



CSE 165: 3D User Interaction

Lecture #11:
Early VR Controllers

Announcements

- Friday Feb 22: project 3 due
 - We will bring the competition level on a thumb drive
- Monday Feb 25: midterm discussion
- Thursday Feb 28: midterm exam

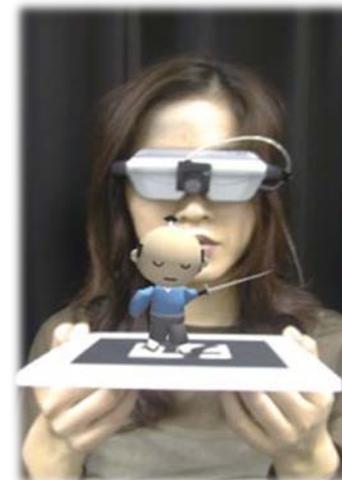
Razer Hydra

- Made by Sixense
- Two tethered controllers
- Electromagnetically tracked
- Two buttons on front
- Thumb stick
- 5 buttons on top
- Symmetric design for left/right hands
- Drivers for Windows, Linux

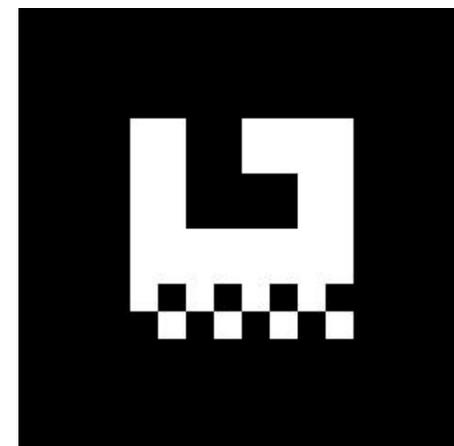


Optical Tracking: ARToolkit

- 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 by Hitlab
 - <https://www.youtube.com/watch?v=ZKwMp5YkaE>



Optical Tracking: HiBall

- HiBall-3100 tracker system, distributed by 3rd Tech
- Developed within wide-area tracking research project at UNC Chapel Hill
- System is composed of:
 - HiBall Optical Sensor
 - Views infrared LEDs in beacon arrays on ceiling with 6 lenses and photodiodes
 - Ceiling beacon arrays
- Tracker update rate: 2,000 Hz
- No metal or sound interference



HiBall beacon array

Ultrasonic Tracking

- Systems measure duration of an ultrasound signal to reach microphones.
- InterSense system uses combination of ultrasound and gyroscope.



