



Augmented Reality for a Casual User: Designing Tools for Interaction with the Virtual World

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Abstract

Augmented Reality (AR) merges the real and virtual worlds into one combined user experience. Users have access to digital data surrounding them, which can be used for various purposes. Real world always has a limited space for representing information, but the digital world can hold any amount of information at any location. This can be used to pass digital content and stories between people, which is not possible in the real world. Everyone should be able to pass on his or her opinions and be able to interact with other people with similar interests. This paper describes AR content creation tools that are currently being implemented. The tools can be used to create AR stories, games and any kind of AR data. Users can customize their digital worlds and create their own layers on top of the reality.

Keywords

Augmented Reality, Mobile Data Creation

INTRODUCTION

Augmented Reality (AR) is a technology where the real world is enhanced with digital data. The surrounding information space is revealed to the user who has a simultaneous access to both the real and virtual worlds.

AR technology enables completely new applications and can open new possibilities for old applications.

There are several approaches to accessing the Augmented Reality. A lot of research concentrates on using a Head Mounted Display (HMD), a wearable computer and small input devices that travel easily with the user. Nice applications can be made with such powerful devices, but they have a few drawbacks, mainly power consumption, weight, price and space. These kinds of devices are generally not accessible for the casual user.

Experiencing the Augmented Reality should not be dependent on expensive state-of-the-art gear. If the AR experience is built for the best possible hardware, the majority of potential users never experience it. Instead of taking a platform and building onto that, we should consider what the users need and what they lack in the real world. The Augmented Reality should add the things that the real world does not have and the users need. For example, a location does not have its complete history visible to a user. The history is something that has been experienced by other users and they have no means of sharing their experiences with others. There can be countless stories experienced by other people that could be accessible through AR.

We want to design tools that give everyone an easy access to the augmented world. It is not enough to be able to view the content in the AR domain; users should be able to actively participate in the AR experience and create their own data into the AR worlds. Augmented reality is a layer on top of the reality and this should be a product of different people's effort, not just a static world that can be viewed. The augmented reality should enhance social interaction between people and one way to do this is to allow everyone to create information to a common collaborative AR world.

Our tools scale from simple low-end tools that can be used quickly to create small objects into the AR world to powerful high-end tools that allow the customization of the entire AR world. The simple tools are intended for the mobile end-users that are actively using the AR world with mobile devices. The powerful high-end tools can be used to create and maintain new AR worlds. These high-end tools will be initially targeted at the desktop computers, as they are much easier to use with good input devices and lots of processing power.

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Image 1. The high-end tools are used for creation and maintenance of an entire AR world. The mobile low-end tools add user experiences to the world.

The different nature of the tools is seen in Image 1. The high-end tools can be used to create the entire world and customize it as wanted. The mobile tools are used to add user experiences to this world. The AR experience keeps on changing as the users add their own things into the system.

EXISTING SYSTEMS

These tools are intended for all kinds of AR applications. The aim of the tools is to create a shared AR experience with a large number of users. The closest existing systems can be found in the area of gaming, as there are several multi-user mobile gaming systems already in use. Real world is an ideal gaming environment as it is constantly available and filled with other people. With a little help, the real world can, for example, be turned into a game arena.

Already, some interesting AR games have been created. In Japan, Dwango released *Samurai Romanesque* [5], which is a weather-affected, massively multiplayer Java-based i-mode game for the i-Appli handsets. Dwango claims the game can accommodate up to 500,000 players, each of which can battle with others at the same time. Characters also can take on one of 16,000 unique appearances. *BotFighters* [2] is a location based mobile game developed by It's Alive. In *BotFighters* the players locate and shoot at each other with their cell phones out on the streets, where mobile positioning is used to determine whether the users are close enough to each other to be able to hit. *Pirates!* [1] is a ubiquitous game played indoors in a limited environment. Each user has a portable digital device that is connected wirelessly to the game server. The users can explore the game area, meet other players, fight each other and trade items. The game is session based, but it could be implemented as a city scale pervasive game as well. *ARQuake* [6] is an Augmented Reality version of the popular *Quake* game. It is played with a wearable computer and the Augmented Reality is shown on a head-worn display. The game requires expensive hardware and it is thus not accessible to the occasional gamer.

