

The CAT for efficient 2D and 3D interaction as an alternative to mouse adaptations

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Abstract

We present the CAT (Control Action Table), a 6 degrees of freedom freestanding input device designed for interaction with Virtual Environments displayed on huge screens. Both isotonic and isometric sensing modes allow the user to easily and efficiently perform 3D interaction techniques. A 2D tablet fixed on the tabletop allows them to perform accurate 2D interaction techniques.

CR Categories: I.3.1 [Computer Graphics]: Hardware Architecture—Input Devices I.3.6 [Computer Graphics]: Methodologies and Techniques—Interaction Techniques H.5.2 [Information Systems]: Information Interfaces and Presentation—User Interfaces

1 Introduction

Huge screens used as collective visualization interfaces allow several co-located participants to be immersed in Virtual Environments (VE). In spite of their potential for group works, huge screens are often under-used because the users cannot easily and efficiently interact with the VE. To overcome this limitation, we have developed a new input device called the CAT (Control Action Table).

2 Physical description

The CAT is a 6 degrees of freedom (DOF) input device looking like a classical circular table, as illustrated in Figure 1. The tabletop can be infinitely rotated in space thanks to three nested rotation axes. This corresponds to an isotonic mode. Three angular sensors, located in the joints, enable to recover the orientation of the tabletop at any time. Moreover, the tabletop is equipped with a dynamometer allowing to recover the forces applied on it, in any 3D direction. This corresponds to an isometric mode. Consequently, the rotations in the VE can be controlled by directly rotating the tabletop while the translations are managed by a rate control process. Finally, a standard tablet is fixed on the tabletop to precisely recover the position of a pen.

3 Interaction techniques

Many interaction techniques can be used with the CAT to perform different interaction tasks.

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Figure 1: The CAT.

Thanks to the 6 DOF of the CAT, the users can manipulate the objects as if they were physically holding them. The similar orientation of both the tabletop and the manipulated objects provides passive haptic feedback.

The 6 DOF of the CAT can also be used to travel in the VE. In this case, the movements applied to the tabletop are mapped to the movement of the camera viewpoint, and the CAT operates as a 3D steering wheel.

Finally, the tablet of the CAT allows to perform 2D interaction techniques inside the VE. These techniques are particularly well adapted to the control of the system as well as the accurate constrained manipulation and selection of objects.

4 Conclusions

The innovative design of the CAT favours a non-constraining, effortless, and efficient interaction with VE displayed on huge screens. A first evaluation has shown that the movement trajectories performed with the CAT were coordinated and that both novice and expert users were widely satisfied by this new device. The CAT is a promising interface for many 3D interactive applications. We are currently making it available as a commercial product.

References

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