



ISSN 2047-3338

VREL: A New Perspective of Virtual Reality in E-Learning

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Abstract– The perspective of learning is changing dramatically with the advent of various electronic media and computing devices. E-learning refers learning through electronic devices, which are two dimensions in nature. The need of another dimension is inevitable in our changing life style to acquire knowledge through E-learning. Producing 3D interactive models is becoming a greater challenge every day. Virtual Reality Modelling Language (VRML) provides a platform independent file format for specifying the geometry, lighting and material properties of a 3D environment, as well as a scripting interface for specifying object behaviours. Our attempt in this paper is to use the tools and techniques available within VRML for a dynamic e-learning environment.

Index Terms– Virtual Reality, VRML, E-Learning and User Interface and Interactivity

1. INTRODUCTION

THE present education community will agree that effective learning is best promoted by authentic activity. New exciting avenues are available in the web to learn complex topics in an innovative manner. The quench for knowledge acquisition has increased thereby utilizing the various mediums available currently like social networking, networking communities, blogs etc. which gives instant access to information. The learning resources are evolved over time and composed of various media from simple textual information and images to complicated intense video streams and 3D geometry. This paper thrusts the need for visualization of 3d geometry which can be generated dynamically through user driven input for the various parameters thus enabling an explorative learning of primitive 3D shapes.

II. E-LEARNING

The e-Learning form of education has expanded significantly. It provides access to a wealth of resources and new forms of communication and virtual communities. The concept of accessing content anytime and anywhere was hindered by simplistic e-learning systems that were essentially repositories with vast amounts of content and very basic facilities. However, as e-Learning has become an

important aspect of many learning experiences, there is a broad range of competing platforms. Any kind of content cannot be simply thrown at the students and expect them to learn. There is a need for high quality content, built with solid educational principles.

In the last decade there has been a shift from a focus on information to an emphasis on communication and a realization that the development of content alone does not lead to more effective learning. Interaction is highly appreciable which yield to dynamic learning. Students use information communication technologies to build knowledge and to communicate with other. Fig. 1 represents a three-tier E-learning architecture.

Tier 1 represents the E-learning database server where all the repositories of course materials in different media forms are stored. Tier 2 is the E-learning Web server which retrieves information as requested by the user from the database server for learning purposes. Tier 3 is in the application level where different types of users interact with the web server for learning in different forms.

III. VIRTUAL REALITY

Virtual Reality (VR) is referred to a computer simulation that creates an image of a world that appears to our senses in much the same way we perceive the real world, or “physical” reality. In order to convince the brain that the synthetic world is authentic, the computer simulation monitors the movements of the participant and adjusts the sensory display or displays in a manner that gives the feeling of being immersed or being present in the simulation. VR is a medium, a means by which humans can share ideas and experiences.

In any classroom, the communication of visual phenomenon is attempted using some combination of two-dimensional display devices such as textbooks, chalkboards, overhead projectors, bulletin boards, and computer screens.

VR is a technology that allows students to explore and manipulate computer generated 3-dimensional, multimedia environments in real time. There are two main types of virtual reality environments. Desktop virtual reality environments are presented on an ordinary computer screen and are usually explored by keyboard, mouse, wand, joystick, or touch screen. Web-based “virtual tours” are an example of a

