RV - AULA 06 - PSI3502/2018

Input Devices and Tracking

Outline

Talk about properties of input devices in general and designed specifically for VE interaction.

Focus on the problem of motion tracking, discussing the basic principles of motion tracking and property of tracking systems.

Purpose of Input Devices

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The first part of any human computer interaction feedback loop.

Purpose: to convey the user's action to the system where it can be interpreted.

Active and **passive** input.

Input Feedback

Multimodal feedback: **active** and **passive** feedback.

Some devices use only active feedback, i.e. Microsoft Kinect or Leap Motion.

Human Related Issues

Encumbrance: the level of physical discomfort resulting from interaction with an input device (uncomfortable or unnatural positions).

Time to disengage: users need to interact with the system only at certain moments in time. The time to disengage from a computer keyboard is different than a data glove.

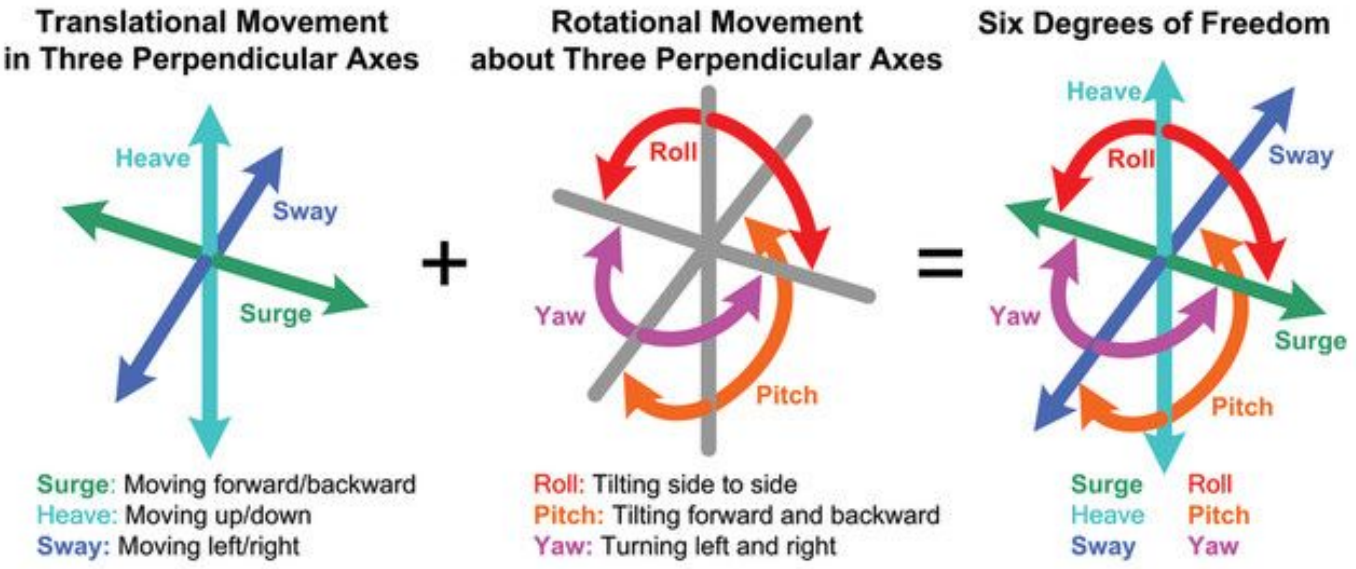
Degrees of Freedom

Number of independent variables that can be controlled directly by the device.

Computer mouse: two degrees of freedom - translation of a pointer in the *X* and *Y* plane.

Single object in 3D space: six degrees of freedom.

Degrees of Freedom



http://www.leadingones.com/assets/img/articles-illu/intro-to-vr/degrees-of-freedom.jpg

Data Gloves

Data Gloves

Sayre Glove, by Electronic Visualization Laboratory at University of Illinois at Chicago in 1977.

https://www.evl.uic.edu/resizedImages/1280x720-sayreglove_sm.png

Data Gloves

Nintendo + Mattel Power Glove.

https://upload.wikimedia.org/wikipedia/commons/thumb/d/d3/NES-Power-Glove.jpg/1200px-NES-Power-Glove.jpg

Data Gloves

Cyber Glove - 1990.

http://www.cyberglovesystems.com/cyberglove-iii/

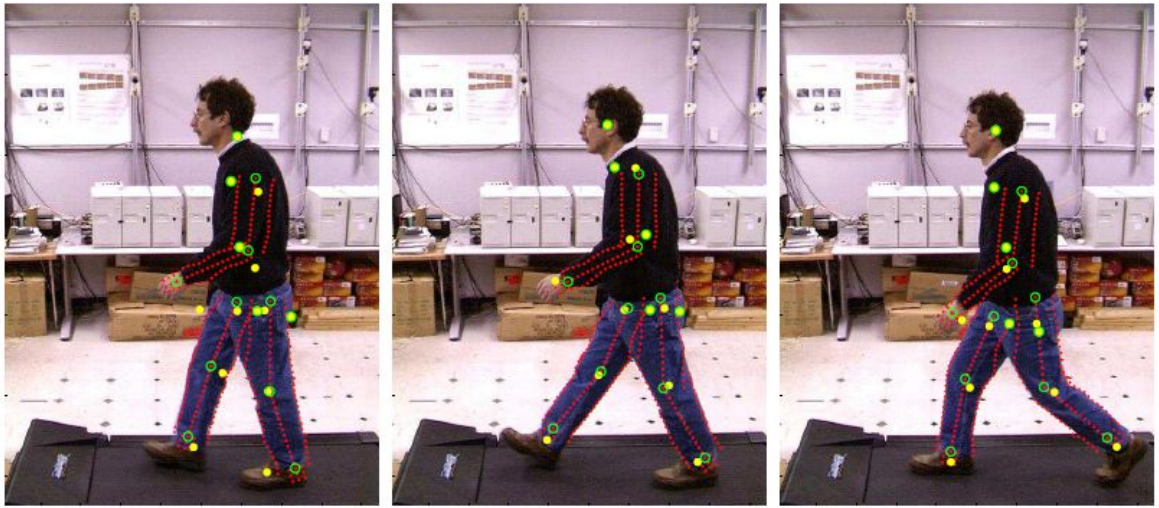
Pinch Glove

Pinch Glove by PINCH System.

https://br.pinterest.com/pin/761038037001828005/

Tracking

Motion tracking: denotes the tracking of a change of the position and orientation of an object in reference to some point in the 3D space.



http://mobilemotiontracking.blogspot.com/2012/10/how-do-i-choose-best-motion-tracking.html

Tracker Properties

Resolution

Accuracy

Jitter

Latency

Drift

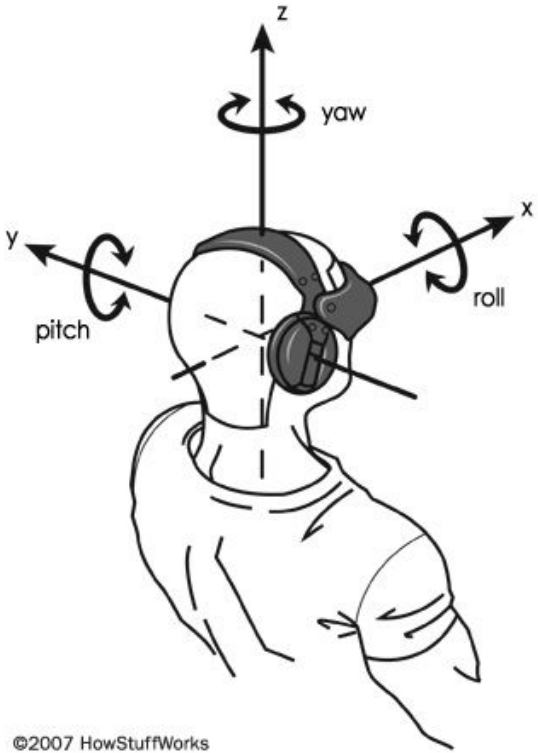
Update Rate

Tracking Technology

Two large classes: contact-based trackers and contactless trackers.

Inertial tracking devices based on microelectro-mechanical sensors (MEMS) have seen a recent surge in applications for motion tracking and similar tasks.

Mechanical Trackers



https://electronics.howstuffworks.com/gadgets/other-gadgets/VR-gear6.htm

Electromagnetic Trackers, AC and DC Electromagnetic Trackers

Two components: transmitter and receiver.

Three orthogonal electromagnetic fields.

AC-based systems use *time multiplexing* and *frequency multiplexing* methods.

DC trackers use static magnetic fields to avoid environmental interference that affects AC-based trackers.

Acoustic Trackers

https://www.roadtovr.com/overview-of-positional-tracking-technologies-virtual-reality/

Optical Trackers

Optical Trackers can have two system configurations:

- **Outside In:** with static sensors and markers placed on the tracked object.
- **Inside Out:** with static markers and sensors placed on the object.

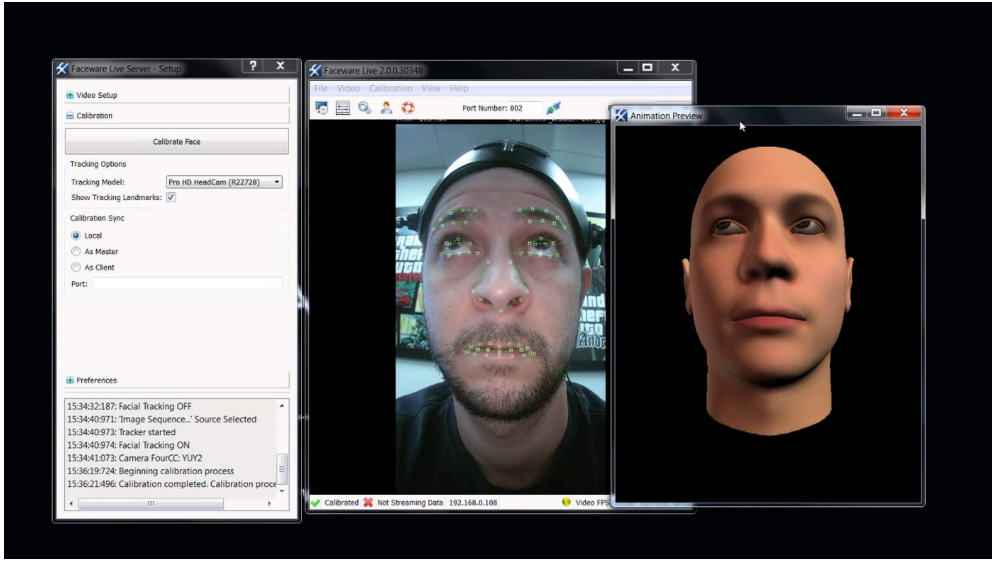
Consumer Products

Motion Capture

Motion Capture implies following the change in the position and orientation of multiples points simultaneously in order to determinate the posture of the whole human body.

Face Tracking

- 2D face tracking
- 3D face tracking
- Facial expression capturing.



https://www.youtube.com/watch?v=Bu9bxx3yyYA

Referências

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D. A. Bowman, C. A. Wingrave, J. M. Campbell, V. Q. Ly, “Using Pinch Gloves for both Natural and Abstract Interaction Techniques in Virtual Environments,” *Proc. HCI International*, 2001.

G. Burdea, P. Coffet, *Virtual Reality Technology*, Second Edition, Wiley-IEEE Press, June, 2003.

E. Foxilin, “Motion tracking requirements and technologies,”, in K. Stanny (ed.), *Handbook on Virtual Environments*, Elrbaum, Mahwah, NJ, pp. 163-210.

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