

Chapter 3.24

A Component–Oriented Approach for Mixed Reality Applications

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ABSTRACT

This chapter introduces a component-oriented approach for developing mixed reality (MR) applications. After a short definition of mixed reality, we present two possible solutions for a component-oriented framework. Both solutions have been implemented in two different MR projects (SAVE and AMIRE). The first project, SAVE, is a safety training system for virtual environments, whereas the goal of the AMIRE project is to develop different authoring tools for mixed reality applications. A component-oriented solution allows developers to implement better designed MR applications, and it fosters the reusability of existing MR software solutions (often called MR gems). Finally, it supports the implementation of adequate visual authoring tools that help end users to develop their own MR applications with no programming skills.

INTRODUCTION

The often underestimated complexity of mixed reality (MR) applications necessitates efficient application design. Rapid prototyping of mixed reality applications is mostly impossible, because of two reasons: Firstly, most of the existing frameworks are in many cases too complex to be extended, and secondly, it needs a lot of software development skills and interface programming knowledge to develop well-designed MR software. In this chapter we want to present a component-oriented approach for developing MR applications. The goal of this approach is to support developers during their development of new MR applications. Having a component-oriented framework makes the programming life easy, because the developers do not have to reinvent everything from scratch. Based on this approach corresponding authoring

tools will support end users to develop their own MR applications without having programming skills. After a short overview in the taxonomy of mixed reality and virtual environments, we present the requirements for such applications. We then describe related work in this field and present a general component-oriented approach, followed by description of two showcases, where our approach has successfully been implemented. Both applications are based on the component-oriented approach and result in a generic and flexible system. Finally, we describe future trends, including the implementation of nice MR authoring tools for end users with no programming skills. We conclude this chapter with a short summary.

BACKGROUND

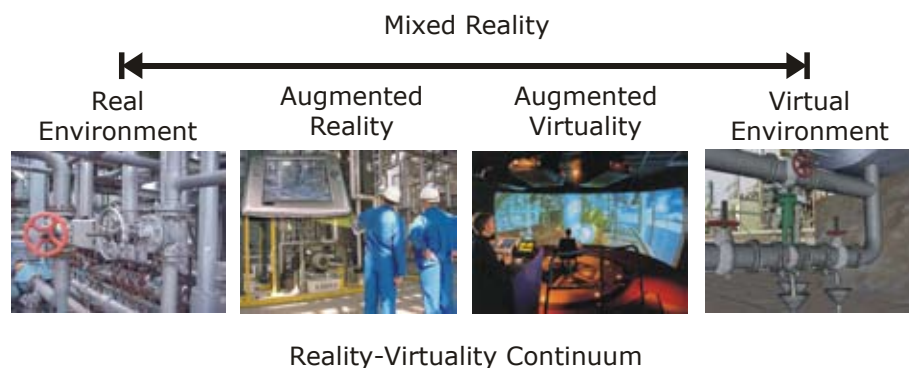
In the following section we will give a short overview of mixed reality describing the requirements for the setup of a MR application and presenting the related work in this field.

From the Virtual Environment to the Real Environment

Mixed reality (MR) is a particular superset of augmented reality (AR) technology that involves the merging of real and virtual worlds somewhere along the reality-virtuality continuum, which connects completely real to completely virtual environments. The terminology was first introduced by Milgram and Kishino (1994) and is depicted in Figure 1. MR technology has been exploited in the medical, military, and entertainment fields (Azuma, 1997); more and more new fields such as industry and training are becoming interested in its possibilities. The use of mixed reality enhances users' perceptions and the interaction with the real world (Azuma et al., 2001). Virtual objects display information that the users cannot directly detect with their senses. In addition, this information conveyed by the virtual objects helps a user perform real-world tasks.

Virtual environments and virtual reality-based applications can become very complex. Even more complex than present VR systems are the VR tools for modeling these environments (Bimber, Fröhlich, Schmalstieg, & Encarnação, 2001). Often, VR applications and the corresponding authoring tools are not easily extendible, and

Figure 1. From the real environment to the virtual environment



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