Ready Player One

Video Games

Head Mounted Displays

CS 415: Game Development

(Virtual Reality Module)

Professor Luciano Soares

ILLINOIS

Head Mounted Displays

- Optics (Displays / Lenses)
- Tracking System
- Processing Unit

Meta Quest Pro

ILLINOIS

Display

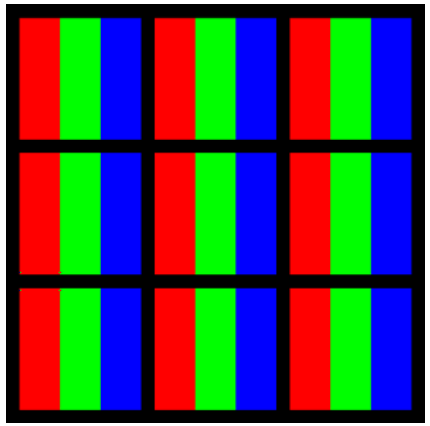
Technologies:
- OLED
- LCD

Resolution:
2000x2000 per eye (typical)

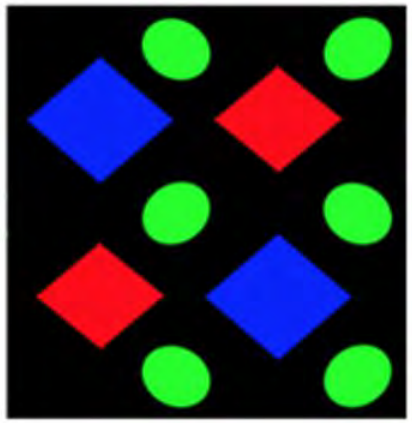
Configuration
- RGB stripe
- Diamond PenTile

Refresh rate:
90 - 120Hz

Meta Quest Pro



RGB stripes

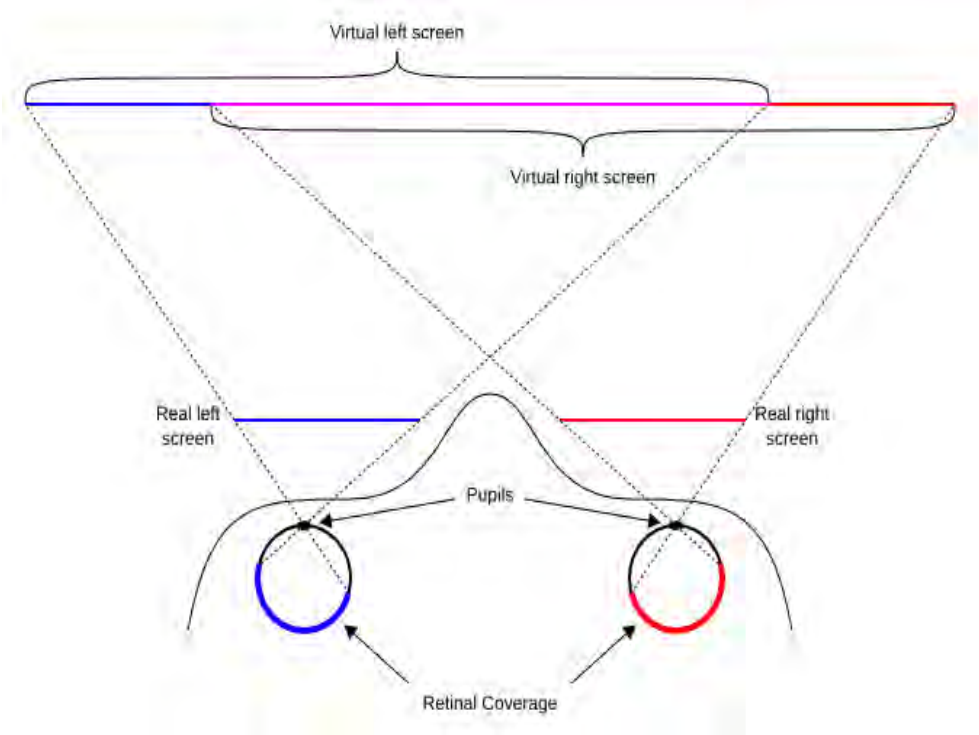


Diamond PenTile

ILLINOIS

Lenses

- Allows perception of distant objects
- Enlarge the image
- Allows eye to focus display image
- Field of view = ~100^{o}

