

To: Professor Martin, Watson 104, Section 61

From: Alvin Chen and Maggie Huang

Date: March 11, 2019

Re: Alternative Design

Design Statement:

Design a video game controller for people with little or no use of their arms.

Alternative Design Description, Headset Connected to Foot Controller

Our alternative design to make a controller, in which, there are two parts: a headset and a foot controller. The headset is suppose to help create a stimulation for the user by producing sounds through a headphone. Additionally, other functions include eye tracking to easily access functions such as a game menu and microphones to connect with other players online. On the other hand the foot control will have all major motor function such as character control and easy to clean. The dimensions of the foot controller is to fit all and light to carry. The controller is going to be compatible with all systems. Other modifications include bluetooth and the use of different materials.

Viable Alternative Solution:

Eye Tracking and Gestures (Alvin Chen)

Eye tracking is a system in which a camera type sensor determines the user's eyes' locations to access other functions without the use of hands (Chew, 2018). Eye tracking is comprised of many individual subsystems including cameras and matrices. The camera in the system is to track the user's eyes movements and gestures. While another subsystem creates a pattern of light over the eyes. With these subsystems, the machine can identify where the user's eyes are located on the visor (This, 2015).

Installing this type of technology within the headset will allow more functions to be easily accessible such as the menu. This can be done if the user just looks around the screen, and selecting an application, such as system setting, just by looking at it for a few seconds. Additionally, if the user quickly looks from left the right two times the application, or game, would close. Being programmable, the user will be able to change the functions associated with each gesture. The cameras would be located on the left and right sides of the visor, so it wouldn't interfere while the user is gaming. The cameras would work in tandem to perceive the user's eye movement (This, 2015).

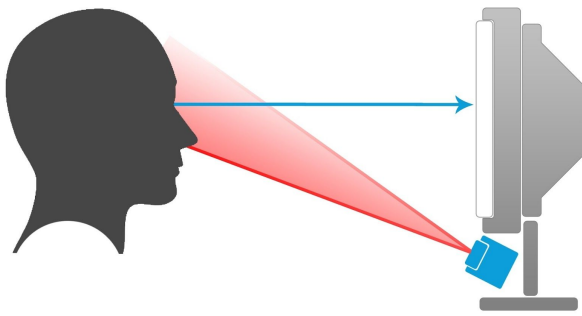


Figure 1- Shows how the user's eyes are tracked by the camera, when the user is looking at the screen. In the headset the cameras would be positioned on the side of the visors.

Applying the Paul and Beitz Criteria, Eye Tracking and Gestures

Our Paul and Beitz Criteria consist of Cost, Structure, User Interaction and Compatibility. With User Interaction being the most important and compatibility being the least. Eye tracking would apply to the User Interaction column because eye tracking helps the user navigate through the menu and allows for easy use. Eye tracking is effective because it allows the navigation of certain tools to be more manageable. The camera is located on the side of the headset's structure so it wouldn't block the user's line of sight when concentrating on a game.

Headphones and Microphones

The combination of the headphone and microphone combination is called the telephone headset in which both devices work in sync. The telephone headset receives and sends information through bluetooth or other wireless sources for quick convenience and flexibility. The headphones are able to pick up incoming frequencies and turn them into known sounds such as a voice or music. While the microphone allows the user to communicate with other players without background noise. Conventionally, the method that allows the user to interact with the telephone headset easily is with the use of buttons and analogs (Davidson, 2017).

The headphones are going to be located on the left and right of the user ears, while the microphone will be located below the user's mouth, as seen in Figure 2. The headphones allow sound to travel to the user without much resistance. On the other hand, the microphone will allow the user to communicate with other players without much background noise allowing for clear speech. The volume of the headphone and whether the user wants the microphone to be on can be controlled by the visor.



Figure 2 - How the headphone and microphone would work together without disrupting the other's functions. In our device the speakers would look similar and the microphone would be located on the right.

Applying the Paul and Beitz Criteria, Headphones and microphones:

The headphone and microphone would apply to User Interaction. The headset's structure allows the headphone will be on both the left and right of the device with an arc connecting both of them, and the microphone will be an extension on the right of the headset. The microphone allows the user to communicate with other players. The headphone produce sounds to stimulate the user. The headphone and microphone has a strong score in the criteria because the headphones allows the user to experience the game more, while the microphone connects the user to the outside world.

