IMGD 3xxx - HCI for Real, Virtual, and Teleoperated Environments: Introduction

by
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Motivation

- Some interesting recent developments
  - Mobile computer systems are cheap, powerful, and everywhere
  - Wireless connections are everywhere
    - Cellular, WiFi, Bluetooth, ...
  - Sensors and actuators are cheap
  - Accessible robot systems are emerging
    - Roomba, MANY kits
  - Wild popularity of new games and platforms
    - Rockband, Wii, iPhone/iPod/iPad, Android
Motivation (cont.)

- I've been working on 3D User Interfaces for Virtual Reality for a looooon time
  - About 15 years

- VR and gaming are very related
  - But games sell!

- Games have gotten a little stale
  - How many more FPSs can you make?

- Graphics are pretty good now!

- Sound is also pretty good!

- So, what's the next big thing?
Questions

☐ Why are car navigation systems so popular?
☐ Why are the iPhone/iPad so popular?
☐ Why is the DS so popular?
☐ Why is the Wii so popular?
☐ What games are popular on the Wii?
☐ What are Sony and MS doing to catch up?
☐ What can Nintendo do to stay ahead?
HCI in Real Environments

- Mobile devices
  - Car Navigation
  - GeoCaching
  - FriendFinder
  - Medical monitoring

- Multi-person coordination
  - Military operations
  - Search-and-Rescue
  - Fire fighting

- Stuff we don't know about yet!
HCI in Virtual Environments

- Layouts for user interfaces
  - Heads-Up Displays (HUDs)
  - Chat windows
  - State

- Spatialized audio/voice

- Haptic (touch) displays
  - Hit by weapons fire
  - Virtual surgery training
  - Steering wheels

- Smell?
- Taste?
- What about input?
HCI in Teleoperated Environments

- Teleoperated robot systems are used more and more
  - Disaster areas
  - Medical micro-robots
  - Space exploration
  - UXVs (UAV, UGV, UUV)

- Operator relies on remote sensors
  - Limited fidelity
  - Communication delays

- Remote actuators change the physical world
Common Problems

☐ All three environments require the user to:

1. Sense something
   - Limited fidelity (screen space, etc.)
2. Make a decision
   - Draw on new and existing knowledge
3. Carry out actions
   - Limited expressiveness (mouse, gamepad, etc.)

☐ Errors can be made at each step

☐ In this course, we will focus on 1 & 3
   - Also known as Input/Output
What to Expect

- This course is about
  - How to build new interfaces for these environments
  - How to design applications (e.g., games) that take advantage of these devices

- This is really a **Chicken & Egg** proposition
  - Devices constrain the application
  - Application constrains the devices
  - User constrains both
  - Environment constrains both
What to Expect (cont.)

- The groundwork to do this stuff right requires
  - A good understanding of the human sensory system
  - A good understanding of building devices
  - A good understanding of the application domain

- The projects you do in this course will help you learn all of this
Summary of Syllabus

- Lectures and in-class work
  - Exercises designed to drive home concepts, or to get you thinking about projects

- 1 Application Design Report (33%)
  - Research a potential application (Real/Virtual/Tele)
  - Design (not build) a novel user interface for it

- ~4 "Smaller" Projects (33%)
  - Individual projects
  - Use the Arduino and Android to build stuff

- 1 Final Project (34%)
  - Team-based
  - Use Arduino/Android, plus other software you choose (Unity, Flash, C4, XNA, etc.)

- All material on class website
  (www.cs.wpi.edu/~gogo/courses/imgd3xxx/)
Readings for the Course

- There will be material from several eBooks:
  - eBooks can be accessed from any WPI computer:
    - [http://proquest.safaribooksonline.com:80/home](http://proquest.safaribooksonline.com:80/home)
    - Enter "Arduino" in the search box

- And also material from the Web:
  - Arduino/Android communities
  - Electrical engineering help
  - Project ideas

- Excerpts from:
More About the Projects

- One of the goals of this course is for you to feel confident to build devices
  - Find sensors to measure what you want to measure
  - Find interesting ways of getting input to the system
  - And output to the real world (e.g., the user)
  - Pinwheels for network traffic

- You can find stuff easily these days
  - Sparkfun (www.sparkfun.com)
  - Digikey (www.digikey.com)
  - Jameco (www.jameco.com)
  - Allelectronics (www.allelectronics.com)
  - RadioShack (www.radioshack.com)
Engineering vs. Science

- Scientific Method
  - Define a hypothesis, test it, and make laws

- Engineering Approach
  - Come up with an idea, build it, refine

- Both of these require solid foundations!
  - You need to do your homework

- Software people are reluctant to mess with hardware
  - Might break something
Arduino Development

- There are Arduino Development Kits for this course in the bookstore
- The kits work in the lab
  - And you can work at home too
- Cross-platform
  - Mac, Linux, Windows
- LOTS of help on the Web:
  - http://www.arduino.cc/
Android Development

- Google gave us phones!
- The Android development environment is eclipse based
  - Java is main language
  - Emulator for testing
- Eclipse has been configured in the lab
  - And you can work at home too
- Cross-platform
  - Mac, Linux, Windows
- LOTS of help on the Web:
  - http://developer.android.com/
Final Project

☐ Two- or three-person teams

☐ Choose an application area

☐ Define a set of interface devices and techniques that support the app

☐ Interim status demos in class

☐ Presentations will be done the last week of this course, where you will show your stuff

☐ More on this later!
Course Support

☐ TA
  ■ Paulo de Barros (pgb at wpi.edu)

☐ Please come to office hours (or other times)

☐ There is a GDC Forum for this course
  ■ http://forums.gdc.wpi.edu/
  ■ All project discussions should be posted there
  ■ You are encouraged to post screen-shots of your progress
Expected Outcomes

☐ Think beyond the gamepad
  ■ Alternative I/O to support a particular application

☐ Feel comfortable building new things

☐ Know how best to provide output to humans
  ■ All the senses

☐ Build up your portfolio
Final Thoughts

☐ This is an experimental course!

☐ I don't know which parts of this course will give you problems
   ■ We need to work together to tweak the content, presentation, etc.

☐ I welcome any and all feedback and suggestions on how to make the course better

☐ We have some flexibility to re-order/change topics

☐ Be playful!

☐ Be ambitious!