MRI - A Mixed Reality Interface for the Masses

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1 Introduction

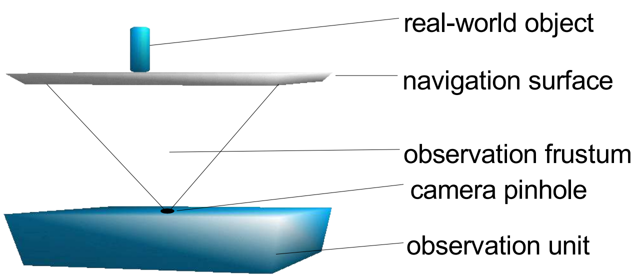
The MRI mixed reality interface provides three degrees of freedom (two coordinates and one angle) control for real-time 3D visualization applications. As opposed to commonly known control devices, the MRI does not demand any training or experience. Instead, operating it can be learned by watching other people use it. This property makes it useful for a large group of people including elderly people, small children or handicapped persons.

2 Exposition

The MRI can be deployed for controlling a large variety of applications like ....

- architectural visualization
- archaeology (e.g. augmented site visualization)
- interactive product presentations
- game based learning and training
- networked communications
- acoustics simulations
- art projects

Technically, the MRI consists of a hardware and of a software part. The hardware is a creative assembly of off-the-shelf components. The two required parts are an observation unit and a navigation surface. The observation unit contains a regular computer and a digital camera which observes the navigation surface.



A schematic of the MRI hardware components

The navigation surface is a simple glass window which is foliated with a light diffusing foil. Optionally, a case can be used for protecting the actual hardware. Since no requirements are imposed on the case it can be as sturdy as concrete or stone, thus providing the possibility to deploy the MRI as a virtually unbreakable user interface for many thousands of people a day as it would be the case at a major exhibition or in a public interactive show.

The software part is a combination of a robust pattern recognition and optical tracking algorithm and of a lightweight distributed communication layer which provides the functionality required for simultaneous net-wide interoperation of up to 16 MRI devices.

In order to realize our tracking system, a well known, template-based algorithm was significantly improved, in order to meet the MRI's high robustness demands.

The MRI's mode of operation is to move any real-world objects with labels resembling a set of special-purpose patterns attached to their bottom sides across the navigation surface. The camera observing this surface delivers the pattern images to the tracking software which, in turn, determines the position and the attitude of the observed targets. Finally, the tracking software sends the coordinate updates to the distributed communication layer which delivers these data to the controlled application via a LAN or even the Internet.

All virtual objects are controlled by moving the corresponding items on the navigation surface

The MRI's major innovation is the overall system assembly which exposes a viable solution to many problems as discussed above. Also some technical improvements have been accomplished. In particular the robustness of the tracking algorithm with respect to varying illumination situations has been significantly improved using a combination of algorithmic changes and of sophisticated hardware design. Finally, the MRI's high usability is the result of thorough design considerations as well as of a series of elaborate usability studies which were carried out during 2005 at the premises of KOMMERZ.

3 Conclusion

The MRI is a well tested and mature input device for providing control over complex 3D visualization applications to a wide variety of user groups. In particular untrained people (e.g. elderly persons or small children) as well as the handicapped gain a major improvement of their personal experience while using the MRI as compared to using commonplace input devices like joysticks, mice or keyboards.

In addition to computer graphics applications, some research has been carried out on using the MRI as a controller for interactive 3D acoustic simulations. and on the simultaneous simulation on spatial acoustics and real-time 3D graphics.