

instantreality

Industrial Applications developed within the Mixed Reality Framework



Dr. Uli Bockholt

Virtual and Augmented Reality

ISMAR 2008

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Fraunhofer

Institut
Graphische
Datenverarbeitung



TECHNISCHE
UNIVERSITÄT
DARMSTADT



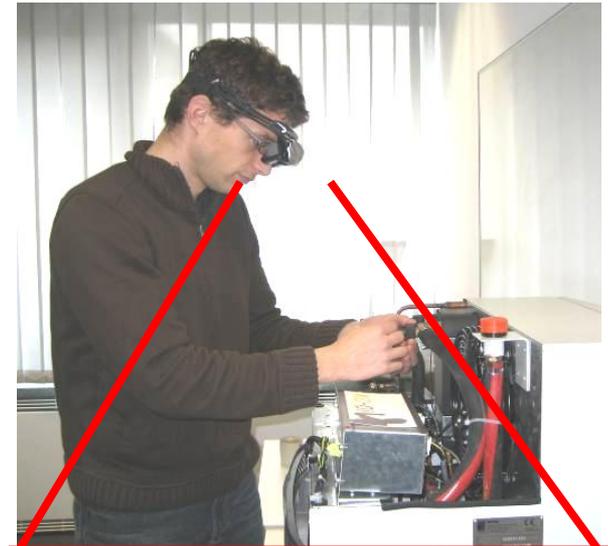
Synopsis

Industrial Applications developed within the Mixed Reality Framework



Outline

- Requirements in Industrial Projects
- Robust and Markerless Tracking
- Augmented Reality on Embedded Systems
- Fusion of CV and CG
- Application Scenarios
- Instant Reality Mixed Reality Framework
- Future Work



Industrial Projects @ IGD VR & AR



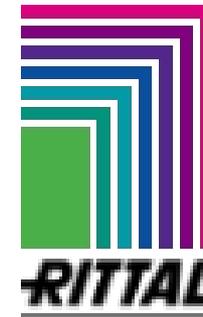
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Direct Industrial funded Projects in AR at IGD in 2008

- Howaldtswerke Deutsche Werft AG
 - Daimler Chrysler
 - Rittal
 - EADS
 - Coperion Group GmbH
 - Messe Frankfurt GmbH
 - Dolmar GmbH
-
- Cooperation in public funded projects
 - AVILUS+
 - SKILLS



DAIMLER



Requirements in Industrial Projects

- Robust & Markerless Tracking
 - Edge Model
 - Poster Tracking
 - 3D-Reconstruction
- Augmented Reality on Mobile Systems
 - Scalability
 - Embedded Rendering
 - PDA, UMPC, iPhone
- Use of Standards
 - Compatibility to CAE-Systems
 - Integratability into industrial Workflows
 - Covering of the complete Mixed Reality





Robust and Markerless Tracking

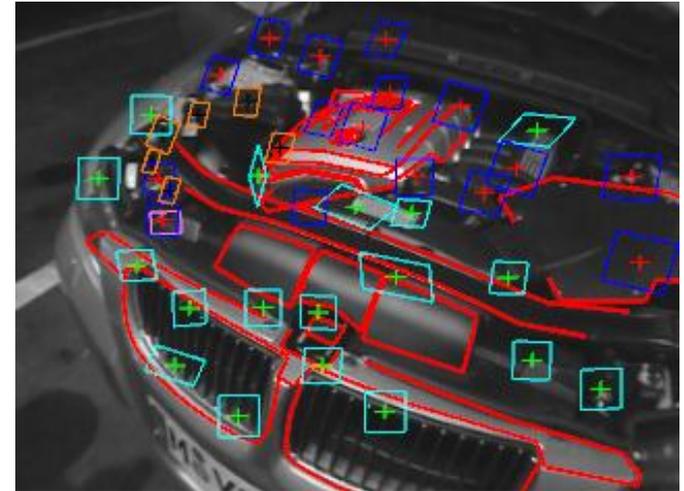
Robust and Markerless Tracking

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Robust and Markerless Tracking

- Initialisation
 - Edge Model
 - Poster Tracking
 - 3D-Reconstruction
- Frame-to-Frame Tracking
 - KLT
 - Edge Model
 - Poster Tracking
- Hybrid sensory
 - Inertial Sensor & CV based Tracking
 - TOF & CV based Tracking



