

# 3D Annotations in Immersive Environments

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The objective of the project is to create a 3D Annotation System for Immersive Environments without concurrent tele-cooperation capabilities and which also might be used in a standard computer. The projected is developed for fulfill the need of such system at the facilities of the Institut Image and at the COLIVRI Laboratory at the Universidad de los Andes; without being restricted to these two contexts.

The final solution must be capable of performing this task in models of a variety of 3D formats, associating with each annotation its type and urgency to be managed. On the other hand the system must meet the ever-present needs of flexibility, performance and specially usability.

## Motivation and Goals

The root of the problem is the inherent complexity of 3D models. The need to reduce these inherent complexity and expand the models through the use of textual information is the primary concern that gave light to this project. Textual information of a general kind would serve to cast clarity and allow a deeper understanding of the modeled scene. In general, to work well in the collaborative research and learning contexts, immersive virtual 3D spaces must include intuitive content creation and annotation tools.

The goal of the project is to solve this fundamental need in a very specific context: the immersive facilities available at the Institut Image.

## Process and Methodology

The project took nearly 20 weeks, including training and preparation in technologies which haven't been used before by the author. During these 20 weeks, a weekly report of the progress was sent to the project advisor, José Tiberio Hernandez Ph.D at the Universidad de los Andes.

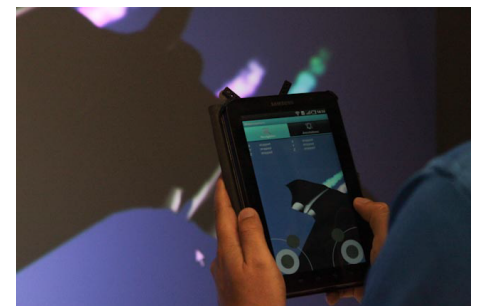
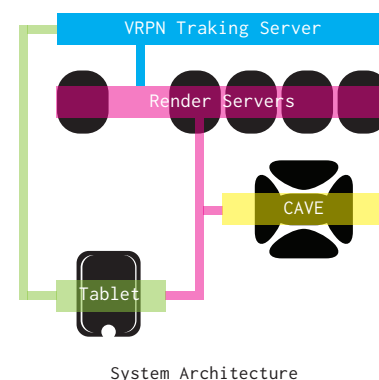
The methodology followed was centered in iterations and prototypes. Nevertheless, given the inexperience of the author in the majority of the tools used to develop the project, only three iterations were made. The first iteration featured a PC prototype of the system fulfilling the basic requisites of the system. The second iteration featured the application workflow and the last iteration delivered full functionality in the contexts expected.

## Implementation

The implementation was made using C++ as the core language and supported upon the OpenScenGraph framework. The communication between devices was made using VRPN. An Android powered tablet was used as the main front-end interaction device in the immersive scenario, thus Java was the language used to develop this part of the project. Given that the OS of the immersive system available at the institute was Windows XP, Visual C++ and Eclipse were used as IDEs during the implementation. Given the need of persistence in the progress made in a model and the potentiality of interaction with third party applications XML was selected as the format to save the annotations.

## Design

The design of the application features a three layer architecture, as seen below. The principal concerns taken into account were the flexibility of the system, usability of the system and its efficiency to deal with high demanding scenes. For these reasons the system features a tablet as the single front-end interaction interface.



The Window Metaphor

The tablet is tracked inside the cave using IR cameras and passive markers to work within a photographic camera metaphor to select the objects of interest when annotating the scene.

The standard interactions methods for immersive environments, like tracking gloves and flysticks, proved highly unusable. So a new interaction metaphor was developed based on the capabilities provided by the tablet. This is called The Window Metaphor and consists on showing on the tablet screen the rendered scene as if the tablet were simply a window or blank frame, a variation of this metaphor, the camera metaphor changes the frustum of the rendered image to make the system more usable.

## Results and Conclusions

The project was delivered within the expected schedule. It was validated by Frédéric Merienne and Sébastien Gerin at the facilities of the Institut Image. Even when it was needed to reduce the scope of the functionality of the application, the project features a complete, highly usable solution for the needs it was addressed. Future work on the same line might be focused on automatizing the synchronization of the annotations to be used by teams in separate geographic locations. The responsivity and adequate calibration of the window metaphor is also prone to improvement.