A VIRTUAL REALITY FOR AVCILAR CAMPUS OF ISTANBUL UNIVERSITY USING VRML

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ABSTRACT

VRML (Virtual Reality Modeling Language), is a result of the increasing interest about VR (Virtual Reality) and 3D modeling technologies and makes VR an indispensable tool for the Web. In this paper our aim is to design a virtual reality model of the Avcilar Campus of Istanbul University using VRML. VRML uses hypertext structure akin to HTML in order to transfer files over the network. For this reason all the features available for HTTP and URL is valid for VRML, too. VRML is used in many different applications including business, education, entertainment, academic and commercial. Using VRML it is possible to design virtual worlds that support 3D objects, lights, animation and sound. Many technologies are supported by VRML in order to achieve these features. In this paper main VRML concepts, supporting technologies and the usage fields of VRML are mentioned.

Keywords: *Virtual Reality, 3D modeling, VRML, Virtual Campus*

1. INTRODUCTION

VRML (Virtual Reality Modeling Language) is a hierarchical scene description language that defines the geometry and behavior of a 3D scene or "world" and the way in which the user navigates it.

In other words, VRML is a language that lets you describe (or model) a 3D image (with surface properties) and scenes, which can be viewed from many different viewpoints. VRML allows the viewer to manipulate objects, fly or walk over landscapes, and interact with a virtual environment consisting of 3D shapes, colors, textures, and sounds. A VRML file is a simple ASCII-text description of geometries [1].

VRML uses 3-dimensional Cartesian coordinate system. The units in VRML are assumed to be meters and the angles are measured in radians. Texture, picture, sound or hyperlinks to other documents can be attached to the surfaces formed by geometric shapes like point and line in the three-dimensional space [2,3,4,5].

VRML world files have the file extension .wrl and require either a stand-alone application or web browser (Internet Explorer or Netscape Navigator) plug-in to be viewed. There is a wide plug-in support for many different platforms.

VRML is to 3D graphics what HTML is to text: it is a common format that can be displayed on any computer using a standard WWW browser or a standalone viewer. That is, VRML can be shared across platforms (Unix, Mac, Windows). An object in a VRML scene can also be linked to another VRML scene on the net so that by clicking on that object (called anchor) you can

visit another 3D scene, in the same way as it happens in an HTML document. VRML is an interpreted language. That is, commands written in text are interpreted by the browser and displayed on the user's monitor [1].

The VRML worlds in the Internet are processed to be viewed by the user's computer. First the user clicks on the hyperlink that is a file with .wrl extension and this file downloads to the user's computer. By this time the VRML plug-in takes control and calculates the three dimensional objects for the virtual world defined by the file. The user can move this three dimensional object or watch animations made by the object. All these movements or animations are dynamic so that the computer makes new calculations each time the user interacts with the virtual world. VRML is the only standardized (ISO/IEC 14772) 3D format suitable for Web delivery (due to its generally small file size) [6]. It is versatile, compact, extensible and constantly evolving - theoretically there is no limit to what can be achieved with VRML given sufficient computing power [7]. The current specification, VRML 2.0, supports JAVA, sound, animation, and JavaScript. It allows the world to be dynamic; always changing.

VRML is not the only Web3D or Virtual Reality technology available. Now that the Web has matured and computers are sufficiently powerful, many companies are developing competing technologies. The reason for choosing VRML for our application is that it is an international standard and it has been supported widely. A VRML world can be created using a simple application like notepad however this requires a good knowledge of the syntax of VRML. Today there are many tools available used to create VRML worlds without writing a line of code.

2. HISTORY OF VRML

VRML has evolved in two phases. VRML 1.0 was adopted in the spring of 1995 and provided the basic file format -- but the worlds were static. The VRML community immediately began work on strategies for incorporating animated behaviors into VRML. In the spring of 1996, the community endorsed the "Moving Worlds" proposal, put forth by a consortium of companies and spearheaded by SGI.

On August 4,1996, the official VRML 2.0 Specification was released at Siggraph 96 in New Orleans. At the fifth VAG meeting in New Orleans, the VAG finalized the formal announcement of the VRML 2.0 Specification, agreed to issue RFPs for a compressible binary format and an external authoring interface to the VRML 2.0 specification, and initiated the formation of the VRML Consortium. The VRML97 International Standard was developed by the Joint Technical Committee 1 (JTC 1) of ISO and IEC in partnership with the VRML Consortium. The formal processing of VRML97 to become an International Standard began in June 1996 with the Consortium's VRML 2.0 draft specification, when representatives from the VAG and JTC 1 (ISO/IEC JTC 1/SC 24, Computer Graphics and Image Processing) met in Kyoto, Japan and signed a cooperative agreement. VRML set an ISO/IEC record as the first specification to be standardized within 18 months and the first International Standard to be published in HTML. Summary of this evolution process is given in Table 1 [1].

Table 1. Evolution of VRML

Year	Version	Explanation
1994	Labyrinth	Prototype 3D interface for the Web developed by Mark Pesce and Tony Parisi
1994	VRML 1	Developed based on Open Inventor format - described static 3D scenes
1996	VRML 2	Silicon Graphics' Moving Worlds proposal for a VRML revision is adopted
1997	VRML97	Recognised as an international standard by ISO and IEC (ISO/IEC 14772)
2000	VRML200x	Proposed revision to VRML97 (ISO/IEC 14772:200x)
	X3D	Under development

3. VRML TECHNOLOGY AND FEATURES

Although VRML is designed to be independent from HTML, hypertext structure is used in order to transfer the files. For this reason all the features available for HTTP and URL is valid for VRML, too. URLs pointing VRML documents is the same as URLs pointing HTML documents except for their extensions. While URLs pointing HTML documents have the file extension .htm or .html, VRML documents have the file extension .wrl, which is an abbreviation for the world file concept.

Virtual worlds can be functional and interactive. It is possible to design virtual worlds that support 3D objects, lights, animation and sound [8]. Many technologies are supported by VRML in order to achieve these features. Some of these technologies are Sound (WAVE, MIDI), Textures (JPEG, GIF, PNG and MPEG1, Flash, Real Media, AVI), Lighting, Special Nodes (background, switch, hyperlink (anchor), billboard and fog), Animation, Sensors, Scripting (JavaScript, Java), Modular (references external textures, models, scenes and scripts), Extensible (if the core VRML nodes aren't enough you can create your own nodes using Prototypes) [9].

4. FIELDS THAT USE VRML

Internet has become a part of our lives and there is an increasing need for the Web services that take advantage of being more visual, user-friendly and interactive. VRML is widely used for these services. VRML creates a new world in the world of Internet. It gives designers the opportunity of presenting the shapes and animations using virtual reality. VRML is used in many different applications mainly business, education and entertainment. Some academic and commercial uses of VRML can be found in [10,11,12]. Computer aided design and production (CAD/CAM), simulation of ship construction process, Art, Chemistry, Medicine, Geography, Civil Engineering, interactive online shopping, interactive games and most important of all education. In Turkey many disciplines mainly including architecture, chemistry, and electric-electronic use VRML in order to design computer models of the results achieved in the academic projects. Some examples of these projects can be found in [13, 14, 15]. Figure 1 shows some examples of VRML applications.

a) VRML arts

b) Virtual city used in education

c) Virtual operating room used in Medicine

d) A virtual robot used in industry

Figure 1. Different usage fields of VRML [11]

5. VIRTUAL CAMPUS APPLICATION

After our research we have seen the power of VRML and as a first project we decided to design a virtual model of our campus and put it on the Web. In this context, view of our *Virtual Campus* designed using VRML is available throughout this paper. Our application has not been completed yet, however main buildings in the campus are available and the Virtual Campus is ready for sightseeing. When this project is completed, a new comer, a new student for example who does not know Avcilar Campus will have the opportunity to collect sufficient information on the Web about the campus before going there. The main entrance of the Virtual Campus is shown in Figure 2.

Figure 2. Main Entrance of the Virtual Campus

A plan of the Virtual Campus that illustrates all the buildings and paths is shown in Figure 3.

Figure 3. Plan of the Virtual Campus

The building of Culture Center which includes Library, Dining rooms, Health center, Pharmacy, canteen, Theatre is shown in Figure 4.

Figure 4. A view of Culture Center

A view of the buildings of Faculty of Engineering and Veterinary Medicine and sculpture of Atatürk is seen in Figure 5. In fact there are more buildings than we give here but showing all of them in this paper is not possible.

Figure 5. View of Engineering Faculty and Veterinary Medicine Faculty

6. CONCLUSIONS AND FUTURE WORK

A new visual programming language has been developed since 1994. The most important of all is the platform independency of VRML. Three-dimensional virtual worlds will take over the Web in the future. Today this, evolution has already began by VRML. VRML technology not only improves the quality of presentations outside the Internet but also increases the interaction level in the Internet and terminates the communication barriers.

In the commercial field, VRML based Web pages have three important advantages over the HTML based ones. Firstly VRML worlds are more dynamic, secondly users spent more time in VRML worlds than they spent in simple HTML pages and lastly VRML worlds have extended interactivity. 3D environments help in understanding spatial relations better and thus can improve task performance and navigation. In principle, 3D graphics has many advantages over

video or 2D graphics and requires less disk quota than the same quality video and 2D graphics.

Despite the limited design of Virtual Campus application, future plans of improving the application by adding avatars to navigate easier makes us excited. For now a Web browser can navigate the Virtual Campus and some important centers can be found using shortcut keys. We are in the aim of gathering this application and another one that is intended with Geographic Information System for a future work and take the advantage of this new system in case of a natural disaster like earthquake.

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