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Augmented Reality in Education: Review of Current Technology

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***Abstract* - Although the physical world is three-dimensional, we particularly prefer two-dimensional means in education. The combination of AR technology with educational content creates a new kind of automated application and improves the effectiveness and attractiveness of teaching and learning for students in real situations. Augmented Reality is a new medium that combines aspects of ubiquitous computing, tangible computing and social computing. This support offers unique opportunities by combining physical and virtual worlds and continuously and implicitly controlling the user from the point of view and interactivity. This document provides an introduction to augmented reality (AR) technology and its educational opportunities. Key technologies and methods are discussed in the educational context. Technology in education can influence and motivate students to actively learn, which leads to an effective learning process. Previous research has identified the problem that technology creates a passive learning process if the technology used does not encourage critical thinking and creating meaning. Indeed, the advanced technology enables users to interact with virtual applications in real time and provides the user with natural experiences. In addition, the merger of AR and education has recently attracted research attention as it has enabled students to immerse themselves in realistic experiences.**

Keywords: AR, technology, education, review, current technology.

I. Introduction

Augmented reality is a technology that works on computer-aided recognition algorithms to use your device's camera to enhance sound, video, graphics, and other sensor-based inputs for real-world objects. The term was coined in 1990 by Professor Tom Caudell [1]. It's a great way to render information from the real world and display it interactively so that virtual elements become part of the real world. Augmented reality displays overlay information in your field of vision and can take you into a new world where the real and the virtual world are closely linked. This is not limited to desktop or mobile devices.

Immersing learners in the real world and interacting with them cannot usually be comfortable. Although the natural world is three-dimensional, we prefer two-dimensional educational materials that are very practical, familiar, flexible, portable and inexpensive. However, it is static and does not offer dynamic content. Alternatively, a computer generated three dimensional virtual environment can be used. However, these scenes require powerful computer graphics which are more expensive than others.

Today, there are two generally accepted definitions of augmented reality. One was given by Ronald Azuma in 1997. The definition of Azuma means that augmented reality.

- combines real and virtual
- It is interactive in real time
- It is registered in 3D

II. Technologies for Augmented Reality Systems

Augmented reality and virtual reality use the same hardware technologies and share many factors such as computer generated virtual scenes, 3D objects and interactivity. The main difference is that virtual reality is meant to replace the real world, while augmented reality respectfully complements it. The main augmented reality devices are screens, computers, input and tracking devices. Transparent and monitor-based displays are two main types of displays used in augmented reality. Transparent displays place images of the real and virtual environment above the user's view. Worldview and optical systems are two types of transparent screens. As shown in Fig. 1

2.1 Head Mounted Displays

Head-mounted device is a kind of display which is worn on the head or as part of a helmet. It has a small display optic in front of eye.

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Figure 1: Head mounted device

Figure 2: Optic-see through system

Video review systems are useful when you need to experience something far away or use an image enhancement system. Transparent optical systems combine computer-generated scenes with the "through glasses" image of the real world. As a rule, an oblique semi-transparent mirror is used for this purpose. This mirror technology allows views of the physical world to pass through the lens and graphically superimpose information that is reflected in the user's eye.

2.2 Handheld Displays

Small computing devices with a display that the user can hold in their hands. A handheld AR system displaying a three dimensional graph registered to the cones and table [5] Smart AR, a visual technology that capable to capture visual objects through its smart phone webcam and project it out as a moving subject over an actual 3D space[11]

Figure 3: Handheld Displays

Another type of device that uses video visualization techniques to overlay graphics on the real world is that of portable screens. These are small computer devices with a screen that the user can hold in their hands. The two main advantages of augmented reality handhelds are the mobility of handheld computers and the ubiquity of camera phones. The disadvantages are the physical limitations of the user to keep the portable device in front of them at all times, as well as the distortion of the effect of conventional wide angle mobile phone cameras compared to the real world from the perspective of eye [7]., Smart phones, PDAs and tablets with cameras, digital compass, GPS units for their six degrees of freedom sensors and reference marking systems used in augmented reality as a pocket screen.