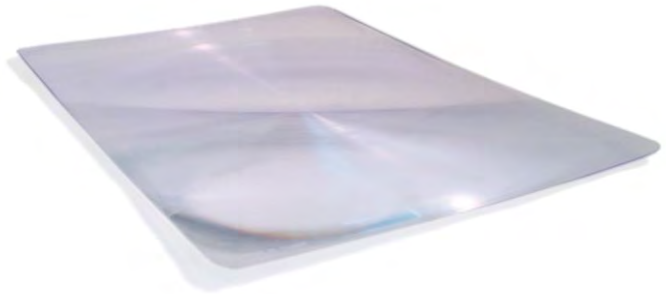


ILLINOIS

Type of Lenses

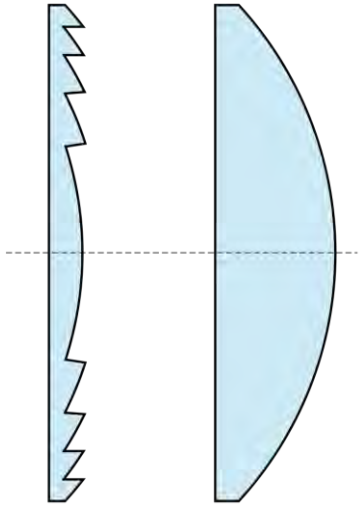
Materials:

- Glass
- Plastic



Fresnel lenses:

- Reduces size (volume)
- Creates artifacts in the image
- Simpler



https://pt.wikipedia.org/wiki/Lente_de_Fresnel

HTC Vive 1

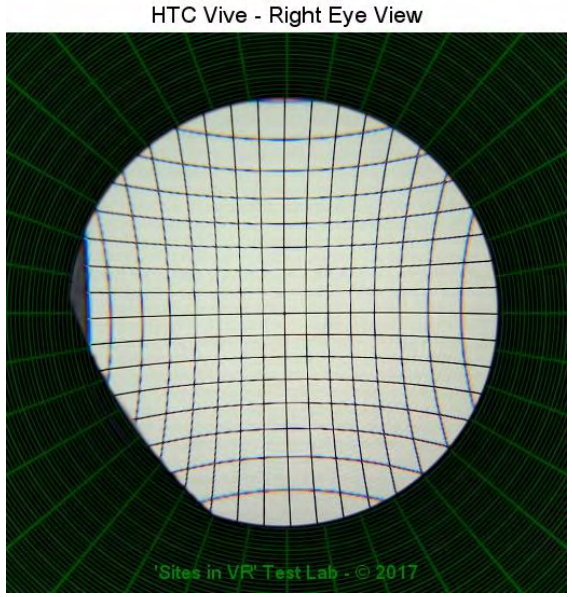
Pancake lenses:

