TIMV-PLUS, A NEW APPROACH OF THE IMMERSIVE E-LEARNING PLATFORMS

Gicu Călin DEAC¹, Crina Narcisa DEAC², Costel Emil Cotet², Mihalache GHINEA²

Abstract: This paper introduces an immersive platform for distance learning. It integrates a lot of useful instruments for e-Learning like: browsing web, screen sharing, video players, virtual library, live streaming, webcam, videoconferences, VoIP, chat, whiteboard, automatic checking systems, and interactive testing evaluation systems. Our platform, TIMV Plus, allows the import of 3D objects in FBX and OBJ format. This type of objects can be obtained by using any 3D software or by being imported from Google Warehouse or Google Blocks, so that more 3D components can continuously emerge on the platform, up to each user’s will. Given the fact that this platform uses a server-client architecture, any new modification is saved on server, and the other users can visualize in real time the new components.

Keywords: e-Learning, Virtual Reality, collaborative learning

JEL classification: I29

Introduction

During the last decade, together with the computer hardware and software evolution, including the Internet technologies like Web 2.0, a lot of e-Learning applications were developed, either proprietary or open source. One of the most used open source LMS platform (Learning Management System) is the Moodle one. In order to sustain their training or learning activities, an impressive number of universities, educational institutions and companies implemented Moodle [1].

Nowadays, there is a huge number of e-Learning platforms all over the world, most of them similar to Moodle. They are characterized by specific particularities imposed by LMS rules and/or contain personalized features. Being very flexible, these platforms are useful for students and teachers, as well, allowing a good administration of the content and various evaluation methods. However, what it lacks is an increased interactivity between users, and an attractive “business and pleasure” combination, especially when the users schedule imposes spending a large period of time on the platform.

There is a lot of research concerning the relation between the efficiency and effectiveness of the e-Learning / MOOC (Massive Open Online Courses) platforms and the increasing time spent online by a

¹ University POLITEHNICA of Bucharest, Splaiul Independentei nr. 313, Sector 6, Bucharest, Tel. 021.402.9302, 021.402.9520, Fax: 021.310.7753
student. Boredom is quickly installed and obviously, the user’s attention decreases, his performance decreasing, too.

1. TIMV 3D platform

With these considerations in mind, we developed in 2014 the platform TIMV 3D [14], which combines the Moodle specific format with a virtual world in a limited space, like a campus. The platform was based on Open Sim, the open source project of Second Life which provides to the users a versatile tool for creating virtual worlds, advanced editors for creating, importing and managing the 3D content, and for improving avatars, in terms of their graphics and functionality. We have managed at that time to implement an HMD version for this platform, but being based on OpenGL the performance was poor (15-20 fps).

In this research, we wanted to update the TIMV 3D platform using current technology in virtual reality, based on the same server - client approach. We chose for this implementation the HighFidelity.io community open-source platform, which offer a good start for developing virtual worlds in Virtual Reality.

However, for such a platform to be useful in the educational process, a dedicated applications implementation is required. Displaying a various and complex content, like media ones, and audio-visual communication components could help [10].

2. PLATFORM TIMV PLUS

2.1. THE ACCESS TO THE TIMV Plus Platform

The access to the TIMV Plus platform is assured by the web address: 37.143.168.19:40102. To access the platform the user must download the HighFidelity Interface application available at https://highfidelity.com/download and point (fig.2) in the GOTO address bar the address: TIMV. After loading the TIMV virtual world in the interface the user can explore the meeting place (fig 1.) and interact with all other users connected to the platform.

Figure 1. The meeting room on TIMV Plus
2.2. THE AVATAR SELECTION AND CONFIGURATION

After his authentication on the TIMV Plus platform, the user passes into an avatar that immediately appears into the TIMV Plus, at the landing zone. The avatar can be personalized and the user can also create a personal avatar using software like Blender, Adobe Fusion, Mixamo, Maya etc.

2.3. NAVIGATION WITHIN THE PLATFORM

The avatar can be manipulated by commands MMORPG (Massively multiplayer online role-playing games), by arrow keys and mouse. The small wheel above the mouse can be used to change the 3D camera position. When this 3D camera is extremely closed to the avatar, on the screen, the displaying mode First person appears (we can see the world throughout the avatar "eyes"). In this virtual world, the full interaction with 3D objects can be achieved by using motion sensors like Leap Motion, Kinect, Razer Hydra, game controllers, Vive trackers etc. Also, by using a webcam the facial expression of the real user can be transposed to the avatar.