Logitech 3D Mouse



InterSense IS-900 tracker



InterSense IS-900 Wand

Hybrid Devices: Haptic Feedback Devices

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



Microsoft force feedback joystick



LEXOS: Frisoli et. al., Italy

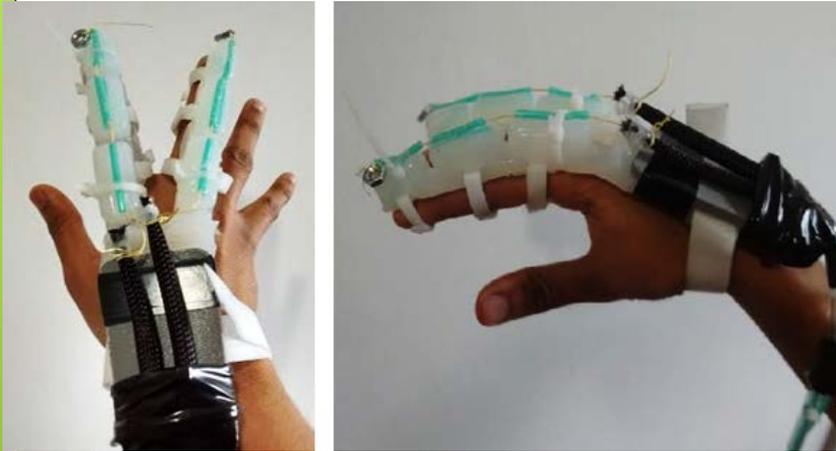


Immersion CyberForce



SensAble PHANTOM

Haptic glove with soft robotics components



Initial glove assembly

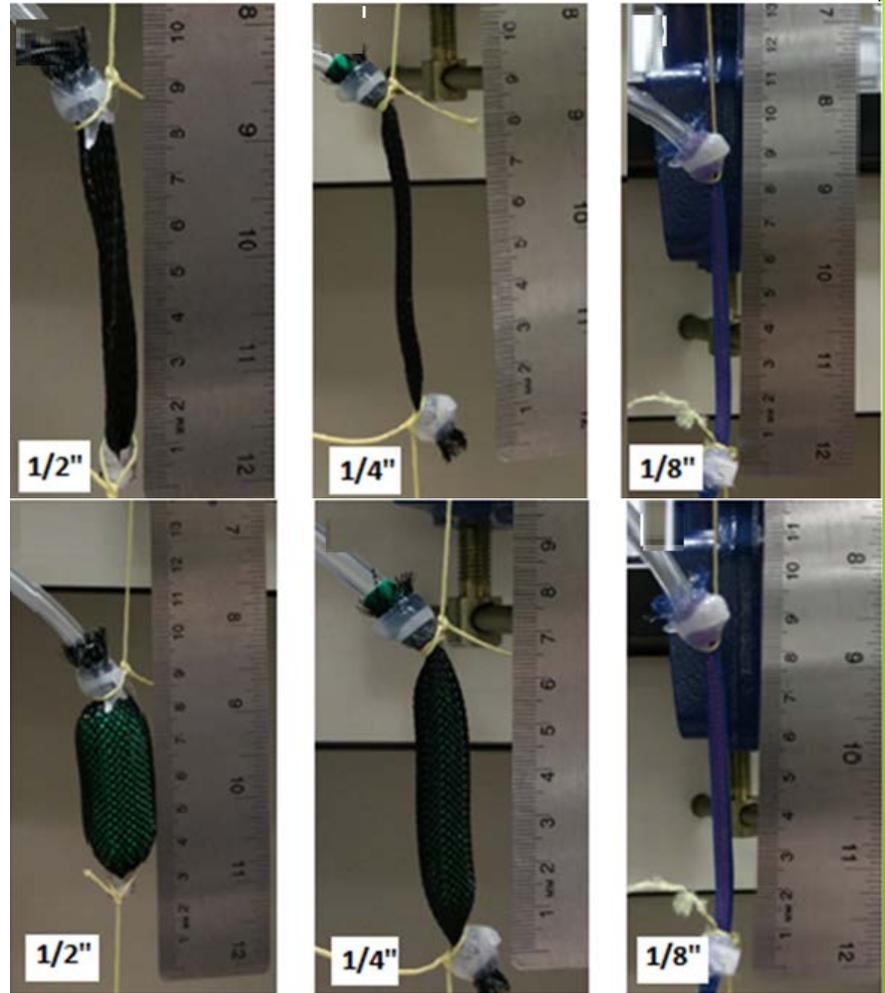
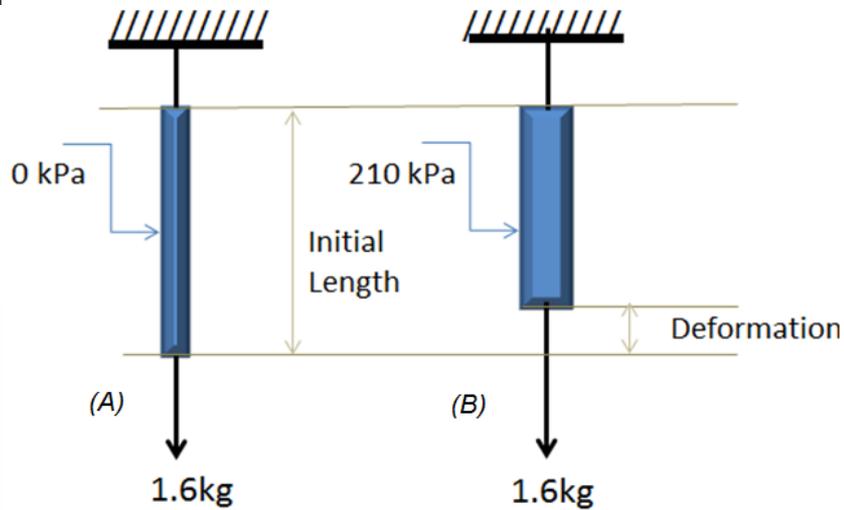
Designed by UCSD Master's student Saurabh Jadhav