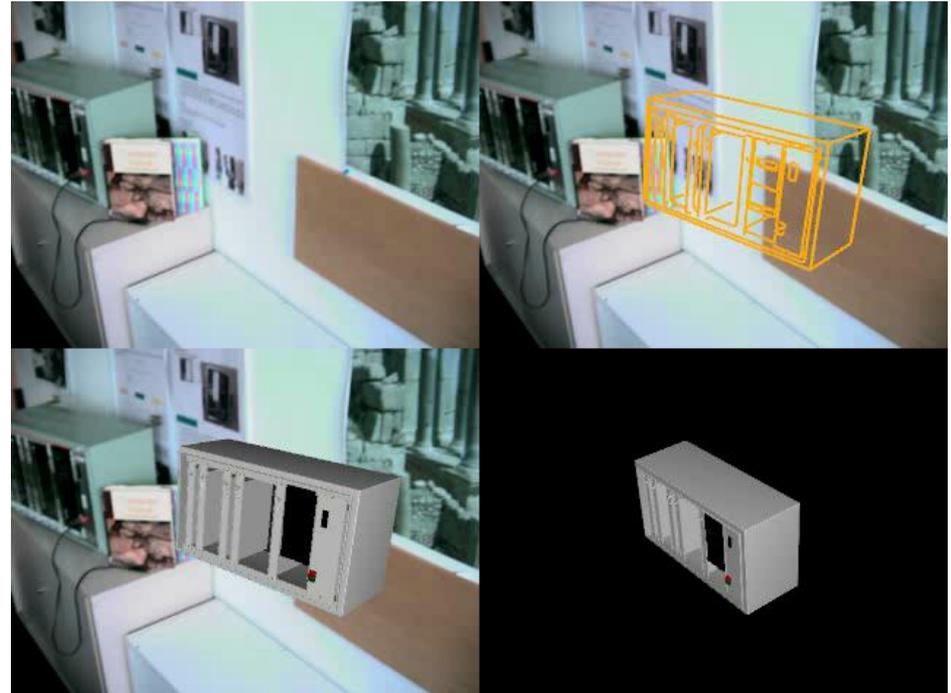
Robust and Markerless Tracking

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Initialisation of the Tracking

- Line Model
 - Line model is brought near to the real object
 - Automatic and precise registration
 - No key frames
 - No learning phase