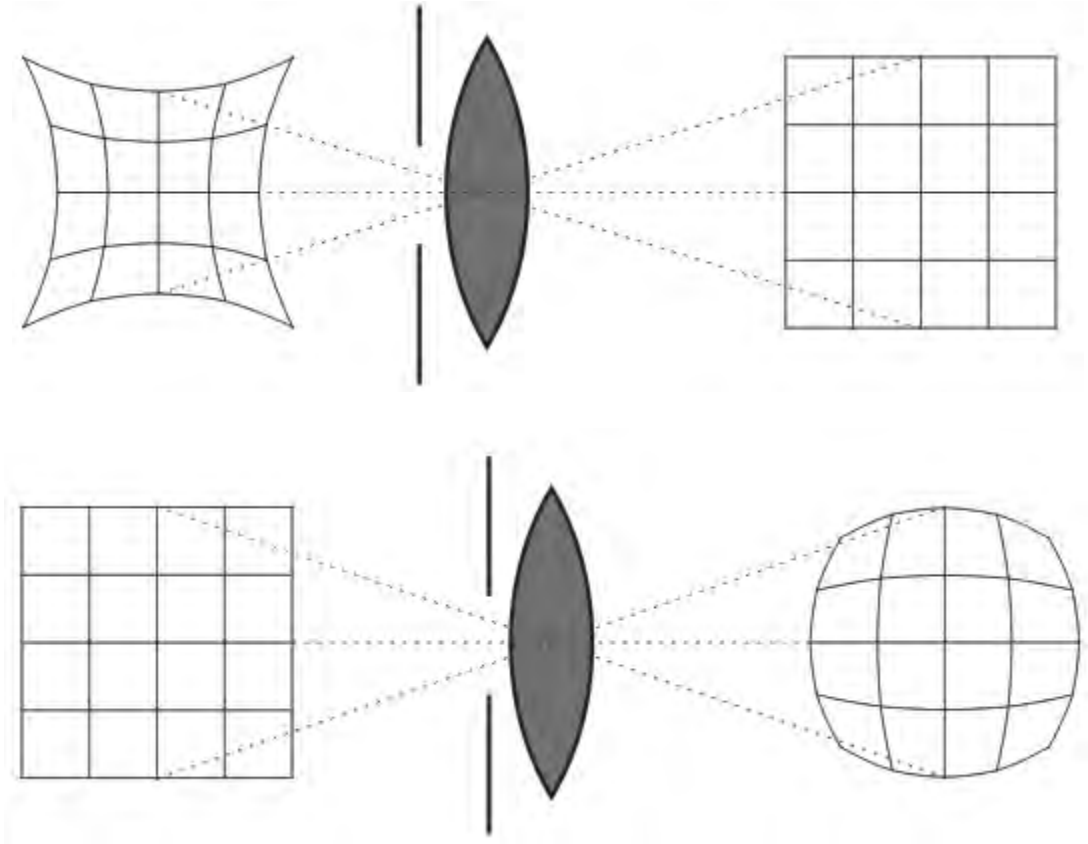
- Bit thicker than fresnel lenses (but positioned close to the display)
- Much less artifacts

ILLINOIS

Spherical Aberrations

One solution is to treat the image before.



