When VR meets UbiComp

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Abstract. In this paper, we introduce "U-VR" which is a new paradigm combining virtual reality with ubiquitous computing. That is, "U-VR" enables users to access VR applications anywhere at any time by exploiting networked pervasive computing resources in everyday life, such as home, school, and office. We illustrate the usefulness of "U-VR" by a number of applications that have been prototyped using the concept of "U-VR". We will discuss how "U-VR" can support the investigation of important research challenges in the area of virtual reality.

"U-VR" is a new paradigm combining VR (Virtual Reality) with ubiComp (Ubiquitous Computing). This can provide users with various applications according to the context of users or environments. "U-VR" can realize the dream of SF (science fiction) novels or movies where a user gets location-based services while walking around or exploits an integrated wall display to control networked appliances while watching a movie at home.

VR and ubiComp individually has different application domains, i.e. virtual world and real world, respectively. As shown in Figure 1, VR extends the perception of human beings in a virtual space which is realized by high performance computing systems. Meanwhile, ubiComp enhances the human perception in real world by exploiting networked infrastructure, i.e. pervasive computing resources in a real space.
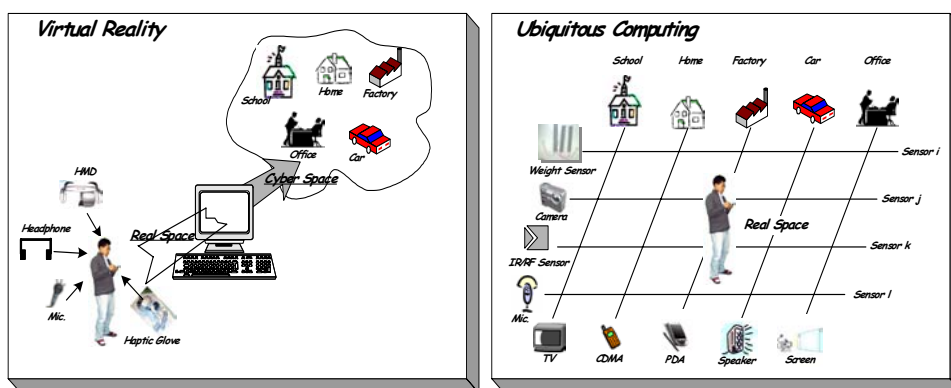

Figure 1. VR vs. UbiComp

In spite of the different application domains, VR and ubiComp share a common purpose, i.e. both expand the perception of human by adding a variety of technologies to environment. VR provides a user

with immersive experiences in a virtual world. By using some interactive devices (e.g. display and haptic device) users can interact with the virtual space while experiencing immersion. Until now, VR has mostly been applied to limited fields such as military, medicine, sport, marine and space. UbiComp also gives a user the infrastructure to access pervasive computing resources without complicated wearable devices. With pervasive sensors applications in ubiComp acquire the context of users and their environment, and automatically trigger appropriate services. Thus, users can enhance their ability by means of the ubiquitous infrastructure and various applications which are accessible anywhere at any time.

However, users in most VR applications have to endure the inconvenience of heavy wearable devices and behavior limitation. On the other hand, users of ubiComp can freely use the pervasive computing resources, but the number of available applications is not enough to satisfy users. "U-VR" is a paradigm integrating real world (in the form of infrastructure) with virtual world (in the form of immersive services). According to the context of users and environments, the immersive services continuously interact with infrastructure to provide pervasive computing resources in daily life. The context is the information of user identity (Who), object identity (What), location (Where), time (When), user gesture (How), and user intention (Why). "U-VR" provides users with a variety of applications, in the form of immersive services, based on the context by exploiting infrastructure in the form of pervasive computing resources. Therefore, users can get plentiful information and services anywhere at any time.
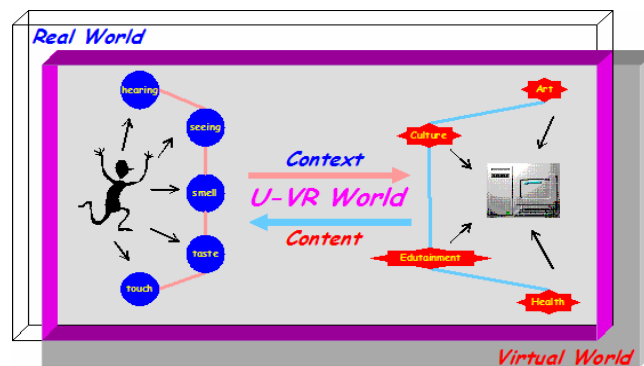

Figure 2. U-VR World

"U-VR" is also similar to Augmented Reality (AR) in a sense that both augment objects with information but more than that. We call it as mediated/attentive AR which enables real world to adaptively interact with virtual world through user's context. The context can be generated by fusing primary information from various pervasive sensors in everyday places. As shown in Figure 2, real and virtual worlds can seamlessly cooperate with each other in "U-VR" through context sharing.

In this paper which introduces "U-VR", we hope to discuss how "U-VR" can support the investigation of important research challenges in the area of virtual reality.