Name: Jonathan Sappington
Instructor: Tim Price
Class: CSCI_220_01
Date: 11/23/2022

Uses for AR

Visual item measurements before purchase, displaying 3D objects on surfaces like couches, appliances, shelves, and other objects to see how much space the item will take up.

Hands-free communication; being able to communicate with co-workers, clients, friends, and family while keeping both hands free to do other tasks.

Session recording, using the headset to record audio notes and use them for further reference.

AR Applications

Notes - The AR headsets below each seem to have a note-taking application that reads the user's voice and writes what they're saying.

Video calls - A common marketing point for AR headsets is the ability to chat with anyone while keeping your hands free from other tasks.

Camera - Most AR headsets have multiple cameras, allowing for environment tracking and placing objects into the environment.

Microsoft HoloLens 2

Rank: #1: Out of the four headsets I've researched, the Hololens 2 seems to be the most in-depth AR headset featuring 2k displays, several applications for business-oriented tasks, infrared cameras, and the ability to process and anchor high-quality 3D objects to the environment. Though the quality is very impressive, there are a few drawbacks, namely the short battery life ranging from 2-3 hours and the very high price mark for this item, which might deter some people from purchasing the device.

Price: $3,500 - $5,000

Positives:
2k displays
3D environment-based tracking
Able to render high-quality 3D meshes
High-quality interface

Negatives:
Low battery life of around 2-3 hours
Expensive

Usability, Reliability, and Performance: Since we've yet to try the Hololens 2, there isn't much I can add from personal experience. What I can do is present what others have said about this

device. From what I've read about the Hololens 2, people find it a very comfortable and balanced fit; the spatial presence of the headset is said to be excellent, allowing for objects to stick within the area they were placed; one critique some people have is the interaction method, being that they prefer actual controllers to hand detection and that the hand tracking isn't quite up to par.

Specs:

- **SoC:** Qualcomm Snapdragon 850 Compute Platform
- **Specs: Display:** 2K 3:2 light engines
- **Head tracking:** 4 visible light cameras
- **Eye tracking:** 2 IR cameras
- **Front camera:** 8MP, 1080p30 video
- **Microphone array:** 5 channel
- **Battery life:** 2–3 hours of active use
- **Bluetooth:** Bluetooth 5.0
- **Storage:** 64-GB UFS 2.1

Vuzix Blade Upgraded

Rank: #2: The Vuzix Blade Upgraded is like a hybrid between the Google Glasses and the Hololens; instead of the bulky design of the Hololens, these pairs are more glasses-like, and unlike the Google Glasses, it boasts a dual screen display and voice activation for an entirely hands-free experience. But while lighter than the Google glasses, it has a few catches, mainly a lower-grade Bluetooth, and some users reported that the device gets uncomfortable during prolonged use.

Price: $1,000

Positives: Lightweight, around 90g
Battery life (8hrs)
Built-in stereo
Voice Recognition

Negatives: Can't wear over prescription glasses
No 3D environmental tracking

Usability, Reliability, and Performance: Similar to the Google Glasses, the Vuzix Blade Upgraded headset has few native applications and is meant more for developers and businesses. However, most people find the device performs well through its intended tasks featuring an alternative voice recognition like Alexa to make the experience more hands-free. From reviews, it looks like this is the better of the two headsets (this and Google Glasses), boasting the same price with a few extra features.

Specs:

- **Passthrough:** Native passthrough, 8MP 1080p autofocus camera

- **Weight:** 90g
- **Resolution:** 480x853 per eye
- **Tracking:** Non-positional 3DoF
- **Bluetooth:** Bluetooth 4.1 LE
- **Battery Life:** 8 hours

Google Glass Enterprise 2

Rank: #3: From what I could find on the internet, the Google Glass Enterprise 2 is the most value for your dollar, being significantly cheaper than the HoloLens 2 ($3,500) or the Lenovo ($1,500). The Google Glass Enterprise 2 features a very simple layout with a small selection of native applications and only one active screen; like the Vuzix, it's not as bulky as the Hololens, and the battery lasts about 8 hours before needing to be recharged, while not as intuitive or feature-rich as the Vuzix, the general consensus is that due to its open-source nature that it's good for AR application development and other features like video calls, note taking, and AR tracking.

Price: $1,000

Positives:
Smaller and more comfortable than the other headsets
1080p30 video
Open source OS
Bluetooth 5.0
8MP camera
Cheaper than the others

Negatives:
Can't be worn with glasses
Screens only one eye
Low amount of native applications

Usability, Reliability, and Performance: Since I don't have access to Google Glasses, I researched the general consensus on the device. Most reviewers find that the Google Glass is a lightweight, comfortable AR headset with a few quirks, such as the lack of prescription glasses support and only having a few native applications that come with the device since it's mostly a development device.

Specs:

- **SoC:** Qualcomm Snapdragon XR1
- **OS:** Android Open Source Project 8.1 (Oreo)
- **Memory / Storage:** 3GB LPDDR4 32GB eMMC Flash
- **Bluetooth:** Bluetooth 5.0
- **Camera:** 8 Megapixel color sensor
- **Resolution:** Up to 1080p30 video
- **Display:** 640 pixel x 360 pixel RGB

- **Microphones:** 3 near-field beam-forming microphones
- **Battery Life:** 8 hours
- **USB:** USB PD 2.0 compliant (fast charge up to 1.5 A @ 5 V)
  USB 2.0 data transfer
  USB-C compliant connector

Lenovo ThinkReality A3

Rank: #4: The Lenovo ThinkReality A3 is the last headset I'll review for this report; there are many more negatives about this headset than the others. The ThinkReality A3 is about $500 more expensive than the Google Glass and the Vuzix Blade Upgraded and, from the reviews, is a lot more clunky to use than the rest requiring the user to hook the device to a compatible laptop, desktop, or Lenovo phone. Besides needing a connection to an external device, most people find the layout easy to use and image quality crisp at an enormous resolution of 1080p.

Price: $1,500

Positives: Image quality
Easy to use
Can wear with glasses

Negatives: Device compatibility limited
PC-oriented
Wired experience

Usability, Reliability, and Performance: Since the device is so expensive and the problem of needing an external connection to use the device, I don't see many people choosing this as their go-to headset for business or average consumer usage I would recommend going for any of the AR headsets discussed earlier in the report.

Specs:

- **Resolution:** 1080p per eye
- **Display:** Dual 1080p AR displays
- **Camera:** 8MP camera
- **Microphones:** 3 integrated mics
- **Weight:** 130g / 0.3 lbs