VR Headset for Endoscopy

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Overview

- Problem statement
- Background material
- PDS
- Design alternatives
- Design matrix
- Future work
- References/Acknowledgments

Problem Statement

Initial reported problem:

- Endoscopic Procedures becoming increasingly common
- Current System inconvenient
  - Virtual reality possible solution
  - Unable to Visualize the Operating Room

After further analysis:

- Immersive system that can transition between and operative and environmental views hands free

(Endoscopic)

Background

- Currently visualized by placing monitors close to the surgeons face
- Specific surgeries Dr. Ahmed performs are endoscopic skull-base surgeries
  - Duration of up to 10 hours
- Not as immersive as traditional methods

(Surgical)

Product Design Specifications Summary

Client Requested Functions-

- Immersive Experience
  - Two Viewing Options: Environmental & Endoscopic
  - Seamless Transitions Between Views
- Comfort for Duration of Surgery
  - Eyes & Neck
- Relevant Compatibility and Reliability

Google Daydream/Google Nexus

Attributes

Connectivity: Android Mobile OS

Components: Compatible Phone, Adjustable Head Straps, Front Door Latch Removable Facepad, Lenses, Remote

Weight: 19.2 oz, frontloaded (9.2 oz headset, 10 oz phone)

Price: $ 290 ($235 Google Nexus, $55 Headset)

Battery Life: 4 hrs (via the Nyan-Gareth Battery Test)
(Google Nexus)

(Google Daydream)

Daydream: Pros/Cons

(Google Daydream: What does it do)

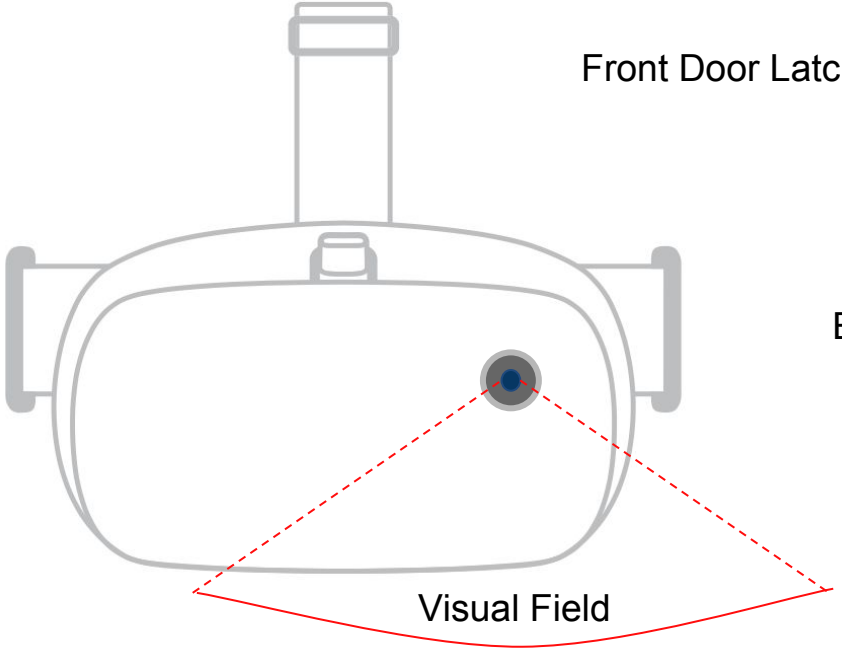
For Google Daydream (PRO):

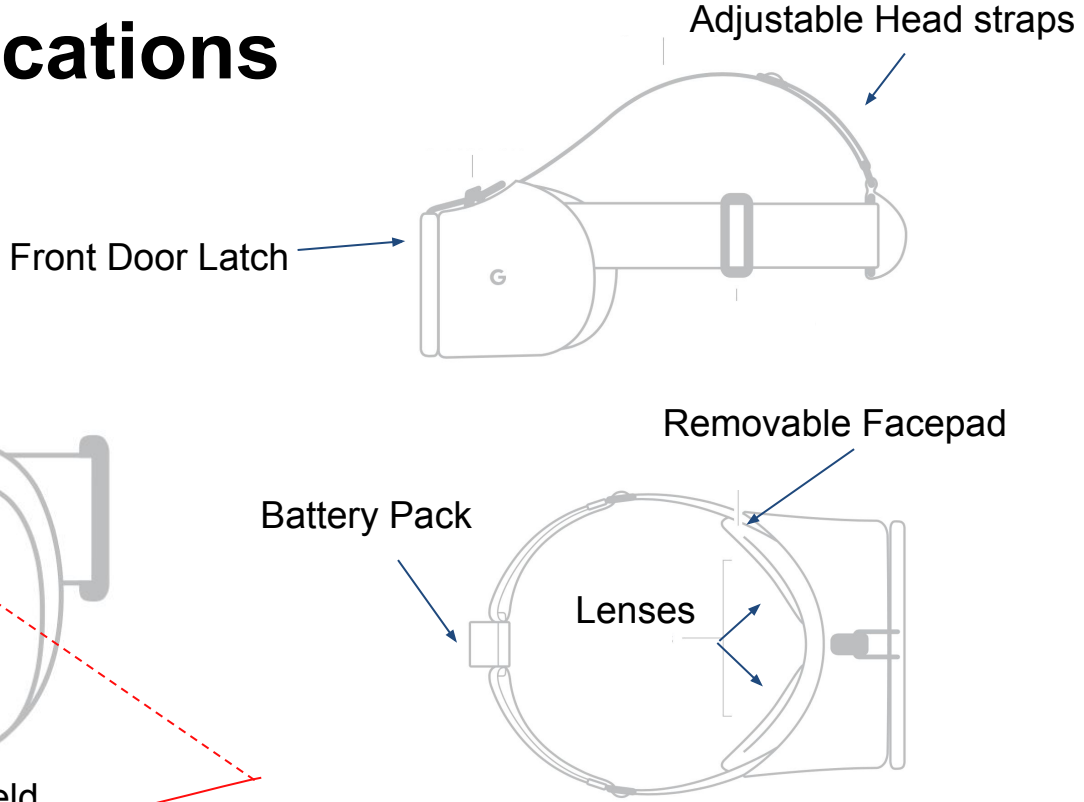
- Cost Effective
- No Ear Obstruction
- Existing Community of Programmers
- Great Battery Life (if modified)

