

SEP

Design of a 3D Viewer for DWARF



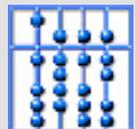
Augmented Reality Collaborative Home Improvement Environment

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Betreuer: Dipl.-Inform. Christian Sandor

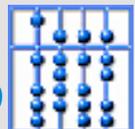
Vortragender: Otmar Hilliges

April 20, 2004



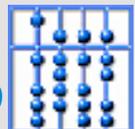
Summary

- Part of ARCHIE project.
- Evaluation of different 3D description standards.
- Design and implementation of a 3D viewer component for DWARF.
- Integration into the ARCHIE application.



Outline

- Introduction
- Requirements Analysis
- Related Work
- Implementation
- Performance
- Future Work



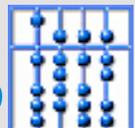
Introduction: Problem Statement

Why is a new Viewer needed?

- Available solutions are “only” browsers.
- Most browsers have been designed for desktop or VR applications.
- Non of the browsers is available for all platforms.
- Different standards for each browser.

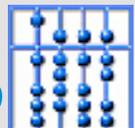
What do we need ?

- Cross-platform Solution.
- Viewing AND Interaction.
- Well defined Interface.
- Different Stereo modes for various displays.



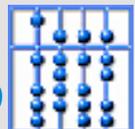
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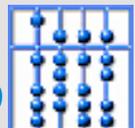
RA: Functional Requirements (I)

- File import: VRML97 / VRML2.0, Open Inventor.
- Realtime rendering of the scene in different modes:
 - Anaglyphic stereo.
 - Line interleaved stereo.
 - Video background.



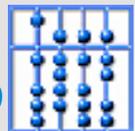
RA: Functional Requirements (II)

- Add/Remove objects from the scene.
- Control objects in the scene (using tracking devices).
- HUD style overlay graphics.
- Calibration of virtual camera.



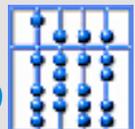
RA: Nonfunctional Requirements

- Fast Rendering for smooth visual impression.
- Lightweight.



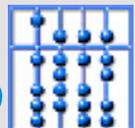
RA: Pseudo Requirements

- Integration into the DWARF environment and UI architecture.



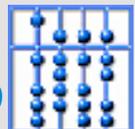
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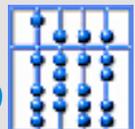
Related Work: 3D Specifications

	Java 3D	VRML	OpenSG	Avalon	Coin3D
Open source	yes	yes	yes	yes	yes
Abstraction Level	medium	high	low	high	high
Threadsafe rendering	yes	no	yes	yes	yes
Threadsafe SG manipulation	yes	no	yes	yes	limited
Authoring Tools	VRML import	yes	VRML import	no	yes



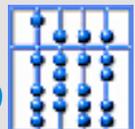
Related Work: Studierstube

- Studierstube AR project based on OIV
 - Video background.
 - Stereo modes.
 - Control of objects.
 - Self-contained system.
 - Problems with dynamics.



