



CSE 165: 3D User Interaction

Lecture #4: HMDs

Announcements

- Homework Assignment #1
 - Due tomorrow at 2:00pm
 - To be presented in CSE lab 220
- Paper presentations
 - Title/date due by **entering into wiki table** on Ted by Sunday, January 17th

Head Mounted Displays

- Have CRT or LCD screens with special optics in front of the eyes
- Display occludes real world
- Provide a stereoscopic view that is updated with the user's head motion



HMDs – Advantages

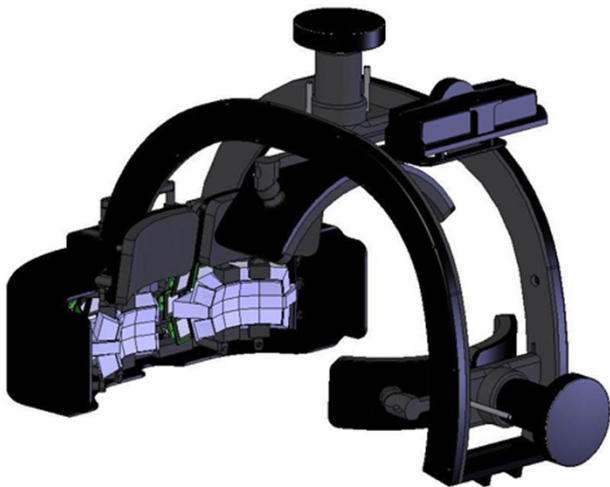
- Provide an immersive experience by blocking out the real world
- Easy to set up
- Do not restrict user from moving around in the real world
- Relatively inexpensive
- Can achieve good stereo quality

HMDs – Disadvantages

- Poor resolution and field of view (FOV)
- Do not take advantage of peripheral vision
- Isolation and risks related to not seeing the real world (e.g., stumbling)
- Can be heavy and uncomfortable, cumbersome to put on

HMDs – Interface Design

- Physical objects require a graphical representation
- Limits the types of input devices that can be used



HMDs in the Early 90s

- Heavy
- Low resolution
- Small field of view
- Simple graphics
- Large computers
- Finicky gloves for user interaction



Facebook Buys Oculus Rift For \$2 Billion

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Luke Plunkett

Filed to: OCULUS RIFT 3/25/14 5:35pm

342,727 🔥 28 ★ ▼



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Facebook has just announced that it's buying Oculus Rift for \$2 billion. Seriously.



"Mobile is the platform of today, and now we're also getting ready for the platforms of tomorrow," Facebook founder and CEO Mark Zuckerberg says. "Oculus has the chance to create the most social platform ever, and change the way we work, play and communicate."

March 25, 2014

Why Now?

- Cell phone tech has matured
 - High resolution screens (~3k in Galaxy Note 4)
 - Fast gyroscopes
 - Accelerometers
- Games use real 3D coordinate spaces
- Graphics cards support 3D for 3DTVs
- Real-time rendering quality close to photo-realistic

Oculus Rift DK1

- 1280x800 pixels
- Fast gyroscope
- Released March 2013
- Orientation tracking only
- Connects to PC via HDMI



Oculus Rift DK2

- HD screen: 1920x1080
- 75 Hz
- Fast gyroscope
- Camera for location tracking
- Field of view: 95 x 105 degrees



Oculus Rift 2016 and HTC Vive

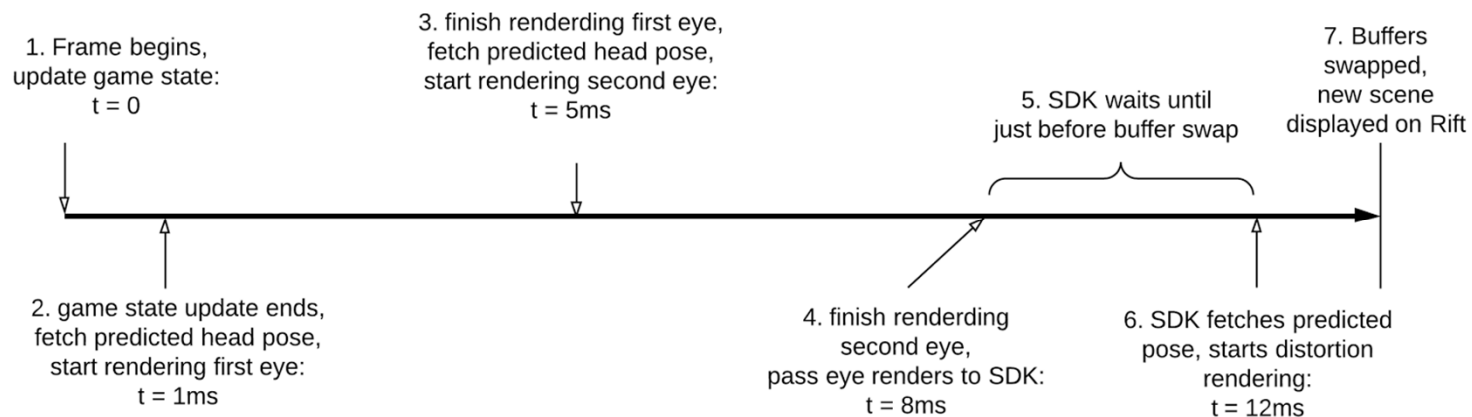


- 2160x1200 pixels
- 90 Hz refresh rate
- ~110x100 degrees FOV



Oculus Rift Inventions

- Integrated positional tracking
- >60Hz refresh rate
- Time Warp:



<http://rifty-business.blogspot.com/2014/08/using-timewarp-on-oculus-rift.html>

Sony Project Morpheus

- Will be sold as part of Play Station
- Sony recently announced that priority is Play Station
- 1920x1080 pixels
- OLED
- Field of view: 100 degrees



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This is a prototype. Design and specifications are subject to change without notice.

Cell Phone VR

Google Cardboard

- Uses existing Android phone
- Free Android app from Google with demos



Gear VR

- Requires Galaxy Note 4/S5/S6
- Field of view: 96 degrees
- Accelerometer, Gyroscope, Compass
- Low photon latency <20ms
- 60 Hz
- AMOLED display
- Resolution: 2560x1440



Carl Zeiss VR One

- For Galaxy S5 or Iphone 6



Issues Today

- HMDs are closed, no see through
- AR coming but not as mature as VR HMDs
- Need to become wireless/more powerful graphics
- Input device dilemma: best if integrated into HMD
- Drivers: most Windows only, few Mac OS, no Linux

Trends

- Better Unity support
- Active developer community
- Unreal engine supports VR
- Gaming is the main driver
- 3D cameras on the horizon for content creation (Samsung Project Beyond, Google Jump, Jaunt One, etc.)

Related Technologies

Google Glass

- Small display in front of one eye
- Not designed for VR
- Project ends in Jan 2015
- Explorer Edition available for selected users (\$1,500)
- Built-in Android 4
- 640x360 pixels
- Built-in 5 MP camera
- Wi-Fi, Bluetooth
- 16GB RAM
- Gyroscope, accelerometer, compass, light sensor



Augmented Reality

- One of the best:
 - Osterhout Design Group R-7
- Qualcomm Snapdragon 805, 2.7 GHz
- Two 720p LCoS displays, 100 Hz
- See-through display
- 5MP camera on the front
- 1400 mAh battery



Auto-Stereoscopic Displays

- Lenticular
- Volumetric
- Holographic

