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xReality Objects Demonstration – Collaborative Laboratory Interactions in Immersive Reality

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Abstract. Laboratory activities for distance learners have been always a challenge for teachers and instructors. Many of the available options are limited to simulations in a Virtual Learning Environment (VLE). Our research focuses on a novel implementation for the aforementioned situation, using immersive technology and mixed reality. In this demonstration we will present the use of real objects coupled to its virtual representation (xReality objects) in order to create a collaborative mixed reality laboratory activity, complementing the paper, "xReality interactions within an immersive mixed reality learning environment" [1] submitted by the authors to EiED'13 summit .

Keywords. Ubiquitous virtual reality, mixed reality, dual reality, virtual laboratory, blended reality, xReality objects, interreality, human-machine interface (HMI), internet-of-things, tangible user interface (TUI), Multi-user virtual environment (MUVE).

Introduction

Nowadays, the internet has opened a door to innovation in distance learning, giving more opportunities for geographically disseminated students in an - everyday more - globalised world. Massive Open Online Courses (MOOCs), Multi-User Virtual Environments (MUVEs), Learning Management Systems (LMS), Virtual Learning Environments (VLEs) among other options are some of the possibilities for complement teaching and learning, particularly in the case of distance learners. However, in the case of laboratory activities for distance learners, current available options are focused on the use of simulations within a VLE. This demonstration proposal presents an innovative learning scenario, using mixed reality in an immersive learning environment, complementing the paper [1] submitted to this summit (EiED'13). The test bed scenario proposed is the creation and participation within a mixed reality collaborative laboratory activity between geographically dispersed learners to produce Internet-of-Things (IoT) applications emphasising computing fundamentals.

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1. Current project

Our project implementation uses the so-called *xReality objects* [1], smart networked objects coupled to a virtual representation of them in a 3D virtual environment; updated and maintained in real time creating a mirrored reality. These objects are developed using a Raspberry Pi[2] (a low cost small computer), as a main component; and a collection of pluggable components. These were implemented using Fortito's BuzzBoard Educational Toolkit[3], a collection of pluggable hardware boards for rapid prototyping, which can be interconnected in diverse combinations to create a variety of quick Internet-of-Things (IoT) prototypes.

1.1. Demonstration description

Our demonstration is based on the following scenarios:

- Single session (Virtual objects): This scenario is analogous to simulations that currently exist for virtual laboratory activities. The user can connect virtual representations of BuzzBoards within the immersive learning environment to create the proposed desktop robot.
- Single session (xReality object): In this scenario the user can interact with the virtual simulation of the robot connected with the real desktop robot using the services available for the device (e.g. movement of the robot, sensors, etc.)
- Collaborative session (single xReality object): This scenario allows two users to communicate within the 3D virtual environment interacting with just one xReality object (desktop robot).

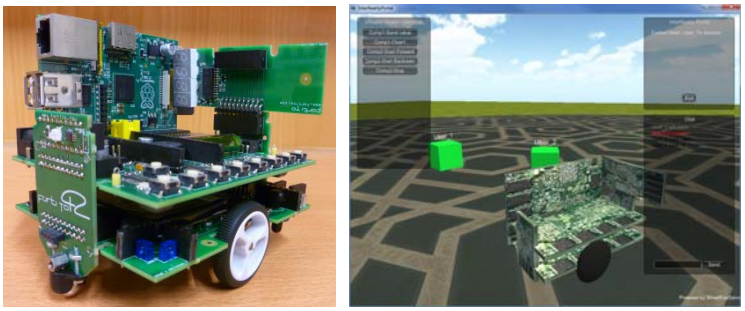

Figure 1. BuzzBoard Desktop Robot & screenshot of 3D Virtual interface.

Future work will include the creation of collaborative sessions using multiple xReality objects: a) when both users have exactly the same hardware mashup and b) when users have different hardware configuration, allowing them to complement each other with the available pieces. A different scenario to consider will be the creation of sequences of services that can be designed by the learners on real time.

[2] Raspberry Pi Foundation – http://www.raspberrypi.org
[3] Fortito Ltd – http://www.fortito.mx/en

1.2. Technical details and requirements

The immersive environment is formed by Immersive Display's ImmersaVu [4], a composite moulded 160° panoramic dome screen, which allows a free-range of head movement. Due to the size of the ImmersaVu (2 mts. length) we will need a suitable space for the device. Along with this we will need access to electric power for the following components: a) the ImmersaVu (1 projector & 1 server), b) 2 PCs, c) the BuzzBoard Desktop robot (1 Raspberry Pi) and d) a network switch. Internet access is not essential but it might be needed for showing videos of other demos.

Figure 2. Immersive Displays' ImmersaVu

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References

[1] A. Pena-Rios, V. Callaghan, M. Gardner and M. J. Alhaddad, "xReality interactions within a mixed reality learning environment," in *3rd European Immersive Education Summit*, London, 2013.

[4] Immersive Display - www.immersivedisplay.co.uk/pdf/immersavu.pdf