Against Google Daydream (CON):

- Insecure phone holster
- Limited input capabilities
- Offset External POV (if modified)
- Limited input capabilities
- Processing Power
- Phone's Intended Usage

Daydream: Modifications





Dell Visor

Summary of design:

- Connectivity: HDMI 2.0 (video) and USB 3.0 A-Type (Data/Power)
- Components: Dell Visor, wiring, cord organizer, converter, raise/lower system
- Weight: 20.81 ounces
- Price: $520 ($450 Headset, $70 Mechanical Modifications)

Pros/Cons

- Hands-free
- Evenly distributed weight
- Complex mechanics/mechanical failure

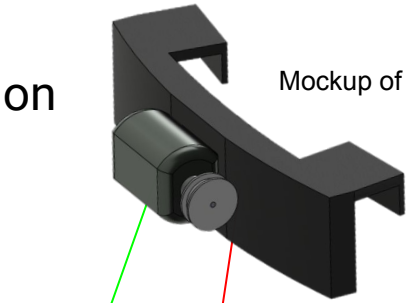
(Dell Visor Windows)

(Dell Visor VR118)

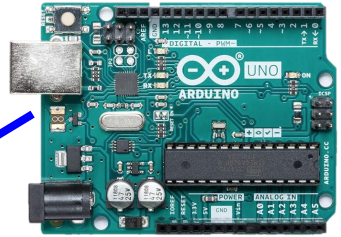
Dell Visor: Physical Modifications

= Attachment Location

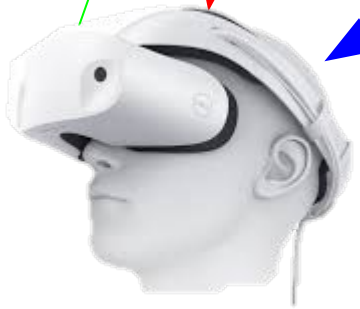
= Hypothetical Wire



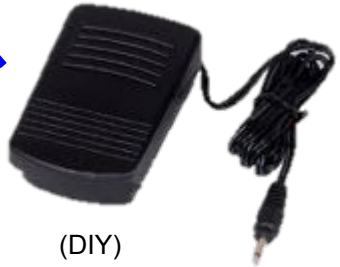
Mockup of motor attachment



(Arduino)



(Dell Makes)



(DIY)

HTC Vive

Summary of Design

- Connectivity: HDMI (video) and USB (data) and DCIN (power)
- Components: Vive, wiring, cord organizer/weight
- Software: Head motion switches endoscopic and environmental view
- Sensors: proximity, Gyroscope, G-sensor, accelerometer, infrared
- Weight: 16.58 oz
- Price: $500

(S. Stein)

Pros/Cons

- No hassle view switching
- Fully immersive view with limited cords
- Awkward weight distribution

Design Matrix

Criteria (weight)	Designs					
	#1 HTC Vive		#2 Daydream		#3 Dell Visor	
	Score	Weighted	Score	Weighted	Score	Weighted
Immersiveness (20)	5	20	3	12	5	20
Comfort/Ergonomics (20)	3	12	3	12	4	16
Programmability (15)	3	9	3	9	5	15
Physical Modifications (15)	5	15	4	12	1	3
Price (10)	3	6	5	10	3	6
Sensing Capabilities (10)	5	10	3	6	4	8
Safety (10)	4	8	3	6	3	6
TOTAL (100)		80		67		74

Future Work

- Move forward with Vive design
- Utilize Makerspace for proof of concept
- Concurrently develop comfort adjustments for Vive Design

(Virtual)

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