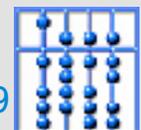
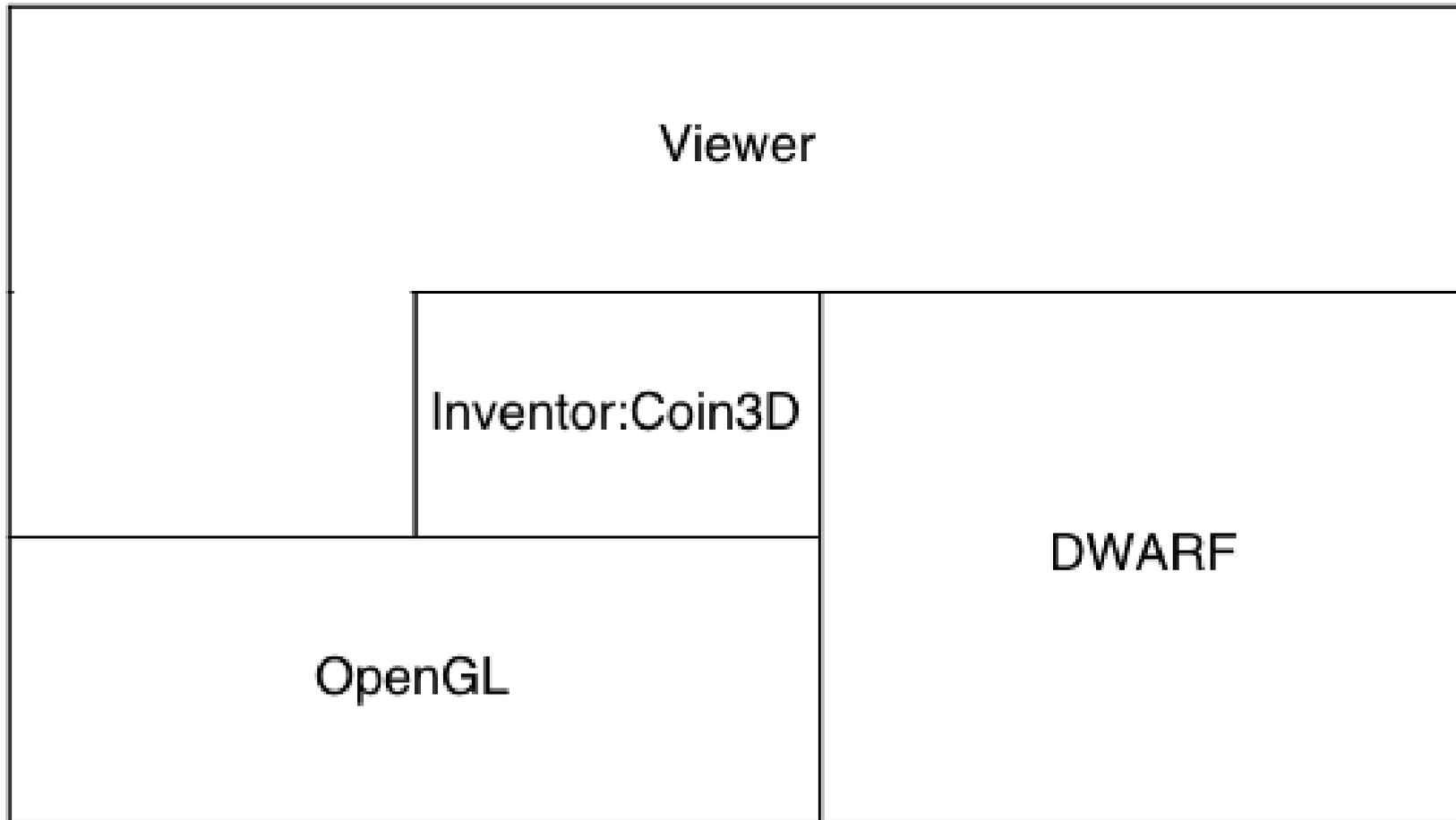
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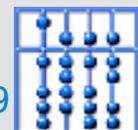
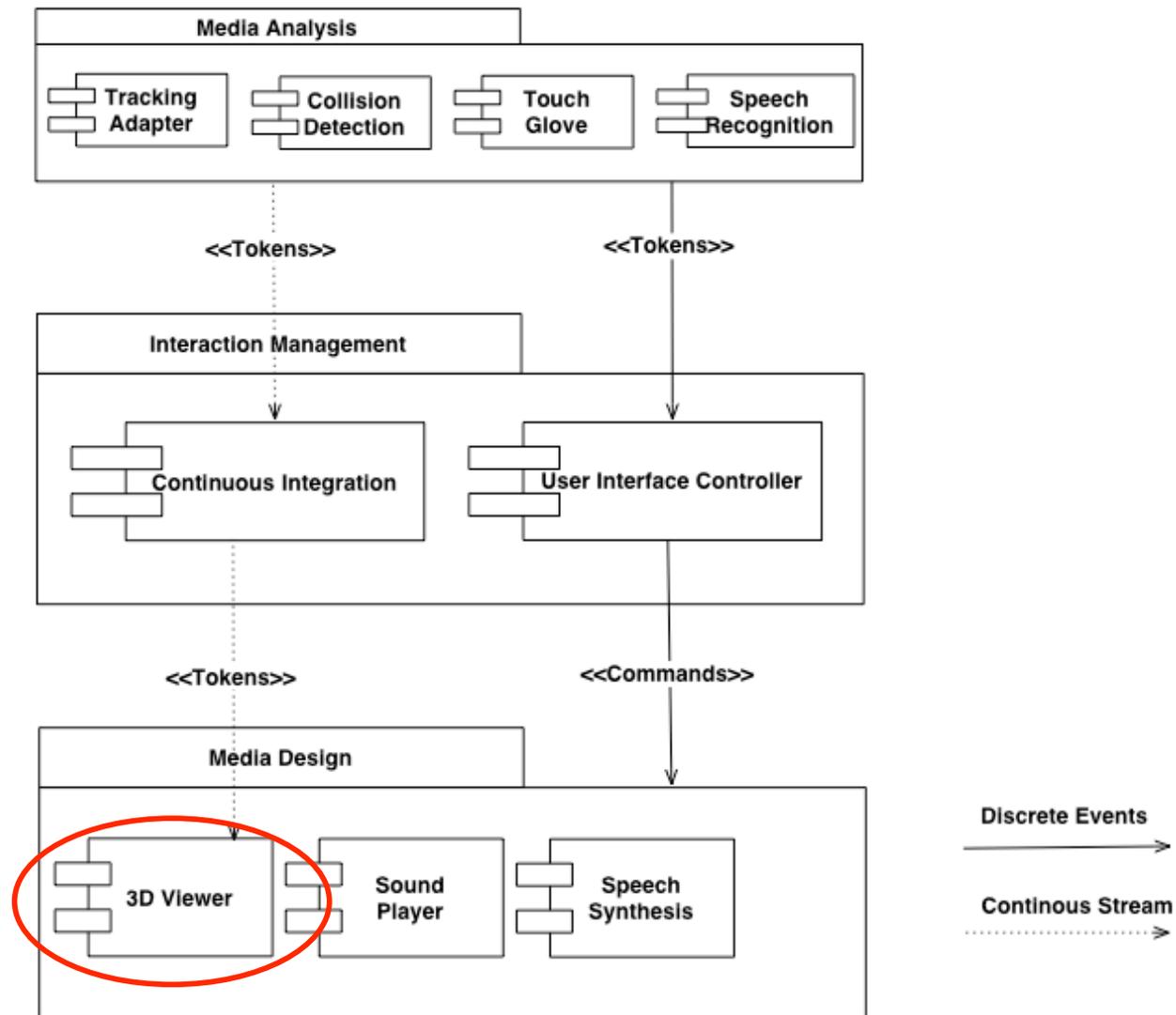


