

Mixed Reality Training Application for an Oil Refinery: User Requirements

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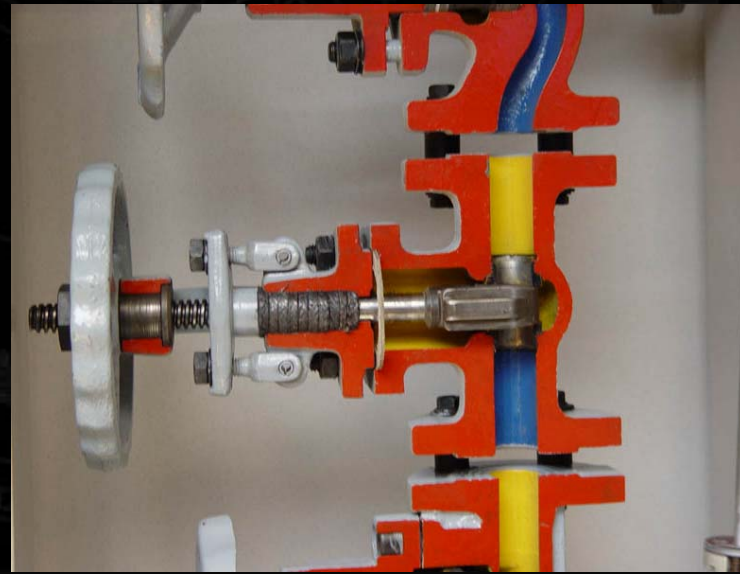
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FINLAND

Outline of the presentation

- Background & Goal
- AMIRE project
- Methods and implementation
- Results
- Conclusions & Future work

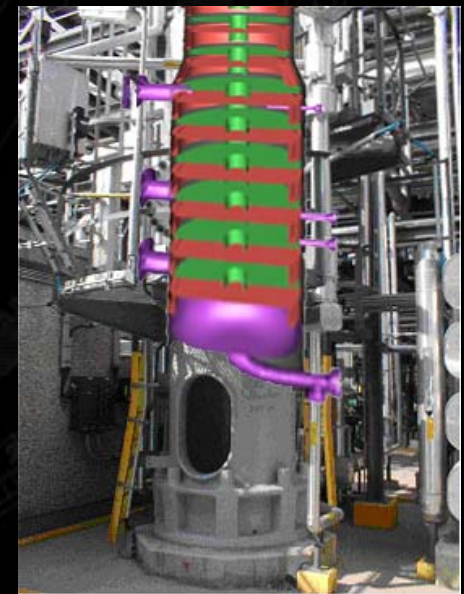
Background

- Currently, a refinery training lasts for one year
- On-site training only in process maintenance, inspection and shutdowns
 - The unit can not be closed only for training
- Aim is to get more on-site training



Goal

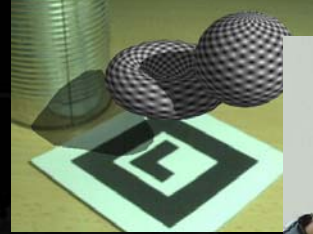
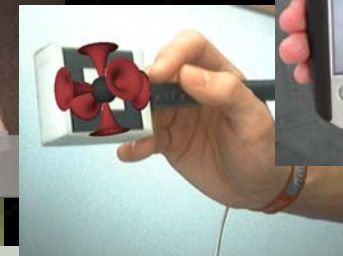
- Navigation through the refinery scene
 - E.g. augmented object onto the real column
- Which type of hardware:
 - Display: Tablet PC vs. HMD solution
 - Tracking: Tracking system (GPS, Marker-detection)
- User requirements for mixed reality training application for oil refinery
 - Users: new employees with academic degree
 - Aim: Train employees on the field without stopping the process



What's the problem in AR?

Possible Application Scenarios

- Education and Training
- Assembly
- Art and design
- Entertainment
- Medical area
- Military area
- ...



