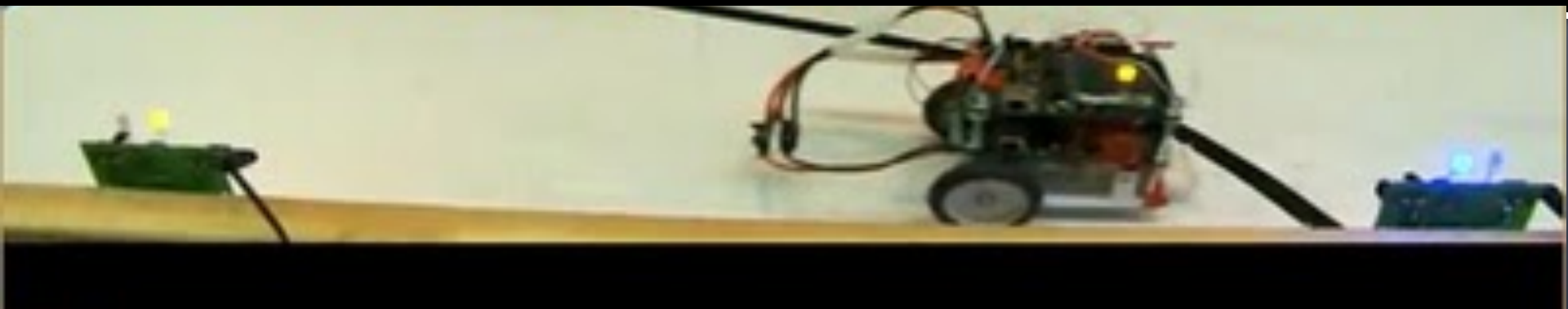
E11 - Autonomous Vehicles

Competition Kickoff



Outline

- Line Following Race Postmortem
- Competition Kick-Off

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

Reliable Platform

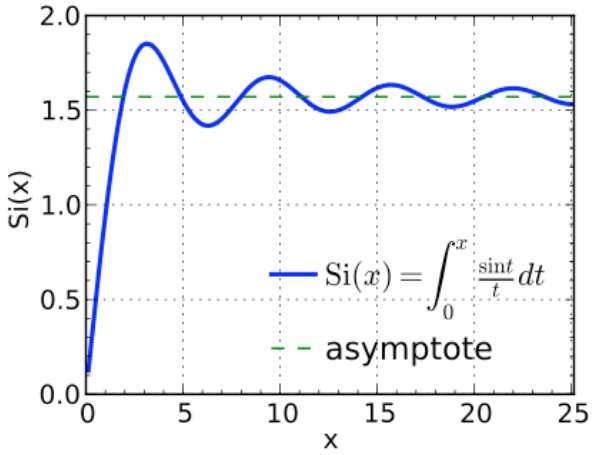
- If any of these aren't robust, get them working right away
  - Preferably before your lab section meets
  - Grutors available for special appointments – email them!
  - Don't succumb to the temptation to postpone!

