VR environment for deaf persons(WIP)

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I. Abstract

This paper goes into detail and talks about solutions found for improving online learning for deaf people. Recently during Covid, online learning has become the main way for teachers to get their content to students. Some teachers have even begun using virtual classrooms to immerse their students into learning as if it were in person. The problem with these virtual classrooms comes with students who may have a loss of hearing. We sought to fix this issue to allow deaf people to enjoy virtual classrooms with the same experience as other students. Our solution provides an interface students could use to turn on captions that will translate the professor live and be displayed wherever the user decides to place the captions in their space. We planned on addressing this matter using technology that already exists but is ported into the virtual space. Using procedural-generated subtitles that already exist on websites like YouTube, this could be ported to the VR space to have the same effect as the 2D one.

II. Keywords

Accessibility, Virtual Classroom, Enhanced Learning

III. Introduction

We realized during this quarantine that online classrooms were becoming more popular and an efficient way to keep students interested in learning. Unfortunately, we also realized this virtual reality classroom experience was not designed to be equal for everyone. We noticed deaf users would not be able to fully experience this as they would lack the key thing needed for lectures which would be audio. We felt this was a significant issue to fix as this paper (see **Fig. VII-A**) talk about how subtitles can help different levels of deaf in people to improve their learning. More of the sources we found when researching this topic mention how "As a result, providing captions and sign-language video clips at the same time in online contents turned out to have a positive effect on learning" (Yoon and Choi 7) from this paper (see **Fig. VII-B**) this study goes into the effect of using subtitles paired along with sign language to improve learning for users. And our last article (see **Fig. VII-C**) is a useful source of maximizing the experience we plan on giving to our users. It talks about how subtitles can be created to make understanding the content easier to comprehend for users. With all of our sources compiled together we had strong reasoning to begin making our interface that would allow deaf users to experience the virtual classroom the same as everyone else.

IV. Methods

Our approach to this problem was to create an interface in a virtual classroom that would be easy to use as well as useful to our users. We plan to make a VR scene in Unity that will act as a virtual classroom. The user will be able to see the teacher's slides, as well as swipe to the right to see subtitles, and swipe to the left to remove the subtitles. The slides will be in a set position at the front of the virtual classroom, but the subtitles will move with the user's head. Doing this should reduce motion sickness and if the user decides to move their head they should still be able to understand what is happening in the lesson. Ideally, our virtual classroom will replicate a real classroom to keep the user immersed. (see **Fig. 1**) The user's starting position will be in front of the virtual classroom, but the user will be able to change seats by either opening a menu and choosing the seat or simply clicking on the seat. The transition of the user moving seats will be the screen fading to black then moving then going back to the scene. Doing this should make the transition from seat to seat feel more natural, as opposed to having the user teleport instantly. Right now we already have a scene loaded into unity and we have planned all of the tasks needed to get to our final product. We have split our tasks up between the two of us as one of us is focused on the programming side while the other is focused on the art and technical side of this interface. If we follow the plans on our Kanban chart (see **Fig. 2**) we will be able to complete our interface in march while being able to test our prototype on the way to add any new features we might have missed.

V. Results

During our literature we noticed how each articles mentions how subtitles can be used to improve the learning deaf people are capable of. Although neither article mentions converting this learning possibility into the virtual reality space. With this gap we saw, we intend to bring subtitles into virtual classrooms to not only include these students into the classroom but also to enhance their learning possibilities. With this information we dived into the design thinking process to come up with our final solution. First we empathized with our users to delve into what the real problem deaf people had with virtual classrooms. We found out it was difficult to pay attention in classes as well as retain any information learned because of the lack of hearing in these classes. Via the virtual world it was also difficult to stay concentrated since they were not immersed in the world the same as if it was a real classroom. With all of this information gathered, we compiled it together to figure out what the key problems our users were facing. The problems we defined was a lack of concentration in class and not retaining any information learned in class. With our problems defined we sought to create a solution that could fix both of these issues. We came up with two major designs that could fix the problem which you can see here (see **Fig. 3**). First was the option to turn in off subtitles with a swipe of the hand which would translate the teachers talking into text for users to read. While our other option was to be a display that would convert the teacher talking into sign language for the user to understand. With all the information gather prior to creating our idea we decided the best option was to create the subtitle interface as we already had proof on why subtitles were good for deaf learning. For our prototype we will start with a button users can press to turn on the subtitles do mimic what our final product will be like. For testing this prototype we would like to find deaf users to test it with but if not we will mute the audio and give it to people to simulate if they could not hear anything in the virtual classroom.

VI. Conclusion

With our findings we think it is a good topic to approach as it has already been proven that subtitles are an amazing way to enhance and keep the attention of deaf students. With our literature review we think we found the best way to branch this aspect of subtitle usage to the virtual classroom. This gap we saw that all of our research had was the best opportunity we had to bring the concepts into the virtual world. This paired with our design thinking process allowed us to create the best possible interface we can make to improve deaf students learning in the virtual classroom. At the moment there are no alternatives we found that are similar to subtitles in a virtual class room, which gives our interface a chance to become a unique solution to this problem with virtual classrooms. Another way of solving the problem would be to incorporate sign language as well as subtitles but we felt this would be too distracting to be able to focus on the interfaces and the actual professor teaching at the same time. Next is to create our prototype and see how people like what we have created and hopefully get constructive feedback we can use to further develop our product to the best it can be.

VII. Bibliography

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VIII. Appendices

Fig. 1. Virtual classroom example
Source: Adapted from [4]

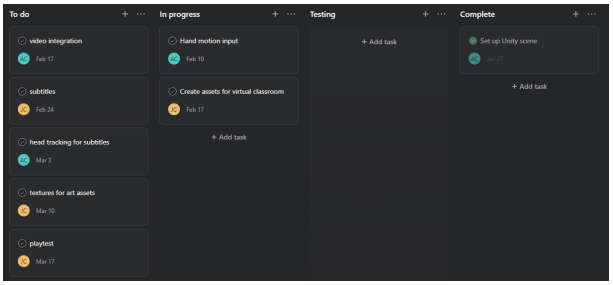

Fig. 2. Kanban
Source: Adapted from [5]

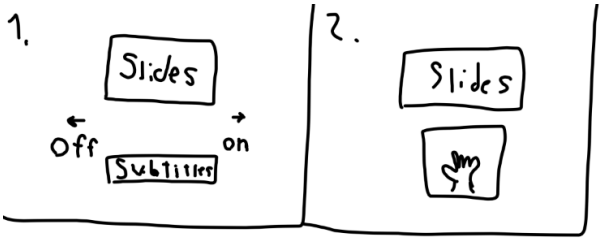

Fig. 3. Design thinking
Source: Adapted from [6]