of design**
- **Get a working prototype early and refine it**
 - Always keep a copy of the last working code