Wireless charging

Wireless charging works by having a transmitter coil inside the charger and a receiving coil inside the device. The electrons within the transmitter coil goes around the receiving coil producing a magnetic field used to power the battery of the device (How). The headset can be wireless charged by placing it on the circular charging pad connected to a wall. By doing this, there aren't going to be wires that will degrade over time and it has been proven that it wouldn't destroy your battery (Hill, 2019). The headset will include a smaller circle on the back that shows where it can be wirelessly charged. By doing this, it allows the charging pad to be small and portable.



Figure 3 - A wireless charger for the phone. With this device incorporated with the headset design, the headset can be wirelessly charged along with the other devices such as phones.

Applying the Paul and Beitz Criteria, Wireless Charging

Wireless charging applies with User Interaction, Structure and Compatibility. This device allows the user to easily charge the headset without plugging many wires in. Wireless charging would make the charging mechanisms between the headset and charger simpler. Additionally, any device that is capable of wireless charging can use the same charger as the headset.

Foot Controller Connection & Controls (Maggie Huang)

The foot controller would connect to the main console through the means of bluetooth wireless connection. Bluetooth connection has been popularized as a means of wireless connection, drastically increasing the mobility of any device. Both the headset and the console would be connected to the foot controller via bluetooth. The versatility of this device makes it so that it can be adapted to be compatible with any other device that can also has a bluetooth connection (Sharma 1865).

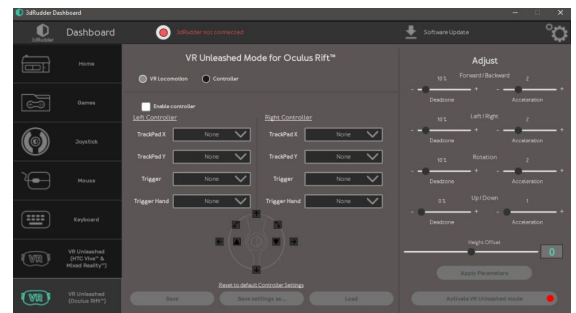
Based on a previous model of a foot controller, called the 3d Rubber. There would have to be a set-up page where the user adjusts the sensitivity of controller and so the user gets comfortable with the controls before proceeding to play any games (Vieux). A shift forward would result in the on screen player moving forward, and a shift left would make the player go left... etc. With dimension requirements in mind, the foot controller would only be about 12 inches in diameter which allows it to cater to the general public, being that the average male foot size is a size 10 (about 10.2 inches). Mimicking the center of any other controller on the market, pressing the center button on the foot controller would allow the user to return to the homescreen of the console.

Figure 4 - The bottom of the device that would allow it to rotate.



Figure 5 - The button in center that would allow users to return to home screen.

Figure 6 - Example of sensitivity set up and instructions.



Applying the Paul and Beitz Criteria, Foot Controller:

With the Paul and Beitz Criteria that was made, movements made by the user to control an online sim would be considered user interaction. The foot controller allows users to move in various directions while also allowing them to personalize their sensitivity settings. Rotational features allowed by the controller eliminates the use of a regular joystick which makes it easier for individuals with upper limb disabilities to control their in game characters. The compatibility of the device would ultimately be how well the foot controller would connect with other devices and it was established that it would do so through wireless bluetooth connection.

Wireless Charging

Different from the method aforementioned, the foot controller could be charged by a system that uses radio frequencies so the distance of reach could be elongated (Gao p5). Other methods of wireless power transfer, such as electrical coupling systems, are designed for ranges less than half a meter. Contrastly, using laser beams, a viable alternative, has is no such limit. Laser beams work by bouncing light or energy between two mirrored surfaces. The resulting beam then radiates through a small opening and directs the beam at its target. Wireless charging using laser beams can be done by attaching one of the mirrors to the overhead source of energy and attaching the other one to the device, in this case is the foot controller (Liu . This way, the controller would virtually never run out of battery, and would always be ready to use and it also keeps the device truly wireless.



Figure 7 - Pictorial display of how the overhead charging system is projected to work.

Applying the Paul and Beitz Criteria, Wireless Charging

By keeping the importance of user interface in mind, wireless overhead charging decreases the amount of work needed for the maintenance of the foot controller. The ease of mobility would increase because there are no additional wire required for the function or charging aspect of the foot controller.