Line Following Race Postmortem

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



http://en.wikipedia.org/wiki/Overshoot_%28signal%29

Overshoot Compensation

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

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

Overshoot Compensation

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

  // follow outside line
  if ( reflect > 870) {
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  }
  else {
    setPowerLevel(255); forward();
  }
}
```

Overshoot Compensation

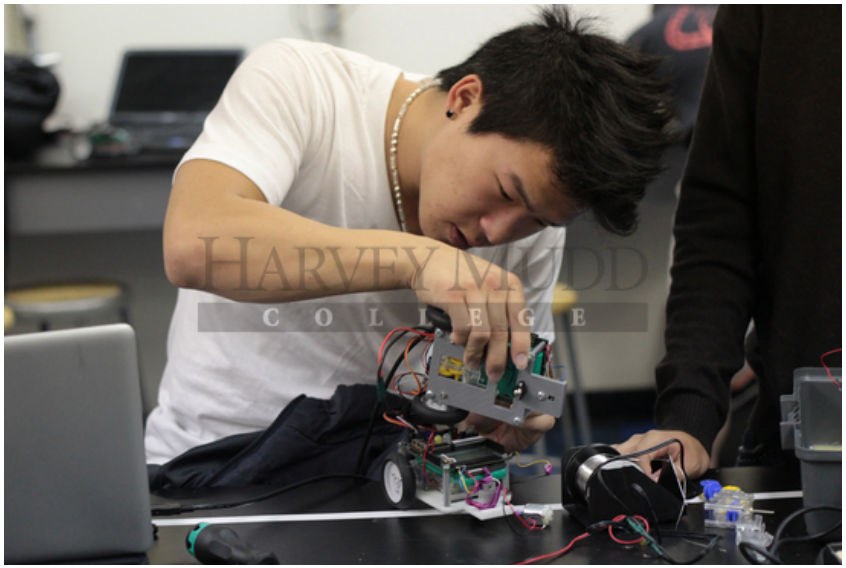
```
void loop()
{
  int reflect;
  reflect = analogRead(4);

  // follow outside line
  if ( reflect > 870 + random(100)) {
    setPowerLevel(130); turnL();
  }
  else if ( reflect < 830 - 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 batteries in advance (!)
- Secure your sensors
  - Inconsistent readings may happen if sensors shift



