# Tinmith-evo5

# An Architecture for Supporting Mobile Augmented Reality Environments

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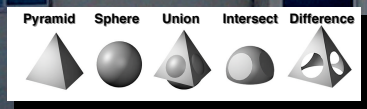
## Summary

This poster presents a new software architecture we have developed, known as Tinmith-evo5, which is designed to streamline the process of writing applications for augmented reality environments. Writing AR applications can be a complex and time consuming task, as there is little existing technology to support this process. Since AR is still in its infancy, there is no 'best practice' for writing these applications yet. We present Tinmith-evo5 as the solution we used to implement numerous complex AR applications.


#1 Overall operation - sensors are processed and rendered to the HMD




#2 Constructive solid geometry operations

## Features

The Tinmith-evo5 architecture is designed to provide a complete solution for processing information and presenting it to the user (see fig 1 and fig 3). Our architecture contains the following innovative features:

- A practical approach to writing AR and VR applications, with the focus narrowed down to allow simplicity and usefulness for the tasks required.
- An overall framework for the construction of applications, describing many levels in the design and implementation (see fig 4) and a complete solution for building VEs.
- Useful high level components, such as a renderer, scene graph (fig 7), CSG modelling engine (see fig 2), user interface menus (fig 6), tracker abstractions, and other software form an integral part of the design. These components are tightly integrated with the rest of the system to perform highly complex tasks which could not be done if designed individually.
- The architecture is designed to be modified and extended easily to support our research work in areas such as user interaction techniques. Using Tinmith-evo5, it is possible to easily build highly complex VE applications, as shown in figures 5 - 9.

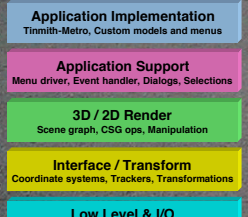

#3 Flow of data through the Tinmith-evo5 system

## Implementation

The applications written with the software run on conventional laptop computers, and integrate with a wide variety of input hardware, such as: the Trimble Ag132 GPS, IS-300 head tracker, custom built pinch gloves, and 3D vision tracking of the hands (fig 5 and fig 6). The scene graph (fig 7) manages the transformations of these devices so they all operate in the proper coordinate systems, allowing complex motions to be calculated easily. Traditional controls such as keyboards, mice, and desktop 2D GUI toolkits cannot be used. As a result of this, new natural user interface techniques based on the 3D data glove were developed to control the system.

## Usage and Applications

We demonstrate our architecture using the Tinmith-Metro application, which allows the user to interactively capture models of outdoor physical structures. Figures 5 – 9 show the application being used in a real world environment. Traditionally, surveyors use methods such as desktop CAD, laser scanning, or cameras to capture buildings, which has problems with objects that partially hide the object. Using our novel infinite planes technique built on Tinmith-evo5, it is possible for a human to enter in complex models and also place down prefabricated street furniture quickly and easily.




#4 Library layering structure

## Potential Uses

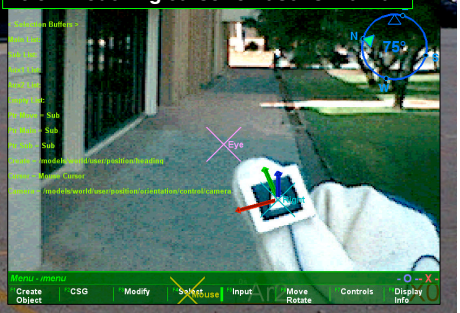
Our outdoor AR systems allow levels of interaction previously unseen, due to the technical capabilities of Tinmith-evo5. Our applications have a wide range of potential uses in areas such as search and rescue, surveying, and GIS visualisation.

## For More Information

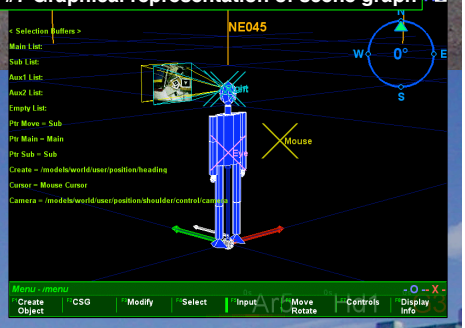
Please visit the web site http://www.tinmith.net, it contains information, pictures, and video demonstrations of our AR systems in use. Please email any questions to the authors at wayne@tinmith.net or bruce@tinmith.net

#5 HMD with camera and data gloves

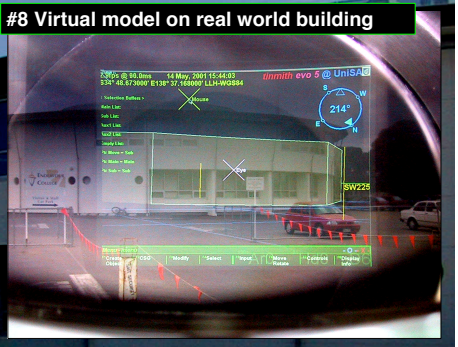
#6 3D modelling cursor on user's thumb



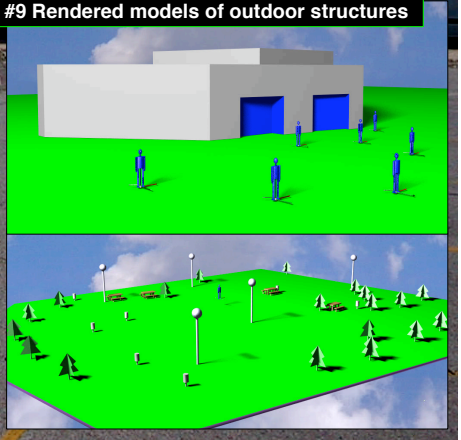
#7 Graphical representation of scene graph




#8 Virtual model on real world building



#9 Rendered models of outdoor structures



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