CSE 190: Virtual Reality Technologies

LECTURE #9: LOW-END HMDS

Announcements

Next Monday: Discussion homework project 2

Project 2 due Sunday May 10th at 11:59pm

Today's VR app presentations:

- Dominic Simone: Expeditions
- Justin Park: Pistol Whip

Part time internship at Sensable Media

We're now looking for new, talented interns with Unreal programming experience. This will be a paid opportunity as well, and of course, it's part time. In addition there is another internship opening for a graduate student with a background in AI (DNNs).

Contact Stewart Matthew: s.matthew@sensabletec.com

Project 3 Smartphone Compatibility

ARCore:

- https://developers.google.com/ar/discover/supported-devices

ARKit:

- https://developer.apple.com/library/archive/documentation/DeviceInformation/Reference/iOSDeviceCompatibility/DeviceCompatibilityMatrix/DeviceCompatibilityMatrix.html

Let us know if your phone is not supported by either ARCore or ARKit

Low-End HMDs

The new wave of HMDs

Cell phone technology has matured

- High resolution screens (~3k since Galaxy S6)
- Integrated fast gyroscopes, accelerometers, magnetometers

Games use real 3D coordinate spaces

Graphics cards support 3D because of 3D monitors

Real-time rendering quality close to photo-realistic

Google Cardboard

Requires smart phone

Compatible with Android and iOS

Built-in magnet serves as button

Inexpensive: <$10

Standardized QR code system to customize rendering

Cardboard and plastic versions available

Sometimes used for promotions

Merge VR

Price point: ~$30

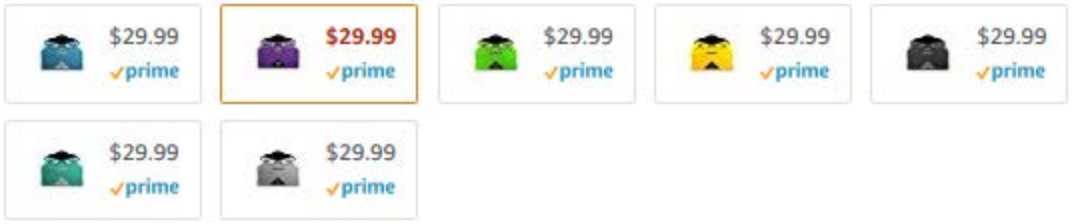
Almost indestructible

Cutout for camera

Bracket for controller

Not big enough for plus sized phones

Many color options



Gear VR

First version released 2015

Requires Galaxy Note 5/8 or Galaxy S 6-9
- 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:
- 60 Hz screen update rate
- Resolution: 2560x1440
- Low motion-to-photon latency: <20ms
  - Oculus (John Carmack) worked with Samsung to optimize graphics driver

Optional 3 DOF controller available

Google Daydream

Released November 2016

Requires Daydream-ready phone (e.g., Pixel 1-3, Samsung Galaxy S8, S9)

90 degrees field of view

Built-in IMU

Proximity sensor

Lightweight fabric material (261g)

Phone specs determine VR display
- Some have up to 2,560 x 1,440 pixels at 60Hz

Includes 3DOF controller
- Dedicated storage space in front cover

	Google Daydream	Samsung Gear VR
Optical Lens	90-degree field of view	101-degree field of view
Display	Depends on device	2560 x 1440 pixel Super AMOLED
Refresh Rate	Depends on device	60 Hz
Required Hardware	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+
Sensor	Accelerator, gyrometer, proximity	Accelerator, gyrometer, proximity
Focal Adjustment	N/A	Focus adjustment wheel
Interpupillary Distance Coverage	~64 mm	54~70 mm
Physical UI	Motion controller (included)	Touchpad, Back button, volume key, and Gear VR controller (included)
Connection	Wireless connection	USB Type-C and MicroUSB
Dimensions	166.8 x 4.18 x 3.88 mm	201.9 x 116.4 x 92.6 mm
Weight	220 grams	310 grams
Color variants	Slate, snow, and crimson	Blue black, orchard gray
Price	$60 (incl. controller)	$90 (incl. controller)

Oculus Go

Released May, 2018

Qualcomm Snapdragon 821

2,560 × 1,440 pixel LCD display at 60 or 72Hz

Apps compatible with Gear VR

Fresnel lenses

Built-in stereo speakers for spatial audio

Headphone jack

3 DOF controller included

Flash memory: 32GB ($200) or 64GB ($250)

Nintendo Labo VR Kit

Cardboard attachments for Nintendo Switch

Includes VR viewer for Switch console

- Resolution: 1280 x 720 pixels (640 x 720 for each eye) at 60fps

Also includes games for the attachments

Commonalities of LE HMDs

Controller
- Either not available (controlled by button(s) on headset)
- Or single controller with 3 DOF

Varying display resolution, can be higher than some high-end HMDs

Lower refresh rate (often 60Hz)

Rendering quality depends on smartphone's GPU

Cumbersome to use when smartphone based

Battery-driven, phones discharge quickly when rendering VR

Smartphone overheat easily → limits session duration

Difficult to write software for systems with wide variety of supported phones:
- differences in smartphone performance
- differences in display resolution, latency, brightness
- differences in operating systems (Android, iOS)