

VIRTUAL EDUCATIONAL ENVIRONMENT FOR LEARNING GRAPHICS TECHNOLOGY¹

Srdan Trajković,
VŠSS Beogradska politehnika,
Brankova St.17, Belgrade
Serbia

Zona Kostić,
Singidunum University
Danijelova 32, Belgrade
Serbia

Dragan Cvetković,
Singidunum University
Danijelova 32, Belgrade
Serbia

Dragan Marković
Singidunum University
Danijelova 32, Belgrade
Serbia

ABSTRACT

This paper presents the results of a one-year experiment in incorporating 3D virtual educational environment in Computer Graphics courses which are part of the Programming and Design engineering degree. Environments enable learners to interact and behave in a natural manner. In this paper modeling and implementation of virtual environment with smart tutorial intended for learning graphics technology is presented. Such environment enables learning through exploration and collaboration in order to understand the basic concept of graphics technology. System is evaluated quantitatively and qualitatively, using formal performance assessment, a pilot project, and syllabus.

Keywords: X3D, Graphics Technology, Education

1. INTRODUCTION

Virtual Reality (VR) is a computer simulated environment regardless of the fact that environment is a simulation of the real world or an imaginary one. VR allows user to interact with virtual environment (VE). VE could be visual experience shown on the screen, with which it could be possible to interact using standard input devices, such as keyboard and mouse systems or by using various multi-modal devices, with tactile feedback.

The combination of synchronous learning tools, Web technology, social networks and video games, haptics and tracking devices creates rich 3D learning environments. These environments enable learners to interact and learn the way not possible outside of virtual worlds. Achieving high level of immersion could provide better distant communication, interaction, and collaboration. Conventional input devices such as the mouse and keyboard lack in intuitiveness when it comes to 3D manipulation tasks.

In practice, there are not yet fully integrated systems to support 3D model of e-learning. The result of this work is a virtual educational environment in the form of classroom that enables interaction between the on-site and distant students and teachers using educational resources through integrated virtual and real classrooms. The key features of environment are: communication using chat; collaboration characteristics with manipulation of shared 3D objects, using the same space by concurrent users, and predefined and saved models.

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Section one introduces the concept of virtual environments, being motivated by pedagogical approach, and educational contexts in which environments can be used; section two gives an overview of published works; section three illustrates virtual classroom for graphic technology; section four describes offset technology process; section presents evaluation of educational applications of graphics technology; section six ends with contribution, conclusion and future work.

2. RELATED WORK

Multi-user 3D environments have seen tremendous growth. Not only they affect large number of participants [1], or hosts big number of VE [2] but the emphasis on interpersonal communication, participation in the joint construction, and development of 3D content is also important.

There are lot of examples from papers and locations [3] [4] [5] [6] [7] [8] of environments which provide facilities to enable modeling, displaying and collaboration. They are created in order to display external media such as video, audio, graphics, and web pages. It could be a classroom for educational purposes or room for design and development. Virtual printing is a simulation of real printing using “woodblocks”, “a paper sheet”, “a BAREN (Japanese squeegee)”, and “inks” in a virtual 3D space [9] [10].

The integration of multimedia content with virtual environment is common in the development of VR applications. There are many technologies that enable presentation of 3D data on the Internet. X3D (royalty-free open standards file format and run-time architecture to represent and communicate 3D scenes and objects using XML) enables the visualization of applications in VR and augmented reality through integration of interactive real time 3D technology [11].

3. VIRTUAL EDUCATIONAL ENVIRONMENT DESCRIPTION

There are many X3D content-creation tools [11]. In this paper, X3D-Edit is used for the environment creation. X3D-Edit is a graphics file editor enabling simple error-free editing, authoring and validation of X3D scene-graph files. Base model, named "VD-20", is virtual representation of real classroom "D-20" as one of many classrooms intended for practical exercises in computer science (fig. 1).



Figure 1. Virtual classroom VD-20

The existence of such classrooms enables real time teaching to be run. Interaction between teacher and student is achieved by using various educational resources through the integration of virtual and real classrooms. Dynamically adaptive system is used to student's and teacher's requests. Time and spatial concurrent work is enabled. Elements are loaded from the library, different browsers are used,

interaction is enabled through access to the same elements (at the same time), and external applications and services are integrated.