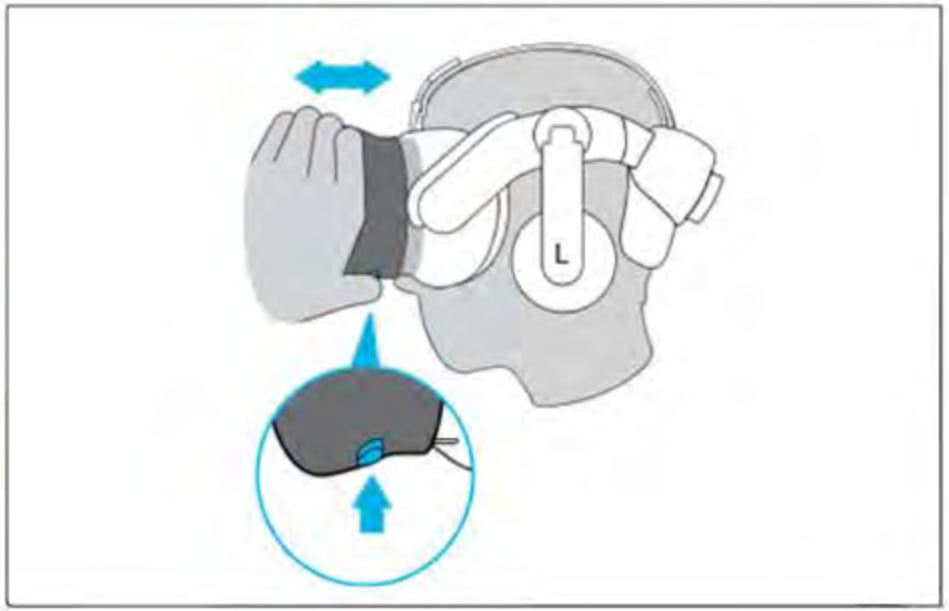


https://smus.com/vr-lens-distortion/

ILLINOIS

Lenses Controls

Inter Pupillary Distance (60 to 70mm)
User's eyes to the lenses

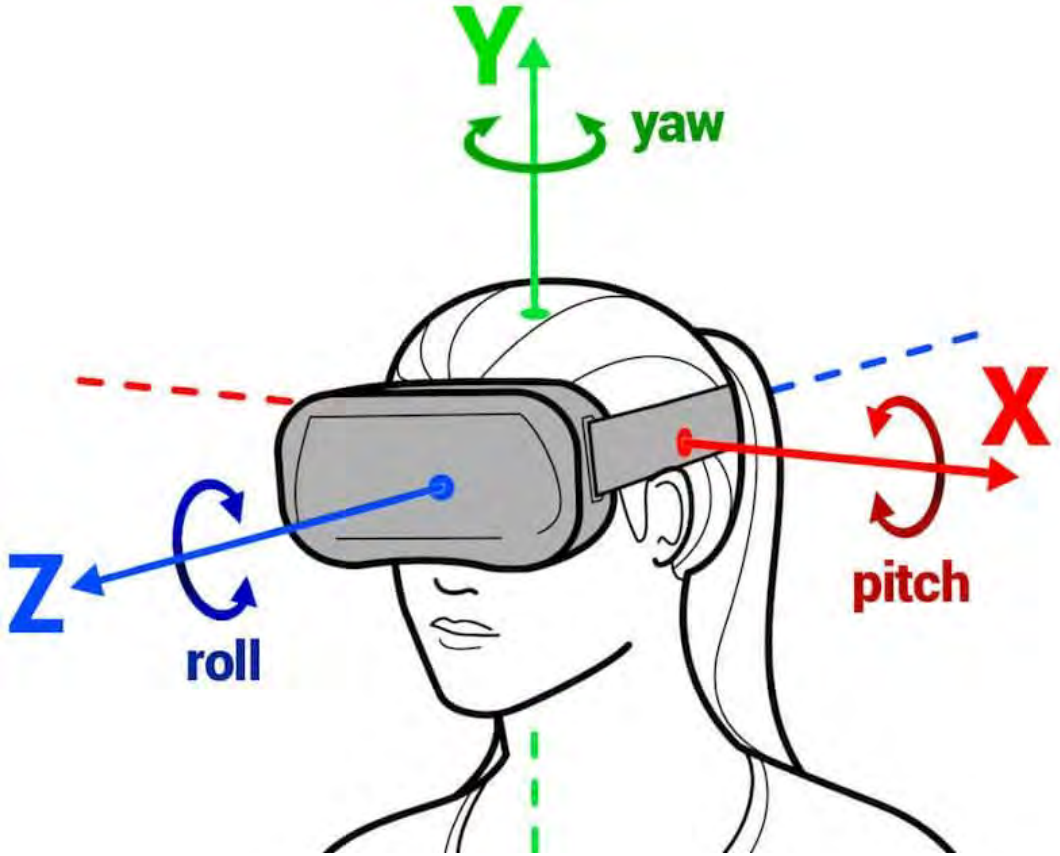