Implementation (I)

- Layering

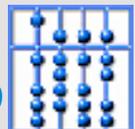
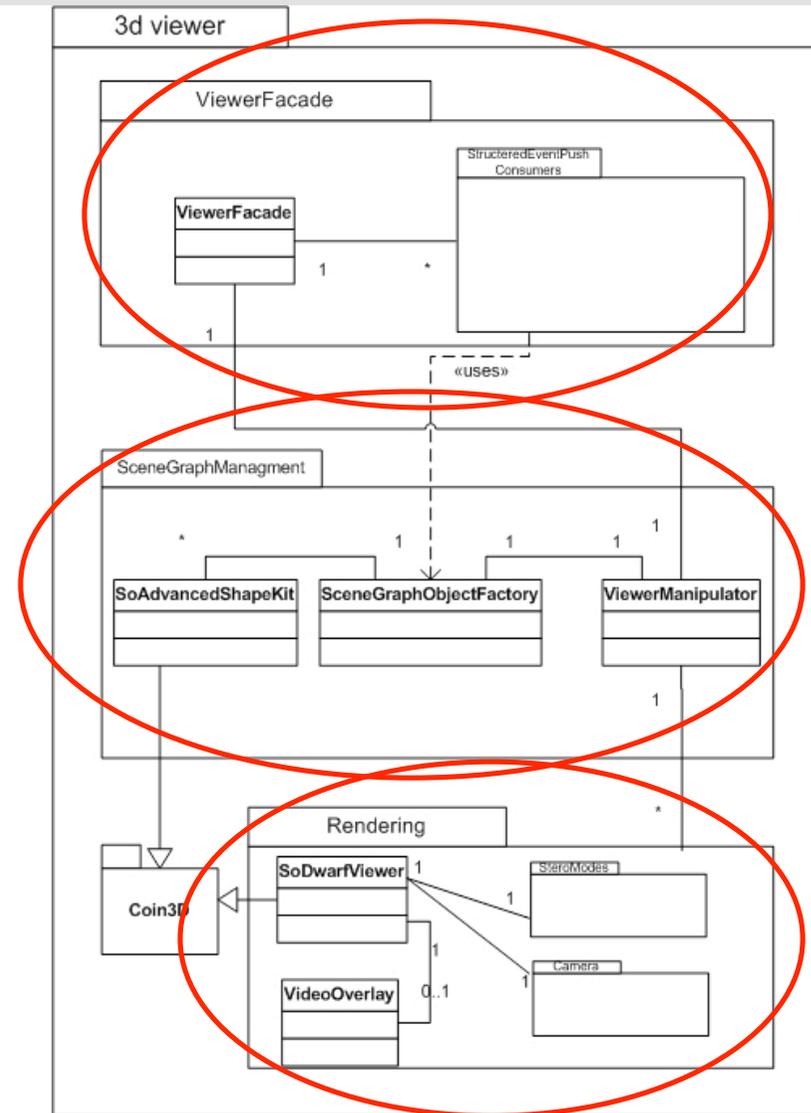