In space displays, video projectors, optics, holograms, radio frequency tags and other tracking technologies are used to display graphical information directly on physical objects without the user having to carry or carry wear the screen [4]. Another way to combine physical objects and computer generated information is to use projection screens. In this three-dimensional physical model, a computer image is projected to create a realistic-looking object.

2.3 Pinch Gloves

A pinching gesture can be used to grab a virtual object, and provides a reliable and low-cost method of recognizing natural gestures.

Figure 4: Pinch Gloves

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Figure 5: Data Glove

Digital cameras and / or other optical sensors, accelerometers, GPS, gyroscopes, semiconductor compasses, radio frequency identification (RFID) and wireless sensors are used as tracking devices to position and align the head, hand or hand. user's portable device. These technologies offer different levels of accuracy and precision. Computers generally used to analyze visual and other data collected. They synthesize and position the increases, then reflect the user's display devices.

The type of interaction between the device and the system between the user and the virtual content of the augmented reality applications defines the system interface. There are four main types of interaction in augmented reality applications: tangible, collaborative, hybrid and emerging multimodal interfaces. With these devices, we can develop five different augmented reality systems. These systems are indoor / outdoor fixed systems, indoor / outdoor mobile systems and indoor and outdoor mobile systems. Mobile systems allow the user to move around using a wireless system. Fixed systems are systems installed wherever they cannot move.

III. Augmented Reality in Education

Technology is not a new issue. It has been used in the following fields: military; medicine; technical design; robots; TV robots; Manufacturing, maintenance and repair applications; consumer design; psychological treatments, etc. [3] Displaying information using virtual things that the user cannot directly grasp with their own senses can allow a person to interact with the real world in an unprecedented way. We can change the position, shape and / or other graphic characteristics of virtual objects using interaction techniques supported by augmented reality. With our fingers or the movements of portable devices such as shaking and tilting, we can manipulate virtual and physical objects in the real world.

Augmented reality can be used for learning, entertainment or playful entertainment by improving the user's perception and interaction with the real world. The user can move around in the three-dimensional virtual image and view it from any point of view, just like a real object. The information conveyed by virtual objects helps users to carry out real tasks. One of the most important ways to improve learning is the tangible interface metaphor. This property allows the manipulation of virtual three-dimensional objects by simply moving real maps without mouse or keyboard.

Augmented reality can also be used to improve collaborative tasks [6]. It is possible to develop innovative computer interfaces that connect the virtual and real worlds to improve personal and remote collaboration. These augmented reality apps look like natural face-to-face collaboration rather than screen-based collaboration. [10]

Web and Internet technologies are popular because, in practice, people still prefer to read books on display screens, and textbooks are still widely available. Another interesting application of this technology is the augmented reality textbooks. These books are printed normally, but pointing the book with a webcam creates visualizations and interactions. This can be done by installing special software on a computer using special mobile applications or a website. This technology can be used to develop any existing book into an augmented reality edition after its publication. Using 3D objects and views, different and imaginative supports, the simplest way to connect the two isolated worlds is to simulate different types of interaction. The use of augmented reality in the pages of printed books turns textbooks into dynamic sources of information. In this way, people without computer experience can still have a rich interactive experience.

IV. Conclusion

Augmented reality can change the way we use computers. Augmented reality makes the impossible possible and its potential in education is just beginning. Augmented reality interfaces provide seamless interaction between the real and virtual world. Using augmented reality systems, learners interact naturally with 3D information, objects and events. The educational experience of augmented reality differs for a number of reasons, as Mark Billinghurst mentioned:

- Support of seamless interaction between real and virtual environments
- The use of a tangible interface metaphor for object manipulation

It is important to coordinate a team of specialists for a possible augmented reality solution in educational matters. To achieve realistic solutions, we need to design and coordinate multidisciplinary research projects to improve content and

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environments. Teachers must work with researchers to develop augmented reality interfaces. Software and hardware technologies play an important and key role in the creation of augmented reality applications. There are engineers who can design different augmented reality environments. However, for the learning of educational technologies, there is a great need for instruction designers capable of designing learning activities for augmented reality.

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