

BME Design-Fall 2018 - THOMAS GEISLER

Complete Notebook

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Sam Simon

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Team contact Information

• THOMAS GEISSLER • Sep 19, 2018 @11:26 PM CDT

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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#>)



12/12/2018 - Project Significance and Societal Impact

• Sam Simon • Dec 12, 2018 @01:40 PM CST

Title: Project Significance and Societal Impact

Date: 12/12/2018

Content by: Sam Simon

Present: Sam Simon

Goals: To identify the overarching goal of our project and the ethical considerations involved while looking at how the problem we are addressing will have an impact globally and locally.

Content:

IMPACT OUTSIDE OF THE COURSE

Virtual reality (VR) technology is not a new addition to healthcare. In the year of 2018, the VR healthcare market itself was valued to be about \$641 million. Although these products are currently limited to training new surgeons for the operating room, our client's vision is to bring these headsets into the OR to be fully integrated into surgical procedures [1]. This evolution of image display from monitor to headset will provide an incredibly immersive experience without threatening workflow at the UW hospital. Outside Dane county, adopting the VR headset and an upright position during surgery has the potential to remedy the development of chronic back and neck pain of surgeons worldwide. It is approximated that about 48% of surgeons that use endoscopy in the workplace experience some form of chronic neck pain as a result of having to look at a monitor [2]. Not only would a surgical VR headset with hands-free transitioning be able to eliminate the need to keep one's neck at awkward angles, but the improved immersiveness provided by the device may also contribute to improved results and healing times in patients following surgery.

Reference:

[1] "The endoscopy 2.0: virtual or reality?," *LinkedIn*. [Online]. Available: <https://www.linkedin.com/pulse/lendoscopie-20-réalité-ou-virtuel-julien-pontet/>. [Accessed: 10-Oct-2018].

[2] C.-C. H. Stucky et al., "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.

Conclusions/action items:

Our client has no doubt that VR is the next forefront in surgery. Although our group took this semester to modify a recreational VR headset, which may not fit the hospital standard, we have been able to conduct a proof of concept for a future group to come in and make small improvements to bring our headset to that level.



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. 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. Handling 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.



10/16/2018 Chosen Design Approval Meeting with Dr. Ahmed

- JOSHUA Niesen - Oct 18, 2018 @12:18 PM CDT

Title: Chosen Design Approval Meeting with Dr. Ahmed

Date: 10/16/2018

Content by: Joshua Niesen

Present: All Members, Dr. Ahmed

Goals: To gain approval for the budget and chosen design to move forward with during the design process.

Content:

Client Meeting 10/16/2018

Dr. Ahmed

1. Most interested in the HTC Vive
2. Computer to use: Definitely have lots of options
3. Developing in the Makerspace for proof of concept
4. Specs on computer to ensure compatibility - please let Dr. Ahmed know these and contact the proper people about this.
5. Unsure of specs on computer
 1. Jason Pearson - has information for hospital computer specs
6. Price fine - just develop first
7. Is there an opportunity to patent the product?
8. Zoom abilities on the headset hooked up to the headset - ideally hands-free
9. Transition between endoscopic view and external view
 1. Really only needed for a few seconds to see the external view, and needs to be accurate to ensure not poking patient in nose or eyes.
 2. Show/suggest more possible transitions/triggers that will allow for toggling between views.

Conclusions/action items:

Dr. Ahmed is very committed to this project and believes that the HTC Vive will serve as the best design to continue pursuing and creating a product from. We have a very available budget for which Dr. Ahmed has multiple modes of paying for the headset. Dr. Ahmed would also like to see more options for toggling between menus and would like to be sent the specifications needed for a compatible computer with the HTC vive. Last, Dr. Ahmed would like to see the addition of a way by which to zoom in his endoscopic view by a hands-free mode.



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 Vive
 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.



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.



10/19/2018 - Major Design Accomplishments Assignments

- JOSHUA Niesen • Oct 22, 2018 @05:36 PM CDT

Title: Team

Date: 10/19/2018

Content by: Joshua Niesen

Present: All Members

Goals: To work on understanding the available headsets at the Makerspace and to designate research tasks to further determine a block diagram that demonstrates how all components will fit together

Content:

1. Team Designation of Minimum Design Accomplishments:
 1. Display live endoscopic view
 2. Display live camera footage
 3. Switch between the above views smoothly in a consistent manner
 4. Additional Design Goals:
 1. 3D Endoscopic video Capability
 2. Zoom control using the headset hands free for the endoscope
 3. Recording of endoscopic procedure
2. Team Split into two groups to accomplish requirements one and two:
 1. Sam Peters, Sam Schini, Jake Coehn: Display live endoscopic view
 2. Josh Niesen, Sam Simon, Tom Geissler: Control of switch between views

Conclusions/action items:

Now that we have formed groups, each group will try to conduct research and find a way to complete their task in the coming week. Once enough research and understanding has formed about how each mechanism will work, we will regroup and share the findings to figure out how to ensure these ideas can work together in the system.



10/31/2018 - Team Makerspace Meeting - Gain Familiarity with Unity

• JOSHUA Niesen • Nov 07, 2018 @08:42 PM CST

Title: Team Meeting 10/31/2018 - Makerspace - Familiarity with Unity

Date: 10/31//2018

Content by: Joshua Niesen

Present: All Members

Goals: To work on understanding the Unity software and required plugins with SteamVr.

Content:

1. Team Display Live Feed:

1. Able to display a pre-recorded video to display in Unity

2. Team Access Gyroscope Values/Switch

1. Discussed the goals of the project through Unity with Taylor
2. Taylor suggested basic VRTK videos that will help to understand the unity software and how to gain access to the gyroscope values

3. **Helpful Links**

<https://forum.unity.com/threads/completely-disable-position-tracking.450644/>

4. How to disable head tracking

5. <https://stackoverflow.com/questions/47486425/how-to-get-the-x-y-z-value-of-htc-vive-gyroscope-in-real-time>

6. Getting x,y,z values

7. **Videos from Taylor:**

8. https://www.reddit.com/r/Unity3D/comments/5l5irg/heres_a_tiny_vive_camera_stream_as_a_texture/

https://www.reddit.com/r/Unity3D/comments/5l5irg/heres_a_tiny_vive_camera_stream_as_a_texture/

<https://www.youtube.com/watch?v=LZTctk19sx8>

<https://www.youtube.com/watch?v=qMhjLT7iVZ0>

<https://github.com/rab-h-sonmai/ViveCamFox>

9. Same as both the reddit ones at the top

<https://blogs.unity3d.com/2017/06/16/codesnippets-toggle-vives-front-facing-camera-and-tron-mode-at-run-time/>

VR TK videos on youtube are very good - relating to steam vr and unity0

Make visual studios account - IDE

More Videos to Look at:

<https://www.youtube.com/watch?v=fzRVTjUp00w>

<https://www.youtube.com/watch?v=tyFV9oBReqq>

Stuff to focus on:

1. How to get at headset rotation values
2. How to get stable camera
3. How transform position values

If you find anything in the videos that relates to this... write down what video and what time

<https://www.youtube.com/watch?v=W9mub3CvTvQ&list=PLTiD-q2AfVNJYGRdR9veojuO0t4v4idmI&index=19&t=0s>

This video explains how to get an object to track with the headset. In our case, the object will be the camera input

<https://unity3d.com/learn/tutorials/s/scripting>

This is a list of all the unity syntax we will need to know while scripting

<https://github.com/ValveSoftware/opencvr/issues/274>

1. At bottom of this page there is syntax for getting the angles

What did Taylor do:

1. <https://github.com/thestonefox/VRTK>
2. Dragged and dropped all the files into your working folder
3. Dragged SteamVR script into SteamVR camera rig on left

Conclusions/action items:

All members of the team will watch the assigned videos in their own time and collectively share a document with video notes so that everyone can collaborate on what they learned and discovered.



11/7/2018 - Makerspace Design Development - Unity Development

• JOSHUA Niesen • Nov 07, 2018 @08:37 PM CST

Title: Team Meeting 11/7/2018

Date: 11/7/2018

Content by: Joshua Niesen

Present: All Members

Goals: To work on understanding the available headsets at the Makerspace and to designate research tasks to further determine a block diagram that demonstrates how all components will fit together

Content:

1. Team Display Live Feed:
 1. Successfully able to display a live feed from laptop camera in Unity
2. Team Access Gyroscope Values/Switch
 1. Developed current unity project and able to display a list of values - working towards accessing Y gyroscope values in real-time
 2. Currently think we need to use rotation about the x-axis to determine the head tile that we will then use to toggle screens

Conclusions/action items:

Now that we have displayed an external camera in unity, we feel much more confident in the ability to display the endoscopic feed. Moving forward we will continue to work on accessing the gyroscope values that will then switch the feed shown.



11/17/2018 - Team Meeting - Unity Development

• JOSHUA Niesen • Nov 17, 2018 @02:58 PM CST

Title: Team Meeting 11/7/2018

Date: 11/17/2018

Content by: Joshua Niesen

Present: Joshua Niesen, Sam Peters, Tom Geissler

Goals: To work on the current unit project and access the gyroscope values for changing the display. Also to begin working on the final design report.

Content:

VR Headset for Endoscopy - Team Meeting 11/17/2018

Things we need to ask about/decide on:

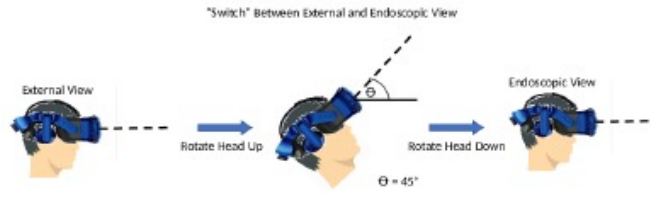
1. Installation/What is our final presentation to Dr. Ahmed
 1. Are we going to actually buy anything or just prove our software and offer the options that will be bought?
 1. Currently proof of concept is the main goal - presenting a system that can be integrated.
 2. When are we going to meet with Ahmed next?
2. Next steps at the end of today?
 1. Is it working?
 2. Do we need to contact Taylor?
 1. Sam Peters will contact Taylor to set up a meeting
 3. Where are we at in the process?
 1. Moving forward, just need to figure out the feed coming in and if this can be treated as an external webcam by the computer.
3. Working on the final report
 1. Need to assign sections and begin putting everything together.
 2. Edits from the preliminary report have been mainly completed - content updates need to be done.
4. Measure angle of neck extension that will be used to toggle between values.

FINAL REPORT:

1.
 1. NEED a math section - thinking possibly using the angles at which we will have the toggle mechanism take place.
2. Go back through and redo the references numbering so that everything properly aligns
3. Need to reference the figures that are placed in the document.

Conclusions:

Using the development we have completed so far, we will reach out to Taylor to try and get a half an hour of his undivided attention to complete a lot more development of the design. Also, changes suggested on the preliminary design report have been completed. Now, continued explanation of the design and fabrication process along with meeting all report requirements will be worked on and completed.



[BME_200_Head_Rotation_Image.pptx\(51.8 KB\) - download](#)



11/27/2018 - Team Meeting - Final Report/Poster

• JOSHUA Niesen • Dec 03, 2018 @10:42 PM CST

Title: Team Meeting 11/27/2018

Date: 11/27/2018

Content by: Joshua Niesen

Present: All

Goals: To work on the final report and assign sections for work outside of the group meeting.