The interface of this system includes X3D model display area and communication area. The users could operate directly the X3D model, performing usual actions such as navigation, exploration, moving objects, and communicating with teacher or student. A teacher or student can add and move objects in the floor plan, making their own schedule. A chat panel is responsible for the chat communication, either text or video, between online users.

4. DESCRIPTION OF THE OFFSET TECHNOLOGY PROCESS

The workflow process of printing technology that we use in this virtual model is shown in figure 2. The process starts by entry of the material that is used in printing process and customer's demand to create a certain product. The first phase of this process is the design of the graphic product and computer realization of typeface so that the product can be developed further on. During this phase a need arises for description of computer resources, both hardware and software that is being used through this phase of realization in this technology.

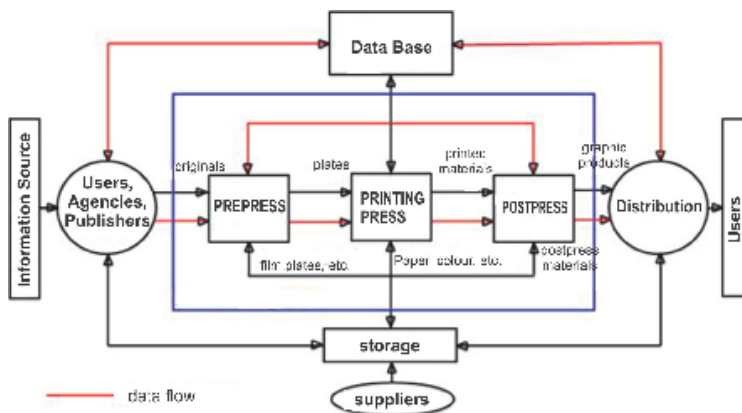


Figure 2. The workflow of printing technology process

After this phase, technological technical prepress follows. It consists of preparation of the material that will be used during the printing phase (cutting paper to the dimension of printing sheet, selection of plates etc.) In this phase, binding of sheets is also being done, proof printing and film or offset plate exposure are realized.

After choosing the material and plate exposure we are ready for the next phase which is printing of sheets. During this phase we describe printing machines and their functioning as well as the way of proof creation. It is also necessary to describe the quality control of proof which is essential for quality printing.

In offset printing we differentiate two basic choices of machines, the sheet-fed press (that prints on individual sheets of paper) and rotation printing machine roll to roll and roll to sheet. The choice depends on print run and purpose of product, and of the quality we wish to achieve. Having finished sheet printing, we move on to post press phase or the final realization of product. Apart from printed sheets, some specific materials such as various kinds of adhesives, foils, cardboard, wire, thread etc. belong to this phase. During this phase, all kinds of binding sheets into final product are being conducted, sheet folding, sheet binding, sheet lamination, cutting and perforation of sheets as well as folding boxes and gluing sheets into a final product, and other operations currently not mentioned. Part of this phase is cutting certain products into their final size (books, magazines, catalogues etc.) and their packaging. The last phase of printing process is storing final products and distributing them to end-users.

5. EVALUATION

System efficiency is measured by comparing the final results of students in the third year at the Faculty of Informatics and Computing who accessed that classroom through the virtual and physical interface. As most objective abilities to analyze the efficiency of virtual classroom in practical use were identified by comparing results of students who used real and virtual classroom. Results of final exam are compared. Exam was conducted in controlled environment and 40 students (20 students that used physical and 20 that used virtual environment). Results of this statistical analysis were expected and are very important for our further work. Absence of statistically important difference in results of control and treated groups, when using confidence interval of 95 percents, proves usability of this concept.

6. CONCLUSION AND FUTURE WORK

This paper presents the results of a one-year experiment in incorporating 3D modeling educational environment in Computer Graphics courses which are part of the Programming and Design engineering degree. The results of our initial experiments are promising enough to encourage further integration of virtual model with sensors and 3D searching.

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