

Calibrating Virtual Environments for Engineering Applications

ABSTRACT: A major disadvantage of some tracking systems used in virtual reality environments is the degradation in accuracy due to the presence of metals and other electromagnetic distortions in the environment. Calibration of the virtual environment to account for these distortions is essential for VR applications in engineering where correlation between the virtual environment and the physical world is important. The goal of the calibration process is to map the distorted tracker space to the physical space as accurately as possible for real-time applications.

In this paper the authors present an integrated calibration system used with an electromagnetic tracking system. The components of this system are described in detail, including data collection, grid refinement, interpolation, and evaluation. The paper describes different alternatives for measuring systematic errors of magnetic trackers in a room, and for automatically correcting them using various techniques to interpolate between sets of measurements to achieve error estimates and corrections. Several key techniques and algorithms are presented in detail and evaluated in terms of accuracy and execution time over a range of cell densities. Among the interpolation methods considered are inverse distance weighting and affine transformation mappings, as well as variations and combinations of these. The calibration system, called COVE (Calibration of Virtual Environments), has been successful in allowing accurate tracking for several engineering applications.