CyberSession: A New Proposition for E-Learning in Collaborative Virtual Environments

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ABSTRACT
E-Learning in fact is another type of learning process through the integration of technology and is perceived as learning via a web browser, over the web or an intranet network. E-Learning in the context of 3D virtual environments promises better performance in the light of new trends for 3D environments among users.

This paper presents the design and first steps to the implementation of a collaborative environment representing course materials through web3D technologies. It highlights the unique ability to run in low bandwidth by simulating user input and transforming work forces into a knowledge resource. In our framework, nicknamed *CyberSession*, users can switch between 2D and 3D environments to support synchronous training, asynchronous training and collaborative training systems.

Categories and Subject Descriptors
H.5.3 [**Information Interfaces and Presentation**]: Group and Organization Interfaces
K.3.1 [**Computer Uses in Education**]: Collaborative learning.

General Terms
Management, Design, Experimentation, Human Factors

Keywords
E-Learning, Collaborative Virtual Environments, Social awareness, Avatars

1. INTRODUCTION
Creation and rapid development of information technology in the current world, with creating new areas and making main changes in other areas is a means for creating new opportunities in different ways. Many of these opportunities have now become a main requirement in information organizations, such as e-government, e-commerce, and e-learning.

Gradual transition from traditional pedagogical methods to new views is based on new technological opportunities in educational sectors. For instance some university classes are now held online and employ multimedia, putting course materials on internet. The increased establishment of virtual schools and virtual universities, etc. can serve as other examples. Although the above mentioned efforts seem promising there exist many shortcomings in the methods involved, infrastructures and help tools in this area.

Today, with promotion of computer based training and electronic learning methods, many universities and research institutes invest in virtual classrooms. E-Learning is a popular term and has various extensions such as Online learning, Web-based training (WBT), Web-based learning and technology based training (TBT) and Computer-based training (CBT).

As innovation accelerates, training programs must become more flexible and less time consuming. However 70% of people never finish WBT (Web-based Training) systems because of the lack of a social contact. Using collaborative web-based training system we have access to an updateable real-time interactive content alongside virtual social awareness.

It appears that too often systems supporting education neglect the importance of social awareness. The focus is on supporting the teacher, individual learning or group activities. Little or no attention is put in fostering encounters among students that do not necessarily belong to the same established social structure [7]. Collaborative interactive learning is a memorable experience. Questions are answered immediately in lively discussions. Learning in groups makes the course fun and ensures a supportive atmosphere [4].

In this paper we present our proposed system to overcome the current problems of multimedia classes and bring better performance to e-learning methods and discuss the lessons we have learned from our experiences. Our proposition nicknamed CyberSession is developed experimentally for LANs and now is in development for WANs.

The paper is organized as follows. First we discuss related works on using Virtual Environments for e-learning in section 2. Then we list the features and abilities of the current CyberSession testbed in section 3. We will present our final architecture for collaborative virtual environments in section 4. We then evaluate our system in Section 5. Section 6 concludes the paper by discussing the limitations of our work and possible future lines of research.

2. RELATED WORKS

Main web-based course management systems that are currently in use are: WebCt, Blackboard, TopClass, Virtual-U, Lotus Real Education, eCollege.com, Symposium, Softarc's FirstClass, Serf and Eduprise.com. These are also known as:

- Courseware products
- Online educational delivery applications
- Online course delivery software products
- Web-based training products

Sharable Content Object Reference Model (SCORM) conformance is the standard for evaluation of these systems. Toward adding more social activity to the above systems the researchers have worked on the idea of collaborative virtual environments. Within a 3D space users can tell where the attention of another participant is directed by way of his/her position and orientation. of users into a computer generated 3D space and tracking their head and/or eye movements in order to convey their gaze [5][6]

There are several research platforms that support on-line virtual communities [8]. Some of the most popular 3D virtual world applications include Active Worlds, blaxxun interactive, OnLive! Traveler and Adobe Atmosphere [3]. These platforms are effective for supporting collaborative virtual environments. In this section we take a look at one of these environments that we have focused in our work.

2.1 Blaxxun Platform

The blaxxun Platform is a modular software system, upon which internet-based communications solutions can be produced. Areas of use include E-Learning, Team Workspaces, Interactive TV, Communities, Virtual Worlds, E-Service and Online Customer Clubs [4]. Blaxxun makes a new form of online learning possible: collaborative e-learning. Now you can present learning content dynamically and in real-time, encourage social contact and ensure effective transfer of knowledge from theory to practice.

