



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

by
Robert W. Lindeman
gogo@wpi.edu

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

Motivation (cont.)

- I've been working on 3D User Interfaces for Virtual Reality for a loooooong 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 is the iPhone so popular?
- ❑ Why is the DS so popular?
- ❑ Why is the Wii so popular?
- ❑ What games are popular on the Wii?
- ❑ What can Sony and MS do to catch up?
- ❑ What can Nintendo do to stay ahead?

HCI in Real Environments

- Mobile devices
 - Car Navigation
 - Hiker GPS
 - FriendFinder

- 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

- 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. Carryout 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

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 to build stuff
- 1 Final Project (34%)
 - Team-based
 - Use Arduino, 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

- We will provide material from several eBooks:
 - ***Programming Interactivity***, 1st Edition, Joshua Noble, O'Reilly.
 - ***Getting Started with Arduino***, 1st Edition, Massimo Banzi, O'Reilly.
 - eBooks can be accessed from any WPI computer:
 - <http://proquest.safaribooksonline.com:80/home>
Enter "Arduino" in the search box
- And also material from the Web:
 - Arduino community
 - Electrical engineering help
 - Project ideas
- Excerpts from:
 - 3D User Interfaces: Theory and Practice, Bowman, Kruijff, LaViola, Poupyrev, 2005, Addison Wesley, ISBN: 0-201-75867-9

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
 - Pinwheels for network traffic
 - And output to the real world (e.g., the user)

- You can find stuff easily these days
 - Sparkfun
 - Digikey
 - Jameco
 - Allelectronics
 - RadioShack

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 are built on solid foundations!
 - You need to do your homework
- Software people are reluctant to mess with hardware
 - Might break something

Arduino Development

- We have purchased Arduino Development Kits for this course
 - You need to pay me back (\$55 each)
- The kits work in the lab
 - And you can work at home too
- Cross-platform
 - Mac, Linux, Windows

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!