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ヘッドマウントディスプレイを用いたヴァーチャルリアリティによる立体音響の共有

HMD-presented virtual reality with personal and social spatial sound

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1. Abstract

Recently, HMD (Head Mounted Display)-presented virtual reality can be experienced. But HMD-presented virtual reality can not share 3D audio via network. Our Spatial Media Group at the University of Aizu has developed CVE (Collaborative Virtual Environment). Using a CVE server we connect HMD and speaker array with audio interface. Our prototype integrates HTC VIVE and TASCAM US-4x4.

2. Introduction

Currently, we can easily develop HMD applications with game engines such as Unity. HTC VIVE have synchronized with reality controller for interactive of operation. The CVE protocol developed by Our Spatial Media Group can connect other applications. The application Twhirleds is mobile application for smartphone and tablet. It can wireless control other applications connected through a session server. To connecting iOS Twhirleds applications to CVE sever, our group provides connection with middleware application iOS-Bridge. There is also a Unity-Bridge to connect between Unity and CVE. It provides a way of connecting all devices and application together. The concrete goal of this study connect to HMD, speaker array, and smartphone using CVE. In the research, I integrate CVE server, Unity, HTC VIVE, and Audio Interface with speakers and smartphone application.

2.1 Background

2.1.1 Unity

Unity is cross-platform (2D and 3D game, application, AR, and VR experiences) game engine developed by Unity Technologies.

2.1.2 HTC VIVE

HTC VIVE is a VR headset developed by HTC and Valve Corporation (See Figure 2).

2.1.3 CVE

The CVE (Collaborative Virtual Environment) protocol is based on a client-server architecture and is developed in Java. It supports interaction of connected devices. We use it to connect to HTC VIVE and get user's transform.

2.1.4 Twhirleds

Twhirleds is a mobile application for smartphone and tablet for Android and iOS. It senses orienta-

tion.

3. Implementation

3.1 Unity with HTC VIVE

First, one can download and install SteamVR Plugin from Asset Store for HTC VIVE in Unity. The Asset Store is an online shop where materials and images of 3D models can be purchased that can be used with Unity. The Asset Store also distributes plug-ins for improving development efficiency. We integrated four audio sources in the scene, set to 3D sound on inspector. Moreover all characters rotate around center position in Unity scene using mobile rotation with Twhirleds. Player can press button in HMD (See Figures 3, 4). This menu has character sound mute button and changes position to other character.

3.2 Unity with Audio Interface

A parallel Unity process also has four Audio sources in the scene, set to 3D sound on inspector. It receives main camera transform and audio time via Unity-Bridge. Moreover we provide sharing environment to set each parameter to main camera and audio source. We use TASCAM US-4x4 audio interface for 3D audio.

4. Scene Components

CVE server can support and number of connection channels. Our Prototype scene uses 6 channels. CH0 is main camera, but it does not take into account z-axis rotate for spectator's VR sickness. CH1 is all character's parent. Channels CH2 to CH5 are each character's Audio Source.

4.1 HTC VIVE Camera Rig transform

Camera Rig prefab transform provided by SteamVR Plugin can be sent with CVE server using CH0. This data is used to synchronize other scene camera rotations.

4.2 Character rotates

All characters rotate based on smartphone orientation. We integrated a Null Object in scene have all character objects, set to CH1.

4.3 Mute and Change character position

HTC VIVE is integrated with hand-held controller for interactive operation. Button presses, location, orientation, and so on one sensed. We use controller to provide mute button and change character position button (See Figures 6, 7). As player moves in scene (See Figures 8, 9). Each parameter is sent through CVE as CH2 to CH5.

5. Conclusion

Build a Scene using Unity, HTC VIVE, audio interface, smartphone, and CVE (See Figure 10). By using this research, not only the players but also spectators can experience the same soundscape.

6. Future Work

Now, share only recorded audio files, but we would like to be able to spatialize realtime audio streams, such as chat space voices.

7. Acknowledgement

I thank members of Spatial Media Group, for their advised and helping me with my thesis.