Updated glove assembly

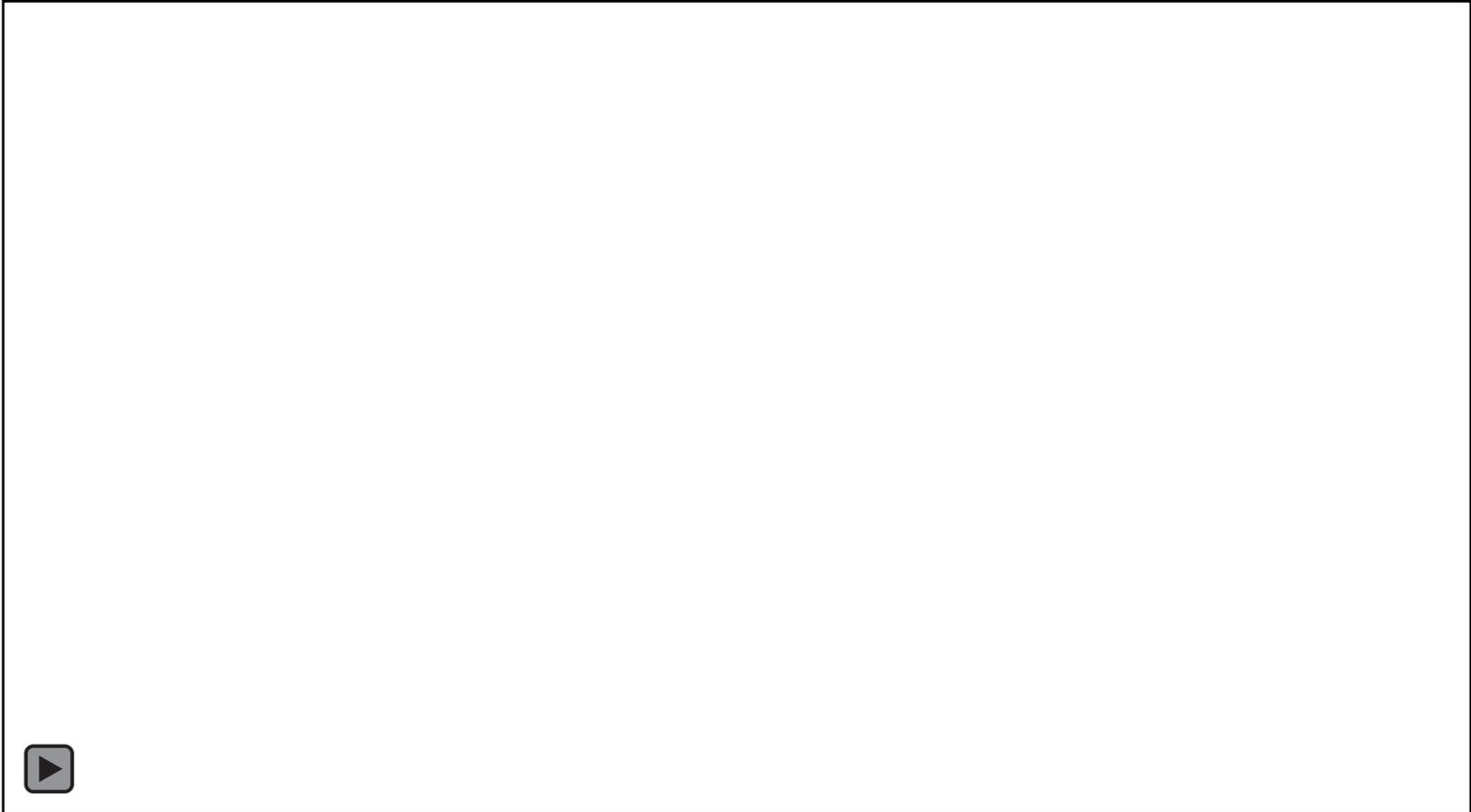
Design of the McKibben muscle

McKibben muscles testing setup:



McKibben muscles in unactuated (top) and actuated (bottom) positions

Use case: playing piano in VR



Pinch Gloves

- Determine if two or more fingertips are touching
- Use conductive cloth to close circuit
- Tethered to controller box
- Designed for pinching and grabbing gestures
- Recognize any gesture of 2 to 10 fingers touching, plus combinations of gestures

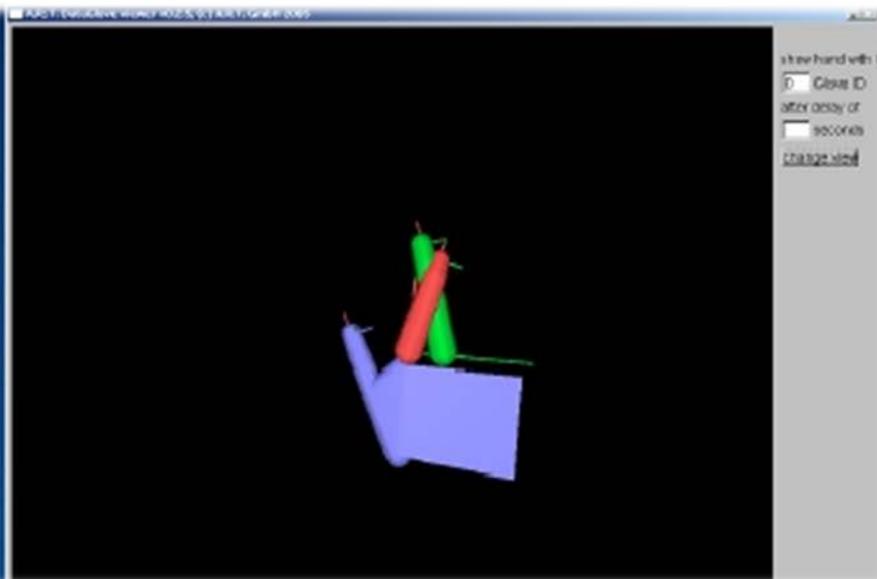


www.fakespacelabs.com



Optical Finger Tracking

- Extension of ART system
- Tracks three fingers and the hand

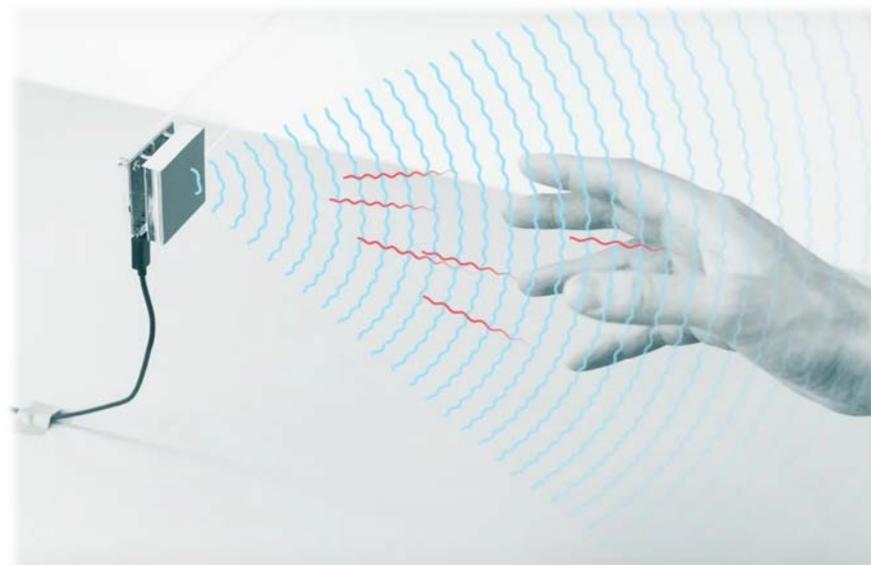


Optical Finger Tracking

- Oblong Industries g-speak
 - Video:
<http://www.youtube.com/watch?v=9OpmxbPzDM0>