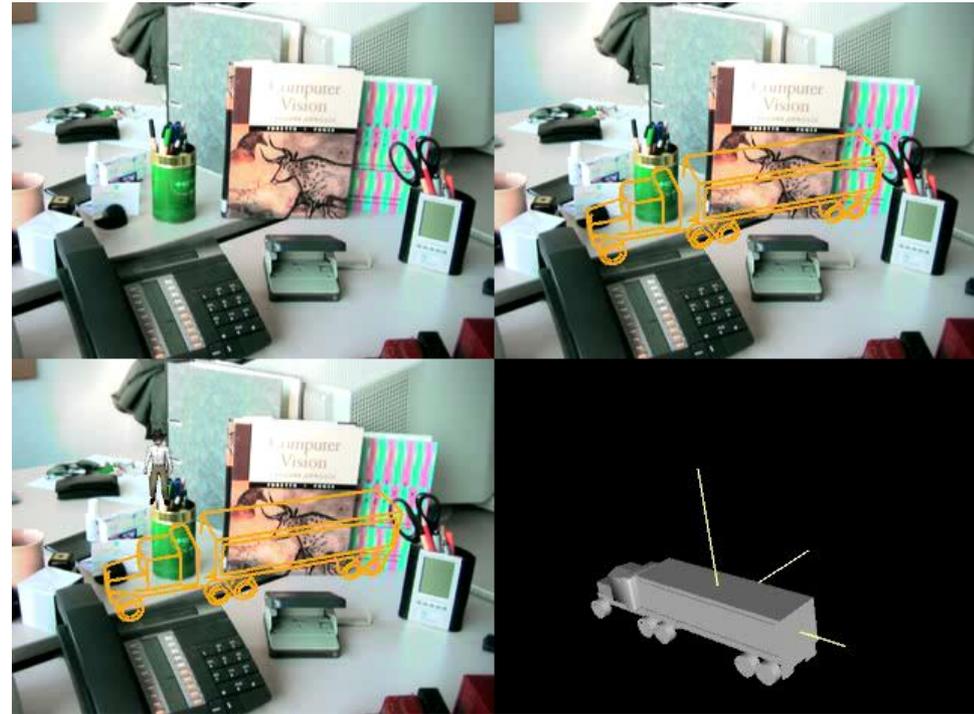
Robust and Markerless Tracking

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Frame-To-Frame Tracking

- Point tracking
 - Extraction of new points
 - Pose computation with known 2D/3D correspondences
 - Estimation or refinement of the 3D coordinates
- 3D-Reconstruction
 - Iterative refinement
 - Computation of the uncertainty (covariance)
 - Refinement with each new frame



Robust and Markerless Tracking

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Hybrid Sensor Technology

- Combination of CV & Inertial Sensors
 - Alignment with full textured 3D-modell
 - Rendering of hypothesis based on camera pose extrapolation
 - Registration of captured camera frame and rendered hypothesis
- Combination of CV & ToF camera
 - Measurement of depths information
 - Iterative Closest Point Matching



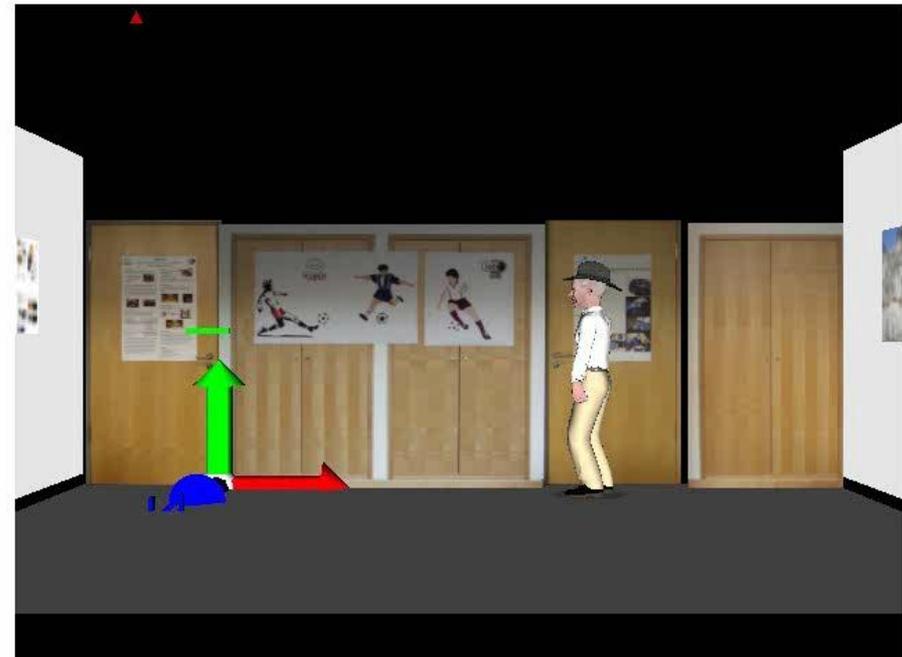
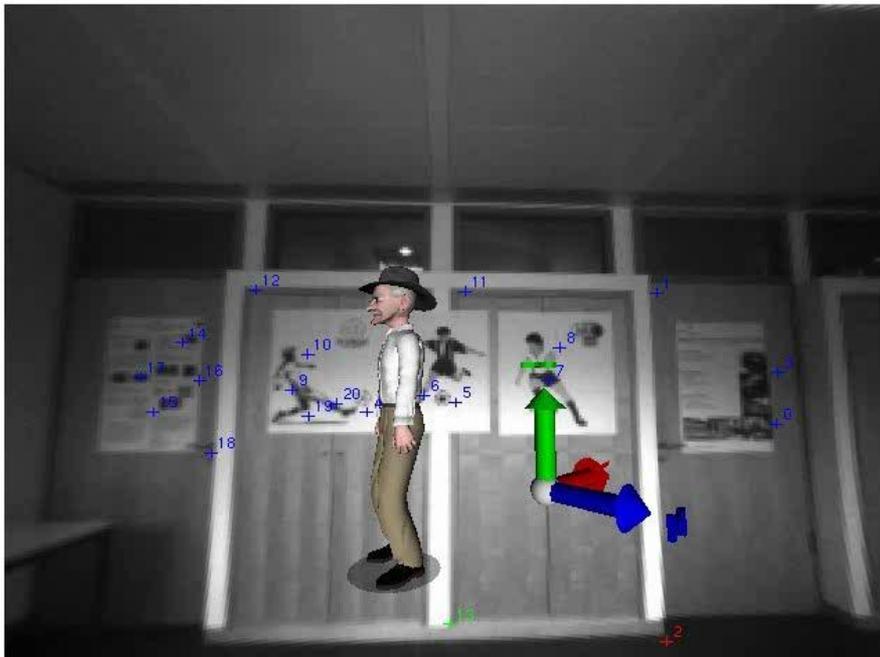
Robust and Markerless Tracking