AMIRE Authoring Mixed Reality

- AMIRE = A mixed reality authoring tool
 - EU funded project (IST-2001-34024)
 - Efficient creation and modification of mixed reality (MR) applications
 - Open source
 - www.amire.net
- Goal of AMIRE
 - Develop an AR application without the help of programmers
- Two demonstrators:
 - Modern art museum demonstrator
 - Oil refinery demonstrator

Idea: Using Mixed Reality Technology

- Users should be able to browse through the refinery without the help of trainers



User and Environment

User

- Users are familiar with basic computer skills
- Should not draw user's attention while moving around
- Should not hinder user from walking and climbing

Environment

- Accurate position of the user and environment ($<1\text{m}$ and $\pm 5^\circ$)
- Full of reflections

Application

Application

- Easy to use, intuitive and self-explanatory
- Different media content: animated video, MR objects, process flow diagram (process orientation on the field)
- 3D vs. 2D (What do they really want to have?)
 - For the management => 3D is cool!
 - For the employees of the refinery => 2D, CAD, schemas (more technical focus)

Equipment

Light	no more than 3 kg
Explosion proof	Very important for a refinery
Ignition protection	Must prevent ignition source arising
Can be taken to the field	Mobile, easy to carry
High resolution	Resolution enough for displaying MR objects
Able to be used outside and in a noisy environment	Weather-proof, splash-proof, limited use of audio

Is there an optimal device?



HMD, e.g. MicroOptical devices + Laptop?



Tablet PC, e.g. Compaq T 1100 with mounted camera.

Was it the correct decision?

Benefits

- Very intuitive – easy interaction
- Power is okay (Geforce 4/fx inside!)

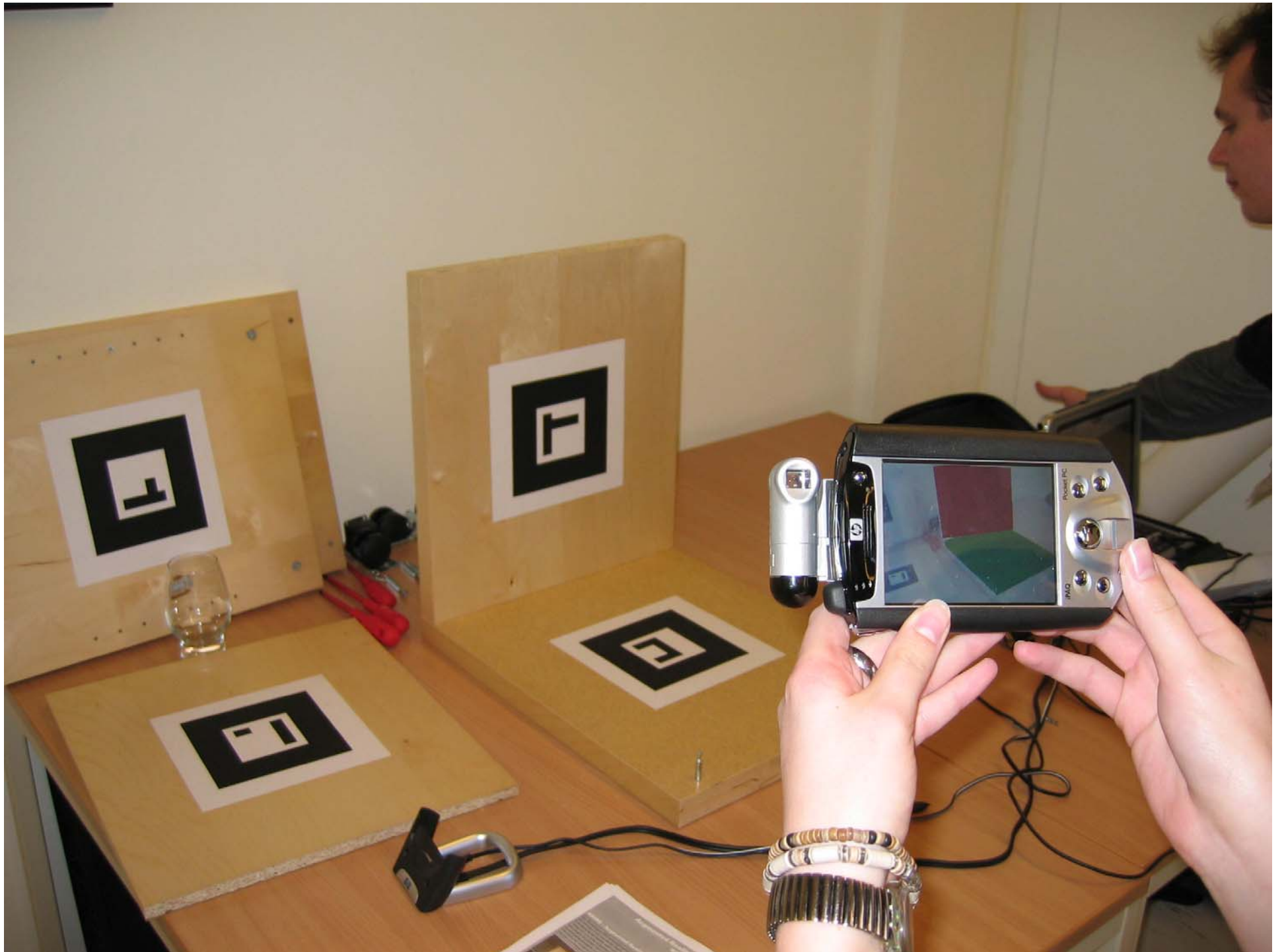
What´s bad?

