

E11 Lecture 15: Game Kickoff

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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 Postmortem

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

Overshoot

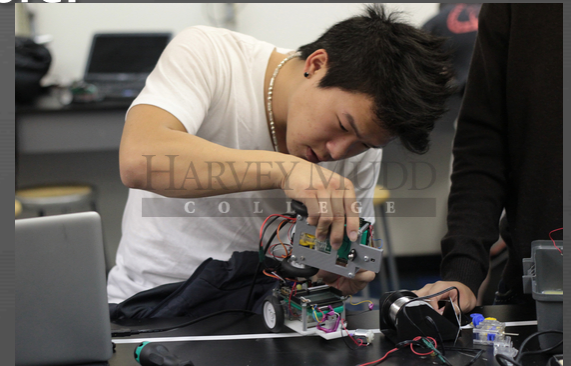
- Feedback control systems tend to become unstable as their speed increases.
 - First manifestation is “overshoot”
 - Many robots demonstrated this, especially if you reduced your gear ratio.

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 (!)
 - Test with fully charged battery
- 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



Jose & Julio's Blue Ribbon Bot

```
void loop() {  
  
    int reflect = analogRead(REFLECTOR-14) ;  
  
    if (reflect <850)  
        turnL(); //Left wheel 230, Right wheel 0 (ACTUALLY TURNS RIGHT)  
  
    else if (reflect < 965 && reflect > 850)  
        turnR(); //Left wheel -200, Right wheel 230 (ACTUALLY TURNS LEFT)  
  
    else forward(); //Both wheels 250  
  
}
```


Game Kickoff

- Video

Physical Modification

- Your robot must have at least one physical modification
 - New sensor
 - New actuator
 - Improved mechanical design
 - 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 (11/20)
 - 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

- **10/28:** **Game Kickoff**
- **11/20:** **Scrimmage**
 - In lecture. Physical mod ready. Demo your operational bot capable of claiming at least one beacon.
- **11/25:** **Final Competition (5:30-7 pm, Big Shanahan)**
 - Invite your friends and family! No lecture/lab this week.
- **12/9-12:** **Final Presentations**
 - In lab section
- **12/9:** **Final Report**

Feedback: What's Working

- 12 Labs
- 4 Robot
- 6 Wonderful, exciting, interdisciplinary
- 4 Learning C
- 3 Lectures
- 2 Grutoring

Feedback: What's Not Working

- 7 Labs too long
- 6 Struggling with C
- 3 Board components
- 2 Lecture too hard to understand
- 2 Class too time consuming
- 1 Lectures don't match lab / problem set
- 1 Lectures boring/too slow
- 1 Lectures too fast
- 1 Lab handout instructions insufficient
- 1 Not sure how everything works

Feedback: What can instructor do?

- 4 More time on C programming
- 3 More office hours not during CS5
- 2 Assumes too much knowledge in lecture
- 1 More guidance and hints on problem sets
- 1 C examples: `tone()`, `Serial.available()`
- 1 Separate class into those with C and those without
- 1 Post lecture slides more promptly
- 1 More explanation of basic electronics
- 1 Link lectures to lab
- 1 Build along in lab step by step
- 1 Offer help before being asked
- 1 Lab assistants shouldn't do homework in lab

Feedback: What can I do better?

- 4 Start work sooner
- 4 Attend / pay better attention in lecture
- 3 Get caught up in lab
- 2 Go to tutoring
- 1 Seek out professor
- 1 Be more gentle with my bot
- 1 Learn programming better

Other Comments

- Midweek grutoring?
- Reflectance sensor acting up
- How to stop servo making “angry clicking noises”
- What is the purpose of the servo?
- Which lab instructions are inadequate?

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