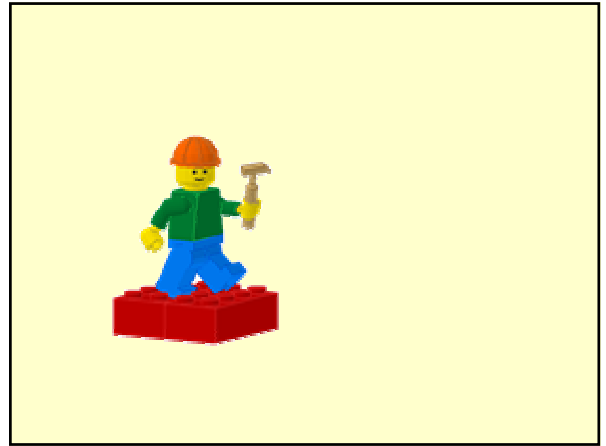


6.270: AUTONOMOUS ROBOT DESIGN COMPETITION




- Welcome
- Lab and class orientation
- Overview of course and schedule
- The Contest
- What's in your kit
- Assignment 1 handed out
- Kit distribution

LECTURE 1: Getting Started




6.270 AUTONOMOUS ROBOT DESIGN COMPETITION



Who We Are

- 7 Organizers prepare contest all year
- 7 TAs help during IAP
- We are students who have taken 6.270
- Each team assigned to one Organizer and TA
- Introductions will be made at the end, with kit distribution


6.270 AUTONOMOUS ROBOT DESIGN COMPETITION



Communication


- Mailing lists:
 - 6.270-participants@mit.edu
 - 6.270-staff@mit.edu
 - 6.270-rules@mit.edu
 - 6.270-fanclub@mit.edu
- Web:
<http://web.mit.edu/6.270/www/contestants>
- Best way: talk to staff in lab

6.270 AUTONOMOUS ROBOT DESIGN COMPETITION




Lab

- 38 00, 38 301
- Lab Hours:
 - Weekdays: 9 am – 11:45 pm
 - Weekends: noon – 10 pm
 - Extended lab hours in last week, of course
 - Phone number for lab: x3-7350
- Cleanliness, etc... or else!
 - We will take away LEGO
 - And during the last week, please remember to take showers




6.270 AUTONOMOUS ROBOT DESIGN COMPETITION



Getting Credit

- 6 units general elective credit P/F, 6 EDP's
- Decide if you want credit by the time you get assignment 1 checked off
 - Tell us your student ID number at assignment 1 checkoff
- Criteria for receiving credit:
 - Qualifying robot
 - Timely completion of all assignments
 - Robot web page, due at end of course – **NO EXTENSIONS!**


6.270 AUTONOMOUS ROBOT DESIGN COMPETITION



Overview of Course

- First week
 - Soldering
 - Basic LEGO structure and bracing
 - Programming the HandyBoard
 - Making motion—actuators and gearboxes
 - Using the RF data
 - Digital sensors (mechanical)
 - Build your first complete robot


6.270 AUTONOMOUS ROBOT DESIGN COMPETITION



Overview of Course

- Second week
 - Coding paradigms
 - Using unique LEGO pieces
 - Robot behavior
 - Analog sensors (color sensing)
 - Shaft encoders
 - Servos
 - Begin building competition robot


6.270 AUTONOMOUS ROBOT DESIGN COMPETITION



Overview of Course

- Last two weeks
 - Build competition robot
 - Debug
 - Live in lab (willingly?)


6.270 AUTONOMOUS ROBOT DESIGN COMPETITION



Schedule – Lectures

- Lecture 1, January 3, Monday, 34-101, 10 am
 - Welcome
 - Contest Description
 - Kit Distribution
- Optional Evening Lecture, January 4, Tuesday, 34-101, 7 pm
 - Basic C syntax
 - Coding Paradigms
- Lecture 2, January 5, Wednesday, 34-101, 10 am
 - Electronics
 - HandyBoard / Interactive IC
- Lecture 3, January 7, Friday, 34-101, 10 am
 - Servos, Sensors, Shaft Encoders
 - Robot Behavior
 - Threads


6.270 AUTONOMOUS ROBOT DESIGN COMPETITION



Schedule – Workshops

- Seven workshops this year
- Can help you finish this week's assignments
- Meet in various places
 - Third floor rooms (34 301 and 34 302)
 - Sixth floor, 6.111 Lab (38 00)


6.270 AUTONOMOUS ROBOT DESIGN COMPETITION



Schedule – Workshops

- Start at 1, 2, 7, 8 pm
- Workshop discussion and activity take one hour
- Limited space available, signups available in 6th floor lab by 6.270 office


6.270 AUTONOMOUS ROBOT DESIGN COMPETITION



Schedule – Workshops

- Signup TODAY!
- Monday, January 3, and Tuesday, January 4
- Workshop 1 – Basic Techniques of LEGO Assembly
 - Basic LEGO infrastructure
 - Review of basic LEGO pieces
- Workshop 2 – Motor Mounting and LEGO Gearboxes
 - Building a gearbox
 - Mounting motors onto your robot
 - Make a gearbox (Assignment 2)


6.270 AUTONOMOUS ROBOT DESIGN COMPETITION



Schedule – Workshops

- Signup after Wednesday's lecture
- Wednesday, January 5, and Thursday, January 6
- Workshop 3 – Electronics Assembly
 - How to solder
 - Soldering RF receiver (Assignment 2)
- Workshop 4 – Code & Sensors I: Basic Control and Robot Skills
 - Programming the HB (Assignment 2)


6.270 AUTONOMOUS ROBOT DESIGN COMPETITION



Schedule – Workshops (Next Week)

- Signup after Friday's lecture
- Monday, January 10, and Tuesday, January 11
- Workshop 5 – Servos, Sensors, and Shaft Encoders
 - Using analog sensors
 - Servo – the other motor
 - Shaft encoding with breakbeam sensor
 - Accelerometers to detect tilt
- Workshop 6 – Advanced LEGO
 - Using the unique pieces
 - Interesting gadgets
- Workshop 7 – Code & Sensors II: Advanced Techniques
 - Open vs. closed loop control
 - Line following


6.270 AUTONOMOUS ROBOT DESIGN COMPETITION



Schedule – Deliverables

- Seven Assignments
 - Due Tuesday (1/4), Thursday (1/6), Friday (1/7), Tuesday (1/11), Friday (1/14), Tuesday (1/18), Friday (1/21)
 - Available online
- Web Page – Saturday, January 29, 11:59 pm
- A Qualifying Robot
- Tuesday, January 25 – Impounding, 38-600, 5 pm
 - Assuming robot qualified
 - Opportunity for staff to make sure robots have no rules violations
 - No further work on robot may be completed at this point
 - **NO EXTENSIONS!**

6.270 AUTONOMOUS ROBOT DESIGN COMPETITION



Schedule – Contest Week

- Mock Contest (for the early birds)
 - Friday, January 21, 38-600, 7 pm
- Contest, Qualifying and Seeding Rounds
 - Sunday, January 23, Kresge, 10 am
 - You can lose *and* qualify!
- Contest, First and Second Rounds
 - Wednesday, January 26, Kresge, 10 am
- Contest, Final Rounds
 - Wednesday, January 26, Kresge, 6 pm
- Lab Cleanup
 - Thursday, January 27, 38-600, 2 pm
 - One person-hour per team, like Parts Sorting – **MANDATORY**

6.270 AUTONOMOUS ROBOT DESIGN COMPETITION



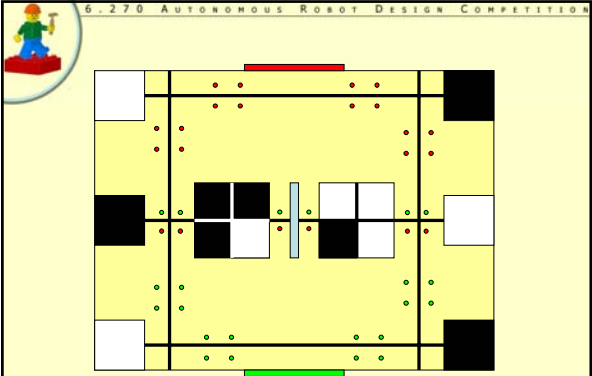
The Contest...



A short time from now, in a galaxy very close by, the masses are in unrest.

The non-trademark-infringing Gedi Knights Council, droid masters, guardians of the free world, and practitioners of the ancient interlocking plastic brick arts, have suffered a huge loss. Their former leader, Chin-wala-kane-ra, better known as "Chuck", has transcended to a higher plane of existence, and no longer will be around to keep the masses in check. An election will be held to determine "Chuck's" replacement, for without a leader, the Gedi Knights will be powerless to stop the ever-growing threats of all-nighters in lab, freshman showering, and Red Sox fans.

6.270 AUTONOMOUS ROBOT DESIGN COMPETITION



2005: Attack of the Drones
May the torque be with you!

6.270 AUTONOMOUS ROBOT DESIGN COMPETITION
2005: Attack of the Drones

A Second Contest!

- We need a t-shirt design!
 - Family friendly (please)
 - Non-trademark infringing
- Submit entries by Monday, January 10, 5 pm
 - 4 color designs (no grayscale)
 - Winner gets fabulous prizes (LEGOs, shirts, etc.)

6.270 AUTONOMOUS ROBOT DESIGN COMPETITION
2005: Attack of the Drones

Contest Rules: The Fine Print

- Competition rounds
 - Qualifying rounds do not count for losses, but count for seeding
 - First and second rounds can lead to elimination before final rounds
 - Seeding based on past performance
- Electronics modifications are permitted
 - New driver circuitry, bigger battery packs, etc.
 - Must provide full schematics (and more) to 6.270 staff BEFORE modification, and they will be made public
- No more beacon
 - Information transmitted wirelessly to your robot during the competition

6.270 AUTONOMOUS ROBOT DESIGN COMPETITION
2005: Attack of the Drones

Contest Rules: The Fine Print

- Assignment extension policy
 - Assignments are due at the time given; if you need an extension, **talk to us!**
 - The first extension is free
 - Each extension after that counts as a loss
 - An extension is good until the next assignment's due date (except the last assignment)

6.270 AUTONOMOUS ROBOT DESIGN COMPETITION
2005: Attack of the Drones

Contest Rules: The Fine Print

- At next lecture
 - Sensor points
 - \$30 electronics rule
- Rules questions? Email 6.270_rules@mit.edu
 - Any decisions on rules questions will be posted on the website
- For more information, see Course Notes, Chapter 2

6.270 AUTONOMOUS ROBOT DESIGN COMPETITION
2005: Attack of the Drones

Your Kit

- Valued at \$1500
- Big thanks to our generous sponsors:

6.270 AUTONOMOUS ROBOT DESIGN COMPETITION
2005: Attack of the Drones

Your Kit

6.270 AUTONOMOUS ROBOT DESIGN COMPETITION
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Your Kit

The Brain: Handy Board

- For Assignment 1, run through test suite to ensure original Handy Board is in working order
- Manual is not included, can get it from "Handouts" site or <http://handyboard.com>

6.270 AUTONOMOUS ROBOT DESIGN COMPETITION
2005: Attack of the Drones

Your Kit

Damaged Handy Board Policy

- After Assignment 1, we assume your Handy Board was good when you got it, and any malfunctions that happen thereafter we will assume were your fault
- If anything breaks, it's your problem—we can help debug, but we won't guarantee anything
- Most common reasons a Handy Board breaks down:
 - Doubling up motor ports
 - Plugging things in backwards
 - Shorting things

6.270 AUTONOMOUS ROBOT DESIGN COMPETITION
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Your Kit

Expansion Board for the HB

- Must be soldered for Assignment 2
- Don't put on Handy Board yet
 - A hack needs to be made
 - We will tell you how to alter the Handy Board for the expansion board upon completion of Assignment 2
- Will be handed out Tuesday

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Your Kit


The Juice: Hawker Batteries

- Three batteries soldered in series (6V)
- Be careful when soldering—they come charged
 - Pro (not really) demo in Lecture 2
- Build them for assignment 4
- Will be handed out at the end of this week

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Your Kit

Battery Recharger




- Must be soldered for Assignment 4
- Four ports for the two battery packs
- Two speeds of recharge: **fast** and **slow**
 - Recharging on **slow** is not dangerous
 - Monitor charger if on **fast** charge (4 hours max)
- Will be handed out at the end of this week

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Your Kit

The Muscles: Motors

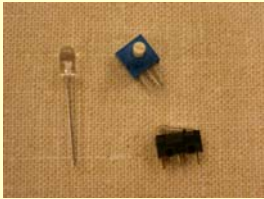


- Two kinds of actuators allowed in 6.270: DC motors and servos
- Need to "LEGOize" these devices – go to workshop 3
- Can use glue or tape to mount them
- Allowed to alter LEGO for mounting

6.270 AUTONOMOUS ROBOT DESIGN COMPETITION
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Your Kit

The Sensors




- Digital
 - Switches
 - Shaft encoders
- Analog
 - Phototransistors
 - Potentiometers
 - Gyroscope
- More to come in Lecture 2

6.270 AUTONOMOUS ROBOT DESIGN COMPETITION
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Your Kit

The RF Receiver

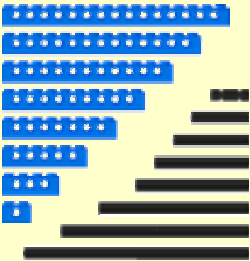


- Assemble for assignment 2
- Lets us give you information during the competition round
 - Voting
 - Position
 - Start/end of match

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Your Kit

The Infrastructure: LEGO




- Except for the base plate, LEGO cannot be modified (unless mounting electrical component)
- Beams: structural skeleton
- Axles: motion connectors

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Your Kit

The Infrastructure: LEGO



- Plates: structural reinforcement and spacing
- Flat Plates, smooth surfaces for sliding mechanisms or for sensor and motor mounting

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Your Kit LEGO Dimensions and Bracing

- Bracing makes structures stronger
- 3 plates = 1 beam
- 2 beams + 2 plates = 3 holes
- Pythagoras works, too
- Count number of nubs between holes
- Any other combination could add unnecessary shear forces

6.270 AUTONOMOUS ROBOT DESIGN COMPETITION
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Your Kit Connectors

- Friction peg – creates structural support between beams; stiff
- Frictionless peg – allow angular movement
- $\frac{3}{4}$ pin – joint two 1-FLU liftarms; create flat surfaces for shafts
- $\frac{1}{2}$ pin (with stud) – join two 1-FLU liftarms
- Axle with stud – can create lateral movement with a stop instead of a $\frac{1}{2}$ bush
- Long friction peg – join three beams together conveniently
- Long frictionless peg – rotate arm that is structurally stronger
- Long friction peg with bush – connect beams from the outside
- Technic axle pin – extending axles out of beams, combining various connectors
- Pin with towball – attach rubber bands, ball and socket
- Axle with towball – attach rubber bands, ball and socket (no friction)

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Your Kit Treads

- Chains are same thickness as gears
- Treads are wider; use for tank models
- Some have tried to make conveyor belts—clever, but impractical

6.270 AUTONOMOUS ROBOT DESIGN COMPETITION
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Your Kit Tires

- The wheel is the final gear in your gearbox
- You can use tape or rubber bands on tires to alter coefficient of friction
- Tires are not always for locomotion—use to draw in or throw out objects
- Your robot will be heavy! Test your robots and wheels with full weight (batteries, HB, game objects)

6.270 AUTONOMOUS ROBOT DESIGN COMPETITION
2005: Attack of the Drones

Your Kit What's *Not* in Your Kit


- Heat Shrink
- Ribbon Cable
- Tools (tool store)
- Extra sensors, servos, motors
- Some stuff that we'll be giving you soon
 - Expansion board kit
 - Batteries and charger kit
 - RF receiver kit

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2005: Attack of the Drones

Your Kit At this point, don't touch:

- The distance sensor (we will talk about it Lecture 3)


6.270 AUTONOMOUS ROBOT DESIGN COMPETITION
2005: Attack of the Drones



Assignment 1

- Due Tuesday night (TOMORROW!) at 11:30 pm
- Five tasks to complete:
 1. Read directions carefully!
 2. Know your Organizer and TA
 3. Test the Handy Board
 4. Make the front-end loader
 5. Discuss rules and strategy


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2005: Attack of the Drones



What's Next

- Distribution
 - Kits
 - Handy Board
 - Pick up Assignment 1
- Go to the sixth floor lab and sign up for workshops beginning today
- Open up your kit and make sure you have everything (go to website to kit contents)


6.270 AUTONOMOUS ROBOT DESIGN COMPETITION
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What's Next



- Get to work on Assignment 1 (due tomorrow)
- Workshops available:
 - Workshop 1 – Basic Techniques of LEGO Assembly
 - Basic LEGO infrastructure
 - Review of basic LEGO pieces
 - Workshop 2 – Motor Mounting and LEGO Gearboxes
 - Building a gearbox
 - Mounting motors onto your robot
 - Make a gearbox (Assignment 2)
- Don't forget to sign up in the 6th floor lab

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2005: Attack of the Drones



Come Pick Up Your Kits!

- Teams 1-8
- Organizer: Ross Glashan
- TA: Mike Lin

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Come Pick Up Your Kits!

- Teams 9-16
- Organizer: Michael Thilmont
- TA: Cliff Frey






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Come Pick Up Your Kits!

- Teams 17-24
- Organizer: Dave Wang
- TA: Roberto Ramirez






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Come Pick Up Your Kits!

- Teams 25-32
- Organizer: Vimal Bhalodia
- TA: Shuang You



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Come Pick Up Your Kits!

- Teams 33-40
- Organizer: Zane Tian
- TA: Mike Matczynski





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Come Pick Up Your Kits!

- Teams 41-48
- Organizer: Brett Groshong
- TA: Jim Roewe





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Come Pick Up Your Kits!

- Teams 49-56
- Organizer: David Ziegler
- TA: Jonathan Wang



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Why are you still here? GO TO LAB!!