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EDUCATIONAL AR/VR SYSTEMS FOR MILITARY PROJECTS

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1 INTRODUCTION

Developments and improvements in computing technology have allowed for vastly improved immersion when consuming digital media. The most notable examples of such technologies are Augmented reality and Virtual reality. The immersion these technologies offer can be used to create educational systems that have more benefits than traditional digital educational systems.

In this thesis project I will be comparing the difference between AR(Augmented reality) and VR(Virtual reality) in the context of educational software. Different implementations and physical devices will be compared and analyzed. A device and a technology will be chosen to prototype an educational application for Observis Oy related to the companys Situational Awareness System(SAS).

The SAS product has a steep learning curve which raises the need for a more efficient educational tool. The goal of the project is to pick the most suitable technologies and implement such a tool. Advantages and disadvantages of AR/VR need to be considered over more traditional digital educational tools.

2 AUGMENTER REALITY AND VIRTUAL REALITY

Augmented reality and Virtual reality are technologies that offer a different view and experience to the physical world. They leverage similar kinds of technology and both aim to provide an enhanced and enriched experience to the user. Both technologies are a part of the general area of mixed reality (Figure 1). However they have different goals and are essentially different in terms of user experience.

Figure 1. Reality-Virtuality Continuum (Paul Milgram et al. 2007)

2.1 Augmented Reality

Augmented Reality can be described as the technology that bridges reality with virtual environments. Real life objects are transformed or replaced with virtual equivalents. Information can be added or removed to the real environment. Key aspects of AR(Augmented Reality) are the ability to run in real time, be interactive, three dimensional and combine real with virtual information. AR is most commonly used with the sense of sight, but it can potentially be used with other senses such as hearing, touch, smell, taste, temperature etc. Augmented Reality can be considered as the next step in graphical user interfaces(GUI) evolution(Mullen and Mullen, 2011). Its current state is comparable to command line interfaces and 2d interfaces in the 1980's and 1990's. It is a vision of future computing and a field that is under research.

Augmented Reality has higher technological requirements compared to VR which has lead to the slower maturity of AR. AR enabling technologies have been developed throughout the history of which the Optical see-through has become the most popular(Microsoft HoloLens, Google Glass, Intel's Vaunt). Optical see-through is achieved by using opaque displays on which virtual overlays can be rendered. The resolution of the real world is left intact as it passes through the screen. Benefits of this approach include power fail safety, which allows users to still see the real world even during a power outage, cheaper production costs of the used displays, no parallax effect that irritates the user's eyes. Disadvantages are the reduced visibility and brightness through the opaque lenses, limitation of the field-of-view, requirement of additional tracking sensors such as cameras, gyroscopes and accelerometers. Due to the lack of maturity of other AR enabling technologies only Optical see-through techniques will be considered throughout this work(van Krevelen and Poelman, 2010).

2.1.1 AR for training and education

Augmented Reality provides new paths to conveying information. Learning experiences are more contextual by connecting and embedding information with the real

world in real time. These approaches are already being utilised by Boeing. Mechanics in the company use AR goggles that aid repairs with embedded textual instructions, illustrate different steps of the repair and help users identify the required tools for a repair. Consequently training resources are reduced and transfer of information between workers is greatly improved(Johnson et al., 2010).

Learning through doing is another approach in which AR shines. Mistakes and errors made during the learning experience have no real consequences. This provides for more authentic learning experiences which cannot be achieved in any other way(Kipper et al., 2013).

2.1.2 AR Challenges

An AR framework has basic requirements to accomplish a combination of the real and virtual world. The four main requirements are sensing, tracking, interaction and display(Figure 2). Sensing refers to capturing environment events and recognising markers or other objects of interest. Tracking handles updating the viewing direction and position of the user relative to the real world. Tracking is an important component of AR as even a slight tracking error can cause misalignment between the virtual and real objects(Wang and Dunston, 2007). Registration refers to how the digital information is being delivered to the user. The registration can be achieved through different methods for different senses: videos, audio, haptic feedback, scent, etc.
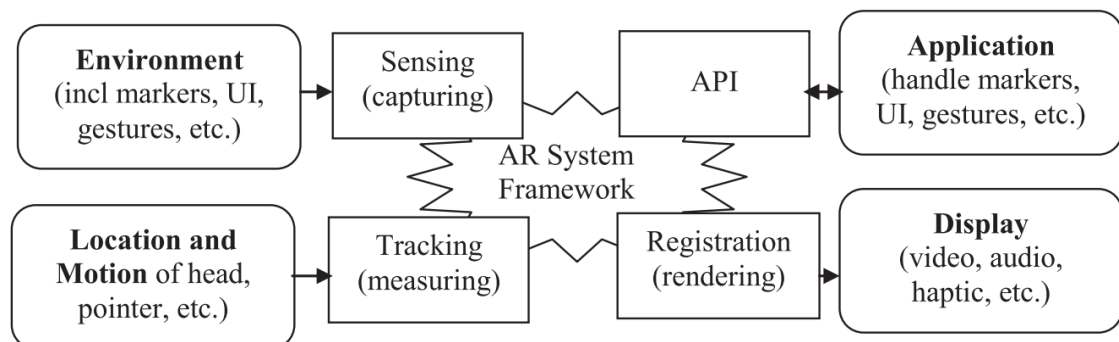

Figure 2. Reality-Virtuality Continuum (van Krevelen and Poelman, 2010)

As most developing technologies AR has many challenges that need to be overcome or improved. The challenges of AR arise from the framework requirements.

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REFERENCES

Generating Bibliographies with biblatex and biber (n.d.).
URL: https://en.wikibooks.org/wiki/LaTeX/Generating_Bibliographies_with_biblatex_and_biber

Johnson, L., Levine, A., Smith, R. and Stone, S. (2010). *The Horizon Report*, Educause Learning Initiative.

Kipper, G., Rampolla, J. and Kipper, G. (2013). *Augmented Reality*, Syngress.

Mullen, T. and Mullen, T. (2011). *Prototyping Augmented Reality*, Wiley.

van Krevelen, D. and Poelman, R. (2010). A survey of augmented reality technologies, applications and limitations, *The International Journal of Virtual Reality* pp. 1–6.

Wang, X. and Dunston, P. S. (2007). Design, strategies, and issues towards an augmented reality-based construction training platform, *ITcon Vol. 12* pp. 1–8.