Announcements

• No class Friday.
• Recitations meet this week
• Assignment 5 due next week
  – convergence process
  – system architecture plan
Review: What’s the problem with this approach?

generate concepts

pick one

synthesize → analyze

improve
Review: Controlled Convergence Approach

generate concepts

Look at sets of design ideas...

…and eliminate the worst.
(rather than pick the best)
Design Convergence...

...isn’t usually smooth.
Example

Design Thinking class at Stanford

http://www.youtube.com/watch?v=JZH70qhmEso

(already watched first 3:45)
Review:
System-level design bridges conceptual and detailed design

- Concept
  - Identify Subsystems
  - Configuration
  - Interfaces

- System
- Detail

We also explore ideas here!
Recommended Design Approach

1. Lots of ideas!

2. Narrow through elimination, not selection.
   - Pugh evaluation matrix

3. Eliminate only when you have enough knowledge to do so.
   - additional research
   - engineering analysis
   - system architecture design
Recommended Design Approach

4. Combine and revise ideas to generate improved designs.
5. Plan system architecture before doing detailed design work.
6. Establish feasibility before commitment.
Why do design projects fail?

1. Misunderstanding what the customer needs.
2. Committing to a solution too early.
3. Lack of teamwork: esp. communication & conflict resolution, and across disciplines.
4. Poor system architecture, especially interfaces.
5. Poor planning.
Why do design projects fail?

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An Engineering Design Process

Client Need → Problem Definition → Conceptual Design → System-level Design → Detail Design → Design Communication → Final Design
System-level Design

specs + design alt’s

Identify principle attributes of leading design concepts:

7. Establish system architecture
8. Model and evaluate alternatives
9. Converge to best alternative
System-level Design

• Identify subsystems of the concept
• Investigate alternative configurations
• Think through interface issues
  – between subsystems
  – with user
  – with environment
System-level Design, cont.

• Choose configuration based on the best interfaces

• Plan the system architecture
  – subsystem configuration / layout
  – interface design / specifications (detailed!)
Block Diagram

- Identifies key subsystems and interfaces

Battery

Electrical Hardware:
- Voltage Regulator Circuit
- 4 Relays

Microprocessor

Solenoid (4)

Mechanical Target Module

User

Ground

Selects skill game

"Pop-up" Signal

Swing target into view

Shoots target down to relatch

Actuation Pulse

Release Latch

Support

12v

3.3v
System Architecture Plan

• Adds interface details to block diagram

- Battery 12v
- Voltage Regulator Circuit
- Microprocessor
  - Port B
    - Bit 0
    - Bit 1
    - Bit 2
    - Bit 3
- 12v to 3.3v
- Electrical Circuit
  - (4) Relays
  - To Solenoid
Exercise

In your teams, for one of your top concept alternatives:

• Create a block diagram

• Brainstorm the best way to interface:
  – between subsystems
  – with users
  – with environment