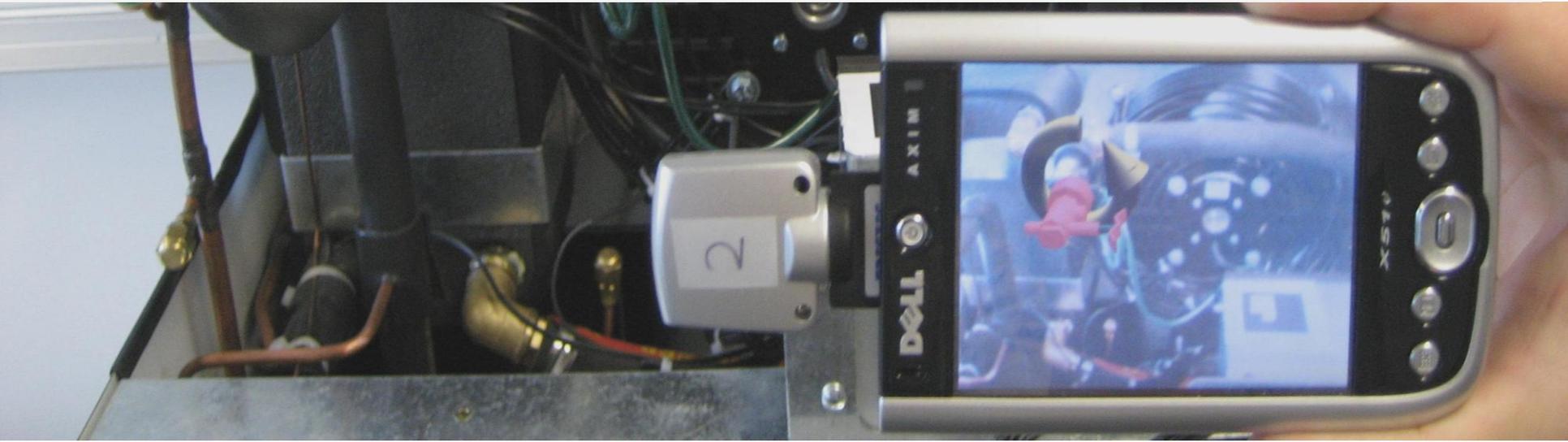
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Results Hybrid Sensor Technology

- Combination of CV & Inertial Sensors





Augmented Reality on Embedded Systems

Augmented Reality on Embedded Systems

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Downscaled Augmented Reality

- Embedded Rendering
 - OpenSG ES
(www.opensg.org)
 - InstantMini
(www.instantreality.org)
- Embedded Tracking
 - Snapshot AR
 - 3D-Animation
 - Markerbased Tracking



