

CSE 190: Virtual Reality Technologies

LECTURE #10: HIGH-END HEAD-MOUNTED DISPLAYS

Announcements

Homework project 3

- Due Friday, May 17th at 2pm
 - To be demonstrated in VR lab B210
 - Upload code to TritonEd by 2pm

Midterm exam on May 23rd

Late grading for project 2 this Friday at 2pm

Instructor's office hour

- This week: Tuesday and Thursday 3:30-4pm (room 2125)

Oculus Rift DK1

Funded through Kickstarter web site

Released March 2013

Single LCD display

1280 x 800 pixels

110 degrees field of view

60 Hz field of view

Fast, custom IMU

Head orientation tracking only (3 DOF)

No controllers



Oculus DK1 Kickstarter Page

[←](#) [→](#) [↺](#) [🏠](#)


https://www.kickstarter.com/projects/1523379957/oculus-rift-step-into-the-game

... [🛡️](#) [★](#)

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KICKSTARTER 10

Oculus Rift: Step Into the Game

A black Oculus Rift DK1 Developer Kit is shown from a side profile. It features a large, curved front panel with the Oculus logo in blue. A red ribbon badge in the top left corner of the image reads "ES NOMINEE".

Developer kit for the Oculus Rift - the first truly immersive virtual reality headset for video games.

Pre-order Rift!

Created by
Oculus

9,522 backers pledged \$2,437,429 to help bring this project to life.

[Campaign](#) [FAQ 24](#) [Updates 83](#) [Comments 2,482](#) [Community](#)



Inertial Measurement Unit (IMU)

Measures

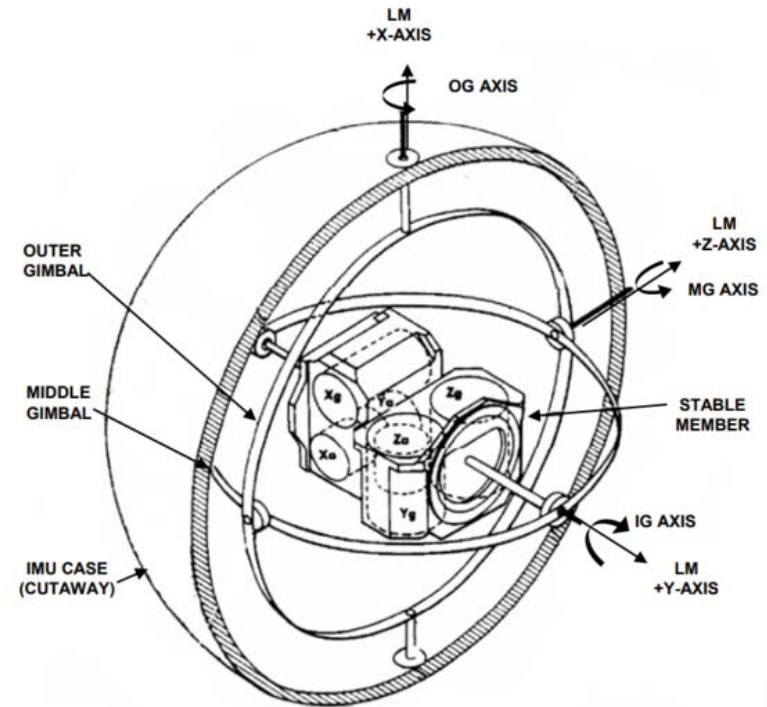
- gravitational force
- angular rate
- magnetic field (optional)

Consists of

- 3 accelerometers
- 3 gyroscopes
- magnetometer

Used in

- aircraft, spacecraft, satellites
- smart phones
- fitness trackers
- remote controls
- game controllers



Oculus Rift DK2

Released July 2014

Single OLED display (same as Samsung Galaxy Note 3)

1920 x 1080 pixels

Field of view: 95 x 105 degrees

75 Hz refresh rate

Same IMU as DK1

6 DOF tracking with IMU and camera for head location tracking

No controllers



Sony Playstation VR

Released October 13, 2016

Sold for Play Station 4

Single OLED display

960 x 1080 pixels per eye

100 degrees field of view

90 or 120 Hz refresh rate

Fixed IPD

Headphone jack

Innovative head strap

External camera for tracking

6 DOF tracking with visible light in different colors

Uses Sony Move controllers



HTC Vive

Released April 5, 2016

2 OLED displays

1200 x 1080 pixels per eye

110 x 113 degrees field of view

90 Hz refresh rate

Adjustable eye distance (IPD)

Integrated camera

Headphone jack

Includes two controllers

6 DOF tracking with 2 Lighthouses



Oculus Rift CV1

Released March 28, 2016

2 OLED displays

1200 x 1080 pixels per eye

94 x 93 degrees field of view

90 Hz refresh rate

Adjustable eye distance (IPD)

Integrated headphones

Infrared LEDs on HMD and controllers

6 DOF tracking with infrared cameras (“sensors”)



Initial Oculus Rift kit



Oculus Touch Controllers

Oculus Rift CV1 Teardown



Oculus Rift: Ear Phones



Face Foam



Infrared LEDs



Separate lens/display assemblies



CV1 Lens

Asymmetric

Hybrid Fresnel lens

Focus varies along vertical axis of lens

→ Push lens higher or lower to focus



Lenses: DK2 vs. CV1

Circular vs. Asymmetric



Microsoft Mixed Reality

First devices released October 17, 2017

Virtual Reality HMDs

- No augmented reality, despite the name

Specifications by Microsoft

Dual 6 DOF controllers with infrared LEDs

Inside-out 6 DOF HMD tracking with two cameras

HMDs built by:

- Samsung, Dell, HP, Lenovo, Acer, Asus



HP Reverb

Released May 6, 2019

Windows Mixed Reality headset

2160 x 2160 pixels per eye

114 degrees field of view

90 Hz refresh rate

6 DOF inside out tracking

Same controllers as other Mixed Reality systems



HTC Vive Pro

Released April 5, 2018

Built-in stereo cameras for AR

1440 x 1600 pixels per eye

90Hz refresh rate

110 degrees FOV

Integrated headphones

New design with sizing dial

2 cameras

Tracking space up to 10 x 10 meters with new Lighthouses 2.0 (released April 23, 2018)



HTC Vive Focus Plus

Released April 15, 2019

Standalone VR HMD

OLED display

1440 x 1600 pixels per eye

75 Hz refresh rate

110 degrees FOV

IPD adjustment

Qualcomm Snapdragon 835

Built-in headphones

Inside-out 6 DOF tracking

Includes 2 controllers



Oculus Quest

Release date: May 21, 2019

Standalone VR HMD

OLED display

1440 x 1600 pixels per eye

72 Hz refresh rate

100 degrees FOV

IPD adjustment

Qualcomm Snapdragon 835

Built-in headphones

Inside-out 6 DOF tracking

Includes 2 controllers



Oculus Rift S

Release date: May 21, 2019

LCD display

1280 x 1440 pixels per eye

80 Hz refresh rate

Internal speakers + headphone jack



Valve Index

Release date: July 1, 2019

1440 x 1600 pixels per eye

LCD display

120 Hz refresh rate (144 Hz experimental mode)

Integrated speakers

Lighthouse base stations 2.0

New Index (“Knuckle”) controllers: sense finger positions, allow open hands

