CSE 165: 3D User Interaction

Lecture #19:
3D Input Devices

Upcoming Deadlines

- Sunday, March 14th at 11:59pm:
  - Homework project 4 late deadline
- Final Exam
  - 3 hour exam, **no interruptions**
  - To be taken in 24 hour window between 6pm Wed 3/17 and 6pm Thu 3/18

Announcements

- CAPE + TA evaluations

Optical Tracking

Oculus Quest 2

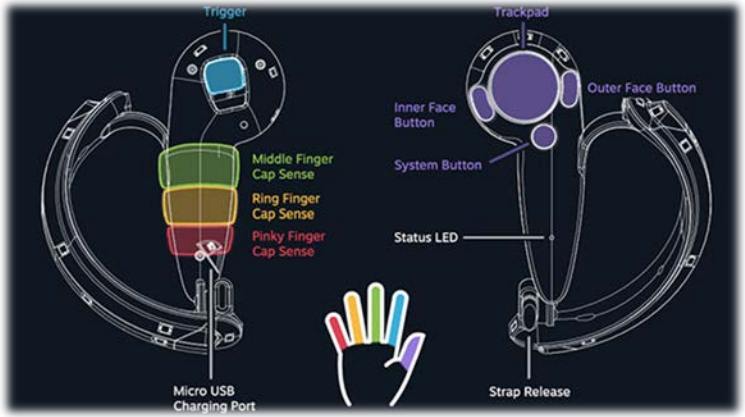
- Release date: Oct 2020
- Standalone VR HMD
- LCD display
- 1832×1920 pixels per eye
- 72 Hz refresh rate
- 100 degrees FOV
- IPD adjustment
- Qualcomm Snapdragon XR2
- Built-in headphones
- Inside-out 6 DOF tracking
- Includes 2 controllers

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

Valve “Knuckle” Controllers

- For HTC Vive
- Hand attached by strap around palm
- No need to hold the controller



Microsoft Mixed Reality

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

PlayStation Move

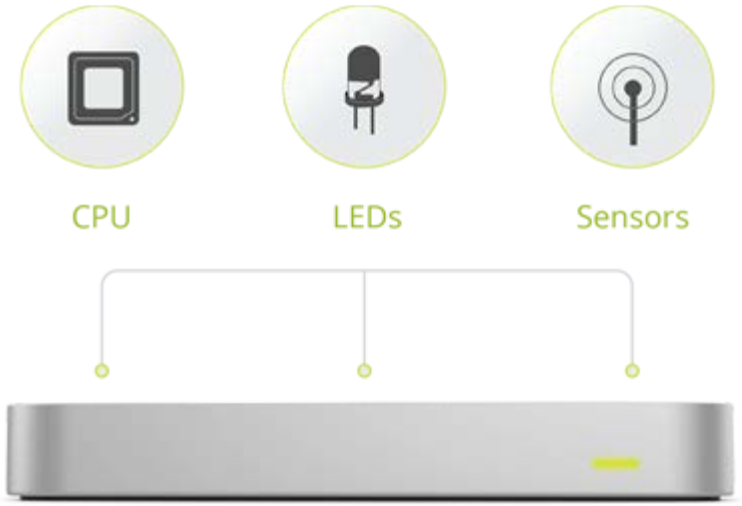
- Consists of
  - PlayStation Eye camera
  - up to 4 motion controllers
- Combines camera tracking with motion sensing for 6 DOF tracking
- Vibration feedback
- Wireless and USB connectivity
- Four buttons (Square, Triangle, Cross, Circle) on front
- Two buttons (Select on left, Start on right) on sides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

