Interaction design of augmented education environments - Augmented and mixed reality for performance and training support of aviation / automotive technicians


1 Leeds Metropolitan University, UK, 2 Medical University Graz, Austria, 3 IP EDV-Dienstleistungs-GmbH, Austria, 4 BRP-Rotax GmbH & Co. KG, Austria

Augmented reality (AR), Mixed Reality (MR) and their mix and combination with other disruptive technologies offer an enormous potential for supporting instructors and trainees in modern education and working environments such as of aircraft maintenance technicians [1] or automotive service technicians. In this paper we investigate and show some examples on how the performance and training of such instructors and trainees can be actively supported. Furthermore we will discuss the new challenges for training designers.

The augmentation of the physical world with interactive, context-aware information (e.g. 2D and 3D content) provides multifaceted possibilities, on various ubiquitous and pervasive computing environments [2]. While there is still the broad opinion that these concepts are just situated in the world of science fiction (SciFi) and SciFi movies, we will relate these techniques to existing technologies and prototypes in research. Terms like outernet, print + or 2.0, augmented goggles, wearable technology are not just remaining pure buzzwords anymore. We will demonstrate how different prototypes applying low cost rapid prototyping methods can be applied as powerful performance assistance and training support instruments, whereby discussing the requirements and user-needs analysis phases as well as human-computer interaction and interaction design issues, user modelling, usability engineering, prototyping and evaluation issues. Different scenarios are possible and provide the basis to generate storyboards. One of the key factors is hereby to analyse typical tasks and activities of users and utilize familiar user interaction paradigms for accessing information, such as using a book or assisting the work with task sheets. For example by augmenting the material that is printed in the book with additional graphical 3D interactive information which can be viewed and manipulated by the instructor and/or trainee, one can provide a link between traditional learning and technology-enhanced learning.

Basing on theoretical and empirical research it is possible then to design via first moodboards and scribbles relevant prototypes. A qualitative and quantitative analysis can be used to define a basic design process for such new environments and settings.

Moreover, MR and AR along with Mobile Tagging (MT) combined with Pervasive Computing provide the possibility to realize a Physical World Connection (PWC) [3] between Reality and Virtuality. In the field of aviation and automotive industry, this offers manifold possibilities for maintenance and service personnel to get access to assistive technologies in a very intuitive way to enhance their operation, work, training, and knowledge. Assistance for the large variety of job tasks can be provided to a certain extent by offering augmentation of the different senses like vision and audition, providing a media-rich interface. Although the roots of Mixed Reality and Augmented Reality are based on prototype applications in the aircraft industry in the early 1990s, the impact of these emerging technologies on special target groups has not yet been investigated and validated by many research groups. With a specific focus on these user communities, applications are considerably more influenced by both usefulness and usability of technology. Consequently, it is argued that key issues in developing such applications are the tracking methodology, the display technology, interaction (devices and framework) and most of all ensuring good usability.

In this paper, a concrete example in a aviation and automotive environment will be presented as a case study for investigating and validating these key issues. Preliminary results of semi-structured interviews and observations in real training and work settings indicate a lack of information concerning existence of such technologies and environments, but show big interest and potential for such educational and
workplace innovations, while concrete visions or user requirements for future augmented education environments remain open and are subject of our further research steps.


Keywords: Augmented reality, Mixed reality, Pervasive computing, e-Training