Impl. (II): Integration with DWARF UI architecture



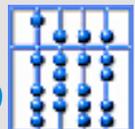
Impl. (III): Packages

- Viewer component consists of three main packages:
 - Communication and event processing.
 - Scenegraph Management.
 - Rendering.



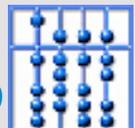
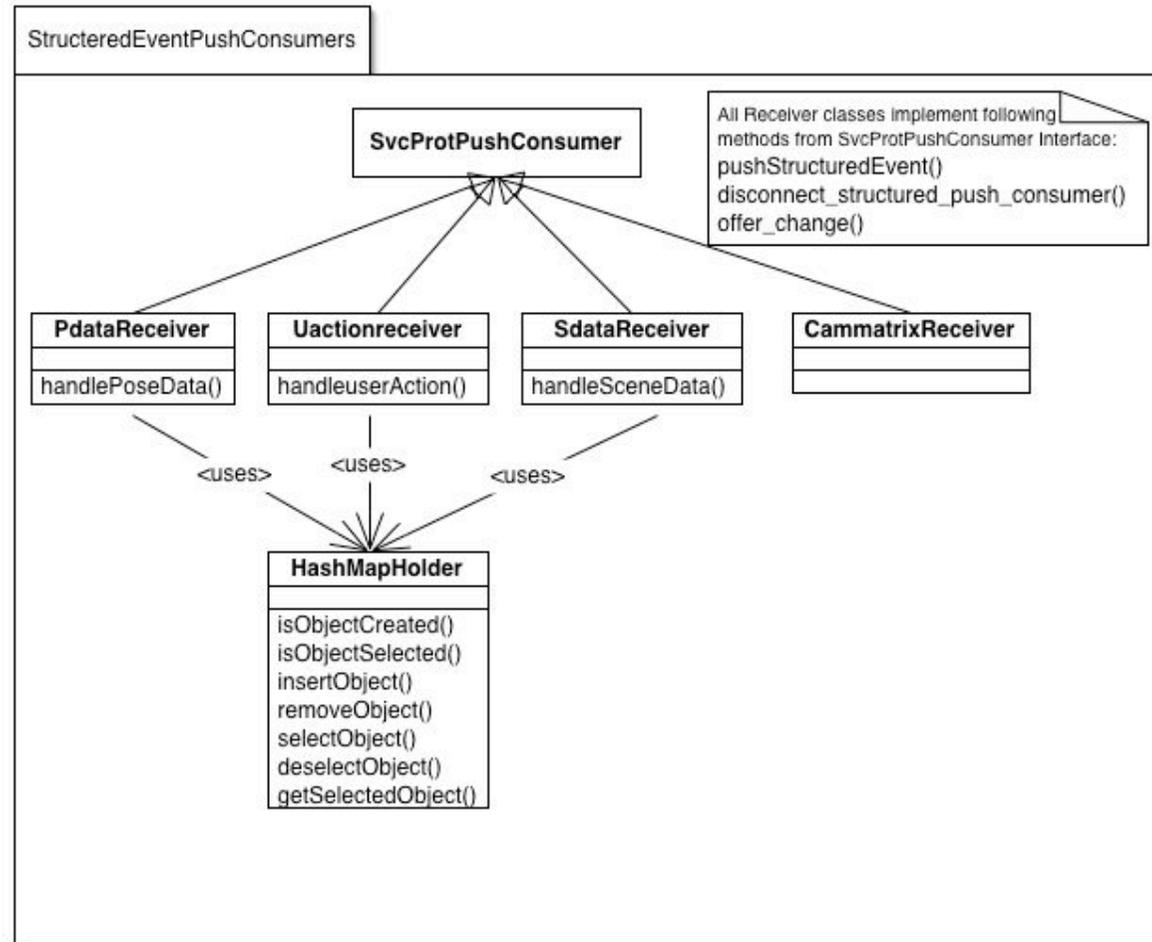
Implementation (IV)