References

Alvin Chen's Sources:

Chew, J. Y., Nagai, Y., Ohtake, Y., etc. (2018, October). A System for Three-Dimensional Gaze Fixation Analysis Using Eye Tracking Glasses. Volume number 5 (Issue 4)
Retrieved from <https://www.sciencedirect.com/science/article/pii/S2288430017301963>

(2015, July 24). This is Eye Tracking. Retrieved from
<https://www.tobii.com/group/about/this-is-eye-tracking/>

Davidson, E. (2017, November 21). How Does a Telephone Headset Work? Retrieved from
<https://smallbusiness.chron.com/telephone-headset-work-34857.html>

(n.d.). How Does Belkin Wireless Charging Work? Retrieved from
<https://www.belkin.com/us/resource-center/wireless-charging/how-it-works/>

Hill, S.. (2019, February 11). The State of Wireless Charging in 2019 and Beyond. Retrieved from
<https://www.digitaltrends.com/mobile/state-of-wireless-charging-2019/>

Maggie Huang's Sources:

Benheck. (2008, May 8). Guitar Hero Pedal Controller. Retrieved from
<https://www.benheck.com/guitar-hero-pedal-controllers/>

Gao, Hao, et al. *BATTERYLESS MM-WAVE WIRELESS SENSORS*. SPRINGER INTERNATIONAL PU, 2019.

Liu, Qingwen, et al. "Charging Unplugged: Will Distributed Laser Charging for Mobile Wireless Power Transfer Work? ." *Shibboleth Authentication Request*, 22 Nov. 2016, ieeexplore-ieee-org.proxy.binghamton.edu/document/7589757.

Sharma, Nirmla. "Implemented to Bluetooth Connections - Fixed Situation." *Implemented to Bluetooth Connections - Fixed COnnnections*, ictactjournals.in/paper/IJCT_Vol_9_Iss_3_Paper_8_1865_1868.pdf. Benheck. (2008, May 8).

Vieux, D. (2018, January 18). Hardware Review: The 3D Rubber That Wants to Put Your Foot in the Game. Retrieved from
<http://vrthegamers.com/hardware-review-3drudder-wants-put-feet-game/>

Responsibilities

Alvin Chen's Research

Question 1:

Context:

This device will run on a battery. Since it will not be plugged while in use. We need to determine a way to charge the device.

Question:

How will the device be charged?

Sources:

(n.d.). How Does Belkin Wireless Charging Work? Retrieved from

<https://www.belkin.com/us/resource-center/wireless-charging/how-it-works/>

Hill, S.. (2019, February 11). The State of Wireless Charging in 2019 and Beyond. Retrieved from <https://www.digitaltrends.com/mobile/state-of-wireless-charging-2019/>

Question 2:

Context:

Our main focus of the device is how the user can interact with the system. One method eye tracking. We will use eye tracing in our design.

Question:

How does eye tracking work?

Sources:

(2015, July 24). This is Eye Tracking. Retrieved from

<https://www.tobii.com/group/about/this-is-eye-tracking/>

Chew, J. Y., Nagai, Y., Ohtake, Y., etc. (2018, October). A System for Three-Dimensional Gaze Fixation Analysis Using Eye Tracking Glasses. Volume number 5 (Issue 4)
Retrieved from <https://www.sciencedirect.com/science/article/pii/S2288430017301963>

Question 3:

Context:

The user should be able to feel what it would be like if they were in the game. This can be done by adding a telephone style headset. We will incorporate headphones and microphones into our device.

Question:

How will the system produce sound and connect with other players?

Source:

Davidson, E. (2017, November 21). How Does a Telephone Headset Work? Retrieved from <https://smallbusiness.chron.com/telephone-headset-work-34857.html>

Maggie Huang's Research

Question 1:

Context:

The foot controller would be compatible with other major systems through bluetooth connection. Through this, there is a wireless connection that allows for ease of access and control when Using. There would also be compatible USB port for any extra extensions that the customer would like to connect.

Question:

How will it be compatible with other systems?

Source: Sharma, Nirmla. "Implemented to Bluetooth Connections - Fixed Situation."
Implemented to Bluetooth Connections - Fixed COnnnections,
ictactjournals.in/paper/IJCT_Vol_9_Iss_3_Paper_8_1865_1868.pdf.

Question 2:

Context:

The foot controller would be used for basic motor controls in the game. Bending the foot controller forward would move the player forwards and back backwards.. Etc.

Question:

What commands can you perform with your foot?

Source: Benheck. (2008, May 8). Guitar Hero Pedal Controller. Retrieved from <https://www.benheck.com/guitar-hero-pedal-controllers/>

Question 3:

Context :

The foot controller would be charged with wireless charging

Question:

How would the device be charged?

Source:Gao, Hao, et al. *BATTERYLESS MM-WAVE WIRELESS SENSORS*. SPRINGER INTERNATIONAL PU, 2019.