Other Lessons

- 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

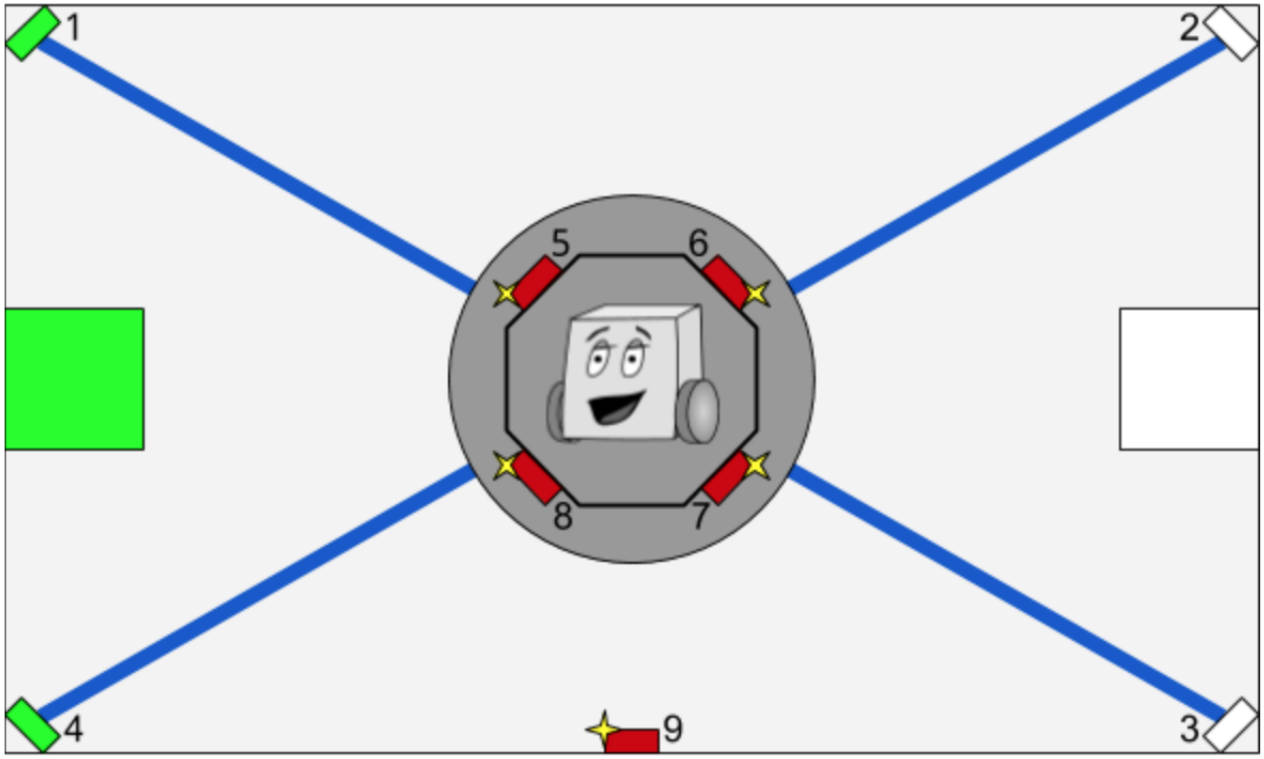
Outline

- Line Following Race Postmortem
- Competition Kick-Off

Competition Kickoff

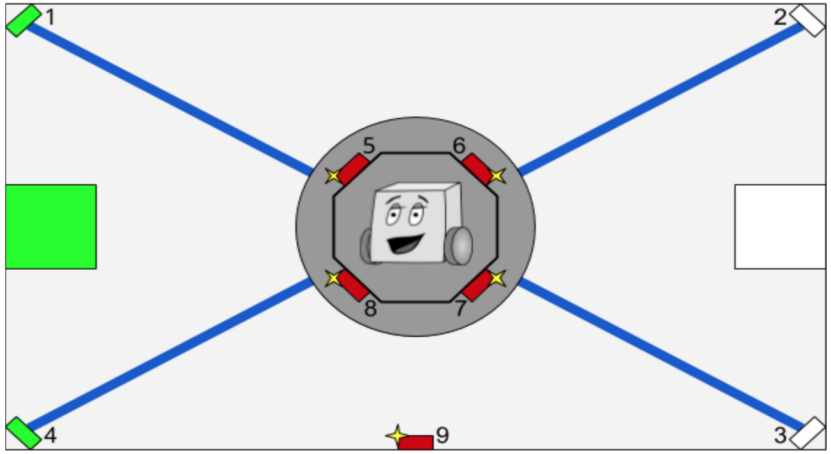
- Moonbase Epsilon
- Green Industries and White Incorporated
- Vying for the universe's largest reserve of epsilonium
  - For making very small things!

Competition Kickoff



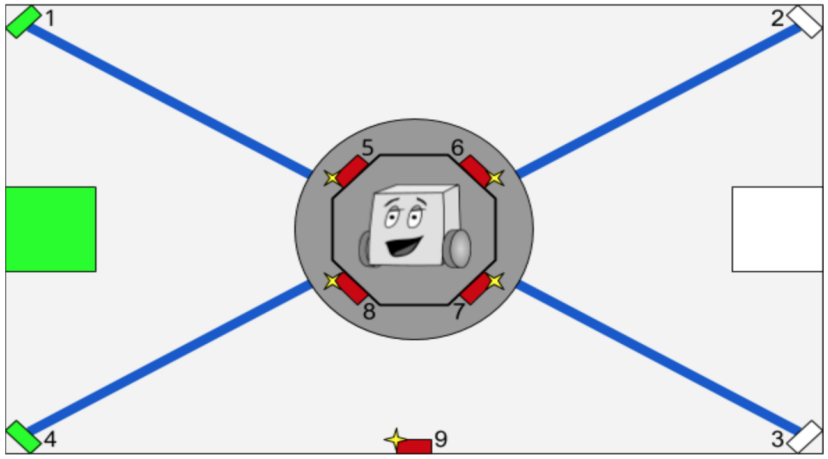
Competition Kickoff

- Locating Stations
  - All stations will broadcast gold codes corresponding to their number, as indicated previously on the map



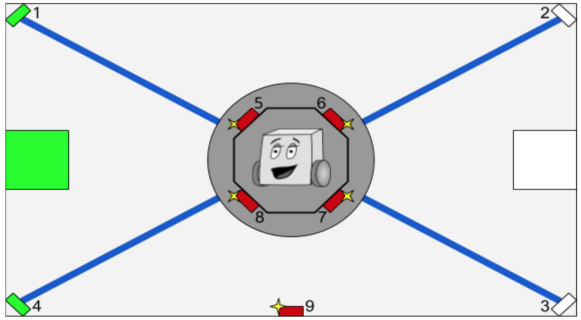
Competition Kickoff

- Claiming Corner Stations (1-4)
  - They are initialized as claimed as shown below.
  - Corner stations have a bump panel on the front.
  - No reclaiming for 2 seconds