Content:

Team Meeting 11/27/2018

Team Meeting Goals:

- Further develop unity project
- Poster
- Report - outline future objectives
- To Do:
 1. Need to include a math section - we can discuss trigonometry and the switching angle method we will be using (Josh Niesen)
 2. Block diagram of how all the components fit together (Sam Simon)
 3. Better background research to show validity and impact on a broader scale.. Not just with Azam? (Schini and Jake)
 4. Pictures of: headset, software, us working schini
 5. Purchasing Plan (Jake)
 1. Computer 903.30
 2. Keyboard/Mouse 15.84
 3. HTC Vive Pro 799.99
 4. VGA to HDMI cable 11.59
 5. GTX 1060 169.99
 6. Wireless option available but not practical based on
 6. Poster (All)
 7. Report (All)
 8. Lag time mathematics (Tom)
 9. Decide if we are using wireless or not... battery big enough? - big battery not enough. We can talk about future work and design and the need for a larger battery pack or a system for exchanging batteries during the procedure.
 10. Saving video procedure (Tom)
 11. Current patents

12. Create some sort of display for poster presentation

Stuff to ask Azam:

- Need to buy a computer as well... is that ok?
- Still need the monitor stand... is that ok?
- Bring a VGA to hdmi and see if computer will see/recognize it
- More info on surgical loupes

Stuff to ask Thompkins:

- Can he review our paper early (not a question)
- Do we need fab plans / testing plans
- How much math is enough

Tompkins Comments

Preliminary Report

1. Learning Objectives - rubric looking for requirements
 1. Mathematics - none
 2. Figures - Number and label
 1. Should mention figures in text
 3. Bibliography
 1. Chose numerical system - References Need to be numbered correctly
 1. We did not put the numbers in numerical order as they were supposed to be.
 2. Alphabetical Way
 1. First author's last name and the date
 2. If multiple authors, use et. al.
 4. Lifelong learning
 1. Find many resources and things to look into - websites, articles, etc...
2. What He DOES NOT LIKE
 1. Utilize - just "use"
 2. Too much writing - doesn't like the length "waste of words"
 3. Dell Visor
 1. Development environment - also needed to program the arduino
 4. Need to reference UNITY

5. HTC Vive
 6. Need to reference things more so that the average reader can understand what we are saying - reference where to find it.
3. Lighting in the room, we don't have control over.

Things to add to report:

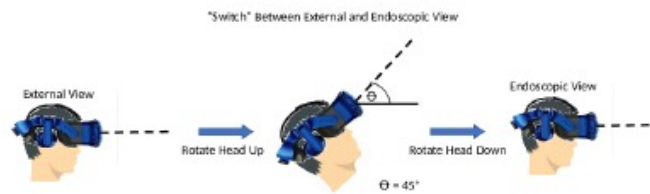
- Need to describe changes to the design as we went through the design process
- Testing
- Introduction
 - Global impact
 - How does this device revolutionize endoscopic surgery?
 - How does this differ from current existing methods?
 - Discussion of current imaging devices that are used during surgery - use monitors that are attached to the headset
 - Motivation
 - NEED to include at least 2 patents of current technology
 - 1.
 - Patent 7,821,530: discussion of the current imaging system. Can talk about this in our problem statement. Cite this in there.
 - Karl Storz patent of a video imaging system that minimizes the effect of EMI on the image data, provides a small, lightweight easy to use camera head, permitting interchangeable use of a variety of intelligent camera heads with a single camera control unit, and allows the utilization of new camera heads with new functions as they become available without having to replace the existing CCU
 - 2.
 -
- 2.2: Fabrication Research
 - More discussion on how to code in unity and the basics of how that works (Sam Peters?)
 - What is Unity?
 - What is the HTC Vive Pro?
- 2.4 Product Design Specifications
 - GO THROUGH AND UPDATE ENTIRELY
- Preliminary Designs
 - Reference google daydream image in text
 - Reference Dell Visor Image in text
 - Reference HTC Vive image

- NEED TO ADD A FABRICATION/DEVELOPMENT PROCESS SECTION
 - Add between Preliminary Design Evaluation and Conclusion sections
 - Materials
 - Rationale for why using each piece
 - Computer-generated images
 - Screenshots of the code
 - Final Prototype
 - Code used in unity
 - Block diagram
 - Figures that are being used
 - Testing
- Results - Need to create
- Conclusions - update to reflect new progress
 - Future work - need to expand
 - Why wireless
 - Where we are leaving the project
- Need to adjust our Citations

Conclusions:

We were able to assess the preliminary report and review the final report guidelines to determine what needs to be added to the current final report draft which will be handed in on Wednesday, December 12th, 2018.

• JOSHUA Niesen • Dec 03, 2018 @10:40 PM CST



[BME_200_Head_Rotation_Image.pptx\(52.6 KB\) - download](#)



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.



9/28/2018 - 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.



10/12/2018 - Advisor Preliminary Presentation/Design Discussion

- JOSHUA Niesen - Oct 16, 2018 @07:13 AM CDT

Title: Advisor Preliminary Presentation/Design Discussion

Date: 10/12/2018

Content by: Joshua Niesen

Present: All

Goals: To discuss the preliminary presentation and the design we would like to pursue.

Content:

Meeting with Prof. Tompkins 10/12/2018

Has Dr. Ahmed tried on a VR Headset before?

- We will discuss this in the meeting Monday

Dr. Ahmed and switching between views

Kevin Ponto

- Doesn't think we can switch from analog to the other
- How much can we mess with the setup

Questions for Dr. Ahmed

- Make/model of the endoscope working with
- COMPUTER!!!!

Conclusions/action items:

We were able to discuss our preliminary presentation with Dr. Tompkins and also the design believed to be most viable to pursue in this project. We also discussed some of the questions and comments that need to arise in our meeting with Dr. Ahmed on October 16, 2018.



10/19/2018 - Advisor Project Status Meeting

- JOSHUA Niesen - Oct 22, 2018 @05:22 PM CDT

Title: Advisor Project Status Meeting

Date: 10/19/2018

Content by: Joshua Niesen

Present: All

Goals: To discuss feedback from the preliminary report and to discuss the current state of the project and what needs to be completed next week.

Content:

Advisor Meeting 10/19/2018

Preliminary Report

1. Learning Objectives - rubric looking for requirements
 1. Mathematics - none
 2. Figures - Number and label
 1. Should mention figures in text
 3. Bibliography
 1. Chose numerical system - References Need to be numbered correctly
 1. We did not put the numbers in numerical order as they were supposed to be.
 2. Alphabetical Way
 1. First author's last name and the date
 2. If multiple authors, use et. al.
 4. Lifelong learning
 1. Find many resources and things to look into - websites, articles, etc...
2. What He DOES NOT LIKE
 1. Utilize - just "use"
 2. Too much writing - doesn't like the length "waste of words"
 3. Dell Visor
 1. Development environment - also needed to program the arduino
 4. Need to reference UNITY
 5. HTC Vive
 6. Need to reference things more so that the average reader can understand what we are saying - reference where to find it.
3. Lighting in the room, we don't have control over.
4. Sophomores - look for skills to pick
5. Progress Reports do not need to go in LabArchives

6. Toggle method:

1. Wants to look up and see endoscopic view, and when look down, he will see the instruments.
7. Would like to see a block diagram showing all the components and how this system will fit together

Conclusions/action items:

We were able to discuss our preliminary Dr. Tompkins and the need to improve the clarity of our writing along with incorporating mathematical knowledge into the report. We have also discussed action items for this next week including a block diagram to show how all of the components of this system will fit together.



10/26/2018 - Advisor Project Status Update

• JOSHUA Niesen • Nov 07, 2018 @08:18 PM CST

Title: Advisor Project Status Meeting

Date: 10/26/2018

Content by: Joshua Niesen

Present: All

Goals: To discuss the current progress made with Unity and SteamVR and the overall system that will be displaying this image. Also, to discuss the upcoming weekly meetings and events that will be occurring as part of the curriculum.

Content:

Meeting with Professor Tompkins 10/26/2018

Research Ideas

1. Discussion boards are very helpful, providing a lot of stepwise opportunity
2. Contact Kevin Ponto's grad student
3. Try to get more time with Taylor to work on the code
4. 3 questions to ask and find out from people

Conclusions/action items:

The team will reach out to external resources including Taylor at the Makerspace to better understand the inner components and complexities of Unity and how the system aims to fit together.



11/2/2018 - Advisor Project Status Update

• JOSHUA Niesen • Nov 07, 2018 @08:08 PM CST

Title: Advisor Meeting 11/2/2018

Date: 11/2/2018

Content by: Joshua Niesen

Present: All Members

Goals: To discuss the current state of the project as we are now consistently meeting in the Makerspace and the progress and knowledge gained so far by working with Unity and SteamVR.

Content:

Advisor Meeting 11/2/2018

Professor Tompkins

Next Friday - show and tell

- Divide teams into half
- Give a pitch to the groups that visit (~1 minute)
- Something physical
- Questions to ask group coming around
 - 1-2
 - Does anyone here have some experience with VR that might be helpful to our project?

If we want a team meeting next week send Prof. Tompkins a couple of possible times

Advising/Course selections suggestions also available

Two Weeks from today - Tong Distinguished Lecture

Three Weeks from today - no meeting due to the holiday

Final team meeting week after thanksgiving

Conclusions/action items:

We need to get a lot done in the coming week involving displaying an external feed and accessing the gyroscope values through unity software. Also, we will need to schedule future meeting with Professor Tompkins outside of our regularly scheduled meeting time.



Product Design Specifications

• JOSHUA Niesen • Dec 12, 2018 @11:03 AM CST

Title: Product Design Specifications

Date: 12/12/2018

Content by: All

Present: All

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

Content:

Product Design Specifications

December 12, 2018

Client: Dr. Azam Ahmed

Advisor: Dr. Willis Tompkins

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

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 lagging 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**12. 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.

13. 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. Our more immersive solution would likely be more expensive than this, but we would like to keep it under \$2000. 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**14. 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.

15. 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.

16. 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.

17. 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 despite their use of bluetooth, 360° POV angles, and sleek designs. Similarly, AR is another type of competing technology applicable to endoscopic procedures.

Works Cited:

4. PDS References

[1] Center for Devices and Radiological Health. "Overview of Device Regulation." *U S Food and Drug Administration Home Page*, Center for Drug Evaluation and Research, www.fda.gov/medicaldevices/deviceregulationandguidance/overview/default.htm.

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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

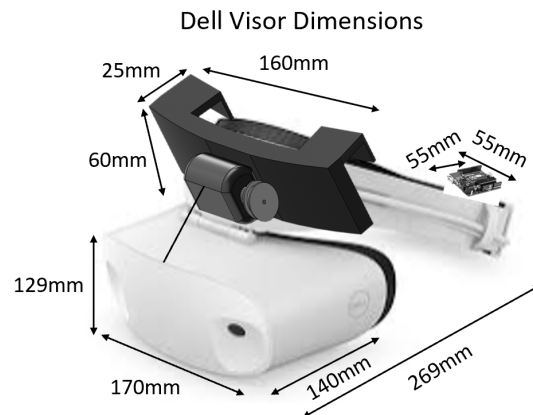
Present: Sam Schini, Tom Geissler, Sam Simon, Sam Peters, Josh Niesen, Jake Cohn

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.



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 as well as head tracks 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.