These games are already in use or have been used. We feel these systems can be further developed by allowing the users to take a much more active part in the experience. We want the users to create their own objects into the AR world and thus define the contents of the world. This also allows the users to communicate much more efficiently with each other as they can create and pass information to others. The people are the best element in these systems and we want to embrace communications between them.

Creating Augmented Reality Information on the Move

When creating digital content with a workstation, the user has access to a lot of computing power, a good display and good input devices. These are luxuries that a mobile user does not have. The mobile user has to deal with limited device capabilities, but this should not be seen as a setback. Our research interests include what kind of and how complex content a casual user wants to create with the mobile device.

Creating augmented reality data while on the move has been studied before. An example work is the Field assistant prototype [3], a set of tools that help a fieldworker while observing the environment. Its Stickepad application creates Stick-e notes, which contain a GPS position. The notes are created from a template and the values can then be edited. Another example work is the Augment-able Reality [4] that allows the user to add voices and photographs to physical objects or locations dynamically. Location is determined with an infrared beacon or an ID marker.

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AUGMENTED REALITY INTERACTION TOOLS

The system

Our augmented reality system is composed of the AR world server and the user client device. The AR world server stores all of the AR data and users access this information with their client devices. There can be several different worlds, each designed for their own purposes.

The world is composed of AR data objects and each user sees a set of these objects in the world. The AR data objects can be any kind of content and each object has corresponding triggering information. Triggering information determines when certain content is shown to the user. The data can be tied to a location, temperature or any other available information. When these triggering criteria are met, the corresponding content is shown to the user. Other users currently in the system are also AR objects and they are also visible to users.

The tools

We want to reach a large number of potential users who want to actively participate in the AR world. To do this, the system needs to be usable in as many devices as possible and the tools need to scale according to each

user's needs and their devices. People should be able to create pieces of information to the AR domain easily and while on the move. The tools are mainly intended to enhance the social interaction between the people using the system.

To achieve a maximum scalability of the tools, they are implemented in Java. Java is usable in a very large number of devices thus scaling from the very low-end mobile devices to powerful desktop computers. The very low-end tools are implemented using Java MIDP and the high-end tools use Java 2 Standard Edition.

The low-end tools used on the move are fairly simple, as they are aimed for devices that have limited capabilities, input devices and processing power. The user can add simple objects into the AR world with the low-end tools. To customize the entire world, we need powerful high-end tools that are used to manage and create worlds. These tools allow the customization of everything in the AR world. The world is initially built with these tools and the mobile users add information objects to the world. All the tools are created with Java, so the high-end tools can also be used in mobile devices as well. We want to give everyone the possibility to take part in the AR and that's why we need both low-end and high-end tools for scalability across various devices.

This framework of creating a background setting for the world and allowing the users of the system to fill the world with their own experiences can be used for various purposes. People can create new layers on top of the reality that provides what they lack in the real world, like a channel for expressing opinions. AR games, for example, can be created easily with this system as the system supports interaction between players and the high-end tools allow the management of the world.

The ultimate goal of the system is to let the end users customize their world. We want to create an easy AR creation tool for the end users, who want to share their feelings, create stories and socialize with other people. We want everyone to create his or her own layer of data on top of the reality and participate in other people's creations. Everyone sees the world differently so everyone should be able to customize the world. The real world is difficult to manipulate, but digital data on top of it can be anything the user wants it to be.

The system is being implemented at the moment and we hope to gain a lot of information on how the people will interact with each other using this system. We believe the majority of the users will only be interested in interaction with each other using the low-end tools while only a small part will actually use the high-end tools.

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