

Bare-Handed 3D Interaction

For interaction with a virtual environment, tracking bare hands is one of the favorite approaches, because it directly exploits the ease and perfection with which humans employ their hands in everyday life. In order to support immersive user experience, markerless real-time hand-tracking without the need of special initialization procedures gained a lot of interest in the last years.

Recently, we developed a novel computer vision based hand-tracking technique, which fulfils these properties and is capable of tracking up to 6 continuous degrees of freedom (DOF) of both hand poses (global positions and orientations) simultaneously and recognizing several stiff postures for each hand (published in [1]). Our system works with at least 25 frames per second with the help of 3 off-the-shelf consumer cameras (see Figure 1). To our knowledge still no superior alternative exists.

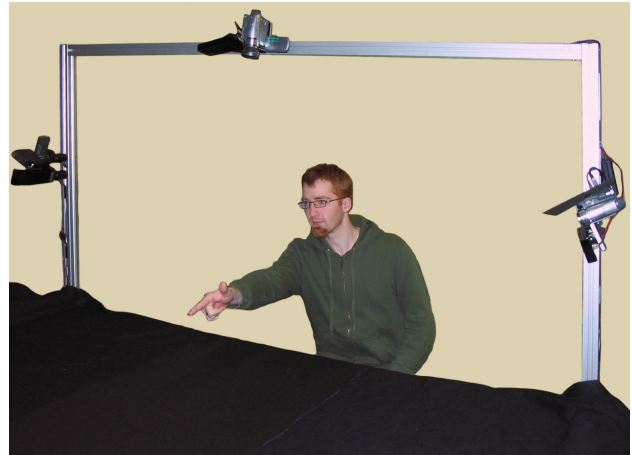


Figure 1: Our hand-tracking prototype.

While such systems enable the translation of real hand movements to virtual movements, several problems have to be solved in order to build a 3D interaction interface on top of the basic hand-tracking technology. Such an interface has to provide mechanisms for basic interaction techniques like grabbing/manipulating/releasing a virtual object and comfortably adjusting its properties (e.g. needed for demonstration and inspection). Thereby an easy to use realization of these techniques is crucial for usability and efficiency of the interface. These techniques have to be adapted to the users' capabilities and incapacities (e.g. the limited range of angle movements of the human wrist), the applications' specifications as well as the requirements and drawbacks of the used hand-tracking method.

To this end, we developed novel interaction techniques for one and two-handed manipulation of a virtual object's position and orientation enabling an intuitive inspection from every point of view (published in [2] and [3]). Moreover, we designed a new 2D mouse simulation technique (published in [2]) which allows for altering object properties in a simple way. Just recently these techniques were combined with our hand-tracking system and smoothly integrated to RTT DeltaGen; a professional tool enabling real-time visualization and editing of professional CAD/CAS datasets. In the accompanying video an example scenario of our interface is shown in action. By adopting our novel two-handed grabbing technique a 3D object can easily be inspected from any point of view. Additionally, editing of the object's properties can be performed by using an intuitive mouse mode. For capturing the video a normal TFT-monitor is used, however, in our installation we adopt a stereo projection screen to further increase the immersiveness.

References

- [1] M. Schlattmann and R. Klein. Simultaneous 4 gestures 6 DOF real-time two-hand-tracking without any markers. In ACM Symposium on Virtual Reality Software and Technology (VRST '07), 2007.
- [2] M. Schlattmann, T. Na Nakorn and R. Klein. 3D Interaction Techniques for 6 DOF Markerless Hand-Tracking. In Journal or Proceedings of WSCG (to appear), 2009.
- [3] M. Schlattmann and R. Klein. Efficient Bimanual Symmetric 3D Manipulation for Markerless Hand-Tracking. In proceedings of Virtual Reality International Conference (VRIC) (to appear), 2009.