BME Design-Fall 2018 - THOMAS GEISSLER
Complete Notebook

PDF Version generated by

JOSHUA Niesen

on

Oct 10, 2018 @11:08 PM CDT

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Team contact Information

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Project description

▪ THOMAS GEISSLER ▪ Sep 19, 2018 @11:38 PM CDT

Course Number:

BME 300/200

Project Name:

Surgical VR Headset for endoscopic skull based surgery

Project Website Link:

http://bmedesign.engr.wisc.edu/projects/f18/VR_headset/

Short Name:

Project description/problem statement:

Dr. Azem Ahmed from the neurosurgery department of University of Wisconsin - Madison School of Medicine and Public Health presented this team with the task to improve surgeon visualization during endoscopic procedures. Endoscopic surgeries have become increasingly prevalent in the operating room along with the visualization techniques used to perform them. Traditionally, large monitors have been used to display the images from the surgical tools (endoscopic view), however, these are bulky and don't provide as immersive of an experience for the surgeon as other methods do. This problem has been partially addressed by using virtual reality (VR) headsets. One major limitation of these, however, is that they do not allow the surgeon to see anything outside of the endoscopic view. This is a problem as the surgeon will have to remove the headset everytime he or she has to change instruments, or perform from a clear line of sight (environmental view). This team's goal is to create a VR headset that would allow the surgeon to transition from the endoscopic view to environmental view without the use of the surgeon's hands, all the while presenting a continuous, non-interfering, and immersive experience for the surgeon.

About the client:

Dr. Azem Ahmed specializes in surgery for complex skull base tumors (meningiomas, pituitary adenomas, and acoustic neuromas), cerebrovascular disorders and neuroendovascular surgery. He also works closely with Ear, Nose and Throat physicians for endoscopic skull based surgery. Some of Dr. Ahmed's research was directed at improving visualization for neuroendovascular procedures. The main goal of this research was to streamline stroke care and assist with clinical decision making while developing a user friendly interface.

* taken from Dr. Ahmed's Bio on UW - Health website (https://www.uwhealth.org/findadoctor/profile/azam-s-ahmed-md-facs/9219#)

Preliminary Questions for the Client

▪ Sam Simon ▪ Sep 16, 2018 @10:05 PM CDT

Title: Preliminary Questions for the Client

Date: 9/16/18

Content by: Sam Simon

Present: Team

Goals: To grow a running list of questions we'd like to pass by the client at our introductory meeting. These questions will clear up some confusion we have about the projects current status and direction.

Content:

- What is the budget available for this project?
- How would you like to go about establishing future meetings? On a come-as-it-goes basis, or regularly?
- If we have project related questions, should we email your secretary or you directly?
- What is the current status of this project? What is getting patented currently and how will it effect our work?
- In the OR, what is currently used in place of the VR headset (i.e. large monitors, telescopic goggles)? Are you familiar with the brands of these products?
- What do you enjoy about the current product equivalent (monitors) you are using, and what are its major cons?
- Ideally, if all major components of the VR headset worked, what "luxury" or potentially beneficial additions would you want?
- Describe your current vision of the product:
    - What capabilities does it have?
    - Where will it see the most use?
    - What are the major sanitary/sterility concerns? Would it be nice is some components were disposable?
- What environment will the product be exposed to?:
    - When conducting surgeries, are their outlets nearby that allow for plugins?
    - What connection is currently used to output an image to OR monitors?
    - Do you have access to these cords? (Could potentially take one back to the ECB)
    - Are we able to shadow you during a procedure in the OR, or a gallery (if UW has these facilities), so we can see your work in action and get a feel for the environment ourselves?

Conclusions/action items:

This post will provide our team with a good base of questions during our introductory meeting with Dr. Ahmed so we can establish a sense of our responsibilities. Any additional questions or answers that arise during this meeting can be written here or in an additional post.

Preliminary Team Meeting with Dr. Ahmed

• JOSHUA Niesen • Sep 19, 2018 @05:40 PM CDT

Title: Preliminary Team Meeting with Dr. Ahmed

Date: 9/17/2018

Content by: Joshua Niesen

Present: Tom Geissler, Sam Peters, Sam Schini, Josh Niesen, Jake Cohn, Dr. Ahmed

Goals: To gain a deeper understanding of the problem the team is being presented with and to clarify subjects involving design requirements, budget, current procedures, case access and future client meetings.

Content:

Initial Team Meeting with Dr. Ahmed

1. Project background and reasoning for this project:

    1. Want to Incorporate into endoscopic procedures

- Will be able to use much more of visual field.

- Decrease magnification errors.

- Increase clarity of image.

- External influences may cause misreading of the microscope

- Design for two-dimensional and three-dimensional microscopes

2.   2. More immersive experience that goes along with the normal workflow of procedures

    3. Demand is due to the increase in these procedures because they are much less invasive than prior techniques

    4. The technology allows for a better experience for surgeons and may lead to higher quality procedures that are performed at a higher level of efficiency

3. Types of procedures/procedure characteristics applicable to this device:

    1. Initially used for endonasal procedures

    2. Ideally many endoscopic procedures will be able to use this type of technology

    3. Procedures occur in dark rooms

    4. Procedures tend to not have a lot of movement occurring. Mainly very specific and careful movements are conducted that require high levels of skill.

4. Limiting Factors/Design requirements to make this a useful product

    1. Not in the workflow of surgical work - making easily adaptable for surgeons

    2. Handing things

        1. Want to be able to see a "normal" view, and also want to see the screen when they want it.

    3. Device must be approximately one to two pounds, but the lighter the better

        1. Current oculars worn weight approximately one to two pounds, therefore, this weight would not be an awkward or new experience

5. Current methods/technology used for these procedures

    1. Oculars

        1. Are on microscope

        2. Have to get close, which limits field of vision

3. Can have errors with magnification

2. Large flat screen television attached to "tower" with machines within

   1. Thinks video quality displayed at 1080p

   2. HD

3. Loops - surgical telescopes

6. Dr. Ahmed Design Opinions/Requests

   1. Want VR - not AR because does not offer utility

   2. Only ~10cm

   3. No opinion for as to whether the device will be created from scratch by the team or if an existing technology will be modified to solve the problem presented.

      1. Over time this technology can be improved as an ongoing effort to improve the solution presented.

   4. Wireless technology would be ideal to avoid having to deal with cords

      1. However, reliability is by far the most important portion of this technology

   5. Zooming controls for the endoscope located on the VR headset would be ideal and make the work easier.

7. How long will this VR headset be worn for procedures

   1. Procedures last approximately eight to ten hours, though they may last longer

8. Design Suggestion: Cameras used for a "normal view" on the VR headset

   1. Using cameras would be fine

9. Project Goals for this semester:

   1. Whatever gets us closer to the end goal

   2. Ideally a product/device that can be worn 6-8 hours with an experience with all the same information as a screen

10. Budget

    1. No explicit budget

    2. Has funds and money that can be used to pay for project expenses

    3. Present Dr. Ahmed with various price points and options and we will discuss what shall be done going forward.

11. Could we possibly view some of these operations/procedures to understand the general workflow of what is occurring?

    1. Can send videos of operations to see what images look like

    2. Tower - in-person demonstration

       1. Larger display monitor

    3. Viewing any cases?

       1. Difficult for undergrads

       2. Will speak with secretary to get access

       3. Will look into paperwork and possibly see a case.

12. Future Meeting with Dr. Ahmed moving forward

    1. Can meet regularly

       1. Regular meeting - will follow up

       2. No particular days that work well.

    2. Or can meet based on schedule

       1. Can usually up midnight/2am if need to

    3.   If have a week's lead time, can meet at a time like this

    4.   If we want a meeting, we can get one to get the question answered.

        1.   Feel free to call anytime - Phone #: (608) 201-0957

Conclusions/action items:

Dr. Ahmed is very committed to this project and willing to answer any questions or discuss any issues that arise during the design project. Using the notes collected along with the project proposal, continued background research and be used to understand the current market available in VR technology. Along with this, we will create the PDS that will define requirements for this design. Last, we will brainstorm solutions and other ideas that may arise during research design.

    3.   If have a week's lead time, can meet at a time like this

    4.   If we want a meeting, we can get one to get the question answered.

        1.   Feel free to call anytime - Phone #: (608) 201-0957

9/7/18 - Project and Team Introductions

▪ Sam Simon ▪ Sep 11, 2018 @09:56 PM CDT

Title: 9/7/18 - Project and Team Introductions

Date: 9/7/18

Content by: Sam Simon

Present: All BME 300/200 students

Goals: To assign roles amongst the team members, establish the project website, set individual goals, and to open up a dialogue with our client and advisor.

Content:

Tasks Accomplished During the Meeting

- Every member must swap their "lab" section to Mr. Tompkin's section
- Team roles must be assigned to each member
    - Thomas Giessler, BME 300 - *Co-leader*
    - Sam Peters, BME 300 - *Co-leader*
    - Sam Simon, BME 300 - *Communicator*
    - Sam Schini, BME 200 - *BSAC*
    - Josh Niesen, BME 200 - *BWIG*
    - Jake Cohn, BME 200 - *BPAG*
- (Leader) Start-up the team's lab notebook on Labarchives
- (Communicator) Email the client to determine his availability for our first client meeting. Attach introductions and a URL to the team's webpage.

Our next TEAM MEETING DATE will take place Sept 11, 9 - 11 pm in Grainger to discuss preliminary research and to begin drafting the progress report

Progress Report Due: Sept 13, 5 pm

Team Goals Before Next Meeting

- Fill out team contact information tab in lab archives
- Visit the makerspace to review the "Hollow Lense"
- Conduct Preliminary Research (roughly 1-2 hrs)

Conclusions/action items:

Today our group primarily got through introductions and setup for the project webpage. We plan to hit the ground running by visiting the Makerspace immediately to see if we can glean some creative ideas from their "Hollow Lense". By the first project report (due Sept 13 by 5 pm) we plan to have a good background knowledge base built in preparation for our first client meeting.

9/11/18 - Progress Report And Client Meeting Setup

▪ Sam Simon ▪ Sep 11, 2018 @10:06 PM CDT

Title: 9/11/18 - Progress Report And Client Meeting Setup

Date: 9/11/18

Content by: Sam Simon

Present: All team members

Goals: To confirm that all team members are aware of upcoming advisor and client meetings. Also, to share preliminary research and establish goals for all team members for the week.

Content:

Tasks Accomplished During the Meeting

- Discuss research findings

- Establish meeting time with client (Tuesday Sept. 17, 7-8:30 am)

- Confirm meeting with advisor (Friday Sept 14, 1:30 - 2 pm)

- Make sure all shared google drive documents on lab archives are shared

- Complete the weekly progress report (due Thursday)

- Establish team goals

- Look into friends who own VR's (potential to glean some creative inspiration)

Conclusions/action items:

Without having talked to our client, our group is somewhat in that dark as to whether this project has previously been developed, what we have available to us, and what components we will be adding to said VR headset. Until our upcoming meeting, each member will need to conduct basic research following the original project proposal. We have at bare minimum established a strong team chemistry and have had the chance to study an existing product in the "hollow sense" at UW-Madison's Makerspace.

9/18/18 - Progress Report and PDS Document Creation

• JOSHUA Niesen • Sep 19, 2018 @05:58 PM CDT

Title: 9/18/18 - Progress Report and PDS Document Creation

Date: 9/18/18

Content by: Josh Niesen

Present: All team members

Goals: To discuss the client meeting conducted 9/17/18 and share its details with Sam Simon. To create the PDS that will have its first draft completed by this week Thursday, 9/20/18.

Content:

Team Meeting 9/18/2018 - Project Report and PDS

1. Goals for this project:

    1. A practical design - something that works smoothly

    2. Modifications

    3. Endoscope - Start with 2D, then work towards 3D

    4. Bluetooth technology for VR headset

    5. Immersive experience that does not interrupt workflow

    6. VR headset able to display camera

    7. Endoscope zooming controls

2. Budget/Monetary Situation

    1. Money should not be an issue

    2. Dr. Ahmed has money available

        1. Would like to be presented with multiple monetary options and then decide on which makes the most sense for a situation.

3. Project Challenges:

    1. Software

4. Design Specifications/Possibilities

    1. Documenting to show what we are doing and will be doing

    2. HTC Vive - cameras on outside to see

5. Action Items/Tasks to Complete:

    1. PDS Initial draft due Thursday 9/20/18 at 5pm

    2. Project Weekly Report

    3. More research about current VR headsets and devices needs to be completed.

    4. Possibly assign categories for research in the future

    5. Future thing to look into: Batteries for the HTC Vibe

        1. The headset can be wireless, but the batteries do not last the length of time required by the procedure.

    6. Voice commands to toggle views using a VR headset

6. Group worked collectively to complete the documents due this week:

    1. PDS

    2. Project Weekly Report

7. Individually, videos with commentary are due as well on Thursday at 5pm

Conclusions/action items:

A lot of progress was made this week by meeting with Dr. Ahmed and the group is ecstatic at the opportunity to work on this project. We will continue to research and conjure up possible solutions to this operational issue while also completing the PDS and required videos for this week.

6. Group worked collectively to complete the documents due this week:

    1. PDS

    2. Project Weekly Report

9/25/2018 - Preliminary Designs/Deign Matrix

• JOSHUA Niesen • Sep 29, 2018 @05:35 PM CDT

Title: 9/25/2018 - Brainstorming and Preliminary Design Creation

Date: 9/25/2018

Content by: Joshua Niesen

Present: All Members

Goals: To complete the main framework of the preliminary designs we will discuss with Professor Tompkins on Friday, September 28, 2018.

Content:

- The three designs being presented: Google Daydream, HTC Vive, Dell Visor, and a personally made device
  - It may be difficult to create our own device - a lot of work with 3D printing among other challenges.
- Team worked on the design matrix and creating the categories with which to evaluate our designs.
  - Categories and weights:
    - Immersiveness (20)
    - Comfort/Ergonomics (20)
    - Programmability (15)
    - Physical Modifications (15)
    - Price (10)
    - Sensing Capabilities (10)
    - Safety (10)
- **Conclusions/action items:**

In the future we will work on continuing to develop and determine the specificities that exist in each of the devices. We will also work on evaluating all of these designs with precision to determine which design is optimal for continuing to move forward in this project.

9/26/2018 - Design Matrix and Progress Report

▪ JOSHUA Niesen ▪ Sep 29, 2018 @05:39 PM CDT

Title: 9/26/2018 - Design Matrix and Weekly Progress Report Creation

Date: 9/26/2018

Content by: Joshua Niesen

Present: All Members

Goals: To finalize the design matrix and rank the designs along with completing the weekly progress report that will be sent to Dr. Ahmed and Prof. Tompkins.

Content:

- The three designs being presented: Google Daydream, HTC Vive, Dell Visor, and a personally made device
  - Ranked all of these devices using our design criteria
- Completed the weekly progress report that will be discussed with Prof. Tompkins on Friday, September 28, 2018.

Conclusions/action items:

We will continue to refine our rankings of the three presented designs and also work on other research that may be conducted about software related issues for when we meet with Prof. Tompkins.

9/29/2018 - Preliminary Design Finalization and Preliminary Presentation Creation

JOSHUA Niesen • Sep 29, 2018 @05:25 PM CDT

Title: 9/29/2018 - Preliminary Design Finalization and Preliminary Presentation Creation

Date: 9/29/2018

Content by: Joshua Niesen

Present: Josh Niesen, Sam Schini, Sam Peters, Jake Cohn, Tom Geissler

Goals: To complete the development of all designs that will be presented next week and complete most of the preliminary presentation that will be presented next week Friday, October 5th.

Content:

- The three designs being presented: Google Daydream, HTC Vive, and Dell Visor.
  - Google Daydream - will need to cut a hole for the camera
  - HTC Vive - all set, will need to work on software and modification for use of camera to view environment.
  - Dell visor - Need to create a mechanical mechanism to lift the visor
    - Decision - will use a motor attachment that is controlled using a foot pedal to raise and lower the visor of the VR headset.
- Assignment of roles for the presentation creation/presenting next week on Friday
  - Tom - Problem Statement
  - Schini - PDS and Design Requirements
  - Simon - Daydream
  - Josh - Visor
  - Jake - Vive
  - Sam - Design Matrix and Future works
- Team worked on completing the preliminary presentation slides

Conclusions/action items:

Going forward we will continue to look at the presentation and ensure that all grammar and organization of the slides is correct. We will also work on rehearsing the presentation so that all portions run smoothly.

9/14/18 - Progress Report to Advisor

▪ JOSHUA Niesen ▪ Sep 14, 2018 @09:34 PM CDT

Title: Progress Report and Team Meeting with Advisor

Date: 9/14/2018

Content by: Joshua Niesen

Present: All members and advisor

Goals: Discuss current project progress and research and to determine future research and actions to be completed in the next week.

Content:

Team Meeting with Advisor - 9/14/2018

1. Team meeting with client will take place Monday, September 17th, from five to six p.m. at the Javid (K4/818) conference room at the UW Hospital.

    a.Suggestions for discussion with client:

      -Discuss the environment the technology will be used in and possibly receive a tour of a facility operation room where technology will be used.

      -Discuss the tools that will be used in the operations and ask to see some of the tools being used

2. Updates to titles on the website need to be completed so that Sam and Tom can be co-leaders. We will need to contact Dr. Puccinelli to make this possible.

3. Makerspace use of VR

    a. The makerspace is willing to look into purchasing a VR headset upon request that could be used during the project.

      - Possible VR headset that seems very intriguing: Magic Leap

4. Brainstorming

    a. The group needs to continue being very open to other viable options to solve the issue at hand and to define the problem further by meeting with the client.

5. LabArchives - updates to the contact information and text entry formats need to be completed along with more research items.