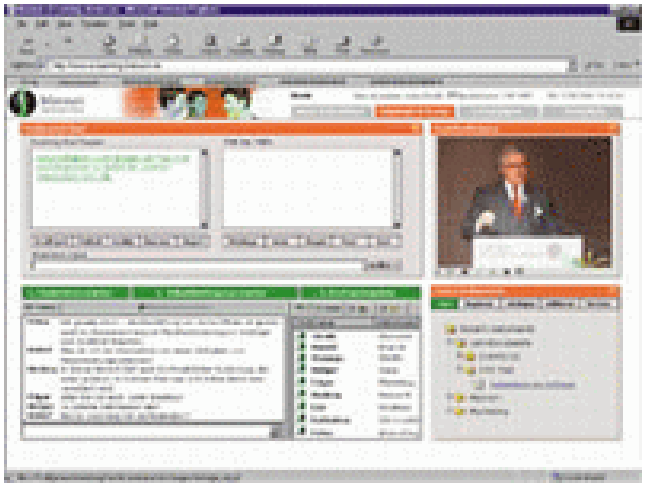

Figure 1. Blaxxun's collaborative e-learning system

The benefits of using such a framework for users are:

- Theory-to-Practice Transfer in Self-organized Study Groups
- Explorative, playful learning in Virtual Classrooms
- Group discussion of Learning Content (Break-out Sessions)
- Motivational Learning (Incentive Program)
- Interactivity during Course via Brainstorming Board
- Needs-oriented Offerings through Profile Matching and CourseFinder
- Monitoring of Courses and Participants via Polls and Quizzes
- Enjoyment of the Virtual Learning Experience
- SCORM-compatible

2.2 INVITE Virtual Training System

INVITE (Intelligent Distributed Virtual Training Environment) is a project in the framework of the Information Society Technology (IST) Program of the European Commission. It started in February 2000, and it will run for almost 3 years [1].

INVITE project provides a good container for the idea of CyberSession and we have some applicable suggestions for increasing its performance. Developers of INVITE propose the following set of requirements for e-learning systems:

- To be easy to use.
- To offer user-friendly help.
- To easily integrate existing digital materials.
- To support audio communication.
- To give the lecturer the capability to administer her/his own courses and to monitor the learners' progress and participation.
- To support multi-modal interaction between the users through visual communication, realistic user representation, and real-time display of users' movements.
- To support application sharing and text communication.
- To offer tools for recording the communication in learning sessions as well as whole learning sessions.
- To visualize the learning environment as realistically as possible.
- To offer an interactive and shared whiteboard.
- To support audio and text translation into other languages.
- To leave certain degrees of freedom for the learners giving them the option of self control in order to enable them to work autonomously.

3. CYBERSESSION TESTBED

In CyberSession there exists only a Server program that is responsible for transformation of messages between client programs. According to the current design, the server program must be executed on a single computer and it has the following capabilities:

3.1 Specifications of the system

1) Definition of minimum online users
2) The ability of changing the teacher (without changing people from behind of computer)
3) The ability of saving a session and re-execution of it without presence of teacher
4) The ability of holding an exam (in this case each workstation works stand-alone)
5) It is to a high extent independent of the program being taught
6) Support of UDP or TCP communication
7) Sharing one or multiple files

The Client version in CyberSession performs two different tasks depending on the position of the user.

First if the user is in the teacher state:

a) At the beginning, keyboard and mouse of the user is locked; no task permissions are granted.

b) After receiving the name of program that must be taught, sends all specifications of that program including registry settings and configuration files to the Server which in turn sends this data to Clients.

c) The mentioned program will be executed in the Teacher and Student's computer but keyboard and mouse of the teacher will remain locked until the full execution of the program.

d) After receiving the start message from the Server, mouse and keyboard exit lock state and the Client program receives all events of mouse and keyboard by installing a hook and handles events with a timestamp that indicates the gap between events and sends it to Server program with a UDP or TCP connection.

e) The user that is in Teacher state can use his keyboard or mouse upon interest.

f) In the case that the Teacher wants to use the hard disk, he must get his files from the section assigned in the server for this work (if hard disks of computers be in a similar form, there isn't any need to this work).

Second if the user not be in the teacher state:

a) In all period of program execution keyboard and mouse of the user are locked

b) In this state Clients receiving registry settings and configuration files will substitute these settings with their program settings so programs execute with the same interface and no problems occur in the program execution.

c) With receiving the name of the executable program, this program executes and after completion of the loading step a message will be sent to the Server.

d) Upon receiving each message from Server indicating occurrence of a keyboard or mouse event, the client program executes the same event on the computer it resides in.

The program with the abovementioned features is implemented as a case study on a LAN and its performance is tested. The main problem in this program is the existence of various configurations of different programs that prevent making similar configurations for their execution. A viable solution is contacting companies that have written these programs to enquire about the configurations.

The second problem is that it is better to use the same monitor, keyboard and mouse for all computers to reduce the problems in transferring events. This must be noticed that display resolution of all clients must be the same.

In CyberSession instead of sending all of the display to computers of class members, only events of keyboard and mouse is transferred to computers of the cyber class. At the beginning the client will go to zero state by linking to the server. In this state all other programs on the computer will be closed by the client version of CyberSession.

