MARE: Multiuser Augmented Reality Environment on real table setup
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1 Introduction

Using augmented reality (AR) in collaborative situations is appealing: it combines the use of natural metaphors of communication (gesture, voice, expression), with the power of virtual ones (simulation, animation, persistent data). But few 3D AR collaborative systems are devoted to keep human’s ability (like grasping, writing). The motivation of this research is to mix together virtual reality techniques ([Schmalstieg et al. 2000]) and computer human interaction techniques ([Fjeld et al. 2002]), so to have the best of both worlds.

We decompose the table space in two parts: first, the personal area where the user put his private real objects (pen, PDA, laptop, cup) and virtual ones (private menu). The second part is the shared area, a round-the-table meeting: it allows collaborators to keep contact (unstroke approach) and the catalogue metaphor (similar to VOMAR[Kato et al. 2000]).

Adding real objects can be used to mix them with virtual mockup, to use them for game surroundings, or as “tangible user interface”. We propose two methods: if we have a CAO model, we ask the user to superpose a virtual representation of the real object to find its position. If not, we ask the user to digitalize the real object by inserting some simple geometric primitives (cube, cylinder, sphere, plane).

For multiuser sessions, we have realized an access control manager, to control personal view information (each user can have a different representation of the same object), to set permission to move or modify objects etc.

We integrated basic editing tools (move, rotate, scale, copy, delete) with a replay event manager and an help, information and annotation service (audio, video, image and wacom input). Our system can be easily used in any domain of application (users just have to customize interface and domain objects). We show some example applications: scientific application, engineering, architecture, urban planning, and game.

2 A testbed for interaction techniques

We present a completely open architecture (XML config files, opengl Performer), dedicated to the evaluation of different new interactives techniques. The system reproduces the configuration of a round-the-table meeting: it allows collaborators to keep contact with the real environment, while interacting with virtual objects. We decompose the table space in two parts: first, the personal area where the user put his private real objects (pen, PDA, laptop, cup) and virtual ones (private menu). The second part is the shared area, communication and common interactive space. In this space the user can:

- interact with virtual and real objects,
- add, remove virtual objects,
- register real objects to the system can account for them.

We present our system and some innovative solutions for these three tasks.

We introduce the concept of least intrusive devices: each user is equipped with devices, that try to keep all liberty of movement for the task in which the user is involved: navigation and interaction with virtual objects, perception and interaction with the real world. We use stereo optical see-through Head Mounted Display attached with magnetic or optical trackers. We also developed a "mixed-pen" metaphor: a pen you can write with, but also tracked with magnetic or optical trackers. We also developed a hand-attached device that can replace the "mixed-pen". Real and virtual objects are moved using the forefinger with the same drag/lift metaphor.

For adding virtual objects, we propose three methods: hierarchical virtual menus (in the private area of the user), gesture recognition (unstroke approach) and the catalogue metaphor (similar to VOMAR[Kato et al. 2000]).

References