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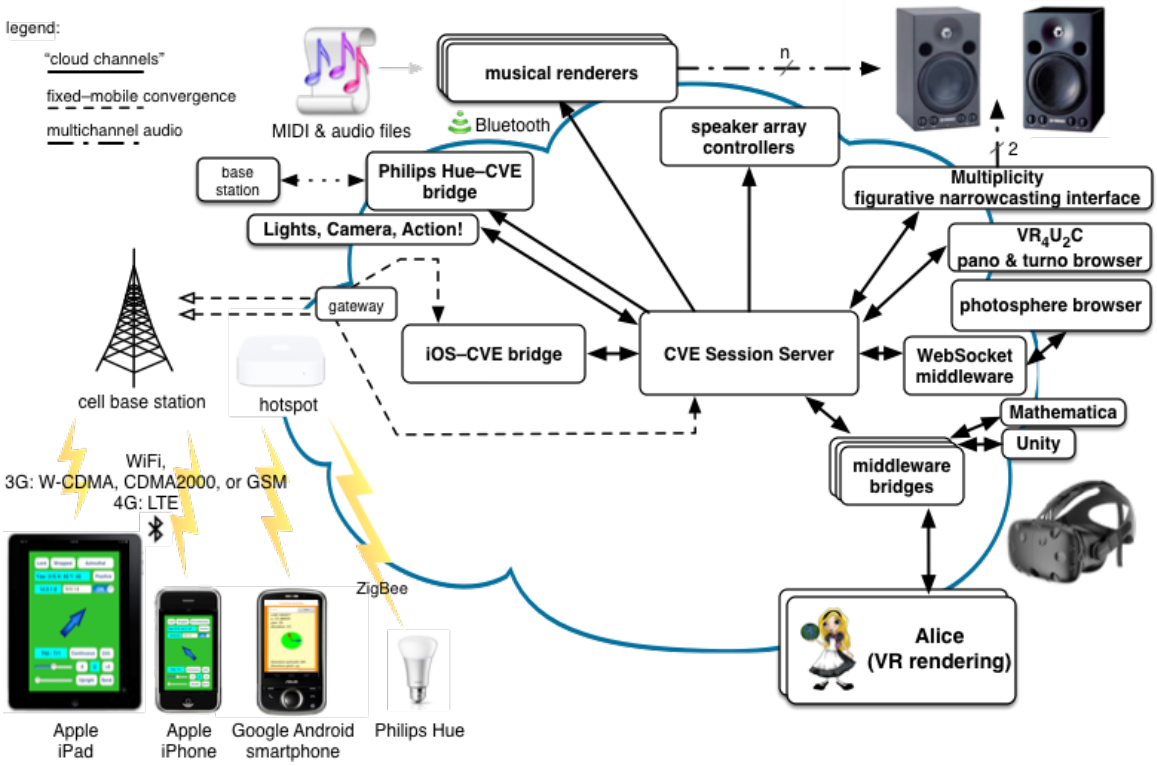

Fig. 1 CVE architecture

Fig. 2 HMD, controllers, and trackers

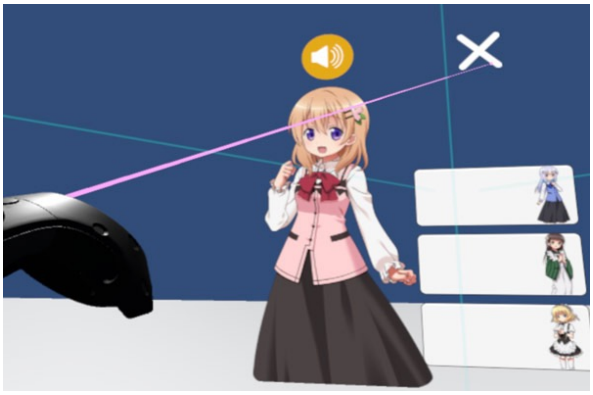

Fig. 4 Open Menu

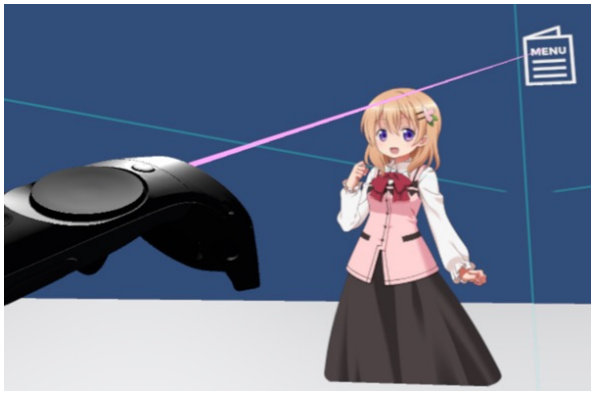

Fig. 3 Menu Button

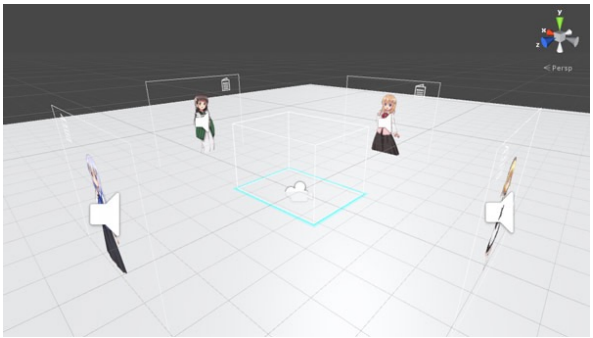

Fig. 5 Original Scene

Fig. 6 Aim at mute button

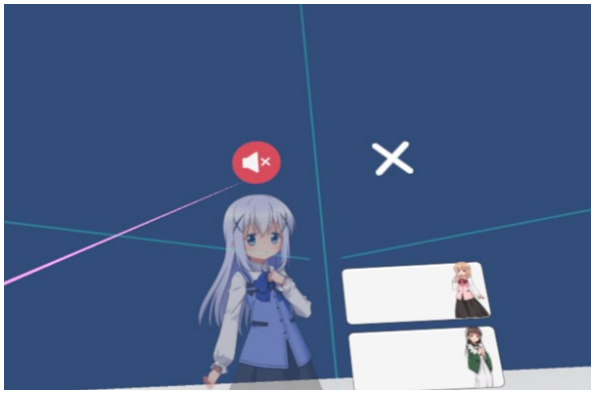

Fig. 7 Muted character

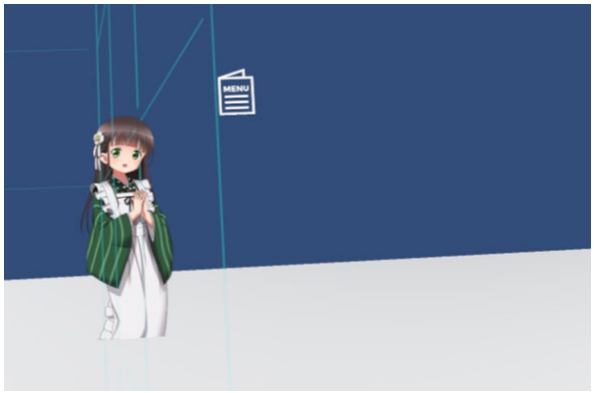

Fig. 8 Before moving player

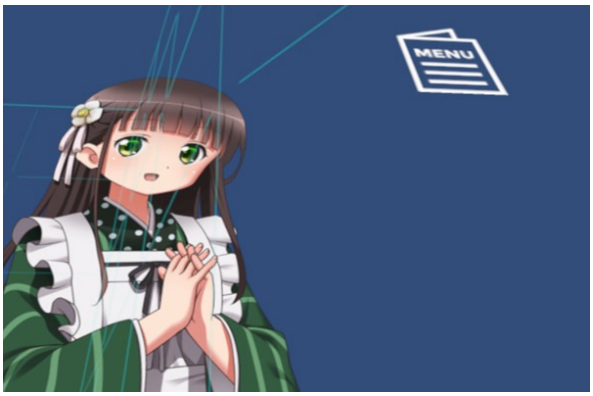

Fig. 9 After move player.

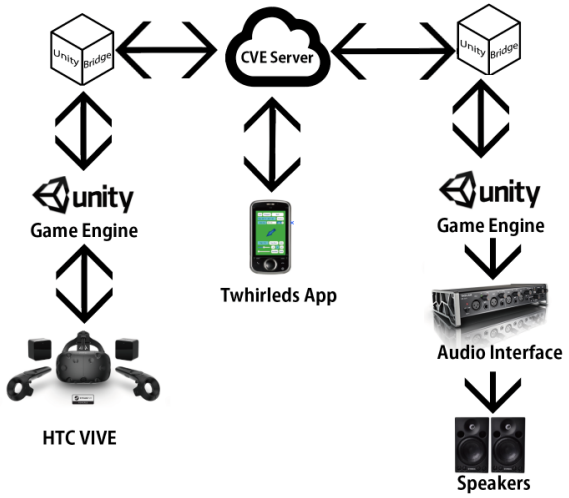

Fig. 10 System architecture

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9) PS VITA「ご注文はうさぎですか?? Wonderful party !」http://5pb.jp/games/gochiusa/character/chino/