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-

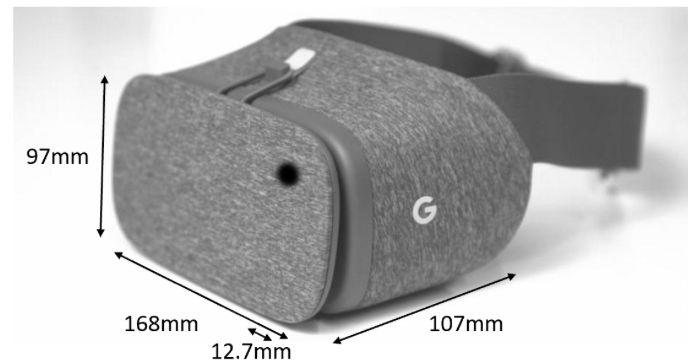
- Price: \$280 (\$220 Google Nexus Phone + \$60 Headset)
- System Requirements: Android Mobile OS
- Weight: 605 g
- Development Environment: Google Daydream Software
- Connectivity: None

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-

Google Daydream Dimension



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.

Final Materials Budget

- Jacob Cohn - Dec 11, 2018 @08:22 PM CST

Purchasing Plan



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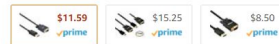
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12/11/2018 - Software Fabrication

• SAMUEL PETERS • Dec 12, 2018 @11:03 AM CST

Title: Software Fabrication

Date: 12/11/2018

Content by: Sam Peters

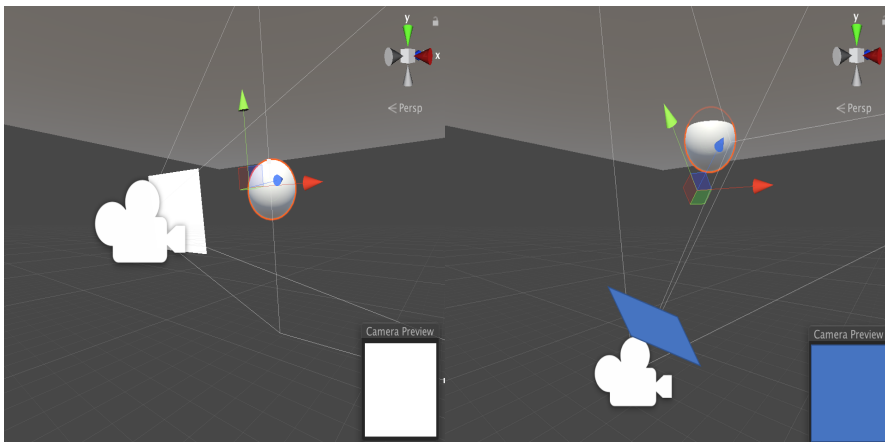
Present: NA

Goals: Describe software fabrication process.

Content:

The core of our fabrication was developing an application in Unity to manage the VR headset. The program consists of two main software components: displaying live video feed and transitioning between video streams. Through leveraging the library of existing classes provided by Unity, we were able to treat each video as a ‘Webcam’ object. The Webcam class initializes a live stream upon the start of the program bypassing standard compile time encodings of video files. Once both streams are initialized, the software is able to selectively display different feeds.

We accomplished the transition between environmental and endoscopic view using the graphical development aspect of Unity. A sphere object is attached to the user that is at a fixed distance in front of the user. When the user looks up, the sphere collides with a plane. Upon collision, a signal is sent to switch video feeds. This motion can be seen in the figure below.



[Figure 1] A graphical representation of a user in the Unity environment. When the user looks up, the sphere collides with a plane and signals for the video stream to change.

Conclusions/action items: Our application was created in Unity with the core challenges of streaming live video and transitioning streams.

Final Design - Block Diagram

• Sam Simon • Dec 12, 2018 @01:51 PM CST

Title: Final Design - Block Diagram

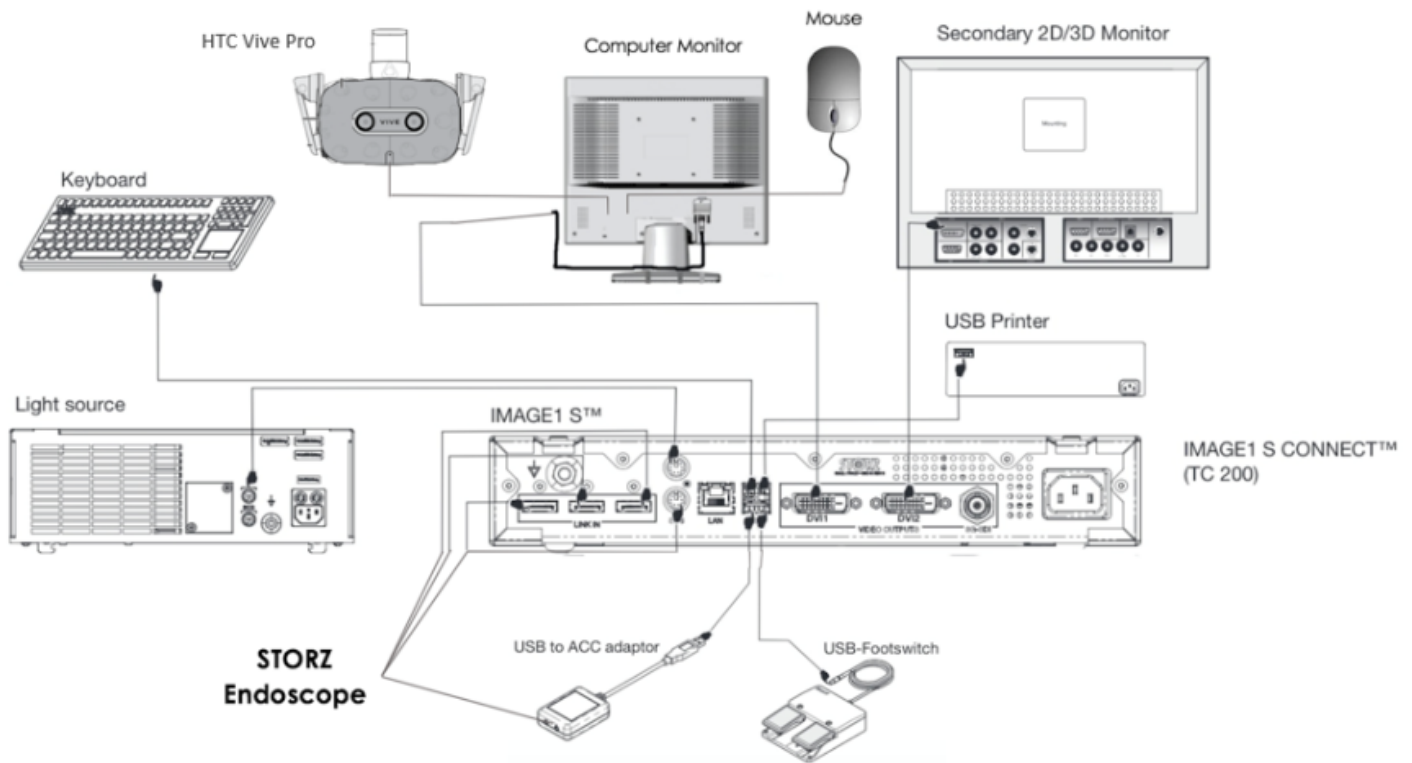
Date: 12/12/2018

Content by: Sam Simon

Present: Sam Simon

Goals: To briefly elaborate on the final layout of our design, including all hardware components.

Content:



- The figure above displays the main components involved in our design, and consists of two main groups:
 - 1. VR hardware
 - The HTC Vive Pro headset is able to connect to a computer monitor using a simple USB-USB cable
 - Any monitor used in the setup must have internet access to be able to run the Unity platform. The monitor should continually be run by an OR staffer to assure that the surgeon is receiving a clear image of the procedure
 - A mouse connected to the monitor allows the user to navigate through Unity to run the appropriate software
 - A wireless adaptor may be purchased for the HTC Vive Pro at an additional cost to eliminate the need for additional cables
 - 2. Story Endoscopy System
 - The imaging system is provided as a single package by Storz and includes plugging for the endoscopy tool as well as a foot switch that allows the client to zoom in and out from the image
 - Traditionally, the image from the endoscope is piped to two monitors in the operating room - however, one of these outputs can be manipulated using a VGA-HDMI adaptor to provide the necessary input to the computer monitor and the headset

Conclusions/action items:

The hardware setup provided is simplistic and flows well with the setup currently found in the operating room. In the future, our client had an interest in changing the system so that the headset may be wireless and the zooming feature could be operated by the headset. This change would involve

purchasing the wireless adaptor and complex Unity programming beyond the current knowledge of team members.

Depth Perception Test

• JOSHUA Niesen • Dec 12, 2018 @11:04 AM CST

Title: Depth Perception Test Protocol

Date: 12/12/18

Content by: All

Present: All

Goals: Test the depth perception of the external camera attached to the HTC vive

Content:

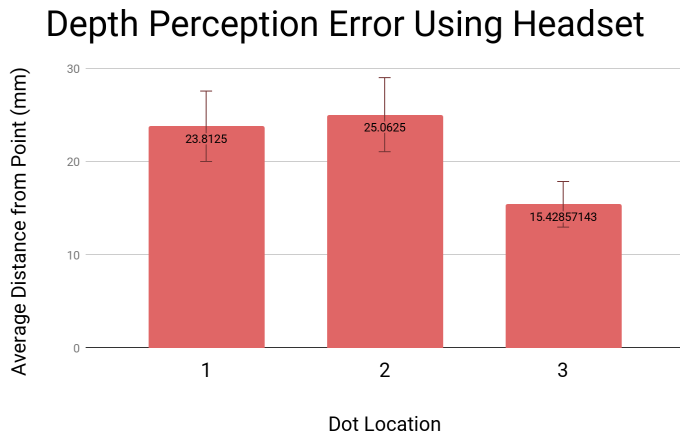
First, the headset was set to the environmental view. Next, the tested individual was given the headset to place on their head and properly adjust so that the headset was comfortable. After two minutes of wearing the headset, the individual sat down in a chair. With this, another chair was placed in front of the individual with a piece of cardboard on the chair that was parallel to the ground and one foot below eye level as can be seen below in the attached picture. The piece of cardboard was 30 cm by 24 cm and had three dots that were 11mm in diameter randomly placed and assigned as number one, two, and three. The base of the chair was located 30 cm away from the base of the chair the tested individual was sitting in. The setup for the testing procedure was now complete.



(Figure 1: picture of test setup)

To conduct the test, ten trials took place. A single trial was conducted by the following method. First, a test conductor announced a numbered dot for the tested individual to locate. Next, the individual placed a marker tip as closely to the assigned dot as possible, without moving the marker once it contacted the cardboard as seen above in Figure 9. Once the marker was in place, another test conductor used a ruler to measure the distance from the center of the dot to the tip of the marker. These data values were recorded in millimeters and placed in the data table shown in the Appendix (Section 11.5) of our final report. This was then repeated nine more times. This entire procedure was repeated three more times for a total of four individuals.

Conclusions/action items:



(Figure 2: Average distance from dot location graph)

Our testing shows that the HTC Vive external camera has significant depth perception issues. Figure 2 shows that closer images are easier to navigate towards and that the quality of depth perception decreases as this distance increases. Thus, the depth perception of the camera on the HTC Vive is not adequate for the application to the operating room and further testing with a dual-camera headset will need to be completed.

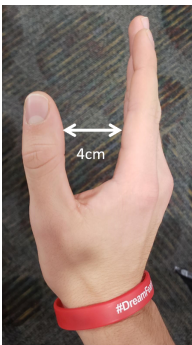
 **Latency Test**

• THOMAS GEISSLER • Dec 12, 2018 @10:40 AM CST

Title: Latency Test**Date:** 12/12/18**Content by:** All**Present:** All**Goals:** Test the latency of the HTC Vive external camera**Content:**

The latency test of the VR headset front camera video feed measured how much of a delay is present in video displayed from the front-facing camera of the headset. This test involved two separate data sets of trials that were cross-referenced and analyzed to form conclusions. To set up the test, the necessary materials involved a yard stick, data table, and the HTC Vive Headset with assisting software and computer.