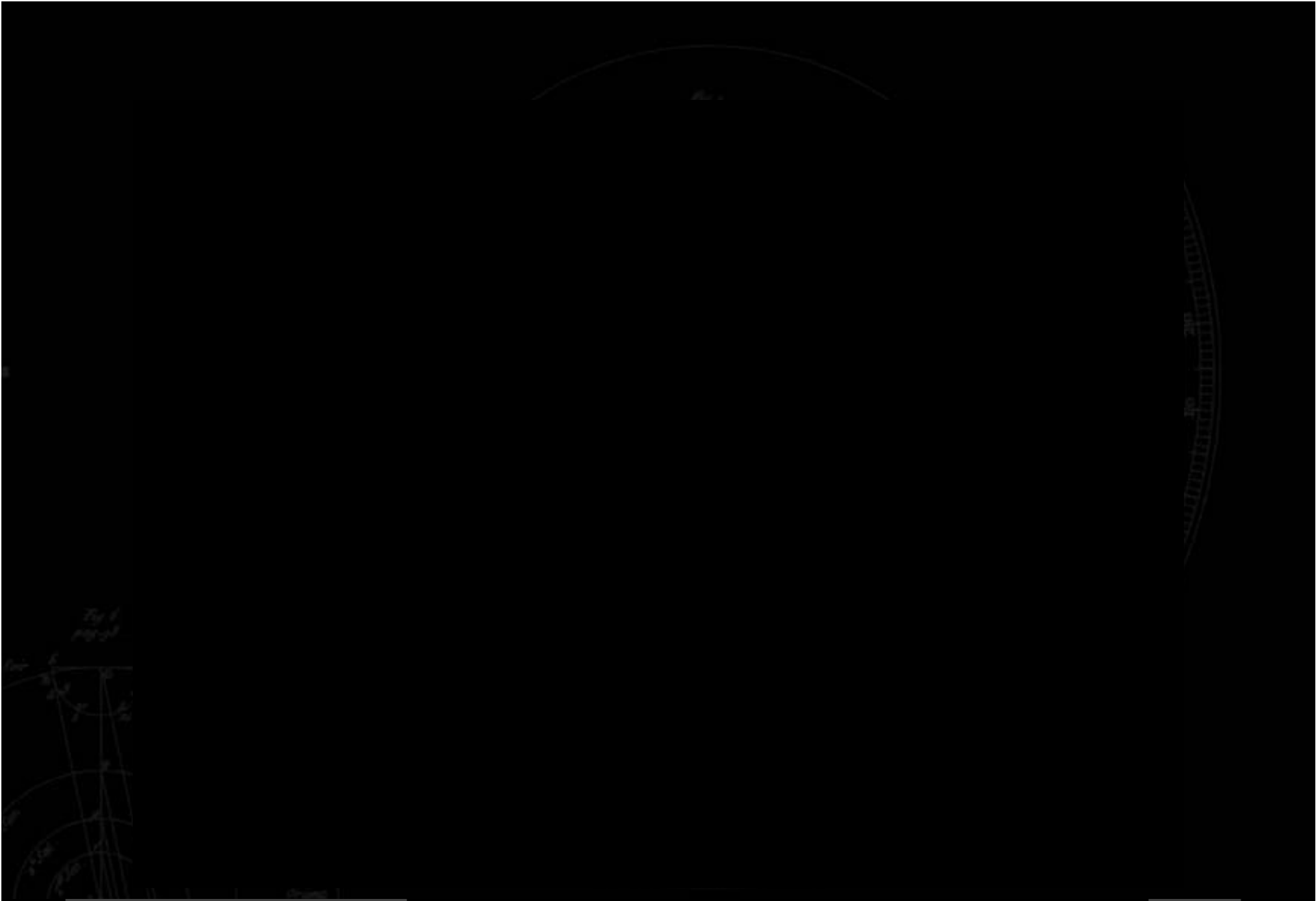
- Still too expensive
- too heavy (> 1.4 kg)
- Right focusing

