

# CSE 165: 3D User Interaction

Lecture #9:  
Today's VR Controllers

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# Announcements

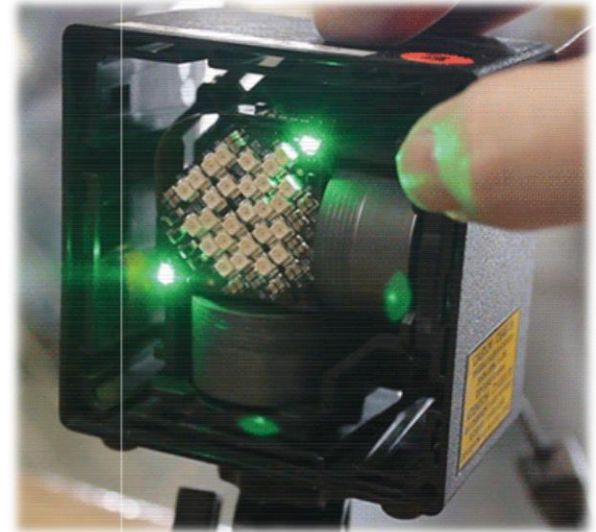
- Homework Assignment 3
  - Due Friday Feb 22<sup>nd</sup> at 3pm
- This Friday: late grading for project 2b

# HTC Vive Controllers

- Released April 2016
- Wireless
- Rechargeable through mini USB
- Optical tracking (IR laser)
- Symmetric design
- 2 buttons on top
- Clickable touch pad
- Trigger for index finger
- Left and right grip buttons



# HTC Lighthouse



- Runs at 60 Hz
  - I.e. horizontal & vertical update combined 60 Hz
  - Broadband sync pulses in between each laser sweep (i.e. at 120 Hz)
- Each laser rotates at 60 Hz, but offset in time
- Usable field of view: 120 degrees

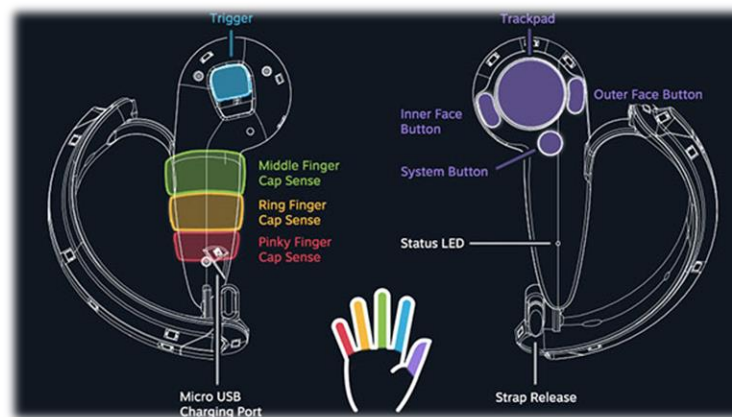
# HTC Lighthouse: Video



<https://www.youtube.com/watch?v=J54dotTt7k0>  
<https://www.youtube.com/watch?v=AbUOVswY5Lo>

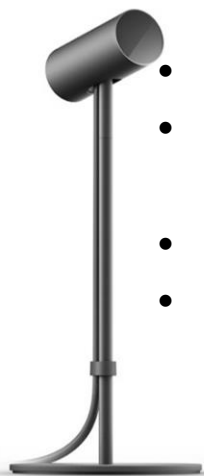
# Valve “Knuckle” Controllers

- For HTC Vive
- Announced in Dec 2017
- Not released yet



# Oculus Touch Controllers

- Released December 2016
- Wireless
- No recharge port
- Optical tracking (infrared cameras)
- Asymmetric design for left and right hand
- 3 buttons on top
- Triggers for index and middle fingers
- Thumb stick
- All buttons touch sensitive, as well as surface on top



# Microsoft Mixed Reality

- Different HMDs
- Same controllers
  - hybrid between Rift and Vive controllers





# Mobile VR Controllers

- Gear VR
- 3 DOF vs. 6 DOF



# PlayStation Move

- Consists of
  - PlayStation Eye camera
  - up to 4 motion controllers
- Combines camera tracking with motion sensing for 6 DOF tracking
- Vibration feedback
- Wireless and USB connectivity
- Four buttons (Square, Triangle, Cross, Circle) on front
- Two buttons (Select on left, Start on right) on sides
- Big Move button front center
- Small PS button on front (power button)
- Analog trigger button on back



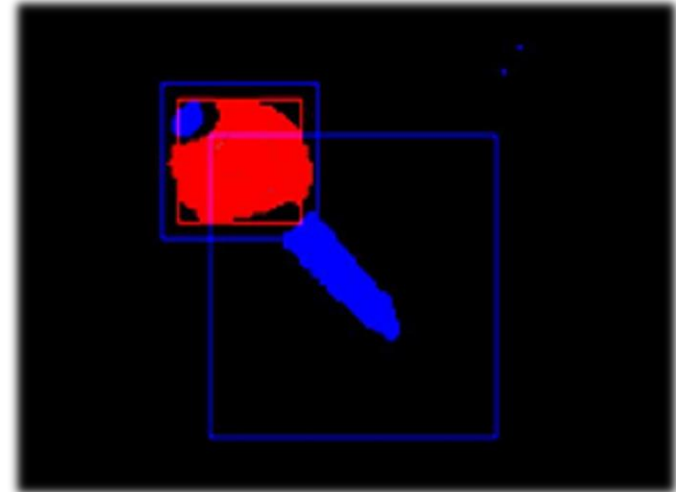
# Move - Camera

- PlayStation Eye
  - 640 x 480 (60Hz)
  - 320 x 240 (120Hz)
  - Microphone array (4 mics)
  - Manual exposure control



# PlayStation Move – 6 DOF Tracking

- Image Analysis
  - Find sphere in image with segmentation algorithm
  - Given known focal length and measured size of sphere in image, calculate 3D position
- Sensor Fusion
  - Combines results from image analysis with inertial sensors
    - Accelerometer
      - Gives pitch and roll angles when controller is stationary
      - Gives controller acceleration when orientation is known
    - Gyroscope
      - Measures angular velocity and acceleration



# Playstation VR

- Uses Move controllers as 6 DOF input devices
- HMD uses visible light for tracking
- HMD tracking camera also tracks Move controllers

