Using Multi User Virtual Environments to Improve the Quality of Secondary Education in Developing Countries

Ishan Somasiri[#1], Chathuranga Hettiarachchi[#2], Indika Perera[#3]

[#]*Department of Computer Science & Engineering, University of Moratuwa, Katubedda, Sri Lanka*

[1]ishan.09@cse.mrt.ac.lk

[2]chathuranga.09@cse.mrt.ac.lk

[3]indika@cse.mrt.ac.lk

Keywords*— *Multi User Virtual Environments, Secondary Education

Secondary education systems of developing countries include a considerable amount of experiments that needs to be physically conducted in a laboratory. But due to lack of resources the student is expected to understand complex, less intuitive and cognitive demanding theories and concepts on their own with minimum opportunities to practical exploration. In this study we have explored the possible use of Multi User Virtual Environments (MUVEs) to overcome this barrier for student learning.

MUVEs are a rich user interaction medium, which simulates a real environment or fantasy with the ability to create content, immerse in as avatars and control over the content in the virtual environment as users wish. There are many platforms created to build MUVEs. OpenSim and SecondLife are two of the popular choices among them. OpenSim is a Free and Open Source MUVE creation tool that allows any user to create and manage their own MUVE instances. Whoever the user that creates the MUVE is supposed manage the system and the infrastructure. On the other hand, Second Life is a paid hosted solution that allows users to register and interact with the MUVE. Because of the flexibility and the cost effectiveness provided by OpenSim, we focused on OpenSim in our implementations.

As a proof of concept for the use of MUVEs in education, we created a model to simulate the Equations of Motion using OpenSim. The student could project objects by varying different parameters and observe the resulting motion.

Some additional use-cases we identified that OpenSim can be used to model simulations are,

- Basic Electrical Theory
- Network Theory
- Friction Related Theory

But creating these solutions using MUVEs presents a set of challenges that needs to be resolved in order to practically implement MUVEs in developing countries.

CONTENT CREATION

When creating a simulation, content such as the terrains, textures, avatars, buildings, and other educational material are needed. Even though basic shapes could be created using the in-built capabilities of OpenSim, modelling complex objects need specialised knowledge. One solution to this would be re-using existing content that is available in the internet. But in the long-run, an easy to use, free content modelling tool is essential.

PROGRAMMING

When creating a simulation, content needs to be programmed to enable user interaction. OpenSim provides four ways to program the simulation content.

Sandbox Scripting

The end users in the simulation can program objects using both Linden Scripting Language and Open Simulator Scripting Language in a sandboxed environment. Due to the lack of an Integrated Development Environment, writing complex interactions using this approach is not trivial.

Internal API Scripting

MUVE clients' script editor can be used to write scripts using the C# language. But the script is not run in a sandbox, so any MUVE user has the capability to damage the system.

External API development

Allows the end-user to write scripts using the C# language, in an external editor, that gets automatically deployed in the virtual world without server restart.

Region Modules

A server-side programming approach in which a programmer can directly interact with the API of the OpenSim server.

Each of these four programming models present challenges of its own and requires a good knowledge in the programming paradigms.

INFRASTRUCTURE

Scalability is one of the greatest issues in MUVEs. After a certain threshold, very powerful infrastructure which are not easily obtainable in a developing country is required. MUVEs heavily depend on the underlying network for communication. Hence in addition to the basic barriers such as low bandwidth, unreliable connections, some prevailing problems related to port assignment and firewall configurations in academic network environments were also encountered.

Issues such as these needs to be worked up on to provide sustainable solutions for them. Even with the challenges discussed in the paper, MUVEs holds great future potential for the use in the secondary education in developing countries.