DELIVERY OF MULTIMEDIA EDUCATION CONTENT IN COLLABORATIVE VIRTUAL REALITY ENVIRONMENTS

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Abstract -The development of Collaborative Virtual Reality Environment (CVRE) for education is a challenging process. One of the many challenges faced during the development of CVRE is the creation, transfer and delivery of educational multimedia content. This multimedia content could include images, voice, video and their combination.

The overall goal of this project was to develop a fully integrated system that allows the faculty and students to seamless share multimedia material. This paper describes the system and technology used for its development and its integration with the CVRE used - Second Life. Second Life is an Internet-based virtual world with a downloadable client program that enables its users, to interact with each other.

The results from this project are expected to help other faculty to migrate their current multimedia educational materials using the system described here for the benefit of the students in the classroom.

Keywords: Virtual Reality, Multimedia, Learning, Share, Technology

INTRODUCTION

The delivery of educational content has always been an important challenge for universities and community colleges. The lack of educational resources to accommodate the ever-growing student population needs [1] limits the availability of many institutions to explore and/or implement emerging technologies to delivery multimedia educational content. Compounding the lack of educational resources, is the fact that more and more students are seeking out education at all levels primary, secondary, and tertiary and therefore educational institutions are hard pressed to expand enough for accommodating their enrollment. Thus, with this in mind, and the advent of the communication revolution, distance education has begun its' push to the forefront in creating an avenue to address this problem [1].

One emerging technological resource in this push for distance education is Collaborative Virtual Reality Environments. While concept of Virtual Reality has existed for many years the concept of Collaborative Virtual Reality is not. Virtual reality (VR) is a technology that allows a user to interact with a computer-simulated environment, be it a real or imagined one [2]. Collaborative Virtual Reality Environments (CVRE) extends the VR definition since CVREs are used for collaboration and interaction of possibly many participants that may be spread over large distances. The applications are usually based on the shared virtual environment [3]. CVREs can be accessed through the Internet and allows a group of geographically separated users to interact in real time for a broad expanse of educational applications such as physics, archaeology, chemistry, astronomy, construction, engineering, etc [4]. The CVREs offer meeting space, networking opportunities and simulations that students in any university can benefit without having to leave their geographical location.

One of the platforms available to develop an Educational CVRE is Second Life which is a virtual 3-dimensional world where the participants have the ability to develop and share multimedia content using a very simple user

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graphic user interface. One of the challenges faced by faculty and students in the CVRE, during the development of educational material, is the creation, transfer and delivery of images, voice, video and their combination. Thus, this paper describes the development of a Multipurpose Virtual Multimedia Selector (MVMS) which allows non-administrators to select, play and change multimedia, video, audio and slide presentations and set visible schedules for events in the Virtual Environment and to upload, revise and organize multi-media content and schedules through the use of a companion web portal.

HARDWARE ARCHITECTURE FOR THE
MULTIPURPOSE VIRTUAL MULTIMEDIA SELECTOR (MVMS)

The use of Second Life as a platform to develop Educational CVRE has already motivated many universities. Some of the universities, domestic and international, already taking advantage of second life for classroom use include: Georgia State University, Atlanta, GA; University of Notre Dame, South Bend, IN; University of Louisville, Louisville, KY; University of Edinburgh, Edinburgh, Scotland; University of Hamburg, Germany; Penn State University; Ohio State; San Jose State University, and more. However, most universities are mainly relying on the Linden Lab servers.

Second Life clients deliver interactive Virtual Reality by streaming series of commands to central servers at Linden Labs. Multimedia is delivered to clients by a different decentralized mechanism. Each client retrieves the media settings and URLs from the avatar's current region. Media is then streamed directly to each client computer without going through the Linden Lab's server. In the case of video, Quicktime output is "scraped" and displayed in the virtual world replacing the media texture with the desired content. Setting a video is then normally accomplished by setting the media texture and pointing the region media URL to a streaming or fixed Quicktime source (Figure 1). This mechanism is too cumbersome for flexible presentation and is difficult for non-experts.
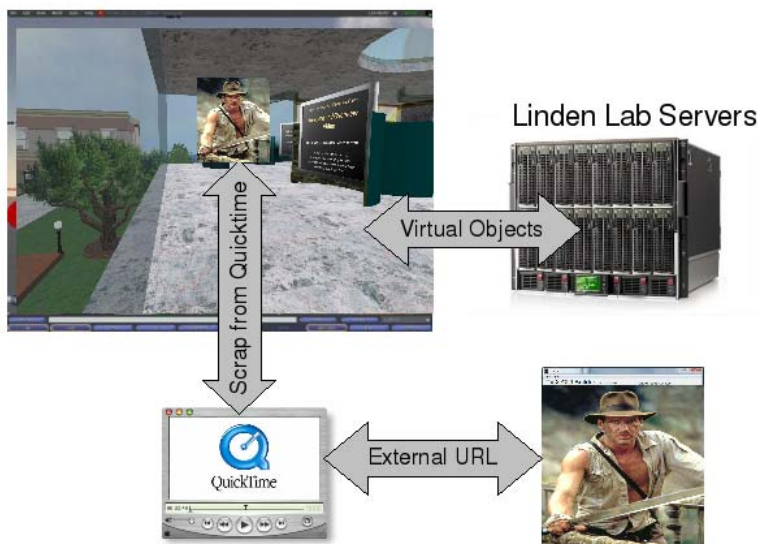

