CSE 165: 3D User Interaction

Lecture #6: Input Devices

Announcements

- Homework project 1 is due tomorrow at 2pm
  - Don’t forget to upload to TritonEd!

New Interaction Techniques

- **Summoning and Superpowers: Designing VR Interactions at a Distance**
  - http://blog.leapmotion.com/summoning-superpowers-designing-vr-interactions-distance/

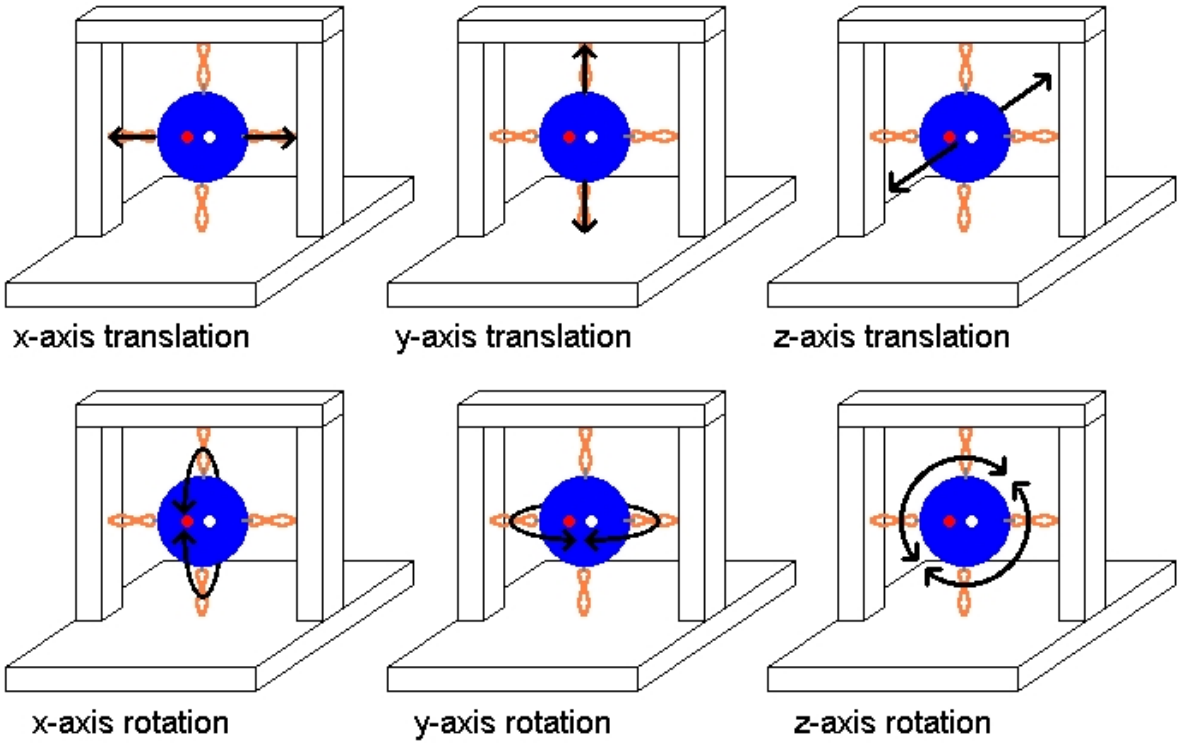
Overview

- Degrees of freedom
- 2-DOF devices
- Relative 6-DOF devices
- Absolute 6-DOF devices
  - mechanical
  - electromagnetic
  - inertial
  - optical
  - ultrasound
  - hybrid
  - special purpose

Degrees of Freedom (DOF)

- DOF: Set of independent displacements that specify completely the displaced or deformed position of a body or system.
- 3 DOF for position:
  - Moving up and down (heaving)
  - Moving left and right (swaying)
  - Moving forward and backward (surging)
- 3 DOF for orientation:
  - Tilting up and down (pitching)
  - Turning left and right (yawing)
  - Tilting side to side (rolling)
  - See also: Euler angles

6 Degrees of Freedom



Keyboard (binary n-DOF) and Mouse (2-DOF)

- Some VR applications are designed for keyboard, mouse or game pads
- Can work well for walk/fly-through applications
- Doesn't work well for 3D selection and manipulation

3 DOF: GPS

- GPS = Global Positioning Satellite system
- GPS receivers determine exactly how long it takes for the signals to travel from each satellite
- Result:
  - Latitude
  - Longitude
  - Altitude

Touch or Pen-based Tablets

- Absolute 2D position
  - 2 DOF
- Microsoft Surface Dial
  - Adds 1 DOF

6-DOF Relative Devices

- Relative position and orientation
- 3dconnexion/Logitech

Spaceball

Space
Navigator

Mechanical 6-DOF Tracking

- Fakespace Boom: doubles as a stereo display
- Geomagic Touch: doubles as a haptic feedback device

Fakespace Boom

Geomagic Touch

Electro-magnetic Tracking

- Fixed transmitter generates low-level magnetic field from 3 orthogonal coils
- Fields generate current in smaller receiver unit(s) worn by user
- 6-DOF tracking achieved by analyzing signal strength in receiving coils
- Advantage: no line of sight restrictions
- Disadvantage: metal in environment can cause interference

Razer Hydra

Sixense STEM