Conclusions/action items:

The team conducted a successful team meeting and was able to regroup and establish expectations that need to be completed with information regarding labarchives and updating some pertinent information along with establishing some ideas for discussion when meeting with the client. Action items include conducting more research about applicable technologies after having met with the client for problem clarification.

9/21/2018 - Progress Report to Advisor

• JOSHUA Niesen • Sep 20, 2018 @10:51 PM CDT

Title: Progress Report to Advisor - 9/21/2018

Date: 9/21/2018

Content by: All

Present: All

Goals: To update the current status of the project and communicate with our advisor about the upcoming tasks we will complete this next week.

Content:

VR Headset for Endoscopy and Microsurgery

Client: Dr. Azam Ahmed

Advisor: Mr. Willis Tompkins, Dr. John Puccinelli

Team Members:

Tom Geissler	geissler2@wisc.edu	Team Co-Leader
Sam Peters	speters9@wisc.edu	Team Co-Leader
Sam Simon	ssimon8@wisc.edu	Communicator
Sam Schini	schini@wisc.edu	BSAC
Jake Cohn	jmcohn2@wisc.edu	BPAG
Josh Niesen	jsniesen@wisc.edu	BWIG

Reporting Period: September 7th through September 20th, 2018

Problem Statement:

Endoscopic surgeries have become increasingly prevalent in the operating room along with the visualization techniques used to perform them. Traditionally, large monitors have been used to display the images from the surgical tools, however, these are bulky and don't provide as immersive of an experience as other methods do. This problem has been partially addressed by using virtual reality headsets. One major limitation of these however, is that they do not allow the surgeon to see anything outside of the operative view. This is a problem as the surgeon will have to remove the headset everytime he or she has to change instruments, or perform macroscopically. The goal of this project is to design a VR headset that would allow the surgeon to transition from the operative view to normal view without the use of the surgeon's hands.

Summary of Team Role Accomplishments:

- Team: Attended a client meeting with Dr. Ahmed. Completion of the PDS and the Week 2 Progress Report.
- Leaders: Divided up research assignments and defined what this team wanted to accomplish this semester given the additional information provided from the client meeting
- Communicator: Confirmed the Tuesday client meeting with Dr. Ahmed.
- BWIG: The project page was updated with team information and team photo uploaded.
- BPAG: Given an open ended budget by the advisor.
- BSAC: Attended first BSAC meeting, got familiar with its various processes, and filled out a preliminary input survey.

Design Accomplishments:

We met with our client early in the week to answer many of the unknowns surrounding the project. Our client provided us with information about the bare-essential requirements of the project (it has to be hands-free, project endoscopic view and environmental view seamlessly, and have an HD-quality image) as well as "reach requirements" (bluetooth compatibility for wireless connection, battery life that lasts the duration of the surgery). With a better understanding of the project, our group was able to begin filling out the Project Design Specifications, briefly laying out the general parameters of our hopeful product. The meeting and PDS write-up honed our group's attention on important aspects of the project that we hadn't before anticipated. We will continue to conduct research on these aspects over the upcoming week.

Activities:

Date	Name	Task	Time (hours)	Weekly Total	Semester Total
9/14/2018	Team	Advisor Meeting	0.5	0.5	0.5
9/16/2018	Team	Client Meeting	1	1.5	1.5
9/18/2018	Team	PDS and Progress Report Work	2	4.5	4.5
9/19/2018	Sam Schini	Research (Current strains/injuries associated with performing operations, Latency metrics, Endoscopic Surgery)	2.0	2.0	3.5
9/18/2018	Sam Schini	Research (Codes/Standards in operating rooms)	0.5	1.0	1.0
9/17/2018	Sam Simon	Research (Existing Products, Mountable Mini-monitors, Raspberry Pi Camera Function)	1.5	1.5	4
9/18/2018	Sam Simon	Research (BNC Connectors, Bluetooth Compatibility, FDA Regulation and Sterility Concerns)	1.5	1.5	5.5
9/9/2018	Sam Peters	Research on available options for VR.	1.5	1.5	3.5
		LabArchives and videos	1	3.5	4.5
9/18/2018	Jake	Research (VR brands and specs)	0.5	0.5	2
9/19/2018	Jake	LabArchives and videos	1.5	2	3.5
9/20/2018	Jake	Research (connectivity, cameras), PDS and Progress Report	1	3	4.5
9/14/2018	Josh	Work on LabArchives and Research Documents - Formatting issues and structuring	1	1	6
9/18/2018	Josh	TEAM Lab Green Permit - Create Part	2.5	3.5	8.5
9/19/2018	Josh	TEAM Lab Green Permit Completed	2	5.5	10.5
9/19/2018	Josh	Organization of team notes from 9/17 & 9/18, work on PDS	2	7.5	12.5
9/18/2018	Tom	Research (Principles of endonasal skull based surgery)	2	2	3.5
9/19/18	Tom	Looked at current VR products as well as some of the applications of VR that currently exist in the medical field	2	4	5.5

Statement of Team Goals:

Our goal for this week will be to investigate the product characteristics that our client brought up in this week's meeting. Ideally, we would like to transition into the brainstorming phase by next week Saturday. This entails that each team member should have a solid understanding of the basic functions and physics behind VR (lenses, bluetooth connection, external facing cameras, design layout). To make the process more efficient, we plan to divy up which member researches what aspect of the project. By dividing responsibilities, and holding each member accountable for going in depth of their product characteristic, each member will be able to review each other's findings in LabArchives and have a more complete understanding of the design process moving forward.

Individual Goals:

- Sam Simon: I will devote this next week to expanding my project research to study VR headsets utilizing external cameras, bluetooth connections that would allow us to establish a connection between the endoscope and our headset, regulations and sterility concerns of the device, and image quality or manipulation to create an immersive environment for our client. Thursday, September 20th, will be spent editing and finalizing our team's PDS for submission the next day. By the end of next week, I would like to have a few raw design ideas brainstormed to discuss with the team.

- Sam Schini: Next week, I will continue to research the latency associated with media input to output. Specifically, I will look into what kind of hardwire connection would eliminate any lag between the monitor and VR headset. I would also like to further examine endoscopic procedures to better understand the logistics of where Dr. Ahmed's head will be looking and how long the glasses will actually be on for. Depending on this, I will look into design specifications that could increase comfort while wearing the VR headset (voice commands, ventilation, anti-fog, etc.).

- Sam Peters: Next week, I plan on reaching out to the Makerspace to confirm that they have the VR headsets that we are interested in using. I would like to additionally research the software used for coding VR and identify what platforms would work best for our purposes. Finally, I want to better understand other applications and current work of VR in surgery.

- Tom Geissler: I plan on continuing my research on available VR options, as well as considering the possibility of developing our own. Additionally I am going to learn more about the specific endonasal surgery Dr. Ahmed conducts to see if there are any other design constraints we haven't thought of. Hopefully by the end of the week we will know if we need to have the Makerspace order any VR headsets for us so we can get those in time.

- Jake Cohn: Next week, I plan to continue research on VR headsets, specifically the connectivity to the operating system with cords, bluetooth, and other mechanisms. I will also interested in researching the cameras that come with certain models and compare them to the cameras that we could mount on a headset. I plan to compare the price ranges of each mounting style then report back with my findings.

- Josh Niesen: Next week my goal is to continue ongoing research for creative VR technology focused on miniscule camera technology. Along with this, I will work on update the team roles for Tom and Sam using the fixes that Ethan has put in place on top of regular uploads.

Difficulties:

There were not many difficulties that arose this week. The only situation where we had a schedule conflict was when we met with our client on Mondays and Sam Simon could not make it. Mainly, we now face the difficulty of research and producing authentic and unique ideas that will create the best solution to our problem.

Project Schedule/Timeline:

Task	September				October				November				December		
	7	14	21	28	5	12	19	26	2	9	16	23	30	7	14
Project R & D															
Current Products	X	X													
Scope Based Surgery	X	X													
Virtual Reality	X	X													
Mechanical Solutions															

Materials		
Cost Estimation		
Prototyping		
Documentation		
Progress Reports	X	
Preliminary Presentation		
Preliminary Deliverables		
Final Poster		
Final Deliverables		
Meetings		
Team	X	X
Client		X
Advisor	X	X
Website		
Update	X	X

Filled boxes = Projected timeline   X = Task was worked on or completed

Expenses: We have not incurred any expenses yet.

Conclusions/action items:

This was a very productive week and we will continue to move forward with research and brainstorming to further our understanding and knowledge of the problem to provide an innovative solution.

9/28/2018 - Progress Report to Advisor

• JOSHUA Niesen • Sep 29, 2018 @05:17 PM CDT

Title: Progress Report to Advisor - 9/28/2018

Date: 9/28/2018

Content by: All

Present: All

Goals: To update the current status of the project and communicate with our advisor about the upcoming tasks we will complete this next week.

Content:

VR Headset for Endoscopy and Microsurgery

Client: Dr. Azam Ahmed

Advisor: Mr. Willis Tompkins, Dr. John Puccinelli

Team Members:

Tom Geissler   geissler2@wisc.edu   Team Co-Leader

Sam Peters   speters9@wisc.edu   Team Co-Leader

Sam Simon   ssimon8@wisc.edu   Communicator

Sam Schini   schini@wisc.edu   BSAC

Jake Cohn   jmcohn2@wisc.edu   BPAG

Josh Niesen   jsniesen@wisc.edu   BWIG

Reporting Period: September 21st through September 27th, 2018

Problem Statement:

Endoscopic surgeries have become increasingly prevalent in the operating room along with the visualization techniques used to perform them. Traditionally, large monitors have been used to display the images from the surgical tools, however, these are bulky and don't provide as immersive of an experience as other methods do. This problem has been partially addressed by using virtual reality headsets. One major limitation of these however, is that they do not allow the surgeon to see anything outside of the operative view. This is a problem as the surgeon will have to remove the headset everytime he or she has to change instruments, or perform macroscopically. The goal of this project is to design a VR headset that would allow the surgeon to transition from the operative view to normal view without the use of the surgeon's hands.

Summary of Team Role Accomplishments:

- Team: Inspected VR headsets available at the makerspace (namely Dell Visor and Vive Pro). All members participated in team meetings to develop the design matrix and discuss brainstormed designs.

- Leaders: Delegated tasks for preliminary design presentation and report. Touched base with sophomores to ensure they understand the current stage in the design process.

- Communicator: Emailed the team's progress report to Professor Tompkins and Dr. Ahmed.

- BWIG: The project page was updated with team's preliminary design matrix and weekly progress report.

- BPAG: Again, been given an open ended budget by the advisor. Looked into prices of possible products and outlining a tentative budget for the project.

- BSAC: Prepared to meet faculty members at this week's meeting by contemplating any course questions regarding semester processes that need to be addressed
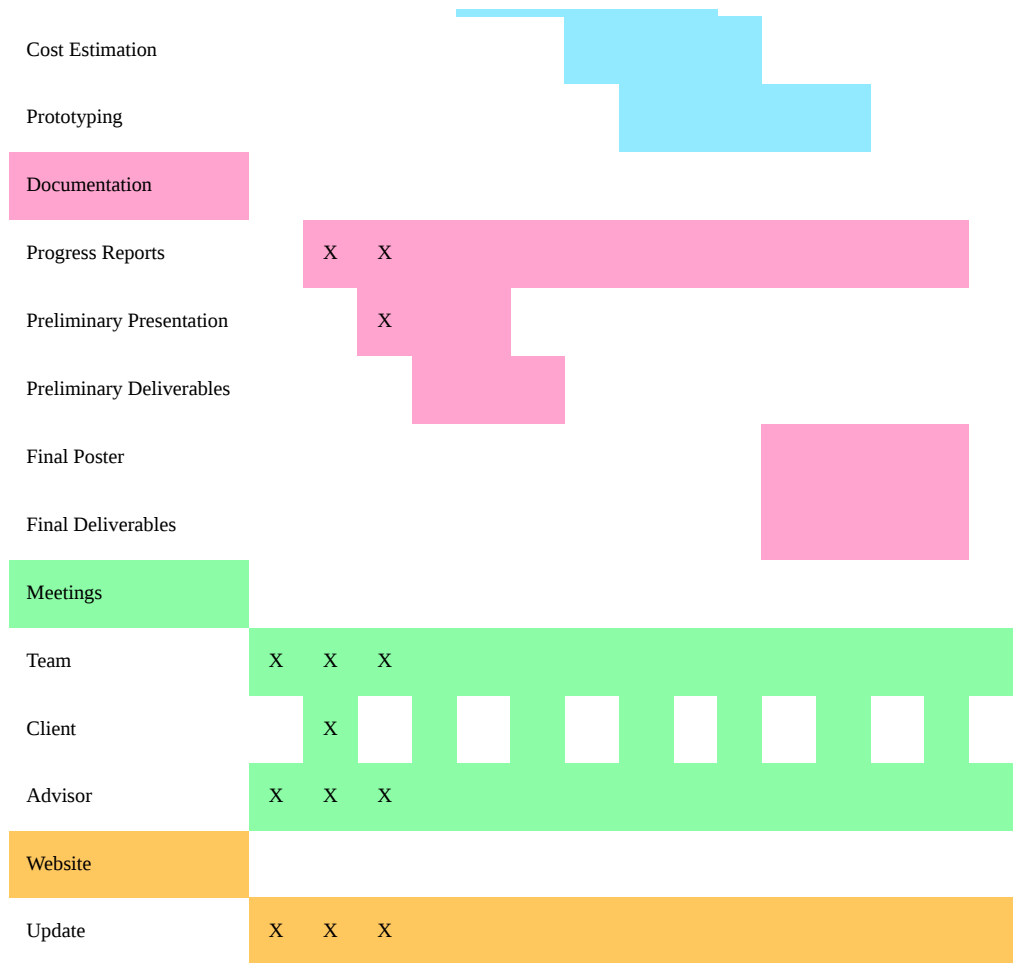
Design Accomplishments:

Numerous members of the design team went on another trip to the makerspace to get a secondary opinion on each available VR headset in light of our new research. In our weekly team meeting, the team came to the conclusion that it would be most feasible to purchase and modify a "premade" headset as opposed to constructing one from scratch, which would add an extra dimension in forcing our team to precisely design the visual field and screen ourselves. We continued to identify headsets with external facing cameras so our device had "hands-free" capabilities, and focused on headsets which were most programmable and modifiable. Our intention is to alter and program the headset (using software such as the Google Daydream Platform) to allow for the additional functionality that our client demands. Taking our best VR headset candidates from our research, we crafted a design matrix and a list of criteria critically important to the project. We ultimately determined that the Dell Visor was the most suitable option and continued to divvy up responsibilities for the upcoming Preliminary Presentation.

Activities:

Date	Name	Task	Time (hours)	Weekly Total	Semester Total
9/21/2018	Team	Advisor Meeting	0.5	0.5	5
9/25/2018	Team	Completion of the Design Matrix and Weekly Progress Report	2	2.5	7
9/26/2018	Team	Discussion of Design Sketches and Brainstorming	1	3.5	8
9/22/2018	Sam Schini	Research (Camera Attachments for VR Headsets, Endoscopic Surgery)	1.5	1.5	5.0
9/23/2018	Sam Schini	Action (Tried on different models of VR headsets at the Makerspace)	0.5	2	6.5
9/26/2018	Sam Simon	Visited the Makespace to pay material fees and test-drive available VR headsets	0.5	0.5	6
9/23/2018	Sam Simon	Research(Daydream platform and equivalents, each headset's capability to receive visual input, Bluetooth adaptors and transmitters, ability to convert 2D live feed into VR video)	3	3.5	9.5
9/24/2018	Sam Peters	Research on the Daydream platform and coding steps	1.5	1.5	6
9/26/2018	Jake	Went to Makerspace to try different headsets on	0.5	0.5	5
9/25/2018	Jake	Recording design ideas and specifications	1	1.5	6
9/25/2018	Josh	Work on LabArchives and Research Documents - Organized all research and categorized it. Visited Makerspace and tested some of the VR devices for ergonomics.	4.5	4.5	19
9/26/2018	Josh	Worked on sketches of the design options that can be discussed and further developed.	0.5	5	19.5
9/19/18	Tom	Research(Specifications for eligible VR headsets, endoscopic procedure read throughs, Daydream software coding syntax)	2	2	7.5

Statement of Team Goals:

We, as a group, plan to finalize our design matrix with the various brainstormed designs we have developed thus far. Our goal is to invite our client to the Preliminary Presentation that we will prepare for this upcoming week so that we may get his input on the designs and get a better bearing of which design he prefers. After visiting the Makerspace this week, we have identified that the weight of any given VR headset may be substantial and researching ways to distribute or reduce that weight on the front of the user's forehead may be necessary. Should our team determine that purchasing and modifying a preexisting headset is the best course of action, we also need to commit a substantial amount of time this week towards learning the in-and-outs of VR programming platforms, such as Daydream.

Individual Goals:

- Sam Simon: Before Sunday, I will need to contact the client to invite him to our preliminary presentation and offer him a brief summary of our progress. Our team needs to get confirmation from our client to proceed with whatever design is chosen by the design matrix and it is my responsibility to facilitate this conversation with Dr. Ahmed. Since I spent this past week trying to find a means to connect an convert the 2D video from the BNC cable into a live-stream VR video, I would like to continue to research softwares like the Daydream platform to bridge that gap in addition to my responsibilities in the preliminary presentation.

- Sam Schini: Next week, I will look into hardware connectors that are compatible with our developing designs and Dr. Ahmed's tower. Additionally, I will further look into which design/headset specifications will work best for Dr. Ahmed during procedures (we will communicate with him to get his input). I will also continue to help develop our designs so that our three preliminary designs are versatile and inclusive of different approaches.

- Sam Peters: Next week I hope to learn more about the specific syntax and coding environment for the Dell Visor. I will download the development environment and starting attempting basic programs in it.