- Typical Tasks:
 1. Load initial scene
 2. Add objects to scene
 3. Add overlay (HUD-style)
 4. Remove objects
 5. Connect objects to trackers
 6. Disconnect objects from trackers
 7. Move Objects in space
 8. Calibrate Cameras
- All tasks are realized with four DWARF events:
 - SceneData: 1-4
 - UserAction: 5-6
 - PoseData: 7
 - CamMatrix: 8



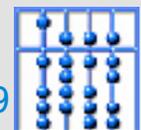
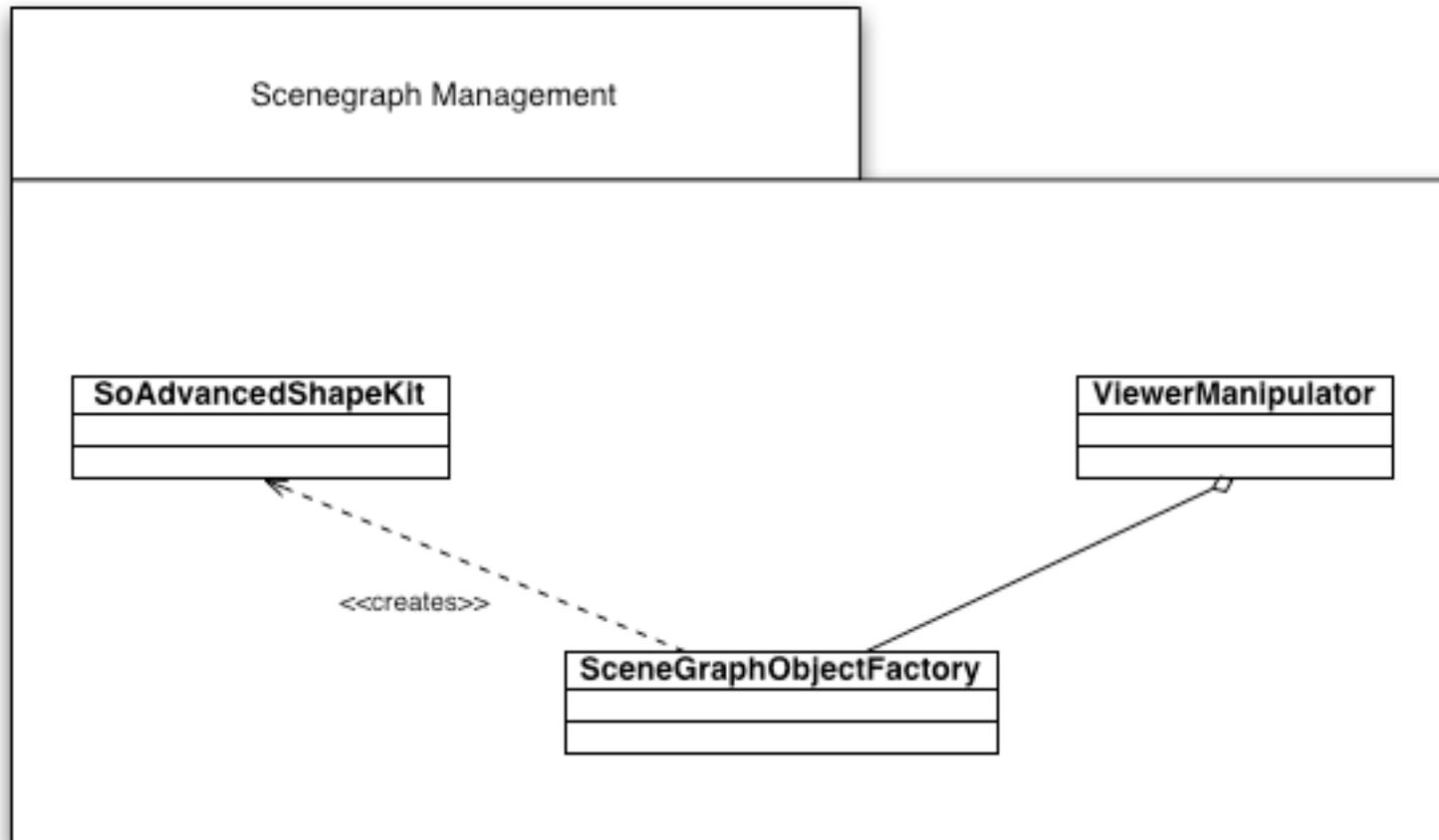
Implementation (V)