To conduct the testing, a test proctor and individual conducting the test stood face to face approximately half a meter apart from one another. To administer a trial, the individual being tested would hold their hand 30 cm in front of the headset at 15 cm below the chin so that the palm of the hand was oriented perpendicular to the ground as seen in the diagram below (see Figure 1).



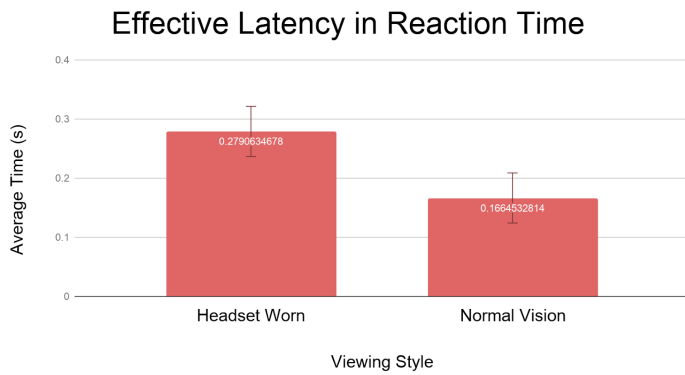
(Figure 1: A visual representation of the hand orientation used to conduct the latency test for the camera feed from the HTC Vive Pro)

Next, the test administer held the 25 inch mark on the yard stick at a flush level with the plane of the thumb and pointer finger created by the individual being tested as can be seen below in Figure 2. The yard stick was oriented so that the one inch mark was closest to the ceiling. When ready, the test administer dropped the ruler at a random point in time at which the individual being tested attempted to grab the ruler as quickly as possible. The length of the ruler recorded was that visible above the thumb and palm of the hand. This process was repeated nine more times using the headset. Once this was completed, the individual repeated this testing without wearing the VR headset for a total of twenty individual trials. This test was conducted on four individuals.



(Figure 2: A picture taken during testing showing a trial of the latency test in which a testee seeks to grab the yard stick as quickly as possible)

Conclusions/action items:



(Figure 3: Average latency time vs. vision condition)

	<i>With Headset</i>	<i>Without Headset</i>
Mean	15.4375	5.5
Variance	19.24599359	5.256410256
Observations	40	40
Pearson Correlation	-0.098785296	
Hypothesized Mean Difference	0	
df	39	
t Stat	12.21151575	
P(T<=t) one-tail	3.34612E-15	
t Critical one-tail	1.684875122	
P(T<=t) two-tail	6.69224E-15	
t Critical two-tail	2.02269092	

(Figure 4: Two-sample T test data)

There was, on average, around 100ms of lag while wearing the headset when compared to not wearing the headset as shown in Figure 3. This is about double the amount of time it takes for information to travel from the retina to the brain. The extra lag time is a major concern moving forward because our client needs to accurately be able to place an endoscope in a patient’s nasal cavity without any work flow interruption of the surgery. Additionally, the two sample t-test we performed resulted in a p value in the magnitude of 10E-15 which means that there is a statistically significant difference between the two sets of data.



Discussion of Final Design and Process 12/11/2018

- Sam Schini - Dec 12, 2018 @12:38 AM CST

Title: Final Discussion of Final Design and Design Process

Date: 12/11/2018

Content by: Sam Schini

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

Goals: Evaluate the final design for our client and future works that should be considered

Content:

- Conclude that the camera on the HTC Vive that was used to conduct the latency and depth perception tests significantly puts the user at a disadvantage compared to normal vision
 - There was around 100ms of lag while wearing the headset when compared to not wearing the headset
 - Which is about double the amount of time it takes for information to travel from the retina to the brain according to a study conducted by Freeman et al. in 2011
- Major concern moving forward: our client needs to accurately be able to place an endoscope in a patient's nasal cavity without any work flow interruption of the surgery
- Testing shows that the HTC Vive external camera has significant depth perception issues
 - Figure 10 in paper shows that closer images are easier to navigate towards and that the quality of depth perception decreases as this distance increases
 - Single camera HTC Vive is not adequate for the operating room and testing with the HTC Vive Pro (with two external cameras positioned in binocular fashion) will need to be done
 - We hope that the HTC Vive Pro will provide a more appropriate stereo vision for the environmental view of the final design and testing results will improve when testing is done on the same four individuals under the same conditions
 - Our goal is to get results from multiple test subjects consistently located within the 11mm diameter circle, comparable to an adult nasal cavity
- Experienced external sensor signaling issues to the VR headset system while it was in use during tests
 - The external sensors placed around the VR room in the Makerspace that allow the Vive to perceive its position in space, would lose connection to the headset when an object or person interrupted the signal
 - This would cause the headset to go blank regardless of the view it was streaming to the user because the headset could not be located
 - This is a concern that will require testing in the operating room to validate if it is a significant issue or not
- Final design has not been tested by our client for the full duration of a surgical operation
 - No data has been collected regarding if there is any physical strain from wearing a headset for 10 plus hours at a time, or eye irritation from extensive time staring at the display
 - We must determine the practicality of wearing this final design for long periods of time before it can be implemented in the surgical setting
- Our client has suggested some additional modifications to the final design: a hands-free feature that allows the endoscopic camera to zoom in view on the display, a 3-D input option that allows endoscope feed to be seen in the third dimension rather than on a plane, and customizable gestures to initiate the switch between views
 - These are secondary modifications that can be made once the final design has been deemed appropriate, practical, and safe for use within a surgical setting
- Our final VR headset design has much future progress to be made; it did realize major innovative application for the operational atmosphere
 - The final design gives our client a truly immersive experience; he will not be exposed to subliminal vision distraction throughout the operating room while performing endoscopic surgery
 - The compatibility of the VR headset with endoscopic feed eliminates the need for our client to statically stare at a bulky monitor without being able to move himself or his vision field around the operating table
 - This design has demonstrated the foundational potential to be used in other surgical operations
 - Our final design can be further applied to other surgeries that require real-time imaging from a camera and simultaneous playback on a display

Conclusions/action items:

The discussion of our final design evaluated any shortcomings that we witnessed after testing with our program and the HTC Vive in the Makerspace. Additionally, we addressed the accomplishments of our final design and what we can look forward to improving in the future.



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
 - ffmpeg - 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.



12/4/18 Final Solution Demo for Ahmed

• THOMAS GEISSLER • Dec 08, 2018 @03:37 PM CST

Title: 12/4/18 Final Solution demo for Dr. Ahmed

Date: 12/4/18

Content by: Thomas Geissler

Present: Tom, Sam Peters, Josh Niesen

Goals: Give Dr. Ahmed a demonstration of our final solution

Content:

While our final design was working prior to the demo, when Dr. Ahmed arrived, we could not get the camera from the headset to display. Despite this, we were able to get the feed from the webcam to work which allowed Dr. Ahmed to get a feel for what our solution would consist of. Additionally, Dr. Ahmed was able to try out the comfortability of the headset itself. Dr. Ahmed did not share our concerns about the weight of the headset, nor our concerns about the depth perception of the camera being off.

Conclusions/action items:

Dr. Ahmed requested another demo of the project so he could see it working to its full functionality, as well as show some of his colleagues the design concept.



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 pathology

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.

Journal of Surgical Oncology 2008;97:658–664

Endoscopic Skull Base Surgery: Principles of Endonasal Oncological Surgery

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DANIEL FRIEDBERG, MD,⁴ PAUL GARDNER, MD,⁵ AND BRAD ALBERT, MD,⁶
¹Department of Otolaryngology, University of Pittsburgh, Pittsburgh, Pennsylvania
²Department of Neurosurgery, University of Pittsburgh, Pittsburgh, PennsylvaniaEndoscopic endonasal surgery can be applied to the management of benign and malignant intracranial neoplasms with good results. For tumors that involve the skull base, an endoscopic “craniofacial resection” can be performed with the incision of the nasal slit. Preliminary experience with this openly endoscopic technique of efficacy neuroanatomic indicates good local control and low complication. Advantages of endoscopic endonasal skull base resection include minimally invasive and decreased morbidity compared to craniotomy and approaches. *J Surg Oncol* 2008;97:658–664. © 2008 Wiley-Liss, Inc.

Key Words: cranial base; endonasal; endoscopic; efficacy; neuroanatomic; craniofacial resection

INTRODUCTION

The introduction of endoscopic technology has had a profound impact on the management of intracranial tumors. Endoscopic intracranial surgery such as involving pituitomas and gliomas^{1–3} can be ideally suited for endoscopic techniques. Published series have demonstrated that endoscopic resection of properly selected tumors is associated with improved local tumor control and decreased morbidity compared to craniotomy approaches.^{4–11} Endoscopic treatment of the skull base also facilitates the postoperative surveillance of patients for recurrent disease prior to the onset of symptoms of radiographic evidence. The application of endonasal endoscopic techniques to the management of endonasal intracranial tumors has been more controversial.^{12–15} The primary concern is adherence to oncological principles. In this review, we will discuss ongoing, forward-looking concerns in skull base resection, the ability to achieve hemostasis and skull base repair, complications, and outcomes.

Over the last decade, there have been significant advances in the use of cranial base surgery with the application of endoscopic techniques to the management of both benign and malignant disease of the cranial base.¹⁶ These include an improved understanding of endoscopic anatomy, the development of new instrumentation, and the description of new endonasal surgical approaches and surgical techniques.^{17–19} The use of optical skull base can now be achieved safely with endoscopic techniques. Current indications will detail these endonasal approaches to benign and malignant intracranial neoplasms. Early results are promising and suggest that endonasal surgery can be safely performed with low morbidity and comparable oncological results.

SURGICAL PRINCIPLES OF ENDONASAL SKULL BASE SURGERY

The key concept of endonasal surgery is cranial surgery viewing the surgical corridor that gives the best access to the pathology. The endonasal is simply an endoscopic technology that may be applied to any surgical corridor. For most intracranial tumors, the endonasal corridor provides the best direct access with the least manipulation and morbidity of normal tissues. For example, a tumor that is

located superior or lateral to the optic chiasm may be best approached using a transcranial approach. Conversely, a tumor that is situated medial to the cavernous internal carotid artery is best approached using an endonasal approach. Considerations in a complete endonasal approach include incision of the crista and identification of significant lesions. Factors that cannot be completely avoided using an endonasal approach may require an open approach or combination of approaches.

