CityCompass VR - A Collaborative Virtual Language Learning Environment

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Abstract. CityCompass VR is a collaborative virtual language learning environment that utilizes interactive omnidirectional video (iODV) content. In the application, two remotely located users navigate through cityscapes in order to reach a common goal. One of the users takes the role of a tourist who needs to find a local attraction, and the other one acts as their guide. The users communicate in a foreign language with each other via headsets. The application is used with HMD device and uses a dwell-time, head-position based interaction.

Keywords: Collaborative virtual learning environments · Interactive omnidirectional videos · Language learning

1 Introduction

Technological leaps in both Virtual Reality (VR) technologies and recording and production of omnidirectional videos (ODV in short; also known as 360° videos) has enabled the creation of immersive and realistic virtual environments (VEs). These environments are typically explored with a head-mounted display (HMD) device or within a CAVE environment. Utilizing VEs in educational settings has been reported more active participation and higher interactivity among the students [6]. CityCompass VR is a collaborative virtual environment developed for language learning purposes. It utilizes iODV content and supports two remotely located, simultaneous users. It has been initially evaluated with 30 Spanish participants (mAge = 27.5) learning English as a secondary language [2]. More extensive evaluations have been planned in Finland and India for students of various ages and school levels, starting from elementary school.

2 CityCompass VR

CityCompass VR is a third evolutionary stage of the CityCompass application family. Its predecessors and their pedagogical potential have been evaluated and reported in several previous studies, e.g. [1, 2, 4 and 7]. These studies reported results regarding user experience, embodied interaction, cross-cultural collaboration and immersion. In the future, we want to expand our research on cross-cultural collaboration and also study the effects of immersion on the user's learning experience.

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User Interface and Interaction. In CityCompass VR, the users can freely explore the ODV content by turning their head to the desired direction. The screen is divided into two viewports, thus creating the illusion of a stereoscopy and a sense of depth to the user. Both users have their own HMD (Fig. 1) devices and have their own individual views of the application (see Fig. 2).

Fig. 1. HMD device with an integrated headset.

Fig. 2. Screenshot from the CityCompass VR application. The application is divided into two viewports.

The application has two types of user interface elements: *exits* and *hotspots*. Exits transition both users to the next scene, and hotspots provide contextual information about the environment. These interface elements are activated with a dwell-timer, i.e. the user has to focus on the desired element for pre-defined time in order to activate it.

Wayfinding Scenario. In CityCompass VR, two users collaborate and navigate through cityscapes in order to find a local tourist attraction. One of the users is the wayfinder, referred as a tourist, who is being guided by the other user, referred as a guide. In the application, the users have to transition from one scene to another through collaboration. Each scene has multiple exits, but only one of these takes the users closer to their goal. The tourist is the one who can transition between the scenes per the guide's

instructions. The application also offers assistance for the guide. If the tourist activates a wrong exit, both users are taken to a dead-end scene. Dead end scenes are indicated with a red lock symbol at the center of the both user's viewports. Once the users activate a dead-end scene, their roles are reversed – now the user acting as a guide needs to find the correct route from given exits, and the tourist needs to guide them (see Fig. 3). After activating the correct exit, they are transitioned back to the previous scene.

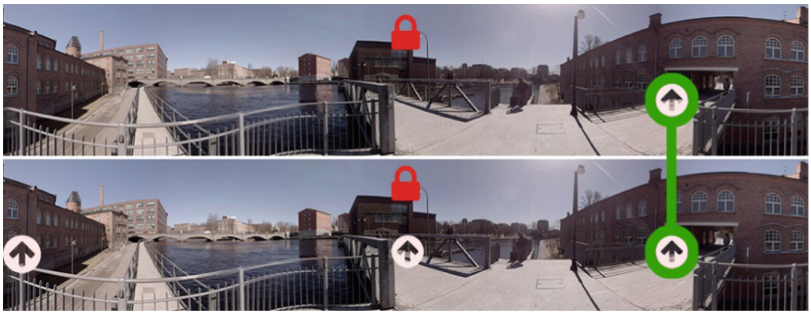

Fig. 3. Dead end scene in CityCompass VR. The guide needs to select the correct exit from three options [2]. (Color figure online)

3 System Architecture

CityCompass VR was developed on Unity. Currently it supports Samsung Galaxy S7 and S8 smartphones together with Samsung Gear HMD device, but can also be ported for HTC Vive and for Oculus Go. It deploys a client-server architecture, and also has a separate view for the observer. This observer view is used on a laptop computer and it provides the researcher information regarding the progression of the wayfinding task and can also playback the audio from both clients. The ODV content used in CityCompass VR is 360° × 180°, and it has a field of view of 60°. In addition to the HMD device, both users wear a headset for communication purposes. For the application architecture, see Fig. 4.

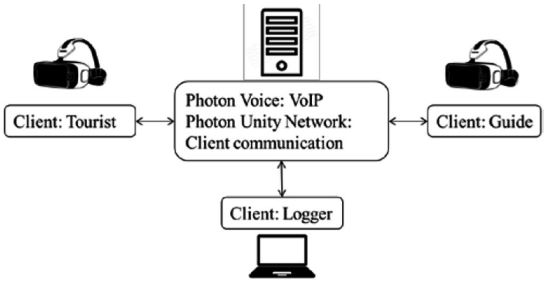

Fig. 4. CityCompass VR application architecture. The two clients are connected to each other via Photon Unity Network and communicate via Photon Voice VoIP service. All activity can be recorded by the logger client [2].

4 Conclusion and Future Work

This paper introduced CityCompass VR, a collaborative virtual language learning environment. In the application, two users collaborate and communicate with each other in order to reach a common goal. The application utilizes head-mounted display devices and interactive omnidirectional videos, which together create an immersive experience for the users. CityCompass VR is a promising tool for research purposes for various domains, including education and language learning. It is suitable for various age groups, starting from elementary school, and the application also has potential for cross-cultural studies (see for example [7]). For future, we are planning on adding several routes from around the world, including night time scenes. Our goal is also to provide a crowdsourcing platform where users can upload their own routes.

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