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The Augmented Round Table – a new Interface to Urban Planning and Architectural Design

Wolfgang Broll, Moritz Stoerring & Chiron Mottram

Fraunhofer FIT, Sankt Augustin, Germany; Aalborg University, Denmark; University College London, UK

wolfgang.broll@fit.fraunhofer.de, mst@cvmt.dk, ucftchr@ucl.ac.uk

Abstract: The Augmented Round Table provides a collaborative interactive AR environment, where users can interact naturally and intuitively. They may create and manipulate complex 3D geometry naturally by using wands, gestures and real world placeholder items as tangible interfaces.

Keywords: Augmented Reality, tangible user interfaces

1 Overview

The Augmented Round Table bridges the gap between real and virtual worlds by enhancing the users' current working environment with virtual 3D objects. Our developments focus on providing an intuitive environment, which supports natural interaction with virtual objects while sustaining existing communication and interaction mechanisms. Real world objects are used as tangible interfaces (Ishi, 1997) together with gestures to augment the social situation in a meeting and make 3D environments attractive even to non-experts. The project develops new types of user-friendly see-through displays, non-intrusive object tracking mechanisms and intuitive user interface mechanisms within a location independent multi-user real-time augmented reality environment. The project addresses a wide area of possible collaborative applications with a focus on architecture and urban planning.

Figure 1: Using gestures and wands to manipulate virtual objects

The goal of the project is to develop an intuitive augmented reality environment supporting common round table meetings. While existing approaches such as BUILT-IT (Rauterberg, et al, 1997) used separate projections screens, in our approach virtual 3D objects are projected into the common working environment of the users by wearable stereoscopic 3D displays (HMDs). Thus round table meetings are enhanced by virtual 3D objects. In contrast to other approaches such as MARE (Grasset, et al, 2002) we focus on natural interactions using unobtrusive AR based input mechanisms. The main focus of the project is the development of new intuitive interaction mechanisms. One approach is the use real world items to realize tangible and intuitive interfaces for the manipulation of 3D objects. This presumes a flexible and sophisticated object tracking mechanism. Therefore the project develops a tracking mechanisms based on computer vision. This mechanism also allows us to recognize user gestures without disturbing the user in his or her natural behaviour by cumbersome hand tracking devices (see figure 1). While similar interface approaches have been presented earlier (Billinghurst, et al, 2000), our approach aims to support meetings involving several people. The developed AR environment thus provides multi-user capabilities to guarantee individual but consistent views among all participants. The power of the augmented round

table approach is demonstrated in the context of an architectural design and urban planning application. This application integrates the intuitive collaborative design by multiple users of the Augmented Round Table with a commercial CAD package and existing simulation software.

2 System Components

The main system components include a multi-user augmented reality environment, a new personal displays (HMD), the use of computer vision to track real world items and user gestures, the realization of intuitive interaction mechanisms for multi-user AR and the integration of the approach in existing CAD and simulation software.

The multi-user AR environment developed allows multiple users to share a virtual space projected into their common working environment. While in general the participants see and interact with the same virtual objects, personal menus and individual additional information can be provided to each user.

As part of the project a new type of a high-resolution see-through head mounted display has been developed by SaabTech. Beside viewing quality (resolution, brightness, etc.), ergonomic design issues guaranteeing a comfortable use were realized. Another very important feature, essential for efficient collaboration is the ability to see other participants' eyes during a session – usually not possible with other types of displays.

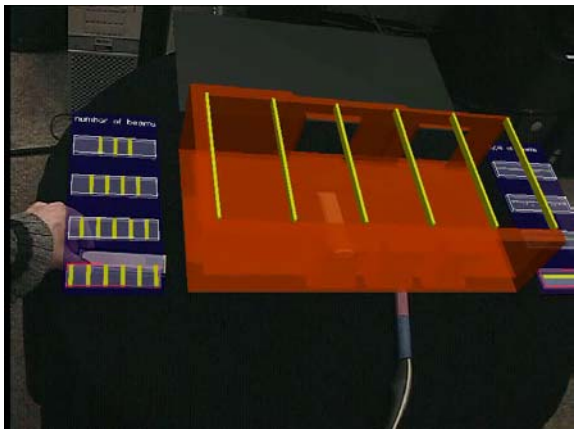

Figure 2: Real world items as tangible interfaces

Computer vision techniques using head mounted and/or fixed cameras are used to track the movements of real world items (placeholder objects, wand) and recognize gestures. Due to the computer vision based approach users can interact without any disturbing cables or sensors connected to their interface elements.

Tangible interfaces, wands (3D pointer) and gesture recognition are used for the realization of intuitive user interaction mechanisms. Users may grab a real world placeholder object, associate the item with a virtual object and thereby create a direct manipulation interface (see figure 2). Users may also select and manipulate virtual objects by a wand or use gesture input to pop-up menus, select items and execute actions.

The system allows us to easily integrate its visualization and interaction capabilities with existing professional or special purpose software. Integration with a solar gain simulation program and commercial CAD software has been realized.

3 Conclusions and Future Work

In this paper we presented the Augmented Round Table providing a new interface for collaborative design and review for architecture and urban planning. The interface relies on unobtrusive input mechanisms and natural and intuitive user interactions.

In our future work we will enhance this interface by additional multi-modal facilities and evaluate the approach by further user studies.

References

Billinghurst, M., S. Campbell, D. Hendrickson, W. Chinthammit, I. Poupyrev, K. Takahashi, H. Kato (2000), { HYPERLINK "http://www.hitl.washington.edu/magicbook/papers/MagicBookProposal.pdf" }, SIGGRAPH 2000 Emerging Technologies Proposal, ACM SIGGRAPH 2000.

Grasset, R., and Gascuel, J.-D. (2002), MARE:Multiuser Augmented Reality Environment on table setup. SIGGRAPH 2002, Conference Abstracts and Applications, Computer Graphics Annual Conference Series, p. 213.

Ishii, H., Ullmer, B. (1997), Tangible Bits: Towards Seamless Interfaces between people, Bits and Atoms. CHI'97, Atlanta, Georgia 1997.

Rauterberg, M., Fjeld, M., Krueger, H., Bichsel, M., Leonhardt, U. & Meier, M. (1997), "BUILD-IT: a video-based interaction technique of a planning tool for construction and design", in H. Miyamoto, S. Saito, M. Kajiyama & N. Koizumi (eds.) Proceedings of Work With Display Units--WWDU'97, pp. 175-176.