

CSE 165: 3D User Interaction

Lecture #8: Input Devices

Announcements

- Homework Assignment 2b
 - Due Friday Feb 8 at 3pm
 - Also late grading for project 2a
- Next Monday: Discussion assignment 3
- Next week: lectures given by TA Jimmy

3D Input Devices for Consumers



Nintendo Wiimote



PlayStation Move



Microsoft Kinect 2



Leap Motion



Razer Hydra

The Wiimote

- Uses Bluetooth for communication
- Senses acceleration along 3 axes
 - Used for sports games (tennis, bowling, etc.)
- 128x96 pixel monochrome camera with built-in image processing, requires sensor bar
 - Enables 2D on-screen pointer
- Standard buttons and trigger
- Provides audio and rumble feedback
- Up to 4 Wiimotes can be active simultaneously
- Connector for attachments
 - Nunchuck
 - Wii Zapper
 - Wii Wheel



Sensor Bar



Wii Zapper



Wii Wheel

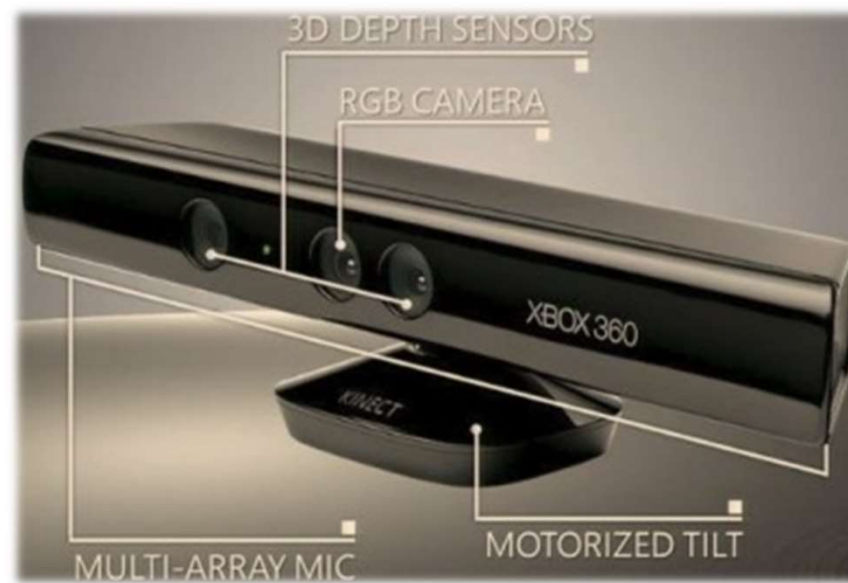
The Wii Motion Plus

- Initially (June 2009) optional add-on, later built-in
- Uses 3-axis gyroscope
- Captures relative 3D orientation
- Improves pose and motion estimation
- Information captured by gyroscope can be used to distinguish true linear motion from accelerometer readings



