Experiential based learning in 3D Virtual Worlds: Data capture and visualization in Second Life

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***Abstract*—Increasingly web based distance education courses are on offer augmented by the provision of remote experimentation laboratories facilitating distant access to campus based physical resources. The design and implementation of remote experimentation facilities in this context has traditionally being a 2–dimensional (2D) process using a standard web browser or client/server architecture. Recently there has been significant growth in the number of virtual worlds for everyday use. These immersive 3D virtual worlds offer the ability to create complex simulations using existing or in-world modeling techniques and scripting tools while offering the functionality to link to the real world and capture data which can be visualized in near real time. This paper investigates the use of the popular virtual world, Second Life, to create experiential based learning experiences in a 3D immersive world for teaching computer hardware and electronic systems. In particular, the paper presents a number of approaches to capturing, displaying and visualizing real world data in such 3D virtual environments.**

I. Introduction

Constant innovation and product evolution necessitates educational institutions and other training providers to continually reassess the content and delivery of curricula making it necessary to devise, implement and evaluate innovative pedagogical approaches to teaching without compromising the cultivation of traditional skills [1]. The proliferation of web based distance education courses in recent years presents new challenges for the teaching of disciplines involving a high level of practical work. Experience in these areas has shown that a complementary inter-dependent approach, combining theoretical material underpinned by practical exercises, is essential for effective learning and as a consequence, distance education courses are increasingly offered online, augmented by remote experimentation facilities [2-13]. The design and implementation of remote experimentation facilities in this context has traditionally being a 2 dimensional process using a standard web browser or client/server architectures. In recent years there has been a substantial growth in the proliferation and use of virtual worlds including Second Life, Active worlds and Multiverse [14] for a range of diverse applications. The creation of interactive content in the majority of immersive virtual worlds is typically carried out offline using complex and expensive 3D modeling packages including Maya and 3D studio Max. Second Life, a virtual world from Linden Labs uses in-world user friendly 3D modeling tools and the linden scripting language to create highly interactive user experiences. In addition the Second Life environment offers the functionality to link to the real world and capture data which can be visualized in near real time.

This paper explores the use of Second Life to create experiential based learning experiences in a 3D immersive world for teaching the principles of computer hardware architectures and electronic circuits. It describes the functionality available in Second Life to model, capture, display and visualize real world data and explores the barriers to controlling real world instrumentation through existing software packages. A number of existing projects and applications will be discussed including the National Oceanic and Atmospheric Administration real-time weather simulation, LAX air traffic data and IBM's virtual network operation centers [15-16]. Section 2 of the final paper will give an overview of Second Life cataloging its features and describing in-world modeling tools and scripting language. Section 3 will examine existing research related to data visualization in Second Life describing a number of approaches to capturing external real world data and importing it for display inside the virtual world (Figure 1).

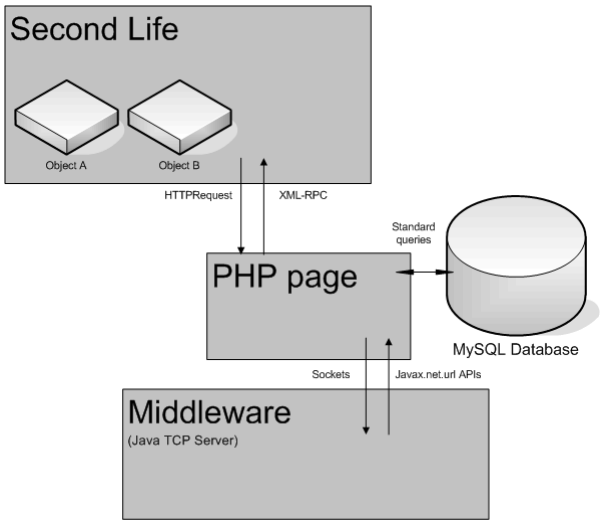

Figure 1 Generic architecture for data capture and display in Second Life

Section 4 will describe two projects carried out at the Intelligent Systems Research Center in Northern Ireland using

Second Life for experiential based learning, and will outline the rationale behind the projects. The first project focuses on the creation of a virtual circuit simulator for a RC filter designed to demonstrate electronic first principles e.g. current flow in RC circuits (Figure 2). In this example, a video tutorial accompanies an interactive 3D stimulator. The second project involves the creation of a large-scale personal computer in the design of a large building which allows students to walk around and inside components, and learn about the interaction of components in modern computer architectures (Figure 3 and 4).

Figure 2 Virtual RC simulator in Second Life

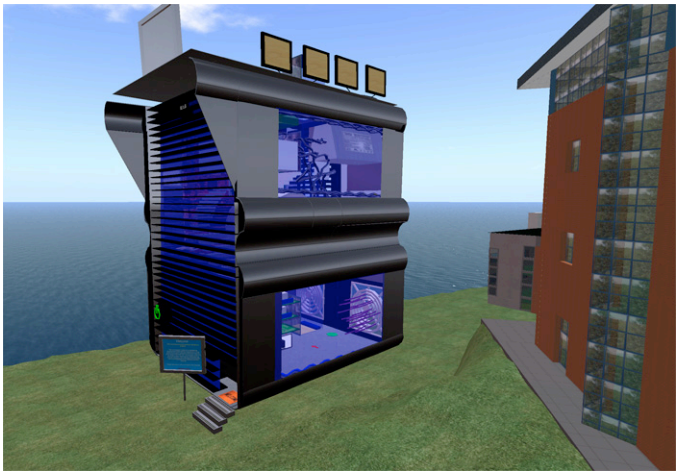
Figure 3 The Large-scale Computer in Second Life

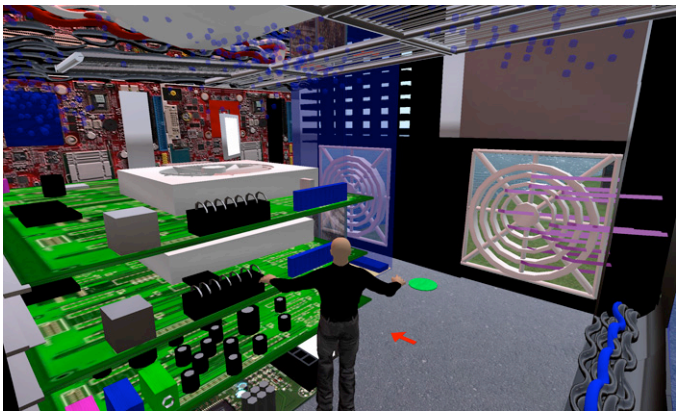
Figure 4 Inside the Giant Computer in Second Life

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