HTC Vive

ILLINOIS

Tracking

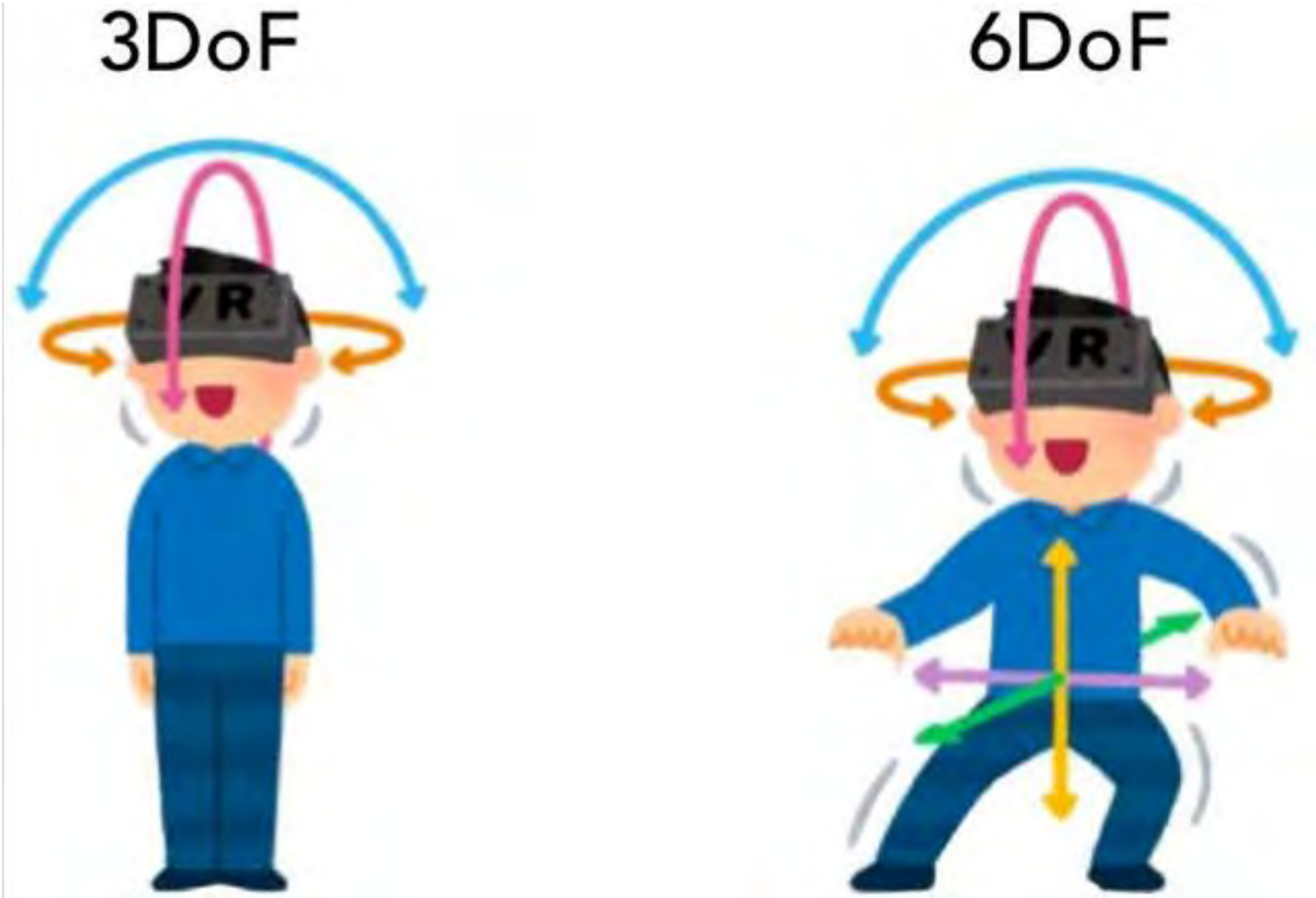
Technique used to identify real-time location and/or orientation of points in space (head position, controls, etc.)