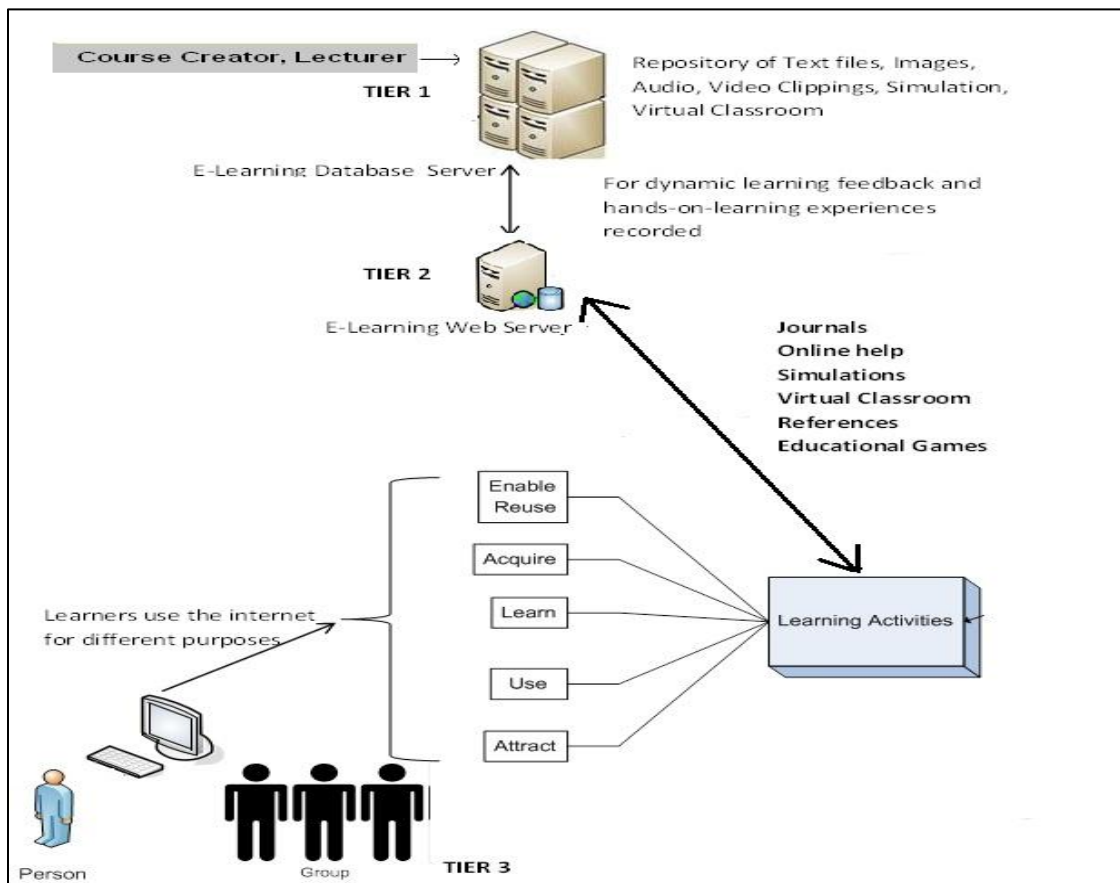


Fig. 1: E-Learning Architecture

commonly available desktop virtual reality format. Total immersion virtual reality environments are presented on multiple, room-size screens or through a stereoscopic, head-mounted display unit. Additional specialized equipment such as a Data Glove (worn as one would a regular glove) enables the participant to interact with the virtual environment through normal body movements. Sensors on the head unit and Data Glove track the viewer's movements during exploration and provide feedback that is used to revise the display – enabling real-time, fluid interactivity. Examples of virtual reality environments are a virtual solar system that enables users to fly through space and observe objects from any angle, a virtual science experiment that simulates the growth of microorganisms under different conditions, a virtual tour of an archaeological site.

This paper deals with the technology used in desktop VR. Learning in a virtual environment is termed as Virtual Learning Environments (VLE). Nowadays, adaptation to the needs of different learners and contexts is becoming an increasingly important aspect of VLE [1], [2].

Virtual reality can work for educators as a tool in assisting students to become immersed in a learning environment where they can participate in their own learning in a technology based environment. Virtual Reality allows us to experience a body of knowledge interactively. Students learn while they are situated in the context where what they learn is to be applied. They get immediate feedback as they explore

their understanding of the material.

In this paper an educational domain is developed for a beginner to learn about 3D objects using VRML. The size, color and geometric shape can be varied dynamically. Here the parameters of the geometric shapes are altered dynamically to view the 3D model so that the student is capable of understanding the concept perfectly.