Conclusion

- PDA, e.g. iPAQ



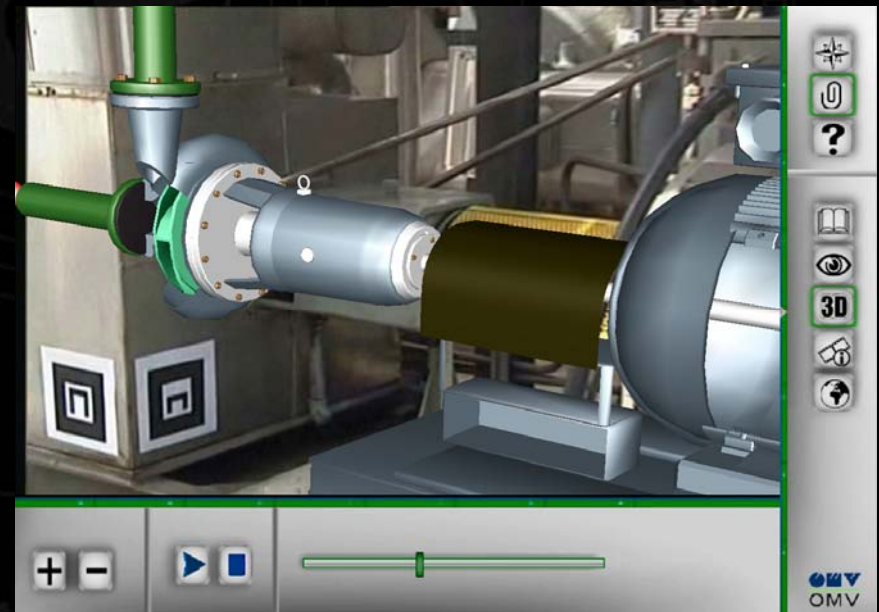
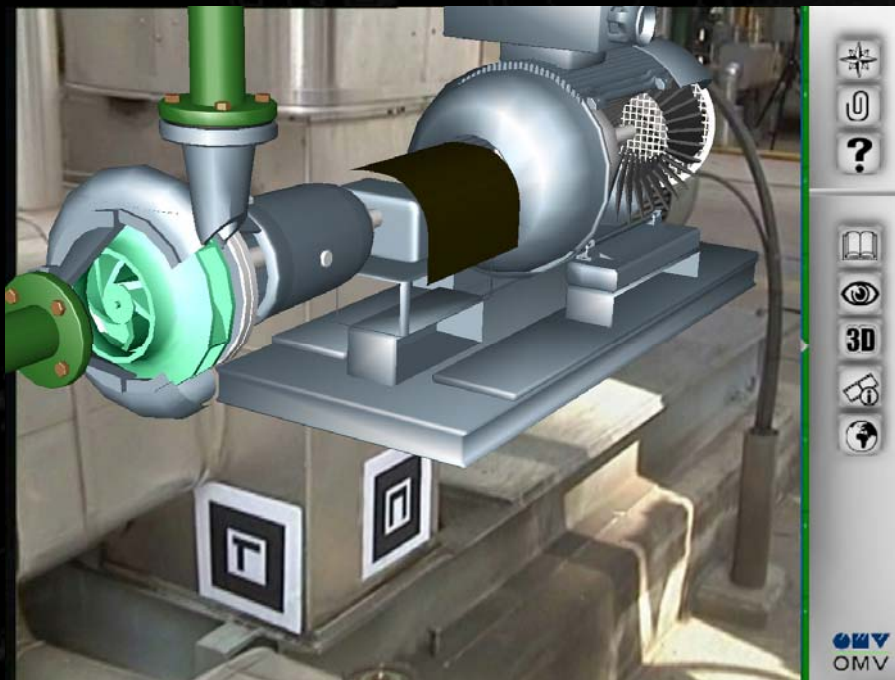




