The Role of Augmented Reality within Ambient Intelligence

Kevin Curran, University of Ulster, UK
Denis McFadden, University of Ulster, UK
Ryan Devlin, University of Ulster, UK

ABSTRACT

An Augmented Reality (AR) is a technology which provides the user with a real time 3D enhanced perception of a physical environment with addition virtual elements—either virtual scenery, information regarding surroundings, other contextual information—and is also capable of hiding or replacing real structures. With Augmented Reality applications becoming more advanced, the ways the technology can be viably used is increasing. Augmented Reality has been used for gaming several times with varying results. AR systems are seen by some as an important part of the ambient intelligence landscape. Therefore, the authors present several types of augmentation applications of AR in the domestic, industrial, scientific, medicinal, and military sectors which may benefit future ambient intelligent systems.

Keywords: Ambient Intelligence Landscape, Ambient Intelligence Systems, Augmented Reality, Intelligent Interfaces, Virtual Elements

1. INTRODUCTION

Ambient intelligence is a human interface metaphor referring to the environment of computing which is aware and responsive to the presence of human interaction. The aim is to place great emphasis on the aspect of being user friendly and efficient and provide support for human interaction. We are still striving for a future world where we will be surrounded by intelligent interfaces that are to be placed in everyday objects. These objects will then be able to recognise but also respond invisibly to the presence of people. The interaction between the technology and the users should be natural (Aarts & Marzano, 2003; Curran, 2009). It also aims to create a system that will be able to recognise all the different scents that are in the environment.

In fact, one can argue that the holy grail of the mobile Augmented Reality (AR) industry is to find a method of delivering the right information to a user before the user needs it, and without the user having to search for it (ReadWriteWeb, 2009). The Ambient Intelligence concept builds upon ubiquitous computing and user-centric design and this paper seeks to provide a snapshot of aspects of modern Augmented Reality systems which may play important roles in the ambient computing landscapes of tomorrow.

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Augmented Reality systems provide contextual information to the user such as the head mounted display within a modern cockpit, by allowing the pilot firstly to see reality through the glass window then overlaying information regarding plane speed, plane trajectory and any relevant information about the current target or objectives. This process of overlaying virtual information on top of reality is the essence of AR and as technology progresses so too will the quality and functionality of these devices. It has been used more recently in the creation of car maintenance visual guides. By overlaying a virtual component and demonstrating to the user how to manipulate the counterpart physical component. The implementation of such AR applications would drastically reduce the level of knowledge required to deal with complex tasks from engineering to surgery (Zhou et al., 2008; Holden, 2011).

Augmented Reality, as a label, is credited to Tom Caudell, who coined the term when he was working at Boeing in 1992 (King, 2009). Caudell was involved in the development of one of the first AR systems; whereby users would be able to follow the installation of complex wiring looms in Boeing aircraft using a head worn device that would allow the engineers to see wiring diagrams ‘projected’ onto their field of vision as they worked. This significantly increased productivity and accuracy as the installations progressed without the need for engineers to constantly move back and forth between the wiring diagrams and the work location. It is thought that the first Augmented Reality (AR) system used simple wire-frame graphics, and a cumbersome head mounted display (HMD) and was first demonstrated in 1968. The HMD was so heavy that had to be suspended from the ceiling. The system was designed by Ivan Sutherland in Harvard University (Cawood & Fiala, 1998). Augmented reality describes the way in which someone’s perception of the real world, and the extraction of information from that perception by their senses, can be augmented to provide more information than can be garnered by those senses alone. All sensory input of the ‘real-world’ can be augmented in one way or another:

- Sight – Something as simple as the added graphics on a sports broadcast showing on-screen banners with scores and statistics to more sophisticated displays used in commercial and military aircraft.
- Haptic – games controllers that ‘rumble’ when certain game-play actions take place. Mobile phones that vibrate to let you know they are ringing.
- Hearing – the beeping noise that is heard in an automobile when reversing, to warn the driver that they are approaching an object behind.
- Smell – an example being the ‘Digilog’ Book whose development is currently under way at Culture Technology Institute at GIST (Singer, 2010) in which the user smells scents based on the storyline.
- Taste – A Meta Cookie (Wilkins, 2010), has been created by researchers at the University of Tokyo, where an otherwise tasteless cookie is given ‘virtual’ flavour.

The possibility of group contribution areas where groups of users can interact in a shared Mixed Reality space could lead to future workspace been more useable as working environments even with participants been located remotely. When dealing with AR systems the technical requirements will be determined by the end functionality required, but most AR applications will require the tracking of real time locations and objects, 6 degrees of freedom allowing the user to move freely along 3 axis, good quality virtual elements well aligned within reality and a reliable refresh rate.

It is straightforward to define a generic Mixed Reality (MR) environment as one in which real world and virtual world objects are presented together within a single display, that is, anywhere between the extrema of the RV continuum (Milgram & Kishino, 1994). The continuum demonstrates that there are separate Real and Virtual Environments on either ends
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