- Communication and event processing.



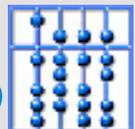
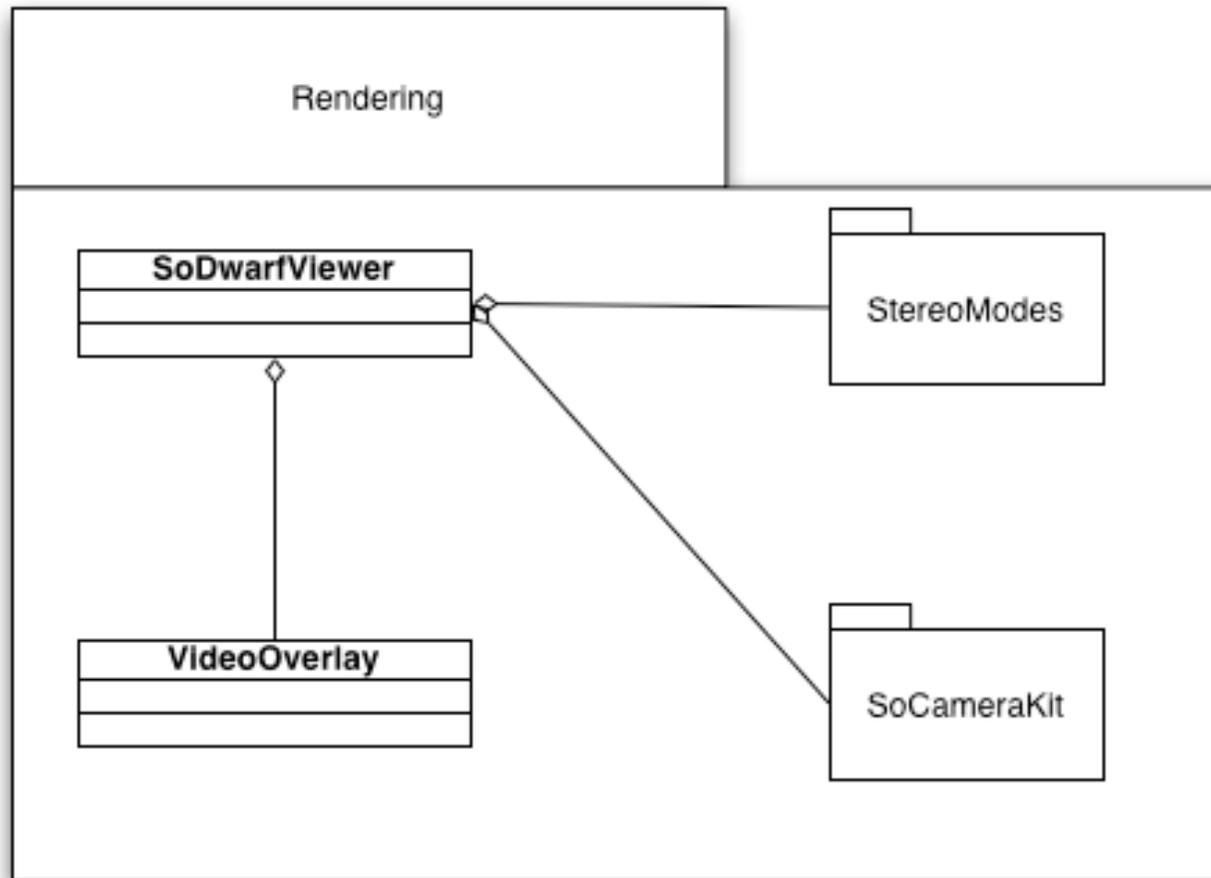
Implementation (VI)

- Scenegraph management.

