Augmented Reality Tools and Learning Practice in Mobile-Learning

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Abstract. There are many augmented reality (AR) applications available that can be used to create educational contents for these mobile devices. This paper surveys the most popular augmented reality applications and we select AR eco-systems to be used in daily teaching activities which are user friendly, do not require programming skills and are free. Different augmented reality technologies are explored in this paper to create teaching activities with animations, videos and other information to be shown on top of interactive documents. It is presented the creation of a novel augmented reality book that was developed with teachers and students. Several examples are also presented that are used in educational activities, from kindergarten to elementary and secondary schools, to improve reading, comprehension and learning of music.

Keywords: Augmented reality, e-learning, m-learning.

1 Introduction

Mobile computing devices allow an exponential expansion of social and participative web technologies, since they represent an increase in the ease of data access and the creation of textual and audiovisual content, even implying a situation to link at anytime and anywhere, where ubiquity is the keyword [1].

These devices have increased processing power and usability, and are accessible on a large scale, which has significantly contributed to their ease of use and at implementing innovative educational processes [2], [3] in numerous educational institutions and universities.

Many augmented reality applications are currently available. The most popular augmented-reality eco-systems are explored in this paper. We present Augmented Reality systems that can be used in daily learning activities. Such AR eco-systems must be user friendly, since they are going to be used by teachers that in general do not have programming knowledge; and open source or free for non-commercial, without any type of water marks.
This paper presents several educational activities and a novel Augmented Reality book created using free augmented reality tools that do not require programming knowledge to be used by any teacher. We discuss different AR ecosystems and show the most appropriate for each particular educational activity presented in this paper covering K-12 teaching. Marker-based and marker less augmented reality technologies are presented to show how we can create learning activities to visualize augmented information that help students understand the educational content.

This paper is organized as follows. Section 2 surveys the most common augmented reality eco-systems. In section 3 we present activities supported on marker based augmented reality for teaching music and improve reading and comprehension. Section 4 describes activities that can be used in a kindergarten and the creation of an AR book, based on marker less AR technology. Finally conclusions are presented in Section 5.

2 Augmented Reality

Augmented Reality applications combine images, 2-D or 3-D virtual objects with a 3-D real environment in real time. Virtual computer generated and real objects appear together in a real time system in a way that the user sees the real world and the virtual objects superimposed with the real objects. The user’s perception of the real world is enhanced and the user interacts in a more natural way. The virtual objects can be used to display additional information about the real world that are not directly perceived.

Ronald Azuma [4] defines augmented reality systems as those that have three characteristics: 1) combines real and virtual; 2) interactive in real time; 3) registered in 3-D.

In general, augmented reality applications fall in two categories: geo-base and computer vision based.

Geo-based applications use the mobile’s GPS, accelerometer, gyroscope, and other technology to determine the location, heading, and direction of the mobile device. The user can see overlapping computer-generated images onto a real world in the direction he is looking at. However, this technology has some problems. The major problem is imprecise location which makes difficult for example the creation of photo overlays.

Computer vision based applications use image recognition capabilities to recognize images and overlay information on top of this image. These can be based on markers, such as QR (Quick Response), Microsoft tags or LLA (latitude/longitude/altitude), or marker less that recognize an image that triggers the overlay data.

There are currently many augmented reality applications and development systems for Android and iOS (iPhone Operating System) smartphones and tablets.