Object-oriented Engineering: Building Engineering Systems Using Smalltalk-80

An Object-Oriented Pedagogical Model for Mixed Reality Teaching and Learning

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***Abstract*— the object-oriented (OO) paradigm is a well-known model that is used widely in the fields of both artificial intelligence (AI) and software engineering. OO models have been shown to be very powerful tools for dealing with complex human oriented activities. In the world of technology, object-oriented programming has been shown to be a very effective way of dealing with the complexity of programming advanced software applications. By bringing the object-oriented world of computing together with the object-oriented aspect of a pedagogical model, we extend our pedagogical virtual machine (PVM) model to be able to link human activities with technical activities inside learning environments. We propose a conceptual 4 layered architecture for our PVM and explain what each layer performs. Finally, the paper concludes by reviewing the main findings and discussing our future research plans.**

Keywords- Mixed-Reality; Augmented-Reality; Internet-of-Things; Cloud-of-Things; Learning Activity; Mobile Augmented Reality; Buzz-Boards; Object-Oriented Paradigm; Mobile Learning; eBooks

I. INTRODUCTION

A. Object-Oriented Paradigm

The object-oriented (OO) paradigm is a well-known model that is used widely in the fields of both artificial intelligence (AI) and software engineering. The core abstraction of object-oriented programming (OOP) is an 'object', with associated properties, behaviors and interactions with other objects [1][2][3][4]. Brad J Cox [5] stated "an object oriented program is structured as a community of acting agents, called objects. Each object has a role to play. Each object provides a service, or performs an action, that is used by other members of the community."

Object-oriented models have been shown to be very powerful tools for dealing with complex human oriented activities. For instance, one view of the world is that people, companies and other organisations are objects, billions of interacting objects, which by properly structuring those objects and their relationships, we end up with the world that functions relatively well, despite the huge complexities involved. OOP adjusts very well, being able to deal with the simplest problems to the most complex tasks. It gives a form of abstraction that vibrates with methods people use to solve problems in their everyday life [5]. Moreover, in the world of technology, object-oriented programming has been shown to be a very effective way of dealing with the complexity of programming advanced software applications. A key concept underpinning OOP is the modularity of the object, in which objects act as independent entities that coordinate actions by exchanging messages. Each object is independently implemented and has the required resources to manage its state and behavior while shield its implementation details from other objects [5]. This is called 'encapsulation' as it hides the user from the need to understand the system at a detailed code level. The user only needs to know what the object does, not how it does it.

B. Rapid Prototyping System

One of the rapid prototyping development systems is BuzzBoard Fig 1. BuzzBoard is an educational technology toolkit that contains several software and hardware modules. There are over 30 BuzzBoard modules for developers to choose from; they can be found on the FortiTo website (www.FortiTo.com). This technology allows students and developers to create Internet-of-Things, Pervasive Computing and Intelligent Environments products. It leaves students more time to focus on creative design elements and programming systems [6]. It is used to help produce students' assignments and projects that are both interesting and simple, such as mobile robots, mp3 players, heart monitors, etc. However, an important architectural principle underlying BuzzBoards is modularity (both software and hardware), together with plug-and-play functionality (boards are identified to the system, and to each other, as they are plugged in), based on a shared bus (Buzz-Bus). This principle leads to a highly flexible and reconfigurable modular system that can be seen as an ideal infrastructure solution for rapid-prototyping and construction of pervasive and intelligent environments [6]. A key innovation arising from the use of BuzzBoard is that it provides an internal hardware network that provides both user driven events (e.g. plugging different boards together) that signal deep soft and hard behaviors. Both of these features play a key enabling role in the scheme, as they provide a way to get essential system information from the learning objects without disturbing the system, which most forms of instrumentation cause. Interestingly, according to Brad J Cox [5], when he started thinking about object-oriented programming he had a vision that everything in this world could be regarded as an object. Interestingly, he also thought of encapsulating hardware as a means to create worlds populated by mixing both hard and soft objects. Both Brad J Cox's thoughts and BuzzBoard have inspired us to think about hardware and software in computer systems as being objects.

In a previous paper [7] we produced a new concept that we referred to as a 'Pedagogical Virtual Machine' (PVM) that aims to cater for development and learning

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