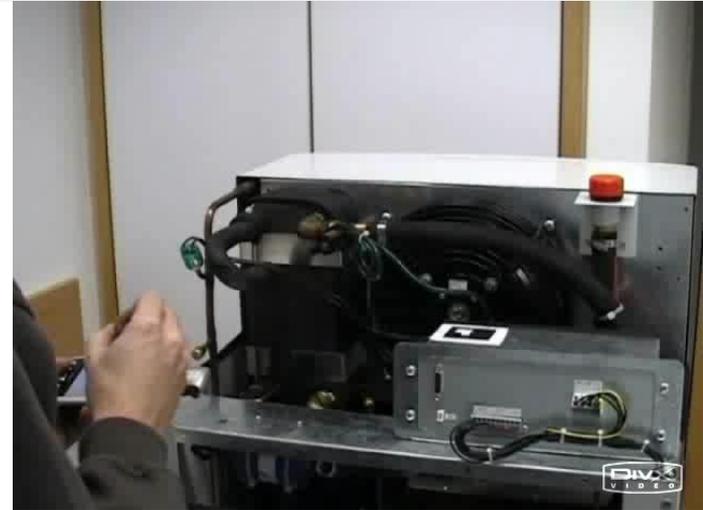
Augmented Reality on Embedded Systems

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Remote Expert Scenario

- Distributed Mixed Reality
 - Video Streaming
 - Distributed Scribbling Tool
- HMD
 - Trivisio
 - Monocal
 - Semitransparent



Augmented Reality on Embedded Systems

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UMPC

- Markerless Tracking
 - Distributed Mixed Reality
 - Video Streaming
 - Distributed Scribbling Tool
 - Complete AR System
- HMD
 - Fraunhofer Alliance
 - Optical See Through
 - Oled
 - Bidirectional
 - Camera Cells for Eye Tracking



Augmented Reality on Embedded Systems

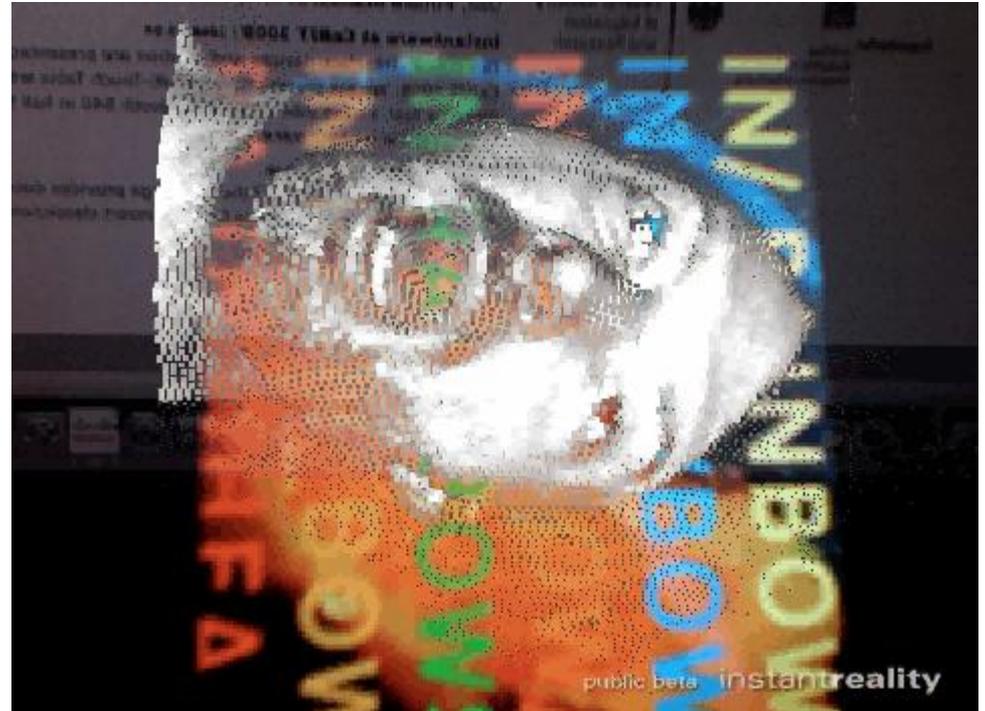
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Apple iPhone

Rendering

- Open SG ES
- Instant Mini
- Flexible Marker
 - Radiohead Laserscan
 - AR Prototyping





Fusion of Computer Graphics and Computer Vision

Fusion of CV and CG

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High Quality Rendering in AR

- PRT Rendering
- Capturing of Illumination Environment using a Fisheye Camera
- Realtime Simulation of Illumination
- High Quality Rendering in AR
- Architecture, Interior Design