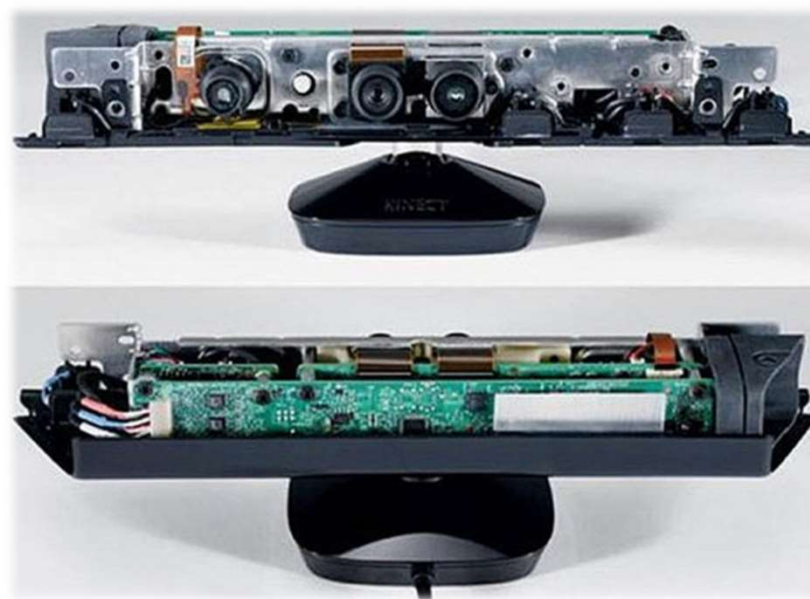
Microsoft Kinect

- Microsoft sold 8 million units in first 60 days on market
 - Guinness World Record for “fastest selling consumer electronics device”
- Kinect features
 - RGB camera
 - Depth sensor
 - Microphone array
 - Motorized tilt
 - Connects via USB
- Enables controller-less user interface
- Full body tracking possible
- 2 versions:
 - Xbox (~\$100)
 - Windows PC (~\$200)



Kinect – Hardware Details

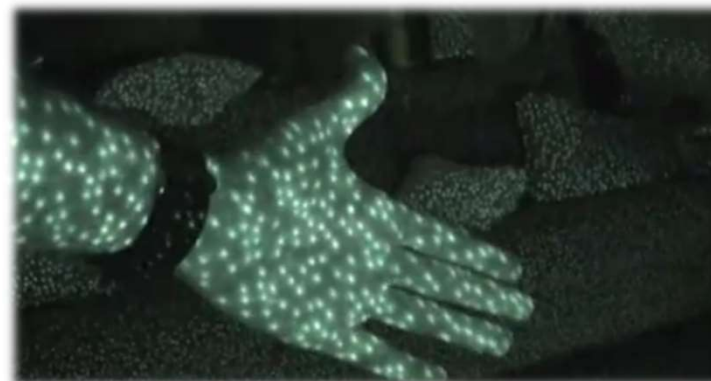
- RGB Camera
 - 640 x 480 RGB pixels at 30Hz
- Depth Sensor
 - 640 x 480 monochrome pixels with 11-bit depth CMOS sensor at 30 Hz
 - Field of view: 57 ° horizontally, 43° vertically
 - Infrared laser projector
 - 4-11 feet range, down to 16 inches in near mode (Windows version only)
- Multi-array mic
 - Four microphones
 - Multi-channel echo cancellation
 - Sound position tracking
- Motorized tilt
 - 27° up or down



www.hardware sphere.com

Kinect – Extracting 3D Depth

- Infrared laser projector emits known dot pattern
- CMOS sensor reads depth of all pixels
- Finds location of dots
- Computes depth information using stereo triangulation
 - Normally needs two cameras
 - Laser projector acts as second camera
- Depth image generation