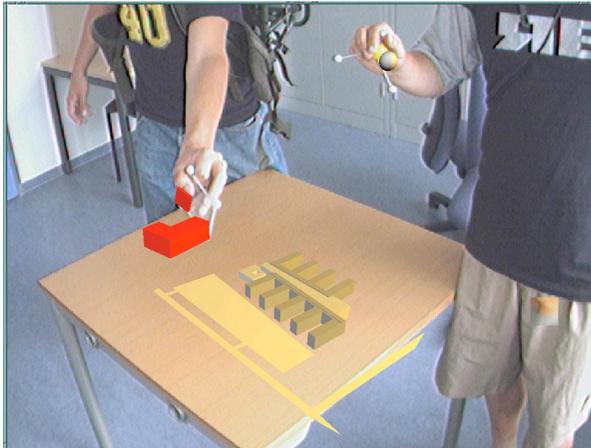


Implementation (VII)

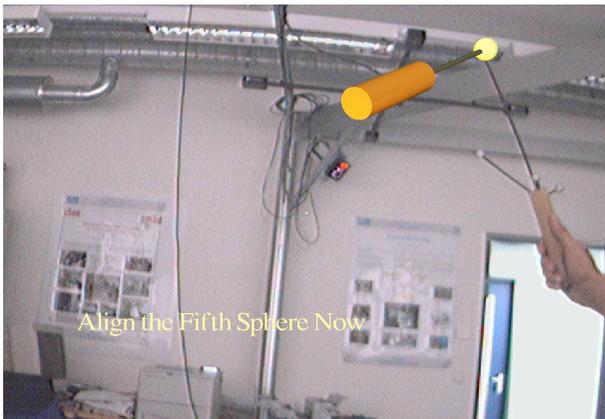
- Rendering.



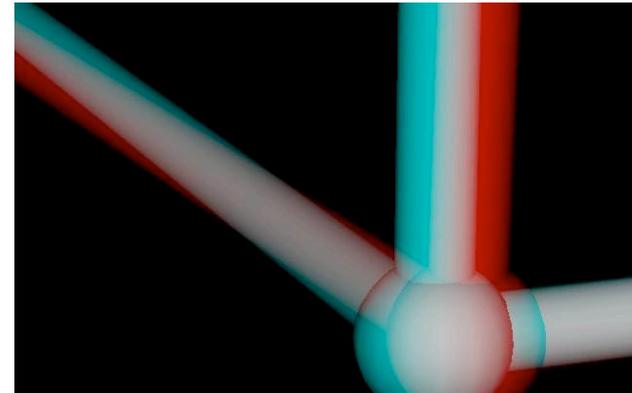
Implementation (VIII): Examples



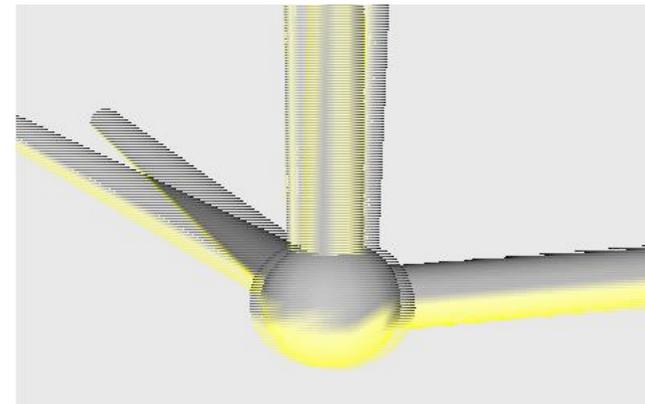
Video see-through



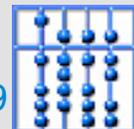
HUD-style overlay



Anaglyphic stereo

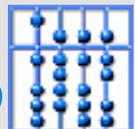


Line-interleaved stereo



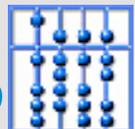
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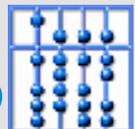
Performance (I): Setup

- Two Tests have been conducted, displaying the SHEEP landscape and as many Sheep as possible.
 - In test one each sheep has sent out its position with 2 Hz (20 Sheep max).
 - In test two each sheep has sent out its position with 10 Hz to let them move smoothly (15 Sheep max).
- Pentium IV 2.5 Ghz Laptop, ATI Radeon graphics card, 512 MB RAM.

