

Tinmith-Hand: Unified User Interface Technology for Mobile Outdoor Augmented Reality and Indoor Virtual Reality

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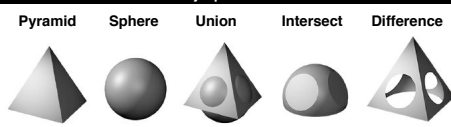
Introduction

This poster presents a unified user interface technology known as Tinmith-Hand, containing the following:

- 3D interaction techniques
- Constructive solid geometry (CSG) (fig 1)
- Glove based menuing system
- Techniques suitable for virtual reality (VR) and augmented reality (AR) environments

We use Tinmith-Hand to build complex modelling applications that can be used in indoor VR and outdoor AR environments.

#1 Constructive Solid Geometry Operations



Proposed Collaboration Application

We propose a system with multiple users:

- Outdoor mobile AR systems (fig 8) gathering real world data, providing information to those indoors
- Immersive VR systems viewing and modifying data, with experts directing the mobile unit to gather appropriate information (fig 4,5)
- Desktop based displays can render data to monitors and large data walls, proving information to large groups (fig 9)

Using Tinmith-Hand, we propose to build an application which can be used in both AR and VR environments with a single user interface. We are currently investigating a search and rescue application, requiring large scale coordination and situational awareness for mobile workers, experts, and team leaders.

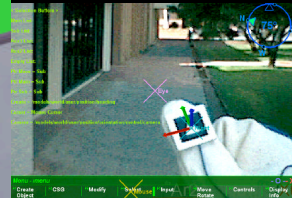
Details

The Tinmith-Hand user interface uses:

- Tracking of the head and hands to provide 3D cursors (fig 2)
- Direct manipulation and image plane techniques for the manipulation of 3D objects close up or far away
- Custom pinch gloves (fig 2,3) that are used to control a new type of menuing system
- Each menu item is mapped to a unique finger on the gloves, and the user traverses the menu using only simple pinch gestures
- The menus are not pointing based, so the user can hold their hands at whatever position is convenient, helping to reduce user fatigue

The indoor VR system (fig 4,5) uses a four sensor Polhemus FasTrak, while the outdoor mobile AR system (fig 8) uses video cameras to track hand motion, an Intersense IS-300 for head orientation, and a Trimble Ag132 GPS for position.

#2 3D AR Hand Cursor and Menu Commands



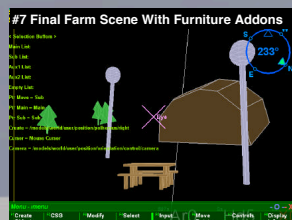
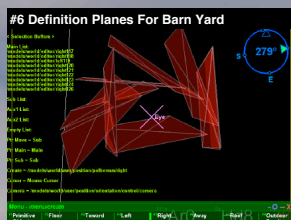
#3 Outdoor Custom Tinmith Pinch Gloves



#4 Indoor Virtual Reality Equipment



#5 Indoor Virtual Reality Equipment



Tinmith-Metro and Tinmith-VR Applications

Tinmith-Metro is an outdoor augmented reality application, allowing users to use CSG and beyond arms reach manipulation techniques to capture the geometry of real world objects. Tinmith-VR is designed to model virtual objects in the same fashion, but also with direct arms reach manipulation. Both modellers are based on the *Infinite Planes Technique*, and can create objects without prefabricated shapes. The example (fig 6,7) shows a scene which was created in the Tinmith-VR application.

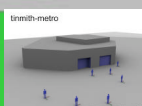
Previous AR-VR Collaboration Examples

Previously, we have demonstrated a mobile user of an AR system (fig 8) interacting with outdoor 3D entities, while another user interacts with the same entities on a 3D workstation situated indoors (fig 9). In this demonstration, multiple systems are connected together via a wireless network, and share simple position and orientation data, without manipulation or editing. We are working on extending this to support full real-time modelling between AR, VR, and desktop environments.

#8 Real Life Augmented Reality User



#9 Artificially Rendered Indoor Scene



Tinmith

More Information at <http://www.tinmith.net>

Please visit the Tinmith project web site which contains information, pictures, and video demonstrations of our AR systems in use. Please email the authors if you would like more information about the Tinmith project, or other Wearable Computer Lab research.



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