Smart eyeglasses

PROJECT REPORT

Submitted in fulfilment for the J-component of CSE4015-Human Computer and Interaction

CAL COURSE

in

B.Tech (Computer Science)

by

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SCOPE

VIT®
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
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Project Details

Project Title: Smart eyeglasses

Project teammate details

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Table of Contents

1. Abstract

According to our theme, it would be clear that the prototype we are imagining is intended for a blind or deaf person, but it is important to clarify that our project is not intended for those who are either blind or deaf. The prototype primarily consists of two features: the first is an auditory channel (earplugs) that will listen and translate the language of the interlocutor into our own preferred language; the second is a vision channel (glasses) that will translate the text written in a foreign language into our own preferred language and can be read through earplugs. Therefore, both systems are connected to one another.

In this endeavor, creativity is more important than simply designing prototypes. We got closer by visualizing ourselves at various locations and then developing the project with the primary goal of resolving the issue while maintaining that perspective. The area of the project is originated from human computer interaction idea implementation as we are keeping interaction as major topic which is the main reason of choosing this topic as our project.

2. Introduction

The first issue we have when visiting new areas is the difficulty in striking up a conversation because our native tongue and their native tongue are not the same. To make it easier for folks who travel to foreign countries or unfamiliar locales where their language does not correspond with the local tongue. The main benefit of this prototype will be time savings, as users won't need anyone's assistance to communicate.

The history speaks, back in 2013 consumers instantly expressed their worry about privacy invasion when the first version of the glasses was introduced. Google Glass symbolized the unavoidable recording of daily life. Initially to reposition the glasses as a tool for professionals like doctors or factory employees. However, worries persisted, and in 2015 Google stopped all work on the Glass project.

Work on the Glass Enterprise Edition was resumed in 2017. This project's relaunch concentrated all of its efforts on developing a solution for industrial settings like factories and warehouses. A new version of Google Glass, the Glass Enterprise Edition 2, was released in 2019.

However, the prototype we are designing is not limited for professionals or employees. Basically, we are designing for travelers who travel to different places/countries, and they face problem in understanding, hearing, or seeing in different language. So, our motive to initiate the project is to make things ease for people.

3. Requirement Analysis

The following list of data were collected by the means of google form. The main purpose of raising these questions was to make clear how the prototype should be designed in the future so that the real product design would be efficient enough. These feedbacks by the reviewer will be helpful to the organization or the individual who are going to make the real product.

- QUESTIONS

- DATA RESPONSES

- RESPONSES RECORDED

A prototype which will convert the sentence spoken in another language to your own preferred language through audio will be easy to use.

21 responses

- Agree
- Disagree
- Somehow yes

90.5%
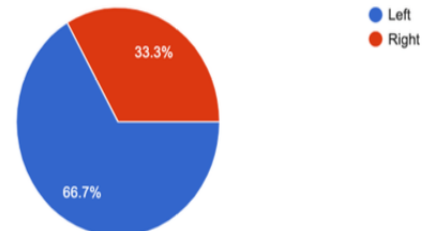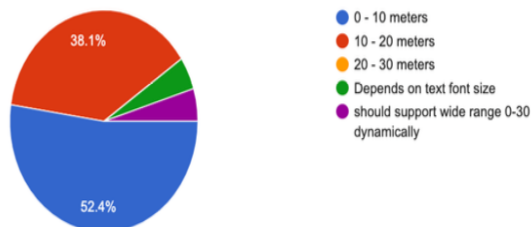
9.5%
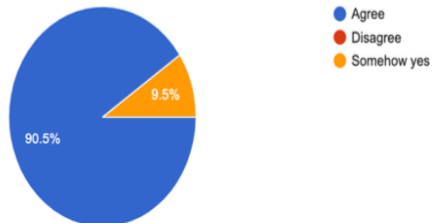
Switch to 'power on' and 'power off' the system should be on the which side of the glass?

21 responses

- Left
- Right

66.7%

33.3%

Which will be the preferable range of vision of glasses to capture and read the text shown?

21 responses

- 0 - 10 meters
- 10 - 20 meters
- 20 - 30 meters
- Depends on text font size
- should support wide range 0-30 dynamically

52.4%

38.1%

Which color of the sunglasses you think would be the most preferable for you to comfort your eyes?

21 responses

- Green
- Grey
- Brown
- Blue
- Black
- SkyBlue
- changaeble glass during sunlight turns black and during no bright light turns transparent

14.3%

23.8%

23.8%

23.8%
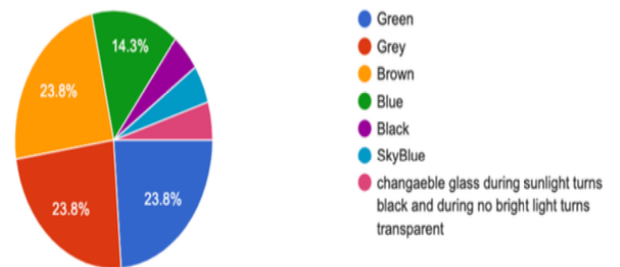
The sunglasses of the prototype would be better if made up of which of the following materials?

20 responses

- liquid crystal on silicon
- Polymer Dispersed Liquid Crystal (PDLC)
- PVC
- Glass
- regular fiber glass material would be good

50%

35%
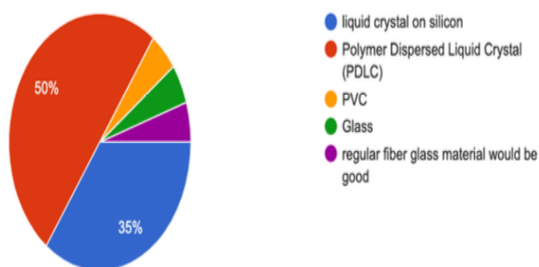
Which bluetooth version would be best for the system prototype to connect with your device?

21 responses

- Version 4
- Version 5
- latest which is supportrd by various devices

66.7%

28.6%
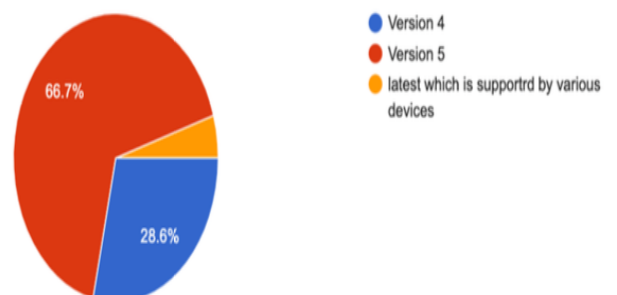
The smart glasses frames should be made up of which of the following?

21 responses
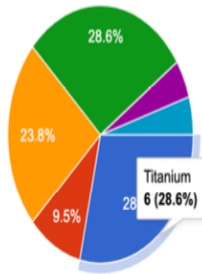
- Titanium
- Monel
- Beryllium
- Polycarbonate plastic
- Boron
- light weigh frame which is durable this may be: plastic or alumnium with plastic coating

28.6%

23.8%

9.5%

Titanium
6 (28.6%)

What type of frame is good for eyes?

21 responses
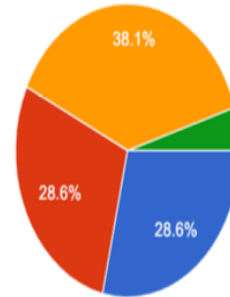
- Oval
- Cat-eye frames
- Rectangular
- Dog eye

38.1%

28.6%

28.6%

4. Data Flow

Click this link to see HTA in clear way:

https://drive.google.com/drive/folders/1CHX8xCCw2Xi3tdK0yDaZ7KdBlJsrK7ec

5. Design Screenshots
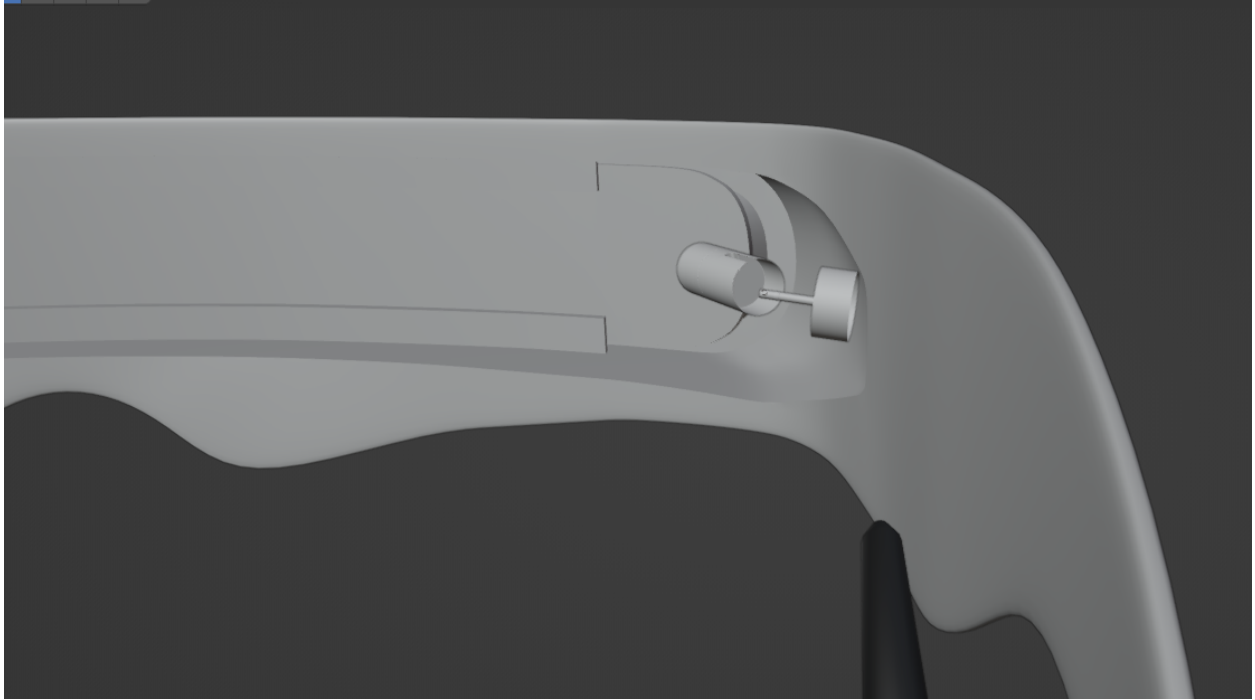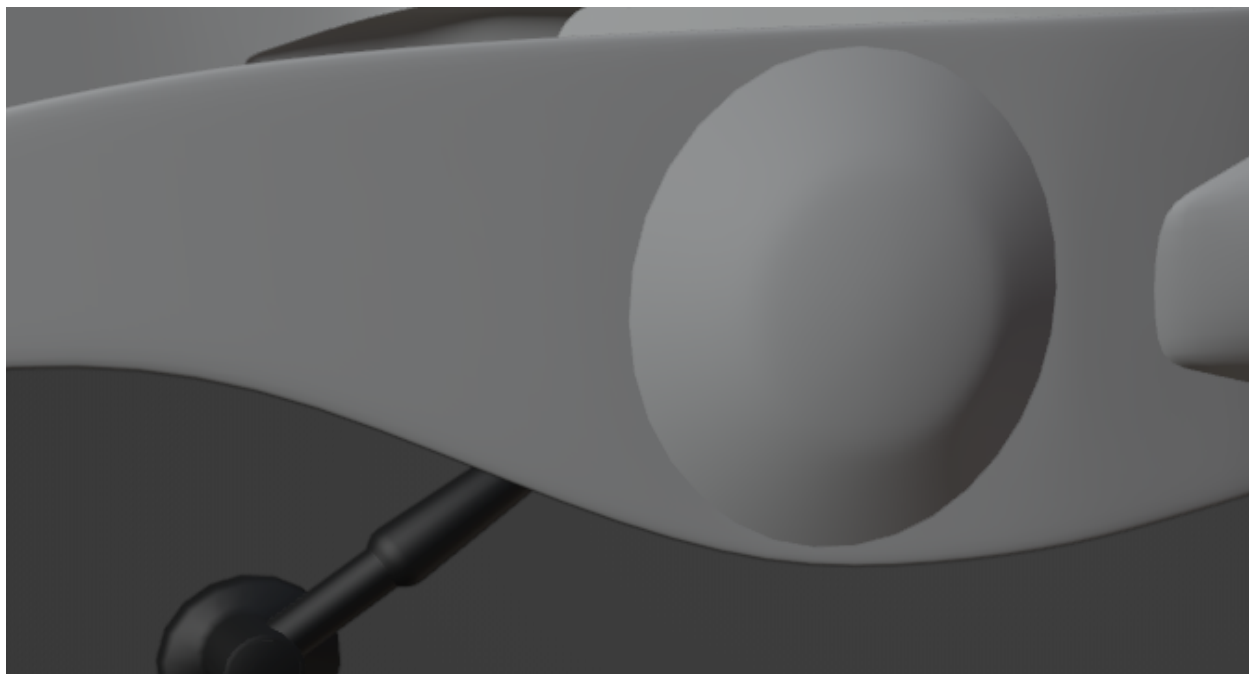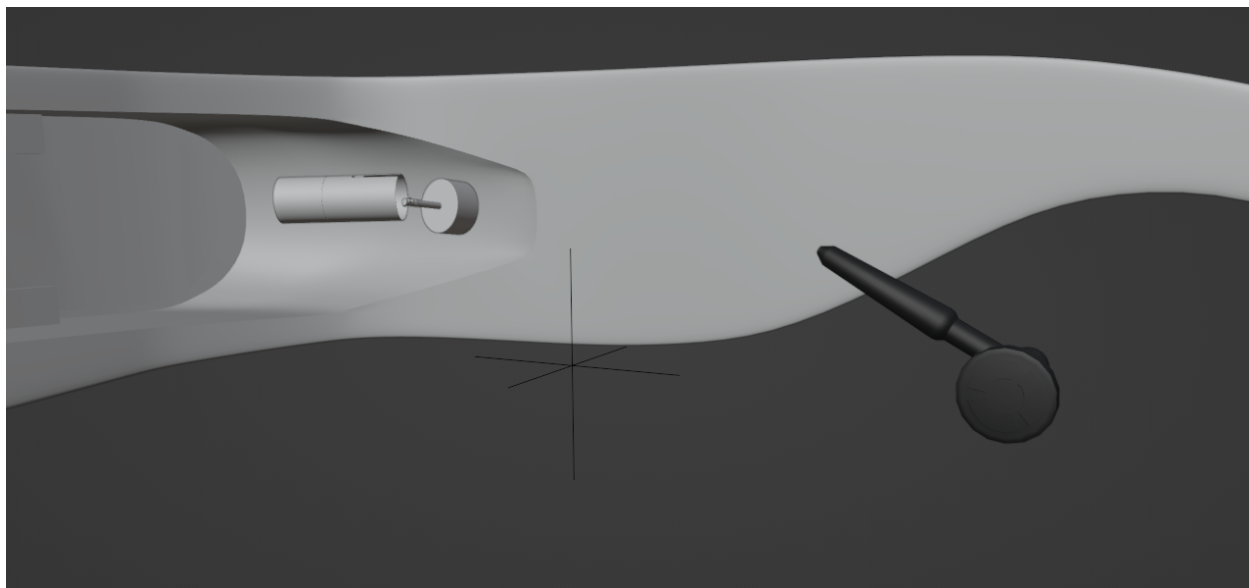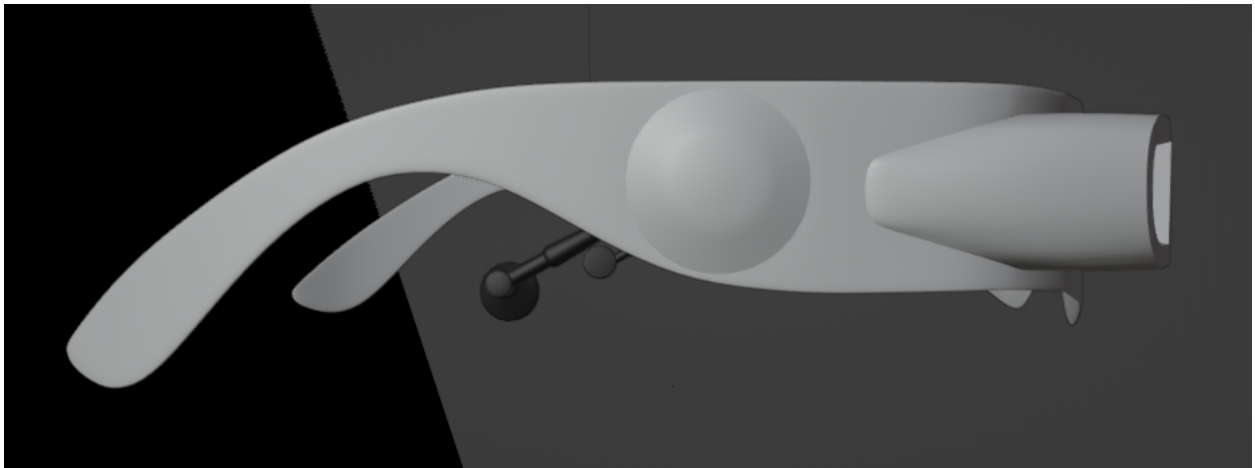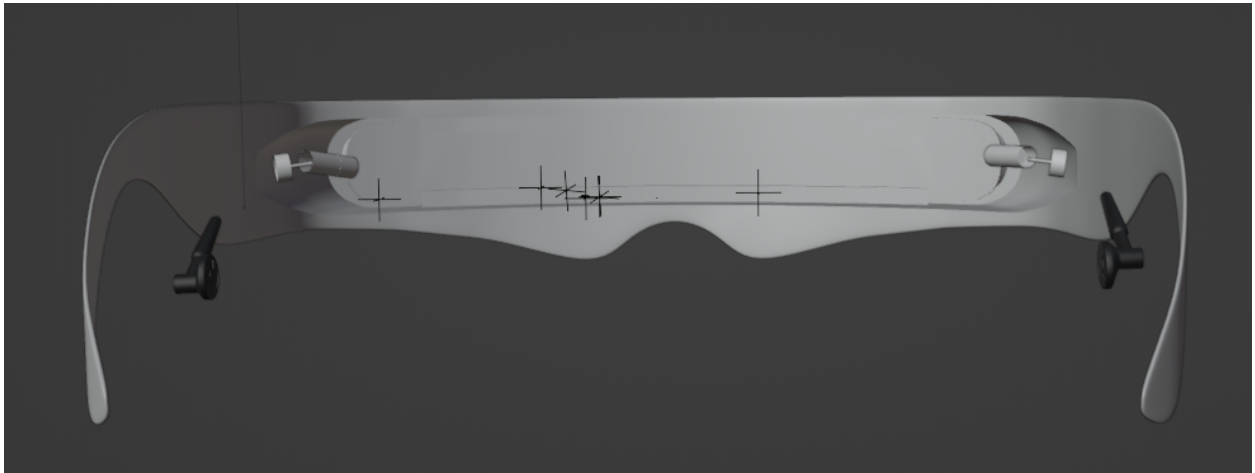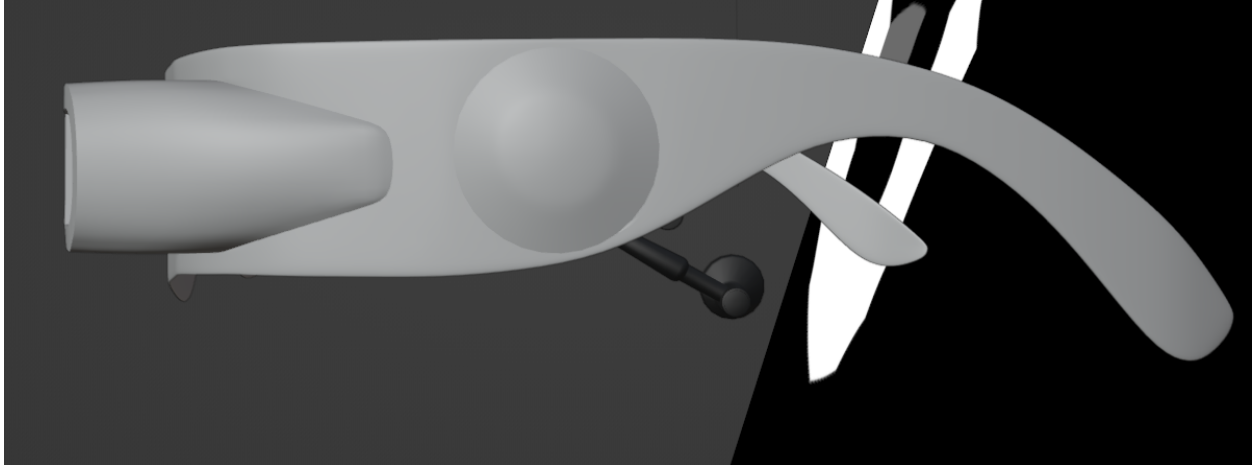
6. 8 golden rules validated

1. Strive for consistency:

Our designed patent is satisfying the first rule as we have tried to maintain the consistency in our design. As shown previously in the 3D model design, the left and the right frame of the glass has same design as well as the earplugs we have put is matching with the frame of the glasses. The color of the frame will be used as grey and for the earplugs is black, so we can say the first rule is valid for our design.

2. Cater to universal usability (enable frequent users to use shortcuts):

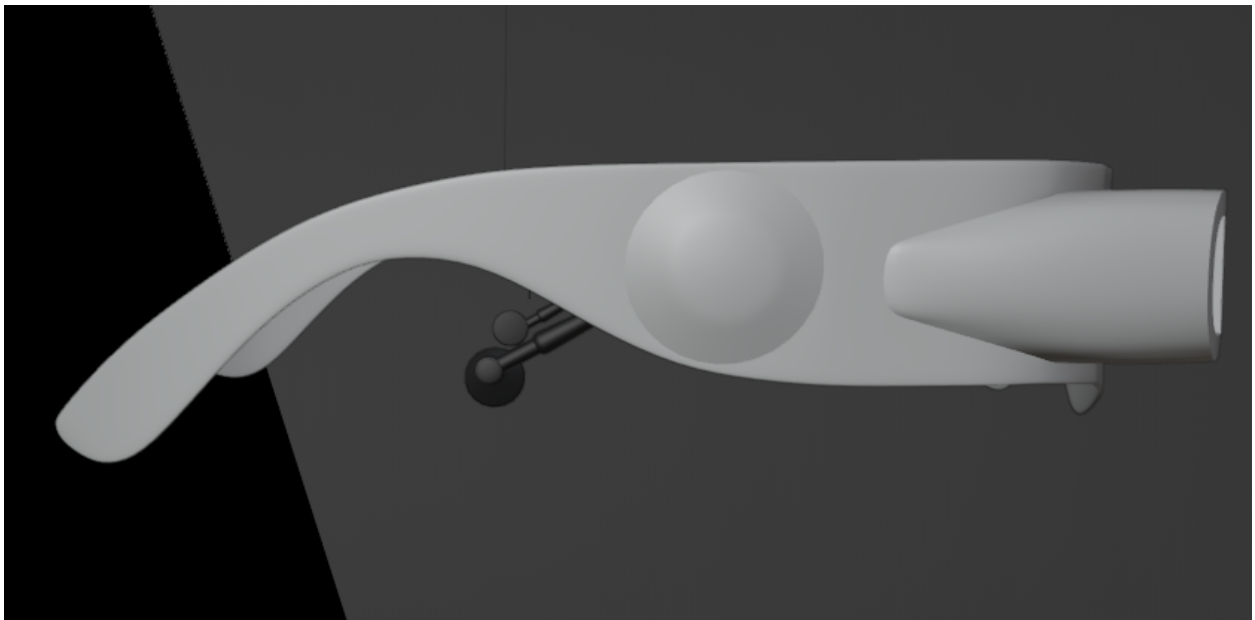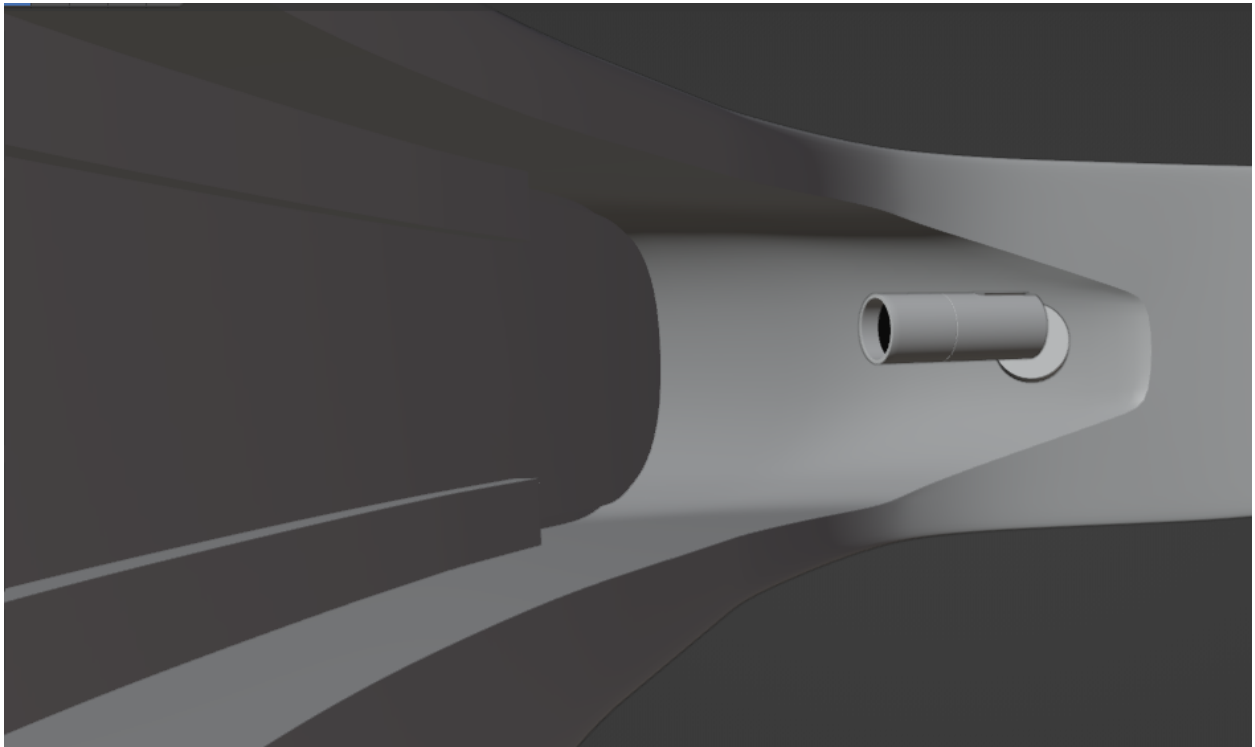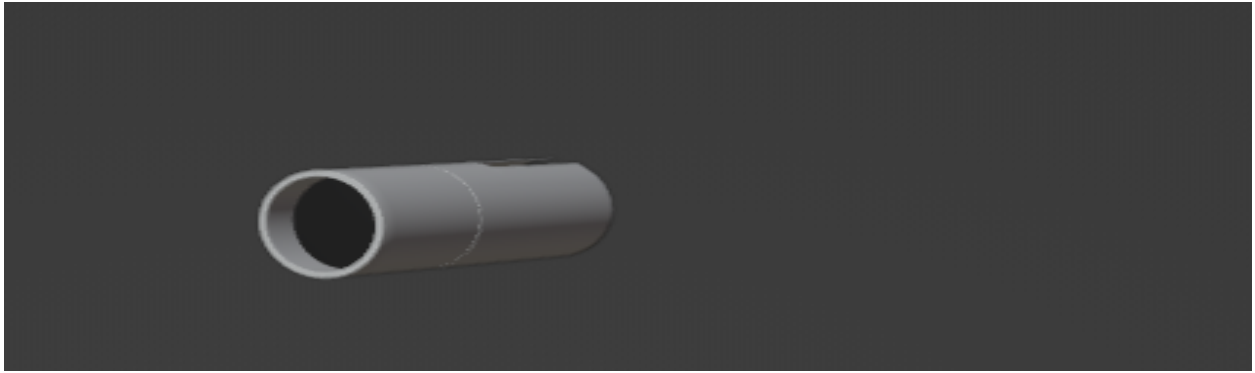Stepping one step forward, coming to the second rule validation testing you can see there is a detachable earplug and a power button to enable/disable to smart lens. Since there is a function key, we can conclude that the second rule is also valid for the designed system.

3. Offer informative feedback:

As you can see in the 3D design in previous pages, the design has earplugs and smart lens in glass. So basically, the idea is to connect the earplugs with a module. The same module is connected with the lens. Now the lens and ear plug are connected via module which help user to indicate the battery level of the system. This will give the user informative feedback. So it satisfies the third rule as well.

4. Design dialogs to yield closure:

To make our design more effective we could add a module to the system using Arduino to keep a buzzer which woold beep a sound when earplugs is turned on and turn off. This will give the user an indication when the system is turned on/off and help them maintain the battery life. This would not let user wonder in dilemma. This validates the fourth rule.

5. Offer error prevention and simple error handling:

The best part of our idea is it give us enough pathway to minimize error. When the power button is pressed for too long time than it was supposed to be then the beep sound won't beep which will indicate the user that the power on/off feature is not activated. Also, when the charge of the device is low it will indicate the user so that user will keep it charged before using. Hence, it offers prevention and simple error handling.

6. Permit easy reversal of actions:

The power button plays major role in this section, the user will be able to do-redo any operation in the device. For example, the user can turn on and turn off the device audio settings according to his need or wish. So, the 6th rule is also valid.

7. Support internal locus of control:

The user will have all the authority to control the lens. This will give the user confidence to use the device without any fear/hesitation to perform any function throughout the device. This validates the seventh rule as well.

8. Reduce short-term memory load:

Once the system is connected to a particular device, the system module will itself connect to the same device via Bluetooth whenever the device is turned on. This will help the user reduce short-term memory load. Finally, this will satisfy the 8th rule as well.

7. Testing

Now when all these ideas are combined together validating all the 8 rules, finally a product can be designed in the real world. This product can be tested through various means. The first one is what we did earlier in our own project by taking review from the user through google forms.

Second thing can be we can initially make 100-200 product samples for testing the product and to get feedback from the user live. For this process the products can be distributed across different regions where different languages are in use. This will help to upgrade our design with innovative feedbacks and hence improvements can be done. Since the feedbacks will be collected from group of different people and different backgrounds, multilingual concept will be valid and design will eventually be more optimal.

8. Questionnaire

1. **Is the style of this element maintained across your site/app?**

   Answer:
   The type of style and architecture in our model is **minimalistic** and this can be found throughout the product interface. From a simple and sleek design to a calm and user friendly UI to display the content on the lens and finally to top on all of it, we used custom customer likeable voice to dictate the translation to make customer feel great while using the product

2. **Is this content placed in the correct location according to the site hierarchy?**

   Answer:
   Our product being a physical product the only templates and regulations to be followed are that of basic ones. The major guidelines for any general ware spectacles currently are:

   - Performance -- optical and geometric properties specified in ISO 8980
   - Design -- the minimization of risk to the wearer is of primary concern
   - Materials -- non-toxic, non-allergenic and non-combustible
   - Mechanical Strength -- robustness is measured by the impact of a 22 mm diameter steel ball at 100 Newtons
   - Transmittance -- luminous and UV specified in ISO 8980

   Apart from the spectacles alone other guidelines to be imposed and followed strictly are related to the audio channel connector that is the earphone:

   1. RED TEST REPORTS
   2. CE MARK
   3. EMC DIRECTIVE
   4. RoHS DIRECTIVE
      1. Cadmium < 100 ppm
      2. Lead < 1000 ppm

   $C\,E$

3. Mercury < 1000 ppm
4. Hexavalent Chromium < 1000 ppm
5. WEEE Symbol

3. Are there shortcuts available for your more experienced users?

Answer:
Yes there is a provision to automate the basic stuff of the glasses like re-calibrating itself after few hours of usage. Auto updates check whenever the user grants the permission etc. For such tasks a new user would have to go through the documentation multiple times but an experienced user can just simply preset timings for auto completion.

4. How can you make it easier for novice users?

Answer:
A simpler UI design with very less almost next to none amount of buttons which could distract the users easily would be very helpful for novice user. Along with these options, a well documented user guide will also be of great help which involves step by step approach from setting up device to debugging error with the help of diagrams also would seem as great addition.

5. Does the user know where they are at in the process?

Answer:
Yes the user will constantly be able to see what is actually happening in real time either in form of projection on lens or audible progress speech. That is in case of text conversion taking a long time wither because of poor input speech voice or network errors, the progress meter will be projected on the screen showing the reason for delay along with a voice which tells the progress in user suitable voice.

6.Does the user know what they have done after performing this action?

Answer:
Yes the user can clearly see the translated text on the lens itself while simultaneously listen to converted audio too. This happenes based on user preset settings to convert either visual or audio or both inputs.

7. How are you communicating this feedback to your user?

Answer:
Feedback communication of output or status of output is displayed in ways:
1. Visual Channel – Any visual text to be converted in a range of maximum of 30 feet will be auto converted from any foreign language to preset required language using Google translate API's. This translated content will be projected onto the Uniglass using 2 mini projectors on the bottom corners of the lens so that user can see the content in a corner of his eye without much discrepancy of actual view.
2. Audio Channel – Any foreign language spoken around the microphone attached to the glasses will be picked up by the Microphone sensor and the exact content is relayed to again a google translate API and the final content is made audible into the user ears using attached earphones in a voice which is custom made to the user so that he feels very connected to the product.

8. Does the user have to do any guessing here?

Answer:
No there is no need of any guessing to be done as the product might seem very alienated at first but with a simple glance over the user manual and trying the product themselves the bridge of uncertaininty is broken and the product seems so easy to use just after first 5 uses.

9.**How are you communicating the system status with the user?**

Answer:
Yes the user will be able to see what is actually happening in real time either in form of projection on lens or audible progress speech.

10.**Have you done everything imaginable to prevent this error from happening on your end?**

Answer:
Coming to error management on the client side, basic conditions and boundary testing is done in each and product created. And in case of any software patching necessary remote upgrade facility is provisioned. In case of a major catastrophic failure causing error on the product, a replacement or correction in site facility of the product is also pre planned.

11.**How easy is it for them to fix it?**

Answer:
To resolve any basic bugs caused due to user using old software etc, the steps to debug are again mentioned in the help book itself and most of the times the glasses auto detect the error and displays appropriate solution on the screen itself.

12. **How many steps does the user have to take to reverse their actions?**

Answer:
To reverse an action of conversion, that is to disable auto convert everything feature on the glasses, the user would just have to double press the button on side of glasses which will make the glasses be on a halt or standby mode and once you need the glasses to convert text again just double press the device again.

13. How can you make your users detect the possibility of reversal?

Answer:

The glasses will have the button for reversal on the exterior clearly visible and all the actions it can perform will be documented on the help book.

14. Will the user feel in control at this specific touch point in your app?

Answer:
Due to feature of halting the translations and conversions it is all in users control to where and how to utilize the software. This feature not only makes the user the ultimate point of utilizer but also enable user to decrease or increase product hinderance in his/her day to day life

15. Does the site feel easily navigable?

Answer:
Yes with the help of the universal button on the side of glasses the navigation of halting the glasses and resuming the functionality is very smooth. Similarly the textual and auditory conversions run simultaneously majority of the time (unless user changes the setting) and this transmission of update display or the textual conversion is also pretty smooth.

16. Are there enough visual cues here for the user to find the functionality or item?

Answer:
In our physical product case the functionality of the glasses is obviously pretty evident for a user who bought it. Even for a new user the entire walkthrough of the software and product utilization can be demonstrated either by a pre recorded video done by our team or with the help of documentation.

17. How can you help the user recall?

Answer:

An experienced user would just start using the product without need of much recall and directly with the help of motor habits. Whereas for a novice user, the recall of the steps to be followed can be overwhelming sometimes but this can be easily overcome in just 5 uses for a average human being.

9. Video drive link

We made a video regarding the eyeglass review. Click the link below to redirect to the google drive link.

https://drive.google.com/file/d/1yv8_rCVc4xXFMYiV8pU1vYXSSdpDTji3/view?usp=share_link

10. Conclusion

The best part of our project is that it is unique. The design we made is all our concept and we validated using 8 golden rules. The product will have a google lens and a earplug which will convert the other language in to your preferred language and also display the same over the glass lens. Since this design is a combination of two prototype, our final output will be optimal as people who travel to travel to different countries and face difficulty in communicating with native people will definitely l find the product useful.