

Announcements

- Keep up with reading (in advance)
- Quiz is a way to check roll
- Download/read lab in advance – lab quiz!
- Each lab write-up due at beginning of next lab
- Email via auburn.edu address

Announcements – cont'd

- Sync your engineering and university passwords
 - » Gives you access to a network drive (H:) that is accessible throughout the College of Engineering
- How to sync password
 - » AU website->Students->Password Update
 - » <https://oitapps.auburn.edu/myaccount/>
- Can enter your current password in all three blanks if the password satisfies all the rules
 - » If not, you will need to specify a new password

Design Competition

- Each team designs and builds a wireless LEGO car
 - » Work on car done outside of class
 - » Transmitter/receiver and driver board will be supplied
 - » Otherwise, team must build the car with their own supplies
- Lectures/Labs 1-7 provide background material for the design project
- Start early on the design project!
- COMPETITION – (Tentatively) Friday, November 7 in the lab

Engineering Design Process

Identify Customer Needs
Establish Product Specification
Define Alternative Concepts
Select the Most Suitable Concept
Design/Integrate Subsystems
Build/Test Prototype
Design/Build Production
Produce
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Engineering Design Process

- **Example:** Mousetrap
- Identify customer needs.
 - » “I want a device that gets rid of the mice in my house.”
 - » “I want a device that won’t hurt my toddler.”
 - » “I want a device that won’t wake me up at night.”

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Engr. Design Process (cont'd)

- Establish product specification.
 - » Device must kill the mouse.
 - » Any moving parts must be inaccessible to toddlers.
 - » Any poison must be inaccessible to toddlers and remain inaccessible when trap is handled.
 - » Device must be quiet

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Brainstorming

- The brain uses two basic modes in the design process:
 - » creative mode
 - » critical mode
- These two modes work against each other.
- Some people are better at one mode than the other
- Brainstorming separates the two processes into different time frames.
- It is important not to think critically during brainstorming.

Engr. Design Process (cont'd)

- Define alternative concepts.
 - » Spring-loaded trap is enclosed. Baffled door keeps out small fingers and muffles mechanical spring noise.
 - » Poison is formed into a module that is affixed to a far corner of the trap away from reaching fingers.
 - » Laser zaps mouse when optical beam shows nothing in door of trap.

RATMOUSE Zapper

...a reusable and safe rodent exterminator that delivers a deadly shock to mice and rats when they attempt to retrieve the bait inside. Once you get one of the rodents a red strobe light on the top blinks tells you its time to empty the chamber. Emptying it can't get any easier! Just hold it over a trash can and let the contents slide out, you don't even have to see or touch the rodent! This product is safe for children or your pets...



- Effective (kills mice, rats, chipmunks and ground squirrels)
- Clean (no blood or guts) and reusable
- More humane mouse trap than snap traps, glue boards, and poison
- Compact (10" x 4" x 4") and easy to use rat trap
- 10 rodent kills or 30 days with one set of 4 alkaline AA batteries
- Flashing kill indicator light (you never have to see the dead rodent!)

Infra-Red Mouse Trap

The body of the trap is made from a **shortbread tin**. Mice enter through a hole cut in the lower-right side of the tin. Once inside, they are forced to walk through a **toilet paper tube** to reach the bait. On the bottom of the tube is an infra-red LED which is aimed at a photo transistor at the top. These components are taken from the write-protect sensors of a **5.25" disk drive**. When the light beam is interrupted, the floppy drive's main motor starts to spin. This instantly retracts a piece of **coat hanger** wire that was holding the door open. The door (which is made from shielding from a **television set** and is hinged with a rod from a **clothes drier** and a **drinking straw**) falls closed, and is secured by five **fridge magnets**. A switch from a **vending machine** detects that the door has shut, and cuts power to the motor. A **computer power supply** provides 5v for the sensor and 12v for the motor.



- I am happy to say that the trap works perfectly. Several mice have been caught and released with this device.
- *Update: It turns out that this mouse trap has an Achilles heel. Because it is made out of junk, it looks like junk. As a result it was thrown out by a relative who took it upon herself to do some cleaning. Grrr...*

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Engr. Design Process (cont'd)

- Select the most suitable concept.
 - » Cost
 - Design cost
 - Material cost
 - Assembly cost
 - » Weight
 - » Appearance
 - » Performance
 - » Safety
- » Environmental risks
- » Reliability
- » Ease of use

Tradeoffs in Engineering Design

Examples:

- Cost vs. performance
- Safety vs. performance
- Performance vs. reliability

Selecting the Most Suitable Concept

- Typically, you have
 - » Several design alternatives
 - » Multiple, often conflicting, criteria
- How do you sort all this out?

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Alternative Methods

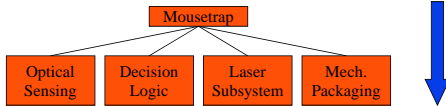
- Positives and Negatives (Pros vs Cons)
- Pugh Chart
- Analytical Hierarchy Process
- House of Quality Method

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Engr. Design Process (cont'd)

- Design the subsystems and integrate them
 - » Break a complex system into small subsystems

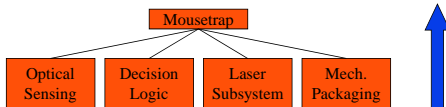


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Engr. Design Process (cont'd)

- Build and test a prototype
 - » Build and test each subsystem
 - » Integrate and test the subsystems



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Design for Lego® Car

- Specification is given.
- Define alternative concepts.
- Select the most suitable concept.
 - » Bottom line is finishing time.
 - » “Cost” is figured in by penalizing use of parts.
 - » Car should be sturdy enough not to fly apart during race.
 - » Car and course must pass minimal safety specs.

Design Subsystems

- Car path & steering strategy
- Power supplied to vehicle
- Torque vs speed
- Vehicle mass, wheels, etc.

Further Design Steps

- Build and test, then modify!!!
- Production design, distribution, and tracking are not relevant to a single-shot prototype design.