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The Modeling of Virtual Environment Distance Education

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Abstract

This research presented a virtual environment that integrates in a virtual mockup services available in a university campus for students and teachers communication in different actual locations. Advantages of this system include: the remote access to a variety of services and educational tools, the representation of real structures and landscapes in an interactive 3D model that favors localization of services and preserves the administrative organization of the university. For that, the system was implemented a control access for users and an interface to allow the use of previous educational equipments and resources not designed for distance education mode.

Keywords: virtual environment; distance education;web

1.Introduction

Virtual reality promised fully immersive environments accessed by specialized body and headset equipment. Easily usable virtual realities of this nature have largely failed to emerge. However, significant progress has been made in related areas and recent advances in multi-user, on-line games playing technology have fostered the emergence of a type of virtual reality in the form of globally accessible multi-user virtual environments (MUVE)[1]. Significantly, recent MUVE developments have moved away from any game-playing content and now simply provide a 3D platform that users may develop in any way the choose. This has fostered the emergence of a 3D internet that is somewhat similar to the world-wide web, in that users develop sites in providing realistic, usable 3D environments is such that the 3D internet is now being hailed as a potential successor to the world-wide web for conducting on-line interactions.

Traditionally, students expect flexibility and mobility of the education environments and more intuitive interaction with the university campus, employees desire an easier access to administrative tools and the society desires better information regarding the university localities, its activities and services. Traditional on-line delivery mechanisms struggle to achieve any sense of community or Ācohort cohesion" in participants even when using the latest Web 2.0 tools such as blogs, forums, etc. Here, students largely study in isolation without the normal social interaction that is so important to a fully rounded educational experience.

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Realize these necessities, this paper put forward to a web based multi-user virtual campus (WMUVC) for distance education, which is based on MUVE to satisfy multi-users' needs of which not only include students and teachers, but also managers and other employees who working for the campus. This paper presents the approach to building a sustainable, cohesive education community.

2.Related works

2.1.Virtual reality technology

Perhaps one of the most exciting developments in the computing arena over the last decade has been the almost stealthy emergence of desk-top, 3D virtual realities.

Virtual Reality (VR), also known as virtual technology or artificial environment, a form of human-computer interaction in which a real or imaginary environment is simulated and users interact with and manipulate that world. Users travel within the simulated world by moving toward where they want to go, and interact with things by grasping and manipulating simulated objects. In the most successful virtual environment, users feel that they are truly present in the simulated world and that their experience in the virtual world matches what they would experience in the environment being simulated [2]. This sensation is referred to as engagement, immersion, or presence, and it is this quality that distinguishes virtual reality from other forms of human-computer" interaction. Virtual reality is a product which developed to a certain level of combining computer technology and science of human understanding of the world. It opened up a new way for the visualization of special information. It has three characteristics Immersion, Interactivity and Imagination.

2.2.Distance education mode

Distance education is a field of education that focuses on the pedagogy, technology, and instructional system designs that aim to deliver education to students who are not physically "on site" in a traditional classroom or campus. It has been described as "a process to create and provide access to learning when the source of information and the learners are separated by time and distance, or both."

There are two distance education modes: synchronous and asynchronous. Synchronous is a mode of online delivery where all participants are "present" at the same time requiring a timetable to be organized. Asynchronous is a mode of online delivery where participants access course materials on their own schedule. Students are not required to be together at the same time. Message board forums, e-mail and recorded video are examples of asynchronous technology [3].

Neither synchronous nor synchronous, nowadays, can fulfill the nature of interaction between students and teachers. What they face, nevertheless, is computer screen or monitor. So, the need for changing this situation emerges recent years.

2.3.Virtual campus

Virtual campus is the representation of university campus in the form of 3D virtual environment, which is usually based on a real campus features and landform, but not necessarily always so. It's a digitized virtual space of an existing or imagined campus, and is mainly utilized as a means of image exhibition or campus design. Many universities have set up their own virtual universities and virtual campuses, Such as Beijing University of Aeronautics and Astronautics, Zhejiang University, Tianjin University in China [4]. However, these virtual campuses just are propaganda forms, while they have no any other effect.

In order to satisfy the requirements mentioned above, the virtual campus, in the future, not only a image of the university, but also the tool make students and teachers which are involved in distance education communication naturally and freely. Only when all these are done it would bring a perfect experience to users.

3.Multi-user virtual campus for distance education

People involved in distance education include students in various locations, teachers who are in different location from students, managers who in charge of the system and other employees. They are different group people regarding to the requirement to the system. This paper engaged in establishing a system which will make distance education sustainable, cohesive and convenient for all users.

3.1.Basic concept

To make the virtual campus more convenient and economical, this paper combines the three dimensional scenery supplied by virtual reality technology and the information dissemination mode of traditional website, such as email, VOIP, camera chat etc together to establish a networked multi-users virtual campus which can realize the combination and share of the teaching resources which can be browsed and This virtual system experiment used freely, and benefit to the users and managers of the distance education system.

