Abstract

This paper presents continuing development of the VCell system, a toolkit and system for low cost persistent multi-user 3D environments using a VRML browser, Java client and LambdaMOO server.

1 Introduction

The North Dakota State University World Wide Web Instructional Committee (NDSU WWWIC) group seeks to develop immersive multi-user environments for use as educational environments. Desirable attributes of these environments include persistence, interactivity, ease of development, low bandwidth consumption, and integrity of user experience. In addition to these goals the system should also seek to address overcrowding issues as the number of users increases. The VCell system seeks to address these issues and is being used to develop the Virtual Cell project for use in biology education.

2 Overview

The VCell system is a networked client-server system. The central server is a modified LambdaMOO server. The client programs are written in Java and construct and display VRML content. In order to avoid Java security issues clients with only the main server running on the machine the client was loaded from, rather than a more complicated spoke-and-wheel variant of the client and server architecture.

VRML 97 was selected as the main graphics format because it had included a scripting and event model accessible from other components, and because VRML continues to be an open and responsive standard. However, the designers of the VCell system felt that solving the problem of streaming VRML animations in general is too complex to be adequately rewarding. Instead, the design focuses on being able to incrementally load scenes, switch between scenes, pass events to and from well defined sections of the scene, and incrementally specify animations.

The LambdaMOO server provides a persistent environment with TCP/IP networking, and server side object oriented scripting because it was written to host a text based multi-user game. Although the LambdaMOO server comes with an object library intended for creating text based virtual environments where the basic division of space is a room, in order to support the 3D environment this library has been supplanted with one supporting scenes as the basic division of space and communication of the graphics data to the client. In addition to handling typical multi-user scenes, the system also provides optional automatic scene duplication to prevent overcrowding in the virtual environment.

The client uses a simple algorithm to incrementally load scenes and display animations. It routes events between the VRML components of the scene and the server, and also handles any additional traditional 2D user interface elements that are needed for each environment.

3 Related Work

The TECFAMOO library from http://tecfa.unige.ch/moo/tecfamoo.html for the LambdaMOO server is a system for generating text based environments which are useful for education. The High Wired enCore library available from http://lingua.utdallas.edu/encore is a similar library also for generating text based environments. The VNet project detailed at vrlworld.net is another attempt at low cost distributed environments with less persistence capabilities.

4 Current Status

VCell's test project, The Virtual Cell, is currently accessible at vcell.ndsu.edu, hosts a number of different scenes and is being used in a series of educational studies. The two images included in this paper illustrate separate modules from that project. The VCell project itself is still under development and does not yet have a public website.

References


Acknowledgments

This research was supported by funding from the National Science Foundation under grant EIA-0086142 and the U.S. Department of Education under FIPSE grant #P116B000734. The authors acknowledge the large team of dedicated undergraduate and graduate students and professors who have made this project so successful. For further information on our virtual worlds software development is available at wwwic.cs.ndsu.nodak.edu.