

Preface

Augmented reality (AR) is a direct or indirect view of real world scenes in which physical objects are annotated with, or overlaid by computer generated digital information. The past two decades have seen a fast growing body of research and development dedicated to techniques and technologies for AR. In particular, due to the recent advances in mobile devices and networking technologies, the use of mobile collaborative augmented reality (MCAR) has expanded rapidly. Although there is still a long way for MCAR systems to become commonplace, successful applications have been developed in a range of fields, for example computer-supported collaborative learning, entertainment, tourism and collaborative architectural design. An overview of recent trends and developments in this rapidly advancing technology is needed. This book is set out to:

- Provide a historical overview of previous MCAR systems
- Present case studies of latest developments in current MCAR systems
- Cover latest technologies and system architectures used in MCAR systems

This book includes 13 chapters. The first two chapters of this book are invited contributions from established researchers in the field. The remaining chapters are extended versions of papers presented in the 2010 international workshop on mobile collaborative augmented reality (MCAR 2010). We briefly introduce these chapters as follows.

In chapter 1, Billingham and Thomas provide an overview of current state-of-art in MCAR. The authors first introduce a set of technologies that are required for MCAR. Then examples of recent MCAR systems are presented. The chapter finishes with an insightful look into requirements and directions of future MCAR.

In chapter 2, Perey et al. discuss the needs, approaches, issues and directions of standardization of AR related applications and services. This discussion includes guiding principles of an open AR industry, AR requirements and use cases, approaches to the AR standards challenge and content-related standards. The current state of mobile AR standards is also introduced and analysed.

In chapter 3, Yew et al. propose a system framework called SmARt World which is to support various mobile collaborative applications in indoor environments.

This system has a three-layered architecture – physical layer, middle layer and AR layer. The initial prototype has been implemented and the tests of it show that it is low-cost, user friendly and suitable for many applications.

In chapter 4, Hoang and Thomas present research directions motivated by the problem of action at a distance in mobile augmented reality. The discussion is based on the authors' augmented viewport technique. Current research challenges are identified, which include the utilization of various types of remote cameras, collaboration features, better visualization of the cameras' views, precision by snapping and improved input devices.

In chapter 5, Webel et al. present a series of analytic results of interdisciplinary research. Based on previous research and experiments performed in cooperation with human factors scientists, improvement of Augmented Reality based training of skills is analysed and recommendations for the design of Augmented Reality based training systems are proposed. These recommendations include visual aids, elaborated knowledge, passive learning parts and haptic hints.

In chapter 6, Vico et al. describe a taxonomy for classifying types of applications involving mobile AR-based collaboration. The authors propose that experiences can be classified according to the type of content generated and then give examples of how current mobile AR applications would be classified. Some possible use cases of the taxonomy and future research are provided.

In chapter 7, Gu et al. describe the development of a mobile AR collaborative game called AR Fighter. The structure and features of this game's prototype are introduced. In this prototype, the authors present a concept of game playing: 2 players can play an AR game without any onlookers interfering.

In chapter 8, Alem et al. present a user study of an augmented reality mobile game called Greenet. This game allows players to learn about recycling by practicing the act of recycling using a mobile phone. The study compares three different ways of playing the game and the results suggest that competitive/collaborative mobile phone based games provide a promising platform for persuasion.

In chapter 9, Gu et al. present a game called AR-Sumo. This game is a mobile collaborative augmented reality network service for educational and entertainment purposes. AR-Sumo provides a shared virtual space for multiple users to interact at the same time. It involves visualization of augmented physical phenomena on a fiducial marker and enables learners to view the physical effects of varying gravities and frictions in a 3D virtual space.

In chapter 10, Wang et al. propose a multi-user guide system for Yuanmingyuan Garden. The system integrates real environments and virtual scenes through entertainment and gaming in mobile phones. Using this system, visitors are able to tour the garden's historical sites and experience the excitements of an AR based game through various novel ways of interaction provided.

In chapter 11, Alem et al. present a gesture based mobile AR system for supporting remote collaboration called HandsOnVideo. The system is developed following a participatory design approach. It can be used for scenarios in which a remote helper guides a mobile worker in performing tasks that require the manipulation of physical objects, such as maintaining a piece of equipment and performing an assembly task.

In chapter 12, White and Feiner present a system for dynamic, abstract audio representations in mobile augmented reality called SoundSight. This system uses the Skype Internet telephony API to support wireless conferencing and provides visual representations of audio, allowing users to “see” the sounds. Initial user experience of the system indicates that visual representations of audio can help to promote presence and identify audio sources.

In chapter 13, Zhou et al. review Spatial Augmented Reality (SAR) techniques. Advantages and problems of SAR in presenting digital information to users are summarised. The authors also present a concept of portable collaborative SAR. This concept is then applied in a case study of an industrial quality assurance scenario to show its effectiveness.

In summary, the research topics presented in this book are diverse and multidisciplinary. These topics highlight recent trends and developments in MCAR. We hope that this book is useful for a professional audience composed of practitioners and researchers working in the field of augmented reality and human-computer interaction. Advanced-level students in computer science and electrical engineering focused on these topics should also find this book useful as a secondary text or reference.

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