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WEB-BASED APPLICATION FOR CREATIVE, COLLABORATIVE, AND CONCURRENT PROBLEM SOLVING

Zona Kostic
Singidunum University
Danijelova 32, Belgrade
Serbia

Dusko Radakovic
Belgrade Polytechnics
Brankova 17, Belgrade
Serbia

Dragan Cvetkovic
Singidunum University
Danijelova 32, Belgrade
Serbia

Igor Franc
Singidunum University
Danijelova 32, Belgrade
Serbia

ABSTRACT
Specific approach based on the real-time feedback has recently become the key collaborative issue. Web applications have been recognized for supporting distance communication in various collaborative processes. In this study, Web-based application for creative, collaborative, and concurrent problem solving is presented. Application represents a new communicative method and serves for practical exercising in distance collaboration. The process relies on using a cost-effective virtual environment aimed to enable a real-life design. Virtual environment, as the main part of the application interface, is cross-browser solution with no need for any plug-ins. It enables real-time communication, group collaboration, and practical co- and re- design. Group-project assessment and the relevant feedback are continuously realized. Evaluation of the proposed approach is conducted. Suggestions and predictions are given about future development as well as the use of virtual environments and Web applications in distance collaboration.
Keywords: Web-based application, virtual design, virtual environment, web-based collaboration, concurrent work, html5.

1. INTRODUCTION
The information technology is promoting changes in manufacturing industry. Virtual design makes the whole process of the product to virtual on the computer, from concept design to using the products, which will be achieved in the virtual environment constructed by computer. Manufacturing network are supported by computer technology, simulation technology, virtual reality technology and information technology. The design and manufacturing processes of new products advance towards the direction of digital, integration and network [1]. Virtual design is application technology based on VR technology. It is application technology of design, analysis, simulation and evaluation, facing principles, structure and performance of products.

Although most programs have modules for collaboration, there is no simple exchange between them. This paper presents concepts that uses X3DOM (www.x3dom.org) as the suitable standard for the exchange. Using X3DOM we created virtual laboratory aimed for practical exercises. The lab is used as a universally designed environment for collaborative design enabling involvement of various software packages.

Much of the attention has been in the creation of virtual environments, with the aim of building shared communities on the web. Another area of application has been scientific visualization in three

dimensions. The main characteristics of the solution proposed in this paper are accomplishing those requirements, and they are: communication; using the same space in order to achieve collaboration by concurrent users; sharing resources through integrated virtual and real environments.

The rest of the work is organized as follows: section two presents related work; section three explains the creation of the application; and finally section four concludes and presents the future work.

2. RELATED WORK

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

There exist many technologies, which enable to present 3D data on the Internet [2]. In accordance to the main focus, which are 3D multi-user collaborative VEs and in relation to our solution, we compared main 3D Web technologies. The most commonly used 3D Web technologies are X3DOM and WebGL (Web-based Graphics Library), both designed for creation of interactive Web-based and broadcast-based 3D content, suitable to integrate with multimedia. However, there is a significant difference between them and their use largely depends on the specific need. For example, WebGL as much progressive brings hardware-accelerated 3D graphics. It works without installing additional software, but only within compatible Web browsers. Regardless of the fact that X3DOM works at much lower level and needs installation of an appropriate plug-in, it enables displaying within any Web browser, and as scene-graph system and with XML encoding, it's a much better choice for beginning students.

The interesting solutions that utilize X3D for creating virtual laboratory, are presented in [3], [4], [5] and [6]. There are lot of examples from papers [7], [8], [9], [10], [11], [12] of environments which provide facilities to enable modeling, displaying and collaboration. It could be a classroom for educational purposes or room for design or development.

In respect to all proposed solutions, the proposed environment enables communication, collaboration by concurrent users, as well as the integration of virtual and real environments.

3. WEB-BASED APPLICATION ARHITECTURE

The process of a virtual laboratory (Fig. 1). creation includes several tools for different purposes. The only requirement that every user had to meet was to have a network connection with the central server. Activities in creating complete laboratory environment are considered with:

- Modeling 3D laboratory and adding functionalities;
- Integrate real and virtual environment by enabling collaboration and concurrent work;
- Making client/server connection.

Modeling the laboratory is referred to as creating its 3D look by which the user has an impression of virtual space. When basic components are modeled and the laboratory assembled, further development is made by adding functionalities. The laboratory modeled is the virtual space used as a shared environment. In the same procedure, the screens created act like real desktops in real time. Full control of real machines from virtual space is also possible. The chain *Virtual_Machine-VNC-X3DOM_Texture* enables concurrent use of the screens in the lab and participants' concurrent work. Finally, the architecture refers to selecting server as support for shared virtual environments and viewer to access these environments.

The virtual laboratory is for collaborative work. As such, its main components must be virtual desktops (screens or monitors) that display real-time content. The idea is to enable everyone to use the computer in the same way as in a real computer lab. It is possible to elect one computer to work, it will be visible to other colleagues, and can access other screens to bring the necessary changes, to

assist colleagues, and move on with work on his computer. Thus, the laboratory can be used as a virtual interface; each user can work separately on his individual project using several different applications simultaneously. In the laboratory, different programs can be run and, thus, provide access to various resources directly from the environment. All the work can be monitored and modified by other participants.

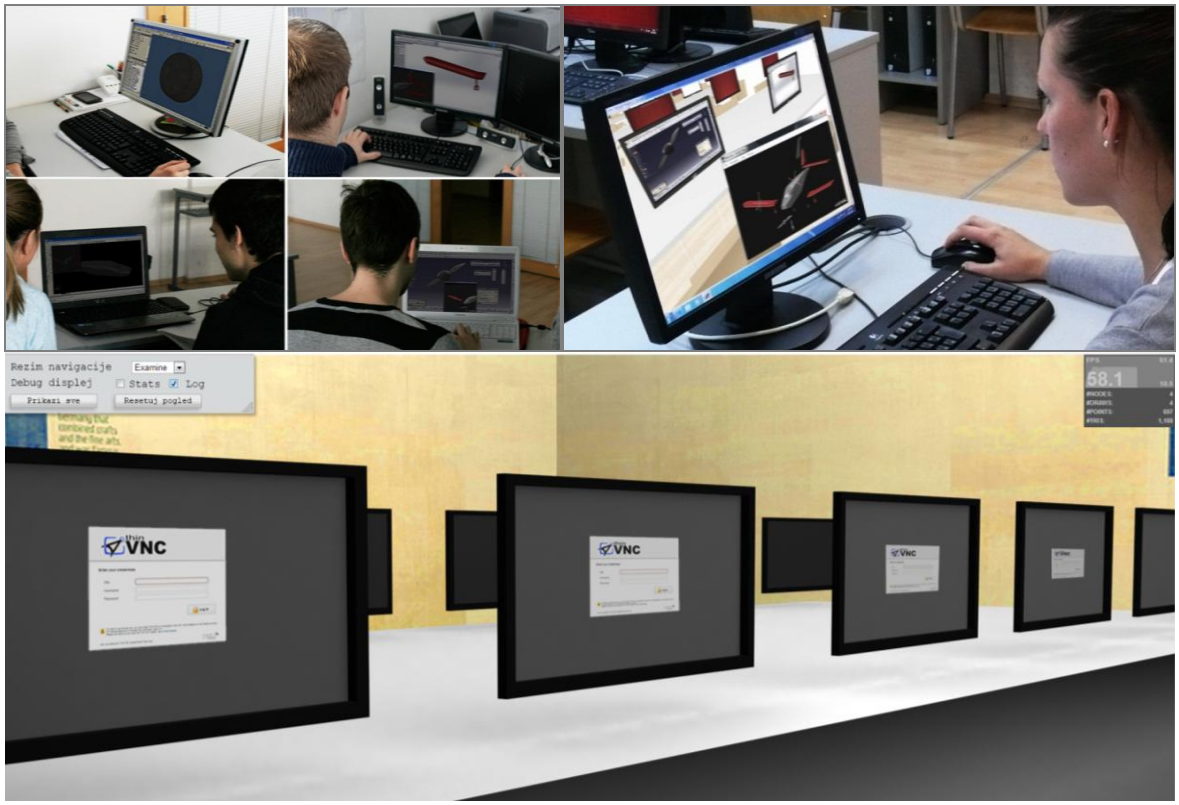

Figure 1. Collaborative work.

4. CONCLUSION AND FUTURE WORK

In this paper we proposed a method for Web-based application for creative, collaborative, and concurrent problem solving is presented. Application represents a new communicative method and serves for practical exercising in distance collaboration. The advantage of this method is in participation in simple projects without any extensive knowledge from relevant fields and they can also contribute to problem solving. In this way, it is possible to visually study and specialize, what is the reason for the use of simpler and less demanding projects. The process relies on using a cost-effective virtual environment aimed to enable a real-life design. Virtual environment, as the main part of the application interface, is cross-browser solution with no need for any plug-ins. It enables real-time communication, group collaboration, and practical co- and re- design. The proposed method has a faster generation of various models.

Although, it is impossible to completely replace the real environment, hence, we seek to bring as more design functions as possible in the virtual environment as to enable practical group-work and to allow participants to perform design at distance. Further integrating and developing as many design functions as possible within the laboratory is our main goal. Mentioned functions could be easily extended to haptic-enabled tools or CAVE system for sharing, learning, and testing.

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