Figure 1. Client – Servers for Media Display

MULTIMEDIA DELIVERY IN A COLLABORATIVE VIRTUAL REALITY ENVIRONMENT

Building upon the multiple servers for the creation, transfer and delivery of multimedia, embedding a single audio, video and/or image in a Collaborative Virtual Reality Environment (CVRE) in Second Life^{TM} is done (as shown in Figure 2) by:

> 1- Setting the "local media texture",
> 2- Setting the "media URL", and
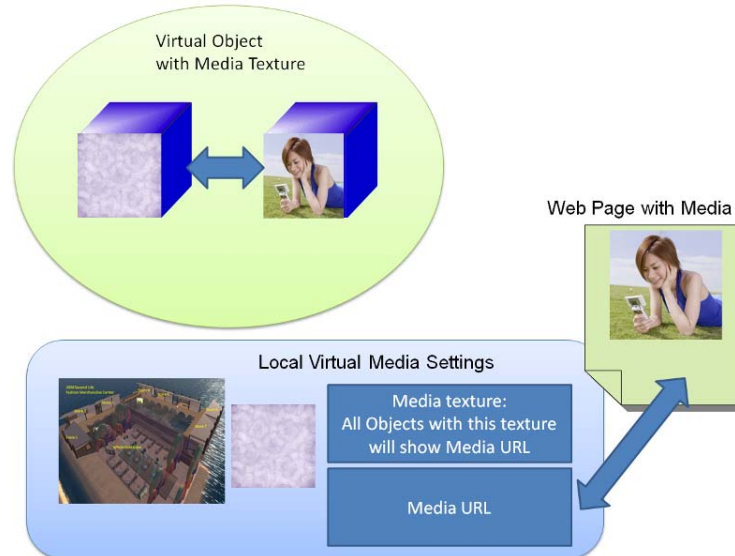> 3- Placing a virtual object with a matching texture to the local texture.

Figure 2 - Creating a Virtual Media display by manually manipulating local setting

This object in the Virtual Environment will display a single fixed media. In other words, the object with the texture matching the local media texture will display the current media URL or play the current audio clip. The result is a fixed video or music clip playing continuously in a loop or the image of the web page or image at the current media URL.

The problem with this method is that this media can only be changed by manipulating the media texture, media URL and other properties. Only administrators with full permissions can perform these operations and dynamic presentation where the speaker or viewers select content is impossible. Thus, the Multipurpose Virtual Multimedia Selector (MVMS) presented in this paper allows non-administrators to select, play and change multimedia, video, audio and slide presentations and set visible schedules for events in the Virtual Environment and to upload, revise and organize multi-media content and schedules through the use of a companion web portal.

THE MULTIPURPOSE VIRTUAL MULTIMEDIA SELECTOR (MVMS)

Building upon the same multiple server architecture, the MVMS technology consists on several interlocked dynamic components: 1- Virtual Signs, 2- Multimedia Players, 3- User Selection Tools and 4- Administrative Web Portal.

The operation of the "Virtual Sign" is very simple, as the user approaches the Virtual Sign, the user is presented with a dynamic information for example a list of current activities (As shown Figures 3 and 4) which in turns is stored in a MySql database. Then the user, simply clicking on an activity and the proper action will be performed in the environment such as teleport the user to a particular place in the environment.

Since the information is stored in a database, the information can be added, removed or modified in the Administrative Web Portal to provide users with an up-to-date schedule. This "Administrative Web Portal" is in

separate server, therefore speakers without administrators with full permission can access this database with out any restrictions. Furthermore, this "Administrative Web Portal" is reachable by clicking near the bottom of the schedule sign - meaning speaker do not have to leave the environment to modify the schedule

Figure 3 - User Avatar approaching a dynamic sign

Figure 4 - Dynamic Schedule Display with click-to-teleport functionality.

The database can contain all the appropriate information regarding images, voice, and/or video. Figure 5 shows the screen of "the Multiplayer", which allows the user to select audio tracks, videos or presentations from a dynamic list similar to the "Virtual Sign". However, the "Multiplayer" also has the "User Selection Tools" (the three bottoms on the top left portion of the screen). The "User Selection Tools' allows the presenter to select what type of media they would like to show to their audience. Upon selecting the appropriate media (Image, voice or video), the speaker is then presented with list of the available media of the type selected as shown in Figure 6. This dynamic list can be updated by uploading or making modification in the "Administrative Web Portal" suite as shown in Figure 7 inside the CVRE.