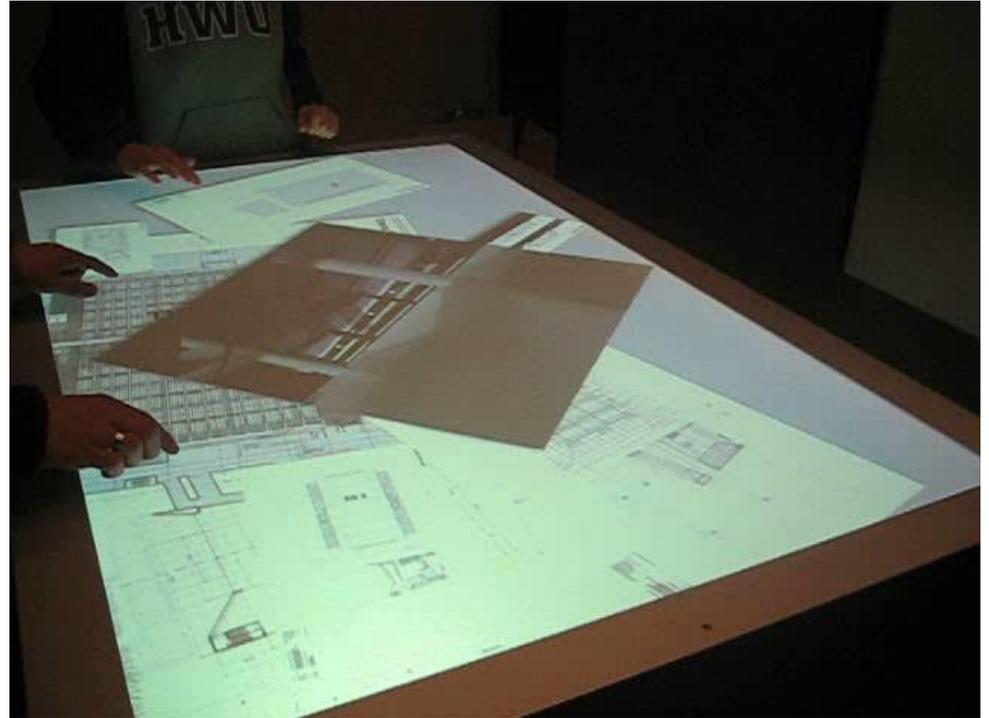
Fusion of CV and CG

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CV for Tracking in VE

- Multi-Touch-Table
- Architecture
- Navigate with your fingers on the map
- Messe Frankfurt GmbH
- Coperion





Standardisation

There is no Standard for VR/AR applications and runtime

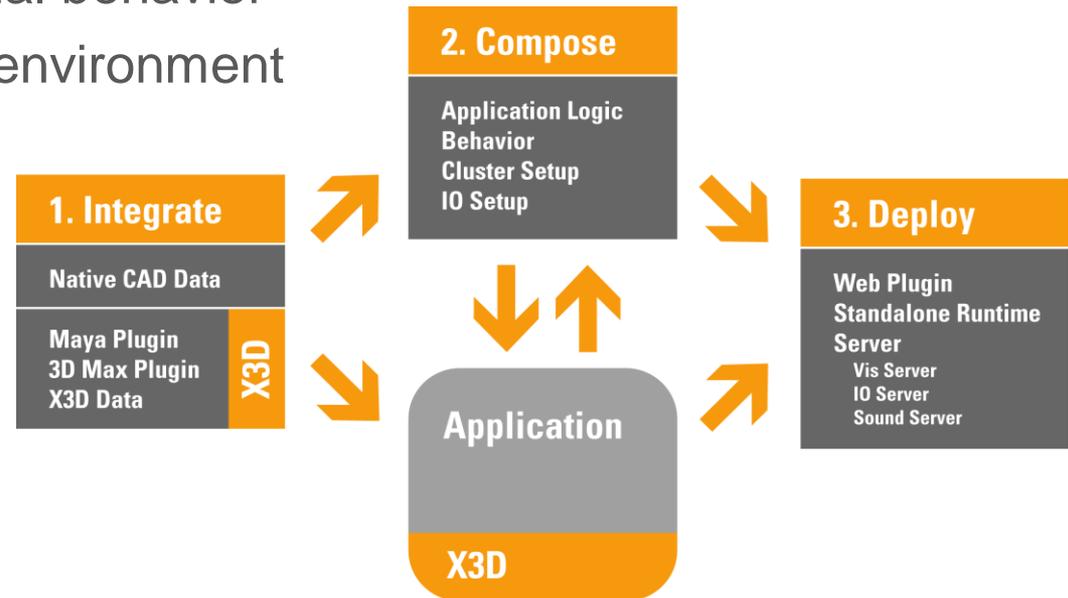
Standardisation

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X3D ISO Standard

- describes abstract functional behavior
- time-based interactive 3D environment
- Multi-parent Scenegraph
- Behavior-graph
- Runtime System
- IO Device Independent
- High level interaction
- Portable
- Xml/classic/binary encodings



Standardisation

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Resources

www.instantreality.org

- Beta5 release
- 30 Device Handler
- Distributed Rendering
- IO-Handler-SDK
- Windows/Mac/Linux

www.opensg.org

- LGPL source
- Rendering

A screenshot of the instantreality website. The header features the 'instantreality' logo with the tagline 'links today's standards to tomorrow's technologies' and a 'beta' badge. A navigation bar includes links for 'story', 'exhibition', 'documentation', 'contact', 'downloads', and 'forum'. The main content area displays a virtual rendering of a cathedral interior, with a 'download publicbeta 1' button and another 'beta' badge. To the right of the image, there is a section titled 'instantreality - advanced mixed reality technology' followed by a paragraph describing the framework. Below this, there are sections for 'News', 'Tutorials', 'OpenSearch Plugin for Nodetypes', 'instantplayer beta1: The all-OS release', and 'Updated Test Files', each with a date and a brief description of the update.

Application Scenarios

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AR Maintenance

- Support for Service Technician
- Visual Guidance
- 3D-Animations
- Authoring Tool



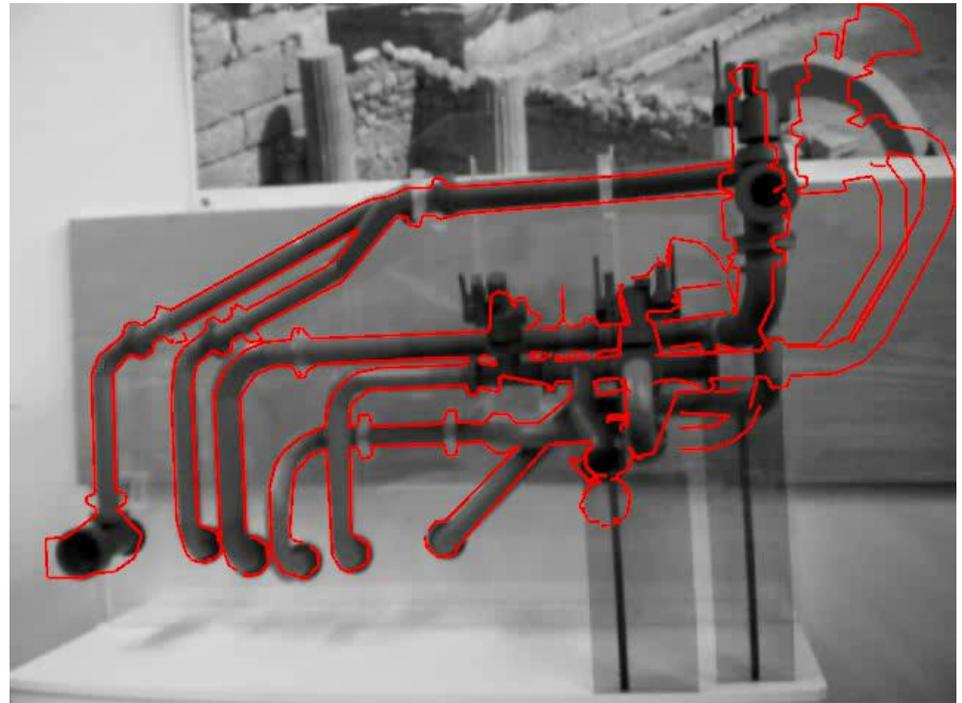
Application Scenarios

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Comparison of Planning and Reality

- Visualisation of Geometry Differences
- Inclusion of Simulation Data into real Environments
- Verification of CAD Models
- Planning of Pipes



Future Work



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Future Work

- Avilus+
- Tracking with minimal Scene Knowledge
- Fusion of different Sensors
- Tracking of Actions
- Capturing of Skills



THANK



YOU !

www.instantreality.org