The WMUVC is environment established in 3D form which can afford a vivid image of the university and is more flexible than 2D rendering form. During the process of course taking, one student can communicate and discuss with teacher and other students as in real classroom, even, refer to experiment courses, students can observe the details and steps of the experiment conduct by teacher. 3D rendering form excels 2D form change of vision either in course vitality or reality, and is much fit for guiding students to study.

The system is a simulation of real life in campus for students can take actives such as having class, taking exercises and making friends; as well as in the real campus, teacher can lecture, review works from students, conduct examinations; managers can manage the daily teaching actives and students' affairs.

3.2.System Architecture

As the users have different level of knowledge about computer and internet, the WMUVC's structure should be simple and it should offer intuitive navigation which could make users communicate naturally. The navigation occurs through a virtual mockup that affords mobility and access to the services available. For remote access to the system and to its services, the interface of communication of the system uses a client-server structure. This way, the user can access a homepage to connect him to an application that establishes a connection with the server through internet.

Mockups in WMUVC are modeled and organized according to structural aspects in the real world and this organization reflects the relationship between mockups. The structural diagram of the system is shown as Fig.1, in which virtual classroom, laboratories and library are connected to each other. Users can access every virtual entity through the network after identity validation.

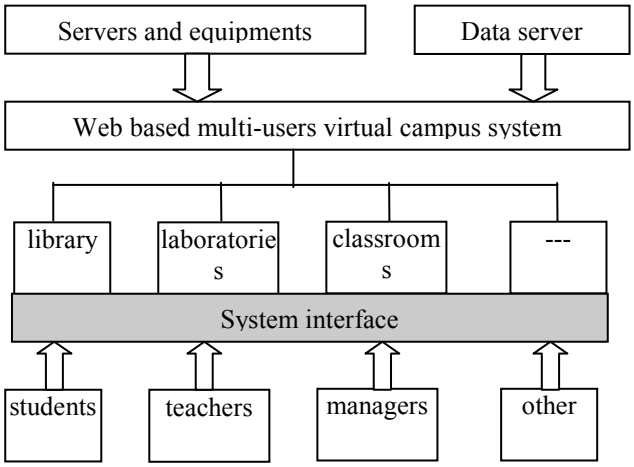

Figure 1. The structure of web based multi-users virtual campus system

The system is composed by: a virtual mockup situated in a Client subsystem; an interface of communication, responsible for the access to the services; and a layer of applications available for users, situated in the Server subsystem. The Client subsystem is responsible for the management and sending requests for the Server through the Internet. The Server subsystem is responsible for translation, processing and reply of the requests.

The theoretical model of WMUVC is shown in Fig.2, which is comprised of three major parts. The left part and right part is the model of student subsystem and teacher subsystem, respectively, which comprise five layers, and the middle part is the Open System Interconnection (OSI) model which comprises seven layers. The left part and right part communicate and exchange information through the middle part. The five layers of WMUVC include:

- *Perception layer:* this layer supplies the user with a virtual campus, and the user can interact with the virtual campus, teacher, and other classmates freely and naturally.
- *Function layer:* this layer consists of the basic functions of WMUVC, including design of the system, simulation to the physical world, transferring information and displaying images and other information, etc.
- *Algorithm layer:* this layer integrates the algorithms necessary for the operation of WMUVC system, such as planning algorithm, graphic rendering algorithm and data processing algorithm.
- *Information layer:* this layer includes the information of campus, course and teacher description, demonstration of some experiments, displaying of the mockups and other things in WMUVC, etc.
- *Physical layer:* this layer comprises the hardware of the virtual environment such as classrooms and other buildings, experimental instruments, tables, chairs, etc.

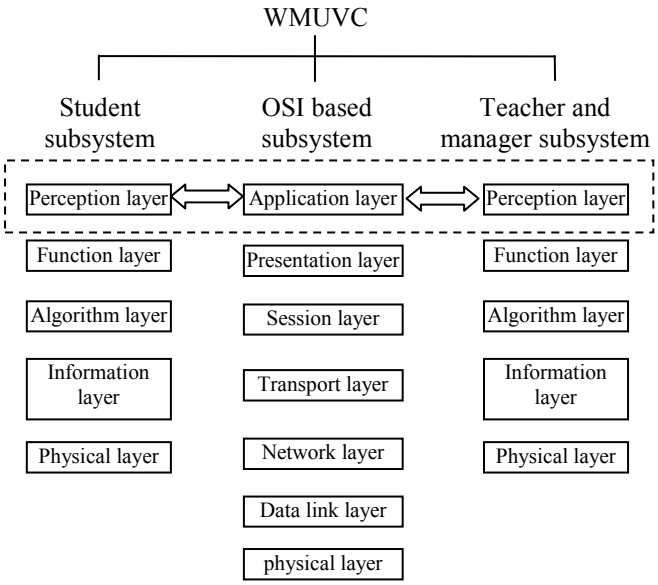

Figure 2. The theoretical model of WMUVC.