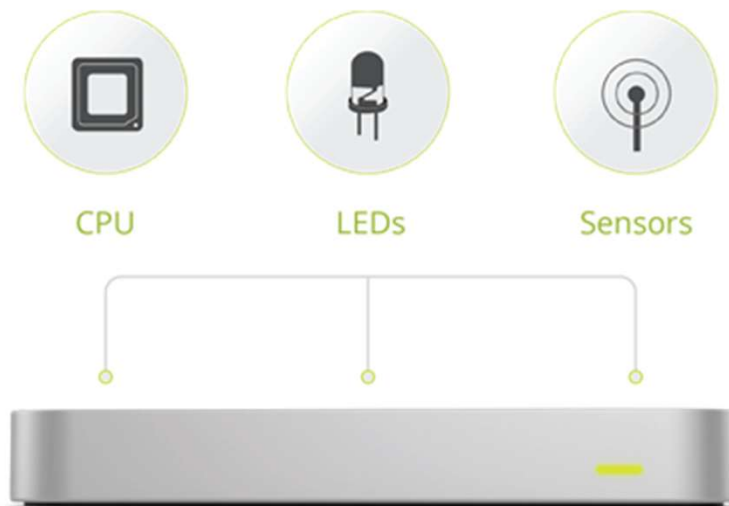
Leap Motion

- http://www.youtube.com/watch?v=_d6KuiutelA



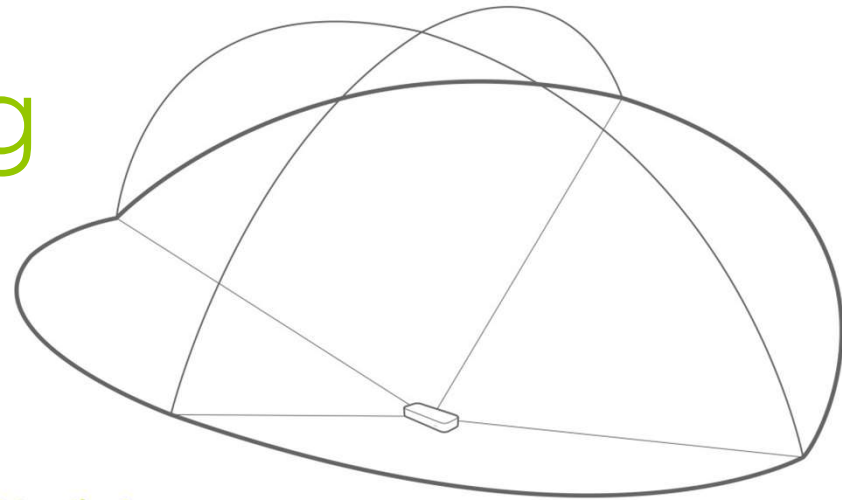
Leap Motion Overview

- Released July 2013
- Small form factor (3 x 1.2 x 0.5 inches)
- Short range finger tracking
- No depth map
- Two IR cameras
- Image processing on host PC
- Inexpensive (<\$70)



Leap Tracking

- USB controller reads sensor data into own local memory and performs resolution adjustments
- This data is streamed via USB to Leap Motion tracking software
- Images appear in grayscale
 - Intense sources or reflectors of infrared light can make hands and fingers hard to distinguish and track



Interaction Area

2 feet above the controller, by 2 feet wide on each side (150° angle), by 2 feet deep on each side (120° angle)



Leap Technology

- 8 cubic feet of interactive space
- 2 cameras
- 3 IR LEDs
- 850 nm wavelength (invisible for the eye)



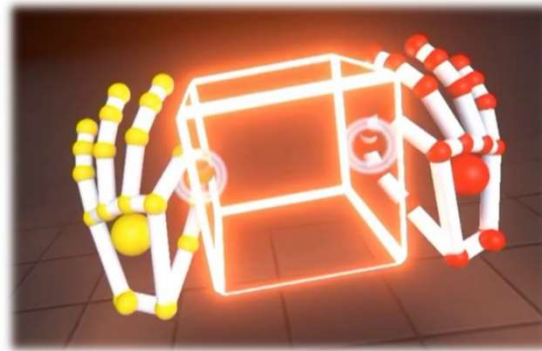
Leap Motion on Oculus Rift

- Leap makes plastic mount
- Mount glues to front of Rift
- Leap is removable
- Leap cable plugs in computer



Orion Driver for Leap Motion

- Released February 2016
- Complete re-write of driver
- Improved tracking
- Grab-and-drop interactions



<https://www.youtube.com/watch?v=rnlCGw-0R8g>

3D UI With the Leap

- Selection
 - Hover w/timeout (dwell)
 - Virtual touch
 - Two-finger pinch
 - Trigger with non-dominant hand gesture
- Manipulation
 - Hand orientation
 - 3-finger orientation
 - Dimensional reduction, e.g., to draw on virtual whiteboard (3D -> 2D)



Working with the Leap

- Finger pinches are often hard to detect
- More than 3 fingers hard to distinguish
- Fingers hard to distinguish when hand not viewed well from head (occlusion by other fingers)
- Improve detection of which hand is which (left/right): carefully bring hands into FOV from bottom edge

Myo

- Released March 2015
- Price: \$150
- Gesture control armband
- Expandable circumference
- Weight: 93 grams
- Thickness: 0.45 inches
- Bluetooth 4.0
- EMG muscle sensors
- Motion sensor
- Haptic feedback (vibration)
- <https://www.youtube.com/watch?v=jOEcsNmTk7g>