- Tom Geissler: Since the preliminary presentation and design matrix are the highlights of this week, I will use my time to identify the key differences between each commercially-available headset that we have identified thus far. This research will involve comparing weights, compatible VR video types (i.e. MPH), and latency. Doing so will give our group a more concrete idea of which headsets outrank the others in various design criteria.

- Jake Cohn: Next week, we should have a plan in place for where we are going with our project and what materials we need. I will then look into purchasing those materials with the go ahead from our client. I will continue to look into ways to create an automatic mechanism for lifting the Dell Visor as well as the possibility of mounting cameras on the outside of it for an external view of the operating room.

- Josh Niesen: Next week my goal is to better understand the google daydream platform that we will be working with. To do this, I will conduct extensive research to understand compatibility for an app that we can create.

Difficulties:

This week we encountered difficulties when creating and assigning the proper criteria with which to evaluate our designs. The challenge with this task was that we are evaluating possible devices that will be purchased, which is difficult when we are trying to define their ability to solve a problem that we will modify them for. Another difficulty that has arisen is turmoil about whether to buy or personally print and assemble a VR device for this application. To solve this, we had to sit down and as a team come to a consensus about how to move forward with purchasing a VR headset. A final difficulty that has arisen this week is discovering camera compatibility and being able to use the cameras on the front of the proposed headsets for viewing rather than just sensing motion.

Project Schedule/Timeline:

Task	September					October			November				December		
	13	20	27	4	11	11	18	25	1	8	15	22	29	6	13
Project R & D															
Current Products	X	X	X												
Scope Based Surgery	X	X	X												
Virtual Reality	X	X	X												
Mechanical Solutions			X												
Materials															

Cost Estimation			
Prototyping			
Documentation			
Progress Reports	X	X	
Preliminary Presentation		X	
Preliminary Deliverables			
Final Poster			
Final Deliverables			
Meetings			
Team	X	X	X
Client		X	
Advisor	X	X	X
Website			
Update	X	X	X

Filled boxes = Projected timeline   X = Task was worked on or completed

Expenses:

   We have not incurred any expenses yet.

Conclusions/action items:

This was a successful week in determining the major designs we will be going forward with into our preliminary presentation. The group will now work on creating our presentation and preparing for the preliminary presentation next week.

9/28/2018 - Advisor Preliminary Designs Discussion

- JOSHUA Niesen - Sep 29, 2018 @05:16 PM CDT

Title: Progress Report to Advisor - 9/28/2018

Date: 9/28/2018

Content by: All

Present: All

Goals: To discuss the preliminary designs that will be presented next week in our preliminary design presentation.

Content:

BME 200 Advisor Meeting 9/28/2018

- Sam Schini - BSAC Meeting this morning - discussed BME 200 and 201 and placement

Kevin Ponto

- WID - lab to go and see the VR headsets - WID living environments lab

Project:

- Discussion with Professor Tompkins:
    - Physical bought VR headset with modifications
        - Price may/will be high
    - How can you have a pure virtual reality system hooked up to a camera?
        - The inputs for the headset can use adapters from the endoscope
    - What's the point of virtual reality if you don't need depth?
        - We are mainly using the screen so that a doctor does not feel as though they have to lean closer, but rather always have the screen right in front of their face.
    - If we are going to buy something and adapt it - it's a reasonable design, except it may not be adaptable to other environments
        - But we are trying to satisfy this client - end goal: client happy
    - How are we going to connect the VR headset to the endoscope?
        - We will use adapters and possibly
    - This course is fine, does it solve the problem
    - Think of simple ways to do this - one SIMPLE thing for the design matrix

Conclusions/action items:

We were able to discuss our current designs with Professor Tompkins and will continue to move forward with the finalization of the designs that will be presented next week when we meet on Sunday.

Product Design Specifications

▪ JOSHUA Niesen ▪ Sep 21, 2018 @09:28 AM CDT

Title: Product Design Specifications

Date: 09/21/2018

Content by: All

Present: All

Goals: To detail and elaborate on the product design specifications and design requirements.

Content:

VR Headset for Endoscopy and Microsurgery

Product Design Specifications

September 21, 2018

Client: Dr. Azam Ahmed

Advisor: Dr. John Puccinelli

Team Members:

Tom Geissler	geissler2@wisc.edu	Team Co-Leader
Sam Peters	speters9@wisc.edu	Team Co-Leader
Sam Simon	ssimon8@wisc.edu	Communicator
Sam Schini	schini@wisc.edu	BSAC
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Josh Niesen	jsniesen@wisc.edu	BWIG

Function:

Dr. Azem Ahmed from the neurosurgery department of the University of Wisconsin - Madison School of Medicine and Public Health presented this team with the task to improve surgeon visualization during endoscopic procedures. Endoscopic surgeries have become increasingly prevalent in the operating room along with the visualization techniques used to perform them [2]. Traditionally, large monitors have been used to display the images from the surgical tools (endoscopic view), however, these are bulky and do not provide as immersive of an experience for the surgeon as other methods do. This problem has been partially addressed by using virtual reality (VR) headsets. One major limitation of these, however, is that they do not allow the surgeon to see anything outside of the endoscopic view. This is a problem as the surgeon will have to remove the headset everytime he or she has to change instruments, or perform an action requiring a clear line of sight (environmental view). This team's goal is to create a VR headset that would allow the surgeon to transition from the endoscopic view to the environmental view without the use of the surgeon's hands, all the while presenting a continuous, non-interfering, and immersive experience for the surgeon.

Client Requirements:

- Create a more immersive view for performing endoscopy.
    - Endoscopic surgery is currently performed with the use of large display monitors stationed above the head of the patient. The monitors occupy a small field of view for the surgeon and result in a suboptimal and potentially distracting means of viewing the procedure.
    - The client would like a wide field of view display that allows for fewer distractions. The more immersive viewing experience will make anatomical visualization easier and facilitate more effective endoscopy.
- Maintain smooth workflow of endoscopic procedures in operating room.

- The client must be able to conduct surgery unobstructed by the new display platform. Any kind of immersive display must allow for an easily accessible environmental view. Cords or accessories to the display must not hinder movements of the surgeon or others in the operating room.

- Create an ergonomic platform for the surgeon using a new interface.

  - The surgeon will be using the display for long periods of time. The display must therefore be comfortable to wear and intuitive to interact with.

Design Requirements:

1. Physical and Operational Characteristics

    1. *Performance requirements:*

The designed VR headset must comfortably sit upon the surgeon's head for the duration of an endoscopic surgery, which averages about 10 to 12 hours according to Dr. Ahmed. Moreover, the VR headset should produce minimal additional strain on the surgeon aside from inevitable operating pains [3]. In terms of technical performance, the headset must reliably deliver 1080p, standard HD display to the user throughout the course of an endoscopic surgery. This display must be a continuous feed from the endoscopic camera communicated through hardwire or bluetooth. Any source of video lag could be detrimental to the surgery. Additionally, the VR headset should be able to effectively switch from the endoscopic view to the environmental view through hands-free command at various times during the course of the operation.

    2. *Safety:*

There are two main safety requirements for the device. The first concerns the surgeon and the second concerns the patient. Since the duration of the surgeries being conducted are so long, the headset has to be comfortable and ergonomically friendly enough so that the surgeon doesn't fatigue. If the surgeon is not performing to the highest level possible, the health of the patient is at risk. Additionally, the device has to provide a continuous and clear, immersive experience for the surgeon otherwise the health of the patient is once again at risk. The most frequent major complication of endonasal skull base surgery (the kind performed by Dr. Ahmed) is a cerebrospinal fluid (CSF) leak [5]. This results from accidental tissue damage. Any lag or deficiency in visualization by the surgeon will increase the risk of CSF leaks and other complications.

    3. *Accuracy and Reliability:*

The VR headset must administer a reliable communicative feed between the endoscopic camera and the display. For seamless streaming, the laging latency should not exceed 30 ms between the video input and output [4].

    4. *Life in Service:*

The device must function with perfect accuracy during all operations with a projected lifespan of five years based on technological trends and development of VR technology. It must also withstand regular use without deformation or breakdown due to standard sterilization procedures.

    5. *Shelf Life:*

The device must be able to be stored in a stable environment without having contamination issues involving sterilization. Along with sterilization, batteries must be self-contained with no issues involving the spilling of harmful contaminants.

    6. Operating Environment:

The device will be initially used in neurosurgical operating rooms. These operating rooms are dark environments with focused light on the patient. The OR contains both sterile and non-sterile fields that must be maintained through proper workflows. A variable number of monitors are in the OR which may be utilized for external displays of the endoscopy view.

    7. Ergonomics:

The VR headset will be worn for 10-12 hours during surgery and must fit comfortably on the surgeon's head with optimal comfort. The VR headset must also be balanced very well and fit snugly to the head to avoid any tipping or movement of the device during regular use. Along with a comfortable fit, the design must not cause any strain or pain in

the head, neck, or spinal regions due to sustained use. The design must focus on easing the view of detailed information pertinent to the procedure that will minimize strain on the body. Within the design, any cords or wires used must be contained and controlled to ensure no entanglement between body parts and cords occurs.

8. Size:

The current oculars used by surgeons cover the eyes and part of the front of the face. This is comparable to current VR headsets which vary in size and are approximately 225x185x140mm. These dimensions will serve as a general baseline for the sizing of our VR headset.

9. Weight:

The weight of the top six major VR headsets range in weight from around 453 grams to 610 grams. The average of these is 501 grams [6]. As of now the oculars used by neurologists now range from about 453 grams to 906 grams.

10. Materials:

The base of the VR headset will be the main material needed since the plan is to modify an existing product. In addition to the headset, cameras will be needed to view the operating room during surgery. The headset could end up being connected to the endoscopic tower via bluetooth but if not we will need to acquire an HDMI cable or USB cable to connect the headset. Depending on what headset is chosen, the design would require the separate purchase of a smartphone to display surgery.

11. Aesthetics, Appearance, and Finish:

The headset will be set on the face of the operator and should fit comfortably for long surgeries. It will have appropriate weight distribution and have small cords connected to the back of the headset. The outside of the headset itself will most likely be unmodified and look similar to the factory versions of the product.

2. Production Characteristics

1. Quantity:

For this project, only one prototype will be constructed. The one prototype will prove whether it will be necessary to continue production and whether it would be feasible to create more on a larger scale for mass distribution. If the prototype excels while being used in a surgical setting, creation of more could be reality and will be pursued.

2. Target Product Cost:

This product is seeking to compete with current television display screens that are approximately forty inches if not larger. The televisions like what Dr. Ahmed is using likely are priced at approximately $500 and may be even more expensive. Therefore, we are seeking to make a product that costs approximately $500. This price point also fits the higher-level virtual reality devices on the market right now. This price would likely involve the entire assembly along with software expenses and any other incurred costs. Though this may increase throughout the development of the device.

3. Miscellaneous

1. *Standards and Specifications:*

VR headsets of display monitors for surgical procedures fall under the Class I Medical Device FDA regulation [1]. Currently, the FDA sets the requirement of going through the 510(k) acceptance process for all new medical devices that are seeking to be offered in the future medical device market. These applications must be sent at least 90 days before individuals intend to market a device and go through a very thorough investigation.

2. Customer:

The client, Dr. Azam Ahmed mentioned that he would prefer focusing on VR devices over other technologies such as AR. He also communicated that he would prefer if the device can be wireless so that there is not tangling of cords that can occur. Additionally, Dr. Azam iterated that this product cannot stall as a lag in video timing or quality would be detrimental to his patients health. Last, Dr. Ahmed has warned that lighter and lighter designs would be best as they will decrease the strain put on surgeons during these extensive procedures.

3. User-related concerns:

The client's main concern for the device is maintaining a smooth workflow. While the immersive view allows for more effective endoscopy, a potential side effect may be preventing environmental views or adding obstacles to the surgeon or team. Our solution must be cognizant of the activity in the OR as well as the motions required of the

surgeon during operation. This may be accomplished by offering a product with a seamless transition between endoscopic and environmental views, and potentially through the addition of voice commands by allowing the surgeon to change views without the need to move his hands.

4. Competition:

Currently, the client uses a large monitor to display the output by the endoscope, similar to that created by Synaptive Medical. This technology presents a wide image that capable of ideal image quality, but lacks the immersiveness of a VR headset and required the surgeon to crane their neck to one side and away from the patient during procedures. Other competing technologies include all VR headsets currently on the market that could be adapted to be used in the OR. Many of these existing products appeal to a recreational audience, and are not adapted to the OR desipite their use of bluetooth, 360° POV angles, and sleek designs. Similarly, AR is another type of competing technology applicable to endoscopic procedures.

Works Cited:

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[4] C. Team, "Cloud Gaming and the Latency Obstacle – cryptonomos – Medium," *Medium*, 24-Nov-2017. [Online]. Available: https://medium.com/cryptonomos/cloud-gaming-and-the-latency-obstacle-98178f983fc6. [Accessed: 19-Sep-2018].

[5] C. H. Snyderman, R. L. Carrau, A. B. Kassam, A. Zanation, D. Prevedello, P. Gardner, and A. Mintz, "Endoscopic skull base surgery: Principles of endonasal oncological surgery," *Journal of Surgical Oncology*, vol. 97, no. 8, pp. 658–664, 2008.

[6] J. Thang, "VR Headset Specs Compared: PSVR, HTC Vive, Oculus Rift, And More," *GameSpot*, 21-Feb-2018. [Online]. Available: https://www.gamespot.com/articles/vr-headset-specs-compared-psvr-htc-vive-oculus-rif/1100-6456697/. [Accessed: 19-Sep-2018].

Conclusions/action items:

The body of the PDS has been formed and will need to be updated with more standards and FDA regulations pertaining to requirements that we must meet as we create this medical device. We will also continue to update design requirements as new ideas arise about possible issues or constraints on the design.

10/9/2018 - Dell Visor

• Sam Schini • Oct 09, 2018 @10:45 PM CDT

Title: Dell Visor

Date: 10/9/2018

Content by: Sam Schini

Present: Sam Schini, Tom Geissler, Sam Simon, Sam Peters, Josh Niesen, Jake Cohn

Goals: Overview the Dell Visor preliminary design

Content:

Market Description- The Dell Visor has one of the most even weight distributions of any VR headset on the market today. The Visor and comfort go hand in hand with its solid, adjustable headband that ergonomically binds to the skull of a user. The display of this headset immerses a user and is hinged, giving a user the option to flip the display up and out of the field of vision for temporary eye relief and environmental vision.

Solution to Endoscopic and Environmental View Transition- This design option will include a hands-free mechanical feature that flips the display up when our client wishes to view his environment. This process will be facilitated with a wire, miniature winch motor, arduino, and interactive foot pedal. Moreover, when our client wishes to raise the endoscopic display, he steps on a foot pedal with an interpretive arduino on it that is hardwired to the winch motor and signals which way to wind the motor, subsequently raising or dropping the display.

Dell Visor Dimensions
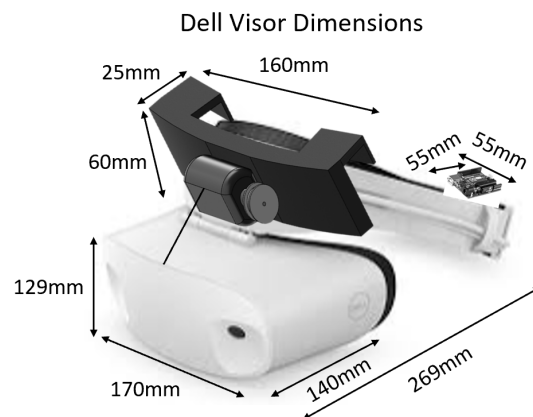
Necessary Modifications to Market Dell Visor- The only modifications necessary for this design are the addition of a motor, wire, and hard wiring on the headset and connecting that to the foot pedal and arduino. No software modifications will be required for transitions between endoscopic and environmental views due to the mechanical nature of this design option.

Design Specifications-

- Price: $540 ($450 Headset + $70 Mechanical Modifications)
- System Requirements: Dell Visor, miniature winch motor, wire, arduino, hard wire, foot pedal
- Weight: 20.81 oz.
- Development Environment: No development necessary
- Connectivity: HDMI 2.0 (video) and USB 3.0 A-Type (Data/Power)

Advantages-

The advantages of the Dell Visor revolve around the even weight distribution, simplicity, and clarity of both perspective views. With the even weight distribution, Dr. Ahmed will be able to wear the headset for extensive periods of time during an operation without feeling neck strain from a front loaded display. Additionally, by flipping the display up, our client will be able to relieve his eyes of continuously staring at a display, and having an enclosed set of goggles over his face. Both of these performance factors will allow the design to be used with continuity and comfort. Because of this design's mechanical simplicity, there will also be no time spent programming or working with a foreign development environment: a time consuming activity.

Disadvantages-

Due to the mechanical nature and multiple different components of this design, there is the possibility of mechanical failure. This is a major drawback of this design because a malfunction in the headset's ability to raise the display could prove detrimental to an operation's progress. Additionally, if our client wishes to move about the operating table/around the patient, he will have to be cognisant of the foot pedal that is hardwired to the headset. This could be a major inconvenience and could hinder the safety of the operation.

Conclusions/action items: This analysis of the Dell Visor as a preliminary design provides that it is a viable option that could satisfy our client's requested functions. An in depth comparison is required by the design matrix to see if the visor will be the design that we choose to proceed forward with.

10/08/18 - HTC Vive Design

▪ SAMUEL PETERS ▪ Oct 10, 2018 @12:38 AM CDT

Title: HTC Vive Design

Date: 10/08/18

Content by: Sam Peters

Present: NA

Goals: To communicate the HTC Vive design concept.

Content:

Figure 1: HTC Vive headset with labeled dimensions.