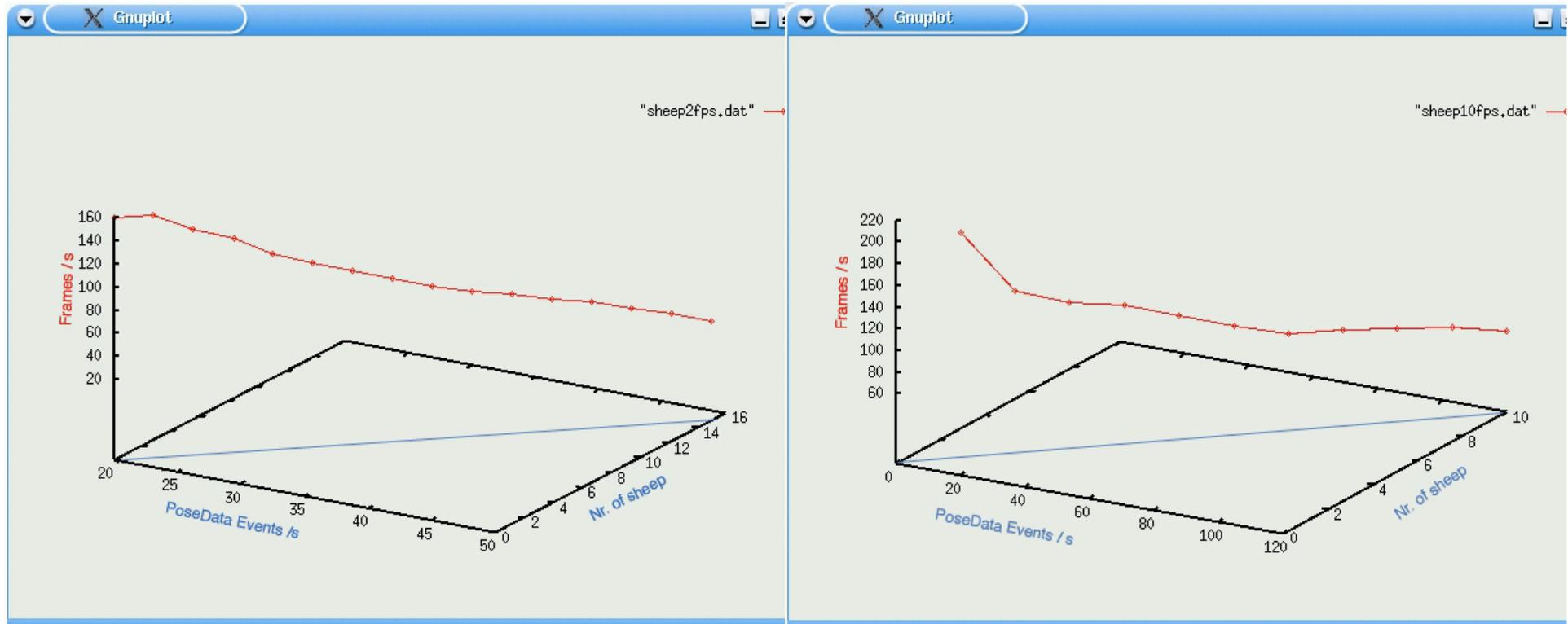


Performance (II): Results

- In both setups the framerate never dropped 25 Fps.
- Viewer component can handle lesser connections with higher update rate better.
- Performance is adequate compared to the capabilities of the DWARF environment.

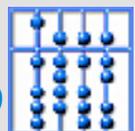


Performance (III): Results



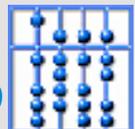
2Hz Update, 20 Sheep, Max FPS: 220, Min FPS 36

10 Hz Update, 15 Sheep, Max FPS: 220, Min FPS 71



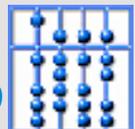
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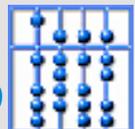
Future Work

- Refine Interface for more control over granularity and more flexibility.
- Add more rendering modes
 - Additional stereo modes.
 - Stereo video support.
 - Video on arbitrary SG objects.
 - Off axis rendering.
- Include view management (labeling).



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- Problems
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Questions

Any Questions ?