Competition Kickoff

- Claiming Central Stations (5-9)
  - Initialized as unclaimed
  - Claimed by flashing a gold code at the station using an LED
    - The gold code must be seeded with the station's number
    - Inverted to change it to green, non-inverted to white



Competition Kickoff

- Timing
  - Matches will last 1 minute

http://lssacademy.com/2008/06/30/ban-the-stop-watch/

Competition Kickoff

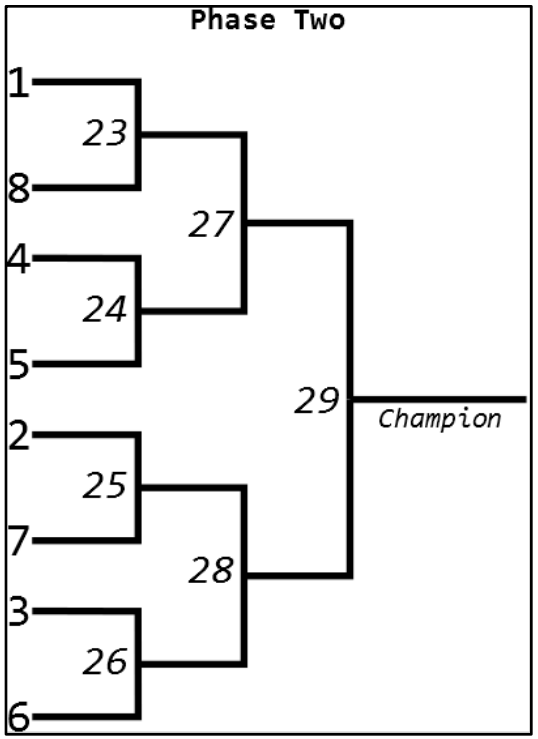
- Scoring
  - **1 point:** each beacon claimed by the team at the end of the match (each team starts with two points for the bump beacons initially at their color)
  - **1 point:** robot ends with any part of their robot touching the ground inside either starting square (only if the robot moved out of the square during the match)
  - **Ties** are broken by the more active team by referee decision

Competition Kickoff

- Dangerous Behavior
  - Robots in danger of damaging the field, the opponent, or themselves may be removed at the discretion of the referee

Competition Kickoff

- Phase 1:
  - Each team plays 2 other teams
  - Top 8 teams qualify based on:
    - Number of Wins
    - Number of Wins by opponents
    - Number of Points earned
    - Original Seeding number
- Phase 2:
  - Tournament Bracket



Competition Kickoff

- Your robot must have at least one physical modification
  - New sensor
  - New actuator
  - Improved mechanical design (must fit inside 7" square)
  - 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 (Nov. 11)
  - Order parts this week!

Resources

- You may spend a maximum of $40
- Your team may print modified chassis
  - At the standard rate of $10/in^3
- Machine shop
  - Only use the machines where you are qualified
  - Always have proctor supervision
- 24/7 Lab access
  - Always try to work with a partner in lab
  - Always keep the door open

Milestones

- 11/06: Demonstration of Gold Code Reading
  - In lab. Students must demonstrate gold codes are detected.
  - Robots must spin around if any of gold codes 5-9 are detected
- 11/13: Scrimmage
  - In lab. Physical mod ready. Demo your operational bot capable of claiming at least one beacon.
- 11/20: Final Competition
  - 5:30-7 pm, (Shan Theater)
  - Invite your friends and family!
  - No lecture/lab this week.
- 12/04: Final Presentations
  - In lab section
- 12/13: Final Report Due

Remember…

- Always back up your code!