IV. VRML

The first version of the VRML standard was specified in 1995, with the current version, version 2.0 (also called VRML97) ratified as an International Standards Organisation (ISO) standard in 1997 [3]. The VRML standards body, the Web 3D Consortium, has recently developed a new standard to replace VRML, called X3D. However, the VRML browsers currently available are more mature and more robust products than the emerging X3D browsers.

VRML was designed to meet the following requirements:

1. Platform independence
2. Extensibility
3. Ability to work well over low-bandwidth connections

VRML (Virtual Reality Modeling Language) is used to create a virtual world and present it to users via the Internet. It shows a realistic looking virtual world without using a special set of glasses or virtual reality helmet.

VRML uses vector graphics to present a 3-D world to users using a 2D screen. As the user chooses to change their vantage point, the world view is recalculated and then presented. VRML (Virtual Reality Modeling Language) stores the vector information for the locations of objects, their edges and vertices. Information about the object such as its color and texture are also stored in the VRML file, typically with a .wrl extension. When the user moves so that the object is deemed to come into their view, its shape and visual effects are generated. Combination of VRML and Java language creates really strong tool for development of the dynamic virtual worlds and on-line presentation of the data taken from any kind of database.

V. DEVELOPMENT CHALLENGES

VRML language is very powerful, but the needs expected are much higher than it serves. It is not the problem to display the data. The problem is to get the data in the form they can be presented in the virtual space described by VRML. At this point the VRML alone is insufficient. There is a need to use the ability of the other languages, which can communicate with VRML and which can exchange the data between. The combinations of languages used today are VRML-JavaScript, VRML-Java, VRML-SQL, VRML-C++, etc.

The VRML rendering software, a VRML browser, normally runs within a web browser, as either a plug-in or an ActiveX control. The VRML browser provides the motion control interface and facilitates the rendering of views via the graphics hardware. Scripting of object behaviours and enhancements to the user interface are normally carried out using the Java or JavaScript programming languages.

VI. IMPLEMENTATION

VRML is used to generate 3-D shapes. Users interact with 3-D shapes and its parameters to view the possible changes in the 3D models. Java Server Pages (JSP) and Active Server Pages (ASP) are the tools for generating dynamic responses for any type of browser. Users can interact with databases, enterprise systems, and Web servers to view the model of their choice.

Since ASP is used to generate the VRML coding for the input given by the user, the system for implementation needs IIS and a dot net platform. The following steps are involved in the design of VREL.

1. The URL of the website must be given in the address bar of the browser.
2. The homepage is displayed with three frames as shown in figure 2. The left frame lists the different 3D geometry shapes available for learning purpose. The right top frame is used to dynamically receive the input of the various parameters of the object of choice from the left frame and display the 3D world within a VRML browser. The right bottom frames displays a description about the world in display.

3. Click the geometry of study. The right top frame displays the screen for input as shown in Fig. 3. In our implementation, the side of the cube When the button is 3, Colors for RGB are [0.8 0.5 0.3]. MAKEVRML is pressed, the given parameters are stored in a database and a ASP coding generates the wrl file dynamically by getting the input from the database and VRML coding is generated on the fly.
4. The VRML browser will display the model according to the specifications given in the right top frame and the description of the object is displayed on the lower frame as shown in Fig. 4.

Fig. 5 displays a Cone generated similarly with RGB color as [1 0.1 0.2], bottom radius 2 and height 4. Other 3D geometric shapes like Box, Cylinder and Sphere can also be generated in a similar fashion. The parameters for box are height, width, depth and the RGB colors. The parameters for Cylinder are height, radius and the RGB colors. The parameters for Sphere are radius and the RGB colors.

Transformations like Scaling, Rotation and Translation can also be implemented for the 3D objects in a similar way.