Design Description:

The HTC Vive is one of the most popular VR headsets on the entry level consumer market today. The headset is best known for its immersive VR experience and is widely used in the gamer community. The Vive requires an external computer to run the device, but has an option for a wireless connection to stream the display. While the headset is relatively light, it is front heavy and not known for its comfort. Similar to the Google Daydream design, switching between endoscopic and environmental view will be implemented with software and the existing Vive front camera. A hands-free gesture performed by the surgeon will switch the endoscopic stream to a live camera view of the environment. Once finished with an environmental view need, the surgeon may switch back to the endoscopic view with another hands-free gesture. With a live connection to a computer and numerous sensors integrated into the headset, this design has the ability to collect data on each operation for later analysis.

Design Spec:

- Price: $500
- System Requirements: HTC Vive headset, Vive to computer cable, computer, computer to endoscope cable
- Weight: 16.58 oz
- Development Environment: Unity game engine
- Connectivity: HDMI (video) and USB (data) and DCIN (power)

Advantages:

The strength of the HTC design lies in its immersiveness and ease of software development. The Vive is known as one of the best virtual reality experiences due to its display quality and isolation from external environment. When used in endoscopy, the Vive would be a notable improvement over conventional monitor displays, allowing for full attention of surgeon to be directed towards the procedure. Additionally, the Vive software can be developed using the popular Unity game engine. The Unity game engine has a strong user community and is known for being an easy to learn introductory engine. With a camera already included in the headset, no additional modifications would need to be made to the Vive in order to create a software solution to switch between environmental and endoscopic views.

Disadvantages:

The HTC Vive has an awkward weight distribution that may be uncomfortable to wear for long periods of time. Since the device may be worn for approximately ten hours, this discomfort could be a serious problem for the viability of the headset. Modification may have to be made in order to better distribute the weight of the device around the head.

Conclusions/action items:

The team will move forward with HTC Vive Design. The next step is to start developing the software that can switch between camera view and some external input.

10/9/2018 - Google Daydream and Google Nexus

▪ Sam Simon ▪ Oct 10, 2018 @02:11 PM CDT

Title: Google Daydream and Google Nexus

Date: 10/9/2018

Content by: Sam Simon

Present: Sam Schini, Tom Geissler, Sam Simon, Sam Peters, Josh Niesen, Jake Cohn

Goals: Overview the Dell Visor preliminary design

Content:

Market Description- The Google Daydream is a light improvement on its predecessor the Google Cardboard. It uses cheap but improved fabrics to provide comfort has well as head tracts to secure the headset comfortably on one's head. It weighs and estimates 620 g and costs approximately $300 at market if you factor in the cost of the phone (Google Nexus) needed to run the daydream software.

Solution to Endoscopic and Environmental View Transition- In order to provide a handsfree transition between views, our group will need to make some modifications. First, we will need to cut a whole in the fabric encasing the phone to allow the device to have an external facing camera. After doing so, the team must program the device over the google daydream software to use head motions to allow for a transition between the two views. This, in turn, would create a hands free transition. The downside in this process is the fact that the camera is not central on the headset and some visual offset would result.

Google Daydream Dimension

Necessary Modifications to Market Dell Visor- In order for this device to be functional, we would need to drill a whole in the front fabric for the phone's camera to peek through. We would also need to add a battery pack (placed in the back loop holster of the head straps) which is wired to the phone so that the battery life is substantial for a procedure. Finally, we would add additional fabric to assure a secure holding of the phone in the headset.

Design Specifications-

- Price: $280 ($220 Google Nexus Phone + $60 Headset)

- System Requirements: Android Mobile OS

- Weight: 605 g

- Development Environment: Google Daydream Software

- Connectivity: None

Advantages-

   One of the main advantages of this design will be that it has limited ear obstruction because there is only a singular horizontal elastic strap wrapping around the sides of a user's head. In the event that our client needs to hear something during an operation, nothing will be in the way to hinder his hearing ability. Another benefit of this design option is that there is already an existing community of programmers familiar with operation of Android systems, so software modifications will be coherent, and there is an abundance of resources if necessary.

Disadvantages-

Because this design contains multiple pieces (phone and headset), there is a possibility that use of this design in the operating room could be unsafe if loose parts become disassembled during a procedure. This is not likely with designed fasteners, but it is a possible disadvantage of the practicality of this design. There are also complications regarding the use of a phone as the display source and environmental view retriever. Within the headset, the Nexus will not provide as immersive of an experience as other design options with internal displays, and the environmental view could be skewed when viewed through the VR headset. This is due to the offset camera of the Google Nexus: it is on the upper corner of the phone, so either skewed to the right or left of Dr. Ahmed's vision field. Moreover, the transition from endoscopic view to environmental may provide a confusing and shifted perspective for Dr. Ahmed that depletes the practicality of this design.

Conclusions/action items: After making modifications to this headset, it could be considered a viable option to proceed with especially on account of its price in comparison to the others. However, our group is unfamiliar with the designing platform and much of the semester would be spent learning it. This design simply requires too much time in modifications to be useful.

10/10/18 Meeting with Kevin

▪ THOMAS GEISSLER ▪ Oct 10, 2018 @05:40 PM CDT

Title: Meeting with Kevin and Alex

Date: 10/10/18

Content by: Thomas Geissler

Present: Thomas Geissler and Sam Simon

Goals: Pick Kevin and Alex's brains regarding VR

Content:

Kevin is an assistant professor in the School of Human Ecology

Alex Speer is a grad student studying effects of VR

Kevin brought up a few challenges we might face:

- Converting Analog signal from endoscope to digital, assuming it is analog as there is less latency involved
- figuring out how to display the feed
- latency as a whole

Possible solutions:

- use a webcam to get a feed of the monitor, then use open cv to get the image you want
- zed mini can incorporate AR into the headset
- programs
    - unity - huge community
    - ffmpg - command line processing, very powerful, hard to use

Conclusions/action items:

Kevin and Alex are both extremely willing to help and will be great resources moving forward with this project. The first order of business is to find out if the endoscopic feed is in fact analog or digital. If it is analog, the next step will be to figure out how to convert it. If it is digital, we can move forward with how to display the image.

9/16/2018 Endoscopic Skull Based Surgery Principles

▪ THOMAS GEISSLER ▪ Sep 20, 2018 @12:52 PM CDT

Title: Endoscopic Skull Based Surgery: Principles of Endonasal Oncological Surgery

Date: 9/19/18

Content by: Thomas Geissler

Present: Thomas Geissler

Goals: Develop a basic understanding of endonasal skull based surgery principles

Content:

Link to Journal Publishing**:** https://onlinelibrary.wiley.com/doi/epdf/10.1002/jso.21020

Introduction:

1. introduction of endonasal endoscopic surgery has reduced morbidity rates and improved control of tumor removal

    1. Critics Cite:

        1. Doesn't adhere to oncological procedure -

            1. "An endonasal approach may actually decrease the risk of tumor seeding compared to an open approach since there is less transgression of uninvolved tissues and visualization of margins is improved"
        2. secondary concerns include visualization problems

            1. attempting to address with this project
2. entire ventral skull can now be accessed with endonasal procedures
3. endonasal skull base surgery is a team effort between multiple surgeons
4. complications:

    1. vascular injuries

        1. " Maintaining good visualization when there is arterial bleeding or brisk venous bleeding is essential to allow safe control of the hemorrhage."
    2. CSF leaks

Principles:

1. Need to choose the best corridor for pathalogy

    1. most direct access with least amount of disturbance of normal tissues
2. standard technique is outlined within the paper
3. Studies to prove effectiveness

    1. somewhat limited data but promising so far...
    2. all of the studies cited are listed in the paper as well.

Conclusions/action items:

There clearly is a concern about Visualization when conducting endonasal skull based surgeries within the neurosurgery community. Lack of good visualization could result in failure to react appropriately during a complication during surgery. Additionally insufficient visualization could directly result in complications as well such as hemorrhaging and CSF leaks.

Endoscopic Skull Base Surgery: Principles of Endonasal Oncological Surgery

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Endoscopic endonasal surgery can be applied to the management of benign and malignant sinonasal neoplasms with good results. For tumors that involve the skull base, an endoscopic "craniofacial resection" can be performed with en bloc excision of the involved dura. Preliminary experience with completely endoscopic excision of olfactory neuroblastomas indicates good local control and few complications. Advantages of endoscopic endonasal surgery include improved visualization and decreased morbidity compared to traditional approaches.
J. Surg. Oncol. 2008;97:658–664. © 2008 Wiley-Liss, Inc.

Key Words: cranial base; esthesioneuroblastoma; olfactory neuroblastoma; craniofacial resection

INTRODUCTION

The introduction of endoscopic technology has had a profound impact on the management of sinonasal tumors. Benign sinonasal tumors such as inverting papilloma and angiofibroma are ideally suited for endoscopic techniques. Published series have demonstrated that endoscopic excision of properly selected tumors is associated with improved local tumor control and decreased morbidity compared to standard open approaches [1–5]. Endoscopic examination of the surgical cavity also facilitates the postoperative surveillance of patients for recurrent disease prior to the onset of symptoms or radiographic evidence. The application of endonasal endoscopic techniques to the management of malignant sinonasal tumors has been more controversial [3–6]. The primary concern is adherence to oncological principles: en bloc excision with adequate margins. Secondary concerns include visualization, the ability to achieve hemostasis and deal with vascular complications, and reconstruction.

Over the last decade, there have been significant advances in the area of cranial base surgery with the application of endoscopic techniques for the management of both benign and malignant diseases of the cranial base [7]. These include an improved understanding of endoscopic anatomy, the development of new instrumentation, and the description of new endonasal surgical approaches and surgical techniques [8–10]. The entire ventral skull base can now be accessed using endonasal endoscopic techniques; sinonasal malignancies with skull base involvement can be excised without violation of oncological principles. Early results are promising and suggest that endonasal surgery can be safely performed with less morbidity and comparable oncological results.

SURGICAL PRINCIPLES OF ENDONASAL SKULL BASE SURGERY

The key concept of endonasal surgery is corridor surgery: choosing the surgical corridor that gives the best access to the pathology. The endoscope is simply an enabling technology that may be utilized in any surgical corridor. For many sinonasal tumors, the endonasal corridor provides the most direct access with the least manipulation and mobilization of normal tissues. For example, a tumor that is

situated superior or lateral to the optic nerve may be best approached using a transcranial approach. Conversely, a tumor that is situated medial to the cavernous internal carotid artery is most accessible using an endonasal approach. Contraindications to a complete endonasal approach include invasion of the orbit and involvement of superficial tissues. Tumors that cannot be completely excised using an endonasal approach may require an open approach or combination of approaches.

Endonasal skull base surgery is true team surgery. Rather than teams of surgeons operating sequentially, endonasal skull base surgery requires surgeons to operate simultaneously, one trained in visualization with the endoscope while the other dissects with two hands. Neither surgeon can accomplish the goals of surgery alone. The collaborative nature of the surgery fosters sharing of knowledge and techniques that exploit the strengths of both specialties. Benefits of working together as a team include improved access and visualization, increased surgical efficiency, improved problem-solving, and resolution of enthusiasm. Perhaps the strongest argument for a team of experienced surgeons working together is the ability to deal with a crisis such as a vascular injury. Maintaining good visualization when there is arterial bleeding is brisk venous bleeding is essential to achieve safe control of the hemorrhage.

The primary benefit of the endoscope is enhanced visualization. Due to the optical properties of the endoscope, there is no loss of light and "line-of-sight" problems are avoided. Angled endoscopes allow visualization around corners, minimizing displacement of normal tissues. Visualization during endonasal surgery is a very dynamic process with constant movement and adjustment of the position of the endoscope to provide the optimal view, avoid contact with dissecting instruments, and guide instruments through the nasal cavity. Although there is loss of true "3D" visualization with an endoscope, 3D visual cues are provided by the constant movement of the endoscope relative to the tissues and other instruments.

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Snyderman_et_al-2008-Journal_of_Surgical_Oncology_1_.pdf(517.2 KB) - download

10/7/18 Surgical Symptoms, Strain, and Selections

▪ THOMAS GEISSLER ▪ Oct 07, 2018 @04:25 PM CDT

Title: **Surgical Symptoms, Strain and Selections**

Date: 10/7/18

Content by: Thomas Geissler

Present: Thomas Geissler

Goals: Get a background in the physical stresses of conducting a surgery

Content:

link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5832650/

This paper was a systematic review and meta-analysis of surgical ergonomics. 5152 surgeon surveys were included. Since our product will be head wearable, I was more interested in vertebral and spinal injuries than I was in appendicular injuries such as carpal tunnel. The report found that 48% of surgeons experienced neck pain, and 50% experienced back pain. Pain was more frequent in surgeons who were conducting MIS or minimally invasive surgery than it was in surgeons conduction open surgeries. This is worth noting as endoscopic surgeries are considered minimally invasive surgeries.

Conclusions/action items:

This issue is relevant to our project as it is something to keep in mind when designing our device. The weight of our product should be minimized to decrease any potential risk of injury due to the weight. Not only the weight of the product, but the distribution of the weight will be important.

9/20/18 HTC Vive

▪ THOMAS GEISSLER ▪ Sep 20, 2018 @08:20 PM CDT

Title: HTC Vive

Date: 9/20/18

Content by: Thomas Geissler

Present: Thomas Geissler

Goals: Determine Specifications of HTC Vive

Content:

Price: 499 for standard and even more for pro version

Operation: requires connection to a pc

Resolution: 1080 x 1200 pixels per eye (2160 x 1200 pixels combined)

Refresh rate: 90 Hz

Additional Specs:

1. front facing camera
2. eye relief adjustments
3. adjustable headstrap with interchangeable parts
4. fits over most glasses

Conclusions/action items:

This headset seems like it has alot of accesory features that are not relevant to the project such as the room visualization specifications. The camera on the front has some cool applications for our project however. The resolution of the screen is very good as well which is important for the surgeon when visualizing internal structures

9/20/18 Oculus Rift

Title: Oculus Rift

Date: 9/20/18

Content by: Thomas Geissler

Present: Thomas Geissler

Goals: Learn the specifications of the Oculus Rift

Content:

link: https://www.oculus.com

Cost: 399

mobility: needs a computer to operate

graphics: 1080/1200

additional specifications:

refresh rate: 90 Hz

1. No forward facing cameras on the oculus rift
2. Accelerometer
3. gyroscope
4. magnetometer
5. Constellation tracking camera
6. Comes with a stand alone version as well

Conclusions/action items:

The Rift has about the same camera and specifications for a cheaper price than the vive. However, it does not have a forward facing camera built in. This is problematic as that mean physical modifications would have to be made to produce the environmental image.

9/20/18 Google Daydream

• THOMAS GEISSLER • Sep 20, 2018 @08:36 PM CDT

Title: Google Daydream

Date: 9/20/18

Content by: Thomas Geissler

Present: Thomas Geissler

Goals: Learn the specifications of the Google Daydream

Content:

Price: $99 for normal, 400 for standalone

Mobility: Comes as a stand alone or with a google phone as the processor

Resolution: 1080 x 1920

weight: .58 lbs

Additional Specifications:

1. Comes with an adjustable headset

Conclusions/action items:

Price wise the google daydream is about the same as the rift and the vive in when you consider either the standalone or having to buy a phone as the processor. Overall the reviews were not as good for this product as the others, and it does not come with a forward facing camera, or attachment for video input.

10/7/18 VR in GI endoscopy

▪ THOMAS GEISSLER ▪ Oct 07, 2018 @04:07 PM CDT

Title: VR in GI endoscopy

Date: 10/7/18

Content by: Thomas Geissler

Present: Thomas Geissler

Goals: Learn about VR integration into GI endoscopy with Intuitive zoom

Content:

link: https://gut.bmj.com/content/early/2018/09/18/gutjnl-2018-317058

Summary:

Dr. Alexander Hann and other researchers as part of the department of internal medicine at Ulm University in Germany developed a system that can magnify an endoscopic image based on head tilt. They also showed that it is possible to integrate VR into the daily routine of endoscopic procedures without impedance. They used an HTC Vive along with the Vive tracker attachment, and an endoscopic training model from Erler Zimmer for ex vivo simulations to identify polyps. One other cool thing they did was to convert 2D images to 3D images based on light intensity.

Conclusions/action items:

This publication adds validity for us using VR for live endoscopic procedures. We could possibly use head tilt as they did to switch between the operative and environmental views. However, I think this could be done using internal gyroscope or accelerometers instead of using the Vive tracker attachment. The tracker attachment requires external sensors placed around the room that could be impeded by the normal surgical procedure.

10/7/18 Green Pass Certification

Title: Green Pass Certification

Date: 10/7/18

Content by: Thomas Geissler

Present: Thomas Geissler

Goals:

Content:

Attached is a picture of my green card along with all of the upgrades I have recieved. I have both the CNC 1 and CNC 11 upgrades.