Some application results

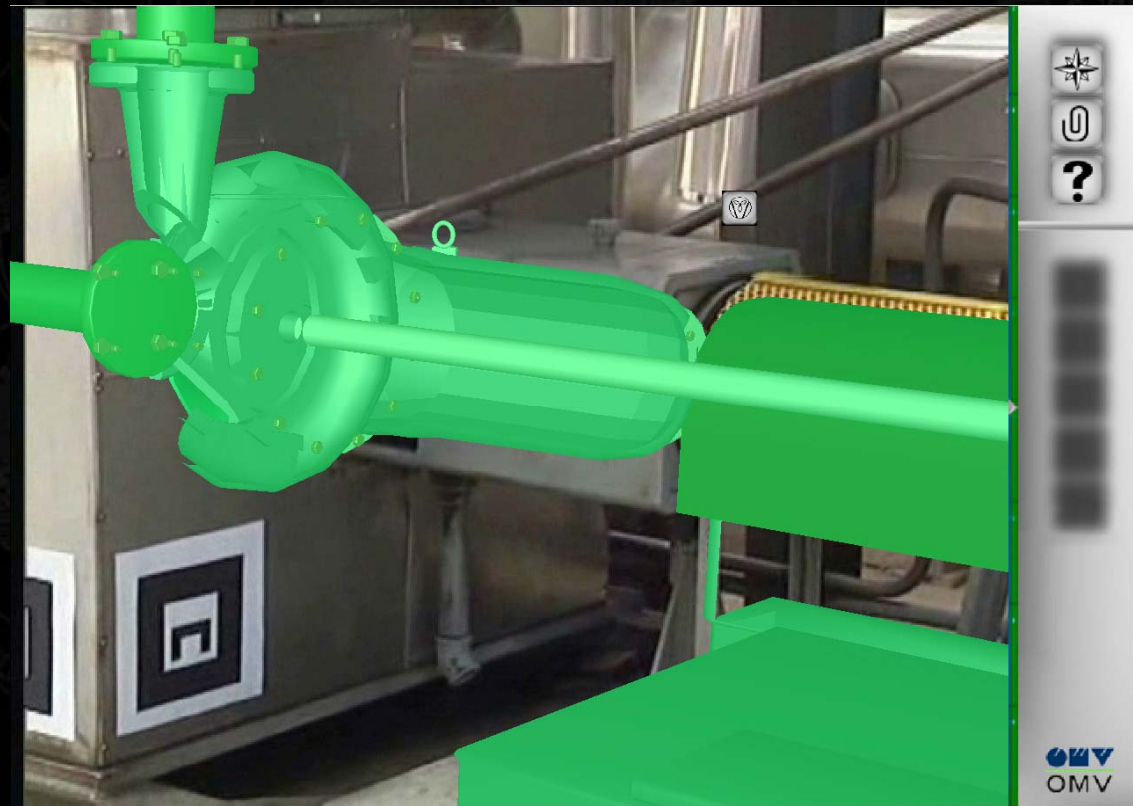
Augmented 3D-geometry with interaction

- Is the real-time orientation important?
- Freeze-mode



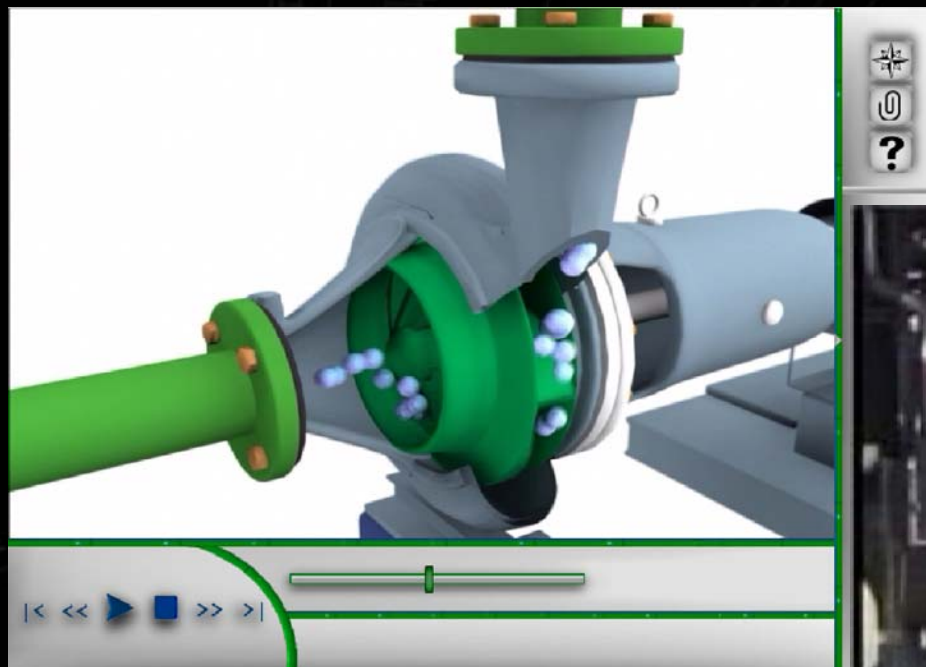
What's about the interaction?