Endonasal skull base surgery is not new surgery. Rather than learned surgeons operating unilaterally, endonasal skull base surgery requires surgeons to operate simultaneously, one trained in visualization with the endoscope while the other focuses with two hands. Neither surgeon can accomplish the goals of surgery alone. The collaborative nature of the surgery demands sharing of knowledge and techniques that explain the intricacies of both operations. Benefits of endonasal surgery do not include depth and accuracy and visualization, in contrast to open surgery, improved patient waking and metabolic risk of anesthesia. 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 a vessel bleeding or both vessels 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. Endoscopic endonasal visualization around corners, increasing deployment of normal tissue. 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 obscuring structures, and gain exposure through the nasal cavity. Although there is loss of the “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 conducting 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

• THOMAS GEISSLER • Oct 07, 2018 @04:09 PM CDT

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 impedence. 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

• THOMAS GEISSLER • Oct 07, 2018 @04:36 PM CDT

Title: Green Pass Certification

Date: 10/7/18

Content by: Thomas Geissler

Present: Thomas Geissler

Goals:

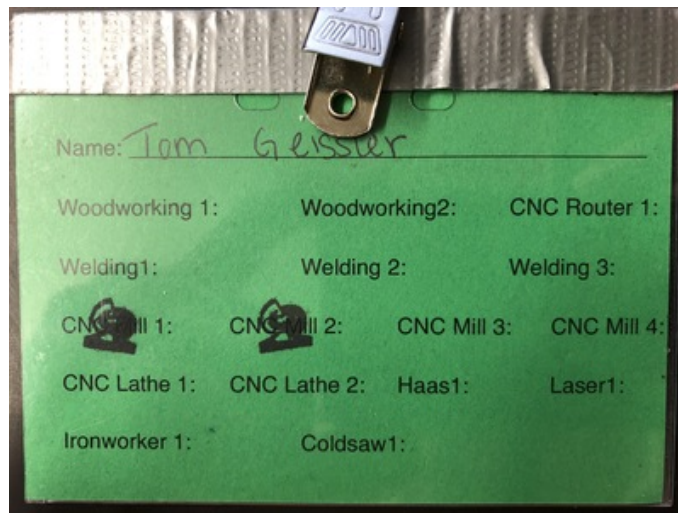
Content:

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:

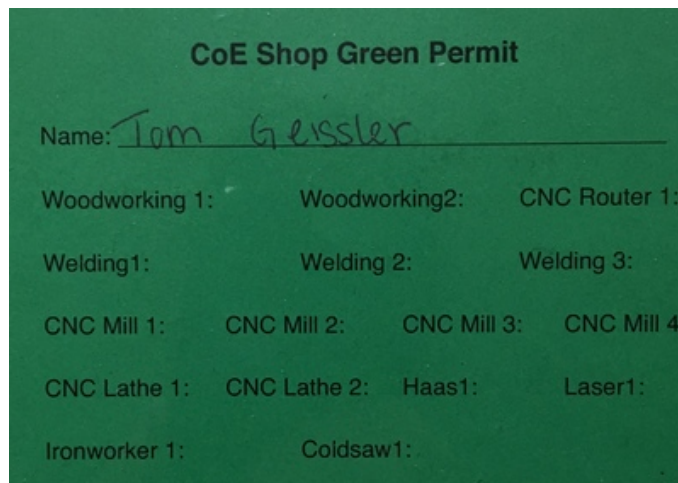
The next step is to get my 3-D printing certification from the makerspace. This could potentially be useful for this projet as well as future projects in bme.

• THOMAS GEISSLER • Oct 07, 2018 @04:37 PM CDT



IMG_1644.JPG(3.3 MB) - [download](#) Greencard (with upgrades)

• THOMAS GEISSLER • Oct 07, 2018 @04:37 PM CDT



IMG_0457.JPG(879.3 KB) - [download](#) Greencard



9/21/18 Codes and Standards

• THOMAS GEISSLER • Sep 21, 2018 @10:26 AM CDT

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.



9/21/18 Leadership Styles

• THOMAS GEISSLER • Sep 21, 2018 @10:24 AM CDT

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. foresee 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.



9/21/18 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.



11/18/18 Webcam Texture

• THOMAS GEISSLER • Dec 08, 2018 @03:43 PM CST

Title: Webcam Texture

Date: 11/18/18

Content by: Thomas Geissler

Present: Thomas Geissler

Goals: Research how to get the camera from the HTC vive displayed as a texture in Unity

Content:

link: https://www.reddit.com/r/Unity3D/comments/5l5irg/heres_a_tiny_vive_camera_stream_as_a_texture/

This is a reddit feed that resources at the Maker space directed us to. The code and directions for applying the texture are provided in the link.

Conclusions/action items:

Work needs to be done to validate that this will work for our applications.



11/15/18 Background

• THOMAS GEISSLER • Dec 08, 2018 @03:47 PM CST

Title: Background

Date: 11/15/18

Content by: Thomas Geissler

Present: Thomas Geissler

Goals: Familiarize myself with Unity development

Content:

Links:

<https://www.youtube.com/watch?v=LZTctk19sx8>

<https://www.youtube.com/watch?v=qMhjLT7iVZ0>

<https://github.com/rab-h-sonmai/ViveCamFox>

<https://blogs.unity3d.com/2017/06/16/codesnippets-toggle-vives-front-facing-camera-and-tron-mode-at-run-time/>

Along with the VRTK channel on youtube.

The above links are to unity development tutorials.

Conclusions/action items:

Watch all of these to familiarize yourself with unity development.



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 weight 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.itk.ac.in/ibc/BNC.pdf>

- The Bayonet-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 B
- 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=Cj0KCQjwrZLdBRcmARlItem=9SIA2763PV7697&ignorebbr=1&nm_mc=KNC-GoogleMKP-PC&cm_mmc=KNC-GoogleMKP-PC-_-pla-_-DLP+Replacement+Lamps-_-9SIA2763PV7697&gclid=Cj0KCC

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 wir

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.

<i>For a single eye</i>	PPD	Horizontal FoV°	Horizontal 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.



10/22/2018 - Handsfree View Transitioning

• Sam Simon • Dec 12, 2018 @02:14 PM CST

Title: HTC Vive Board - Handsfree View Transitioning

Date: 10/22/2018 (date the message was sent to the discussion board)

Content by: Sam Simon

Present: Sam Simon

Goals: To see if there is already a built-in feature on the HTC Vive Pro to switch to the external camera without use of one's hands.

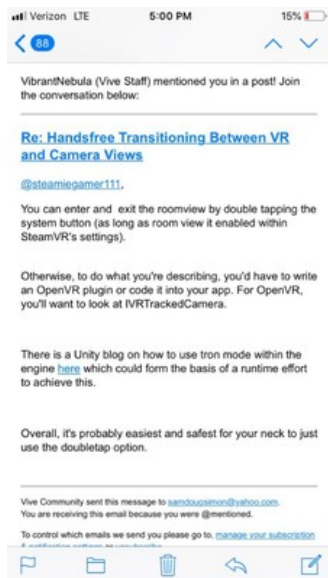
Content:

My message to the community:

Handsfree Transitioning Between VR and Camera Views

I'm currently working on a project where I will be switching between the HTC Vive Pro's VR view and that of the external cameras. At the moment, I need to go into Steam VR to enable the cameras and manually make the transition. Ideally, I would like to program a method that would allow me to switch views by a head movement using the Vive Pro's built in gyroscopes and accelerometers; however, I'm unsure how to do so.

Community Feedback:



Conclusions/action items:

The VR staff that replied to my message reiterated what we already knew - that a button exists to perform this function - but did not specify an easy method to perform this action handsfree. The individual did open up a lead with OpenVR that may allow us to code a switch, however we will need to further investigate whether this software is compatible with Unity which is the platform we intend to use.



9/11/18 - Google Cardboard

• Sam Simon • Oct 10, 2018 @01:56 PM CDT

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] [Ong, Joo L., and Teja Guda. *Translating Biomaterials for Bone Graft Bench-Top to Clinical Applications*. CRC Press, 2016.]
 - 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
 - **Surgical VR Headsets or Monitoring Devices** 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] [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/ClassifyYourDevice/ucm2005371.htm [Accessed: 13 February 2018].]
 - 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] [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].]
 - 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/DeviceRegulationandGuidance/Overview/ClassifyYourDevice/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/DeviceRegulationandGuidance/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.



9/15/2018 - Electrochemical Mirrors

• Sam Simon • Dec 12, 2018 @02:06 PM CST

Title: Electrochemical Mirrors

Date: 12/12/2018 (Page Created), 09/15/2018 (Originally Written)

Content by: Sam Simon

Present: Sam Simon

Goals: To assess whether the client's desire to use electrochemical lenses is feasible.

Content:

The client's proposed electrochemical lens does not appear to be an ideal design in light of the resources available to us. The lenses themselves are extremely expensive and there doesn't seem to be any current technology that can switch a lens between displaying an image (in a clear and non-transparent manner, at an image quality appropriate for the surgical procedure) to becoming clear.

Instead, we suggest that a periscope system be used, where a transparent plate (plastic or glass) is placed in front of the surgeons line of vision, whereas the screen displaying the endoscopic procedure is placed above the surgeons line of vision. An electrochemical mirror (switching between reflective and transparent states by means of changing voltage) is placed between the surgeon's eyes and the transparent plate. Therefore, the device may control when the surgeon can see the "real world" (the mirror becomes transparent) and when the surgeon views the surgery (the mirror becomes reflective, deflecting the line of vision to the screen). Through providers like Kent Optometrics and Elmont Glass, we assure such a mirror exists and is commercially available at an affordable rate. As far as a trigger to switch between the clear and endoscopic views, we propose using accelerometers to track head movement. A predetermined motion would be calibrated to trigger the switch. This is where Tom's experience in the signal processing of accelerometers will be helpful. A switch based on head movement would be far simpler and would less frequently "misfire" than a switch based on eye movement.

Conclusions/action items: [Updated]

After conducting some preliminary research as a group, our team determined that producing our own headset and calculating the optical parameters we would need to avoid eye irritation was simply not possible within the time constraints of a semester. Instead, our group has chosen to modify a preexisting VR headset to fit the needs of our client. Doing so will allow us to focus on the software - the true focus of this project - over hardware.



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 borders
- Standards require the tracking of dimensions, and factor of safety in the final design

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

• Sam Simon • Oct 10, 2018 @12:57 PM CDT

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
- Better 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 unnecessary 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](#)



10/28/18 - Unity Tutorials

• Sam Simon • Dec 12, 2018 @02:05 PM CST

Title: Unity Tutorials

Date: 10/28/2018

Content by: Sam Simon

Present: Sam Simon

Goals: Learn how to navigate the Unity HUB and gain a basic understanding of code in Unity.

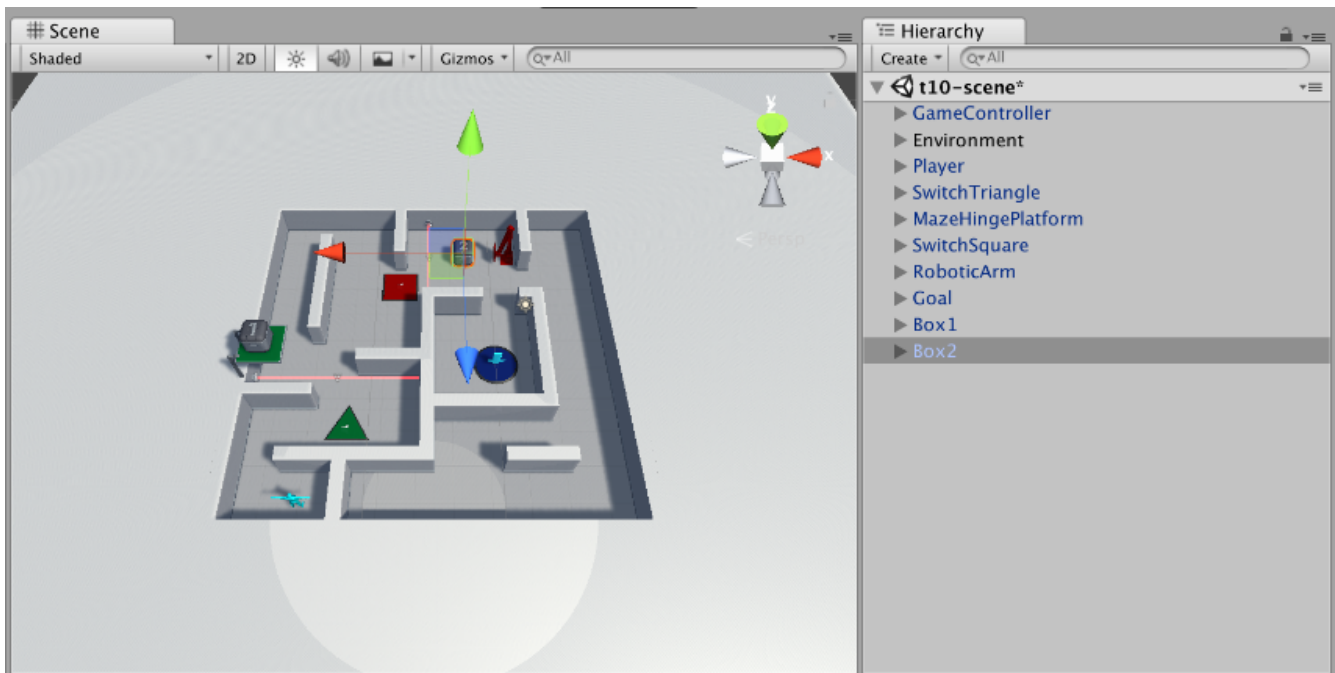
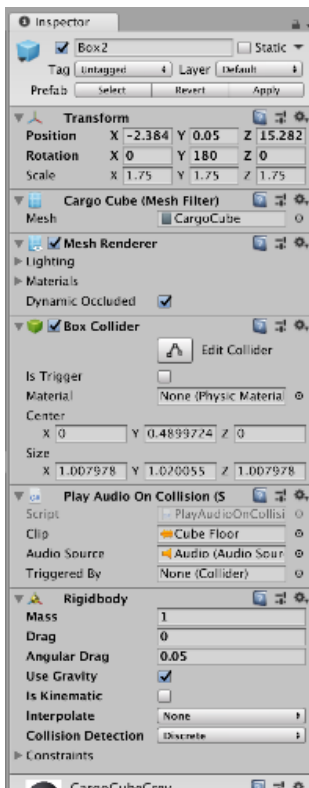
Content:

01: Play and Edit Mode

- Unity games are developed by continually "playing" the game and then pausing to edit
- The unity scene consists of two boxes:
 - the SCENE- shows all backgrounds and figures used in the game
 - the GAME - when playing, shows the players view of the stage as they move around
- Clicking the play button begins the game; clicking play again goes back to the edit scene

02: Game Objects and Components - Rigidbodies to the Rescue

- Scenes in Unity are composed of building blocks called GameObjects and components
- a GameObject is an object or structure on its own; it acts motionless and has no physics until a component is added to it giving it some form of physics (i.e. respond to gravity)
- To make an object rigid and to respond to gravity, the Physics-->Rigidbody component must be added to it
 - click on the object (in the Scene or in the Hierarchy screen); then in the Inspector screen, click add component
 - Hierarchy screen - displays the name of all GameObjects in the scene
 - Inspector screen - displays all the qualities and components of a selected GameObject



03: Tweaking Components - Values vs Zombies

- The values of components (i.e. speed of an enemy, rate at which an object falls) can be changes in the Inspector window
- Unity has built in components or we can code/make our own custom ones

04: Prefab Power - Ramping Up

- The Project window shows all the files (called "assets") that are used in the game. They can be 3D models, audio, scripts, etc.
- Prefabs are types of assets that act as a template for a certain GameObject (essentially a saved file)
- By dragging an asset from the Project --> Hierarchy window, an instance of that GameObject appears in our Scene
- the Transform of a GameObject its its xyz coordinate, its scale, and rotation; all of these can be adjusted in the Inspector window to change the objects placement on the Scene

Conclusions/action items:

Completing these tutorials has made me comfortable with the general layout of the Unity design studio, however I will need to further practice collision mechanics in Unity in order to create a useful code for our headset.



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: Oculus 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 formally 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 necessarily 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 than 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.



10/31/2018 Potential Contacts

▪ Sam Schini ▪ Dec 11, 2018 @05:06 PM CST

▪ Sam Schini ▪ Dec 11, 2018 @05:15 PM CST

Title: Contacts to Help Resolve Unity Live-Stream Feed Difficulties

Date: 10/31/2018

Content by: Sam Schini

Present: Sam Schini, Sam Peters, Jake Cohn

Goals: Find help for a solution to not being able to convert live-stream footage into Unity Game Engine

Content:

Tyler Caraza-Harter- Computer Science Professor

- Contacted via email to see if has familiarity with Unity Game Engine and would be willing to help
- Knowledgeable in programming
- Microsoft background

David Allen- Computer Science Student

- Contacted via text to see if has any experience with Unity
- Deep understanding of other gaming engines

Conclusions/action items:

Both contacts were reached out to, but neither responded in a timely enough manner before Sam Peters resolved the issue.



Solution to Unity Webcam Stream

• Sam Schini • Dec 11, 2018 @05:35 PM CST

Title: Solution to Live-Stream Program for Unity

Date: 11/7/2018

Content by: Sam Schini

Present: Sam Schini and Sam Peters

Goals: To find a code block that is a solution that allows Unity to live-stream from an external camera, so that the stream can be transferred to a Virtual Reality headset.

Content:

<https://answers.unity.com/questions/909967/getting-a-web-cam-to-play-on-ui-texture-image.html>

This source is from a Unity endorsed question and answer forum. This source outlines the code block that allows Unity to view live external feed from a "Webcam" such as the endoscopic camera. The code highlights internal methods of Unity ("RawImage" and "WebCamTexture") that allow Unity to stream feed from the external camera on its home display.

Conclusions/action items:

Sam Peters was able to program in Unity with similar code as provided by this source for a solution to our issue.



9/19/2018 Design Topics Videos

- Sam Schini - Sep 19, 2018 @11:24 PM CDT

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.

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

• Sam Schini • Oct 09, 2018 @09:11 PM CDT

• Sam Schini • Oct 09, 2018 @09:22 PM CDT

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 with Faculty

• Sam Schini • Dec 01, 2018 @06:39 PM CST

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 and faculty 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.



10/12/2018 Meeting

• Sam Schini • Dec 01, 2018 @06:39 PM CST

Title: Second Student BSAC Meeting

Date: 10/12/2018

Content by: Sam Schini

Present: Sam Schini

Goals: Discuss BME 201 structure and timing, Chem 344 requirement removal, and project selection processes.

Content:

Overview-

- Break into groups with one BSAC executive board member who facilitated a conversation
- BME 201:
 - 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, accommodates 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, too much emphasis on bioinstrumentation compared to other tracks, not enough SolidWorks exposure
- Chem 344
 - Not all accredited BME programs require Chem 344 lab: it is not needed for some tracks
 - Not many students find it relevant for other courses
 - Possible course substitutes are: BME 399, ECE 270, Mechanics and Materials lab for biomechanics students, Medical Physics-Imaging
- Project Selection Process
 - 1st Priority: Unsuccessful Proposal BME 400 students (Bring others with them)
 - 2nd Priority: Remaining BME 400 students (Bring others with them)
 - 3rd Priority: Unsuccessful Proposal BME 300 students [NO others with them]
 - 4th Priority: Remaining BME 300 students [NO others with them]
 - 5th Priority: BME 200 Students

Conclusions/action items: BME 201 has many pros and cons and could certainly modify curriculum to provide more expansive and relevant material for future BME courses. Chem 344 is not a necessity for tracks other than biomaterials, and could be substituted for by other labs that pertain to biomechanics and bioinstrumentation. Finally, the project selection process could be slightly tweaked for next year in that BME 300 students will not be able to bring 300/200 students up with them.



10/26/2018 Meeting with Faculty

• Sam Schini • Dec 01, 2018 @06:25 PM CST

Title: Second Student BSAC Meeting with Faculty

Date: 10/26/2018

Content by: Sam Schini

Present: Sam Schini

Goals: Discuss project selection process with faculty, Chem 344 requirement removal, and COE/makerspace single fee.

Content:

Overview-

- Break into groups with one BSAC executive board member and faculty who facilitated a conversation
- Project Selection Process:
 - Faculty (Dr. P) approves for 300 students who do not win their proposals to still bring along team members from their proposal, but does not approve of the individual proposals, but want to help facilitate team formation
 - Concerns were discussed about the advisor selection of teams during the BME draft process
- Chem 344
 - Not all accredited BME programs require Chem 344 lab: it is not needed for some tracks
 - Not many students find it relevant for other courses
 - Possible course substitutes are: BME 399, ECE 270, Mechanics and Materials lab for biomechanics students, Medical Physics-Imaging
 - Possibly a modified Organic Chemistry lab for Biomaterials students since polymers and lab technique are very important
 - Is a hefty course load that should be considered since may not be as relevant to certain tracks
- COE shop and makerspace fee
 - Currently \$50 a semester
 - Lifetime fee would incentivize using the shop more, but freshman may not be sure if they will for sure need to purchase the lifetime
 - Solutions:
 - Could be incorporated into college of engineering tuition
 - Could decrease the lifetime fee each year for students

Conclusions/action items: Project selection process will still focus mainly on team development, so students will be allowed to bring others with them to work on projects. Chem 344 may not be fair for all BME students to take, so there are likely alternatives that will be addressed in the near future. The lifetime shop fee will likely be presented on a year to year basis giving students the option to purchase it when most convenient for classes and personal interest.



11/9/2018 Meeting

• Sam Schini • Dec 01, 2018 @06:38 PM CST

Title: Third Student BSAC Meeting

Date: 11/9/2018

Content by: Sam Schini

Present: Sam Schini

Goals: Discuss BME banquet and 300 project management.

Content:

Overview-

- Break into groups with one BSAC executive board member who facilitated a conversation
- BME Banquet:
 - Partner with BMES to host a BME banquet in April
 - Showcase the BME program to parents/ celebrate our accomplishments with parents, students, and faculty
 - Varsity Hall, Local BME alum as keynote speaker, several design teams present their projects, Makerspace tours across the street
 - Concerns and Thoughts:
 - Distance is limiting factor for parent attendance
 - Some students wanted graduation week, others want as far away from graduation as possible
 - Could potentially be a big fundraising thing
- BME 300 Project Management
 - What can we do to set 300/200 teams up for success?
 - Concerns and thoughts:
 - "Checks ins" to hold 300s accountable to the training process seems like a good idea, since some 200s feel like their 300s don't engage with them at all
 - There are no set guidelines for what 200 students should be learning from their 300s and 300s feel like they don't know/are not prepared to teach the content to others
 - This is a huge time commitment on top of the design process for the 300s, many feel they just do not have the time to help 200s on top of doing their design work
 - There is a problem with some students not doing anything for their projects and not being invested in design in all
 - The amount of writing required for design should be reduced: teams feel that they can't spend as much time on their projects because of prep for the deliverables
 - Soutlion:
 - Mentors are BME design group co-members.

Conclusions/action items: The BME banquet seems to be a nice gesture that has the ability to raise money for the BME department, but the many barriers of travel and logistics of a large event make it difficult to justify. There should be some form of 300 mentorship enforcement within design groups to allow 200s to be included and excel within the group. This will ensure more successful mentorship as they become 300s.



11/30/2018 Meeting with Faculty

• Sam Schini • Dec 01, 2018 @07:10 PM CST

Title: Third Student BSAC Meeting with Faculty

Date: 11/30/2018

Content by: Sam Schini

Present: Sam Schini

Goals: Discuss Show and Tell session, replacing 402 presentations with this session, BME banquet.

Content:

Overview-

- Break into groups with one BSAC executive board member and faculty who facilitated a conversation
- Show and Tell:
 - General consensus was that students enjoys this more than giving formal presentations for grade
 - Benefits:
 - Students could get feedback/input from other students regarding their project and how to progress it
 - Was a good check up to incentivize progress
 - Issues:
 - 200s tended to shy behind the presenting of 300s
 - There was not enough time to thoroughly discuss projects/have peers ask enough questions (may be necessary to put stricter time constraints on pitch)
- Replacing 402 Presentations with Show and Tell Session
 - Evaluated how well show and tell session was and if how it could be more definitive to replace presentations
 - How would it be graded?
 - How could an elevator pitch be defined for this purpose:
 - Much more focus on content not presentation of pitch
 - There will be a survey regarding show and tell sent out to the BME program members
- BME Banquet:
 - BMES/BSAC joint organizational event for the BME department
 - The idea is to host a BME banquet in April to show design progress to parents, students, and faculty and plan is to have it in the Spring this year
 - Fundraiser opportunity for the BME 201 curriculum Discussion:
 - Generally positive feelings about the idea
 - CONCERN:
 - Timing of the event
 - Scheduled close to finals and end of semester
 - Week 8,9,10 proposed
 - All BMEs would be invited for fundraising aspect
 - CONCERN:
 - Pricing- Depends on what you want to eat/attendance
 - Union South has a catering system set up with a pre-selection menu based on RSVP
 - Students price probably shouldn't be > \$20
 - Parents (required price) shouldn't be > \$30
 - There are other methods of fundraising than a banquet
 - There may be other ways of involving parents
 - Hidden fees in setting up the banquet would decrease the amount raised for fundraising
 - Survey students to determine rate of attendance

Conclusions/action items: The show and tell session worked well and will likely be used again in the future, however, not yet sure if it was informative enough to completely replace presentations. BME banquet has many logistical aspects to be worked out regarding the cost and actual attendance from students. Additionally, there is already a graduation banquet for BME seniors, so this additional one may not have much more value for students.



Neck Extension Values for Gyroscope - Angle of Extension

• JOSHUA Niesen • Nov 17, 2018 @03:07 PM CST

Title: Normal Neck Rotation Values for Switching Mechanism

Date: 11/17/2018

Content by: Joshua Niesen

Present: Joshua Niesen

Goals: To discover the average values that neck rotation takes place at that can then be used to program the headset to toggle between views at the given rotational values.

Content:

Source 1:

The term "extension" refers to the action of moving the head backwards and extending the neck.

Normal head extension is 60-70 degrees at the maximum value.

Pennington, Mike. "Neck range of Motion at Turning Point Physical Therapy." Internet: <https://turningpointpt.com/pain/neck-pain/neck-range-of-motion-at-turning-point-physical-therapy>, Mar. 17, 2017 [Nov. 17, 2018].

Source 2

Normal head extension is 45-70 degrees.

Stephens, Kristi. "Normal Neck Range of Motion." Internet: <https://www.livestrong.com/article/95456-normal-neck-range-motion/>, Aug. 14, 2017 [Nov. 17, 2018]

Conclusions/action items:

The values presented in the text are consistent and will be used when we program a value at which the view for the headset will switch.



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.

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 efficiency 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

• JOSHUA Niesen • Sep 14, 2018 @08:50 PM CDT

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 training, 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 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.wearable.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

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 tend to be class I medical devices in eyes of FDA

Sam Peters

Current Market Devices

Current VR Headsets

Google Daydream View

• \$100

• Just uses phone

• Uses daydream software

Oculus Rift

• Runs HDMI for input

• Must be powered by a computer → Additional \$850

• \$500

• Mirage Solo

• \$400

• Standalone

• Apparently heavy and not comfortable.

duplicate info to Tom

BME 200 Research Conducted Thus Far 9/25/2018

Tom Suggs/Hopwood

Principles of Endovascular Oncological Surgery

• Need more visualization

• Best tech: Promising surgery, heavily relies on imaging → when we provide.

MTC Vibe

• \$99 Standard. Max for pro

• Good resolution - extra non-invasive beam

Current Market Devices:

• Price

• Software

• Resolution

• Weight

• Size

• PPA

• Camera front built in?

• Better? → ES so, how long?

Tom

Current Market Devices

Oculus Rift

• \$399

• Need computer to operate

• ? What is meant by a structure sensor?

Google Daydream

• \$99 "normal" • \$400 Standalone

• Sim alone or use google phone as processor

• Lower Resolutions

• Does not have an attachment for video input. Will need more to figure this out.

Tom

Current Market Devices

Sam Simon

Current Market Devices / Components

Sam Simon

VR Structural Design + Ergonomics

Design of headset to fit head + face.

BNC Connectors + Bluetooth Connectivity

• BNC → simple twist very easy

• New Big Bluetooth BNC Adapter

• Can connect to a bluetooth receiver.

• Able to fit bluetooth receivers

• BNC → simple twist very easy is a cable → one of client's wants to not have

All these components can become expensive

Joshua

Basics of VR: Hardware

- ^{Learn more about the different types of VR} Introductory Problem Information
- General media coverage of VR technology in surgery.
- Breakdown of how VR works at the most basic levels
- 60FPS minimum for these VR headsets to not cause lag/nausea.

Joelle

Medical Procedure

- General Endoscopy
- Discussion of general endoscopic procedure
- Barbecks what Tom said about Endosomal procedure: Very touchy

Joelle

Medical Procedure

- VR Surgery
- Discussed VR use for training of doctors
- Not pertinent to this project

Joelle

Current Market Devices

- VR Styles & Connectivity
- HTC Vive - high end → 3d time being monitored.
- Bias of using a smartphone headset instead of a self-contained headset due to B.
- Requesting more research for ~~positive~~ VR headsets

Sam Sohni

Medical Procedure: Surgeon Issues

- Operation Related Injuries: Surgical Procedures
- Eye Strain
- Neck Pain
- Suggests a study of surgeons using VR to see statistically if less than eye strain & neck/brace pain

Current Market Devices

- Sam Peters (Cont'd) Types of VR Headsets
- HTC Vive
- \$550
- Requires computer, but has \$300 option for wireless

Sam Peters

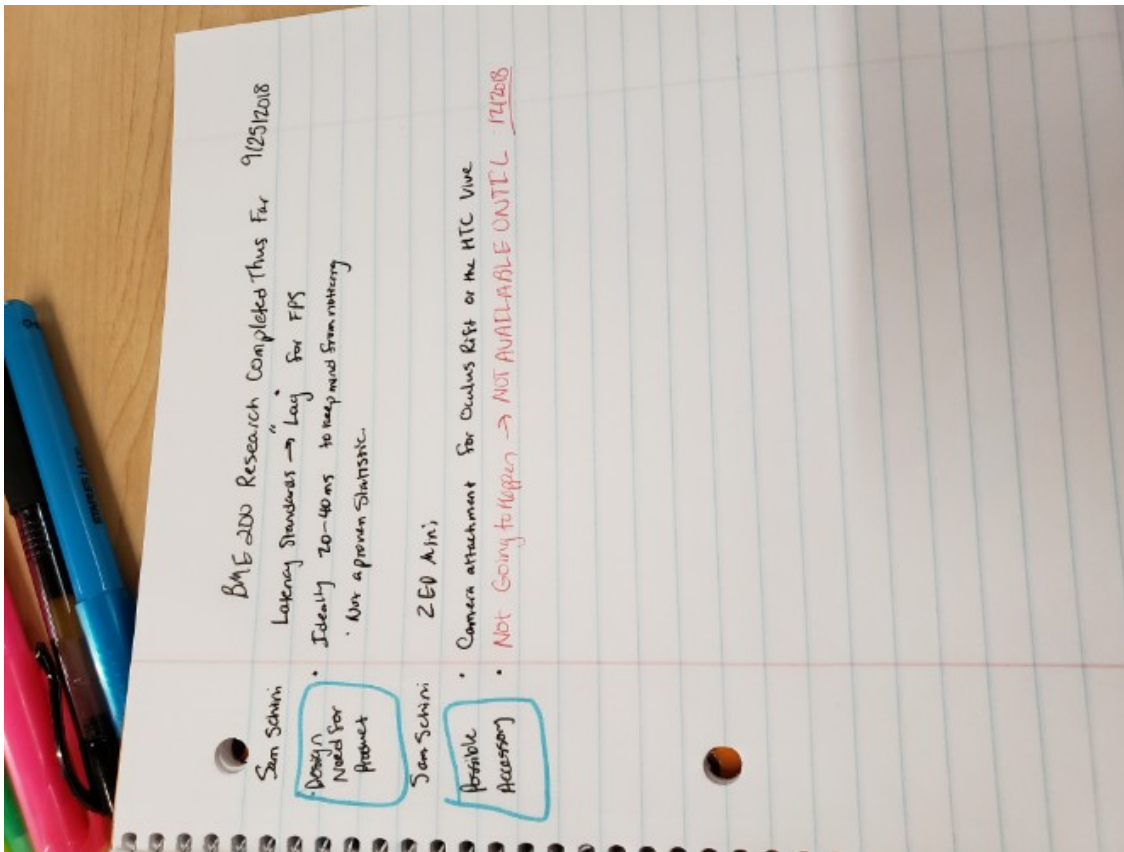
Current Market Devices / Components

- VR Software
- Daydream Platform (Google)
 - Compatible with Android + Nerve Solo
 - Easy to move to other devices.
- Google SDK for Android
- SDK for loading Daydream VR on Android platform.
- Android platform mainstream
- Best VR for HTC Vive
- OpenVR SDK by Valve
 - Supports multiple VR hardware + applications don't need to be vendor specific
- Steam VR SDK
 - Lets developers create single interfaces that work across all VR headsets

Joshua

Current Market Devices / Components

- Modular & Convertible Reality Headset System
- Online avatars design to understand VR headset components
- Discussion of eye tracking technology
 - Light reflection off eye for tracking → ^{Very complex algorithm, but the world has already been done.}
- Discussion of infrared technology to track avatars, similar to above.



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.



Samsung_HMD_Odyssey.JPG(53 KB) - [download](#)



Samsung_HMD_Odyssey_1_.JPG(104.5 KB) - [download](#)



Oculus_Rift.JPG(11.2 KB) - [download](#)



Oculus_Rift_1_.JPEG(23.8 KB) - [download](#)



Dell_HTC_Vive.JPEG(69.6 KB) - [download](#)



Dell_HTC_Vivo_1_.JPEG(105.9 KB) - [download](#)



Dell_Visor.JPG(72.2 KB) - [download](#)



Dell_Visor_1_.JPG(86.6 KB) - [download](#)



10/22/2018 - Sam Simon Email Screenshot from Steam VR Community

• JOSHUA Niesen • Oct 22, 2018 @06:16 PM CDT

Title: Sam Simon Email Screenshot - Steam VR Community

Date: 10/22/2018

Content by: Josh Niesen

Present: Josh Niesen

Goals: To display the response Sam Simon got from a question he posed to the Steam VR Community to further our research for controlling the enclosed gyroscope in the HTC Vive Pro

Content:

Screenshot of email attached.

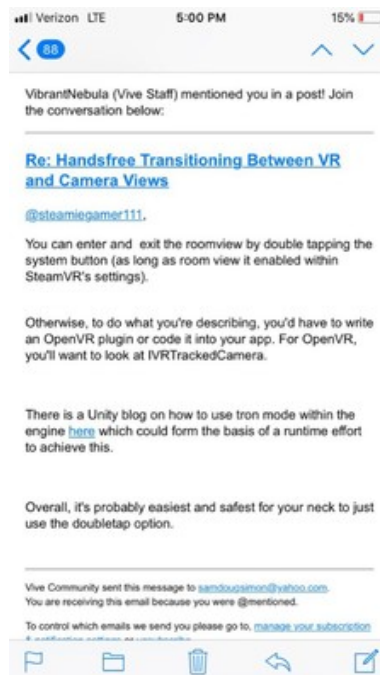
E-mail

VibrantNebula (Vive Staff). Handsfree Transitioning Between VR and Camera Views. Personal E-mail (10/22/2018)

Conclusions/action items:

The blog post instructs us that there is a button already on the headset that allows the user to switch between the external view and the endoscopic view. However, we will need to either write an OpenVR plugin or code it into our app. This decision will need to be based on more research to determine which method will be the simplest to attain.

• JOSHUA Niesen • Oct 22, 2018 @06:10 PM CDT



BME200_Gyroscope_Email_-_Sam_10-22-2018.jpg(124.9 KB) - [download](#)



10/22/2018 HTC Vive Pro Steam VR

- JOSHUA Niesen - Oct 22, 2018 @07:03 PM CDT

Title: Sam Simon Email Screenshot - Steam VR Community

Date: 10/22/2018

Content by: Josh Niesen

Present: Josh Niesen

Goals: To gain knowledge and information regarding access to the gyroscope values that are being used for the HTC Vive Pro headset.

Content:

HTC Vive Gyroscope/Camera Control Research

SteamVR Developer Hardware - Discussion

1. "Currently you can get the raw difference by running "lighthouse_console.exe /imu /dump" located in the SteamVR tools folder. This gives you a realtime log of the values. However, logging this breaks the tracking and require you to restart your SteamVR project in Unity to get tracking. The output looks like this:

```
0.565085 563209    gyro -0.04 +0.03 -0.01 accel +1.10 -9.81 +0.73
0.566085 611217    gyro -0.03 +0.03 -0.01 accel +1.14 -9.74 +0.69
0.567085 659224    gyro -0.03 +0.03 -0.02 accel +1.18 -9.74 +0.70
0.568085 707231    gyro -0.03 +0.03 -0.02 accel +1.20 -9.71 +0.65
0.569085 755239    gyro -0.03 +0.02 -0.02 accel +1.22 -9.77 +0.74
0.570086 803246    gyro -0.03 +0.03 -0.02 accel +1.17 -9.79 +0.69
0.571086 851253    gyro -0.03 +0.03 -0.02 accel +1.15 -9.78 +0.66
```

2. "I had a quick and dirty look at osvrv for unity and it seems you can access the data directly (position and rotation) by getting reference to a PoseAdaptor object which is kept up to date by osvrv itself. Update looks to be called whenever the engine wants and grabs the current data from a PoseAdaptor then. Not sure if that will get you to 100Hz but atleast will let you to get updates async from the engine.

Here would be my starting point:

<https://github.com/OSVR/OSVR-Unity/blob/master/OSVR-Unity/Assets/OSVRUnity/src/PoseInterface.cs>"

Coral et al. "Accessing the raw gyro/accelerometer data through OpenVR?" Internet:

<https://steamcommunity.com/app/358720/discussions/0/45184885023434508/>, Jun. 22, 2018 [Oct. 22, 2018]

VIVE Pro HMD - Activating the dual camera

Activating the dual camera

You need to enable the settings for the dual camera of VIVE Pro before you can use it in VR.

From your computer, open the SteamVR app.

Click , and then select Settings > Camera.

Click Enable Camera.

Close and reopen the SteamVR app.

Click , and then select Settings > Camera.

Select Allow Camera in Dashboard.

“Vive Pro HMD Support - Activating the dual camera.” Internet: https://www.vive.com/us/support/vive-pro-hmd/category_howto/activating-the-dual-camera.html, [Oct. 22, 2018].

Conclusions/action items:

Above are a couple of methods that we can test to see if we can access the values of the gyroscope on the VR headset. This is a major step forward if we can access these values. Next, we need to find where the click of the button on the headset toggles to the front view. Then we can add code so that the gyroscope values can also control the view displayed so that the headset will switch views when we tilt the headset appropriately. Last, more research needs to be done for OpenVR and also for creating an app in SteamVR.



HTC Vive Pro Wireless Capabilities

- JOSHUA Niesen • Oct 22, 2018 @06:49 PM CDT

Title: HTC Vive Pro Wireless Capabilities

Date: 10/22/2018

Content by: Josh Niesen

Present: Josh Niesen

Goals: To highlight a Youtube video I found discussing the wireless capabilities of the HTC Vive and HTC Vive Pro.

Content:

HTC Vive Wireless Adapter Review - Freedom is Wireless

“HTC Vive Wireless Adapter Review - Freedom is Wireless.”Internet: <https://www.youtube.com/watch?v=5tondYxB9Vo>, Sep. 24, 2018 [Oct. 22, 2018].

1. Headset powered by htc quick charge 3.0 battery pack
2. No warning if the battery is becoming low - which is important in our case
3. Image can cut out if CPU on computer is not able to keep up - very important.

Conclusions/action items:

The Youtube video brought to mind a couple of points I wanted to highlight here to keep in mind our requirements for the battery supply and also the specifications that we will need in order to provide a consistent and clear image to Dr. Ahmed.



Endoscope Video Feed Information

• JOSHUA Niesen • Nov 02, 2018 @04:07 PM CDT

Title: Video Feed From Endoscope Research

Date: 11/2/2018

Content by: Joshua Niesen

Present: Joshua Niesen

Goals: To discover the necessary video feed requirements for the project.

Content:

Conclusions/action items:

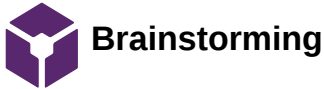
• JOSHUA Niesen • Nov 02, 2018 @04:07 PM CDT

11 Technical description

11.1 Technical data

IMAGE1 S CONNECT™ TC200	
Technical data in connection with the IMAGE1 S™ LINK modules	TC 300 H3-LINK TC 301 X-LINK TC 302 D3-LINK TC 304 4U-LINK
HD video outputs	2 x DVI-D 1 x 3G-SDI
Signal output format	1920 x 1080p, 50/60 Hz
LINK input ports	3 x
Service interface	RJ45
USB port	4 x USB (2 x front, 2 x rear)
Image format	JPEG
Video format	MPEG 4
SCB interface	2 x 6 pin Mini DIN
Storage/transport/temperature	-10 °C...+60 °C, +14 °F...+140 °F
Humidity	Operation: 20 %...85 % (non-condensing) Storage/Transport: 20 %...95 % (non-condensing)
Atmospheric pressure	Operation: 70 kPa...106 kPa Storage/Transport: 50 kPa...106 kPa
Operating rated altitude NN	3000 m
Operating temperature	0 °C...+40 °C, +32 °F...+104 °F

Image_1.PNG(107.4 KB) - [download](#)

**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 Odyssey
- 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 an 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.

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

• JOSHUA Niesen • Sep 21, 2018 @08:57 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/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.



9/8/2018 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 CO₂

-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



9/8/18 VR surgery

• Jacob Cohn • Dec 12, 2018 @08:23 AM CST

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

<https://www.theguardian.com/technology/2016/apr/14/cutting-edge-theatre-worlds-first-virtual-reality-operation-goes-live>

<https://www.medicalrealities.com/shafi-ahmed/>

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



9/18/18 VR styles and connectivity

• Jacob Cohn • Dec 12, 2018 @08:25 AM CST

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: Full specs found in Existing VR Headsets folder

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.



9/25/18 HTC Vive

• Jacob Cohn • Oct 07, 2018 @04:15 PM CDT

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.



9/25/18 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



9/25/18 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.



9/26/18 Test of Headsets

• Jacob Cohn • Dec 11, 2018 @05:01 PM CST

Title: Test of Headsets

Date: 9/26/18

Content by: Jake Cohn

Present: Jake Cohn and Sam Schini

Goals: Try on headsets and determine which is most comfortable and ergonomic

Content:

HTC VIVE: This headset was relatively lightweight, fit well, but the straps were hard to maneuver. A bit of an ergonomic problem with the headset being very front loaded in terms of weight. I was imagining being a surgeon having to wear it for hours on end and it seems like it would get annoying and would not be so helpful to the problems such as neck and back strain that our client desires to be relieved. Overall, it could be a good headset for our use because it has a front facing camera but it was not the most comfortable headset that we tried on.

DELL VISOR: I will preface this by saying that this does not have a front facing camera, so we would not be able to use the hands free head motion switching mechanism. It was very comfortable and fit my head extremely well. With this, I could imagine wearing it for long periods of time and not being too bothered by it. It did not have straps, which was nice to not have to deal with. It just had a sliding mechanism that allowed it to open or close based on the head size of the operator.

Conclusions/action items: Going forward, I think it is important for the client to try these headsets on to be able to tell us how he thinks they feel. With this, he is a busy man so I'm not sure how realistic that is. I think we should continue to explore ways to mount a camera on the Dell Visor, which was a bit more comfortable than the Vive.



11/4/18 Unity Notes

• Jacob Cohn • Dec 11, 2018 @05:22 PM CST

Title: Unity Notes

Date: 11/4/18 and 11/5/18

Content by: Jake Cohn

Present: Jake Cohn

Goals: Learn the basics of Unity

Content:

<https://forum.unity.com/threads/completely-disable-position-tracking.450644/>

-details around the ability to use and disable head tracking capabilities of the HTC Vive.

<https://www.youtube.com/watch?v=LZTctk19sx8>

-details surrounding starting out with unity. Creating planes and simple objects with code.

<https://www.youtube.com/watch?v=qMhjLT7iVZ0>

-this combines the two from above with using the objects and basics to create an application on Unity.

<https://github.com/rab-h-sonmai/ViveCamFox>

-This was key in showing the details on the camera implementation into the unity surface.

-This is going to be very necessary for the future of the project and getting the endoscope's feed to display to the headset.

<https://www.youtube.com/watch?v=fzRVtJUp00w>

<https://www.youtube.com/watch?v=tyFV9oBReqq>

-Both of these go through more basics on Unity and even include the use of steam.

Conclusions/action items:

Continue to learn more about unity so that we can find a way to integrate the endoscope into the unity program and also work with the trigger mechanism we hope to achieve.



12/5/18 Purchasing Plan

Title: Purchasing Plan

Date: 12/5/18

Content by: Jake Cohn

Present: Jake Cohn

Goals: Create a plan of what to buy and where for our client if he chooses to invest his money into our project in the future.

Content:

Purchasing Plan

logitech **Logitech MK120 Wired USB Keyboard and Mouse - Black**

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9/20/18 Codes and Standards

• Jacob Cohn • Sep 20, 2018 @03:55 PM CDT

• Jacob Cohn • Sep 20, 2018 @04:11 PM CDT

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



9/20/18 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



10/12/18 BPAG Meeting

• Jacob Cohn • Dec 12, 2018 @07:53 AM CST

Title: BPAG Meeting Notes

Date: 10/12/18

Content by: Jake Cohn

Present: Jake Cohn

Goals: Learn about the procurement process

Content:

Get the client to buy it for us → Not reimbursement

Keep track of purchases

NON BME → UW MD → no limitations on personal funds

→ university funds **Shop@uw**

Many different places with fast shipping and substantial discounts****

→ **DoIT for cables** and accessories (maybe headset)

→ CoE student shop with funding info → sign up with credit card for 3D printing

Reimbursement

Hard copy receipts (within 90 days)

Table with parts and link

Make sure

Beware of ineligible vendors

Susan Sauer ssauer@wisc.edu

2124 ECB 6082623036

If he uses personal funds all the rules are basically null

Expense spreadsheet on course page

Conclusion/action items: If our client would like us to go all in on our expensive project, I plan on having him purchase all of the materials at one time and picking them up from him. This would avoid any reimbursement problems.



2016/09/05-Entry guidelines

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

Use this as a guide for every entry

- Every text entry of your notebook should have the **bold titles** below.
- 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.

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.



Title:

Date:

Content by:

Present:

Goals:

Content:

Conclusions/action items: