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Virtual Reality for Online Classes

Sarang Chouguley

sarangchouguley284@gmail.com

St. Vincent Pallotti College of Engineering and
Technology, Nagpur, Maharashtra

Manaswi Ghormare

manaswighormare1@gmail.com

St. Vincent Pallotti College of Engineering and
Technology, Nagpur, Maharashtra

Ashwini Thool

ashwinithool56@gmail.com

St. Vincent Pallotti College of Engineering and
Technology, Nagpur, Maharashtra

Shantanu Nagmote

shantanunagmote16@gmail.com

St. Vincent Pallotti College of Engineering and
Technology, Nagpur, Maharashtra

ABSTRACT

The COVID-19 pandemic has been unprecedented and challenging leading us to explore alternative thinking in every aspect of our daily life. One such area is the educational environment which is undergoing a transformation due to the need for remote contactless teaching. While existing web platforms like MOOCs and Youtube have been able to offer a one-way communication channel, video conferencing tools like GoogleMeet, Zoom has built upon it to provide a nominal degree of human interaction. This paper discusses our project which uses virtual reality technology to enhance this even further and further improve the online classroom experience.

Keywords— Virtual Reality, Online Classroom, Google Cardboard

1. INTRODUCTION

Virtual Reality (VR) is a simulated experience that feels like the real world. Applications of Virtual Reality include entertainment (e.g. video games), education (medical training), and business (e.g. virtual meetings) [1]. These systems use virtual reality headsets, which simulate a user's physical presence in the virtual environment.

Because of the ability of virtual reality systems to simulate a virtual environment and the user's movement in this environment, they can be used to create or host virtual meetings where users can join and interact with the environment and other users. These interactions generate the feel of face-to-face meetings. Such a system also creates a humane connection through hand-shake and eye contact in the virtual environment. This ability to feel and connect virtually allows users to engage more effectively in online meetings.

However, to use virtual reality applications special virtual reality headsets are required, which are expensive and bulky. An alternative to this is Google Cardboard.

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Google Cardboard is a virtual reality (VR) platform developed by Google. Named for its fold-out cardboard viewer into which a smartphone is inserted, the platform was intended as a low-cost system to encourage interest and development in VR applications. Users can either build their own viewer from simple, low-cost components using specifications published by Google or purchase a pre-manufactured one. To use the platform, users run Cardboard-compatible mobile apps on their phone, place them into the back of the viewer, and view content through the lenses [2].

Advantages of using Google Cardboard are its low cost, small size, ease of use, and build. But it also has some drawbacks like limited interaction with the virtual environment, low-resolution environment, etc.

2. LITERATURE REVIEW

Since Virtual Reality allows users to collaborate better in online meetings, applications have already been developed which use virtual reality to host video conferences, online meetings in a virtual environment. Some of these applications are listed below:

- (a) Spatial
- (b) MeetinVR
- (c) Glue
- (d) FrameVR
- (e) Engage
- (f) VRChat

These applications provide a realistic environment with the ability to present documents on a virtual whiteboard, perform virtual handshakes, compile notes, write in the air, etc.

One major downside of these applications is that they depend on high-end costly virtual reality headsets. Some of these headsets need powerful processing units to work. These factors limit their ability to be used by normal users like students and teachers.

This project, therefore, aims at developing an application that can run on an android smartphone. As it uses an Android smartphone available at low cost today, this application can be used by teachers, educational institutes, and students to host virtual classrooms.

3. METHODOLOGY

3.1 Requirements

The main requirements of this project were as follows:

- (a) The application should be able to run in android systems compatible with Google Cardboard.
- (b) The graphics quality should not be too high or too low.
- (c) All Features of a video conferencing application like voice chat, presentation, notes, etc should be present in the application.

3.2 Components

To build this application the elements that have been used are Virtual Reality technology, Google Cardboard, Unity software, Blender and Photon Engine.

Unity's platform is used to create two-dimensional, three-dimensional, virtual reality, and augmented reality video games and other simulations. It supports more than 25 platforms and is the basis for most virtual reality and augmented reality experiences [3]. Photon Engine was used for backend as it is a game engine specializing in multiplayer game development. It's a series of products, software, technology, and networking components that bring great speed, performance, and more to online play. Photon engine provides features like servers for multi-user connection, voice chat, etc. [4].

Blender is a free and open-source 3D computer graphics software toolset used for creating animated films, visual effects, art, 3D printed models, motion graphics, interactive 3D applications, virtual reality, and computer games. Blender's features include 3D modeling, UV unwrapping, texturing, raster graphics editing, rigging and skinning, fluid and smoke simulation, particle simulation, soft body simulation, sculpting, animating, match moving, rendering, motion graphics, video editing, and compositing[5]. It was used in this project for creating the virtual environment and user avatars.

3.3 Architecture

The application uses a client-server architecture explained in the following figure 1:

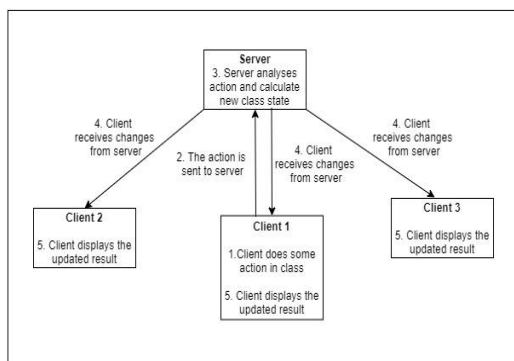


Figure 1: Client-Server Architecture of project

3.4 Approach

Below steps are used to create or join a VR classroom.

1. The user (i.e., student or teacher) has to first login into the server with a username.

2. On successful login, the user is greeted with 2 choices, either to create a class or join an existing class using its unique name.
3. The teacher can use the option of creating a classroom to create a new class.
4. A new class needs to have a unique name, which is used by any student to join that particular class.
5. Once the class is successfully created, the students can join the class using the join an existing classroom option.
6. Students need to enter the class name they wish to join, if the class exists with the given name, students join the class successfully.
7. On joining the class students are greeted with a welcome screen. In order to enter VR mode, users can tap on the screen, and they will enter the VR mode.
8. In VR mode the user can move the smartphone to view the classroom and others users present in the class in 3d.

3.5 Challenges

The challenges in building this application were:

- (a) Integration of avatars and virtual environments.
- (b) Integration of video conferencing features.
- (c) Integration of Real-time Communication.

4. RESULTS AND DISCUSSION

Following features were implemented successfully:

- (a) VR characters
- (b) Multi-user connections
- (c) Character movement synchronization with phone movement.
- (d) Voice chat

Following are some of the screenshots of the finished project:



Figure 2: Login Screen

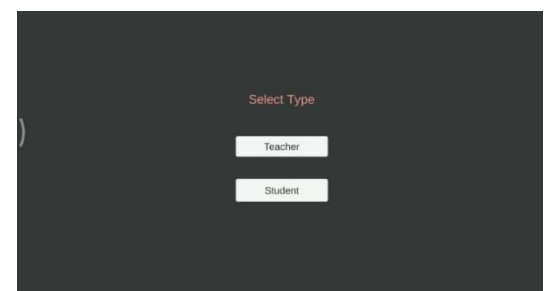


Figure 3: Select Type Screen



Figure 4: Create Classroom screen



Figure 5: Classroom Welcome Screen

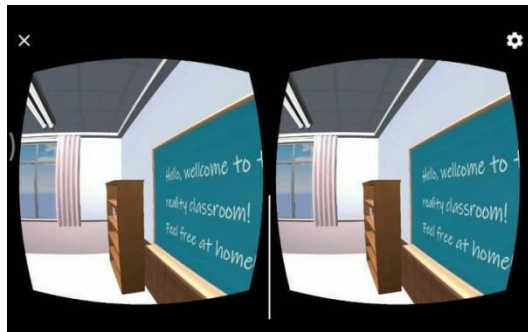


Figure 6: Classroom in VR mode

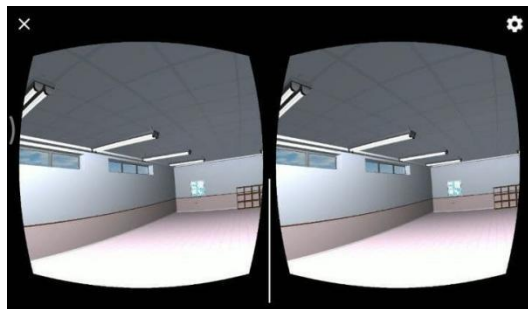


Figure 7: Classroom in VR mode

While developing the application, it was found that there is limited support available for VR development for the android platform. Much development is needed in this area to create more enhanced applications.

Some drawbacks exist in the implementation like lack of full-body movement, facial features synchronization in the VR environment and document presentation.

5. CONCLUSION

Using Virtual Reality technology over Google Cardboard it is possible to provide an enhanced online classroom experience to teachers and students alike. This project proves that mobile applications like this can be developed which would allow students and teachers to get a more immersive experience of online classes.

More surveys and studies should be conducted on the effectiveness of this application in improving the online class experience for teachers and students.

6. REFERENCES

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