Playstation VR

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

Leap Motion

- 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



Leap Motion Video

Leap Motion on Oculus Rift

- Leap makes plastic mount
- Leap is removable
- Leap cable plugs in computer

Haptic Feedback Devices

Hybrid Devices: Haptic Feedback Devices

- PHANToM haptic device
- Force feedback joystick
- Exoskeleton-like devices

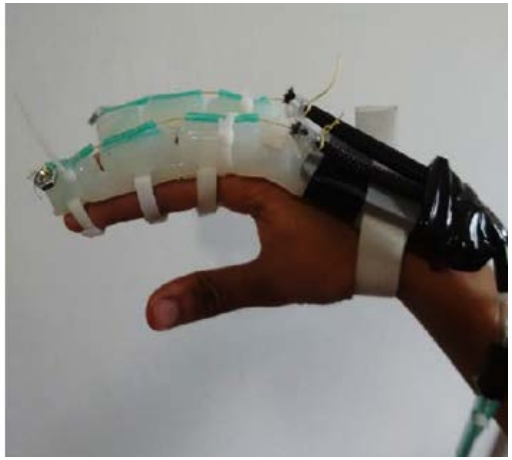
Immersion CyberForce

LEXOS: Frisoli et. al., Italy

SensAble PHANToM

Microsoft force feedback joystick

Haptic glove with soft robotics components

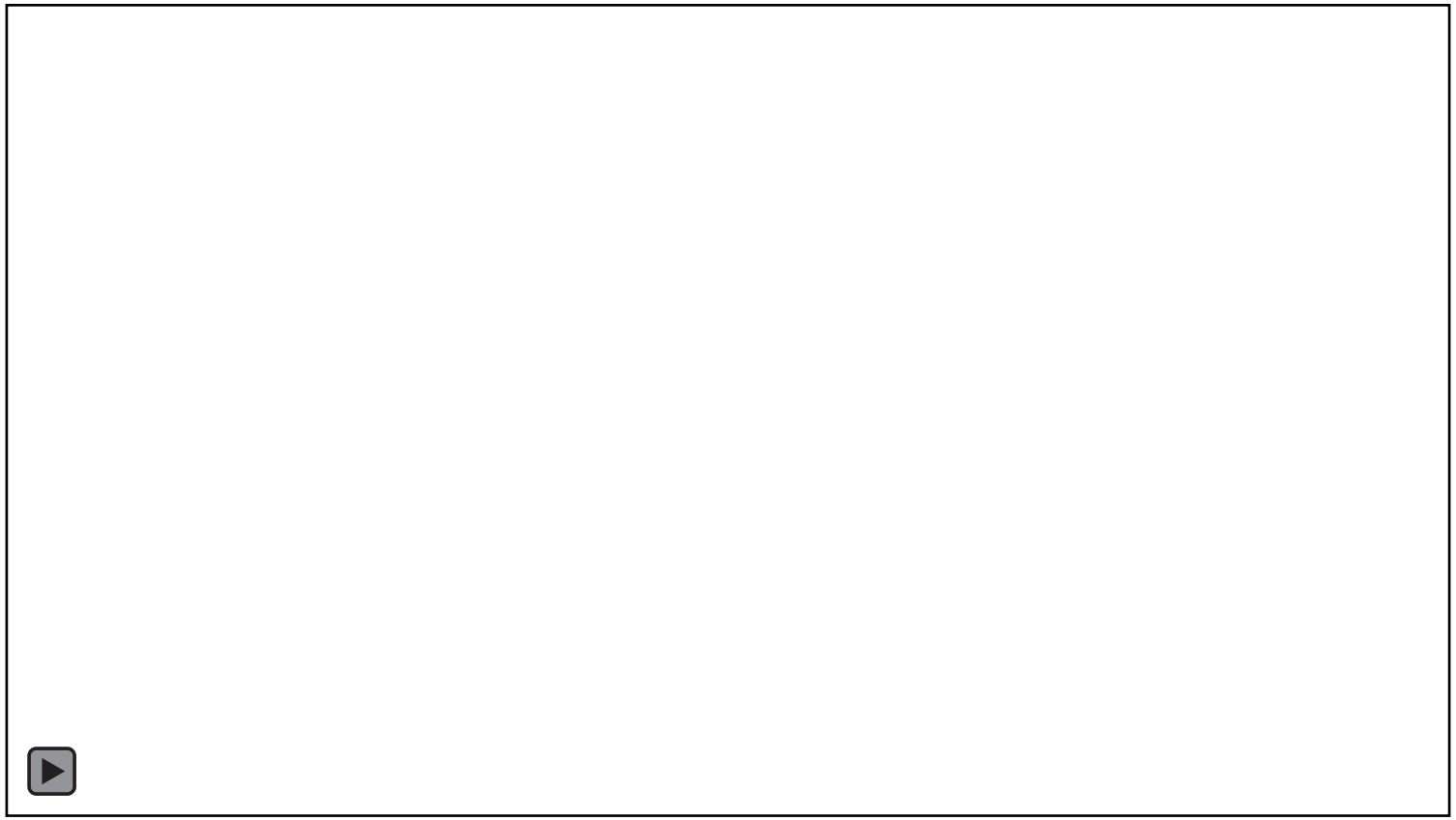


Initial glove assembly

Designed by UCSD Master's student Saurabh Jadhav

Updated glove assembly

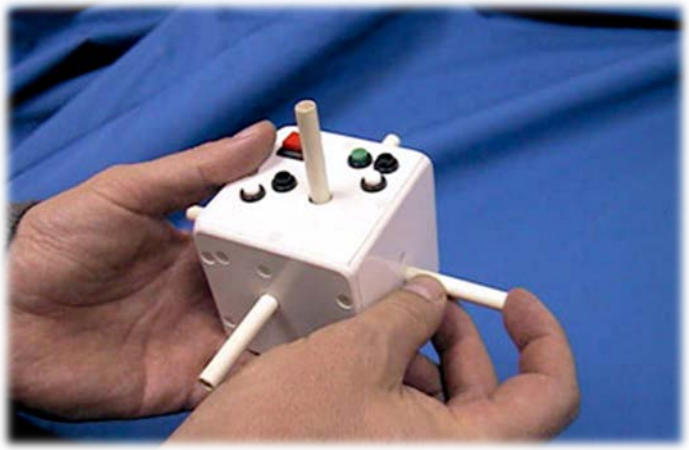
Use case: playing piano in VR



Application Specific Devices

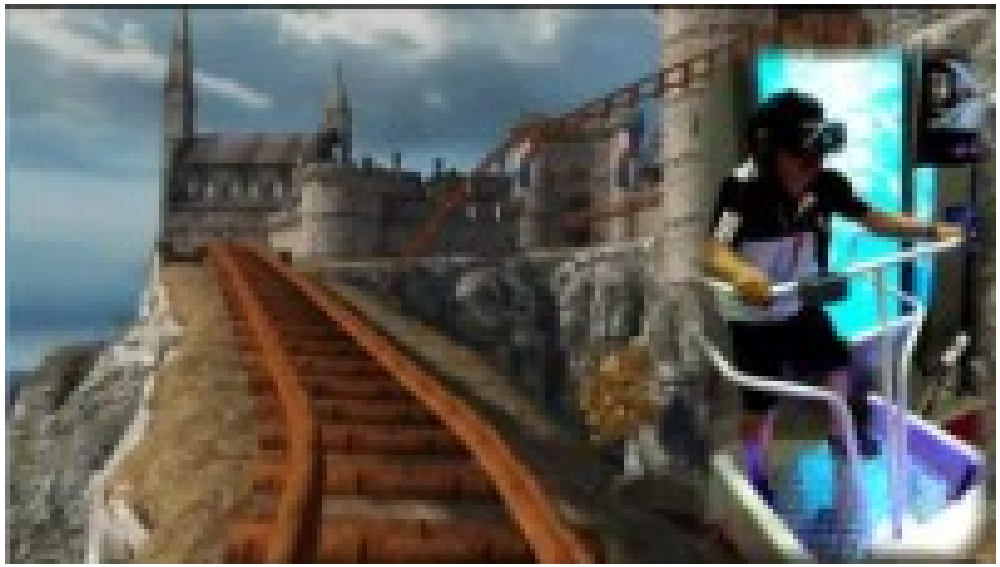
Special Purpose Device: Cubic Mouse

- Developed at Fraunhofer Institute
- Cube shaped box with three rods represents a physical coordinate system
- 6DOF tracker is inside cube
- Rods used to manipulate x-, y-, and z- coordinates of an object (built for controlling cutting planes)
- Target application area: volume rendering for oil and gas industry



Application-Specific Devices

- Virtual hang-gliding over Rio de Janeiro (L. Soares at. al.)
- Virtual canoe, Siggraph 2005



Cave Painting

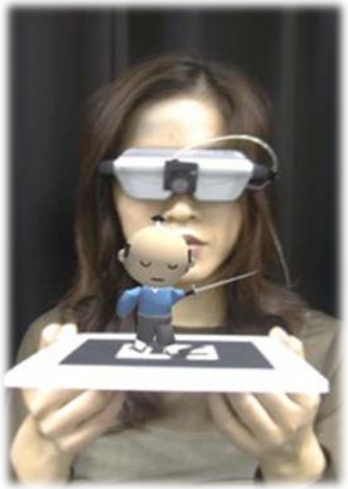
- Physical props (brush, color palette, bucket) allow intuitive painting
- Created by Daniel Keefe at Brown University (now Univ. of Minnesota) in 2001
- Google Tilt Brush and Oculus Quill are modern versions for HMDs

Cave Painting Video

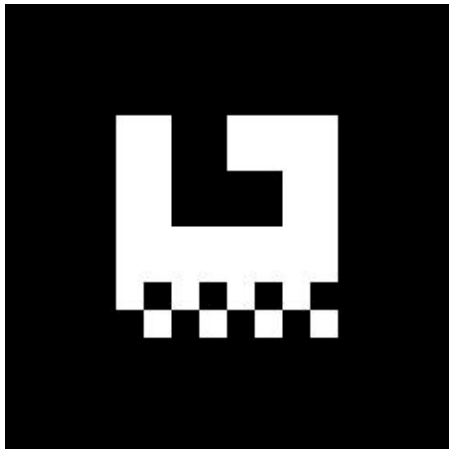
Marker Based Tracking

Optical Tracking: ARToolkit

- Developed in 1999 by Hirokazo Kato, HITLab, University of Washington
- Printable markers
- Camera based (webcam sufficient)
- Flexible marker design
- Simple programming interface
- 6 DOF tracking possible



ARToolKit



ARToolKit marker

ARToolKit Video

Augmented Reality

- Android app:
  - Download “Augmented Reality EdTech Tryit” by CreativiTIC from Google Play Store
    - https://tinyurl.com/y43emzw4
  - App uses Vuforia from PTC for image recognition
- Then point at images on next slide