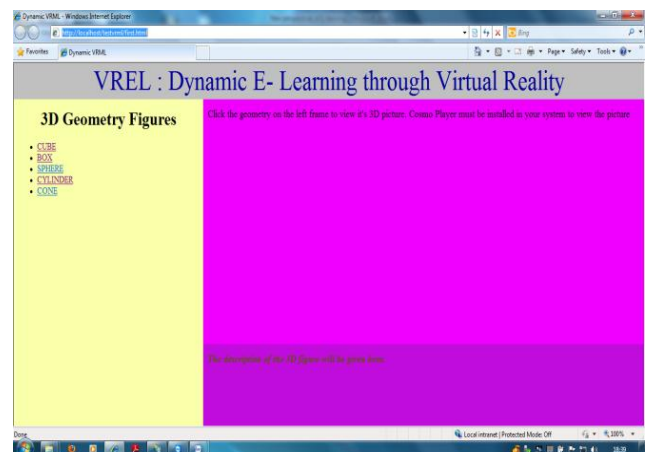


Fig. 2. Homepage of VREL

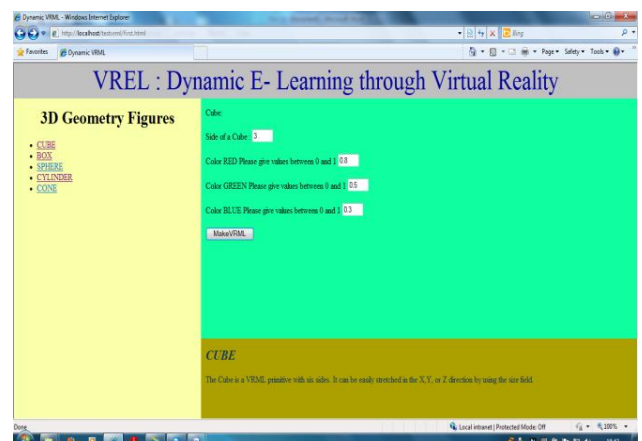


Fig. 3. Input frame of VREL

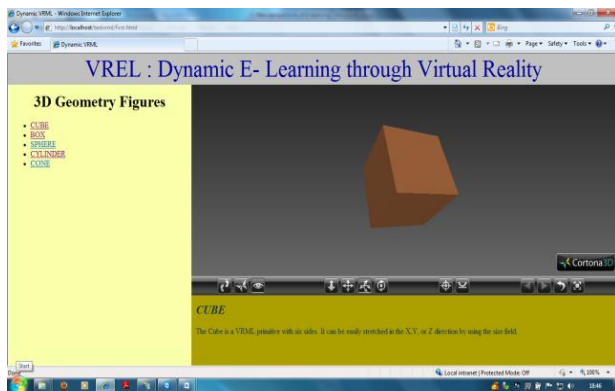


Fig. 4. Generation of a Cube

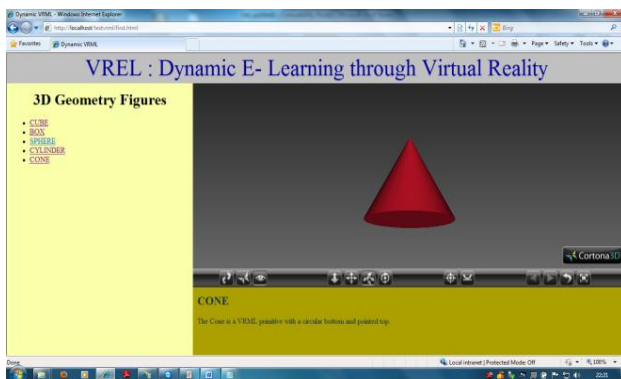


Fig. 5. Generation of a Cone

VII. CONCLUSION

VR based educational model gives the student a lot of potential. The communicative character of the virtual environments would allow students and staff to meet in social shared spaces and engage in on-line real-time webinars and tutorials. Building complex shapes can also be included in this design by adding the primitive nodes.

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