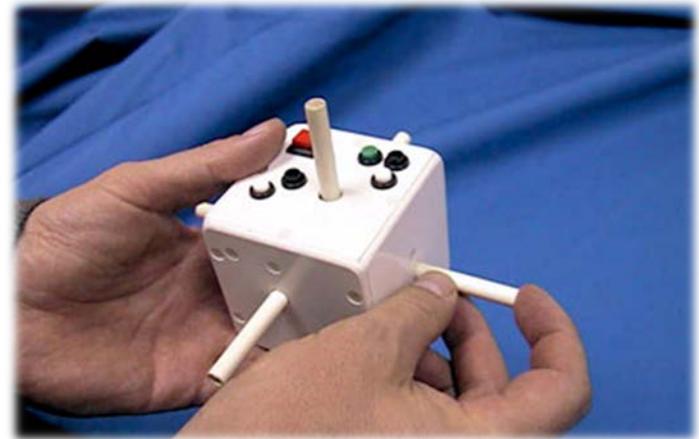
Radar



- Project Soli
 - <https://www.youtube.com/watch?v=0QNiZfSsPc0>
- Soli sensor technology works by emitting electromagnetic waves in a broad beam
- Objects within the beam scatter this energy, reflecting some portion back towards the radar antenna
- Properties of the reflected signal, such as energy, time delay, and frequency shift capture information about the object's characteristics and dynamics, including size, shape, orientation, material, distance, and velocity

Special Purpose Device: Cubic Mouse

- Developed at Fraunhofer Institute by B. Frohlich and J. Plate
- 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



Cubic Mouse Video

- http://www.youtube.com/watch?v=1WuH7ezv_Gs



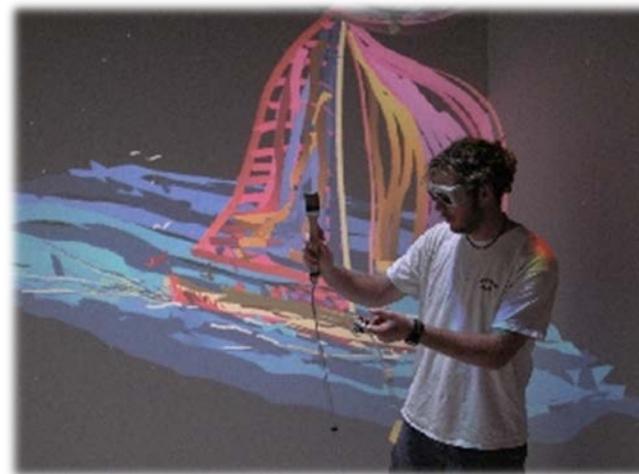
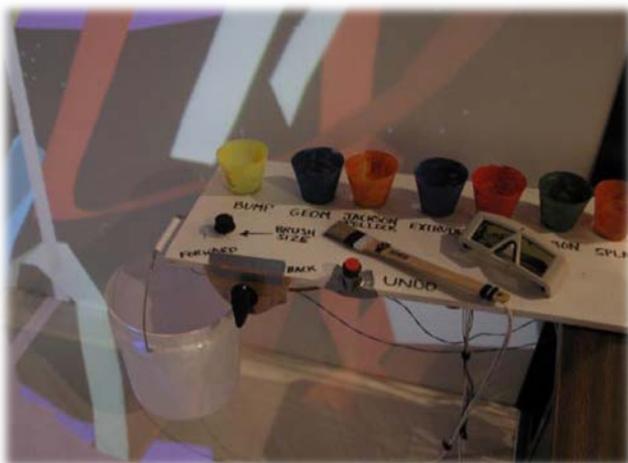
Application-Specific Devices

- Virtual hang-gliding over Rio de Janeiro (L. Soares et al.)
- Virtual canoe, Siggraph 2005
- <https://www.youtube.com/watch?v=8kjZ-nKjfgE>



Cave Painting

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



Cave Painting Video

- <http://www.youtube.com/watch?v=WQv-LnHrmwU>



Augmented Reality

- Android app:
 - Download "[Augmented Reality Try it Free](https://play.google.com/store/apps/details?id=com.creativitic.augmentedreality)" 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