Conclusions/action items:

The next step is to get my 3-D printing certification from the makerspace. This could potentially be useful for this projet as well as future projects in bme.
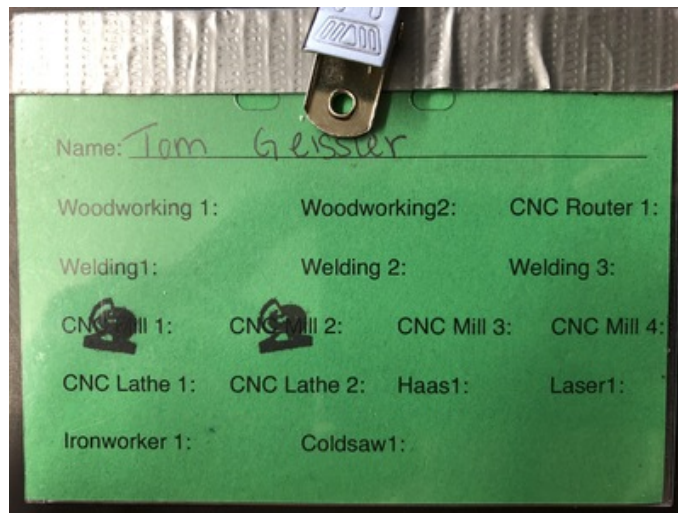
IMG_1644.JPG(3.3 MB) - download Greencard (with upgrades)
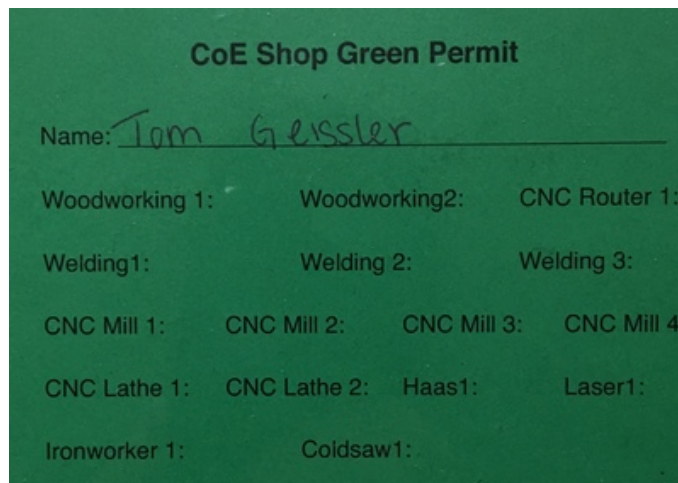
IMG_0457.JPG(879.3 KB) - download Greencard

Codes and Standards

Title: Codes and Standards

Date: 9/21/18

Content by: Thomas Geissler

Present: Thomas Geissler

Goals: Learn about Codes and Standards

Content:

Why Use:

1. Simplifies callouts and drawings
2. more control over purchasing and design

Types of Standards:

1. Consensus - agreed to by common consensus
2. Defacto - developed by the marketplace
3. government

* ANSI doesn't write standards, sole representative in ISO

International Standards

1. Ensure quality, safety compatibility
2. facilitate trade
3. climate change and energy

Resources to find standards:

1. assits.dap.dla.mil
2. http://www.nssn.org

Conclusions/action items:

Standards are a hassle, but also very important and can simplify things across the board. Pay attention to them and use the resources provided to help find them.

Leadership Styles

Title: Leadership Styles

Date: 9/21/18

Content by: Thomas Geissler

Present: Thomas Geissler

Goals: Learn about Leadership Styles

Content:

Great Person Theory:

1. Leaders possess special traits which set them apart from others, and that these traits are responsible for their position of power and authority
2. Fails to mention that leaders can be made over time

People follow leaders because they like or they admire them

*many types of leadership styles and many different scenarios where these leadership styles will work

Tips:

1. Build Trust and inspire teamwork
2. concentrate on expanding team capabilities
3. create a team identity
4. make the most of team differences
5. forsee and influence change

Conclusions/action items:

There are many different ways to be a leader and many situations where being a leader means different things. Bottom line is a leader must find a balance between them all and figure out what works best for his or her team.

Building and Maintaining Teams

▪ THOMAS GEISSLER ▪ Sep 21, 2018 @12:21 PM CDT

Title: Building and Maintaining Teams

Date: 9/21/18

Content by: Thomas Geissler

Present: Thomas Geissler

Goals: Learn about Building and Maintaining Teams

Content:

Companies value teamwork for competitive advantage:

1. jobs are complex and dynamic
2. even within academics teamwork is becoming increasingly vital

Functional Groups:

1. Concentrate on what you can change i.e. not team members personalities
2. roles and norms is important

Communication:

1. use simple clear language
2. be an active listener

Decision making:

1. be open
2. break into small groups

Conflict:

1. Sometimes good
2. start with what you agree on

Conclusions/action items:

Having good teamwork is important in ensuring productivity of the team as a whole. These are all tips to keep in mind.

9/11/18 - VR Structural Design and Ergonomics

▪ Sam Simon ▪ Oct 10, 2018 @01:54 PM CDT

Title: VR Structural Design and Ergonomics

Date: 9/11/2018

Content by: Sam Simon

Present: Sam

Goals: To research the design considerations that should be taken into account when developing a VR headset to fit the head and facial structures of almost any user.

Content:

https://www.roadtovr.com/nonobject-designers-dream-up-new-vr-headset-ergonomics-input/

"Designers Prototype New Approaches to VR Headset Ergonomics and Input"

- Most common types of VR headset support:
    - 1.) Side and top strap approach
        - Pros: Simplistic, materials are cheap
        - Cons: Discomfort, pressure on forehead
        - This design disperses wait across the head to limit the front-pulling of the face, which is often a limitation for heavy designs and could cause neck strain on the surgeon
    - 2.) Halo approach
        - Pros/Cons: Similar to the first
        - Instead of flexible fabrics, the halo design uses a hard metal "halo" which encircles the head
        - This design is seen on the Dell Visor (See Team Activities > Design Process > Design Ideas > Dell Visor)
        - This design does not offer as comfortable as the first and the halo is "awkward" and does not always fit each head the same
- Suggested alterations to the VR headset support system:
    - 1. Integration of the headset with a "baseball cap" netting that covers the whole head
        - Pros: distributes the weight of the headset, comfortable to wear
        - Cons: odd look, difficult to remove, may pull forward on face, not appropriate for hospital setting
    - 2. Split system, functioning similar to reading glasses which splits down the middle and may be removed and reattached around the neck
        - Pros: ease of removal
        - Cons: Would interfere with internal components of headset, magnets would be most likely, probably more expensive to work around

---

Conclusions/action items:

It has become apparent that our group will need to consider weight distribution when determining a headset to use. Most designs offer a make that has its weight located mainly in the front box (400-900 g) which can cause lots of strain on the neck and back when used for extended periods. To combat this issue, our group should consider suspension systems or other modes of dispersing weight over the head.

9/20/18 - BNC Connections and Bluetooth Connectivity

Title: BNC Connectors and Bluetooth Connectivity

Date: 9/20/18

Content by: Sam Simon

Present: Sam Simon

Goals: To discover a method that will allow our headset to be wireless via bluetooth connections

Content:

- Case: Our client has expressed his interest in having a completely wireless headset as to not impede his movement during surgeries. To accomplish this task, he suggested the use of bl

https://www.iitk.ac.in/ibc/BNC.pdf

- The Bayonnet-Neill Concelman (BNC) cord is essentially a quick-connect coaxial cable
- IN essence, the cable is a simple coaxial input; the only difference between this cords and others like it is the present of this strange connection. Numerous adaptors exist to change a BN
- The mechanism functions by simply twisting the cord notches into place. One connected contains a build with can be twisted into the slots of th either for a quick secure fit

-
    - most commonly made in 50 or 75 ohm versions
        - BNC connectors work via male and female connectors, and simple twist mechanisms allow them to cinch together

    New Egg Offers Bluetooth adaptors on a small level that can be directly attached to these wires and allow the information to be stemmed to our headset should it have a bluetc

    https://ad.doubleclick.net/ddm/clk/283712203;110538935;y;u=ds&sv1=34827382211&sv2=3075100329706001&sv3=4757020281518730144&gclid=Cj0KCQjwrZLdBRCmARI
    Item=9SIA2763PV7697&ignorebbr=1&nm_mc=KNC-GoogleMKP-PC&cm_mmc=KNC-GoogleMKP-PC-_-pla-_-DLP+Replacement+Lamps-_-9SIA2763PV7697&gclid=Cj0KCQ

    Adafruit offers bluetooth receivers on a micro scale that can be easily implanted into our device and connected to our raspberry pi to output the image to a screen.

Conclusions/action items:

The process will take a lot of finicking, but it seems that connecting coaxial cables to bluetooth is a relatively simple process that can easily be integrated with the raspberry pi to achieve our wire

9/25/18 - Conversion of 2D Video into Lifestream VR

▪ Sam Simon ▪ Sep 28, 2018 @11:52 AM CDT

Title: Conversion of 2d Video into Lifestream VR

Date: 9/25/18

Content by: Sam Simon

Present: Sam Simon

Goals: Identify softwares which can can upload onto a raspberry pi or the headset in order to convert the 2d input from the coaxial cable into the VR which can be output into the headset.

Content:

https://pdfs.semanticscholar.org/7663/0ed95526a03b8150f820b359584d12bd60d5.pdf

- Switching from a 2D image to VR posses several problems:
  - In order for the image and resolution and latency to be fluid for the brain, it requires many more pixels than currently exist in the best monitors
  - higher resolution must be shown at lower latency to preserve continuity of the image
    - Latency is described as the time between when the head is moved, and when the image is altered to reflect the change in head position
  - The Field of View (Fov) of the individual must be considered should the product use a 360 degree turn table.

For a single eye	PPD	Horizontal FoV°	Horizontel Kpixels	Vertical FoV°	Vertical Kpixels	Total Mpixels
Full FoV Resolution	60	160	9.6	175	10.5	100.8
Stereo FoV Resolution	60	120	7.2	135	8.1	58.32

Chart 1: Virtual reality rendering requirements

- This table specifies the number of pixels required in the vertical and horizontal direction to achieve the resolution we desire

http://www.pavtube.com/best-vr-video-converter.html

- There are a plentiful number of 2d Video to VR video converters that exist, but all require the video to be a recording and cannot convert the stream at the time of the transformation
- The table below describes the types of video files that can be downloaded to each type of headset
- Being able to lifestream video from 2D into VR is a costly procedure and may exceed out budget

Name	PlayStation VR	HTC Vive	Oculus Rift	Samsung Gear VR	Daydream View
Resolution	960 by 1,080 (per eye)	1,080 by 1,200 (per eye)	1,080 by 1,200 (per eye)	2,560 by 1,440	Dependent on phone
2D Format Supported	MP4	MP4	MKV, MP4, AVI, WMV	MP4, AVI, and FLV	MP4
3D Format Supported	360 degree Video (SBS if VR player are installed)	3D SBS/360 degree Video	3D SBS/360 degree Video	3D SBS/360 degree Video	3D SBS/360 degree Video
Field of View (degrees)	100	110	110	Not specified	Not specified

Conclusions/action items:

In order to offer our customer the most immersive experience, it is necessary that our product ditches the 2D field offered by existing competitors and existing monitors and transform the video feed into a VR output that can be projected within our headset. Many software currently exist but require the video to be a recording like a movie that is

uploaded and takes time. This is not a possibility for this project as the client requires that the video be updated nearly immediately in the headset without lag or the patient will be at great risk.

9/11/18 - Google Cardboard

Title: Google Cardboard

Date: 9/11/2018

Content by: Sam Simon

Present: Sam

Goals: Discuss the design features present in the google cardboard that we can burrow and consider in our own project.

Content:

The Google Cardboard product was designed cheaply to make it commercially available to all users and to allow greater access to VR. The design consists of cardboard, plastic, and magnets, hook-and-loop fasteners like Velcro and is supported by a single elastic strap around the users head.

https://www.technavio.com/blog/the-pros-and-cons-of-google-cardboard

"The Pros and Cons of Google Cardboard"

- Pros:
    - Low Cost Materials (Shell is cardboard, lenses are plastic, and the magnets are cheap) making it not exempt market price fluctuations
    - Simple construction and ease of use
    - Materials are disposable at a cheap price
        - The capability of having exposed, disposable parts could but useful in the operating room setting to avoid infection and contamination of materials
- Cons:
    - Very cheap feel
    - All compartments are open air, allowing fluid and contaminating gases to enter the area of the electronics
    - No padding or comfort for the user
    - Cheap design makes the user prone to getting headaches from the poor quality of applications
        - Undesirable for surgeries that could take numerous hours to complete

https://www.thingiverse.com/thing:729029/files

Conclusions/action items:

Although the google cardboard is cheap and obviously would not be the ideal model for the hospital setting, it does has some unique factors that we may want to factor into our final design. For example, it uses lightweight materials to reduce wear on the users, cheap materials to make it accessible to wider fan base, and could be deemed recyclable and disposable for sterility reasons. This design has been updated to the Google Daydream which provides more comfort and luxury with higher quality materials.

9/24/2018 - Google Daydream and Equivalents

▪ Sam Simon ▪ Oct 10, 2018 @01:57 PM CDT

Title: VR Software **-** Google Daydream and Equivalents

Date: 9/24/2018

Content by: Sam Simon

Present: Sam Simon

Goals: To look into existing softwares which will allow us to modify video into a version that is compatible with some form of screen and develop a seamless VR image.

Content:

- Google Daydream
    - Limited functionality to only project images on smartphones (cannot alter and send video feed to higher end headsets such as the Vive Pro)
    - Designed to make VR creation an easy more accessible process to users
    - Development is simple and can immediately project the video onto a sphere similar to other equivalents
        - The program offers the ability to change rendering, resolution, and highlight specific nodes in the image to make it more seamless and avoid use nausea
- Unity/UnrealSDK (https://medium.freecodecamp.org/how-to-make-a-360-vr-app-with-unity-51cbe41ad8f1)
    - Uses the gyroscope and camera capabilities of your smartphone to sense head movements
    - Can be downloaded and easily installed as an app
    - Takes a 360 degree video and projects it onto the inside of a "sphere" which the viewer can look around and explore
        - Could be problematic as it requires us to turn our rectangular 2D image into a 260 degree image first
    - Runs on Android
    - Unity is also considered to be compatible with higher end headsets such as the Vive Pro and Oculus Rift
    - https://unity3d.com/learn/tutorials/topics/xr/getting-started-vr-development
        - Describes a step-by-step process towards developing VR video on Unity's program

---

Conclusions/action items:

What software we use will largely depend on what form of headset we look to pursue. Although Google Platform would be the easiest to install and use, it is unlikely we will be using a phone in the final design. Instead, it might be more important to develop some familiarity with Unity which is more applicable on devices such as the raspberry pi.

9/21/18 - FDA Regulation and 501(k)

▪ Sam Simon ▪ Sep 21, 2018 @12:08 PM CDT

Title: FDA Regulation

Date: 9/19/18

Content by: Sam Simon

Goals: To identify that safety restrictions, testing, and credentials required of a bone graft to surpass FDA approval.

Content:

- **CLASSIFICATION** [Simon - 2] <mark>[Ong, Joo L., and Teja Guda. *Translating Biomaterials for Bone Graft Bench-Top to Clinical Applications*. CRC Press, 2016.]</mark>
    - classification of a medical device varies based on the risk of said device
        - risk will vary based on
            - i. intended purpose
                - devices are more risky the longer they are intended to be in contact with the body
                - risk increases with the invasiveness of the device
                - risk involved with delivering medicine or energy to the patient
            - ii. effectiveness of risk management
            - iii.intended users
            - iv. technology
    - <mark><u>Surgical VR Headsets or Monitoring Devices</u></mark> are typically classified as Class I medical devices as they pose to injury or interaction with the patients body
- ***What is the difference between a Class II and Class III Device?:*** [Simon - 6] <mark>[Center for Devices and Radiological Health. "Classify Your Medical Device." *U S Food and Drug Administration Home Page*, Center for Devices and Radiological Health, www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/Overview/Cla- -ssifyYourDevice/ucm2005371.htm [Accessed: 13 February 2018].]</mark>
    - Class II devices are typically:
        - in short term use
        - do not remain in the body
        - do not administer medicinal materials
        - moderate-low risk
        - require general labeling, sterilization, and testing requirements
    - Class III devices are typically:
        - use long-term in the body or remain in the body
        - are absorbed by the body or administer a medicinal substance
        - are made from the incorporation of animal or human tissue cells
        - require all normal general requirements and additional clinical and scientific testing and, even more, premarket approval

- **STEPS REQUIRED FOR THE PASSAGE OF A CLASS III MEDICAL DEVICE** [Simon - 7] <mark>[Center for Devices and Radiological Health. "Premarket Notification 510(k)." *U S Food and Drug Administration Home Page*, Center for Devices and Radiological Health, www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/HowtoMarketYourDevice/PremarketSubmissions/PremarketNotification510k/default.htm. [Accessed: 2/ February 2018].]</mark>
- FDA Requirements for Passage of Class III Devices:
    - 510(k)
        - required for all devices that are being introduced to the commercial market for the first time
        - demonstration that the device intended for market is as safe and effective as devices currently in that market
        - must state a similar device and show the improvements or similarities that exist
            - any legally marked device may be used as a comparator
        - the device is cleared if:
            - it has the same intended use and technological characteristics as the comparator
            - OR it has the same use, and may have different technology so long as it does not raise safety concerns and clearly demonstrates its safety and effectiveness
    - clinical testing
    - labeling
        - package labeling must explain all product components
    - sterilization and shelf life testing
    - biocompatibility testing
        - passage of the ISO 10993
        - must prove the viral inactivity of any human/animal biomaterials present in the component
    - performance testing in vivo
        - any item with the intention to be implanted must have undergone intensive paperwork it ensure its safety in its intended function

References:

- [Simon - 2] Ong, Joo L., and Teja Guda. *Translating Biomaterials for Bone Graft Bench-Top to Clinical Applications*. CRC Press, 2016.
- [Simon - 6] Center for Devices and Radiological Health. "Classify Your Medical Device." *U S Food and Drug Administration Home Page*, Center for Devices and Radiological Health, www.fda.gov/MedicalDevices/DeviceRegulationandGuida nce/Overview/Cla- -ssifyYourDevice/ucm2005371.htm [Accessed: 13 February 2018].
- [Simon - 7] Center for Devices and Radiological Health. "Premarket Notification 510(k)." *U S Food and Drug Administration Home Page*, Center for Devices and Radiological Health, www.fda.gov/MedicalDevices/DeviceRegulationand Guidance/HowtoMarketYourDevice/PremarketSubmissions/PremarketNotification510k/default.htm. [Accessed: 2/ February 2018].