https://medium.com/visionary-hub/a-new-reality-virtual-reality-78608278013b

ILLINOIS

Degrees of Freedom



https://endabates.wordpress.com/2019/05/23/spatial-choral-music-and-360-video/

ILLINOIS

Tracking technologies

Mechanical

Electromagnetic

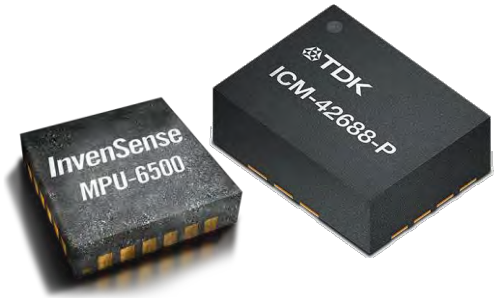
Acoustical

Inertial (accelerometers, gyroscopes)

Optical

Magic Leap 1 6DoF electromagnetic tracking

Fakespace Boom

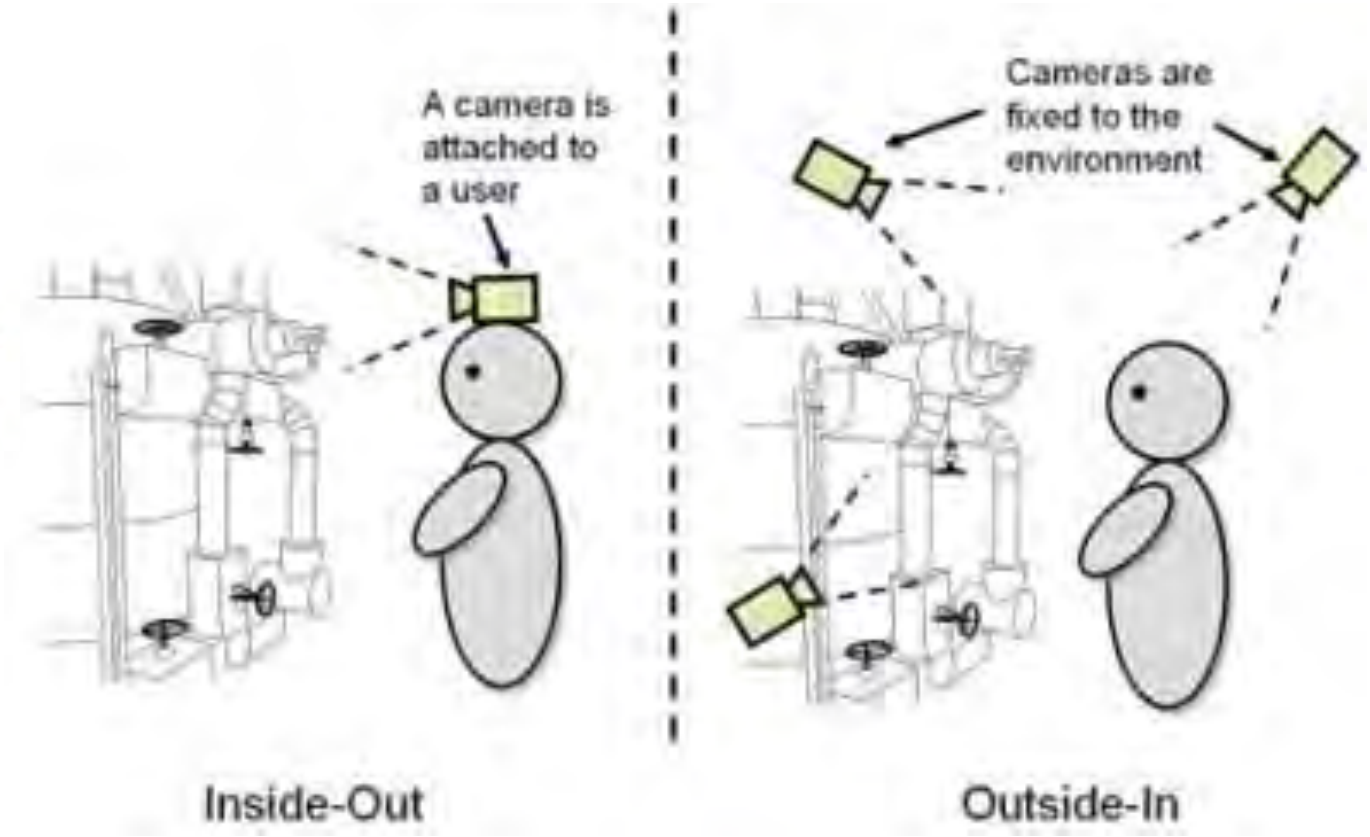


Inertial Measurement Units (IMU)

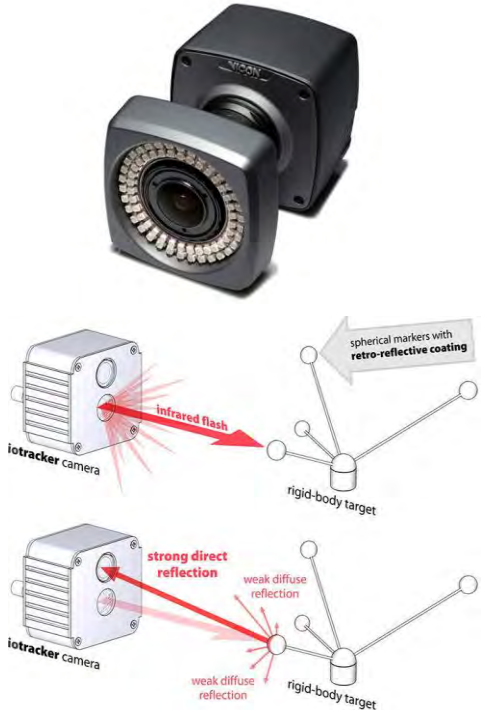
ILLINOIS

Traditional Tracking Methods

Nintendo Wii



https://xinreality.com/wiki/Inside-out_tracking

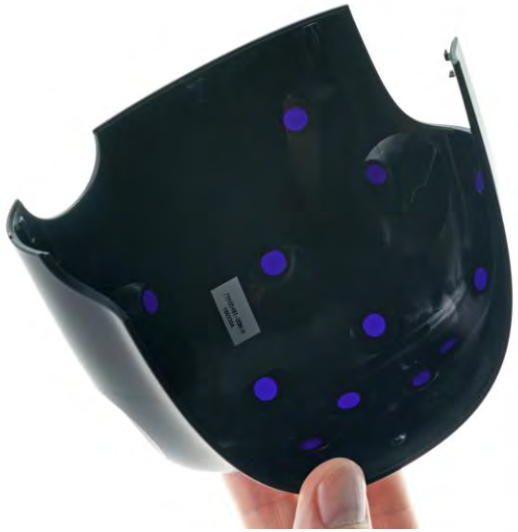


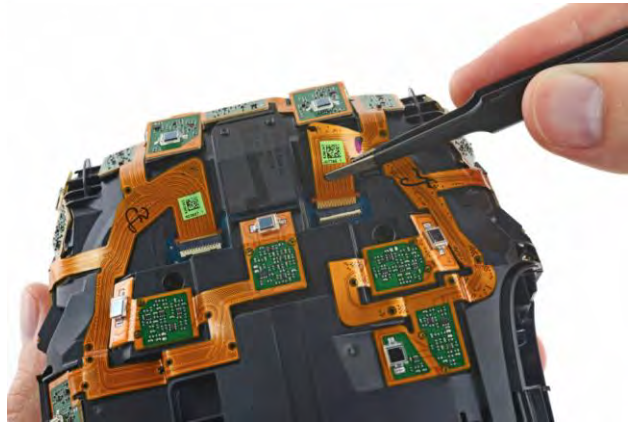
Vicon

ILLINOIS

Vive Tracking Sensors

- Position and Orientation
- Good precision
- Depends on Base Stations



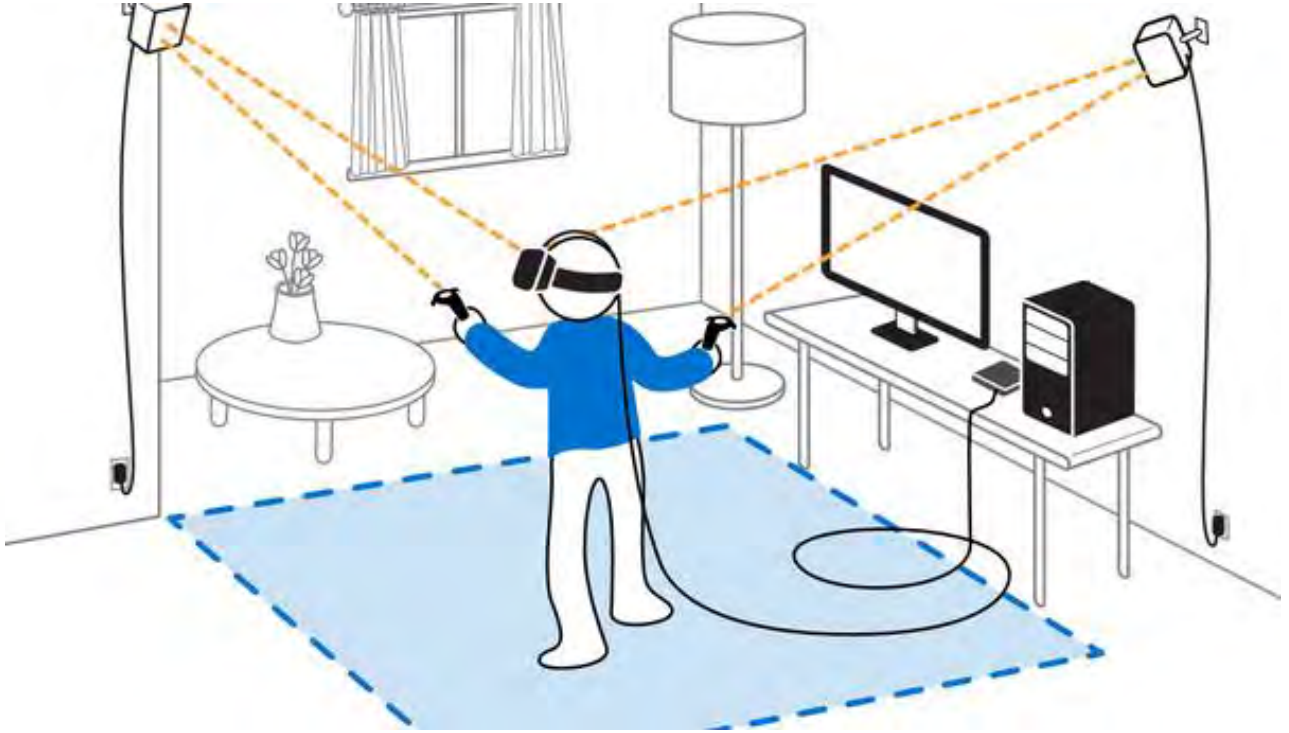


https://www.thevrist.com/steamvr-tracking

ILLINOIS

Base Station

Emits infrared pulses and sweeps



ILLINOIS

SLAM (Simultaneous Localization and Mapping)

ILLINOIS

Processing Unit

- Qualcomm SXR2155P Snapdragon XR2+ Applications Processor
- Micron MT62F1536M64D8CL-026 WT:B 12 GB LPDDR5 SDRAM Memory
- Western Digital SDINFDO4-256G 256 GB NAND Flash Memory (UFS)
- Lattice Semiconductor LIF-MD6000-6 CrossLink FPGA
- Qualcomm PM8150L Power Management

https://www.ifixit.com/Guide/Meta+Quest+Pro+Chip+ID/154876

ILLINOIS