4. ARCHITECTURE OF CYBERSESSION IN COLLABORATIVE VIRTUAL ENVIRONMNETS (CVE)

In our new architecture we have conceived all useful appliances in a cyber class room. The functionalities that are supported in this way are:

Communication between attendees: This ability will be supported by chat environment for users. Also there is an internal messaging system and a discussion board for sharing ideas.

Social awareness: This feature of the environment gives the attendee the ability of having an overview to online users, their status and position and their movement using their avatars.

Avatar simulator: Avatars of users better support social awareness since they simulate the real class attendees and for creating them we use an avatar simulator.

Billboard simulator: Billboard of the class is the place that course materials will be shown to attendees, this billboard that can be implemented with billboard node of X3D standard has two abilities: representation of course materials in CVE and also acting as a desktop of the user like the current CyberSession testbed.

Class administration: Administration of the class in the new framework is in the hand of server that that is responsible of transmission of messages between teacher computer and student computers.

The architecture of our system is dictated in Figure 2 in the form that is described above. The teacher's computer will send two different messages to the Server that are indicated in the diagram with (a) and (b).

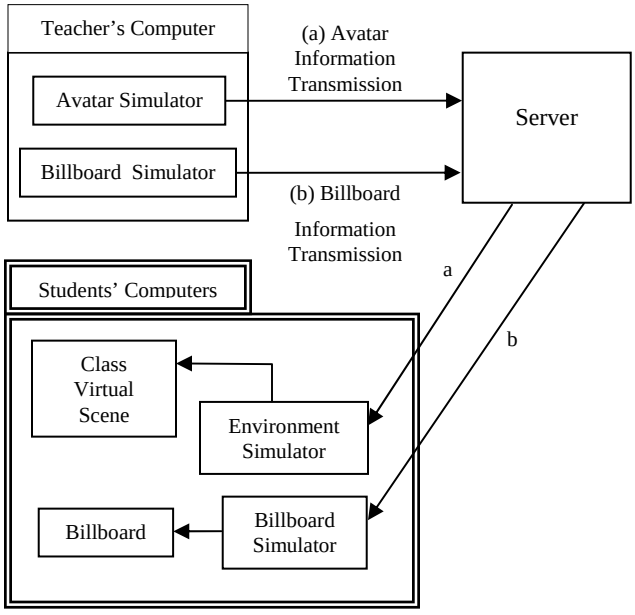

Figure 2. CyberSession Architecture

The (a) type messages contain the teacher avatar movements that can be produced using keyboard, mouse, … and contains full information about the position of teacher, teacher's body, etc.

In (b) type messages information related to billboard changes will be sent to the Server. This function can be performed as in 2D systems, i.e. by installing a hook on the teacher's computer or with the Remote Desktop protocol in windows or other protocols which will send information related to the billboard to both the server the students. The students will receive two messages (a) and (b) from the server that are the messages from the teacher's computer.

5. EVALUATION

E-Learning methods on Internet generally reduce training costs dramatically and increase the productivity of trainers since they have access to learning contents. In this section we briefly describe the main benefits of our method and the problems it solves as an e-learning solution.

5.1 Current problems of multimedia classes

1) The price of instruments (video projector, smart board and other tools of a multimedia class) is high.
2) In the class, PowerPoint or PDF slides are unable to represent details of the course and scientific points in this way.
3) Teaching is done in one direction and without assessment of /feedback from the student.
4) Evaluation of student in class is possible only in an oral manner.
5) Teacher must be physically present at the place of course and in all periods of representation.
6) Representation of course in different places is not possible concurrently.
7) The representation of course is only possible in the format of movies with high costs and volume and low quality of training.

5.2 Main benefits of our approach

1) Low price in contrast with current costs of multimedia classes.
2) Ability of practical representation of course with all details.
3) Ability of requesting any student at any point of the course representation to continue the job.
4) Possibility for practical evaluation of students.
5) Students may ask questions/interact with the teacher's permission.
6) Actual physical location for course representation is unnecessary.
7) Ability of streaming the voices of the teacher to students, student to teacher and student to students with suitable performance depending on available bandwidth.
8) Ability of saving and re-representing course sessions for review or re-use with low volume, low price and without loss of quality.
9) Ability of offline representation of saved courses (without need for the presence of teacher).

6. CONCLUSION

In this paper we presented our experiences on development of a new method for e-learning that simulates the cyber class with transmission of the attendees activities on their PC and then presented a design for extending this idea to collaborative virtual environments. With this system users will attend in a fully interactive class and with low cost of communication can access to huge amount of information. While this system may have some weaknesses but the use of an interactive virtual environment offers innovative and unique educational opportunity to both traditional classrooms and a medium for distance education.

Our main future trend is implementation of the CVE version of CyberSession with the design reported in this paper. We are also in the middle way of negotiation with Blaxxun Technologies GmbH to use their Blaxxun Platform as a container for CyberSession project.

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