

# CSE 190: Virtual Reality Technologies

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LECTURE #10: LOW-END HMDS



# Announcements

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## Homework project 3

- Due Friday, May 18<sup>th</sup> at 2pm
  - To be demonstrated in VR lab B210 in **two groups** like for project 2
  - Upload code to TritonEd by 2pm

## Midterm exam

- Thursday, May 24<sup>th</sup> during lecture 2-3:20pm
- Written exam
- Closed book

# Low-End HMDs

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# Google Cardboard

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Requires smart phone

Compatible with Android and iOS

Built-in magnet serves as button

Inexpensive: <\$10



# Merge VR

\$30 at Walmart or Amazon

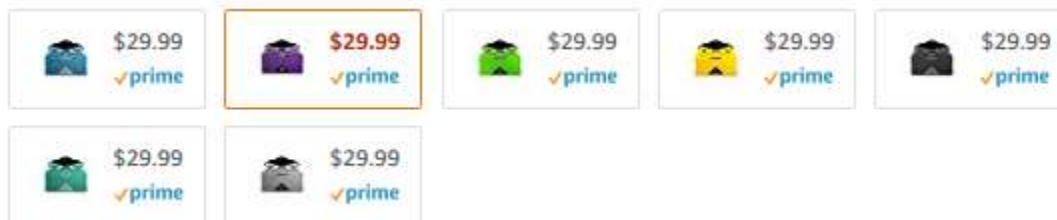
Indestructible

7 color options

Cutout for camera

Bracket for controller

Not big enough for Iphone 6+



# Carl Zeiss VR One

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Compatible with iPhone 6, Samsung Galaxy S4, S5, S6, Nexus 5, and LG-G3

High quality lenses

See-through front cover for AR applications



# Gear VR

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Requires Galaxy Note 5/8 or S6-9

- Different versions of HMD available

100 degrees field of view

Built-in low latency IMU (Internal Measurement Unit) with accelerometer and gyroscope

Head proximity sensor

Touch pad on right side

Phone related:

- 60 Hz screen update rate
- Resolution: 2560x1440
- Low photon latency <20ms
  - Oculus worked with Samsung to optimize graphics driver

3 DOF controller



# Google Daydream

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Requires Daydream-ready phone  
(eg, Pixel 1+2, Samsung S8/Note8)

90 degrees field of view

Built-in IMU

Proximity sensor

Lightweight fabric material (261g)

Includes 3DOF controller

Dedicated space for controller in  
front cover





	Google Daydream	Samsung Gear VR
<b>Optical Lens</b>	90-degree field of view	101-degree field of view
<b>Display</b>	Depends on device	2560 x 1440 pixel Super AMOLED
<b>Refresh Rate</b>	Depends on device	60 Hz
<b>Required Hardware</b>	Google Pixel, Pixel XL, Huawei Mate 9 Pro, ZTE Axon 7, Motorola Moto Z, Asus Zenfone 3 Deluxe	Galaxy Note 5, Note 7, Galaxy S6, S6 Edge, S6 Edge+, S7, S7 Edge, S8, S8+
<b>Sensor</b>	Accelerator, gyrometer, proximity	Accelerator, gyrometer, proximity
<b>Focal Adjustment</b>	N/A	Focus adjustment wheel
<b>Interpupillary Distance Coverage</b>	~64 mm	54~70 mm
<b>Physical UI</b>	Motion controller (included)	Touchpad, Back button, volume key, and Gear VR controller (included)
<b>Connection</b>	Wireless connection	USB Type-C and MicroUSB
<b>Dimensions</b>	166.8 x 4.18 x 3.88 mm	201.9 x 116.4 x 92.6 mm
<b>Weight</b>	220 grams	310 grams
<b>Color variants</b>	Slate, snow, and crimson	Blue black, orchard gray
<b>Price</b>	\$60 (incl. controller)	\$90 (incl. controller)

# Oculus Go

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Qualcomm Snapdragon 821

2,560 × 1,440 pixel LCD display

Binary compatible with Gear VR

Fresnel lenses

Built-in speakers

3.5mm Headphone jack

3 DOF controller

32GB (\$200) or 64GB (\$250)

Released May 1<sup>st</sup>, 2018



# Issues Today

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## High-End (PC-Based) VR:

- Too many cables: HMDs need to become wireless
- Drivers: most Windows only, few Mac OS, no Linux
- Camera calibration cumbersome

## Low-End (Smart Phone) VR:

- Most apps only have orientation tracking
  - Position tracking possible with Apple's ARKit and Google's ARCore, but not yet widely used
- Hand-held controllers not standardized and not supported by many apps

## Both:

- More powerful GPUs needed for more realism
  - HMDs don't allow view of environment and look weird: socially awkward
  - AR coming, but not ready for widespread use
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