While the seven layers of OSI model include application layer, presentation layer, session layer, transport layer, network layer, data link layer, and physical layer. The dashed block is the established WMUVC system. Students can enter any virtual classroom to having class; any laboratory to operate experiments; library to reading books, teachers can lecture in the virtual classroom or laboratory, and managers can overview the activities and process occurring in the system, as long as their identities is validated.

3.3.Communicate interface

Considering variety of the users, the communicate interface of the system should be flexible, available and easy to use. As the C-S construction of the system, the interface could built on the web browser such as Microsoft Internet Explore, Firefox, Opera, Safari etc, then users can access the information and take courses any where, any time as long as they work with computer and internet.

Furthermore; the WIFI could be the solution to connect the users and system too, then, users can acquire the information and message with a smart phone, justly. This will make the system more convenient, and flexible.

3.4.Data and security issues

Expressing the special information of the users and non-spatial data of the objective world such as buildings teaching equipments in the virtual environment is an important goal and difficult task in WMUVC system. Since complexity and diversity of the real world, various data is essential and should be integrated, and a complex data model is used to express the system's vector data, raster data, as well as CAD data. For the sake of management and collection, data are divided into spatial data and management data as shown in Table I.

TABLE I. A LIST OF DATA TYPES

Data name	sources	functions
Topographic map	Maps of the real world	To provide information for simulation to the real world
Buildings data	Photogrammetric survey	To provide referring information for modeling
Features data	Questionnaire	To provide relative user' information
CAD data	Engineering design profiles	To provide information for mockups modeling
Texture images	Picture from digital camera	To provide a realistic images for mockups

Although one would expect relatively open access to a University campus, it would not be unreasonable to restrict access to some areas to either staff only or students and staff only, to prevent, for example, casual visitors from disrupting a teaching session. Virtual worlds as with any other internet activity have their share of disruptive, destructive users, who seek to disrupt or deface sites in a similar fashion to website defacement. Access controls, although not infallible, can be imposed at varying levels of granularity, from restricting access to the site to registered users to restricting access to a particular venue to a class list.

4.Development and modeling

The WMUVC system is developed with Southwest University of Science and Technology exemplified. Through the procedure, VRML and 3DSMAX is used for modeling the mockups, and virtual worlds. In general way, the tools used to develop virtual campus can be divided as:

- Packages for 3D drawing;
- Packages or languages for VR modeling;
- Programming languages to allow the development of interaction and access control.

4.1.Tools for implementation

- *Virtrual Reality Modeling Language(VRML)*

Virtual Reality Modeling Language (VRML) is one of the most popular tools for establishing the 3D environment. VRML introduces the interactive 3D rendering form into the World Wide Web, and it is a multi-platform used modeling language. VRML uses the node as the basic unit, and defines the common descriptive languages of 3D application system such as light source; animation, changing of levels, etc, and it have the function of simply description of the behavior characteristics. VRML has the advantages of expansible, multi-platform, interaction, etc [5].

- *3DSMAX for modeling*

VRML uses nodes to establish virtual scenes. However, using nodes to design models is not very convenient, and is difficult to design complicated models. However, the 3DSMAX can make up for the disadvantages of VRML.

3DSMAX is mainly used in the fields of architecture design, product design and three dimensional animation design. The models designed by 3DSMAX have good feelings, and are easy controlled [6]. While in the virtual campus which mainly focus on the feeling of interaction and immersion, the detail is not a leading factor, so, the simply-operated modeling software 3DS MAX is popular in the designing of virtual campus.

4.2.Models and interfaces

The models in WMUVC include: buildings such as classroom, library and laboratories, vegetal structures like trees, flowers and bushes, and avatars which is the presentation of students and teachers and other people who involve this system. Every mockup is linked to department homepages, laboratories and educational tools including literature, videos and listening materials referring to the courses. The modeling could not be performed from CAD models due their complexity and elevated number of points to describe each structure. But the CAD models generated by 3DSMAX were used to identify proportions and localization of the structures in the virtual environment. The models shown Fig.3 is one classroom in the WMUVC system.

Figure 3. One classroom model of the WMUVC system

The system developed in this research is based on web include Internet and WiFi, so the communication interface is built in browser such as Interne Explore. Just doing this, users

can access the information and other education materials, and, furthermore, some words expressed materials, videos and listening materials could accessed by WiFi through smart phone or other devices. Fig. 4 is the interface of the system, users can load on the system with their identities validation to get start the courses. For the non-member people, they could skip the common information.

Figure 4. The interface of WMUVC

5.Conclusion

The experience obtained from this system should be used as basis for the complete implementation of the Virtual Campus. The purpose of this research is to provide a complete methodology for the modeling of virtual environment to expand its use for other applications.

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