- How does the user know if he/she can interact with that object?



Some application results

Movies: Animations & videos

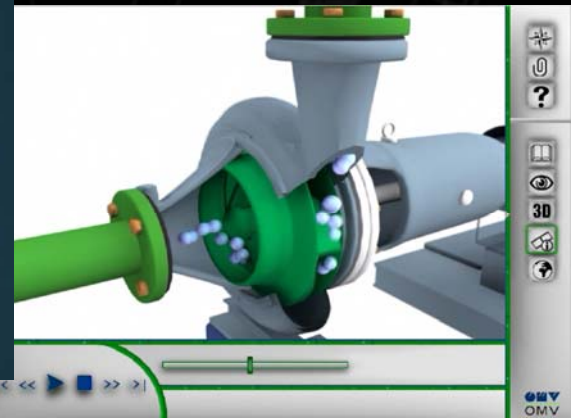
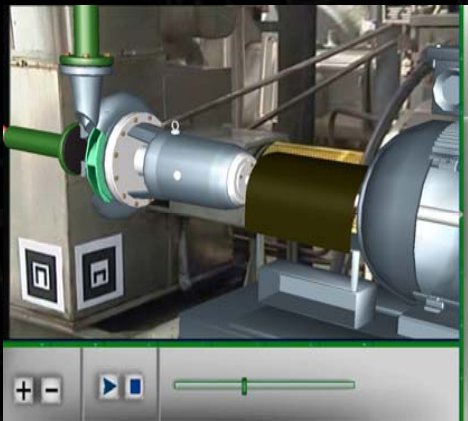
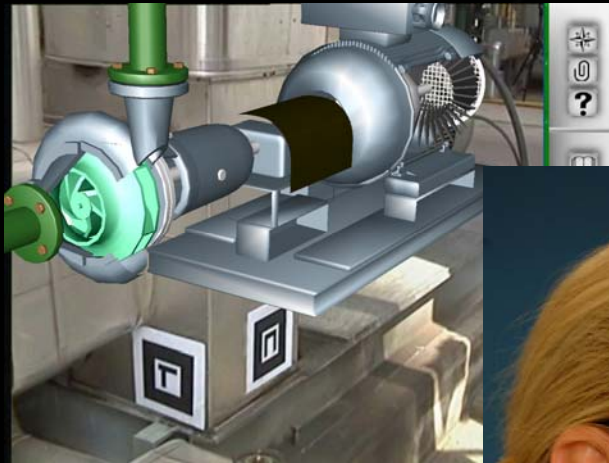


Some application results

2D information



And what's about the HMD?



Additional requirements

- Data should be up-to-date
 - Automatization of 3d content creation (CAD => 3D model)
 - Authoring tool for small modifications (AMIRE = Authoring Mixed Reality)
 - Work for content << Work for teaching
- Direct connection to the control point
 - to get real-time data, e.g. pressure, temperature etc.

Conclusions & Future Work

Equipment requirements are very demanding in an oil refinery

- Explosion-proof, not an ignition source
- Light, easy to carry, enough display and resolution

Environment is very demanding

- Changing conditions (temperature, light, weather)
- Difficulties in accurate positioning

Mixed reality has a lot to offer for employee training in an oil refinery

Special thanks to ...

Guggenheim BILBAO

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