Conclusions/action items:

The product we intend to create has clearly set regulations that more lenient than other, most risky medical devices. In order to appease our client, it is of the utmost necessity that we abide by the rules laid out in the ISO 10993 and similar legislature so that it will be made easier to bring our product to market when the time comes. As with any business hoping to market a product, it is important to keep risk management in mind when creating this product.

9/25/2018 - Engineering Standards and the Design Process

▪ Sam Simon ▪ Oct 10, 2018 @12:49 PM CDT

Title: Engineering Standards and the Design Process

Date: 9/25/2018

Content by: Sam Simon

Present: Sam Simon

Goals: Briefly review the steps and procedures our group should take when designing out product.

Content:

Standards and Why We Have Them

- Standards allow us to make sure we follow steps to ensure the quality and base knowledge to develop a product
- Assures we approach each problem from a position that will ensure success
- Standard - essentially a formal, expected manner of assuring quality in the way a group approaches a problem
- Limits costs by establishing a set and effective system of product design
- Types of Standards:
    - Consensus - Formally established
    - Defect - Establish or expected by the marketplace
    - Government - put into action via law and regulations

Who Generated Standards and What are they

- Created by the IEEE board.
- American National Standards Institute (ANSI) Assures functional process taken place in America, however, ANSI is also a member of the International Standards Board which assures trace, quality, and safety are possible across international boarders
- Standards require the tracking of dimensions, and factor of safety in the final design

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Conclusions/action items:

This presentation loosely defined standard in the broad engineering design context. It will be a useful resource as far as knowing the organizations in charge of making standards. We can go to their websites to determine how our project is impacted.

9/25/2018 - Leadership Styles

Title: Leadership Styles

Date: 9/25/2018

Content by: Sam Simon

Present: Sam Simon

Goals: As a junior and leader in that sense, I'd like to glean some information as to how I can be a helpful role model for the sophomores of our group.

Content:

What is a Leader

- Leadership involve motivating, aspiring, and teaching people through compassion and persistence rather than by demanding work out of peers
- Although I do not have the role "Team Leader", I still offer valuable input as a role model and should treat my position as such
- Leaders:
    - Establish attainable goals
    - Check in to make sure members are progressing towards those goals
    - Aid in reaching such goals
- Numerous traits are more associated with leadership then others: drive, integrity, self-confidence, creativity, and flexibility
    - Flexibility is important so as to avoid being a dictator over those in need of help
    - The Great Person theory suggests that we may learn these traits and practice them (do not have to be born a leader, per say)
- There should not be a tradeoff between production and concern for individuals, although some leaders treat it that way

Conclusions/action items:

Although broad and brief, this presentation brought to light some key behaviors that could benefit this team. While Dr. Chesler provided a list of positive characteristics of a leadership, I will attempt to put those characteristics into action to help our team moving forward.

9/25/18 - Teamwork

▪ Sam Simon ▪ Oct 10, 2018 @01:09 PM CDT

Title: Teamwork

Date: 9/25/2018

Content by: Sam Simon

Present: Sam Simon

Goals: Discuss ways to improve our team fluidity and make us a more function unit.

Content:

Reasons to develop good teamwork:

- Great teamwork and comfort with other members allows the team to be more efficient and effective
- Better communication allows for us to make better decisions
- Betters designs result from teams that can resolve conflict and find a middle ground

To develop an effective group, we need to:

- Establish clear roles and goals for each member
- Assure everyone is on time and completing their assigned duties
- Assure those with wisdom and experience as disseminating that wisdom to the other members.

Responsibilities of a team leader and members:

- Make expectations clear and limit distractions or unessesary uses of time that may limit progress
- Collaborate on large tasks and ask other members for assistance in reviewing progress
- Give and accept feedback
- Consistently questions whether your team is being the most productive it can be, and find reasons it might be lacking in one way or another

Three important examples of communication styles:

1. Magistrate - says what's on his mind and argues with force
2. Candidate - Analytic and chatty, but listens well
3. Senator - Moves between both styles
- Everyone is a mix of these styles and must learn to borrow the best aspects of each

Conclusions/action items:

Some of this presentation was a restatement of the information we learned in the leadership presentation, and also offered a list of viable characteristics that we should practice as a leader. More than anything, moving forward, I think it is important to promote an open workplace where members can share ideas and provide reliable yet critical feedback on ideas.

10/7/18 - Green Pass Certification

• Sam Simon • Oct 10, 2018 @12:34 PM CDT

Title: Green Pass Certification

Date: 10/7/18

Content by: Sam Simon

Present: Sam Simon

Goals:

Content:

The photos provided show my green pass certification.

Conclusions/action items:

Seeing as how we may need to develop plastic and structural pieces for this project, it make be useful to go to the Makerspace and gain familiarity with their 3D printing services.

• Sam Simon • Oct 10, 2018 @12:35 PM CDT

Screen_Shot_2018-10-10_at_12.33.13_PM.png(2.7 MB) - download

• Sam Simon • Oct 10, 2018 @12:35 PM CDT

Screen_Shot_2018-10-10_at_12.33.01_PM.png(2.3 MB) - download

9/18/18 - Current VR Headsets

▪ SAMUEL PETERS ▪ Sep 21, 2018 @10:30 AM CDT

Title: Current VR Headsets

Date: 9/18/18

Content by: Sam Peters

Present: Sam Peters

Goals: Explore the current VR headsets on the market today.

Content:

Source: https://store.google.com/us/product/google_daydream_view

Title: Google Daydream View $100

- Headset to place a google phone into
- Comes with a motion sensing controller
- Stylish and comfy
- Use Daydream software

https://www.oculus.com/rift/#oui-csl-rift-games=mages-tale

Title: Occulus Rift $500:

- Takes HDMI
- Comes with two hand controllers and IR sensors that could be placed around the room
- Needs to be powered by a computer $850
- No camera on front, would need clever way of seeing surroundings

https://www.lenovo.com/us/en/virtual-reality-and-smart-devices/virtual-and-augmented-reality/lenovo-mirage-solo/Mirage-Solo/p/ZZIRZRHVR01

Title: Mirage Solo $400

- Standalone
- Cameras on the front(not sure if they're usable)
- Runs on google Daydream
- Heavy and not very comfortable
- Able to store 256G of data with SD chip

https://www.vive.com/us/product/vive-virtual-reality-system/

Title: HTC Vive $500

- Front facing camera
- Tons of connection possibilities
- Internal sensor
- Would require computer but has $300 option for wireless

Conclusions/action items:

There are multiple VR headset options available. I will talk to the Makerspace to see if they have these options.

9/21/18 - VR Software

▪ SAMUEL PETERS ▪ Sep 21, 2018 @11:29 AM CDT

Title: VR Software

Date: 9/21/18

Content by: Sam Peters

Present: Sam Peters

Goals: Identify different software options and their strengths and weaknesses.

Content:

https://en.wikipedia.org/wiki/Google_Daydream

Title: Daydream Platform

- Google Daydream is Google's follow up to cardboard
- It is compatible with the Android platform and Mirage solo
- Would easily move over to other devices

https://developers.google.com/vr/develop/android/get-started

Title: Google SDK for Android

- Google provides an SDK for coding Daydream VR on the Android platform
- There are example tutorials from Google
- Android platform is mainstream

https://thinkmobiles.com/blog/best-vr-sdk/

Title: Best VR for HTC Vive

- OpenVR SDK by Valve is an API and a runtime environment with great samples. It supports multiple VR hardware and applications don't have to be vendor specific. The runtime is of SteamVR.
- SteamVR SDK lets developers create single interfaces that will work on different VR headsets, including HTC Vive. Moreover, it gives access to controllers, chaperoning, models and it also allows content preview in Unity play mode.
- VRTK, or Virtual Reality Tool Kit, appears to be a collection of handy scripts for VR applications. It works in Unity3d engine.

Conclusions/action items:

I will talk to the Makerspace to see what resources they have.

10/7/18 - Game Engine Research

▪ SAMUEL PETERS ▪ Oct 10, 2018 @12:47 AM CDT

Title: Game Engine Research

Date: 10/7/18

Content by: Sam Peters

Present: Sam Peters

Goals: Understand what a game engine is to get a mental map of how to use Unity.

Content:

Source: https://www.youtube.com/watch?v=DKrdLKetBZE

Title: How Game Engines Work

- A game engine is a framework for making games that includes repetitive elements found in many different games
- It is not the most space efficient and it is not optimized for speed, but it allows for rapid development of new games with less coding needed
- Unity is one such game engine that has a large user community and is a good starting entry level game engine
- Unity is one of the most popular game engines for creating VR applications

Conclusions/action items:

I now have an understanding of what a game engine is, and I will download the Unity game engine and begin exploring it.

10/7/18 - Unity

▪ SAMUEL PETERS ▪ Oct 10, 2018 @12:53 PM CDT

Title: Unity

Date: 10/7/18

Content by: Sam Peters

Present: Sam Peters

Goals: Learn more about the specific game engine Unity.

Content:

- Unity is a game engine that allows for publishing to multiple platforms
- The platform that we are interested in publishing to is Steam VR, which is the app store for the HTC Vive
- There are many resources on Youtube for creating your first projects with Unity and below are some of the videos
- I followed along on the Making a 2D Game in Unity. While we are not trying to make a 2D game, we are focusing on a non moving platform for VR that is 2D representation of the endoscopy and surrounding environment

Source: https://www.youtube.com/watch?v=on9nwbZngyw

Title: How to Make a 2D Game in Unity

Conclusions/action items:

- Installed Unity and tinkered around on it

9/19/18 - Video Lessons

▪ SAMUEL PETERS ▪ Sep 19, 2018 @08:20 PM CDT

Title: BME Video Trainings

Date: 9/19/2018

Content by: Sam Peters

Present: Sam Peters

Goals: Summarize video learnings.

Content:

Codes and Standards:

- Standards could be used for: legal necessity, simplification, consensus in the design community, taking advantage of already well design items
- Standard = written description of a product, process, test, or procedure formaly agreed to
- Standard types: consensus, defacto, government
- Standards can be difficult to find but there are many resources available

Leadership Styles:

- Leadership = process where one individual influences group members towards attaining defined goals
- Great Person theory focuses on who people are however it may be more important to focus on leadership traits
- Many different leadership styles: permissive autocrat, directive autocrat
- Matrix of concern for production and people highlights different priorities of leaders

Teamwork:

- Present in life no matter what career or activity
- Superstars don't neccessarily make for a good team dynamic
- Functional groups concentrate on what they can change
- Effective groups have norms for what is acceptable in the teamwork setting
- Effective listening is essential in a group setting
- Conflict can be beneficial when handled with grace and an open mind

Conclusions/action items:

These videos have given a good idea of leadership considerations for the semester. Additionally, it will be important for our group to research and act on existing standards relating to VR.

9/19/2018 - Operation Related Injuries/Strain for Surgeons

▪ Sam Schini ▪ Sep 19, 2018 @11:15 PM CDT

Title: Operation Related Injuries/Strain Symptoms of Practicing Surgeons

Date: 9/19/2018

Content by: Sam Schini

Present: Sam Schini

Goals: Examine the current statistical figures of strain felt by surgeons in order to better understand the effectiveness of a potential VR headset's ergonomics.

Content:

Source citation: C.-C. H. Stucky et al. 2018, "Peer review report 1 on 'Surgeon symptoms, strain, and selections: Systematic review and meta-analysis of surgical ergonomics,'" *Annals of Medicine and Surgery,* vol. 25, p. 19, Jan. 2018.

or

Source: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5832650/

In this meta-analysis study, the strains associated with surgical practices are highlighted. The data was compiled from the surveying of a multitude of different types of surgeons (including neurosurgeons). The relevant data found was that 26% of surgeons report eye strain as a result of prolonged procedures and 48% report neck pain. These areas are the most likely to be impacted by the use of a VR headset during a surgical procedure, and in order to progress in introducing an ergonomic headset into practice, these figures should not be surpassed. The rationale for looking at this study is that if the VR headset is implemented, and surgeons who use it are surveyed, the proportion that report neck/eye strain should not exceed these figures, otherwise the VR headset is not executing set ergonomic standards.

9/19/2018 - Latency "Standards" to Avoid Lag

▪ Sam Schini ▪ Sep 19, 2018 @11:26 PM CDT

Title: Latency Standards that Display Noticeable Lag to Humans

Date: 9/19/2018

Content by: Sam Schini

Present: Sam Schini

Goals: Examine quantitative figures associated with noticeable media lag that could effect a surgical operation.

Content:

Source citation: C. Team, "Cloud Gaming and the Latency Obstacle – cryptonomos – Medium," *Medium*, 24-Nov-2017. [Online]. Available: https://medium.com/cryptonomos/cloud-gaming-and-the-latency-obstacle-98178f983fc6. [Accessed: 19-Sep-2018].

or

Source: https://medium.com/cryptonomos/cloud-gaming-and-the-latency-obstacle-98178f983fc6

This article discussed the variations in latency throughout the online gaming world, and their effects on perceived lag. Although this is a different industry than surgical practice, the latency measurements discussed (20ms - 40ms) do apply to the connections between media inputs and outputs when using cameras and monitors in surgical procedures. Furthermore, this is a quantitative baseline standard that our group should shoot for in order to minimize any lag between a VR headset display and camera intake.

9/23/2018 ZED Mini: Front-Facing Camera

▪ Sam Schini ▪ Sep 23, 2018 @11:04 PM CDT

Title: ZED Mini

Date: 9/23/2018

Content by: Sam Schini

Present: Sam Schini

Goals: Further understand the current market of VR front facing camera attachments

Content:

Source- https://www.stereolabs.com/zed-mini/

- The ZED Mini is a camera attachment for the Oculus Rift or the HTC Vive
    - The camera attachment captures high-resolution stereo video (2560x720)
    - Wide-angle dual lenses grant realistic depth perception (0.5-40ft)
    - Utilizes USB 3.0 Type-C port connector
    - Only weighs 0.14 lbs
    - Compatible with Windows and Linux
- Purpose of the ZED
    - Captures mixed reality via adding augmented reality to a normal environment through front-facing camera
- Surgical Issues
    - Not too practical for surgical operation unless surgeon is interested in an immersive augmented reality experience
    - Not available until December 2018
- Potential Uses
    - Could be coupled with a VR headset receiving input from a different camera to provide front-facing view of an environment at the command of a user (not current purpose)
- Cost
    - $450

Conclusions/action items: The ZED mini would not be of practical use for this design project unless it could be paired with a VR system and simply be used as a front-facing camera.

9/26/2018 Visit to Makerspace

▪ Sam Schini ▪ Sep 26, 2018 @11:19 PM CDT

▪ Sam Schini ▪ Sep 26, 2018 @11:31 PM CDT

Title: Evaluation of different VR headset models available at the Makerspace

Date: 9/26/2018

Content by: Sam Schini

Present: Sam Schini and Jake Cohn

Goals: To determine which headset models are the most ergonomic and feasible to wear for the duration of surgery

Content:

HTC VIVE-

- Pros
    - 100% immersion into headset without any environmental interference
    - Very sturdy, versatile, and adjustable suspension
- Cons
    - Weighted awkwardly on head: very front heavy
    - Felt neck strain after just a few minutes of wearing it
    - Bulkier in front that other options

DELL VISOR-

- Pros
    - Simple suspension system and secure fit
    - Goggles flip up to alleviate face from being contained in headset
    - Sleek design and function
- Cons
    - Does compress back of head to get the secure fit: could be straining or irritating
    - Allows minimal amounts of light into the headset

Conclusions/action items: From this visit, Jake and I can conclude that the DELL VISOR seems like a more viable option for a VR headset that is used for long surgical operations. Furthermore, our client needs to provide his own feedback to us so that we can determine which headset does in fact have a more ergonomic design.

9/19/2018 Design Topics Videos

Title: Design Topic Video Lessons

Date: 9/19/2018

Content by: Sam Schini

Present: Sam Schini

Goals: Summarize three videos that further the my understanding of official codes and standards and group work fundamentals.

Content:

"Codes and Standards"-

- Legal necessity whenever designing products; can reveal what has already been created
- Drawings must be incredibly accurate as they are for the people who will make product
- Standard: written description of criteria for specific product, process, test, or procedure that is agreed to by formal process (American National Standards Institute; controls process)~represent minimal design practices
- Types: Consensus, Defacto, Government regulations
- Process for development: Developer submits statement> once approved by ANSI, draft test is written> draft is reviewed> developer submits final review request> ANSI approves and publishes> reviewed every 5 years
- ANSI does not write standards
- International standards help level competition world-wide
- International Standards Organizations: ISO & IEC
- Standards are expensive and difficult to find
- Find standards in public databases: NSSN

"Leadership Styles"-

- Leadership: Process by which one individual influences other group members to reach goals (leads, does not dictate)
- Leaders are liked and respected as in "great person theory"
- Leader goal is to establish organizational mission
- Leaders have drive, honesty/integrity, motivation, self-confidence, intelligence, creativity, flexibility
- Directive: telling people exactly how to do jobs vs. Permissive: allowing subordinates to craft own jobs
- Democratic vs. Autocratic
- Concerns: productivity vs. happiness of people working (moral)
- Situational leadership theory: most important leadership depends on emotional support and guidance; delegating, participating, selling, telling
- To be a better leader: emphasize teamwork, create team identity, build respect among team, persevere

"Building and Maintaining Teams"

- Means for people to work in a team
- Success and teamwork go hand in hand in today's job industry
- Team functions should be quick, productive, communicative
- Groups function on how they can change as a whole and not individually
- Group norms: members that adhere to norms work better and more productively
- Productivity does not increase linearly; most progress is made by the end of the project
- Listening to others, responding, and understanding is key to communication
- Decision-making should be evaluated to note the teamwork
- Complete open discussions lead to better solutions
- Conflict resolutions: concern with others' outcomes vs. concern with own outcome
- Collaboration is best conflict mindset

Conclusions/Action Items: Teamwork is key in order to maximize productivity when engineering a design, but strong leadership also plays an important role in facilitating group work and motivation. Moreover, collaboration is very important when working with others. Action items for the near future are finding official codes and standards that pertain to potential VR headset usage in the surgical workplace.