Figure 5 - Virtual music, video and presentation selection screen.
Note the green and yellow buttons which control the type of media to be selected.

Figure 6 - A dynamic List of Available Audio files.

Figure 7 - Web administration of dynamic content

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The purpose of MVMS is to provide educators with the ability to schedule and present in the CVRE without lengthy preparation and in a flexible modifiable-at-a-moment's notice way. Figure 8 shows a typical MVMs presentation environment where multiple people that may be spread over large distances can listen and watch multimedia content while collaborating in the environment.

Figure 8 - A multimedia presentation environment which can dynamically show any content uploaded to the web portal.

In short, the MVMS portal is operated as follows:
  1- Presenter uploads desired content to the portal server,
  2- Presenter selects new item as available for a scheduled activity,
  3- In the virtual environment the presenter then select the new media at any time.

Essential all the steps taken by and administrator are automated with data stored in the web portal database. This database is updated through administrative pages. Since various types of media are supported in the environment including audio, video and libraries of images most often used as slides in presentations MVMS supports dynamic selection of both the type and choice of content as shown in Figure 9.
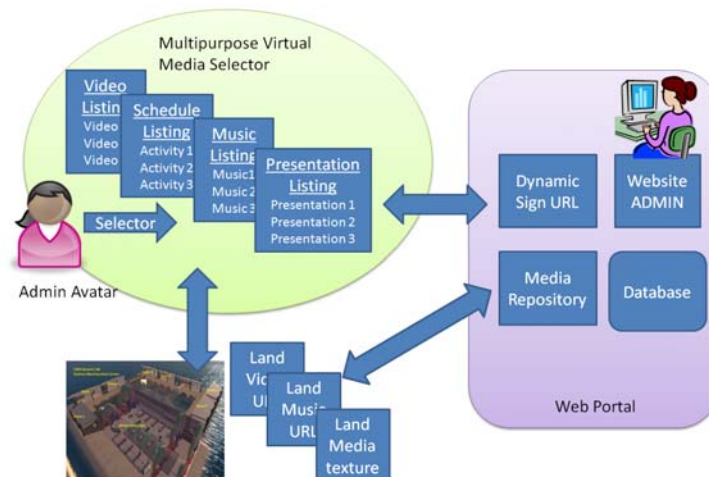

Figure 8 - An overview of Multipurpose Virtual Multimedia Selection Technology.

SUMMARY

Collaborative Virtual Reality Environments (CVRE) have the potential to revolutionize distance education by allowing users to interact with a computer-simulated environment, be it a real or imagined one as well as taken advantage of multimedia educational materials including images, voice, videos and their combination.

The proposed approached presented in this paper using Second Life as a platform for the CVRE and multiple server to store and manage the multimedia content will allow the educators to use their current multimedia material with minimum effort. Furthermore, the administrative tools developed by the research team allow non-technical people the ability to schedule and present in the CVRE without lengthy preparation.

The results from this project are expected to help other faculty to migrate their current multimedia educational materials using the system described here for the benefit of the students in the classroom.

DRAWBACKS, CAVEATS AND FUTURE WORK

The main drawback is that Avatars in the virtual environment can only view one multimedia content at a time. Thus, it is not possible, for example, to play two videos which can both be viewed by the same audience. This is a fundamental limitation of the Second Life CVRE environment which we hope will be lifted with further technical development. The primary caveat is that the complex interplay of dynamic signs, web server and database is computational expensive. Large number of simultaneous interaction tends to bring the web server to a halt. The USM research team have obtained access to an advanced multi-core server in ICEE to experiment with the upper limits on multi-media presentation.

The current focus of development is to provide a complete higher level administration suite reachable inside the environment. These tools would show current and planned usage of various MVMS presentation areas allowing better control of the environment and more effective scheduling and usage statistics gathering. Figure 9 shows the current environment-wide administrative center under development.

Figure 9 - Environment-wide administration center to control and gauge
usage of multiple multimedia presentation areas

REFERENCES

[1]   O. Darkwa, and F. Mazibuko, (2000, May) "Creating Virtual Learning Communities in Africa: Challenges and Prospects" First Monday, Peer-Reviewed Journal on the Internet, vol. 5, no.5, http://www.firstmonday.dk/issues/issue5_5/darkwa/, Accessed July 31, 2003

[2] Wikipedia, "Collaborative Virtual Reality Environment Definition", http://en.wikipedia.org/wiki/Virtual_reality

[3] C. Bouras, and A. Filopoulos, (1998) "Distributed Virtual Reality Environments Over Web for Distance Education" http://ru6.cti.gr/Publications/269.pdf

[4] Wikipedia, "Virtual Reality Definition", http://en.wikipedia.org/wiki/Virtual_reality