2.4. TEACHING TOOLS

In the virtual world of TIMV Plus we have integrated full web browser support with WebRTC, audio-video conference applications (fig.3), live streaming, web base integration for different tools like screen sharing, video sharing, whiteboard and full implementation of all web based e-Leaning platforms. Communications within the platform can be asynchronous (by messaging), or synchronous (by text chatting, audio chatting and video conference). By using Web-intercom application, a connection between text chatting systems (installed on the 3D platform), and the platform Moodle itself is facilitated.
To enrich users’ communication with nonverbal items, TIMV Plus use the motion capture technique so any real gesture of the user is transposed in VR to the avatar. In the previous TIMV3D platform we have used a panel **Gestures** with pre-configurable action sets, accessible by clicking on the upper right side of the avatar.

By implementing all this tools in the HighFidelity platform, we extend its capabilities and we achieve a proper VR platform for e-Learning. This VR platform can be successfully used for distant learning or for classes to conduct different experiments using the integrated physics engine to simulate complex physics models in a safer and collaborative way. Collaborative teaching methods like Fishbowl and Jigsaw etc. could be easily implemented using the TIMV Plus platform (fig.4, 5).

![Figure 4. Fishbowl collaborative learning in TIMV Plus](image)

![Figure 5 Jigsaw collaborative learning in TIMV Plus](image)

The role-playing enabled by the platform in case is also part of gamification, the very trendy approach in what the actual digital generation is concerned. By using a friendly open source infrastructure ([HighFidelity.io](https://HighFidelity.io)), this version of the platform improved the previous platform based on Open SIM. Thus, the users find a generous virtual 3D world with a futuristic architecture, very attractive from gaming point of view.
The users can participate to the presentation of one of the most important professors around the world, without using teleconference equipment, quite expensive for a university, in the real life.

Remember that communication between students and/or between students and professors could be set on the platform even when one or more of them are not in the classroom! The teacher can live at thousand kilometers away or his students can be on the beach, at home or making jogging.

The platform is so flexible that allows the continuous updating for any part of the campus, for any tools and support, education being its ultimate aim (not forgetting either about socialization and entertainment). It allows 3D objects import (textural meshes in FBX and OBJ format) obtained by any 3D application (Cinema 4D, Blender, 3D Studio Max etc.) (fig.6).

After a 3D model is imported to the platform it will be rendered in real time (meshes and textures). A geometric mesh is a collection of vertices, edges and faces, that define the shape of the 3D model and textures help in defining detail, color or surface textures. Loading models in TIMV Plus, involves real-time rendering (drawcalls). Depending on the complexity of the models, the drawcalls can differ. The rendering process can be optimized, using baking, which compress the poly meshes and textures.

Besides the model entities (imported 3D objects) there are several of other entities available directly in the tablet menu, like: box, sphere, light, text, web, zone, particle. After choosing the creation of a new entity this entity is rendered and can be edited using a mouse or a trackpad. You can edit an entity position, rotation and scale, and also you can duplicate and delete entities. A list of all entities from a domain can be available in the Create panel of the virtual tablet.

It is possible to edit entities in VR mode directly in the application, using a virtual tablet, accessible from the controllers. (fig.6)
The platform includes a physics engine that makes possible various simulations. The realistic environment and actions accuracy of the virtual world thus obtained push the limits far beyond reality.

**Conclusion**

*By developing and implementing TIMV Plus platform, we obtained a flexible, attractive and interactive instrument, which may be used in any educational activity. It provides the user with a challenging and collaborative environment, inside a virtual world where each one asserts own personality, individually or as part of the community. It thus becomes a powerful support for education, learning, evaluation, socialization [3]. The platform can be extended with a blog and an online LMS platform with a proper SEO optimization for a better visibility of the available courses.*

However, no matter how many facilities and/or gadgets this platform provides, it is important not to forget that its aim remains the learning process improvement. Successful educational organizations function “as adaptive social systems within which people cooperate in order to achieve common goals, [...] and teachers match their teaching methods to the type of intelligence the students exhibit. These systems are like living organisms that regenerate through the knowledge they create, their ability to pass it to others and the exchanges and relationships they foster among people” [13]. In general, an effective professor – student relationship “needs time and takes place during classes as much as outside them and requires a thorough developing of the abilities and competences specific to the emotional intelligence” [14]. Therefore, it is at least improbable to be simply replaced by the virtual reality hold by a platform, no matter how spectacular it would be. The only successful solution still is their mutual support and integration.
References

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