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Engineering

SOCIAL VIRTUAL REALITY COLLABORATIVE PLATFORM

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ABSTRACT:
THIS PAPER DESCRIBES SOME RESULTS OF AUTHORS' RESEARCH FOR DEVELOPING A SOCIAL VIRTUAL REALITY COLLABORATIVE PLATFORM. THE PLATFORM PROVIDES USERS WITH A WEALTH OF COLLABORATIVE TOOLS THAT MAKE IT POSSIBLE TO INTERACT AND RUN COMPLEX ACTIVITIES REMOTELY IN A VIRTUALLY IMMERSIVE ENVIRONMENT.

KEY WORDS: VIRTUAL REALITY, SOCIAL PLATFORM, COLLABORATIVE WORK

INTRODUCTION

Virtual Reality (VR) is a technology that allows the user to interact with a computer simulated environment, via Head Mounted Display (HMD) or through CAVE stereoscopic projection systems, to experience a world that is not physically and is not real[5]. Some environments include additional sensory information, such as audio, tactile information - used by haptic systems - known as force feedback. Users interact with the virtual environment through standard input devices such as mouse, keyboard, multimodal devices (wired glove, extension arm - arm boom, omnidirectional treadmill, Leap Motion Controller or Nimble VR). Simulated environments can be like the real world (flight simulation exercises for astronauts, flight training for pilots or military training) or may be different from the real world (VR games). If we include concepts of real life in the virtual world, we can talk about a new concept - augmented virtuality[6]. Our research has

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[5] Hype Cycle for Emerging Technologies, Gartner Research, August 2008
[6] Burdea G., Coiffet Ph., La realite Virtuelle, Ed. Hermes, Paris, 1995

focused on expanding the capabilities that a virtual reality platform makes available to create an immersive, truly collaborative work environment.

MAIN TEXT

To develop such a complex platform, we needed first to select a proper engine to start with. After a study of the options currently available on the market, we have selected the High-Fidelity engine, an open-source engine that enables the expansion and development by exposing the engine core by java script and qml[7]. This engine allows the importing of 3D models in FBX and OBJ format[8,9] and fully support PBR materials and procedural textures. The engine allows also importing of rigged 3D characters as avatars and have a good physics engine for complex simulations and interaction.

From the facilities developed by our team on the virtual platform, we mention:

- 3D animated product layouts and animated 3D CAD model visualization. This tool allows importing and visualization of complex animated CAD models, exported as baked FBX from the 3D designing application. This tool allows an easy way to import and study the models and trigger various animations based on some developed scripts.

- Live audio communication. The platform includes a high-fidelity audio interface with a surround mixer, that allows a realistic communication between users. The mixer compute automatically the attenuation based on the distance between the users and spatial surround panning base on the angular position in the domain (fig.1). Based on this existing interface, we have developed some applications for sound recording and playing, that allows us to integrate an audio messaging system into High Fidelity platform and to play multichannel sound tracks in sync, the sound for each channel coming from a specific point in 3D space.

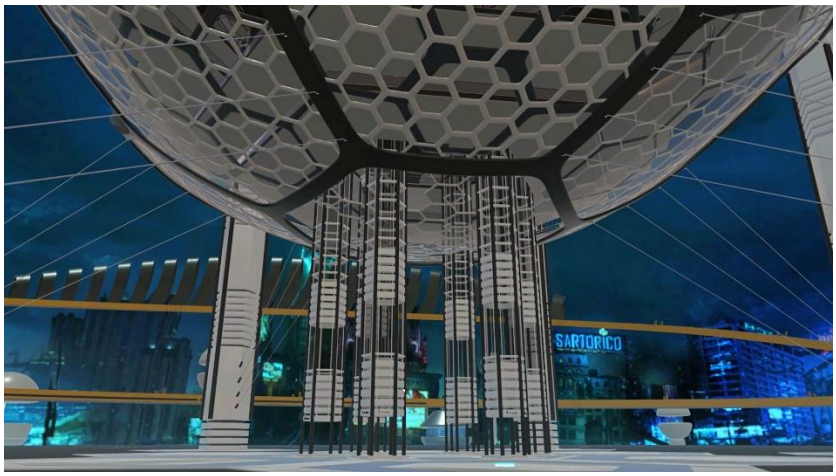

Figure1 – ImproMedia domain main building

[7] www.highfidelity.com
[8] Chaillou C., Froumentin M., La Synthese d'images, 1997, Ècole Universitaire d'ingenieurs de Lille, France
[9] Ștefănescu B., Tehnici moderne de generare a mediilor virtuale prin sinteză grafică asistată de calculator

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- customizable 3D avatars with VR tracking system and default gesture desktop interface (fig.3). The platform includes a realistic physics simulation system for avatar movement and 3D tracking of user movement, based on HTC Vive and Oculus Rift trackers or Leap-Motion controller.

To enhance the nonverbal communication and body language, the platform includes also an advanced gesture interface for the users that use this platform in desktop mode and don't have trackers. Users can select some predefined animations like dance, clap, wave, rise hand, sit, point at, by pressing the application buttons. The default avatar animation will be override for a short time with the selected animation.

Starting from this existing implementation, we have integrated a Real-time Speech Emotion Recognizer based on Tensor Flow. This application can do the feature extraction, build the classification model and based on this model can detect the human emotions based on the voice inflexions. This recognized emotions, based on a scoring system (fig.2) are used to drive the blend shapes of the avatar and reflect in real time the emotions of the real user into the avatar face. The model was trained on Berlin Database of Emotional Speech[10] but can be trained based on each specific user audio recordings.

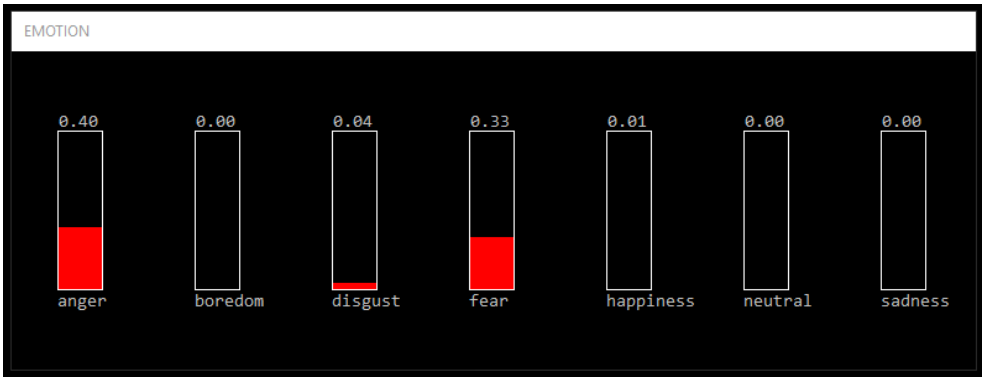

Figure 2. Detected emotions scorring

Figure 3 - Customizable 3D avatars

[10] Berlin Database of Emotional Speech, http://emodb.bilderbar.info

- contact list. The platform allows users by a simple handshake to exchange contacts and add friends. Starting from this implemented feature we have created a business card exchange application. Users can exchange business cards that can be visualized inside the platform and also on an external web application.
- Interactive teleportation system. The platform allows users to teleport inside a domain and from one domain to another using a go to application. We have developed some scripts for portal droppers in order to do this navigation in a collaborative way. When a user wants to invite other users to go on a specific location, this user opens the portal dropper interface, select or type the destination and press the drop button. A portal will be included in 3D space and all the users that will enter in this portal will be redirected to that specific location.
- chat text – application based on JavaScript and Node.js that allows text-based and cross domain communication between users.
- video conferencing – JavaScript, WebRTC multiuser application that allows audio-video communication for the users inside VR or between VR and real world. The application allows also screen sharing and video sharing from YouTube and Vimeo.
- display system for brochures, web pages, business cards, videos, catalogs, which visitors can collect and view in the VR environment or through a web interface. This tool is based on a MySQL database and a JavaScript client application.
- The platform allows the access of web applications inside a Web Entity, which is a chromium-based web browser. We have integrated many web applications for collaborative working using this option for text editing, project planning, whiteboard, CRM, ERP etc.
- snapshots using this app the users can create photos in the virtual environment and share them in their network of friends on Facebook or twitter. The snapshots can be printed also in VR as 3D framed photo.
- Camera - Virtual video camera that shoot in the VR environment and export videos and 360 panoramas. We have created some scripts for camera movement, in order to make the shooting process more natural and effective. Using this scripts tha camera can automatically follow an avatar or can be remote controlled having smooth motion.
- multimedia presentation system (fig.4), including slides, video, polls, live webcam streaming. A Node.js WebRTC application that allows the uploading of slides and videos to be presented in sync to the users.

Figure 4 - Multimedia presentation system

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- screen share (possibility to display live PC screens in VR) and also do remote desktop connections.
- simultaneous audio language translation system. A WebRTC JavaScript application using google API for translation, that allows instant translation from / to 200 different languages in real time. The presenter will talk in his native language and the translation is automatically screened as a text to each user in his preferred language (fig.5).

Figure 5. – Aula with multimedia and automatic translation system

- augmented reality system (by scanning with the VR phone of augmented images, 3D objects, animations, information or video files will be displayed)
- WebRTC live streaming that allows live broadcasts in the VR environment from VR to Web and from outside to VR
- user monitoring system (detailed traffic, username, date, access time, collected promotional materials)

Based on these tools, we can think of many applications where we can integrate an unlimited number of tools and features. Here's some possible applications:

- Virtual office
- E-Learning
- Virtual Exhibitions (fig.6)
- Webinar
- Product launch
- Training
- Recreational events
- Scientific sessions and conferences
- Videoconference from / to VR and real world
- Live streaming from VR to real world

Figure 6. – Virtual Exhibition stands

CONCLUSION

Using the JavaScript and qml API of the HighFidelity platform we have succeeded to extend his capabilities in order to create a truly social collaborative and immersive VR environment. The platform can be accessed by installing the HighFidelity engine interface from: https://highfidelity.com/download/thanks#client

After the installation you can access the platform, pushing the GOTO button and typing the domain name called impromedia.

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