

Challenges and Opportunities in the area of Collaborative Augmented Reality Games

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Abstract. In this paper we describe our view on challenges and possibilities in creating pervasive games. We present an overview on our research activities in Games and Augmented Reality. We outline our expectations and contributions for the Pervasive Gaming Workshop.

Introduction

Games are interactive processes which usually involve several players. Of course, there also exist successful games for single players, but the majority of games are played in a group of people. CSCW is a research discipline that aims to support groups of people working together. Research in this area results in requirements for hard- and software but also influences the way people socially interact in teams. Therefore research results of CSCW might easily be adapted for research on computer games and especially pervasive games.

This approach also applies to the development of user interfaces. Pervasive Computing aims at the invisible, seamless interface which are build in objects of our everyday life[1]. Applications in Pervasive Gaming add further requirements in terms of lightweight and easy to use interfaces. Augmented reality (AR) enhanced with location-based and context-sensitive systems offers a possible solution to these requirements[2]. AR allows to integrate synthetic objects into our physical world in a seamless way.

New types of technology requires new interaction concepts and demands for new ways to present content to its users[3, 4]. Traditional games, for example, address a wide range of emotions[5]. Computer games up to now focus on only a few [6]. In how far will it be possible to transfer the quality of traditional games, which has been developed throughout a long period of time, to this new type of gaming applications called pervasive games? How to provide the player with an immersive and satisfying gaming experience which employs all the new features offered by pervasive computing? To create convincing pervasive games, new game concepts are required which merge traditional approaches on gaming which have proved to be successful with the possibilities of the new technology.

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Computer games nowadays are getting more and more complex. Starting with simple applications like computer tennis or PacMan, computer games now offer a wide range of applications from fully developed fantasy spectacles to highly demanding simulation games. Tools which support the game developers therefore obviously become essential. This is even more true as pervasive games put higher demands on the application regarding context-sensitivity and interaction design. New authoring concepts are required that allow content providers to create content-rich, context-sensitive applications. To allow pervasive gaming, multiple gaming devices with different characteristics have to be supported. This defines new requirements for authoring tools which need to abstract from the underlying technology. Furthermore, the authoring tools demand to support the design of game interfaces which adopt to the situations and the emotions of the players.

Authors Research Activities

We have developed NetAttack - an Indoor and Outdoor Augmented Reality game that can be played with several competing teams. Each team consists of an indoor player and an outdoor player. The indoor player (cf. 1) sits in front of his or her desktop computer and supports the outdoor player with valuable information: where to find hidden items, how to defeat competing teams and what to do next to win the game. The outdoor player (cf. 2), equipped with laptop, position and orientation sensors walks around on a defined game field trying to collect game items and to hide from competing outdoor players.

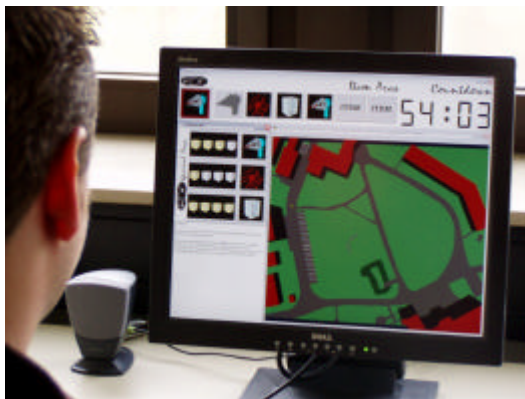


Figure 1: Indoor player with a map of the game area and an overview of the collected game items.



Figure 2: Outdoor player searching for virtual game items.

Our major goal of this project was to develop a collaborative game that integrates players with different user interfaces. A challenge was to design the game in a way to be as interesting and enthralling for the indoor player as for the outdoor player. We have tried to enable this feature with a strong connection and dependence between both players of one team. Neither the indoor nor the outdoor player may win the game all alone. The indoor player needs the outdoor player to collect items and the outdoor player needs the indoor player to get information about hidden game items. Other technical goals of this project were to gain experience in how to handle incomplete WLAN coverage and the accuracy of low-cost GPS receivers.

We have implemented the tracking of the outdoor player using a GPS receiver, an inertial tracker and a video camera. Computer vision tracking is used to refine the GPS tracking data which has proved to be quite inaccurate. The data from the position sensors has been merged to obtain a reasonable precision. Head-sets support the communication between the indoor and the outdoor player of a team. NetAttack has been developed as a distributed application. The various components communicate via an event-based protocol. A central component guarantees consistency. Before starting to play the game, the game levels have to be configured. For each game level e.g. the game area, number and position of the game items and the playing time may be defined.

Our current set-up includes two teams each consisting of an indoor and an outdoor player. We have conducted initial tests with students and volunteers from our institute based on this setup. We are planning to extend the system to allow more flexible team configurations and to support a greater variety of user interfaces. Further evaluation will be conducted on several occasions throughout the year. The system will be available for play to the public on the open day of our institute.

Pervasive games are an ideal testbed for Pervasive Augmented Reality applications [7] and we are planning to extend our work in this area. Our activities in the research area of Pervasive Gaming also includes a Collaborative Augmented Reality game, which will be developed within a graduate seminar on Collaborative Mixed Realities. The game employs one or several portable projectors which are tracked to augment

blank walls with virtual water pipes and little monsters. Some users are equipped with projectors, some are using tracked pens to shoot the monsters. The little monsters are moving rapidly through the pipes and only spatial audio gives a hint where they are currently located. With this game we want to investigate the collaboration between players which are equipped with different interaction devices. In which way and to which extent do players collaborate? How to reach the same level of attractivity in the design of user interfaces? We aim at games which may be played with multiple interaction techniques concurrently and which support rich human-to-human interaction.

Expectations

The development of NetAttack was our first approach on Pervasive Gaming. In the development of the concept, as well as in the realisation and play of the game we encountered several problems and developed solutions specific for NetAttack. In the workshop we would like to present our concept of the game, discuss the challenges we encountered and compare our experiences with those of workshop participants working on similar projects. We also look forward to learn more about possible alternatives in concept and implementation.

The game will be tested extensively at an open house event in the near future. The experiences on playing NetAttack will influence our planning of a seminar on Collaborative Mixed Reality applications in summer. We are therefore very interested to learn about other people's experiences in playing pervasive games. We also would like to review and discuss possible implications resulting from the use of new technologies, e.g. social implications, awareness issues and privacy. With our background on augmented reality, collaborative work and storytelling we hope to be able to provide a complementary view in this discussion.

Last but not least we would like to get an overview on the current tendencies and different approaches in Pervasive Gaming. We would like to brainstorm with people sharing the same interest for new ideas and possibly find new partnerships for future projects in this area of research.

Short Biographies

Irma Lindt

Irma Lindt is working as a research associate at the Fraunhofer FIT in St. Augustin, Germany. She is also a lecturer at the University of Applied Sciences, Offenburg. She has been working on several EU projects in the area of Collaborative Augmented Reality. Her research interests include Mixed Realities, 3D user interfaces and interaction authoring. Irma Lindt received her masters' degree in Computer Science from the Eastern Michigan University, USA.

Léonie Schäfer

Léonie Schäfer is currently working as a research associate at Fraunhofer FIT in St. Augustin, Germany. She is carrying out research in the area of Collaborative Virtual Environments, Storytelling and Crossmedia. Léonie Schäfer published several papers and organised workshops at major conferences, has been guest editor for the Journal of Virtual Reality, Springer Verlag and is a member of conference committees on Storytelling, Interactive Systems and CVEs. Before joining Fraunhofer FIT, Leonie Schäfer has been working in an advertising agency, as software developer in a multimedia company, in project coordination at an event agency for a world fair exhibition project and as a research associate for a multimedia project at the University of Technology Berlin. She received her M.S. degree in Computer Science from the Berlin University of Technology. For more information, please see <http://orgwis.gmd.de/~leonie/Portfolio/>

References

1. M. Weiser, *The Computer for the 21st Century*. Scientific American, 1991. **265**(3): p. 66-75.
2. B. Thomas, B. Close, J. Donoghue, J. Squires, P.D. Bondi, M. Morris, and W. Piekarski. *ARQuake: An Outdoor/Indoor Augmented Reality First Person Application*. Proceedings of the *4th Int'l Symposium on Wearable Computers*. 2000. Atlanta, Ga, USA.
3. S. Björk, J. Falk, R. Hansson, and P. Ljungstrand. *Pirates! Using the Physical World as a Game Board*. Proceedings of the *Interact'01*. 2001. Tokyo, Japan.
4. M. Flintham, R. Anastasi, S. Benford, T. Hemmings, A. Crabtree, C.M. Greenhalgh, T.A. Rodden, N. Tandavanitj, M. Adams, and J. Row-Farr. *Where on-line meets on-the-streets: experiences with mobile mixed reality games*. Proceedings of the *Conference on Human Factors in Computing Systems*. 2003. Florida, USA, ACM Press.
5. K. Salen and E. Zimmerman, *Rules of Play : Game Design Fundamentals*. MIT Press. 2003.
6. K. Salen and E. Zimmermann, *Gamelab workshop*. 2003: Utrecht, NL.
7. T. Starner, B. Leibe, B. Singletary, K. Lyons, M. Gandy, and J. Pair. *Towards Augmented Reality Gaming*. Proceedings of the *Imagina*. 2000. Monaco.