TEAMLab Permits

Title: Current Fabrication Permits

Date: 10/9/2018

Content by: Sam Schini

Present: Sam Schini

Goals: Demonstrate up to date fabrication lab certifications

Content:

You have the following permits and upgrades:

Name	Date
Red Permit	09/28/2017

Conclusions/action items: The Red Permit is the current up to date permit that I have regarding fabrication certification.

9/14/2018 Meeting

Conclusions/action items:

Title: First BSAC Meeting

Date: 9/14/2018

Content by: Sam Schini

Present: Sam Schini

Goals: Discuss the accomplishments of the first BSAC meeting

Content:

Overview-

Introduce Members (names, major, and respective "get to know you" questions)

Discuss the purpose of Biomedical Student Advisory Committee

- Evaluate curriculum and design courses from student perspective
- Communicate ideas and feedback to faculty
- Provide mentorship to aspiring biomedical engineering freshmen students
- Communicate weekly progress and conversation with design teams

Conclusions/action items: After the first BSAC meeting, I understood the responsibilities and "power" of being a representative. I know to bring recommendations and conversation to each meeting in order to progress the system of feedback.

9/28/2018 Meeting

Title: First BSAC meeting with Faculty

Date: 9/28/2018

Content by: Sam Schini

Present: Sam Schini

Goals: Discuss the main takeaways from first meeting with faculty

Content:

Overview-

- Introductions of students and faculty (names, majors/careers, "get to know you questions")
- Break into groups with one BSAC executive board member who facilitated a conversation on the current placement of BME 201 within the curriculum
- Pros of the current placement: students are exposed to the design process before being introduced to specific tracks of BME, students gain experience working with a client and older mentors, accomodates transfer students
- Cons of current placement: students go through BME 200 without completely understanding the tracks of BME, students may feel like they are going through their BME 200 project without enough technical experience

Conclusions/action items: There are both pros and cons associated with the current placement of BME 201 (spring semester of sophomore year), but all points brought up will be considered and discussed among faculty for future reviewal if necessary.

Competing VR Eye-Tracking Technology

▪ JOSHUA Niesen ▪ Sep 14, 2018 @08:49 PM CDT

Title: VR Headset Current Available Technologies

Date: 9/10/2018

Content by: Joshua Niesen

Present: Joshua Niesen

Goals: Conducting research to discover possible VR technologies that can be applied to this project.

Content:

BME 200 - VR Headset Competing Technology

1. Modular and Convertible Virtual Reality Headset System

    1. VR Headset design comprised involving a complex design

    2. Incorporates the use of a phone or mobile device

    3. Discusses the possible use of an eye tracking technology

    4. Reiterates customizability for the user for optimal comfort

Thurber, Daniel. "Modular and Convertible Virtual Reality Headset System." United States. US 20150253574A1, 10 September 2018

2. System and Method for Resonant Eye - Tracking

    1. Previous designs of eye-tracking systems are too bulky and large, often using a lot of energy and also producing a sub-adequate picture quality.

    2. System uses light reflection off of the eye and the use of algorithms to determine eye position and thus track the eye

Palmer Luckey, Brendan Iribe Trexler, Graham England, Jack McCauley. "System and Method for Resonant Eye - Tracking." United States. US 20180210547A1, 10 September 2018

3. Virtual Reality Headset

    1. Contains drawings for the design of a VR headset that can be studied and analyzed for possible brainstorming

Palmer Luckey, Brendan Iribe Trexler, Graham England, Jack McCauley. "Virtual Reality Headset." United States. US00D738374S, 11 September 2018.

4. Infrared Sensory Eye Monitoring

    1. Article suggested the use of infrared technology and analysis of the reflection of this electromagnetic radiation off of the eye to analyze eye movements

Sophie Charara. "Explained: How does VR actually work?" Internet: https://www.wareable.com/vr/how-does-vr-work-explained, 26 December 2017 [10 September 2018]

Conclusions/action items: The above technologies offer different aspects and competing designs that may have elements applicable to the project and may spark new ideas for the project. In the future, action should be taken to learn about more VR headset designs and unique design concepts related to different types of VR headsets.

📦 **Device Compatability**

▪ JOSHUA Niesen ▪ Sep 26, 2018 @11:53 PM CDT

Title: Device Compatability

Date: 09/25/2018

Content by: Joshua Niesen

Present: Joshua Niesen

Goals: To discover device compatability as it relates to other devices and also use by surgeons and their ability to adjust to the device and perform optimal procedures.

Content:

BME 200 VR Device Compatability Research

Compatibility for Surgeons

- Study investigated how VR impacted surgeons within endoscopic procedures and their efficiency

- Discovered that practice using the VR integrated system and using simulations drastically improved surgeon efficency and effectiveness when using the device.

T. Miki, M. Miyake, T. Iwai, I. Tohnai, A. Iwasaki, Y. Ohbayashi, K. Kotani, J. Dang, M. Isobe, and Y. Matsui, "Development of virtual reality training system for oral surgery assisted with the endoscope," International Journal of Oral and Maxillofacial Surgery, vol. 42, no. 10, pp. 1244–1245, 2013.

- Continued research into how VR practice and use improves procedures

- Proof that practice on VR systems led to a huge decrease in the time procedures took

- Mistakes during procedures decreased from approximately ten to zero which is very good for precise operations.

T. Miki, T. Iwai, K. Kotani, J. Dang, H. Sawada, and M. Miyake, "Development of a virtual reality training system for endoscope-assisted submandibular gland removal," Journal of Cranio-Maxillofacial Surgery, vol. 44, no. 11, pp. 1800–1805, 2016.

Multi-input interface compatible device and method of virtual reality equipment

- Description of a patent that essentially allows connectivity of multiple types of devices to a single VR headset for multiple outputs

- Allows for a central display with ease between various inputs that can be connected to the device.

- Device describes a lot of USB type-C connections that today are very easy to come by and mainstreamed with various adapters - good idea

- Describes a HDMI input display. However, it also describes something about a USB-C connection for the HDMI so that everything is the same input

- In my opinion this design/product could allow for very easy connecting between BNC connection and our device if it does not have a BNC connection

S. Qing, Z. Zhiyu, Z. Jingwei, M. Baojun, and C. Xinliang,   "Multi-input interface compatible device and method of virtual reality equipment." China. CN107341120, 09/25/2018

Conclusions/action items:

The above studies and patent present devices and studies that discuss the issue of compatability in the surgeon adjustment process and also the opportunity for connection of other devices to the VR headset to other devices.

Basic Design Overview

Title: Introductory Problem Information

Date: 9/10/2018

Content by: Joshua Niesen

Present: Joshua Niesen

Goals: Conduct general research to further understand the need in the market for VR in surgery and a basic description of how VR works.

Content:

BME 200 VR Headset for Endoscopy and Microsurgery Research

Public Media Information and Call to Action: Forbes

1. Uses for VR: training, education, visualization, psychology, telehealth & telesurgery, screen consolidation, physical raining, health, fitness.

2. Surgeons need 50 to 100 cases in order to become proficient in a specific surgery.

3. A lot of robotic innovation involving VR controls in the OR is taking place to increase accuracy and precision. Specifically, this would allow for more precise of movements and incisions and a decrease in the amount of bleeding that takes place.

Charlie Fink. "How VR Saves Lives In The OR." Internet: https://www.forbes.com/sites/charliefink/2017/09/28/how-vr-saves-lives-in-the-or/#6dd3ce693099, 28 September 2017 [9 September 2018]

How the technology works:

1. Uses the overlay of graphics

2. Lenses focus and reshape a picture for each eye to create a stereoscopic three-dimensional image by angling the two two-dimensional images to mimic how each eye views the world.

3. For this to work, need at least 60 frames per second

4. Head-tracking system types: gyroscope, accelerometer, magnetometer

    1. The speed of the head-tracking system must be less than 50 milliseconds or else will experience the feeling of "lag"

Sophie Charara. "Explained: How does VR actually work?" Internet: https://www.wareable.com/vr/how-does-vr-work-explained, 26 December 2017 [10 September 2018]

Conclusions/action items: The opportunity for the use of VR in surgeries and operations is huge and is already being applied. Also, the VR headset technology is quite interesting and will require diligent design and understanding of how the technology works. For future research, more broad findings can be explored about possible headsets or technology similar to VR that can be implemented for surgery. Also, more in-depth information can be collected about VR headsets and the intricate pieces that make up the design.

BME 200 Organization and Categorization of Current Resarch 9-25-2018

• JOSHUA Niesen • Sep 25, 2018 @05:16 PM CDT

Title: Organization and Categorization of Research Conducted this Far by Team Members

Date: 09/25/2018

Content by: Josh Niesen

Present: Josh Niesen

Goals: To document and capture the categorization of research that I have organized in my notebook.

Content:

BME 200 Research Conducted Thus Far 9/25/2018

Tom

Surgery / Procedure — Principles of Endonasal Oncological Surgery
- Need more visualization.
- Basically; Nervous Surgery, heavily relies on imaging → which we provide.

Tom
MTC Vibe
Current market devices:
- Price
- Software
- Resolution
- Weight
- Size
- FPS

- DIFF. Standards. Market for pu
- Good resolution— extra reinforced frame
- Camera front built in?
- Better?
  → If so, how long?

Tom
Current market devices
Oculus Rift
- $399
- Need computer to operate.
- ? What is meant by a standalone version?

Tom
Current market devices
Google Daydream
- $99 "normal"   • $400 standalone
- Standalone or use google phone as processor
- Lower Features ?
- Does not have an attachment for video input ? would have to figure this out

Sam Simon
Current market devices / Components
VR Structural Design + Ergonomics
Design of headset to fit head + face.

Sam Simon
BNC Connectors & Bluetooth Connectivity
- BNC → simple twist, very easy   as a cable → one of client's wants, to not have
- New Egg Bluetooth BNC Adapter
- Can connect to a bluetooth receiver.   All these components can be one

Tom
Current market devices / Add-ons
Adafruit Bluetooth receivers

BME 200 Research Conducted Thus Far 9/25/2018

Sam Simon
Current market devices
Google Cardboard
- Cardboard, Plastic, magnets
- Offers an option for easy disposal of a device → no issues with sterilization.
- Cheap
- No comfort
- Not really applicable to this project

Sam Simon
Regulations / Standards
FDA Regulation
- Standard for use of a bone graft → getting past the FDA.
- VR Headsets how to be Class I medical devices in eyes of FDA

Sam Peters
Current VR Headsets
Google Daydream View   duplicate info to Tom
- $100   • Just uses phone
- Uses daydream software

Oculus Rift
- Runs MDNE for input
- Has to be powered by a company → Additional $850
- $500

Mirage Solo
- $400
- Standalone
- Apparently heavy and not comfortable

Sam Peters (Cont'd) Types of VR Headsets

Current
Market
Devices
- HTC Vive
  - $500
  - Requires computer, but has $800 option for wireless

Sam Peters VR Software
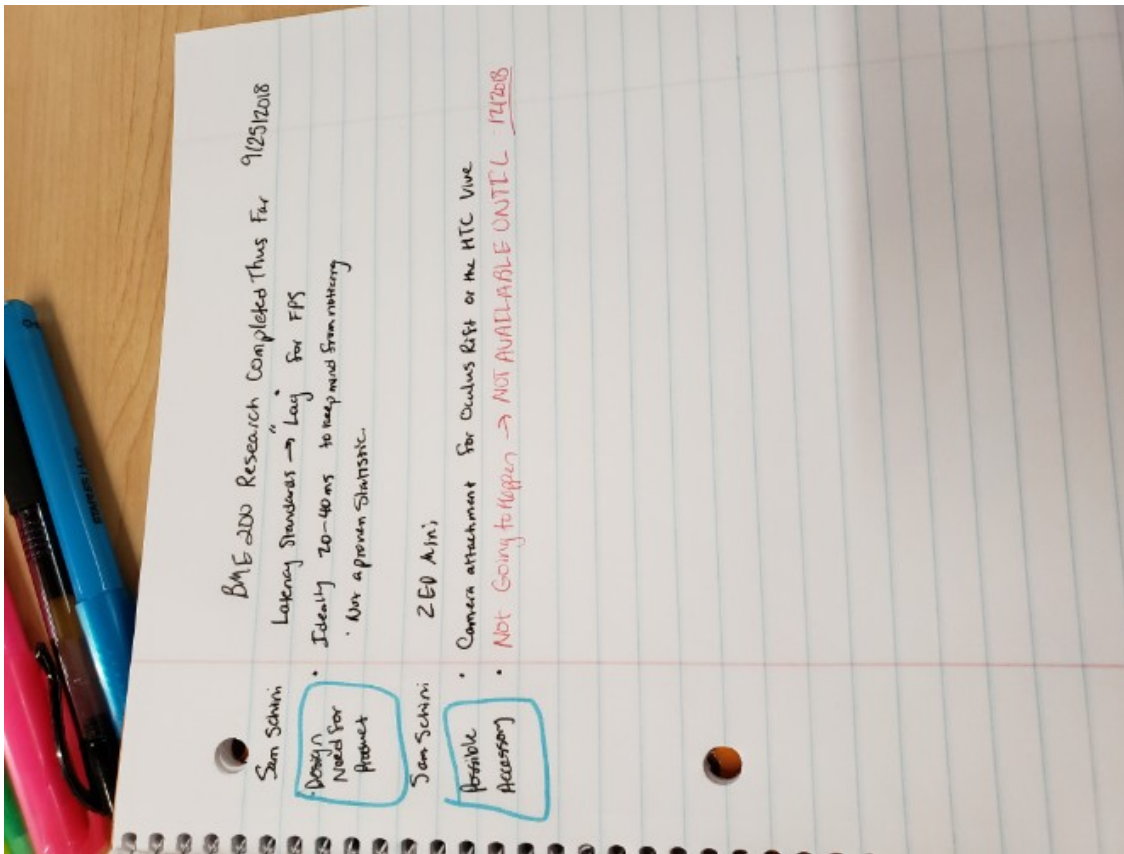
Current
Market
Devices /
Components
- Daydream Platform (Google)
  - Compatible with Android + Merge Stop
  - Easy to move to other devices.
- Google SDK for Android
  - SDK for creating Daydream VR on Android platform
  - Android platform mainstream
- Osvr VR for HTC Vive
  - OpenVR SDK by Valve
    → Supports multiple VR headsets + applications don't need to be vendor specific
  - Steam VR SDK
  → Lets developers create single interface that work across diff. headsets

Josh N.

Current
Market
Devices /
Components
- Modular + Convertible Reality Headset System
  - Online available design to underscore VR headset components
- Discussion of eye tracking technology
  - Very complex algorithm, with low has cheap function
- Light refraction use eye for tracking →
- Discussion of infrared technology to trace and/or similar to above.

Josh N.

Basics of
VR:
Market
Worth
- Introductory Problem Information
  - General media coverage of VR technology in surgery.
  - Breakdown of how VR works at the most basic levels
  - 60 fps minimum for these VR headsets to not cause lag forward.

Jake

Medical
Procedure
- General Endoscopy
  - Discussion of general endoscopic procedure
  - Reiterates what Tom said about Endovascal procedures. Very touchy

Jake

Medical
Procedure
- VR Surgery
  - Discusses VR use for training of doctors
  - Not pertinent to this project

Jake

Current
Market
Devices
- VR Styles & Connectivity
  - HTC Vive - high end → Picture being mentioned
  - Talk of using a smartphone headset instead of a self-contained headset due to $.
  - Requesting more research for positive VR headsets

Sam Schini

Medical
Procedure
Surgeon
Issues
- Operation Related Injuries: Surgical Procedures
  - Eyestrain
  - Neck Pain
  - Suggests a study of surgeons using VR to see statistically
    it's less from eyestrain & neck / back pain.

BME 200 Research Completed Thus Far   9/25/2018

Sam Schirri
- Latency Standards → Lag for FPS
  - Ideally 20-40 ms to keep mind from noticing
  - Not a proven Statistic

Sam Schirri
- 260 Aim,
- Camera attachment for Oculus Rift or the HTC Vive
- Not Going to Happen → NOT AVAILABLE UNTIL : 1/4/2018

(Design Need for Product)

(Possible Accessory)

Conclusions/action items:

We currently have completed a lot of research that involves the current types of VR devices on the market along with a thorough understanding of endoscopic procedures that the VR device will be used in. More research should be conducted to further understand the imaging that will be displayed from the endoscope to the VR headset to understand two dimensional and three dimensional imaging using the VR headset.

Makerspace VR Visit 9/25/2018

• JOSHUA Niesen • Sep 25, 2018 @07:57 PM CDT

Title: Makerspace VR Visit

Date: 9/25/2018

Content by: Josh Niesen

Present: Josh Niesen

Goals: To put on and try the various VR headsets made available and see their construction in-person.

