

3D User Interfaces for Games and Virtual Reality

Lecture #4: The Wii Remote

Spring 2011

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Motivation

- Wiimote controller
 - provides 3D UI in the home
 - 3DUI in mobile environments
- Makes games accessible to casual users
- Need to understand the device
 - advantages and disadvantages
 - how to develop 3DUIs



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The Wiimote Device

- Wiimote features
 - uses Bluetooth for communication
 - senses acceleration along 3 axes
 - optical sensor for pointing (uses sensor bar)
 - provides audio and rumble feedback
 - standard buttons and trigger
 - uses 2 AA batteries
- Supports two handed interaction
 - can use 2 Wiimotes simultaneously
- Easily expandable



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Wiimote Attachments

Nunchuk



Steering Wheel



Zapper



Wii Helm



Boxing Gloves



Sports Pack



Fishing Reel



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The Wiimote – Coordinates

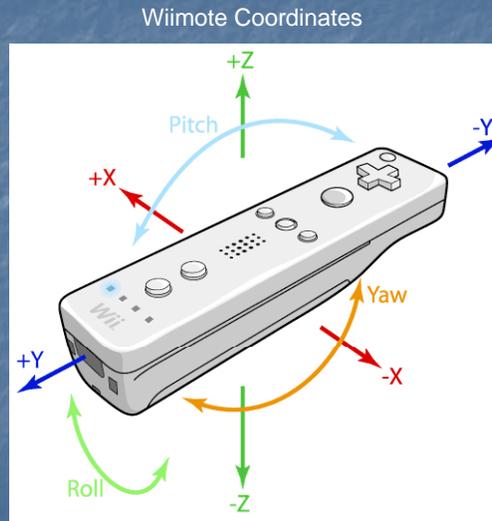


Image courtesy of www.osculator.net

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The Wiimote – Optical Data

- Data from optical sensor
 - uses sensor bar
 - 10 LED lights (5 of each side)
 - accurate up to 5 meters
 - triangulation to determine depth
 - distance between two points on image sensor (variable)
 - distance between LEDs on sensor bar (fixed)
 - roll (with respect to ground) angle can be calculated from angle of two image sensor points
- Advantages
 - provides a pointing tool
 - gives approximate depth
- Disadvantages
 - line of sight, infrared light problems
 - only constrained rotation understanding

Sensor Bar



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The Wiimote – Motion Data

- Data from 3-axis accelerometer
 - senses instantaneous acceleration on device (i.e., force) along each axis
 - arbitrary units (+/- 3g)
 - always sensing gravity
 - at rest acceleration is g (upward)
 - freefall acceleration is 0
 - finding position and orientation
 - at rest – roll and pitch can be calculated easily
 - in motion – math gets more complex
 - error accumulation causes problems
 - often not needed – gestures sufficient
- Advantages
 - easily detect course motions
 - mimic many natural actions
- Disadvantages
 - ambiguity issues
 - player cheating
 - not precise (not a 6 DOF tracker)



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The Wii Motion Plus

- Current Wiimote device
 - gives user a lot of useful data
 - not perfect
 - ambiguities
 - poor range
 - constrained input
 - Wii Motion Plus
 - moving toward better device
 - finer control
 - uses dual axis “tuning fork” angular rate gyroscope
 - true linear motion and orientation



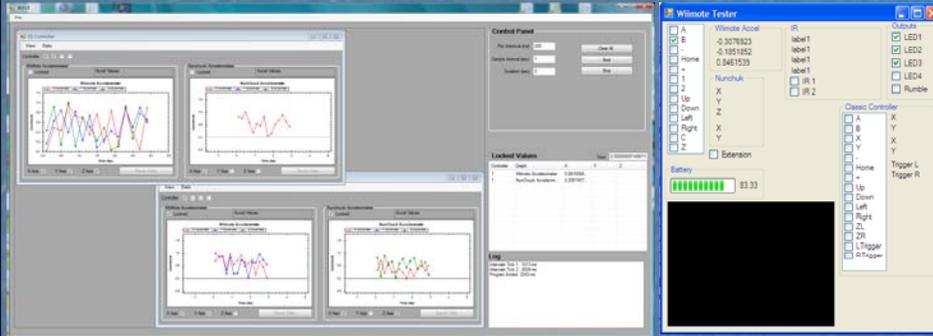
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Visualizing Wiimote Data

- Important to see data to understand device



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Programming with the Wiimote

- Connect to computer
 - does not work for every bluetooth device
- Obtain Wiimote software
 - many variations and APIs (C, C++, C#, Java, Flash)
 - Brian Peek's API (www.coding4fun.com)
 - low level API
 - Paul Varcholik's XNA 3DUI Framework (www.bespokesoftware.org)
 - contained within larger framework
 - include gesture recognizer
 - Unity 3D
- Write code and enjoy
 - heuristics
 - gesture analysis

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Case Studies

- Wiimote used in many different ways
 - most famous – Johnny Chung Lee
- Two main approaches
 - wear sensor bar, use Wiimote as camera
 - hold/wear Wiimote
- Games
 - music
 - dance
 - navigation
- Robotic control

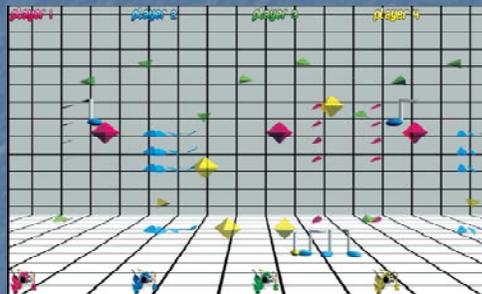
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One Man Band

- Goal
 - provide musical interfaces using a single device
 - easy to use, powerful, and expressive
 - mimic real instruments
- Features
 - guitar, violin/bass, drums, trombone, theremin
 - MIMI – Multi-Instrument Musical Interface
 - heuristic recognition
 - exponential smoothing



Bott et al., 2009

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Real Dance

- Goal
 - full body experience that feels like real dancing
 - untethered: no need to stand in one place or position
 - increasing amount of recognizable movements
 - preventing cheating by inaccurate movements
- Approach
 - attach Wiimotes to arms and ankles
 - heuristic evaluation of motion signals
- Visual Interface
 - timeline of icons
 - score feedback with avatars
 - animated instructor figure
 - user based figure



Charbonneau et al., 2009

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Navigation in World of Warcraft

- Work at V. Tech – Silva and Bowman
- Goal
 - reduce interaction complexity in WoW
 - improve navigation
 - help player concentrate on other tasks
- Approach
 - leaning metaphor
 - use Wiimote as camera
 - wear IR sensor bar



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Navigation in Sports Games – I

- Goal
 - more natural interface in American football
 - maneuvering
 - navigation
 - evasion
- Approach
 - IR head tracker
 - Wiimote/gyroscope
 - gesture recognition
 - integration



Williamson et al., 2010



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Navigation in Sports Games – II

- Work at Brown University – Wilson, Reddy, and Jenkins
- Goal
 - explore exergaming
 - wiisoccer
 - natural locomotion
- Approach
 - track players foot motion
 - sensor bar attached to leg
 - Wiimote used as camera
 - kick, pass and player speed detected



<http://www.cs.brown.edu/people/awilson/exergaming-home.html>

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Robot Control

- Goal
 - explore robot control using Wiimote
- Approach
 - use rest orientation for driving robot (tilt sensing from accelerometers)
 - gestures with simple classifier
 - forward, back, turn left, turn right, stop



Varcholik et al., 2008

Next Class

- Visual displays
- Readings
 - Siggraph 2010 course notes on 3D UI and Video Game Hardware