Content:

Oculus Rift

- Feels "cheap" - the foam around the edges of the VR headset feels as though it would rip after repeated use
- Lack of padding on the straps for the head
- Strong connection to head - does not move
- Some light was getting in from the bottom - this would obviously be removed in a dark room
- No camera on the outside
- No ports or locations where can plug into
- Does use a HDMI and USB regular connection for use
- Simple design that seems to work

Dell HTC Vive

- Very nice headset
- Has HDMI, DCI, and USB regular inputs
- Has a nice liner around the eyes and a nice padded support strap that allows for cushioning on the head
- Strong build quality that does not feel flimsy
- Did not move or shift while place on the head
- Did seem somewhat heavy, though need to compare this to the regular weight these surgeons are experiencing.
- Front camera is located directly in front on lower portion that looks down already

Dell Visor

- Headset that does not have an upper strap, rather just goes around the head - which gets somewhat tight
- The eyepiece flips out which allows for visualization of the room then
- Some padding on front and back but could still use more
- Is a solid build quality that does not feel as though it will fall apart
- Dual cameras on the front to see in front when using
- Uses HDMI and USB regular connections

Samsung HMD Odyssey

- Very solid and well put together headset
- Could use more work with the padding in the front on the forehead as it seems too tight
- Easily adjustable
- Has two cameras on the front
- Runs HDMI and regular USB
- Somewhat large and bulky
- Lots of plastic housing
- Quite expensive - the most expensive of the viewed options

Conclusions/action items:

The Makerspace has a lot of headsets that we can mess with and use to do some testing to evaluate which optimal headset will allow us compatability with the endoscope and will also allow for us to properly toggle between different inputs.

▪ JOSHUA Niesen ▪ Sep 25, 2018 @07:11 PM CDT

Samsung_HMD_Odyssey.JPEG(53 KB) - download

▪ JOSHUA Niesen ▪ Sep 25, 2018 @07:12 PM CDT

Samsung_HMD_Odyssey_1_.JPEG(104.5 KB) - download

▪ JOSHUA Niesen ▪ Sep 25, 2018 @07:13 PM CDT

Oculus_Rift.JPEG(11.2 KB) - download

• JOSHUA Niesen • Sep 25, 2018 @07:14 PM CDT

Oculus_Rift_1_.JPEG(23.8 KB) - download

• JOSHUA Niesen • Sep 25, 2018 @07:16 PM CDT

Dell_HTC_Vive.JPEG(69.6 KB) - download

• JOSHUA Niesen • Sep 25, 2018 @07:17 PM CDT

Dell_HTC_Vivo_1_.JPEG(105.9 KB) - download

JOSHUA Niesen • Sep 25, 2018 @07:18 PM CDT

Dell_Visor.JPEG(72.2 KB) - download

JOSHUA Niesen • Sep 25, 2018 @07:19 PM CDT

Dell_Visor_1_.JPEG(86.6 KB) - download

🧊 **Brainstorming**

• JOSHUA Niesen • Sep 25, 2018 @08:05 PM CDT

Title: Design Brainstorming

Date: 9/25/2018

Content by: Joshua Niesen

Present: Joshua Niesen

Goals: To brainstorm as many design ideas as I can.

Content:

Design 1:

- VR headset using a camera to visualize the surroundings
- Possible VR headsets that could do this: Dell HTC vive, Dell Visor, Samsung DMD Oddyssey
- Toggle back and forth between menus

Design 2:

- Use a mechanical hinging mechanism that opens the display when want to see instruments being handed and then the same hinging mechanism that closes the hinge so that the display is back to its resting position.
- Use voice activation to initiate raising or falling mechanism
    - Would require mechanical motion, which may be difficult
- VR headset on the market to do this: Dell Visor

Design 3:

- Electrochromic Glass - use this material to create a filmy or clear display that then allows the surgeon to see the outside world or the display wanted
- Running a electric current through this glass would be the initiating source for the display to be foggy or clear.

Design 4:

- Dual Display - one eye is able to see outside while the other eye can see the wanted display
- The design could use AR or VR

Design Task: Toggle Between Inputs

1. Head shake/movement/orientation changes in a gyroscope that cause the toggle to occur.

2. Voice operated

3. Button that is located easily for the surgeon to click it with his teeth

4. Eye Sensors - would need to be very discrete movements that caused toggling to occur.

   a.Infrared

   b. Light

Conclusions/action items:

This design project has many components that need to be considered. It may be best if we split up the possible design options into categories, and then we brainstorm three ideas for each category, thus assembling three designs that really have movable pieces from which we assemble the final design.

TEAMLab Permits and Upgrades

▪ JOSHUA Niesen ▪ Sep 21, 2018 @12:17 AM CDT

Title: TEAMLab Permits and Upgrades Documentation

Date: 9/21/2018

Content by: Joshua Niesen

Present: Joshua Niesen

Goals: To demonstrate acquisition of permits required to work in the TEAMLab

Content:

You have the following permits and upgrades:

Name	Date
Green Permit	09/19/2018
Red Permit	02/15/2018
Welding 1	04/12/2018
Laser 1	03/28/2018

Conclusions/action items:

The above items are the permits I currently have and I will update this list as new additions to my permits as those arise.

BME 200 - Design Weekly Videos/Documents 9/14/2018

▪ JOSHUA Niesen ▪ Sep 21, 2018 @09:23 AM CDT

Title: BME 200 - Design Weekly Videos/Documents 9/21/2018

Date: 9/21/2018

Content by: Joshua Niesen

Present: Joshua Niesen

Goals: To watch the weekly design videos assigned for the week and take notes on some of the important content.

Content:

BME 200 Design Weekly Videos 9/14/2018

Video: The Design Process

1. First need to recognize the problem and probe deeper into understanding what this is

2. Conduct thorough research to further understand the current solutions on the market while also further understanding the extent of the problem.

3. Identify the goals of the design through the PDS

4. Brainstorming - good to come up with at least 100 ideas through brainstorming sessions to establish many possible solutions

5. Reflect on these brainstormed ideas and relay how these designs accomplish the established goals.

6. Focus on the details - we need to pay attention to these to create a proper design

    1. Materials

    2. Ergonomics

    3. Design

    4. Cost

    5. Safety

    6. Manufacturing

7. Tie in everything known and acknowledge those things we do not know.

8. Design Validation - analysis of design using analytical tools and also conducting simulations or other physical testing.

9. Mock-ups

10. Prototype

11. Testing of the prototype

The Process:

1. Very messy, are going to have to flow and move throughout the process, this is not a flowchart, but rather is jumble of iteration and flexibility

Good Designer:

1. Knowledge - math, concepts, ideas

2. Skill - application of knowledge

3. Practice

4. Attitude - want to explore and take risks.

Video: Communication in Design: Working With Clients

1. Understand the client - their interest, but they do not have expertise in this area

2. Need your abilities, and to define this design to solve the problem

3. Normally not their priority in life - keep it in their priorities

4. Interact properly, show initiative with client.

5. Engage with enthusiasm - show that this is an important project to YOU

    1. Be very prepared - give client specificity

6. Pose difficult questions to client

7. Give rationale for reasoning

8. Assemble concise lists before meetings so that the client is also prepared and has thought out the options presented.

9. Use different forms of communication for different interactions

Video: Design Considerations: Design Ethics

1. Scientific Misconduct

    1. Negligence of ideas - fabrication of data and falsification of data - not honest error

    2. Plagiarism

    3. Violating ethical standards

    4. Suppression of negative results

2. How to avoid misconduct

    1. Cite sources

    2. All authors included

    3. Confidentiality

    4. Risk analysis

3. Understand the moral standards set in place and expected of you

Conclusions/action items:

There are many key factors playing a role in design and acquisition of background information pertinent to the design process. All of these pieces will play a pivotal role to ensure that the design is effective and performs up to the set standards of society while also creating a higher likelihood of success for the device.

BME 200 - Design Weekly Videos/Documents 9/21/2018

Title: BME 200 - Design Weekly Videos/Documents 9/21/2018

Date: 9/21/2018

Content by: Joshua Niesen

Present: Joshua Niesen

Goals: To watch the weekly design videos assigned for the week and take notes on some of the important content.

Content:

BME 200 - Design Weekly Videos/Documents 9/21/2018

Video: The Design Process: Codes and Standards

1. Not following the consensus of the design community is highly important

2. Drawings are very important, need to be very accurate and detailed - guided by standards

    1. Simplified callout

3. Standard - written description of criteria for a product, project, test, procedure.

    1. Consensus standards - group comes together to make decision on standard

    2. Accepted standards - common standards

    3. Government codes and standards

4. Hard to find - expensive to write

    1. Those who own the copyright do not want to share them, want to make money and have people buy them

5. ANC - very important group that helps with ISO

6. ISO - International Standards Organization - worldwide body

    1. Want international standards to level costs and give a baseline for worldwide technology to make it easier on companies.

7. Where to find standards

    1. Military standards - database is being sold, but still has some standards

    2. NSSN - public database but does not have full text

    3. Reference librarians can often help a lot

    4. Research libraries - wendt collection, Milwaukee

    5. Find standards online and then search for them

8. Help keep safe from lawsuits and issues

Video: Communication in Design: Leadership Styles

1. Leadership - process whereby one individual influences other group members toward attaining defined group goals.

2. Lead by action

3. Coercion

4. Establish organizational mission

5. How to Be a Great Leader

   1. Special traits

      1. Drive - desire

      2. Honesty/integrity

      3. Leadership Motivation

      4. Self-confidence

      5. Intelligence

      6. Creativity

      7. Flexibility

6. Learning to become a better leader

   1. Directive vs. Permissive - want to find a balance

   2. Decision-making - democratic vs. autocratic

7. Productivity vs. Concern for people

   1. Too much concern can defeat productivity

   2. Too little concern can cause people to be upset

8. Delegating,, Participating, Selling, Telling

9. Tips and Tricks

   1. Inspire trust and teamwork

   2. Expand abilities - build confidence

   3. Team Identity - who are we?

      1. Make a diverse team to create more innovative solutions

   4. Be on lookout for unforeseen problems and deal with those proactively.

Video: Communication in Design: Building and Making Teams

1. Need teamwork for productivity and safety

2. More successful - more focus on teamwork

3. Group Development

   1. Communication, smart decisions, get the work done

   2. Focus on what can change - things to resolve

4. Norms: Unspoken rules

   1. Respect, arriving on time

   2. Groups that adhere to norms tend to be more productive

5. Productivity - tends to be a curve like a hockey stick

6. Communication Styles

   1. Clear speech and attentive listening

7. Effective Making of Decisions

   1. Make decisions that are smart and effective

   2. If two groups come to same decision, likely good

8. Concern with other outcomes vs. own outcomes

    1. Collaboration

9. Resolving conflict

    1. Establish where at in agreement, and then move into discrepancy and discuss why upset.

Conclusions/action items:

There are many complex variables that play a role in the design process that involve group work. Also, it is very difficult to find standards and use of the librarians here on campus will likely be of great benefit in order to discover standards that apply to our medical device.

8. Concern with other outcomes vs. own outcomes

    1. Collaboration

9. Resolving conflict

    1. Establish where at in agreement, and then move into discrepancy and discuss why upset.

Endoscopy

- Jacob Cohn • Sep 19, 2018 @06:33 PM CDT

https://www.sciencedirect.com/topics/medicine-and-dentistry/endoscopy

Title: General Endoscopy

Date: 9/8/2016

Content by: Jake Cohn

Goals: Develop a working knowledge of endoscopic procedures

Content:

Hopkins Rod Endoscope: Endoscopic rod made of glass with interspersed airspaces

Process of endoscopy

-fill body part/cavity with CO_2

-use fiberoptics and "cold light" (heat resistant glass around bulb) to see the cavity

-electrocoagulation: mono/bi polar electrocautery allows for hemeostasis

-use CCD (charged coupled device) for the imaging of the interior along with HD monitors

Conclusions/action items:

ADVANTAGES

-minimally invasive

-avoid major surgery

-less rehab time

-exploratory procedure possible

DISADVANTAGES

-easier to miss something

-limited amount of applicable surgical procedures

VR surgery

▪ Jacob Cohn ▪ Sep 19, 2018 @06:31 PM CDT

https://www.gastrojournal.org/article/S0016-5085(17)34319-6/abstract

https://www.jisc.ac.uk/blog/think-virtual-reality-surgery-is-a-thing-of-the-future-think-again-28-feb-2018

Title: VR Surgery

Date: 9/8/2018

Content by: Jake Cohn

Goals: Learn more about VR products already in the surgical market

Content:

Professor Shafi Ahmed cocreated the first VR surgery training device

Only the surface of potential, possibility of making gloves that give real time feedback

This is just a training module and does not get used in actual surgery

Conclusions/action items:

-Not used in actual surgery, just in training

-Does not overlap very much with our project

VR styles and connectivity

Jacob Cohn • Sep 20, 2018 @03:54 PM CDT

Title: VR styles and connectivity

Date: 9/19/18

Content by: Jake Cohn

Goals: Determine how much we need to spend on a quality machine and how we could connect it to the surgical equipment

Content:

Some high end models have quality cameras built in like the HTC Vive.

If we used a smartphone style headset, could we transfer from internal endoscopic view to the view on the phone's camera (which would be of the operating room)

That could be a much cheaper option than spending 500+ dollars on a fancy machine.

Phones are also relatively easy to replace and update

Hypothetically, if our Vive breaks, we cannot really simply replace the screen like in a version with a smartphone.

Conclusions/action items:

We need to not jump to conclusions on getting a fancy top of the line headset and look at the situation more practically.

HTC Vive

Title: HTC Vive Research

Date: 9/25/18

Content by: Jake Cohn

Goals: My goal is to determine what VR headset is best for the purposes of our project.

Content:

Specs:

Input: hdmi for video, usb for data, power cord

Resolution: 2160 x 1200

Field of View: 110 degrees

Price: $500

Weights: 16.58 ounces

Sensors: Proximity Sensors, Gyroscope, G-sensor, accelerometers, infrared

Pros:

-great image quality

-camera on the front for an environmental view as well as an endoscopic view

-quality internal technology (sensors)

-would be fully immersive (what our client wants)

Cons

-relatively expensive

-front loaded, slightly uncomfortable

Conclusions/action items:

The HTC Vive was not as comfortable as the Dell Visor, but it fulfills every other category that our client wants including a fully immersive view, which is something the Dell Visor cannot do. This headset appears to be a good option to move forward with.

Dell Visor

▪ Jacob Cohn ▪ Oct 07, 2018 @04:16 PM CDT

Title: Dell Visor Research

Date: 9/25/18

Content by: Jake Cohn

Goals: My goal is to determine which VR headset is best for our project.

Content:

Specs

Connectivity: HDMI for video USB for audio and power

Resolution: 2880 x 1440

Price: $449

Weight: 20.81 ounces

Field of view: 105 degrees

Sensors: accelerometer, gyroscope, magnetometer

Pros
-Feels very natural on my head
-immersive view with high resolution
-ability to flip up for an environmental view
Cons
-Flip function is manual without modification
-relatively expensive

Conclusions/action items:

The Dell Visor seems completely capable of doing what we need it to do. We would have to create an automatic mechanism to lift the screen for our client's desired environmental view, which would take away from the immersive experience he hopes for. Overall, this is a quality option, but has more of a chance to balk during surgery with our hypothetical mechanism which is a slight concern

Google Daydream

▪ Jacob Cohn ▪ Oct 07, 2018 @04:16 PM CDT

Title: Google Daydream Research

Date: 9/25/18

Content by: Jake Cohn

Goals: My goal is to determine which VR headset is best for our project.

Content:

Specs

Weight: 9.2 oz (plus a phone)

Resolution: Phone dependent (around 2000 x 1000)

Price: $55 for headset plus a phone (around 300)

Connectivity: Universal phone input

Pros:

-relatively inexpensive

Cons:

-lacks stability on head

-not as great of an immersive atmosphere

-connection and software capabilities are lacking

-compatibility concerns

Conclusions/action items:

The Google daydream is limiting because the amount of software editing we can perform on a phone is limited. The other headsets on the market connect to a pc, which is easier to code on and adapt to our project needs. Although this is one of the most inexpensive options on the market, I don't believe it will work best for our project.

Codes and Standards

Title: Codes and Standards

Date: 9/20/18

Content by: Jake Cohn

Goals: Learn about codes and standards

Content:

Standards are determined by larger organizations to organize

They are expensive to make

Standards are reviewed every 5 years

Everyone wants one set of standards, so international standards is taking over (27 countries) (ISO, ANSE)

Countries that do worldwide business prefer this

Standards help to make it easy to put things together like nuts and bolts

Full text is not available readily because they are so expensive

Conclusions/action items:

Follow standards when available

Seek out standards when you run into problems

Leadership and Teamwork

▪ Jacob Cohn ▪ Sep 20, 2018 @04:18 PM CDT

Title: Leadership and Teamwork

Date: 9/20/18

Content by: Jake Cohn

Goals: Learn and process what makes good leadership and teamwork

Content:

leadership- one team member who influences other members by action and voice

teamwork is essential for success in anything (not just engineering)

traits for leadership

drive

honesty/integrity

self confidence

Conclusions/action items:

Leaders often are unexpected and not in the "leadership role" in a group

Managing and leading are two very different things

2016/09/05-Entry guidelines

▪ John Puccinelli ▪ Sep 05, 2016 @01:18 PM CDT

Use this as a guide for every entry

- <u>Every text entry of your notebook should have the **bold titles** below.</u>
- <u>Every page/entry should be **named starting with the date** of the entry's first creation/activity, subsequent material from future dates can be added later.</u>

You can create a copy of the blank template by first opening the desired folder, clicking on "New", selecting "Copy Existing Page...", and then select "2014/11/03-Template")

Title: Descriptive title (i.e. Client Meeting)

Date: 9/5/2016

Content by: The one person who wrote the content

Present: Names of those present if more than just you (not necessary for individual work)

Goals: Establish clear goals for all text entries (meetings, individual work, etc.).

Content:

Contains clear and organized notes (also includes any references used)

Conclusions/action items:

Recap only the most significant findings and/or action items resulting from the entry.

2014/11/03-Template

• John Puccinelli • Nov 03, 2014 @03:20 PM CST

Title:

Date:

Content by:

Present:

Goals:

Content:

Conclusions/action items: