Augmented Reality at Airbus

Tracking: Experiences, Restrictions & Future Scenarios
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The past – ARVIKA

IAW
Siemens A&D
Siemens ZT
Telekom
UI Design

DaimlerChrysler
IGD
Siemens A&D
Siemens ZT
TU Munich
VRCom
WZL
ZGDV

Audi
DaimlerChrysler
EADS-M
Airbus Germany
IGD
QualiSys
Siemens A&D
VRCom
VW
WZL

EADS-M
Ford
Siemens A&D
VW
WZL

EADS-M
DS Technologie
Ex-Cell-O
Ford
Gühring
Hüller-Hille
Index
Siemens A&D
Siemens KWU
Siemens ZT
TU Munich
WZL

ARVIKA members marked bold were sub-project leaders
AR-supported installation tasks

Installation of fresh water pipes

• Step-by-step instruction
• Simple information system
• Overlay of 2D drawings

Hardware

• Standard laptop
• Sony Glasstron
• Web-Cam

Software

• Web-based Information System
• Marker-based tracking with AR-Browser

„Make first experiences with AR“
AR-based development

Visualisation of volumetric airflow on a passenger seat

- Cooperation with DaimlerChrysler research
- Voxel CFD data superimposed on a real cabin mockup
- Other data can be displayed (e.g. temperature)

Hardware
- Standard laptop
- Sony Glasstron
- Web-Cam

Software
- DBView (VR software made by DaimlerChrysler research)
- Marker-based tracking with DBView AR-Module
AR-supported cable plugging

Mobile AR support while finishing the connector plugging

- System shows where to connect the cable
- Special display-centric AR user interface
- Fully speech operated hands-free system

Hardware

- Xybernaut MA V
- Binocular HMD (Tekgear M2)
- Mini-Camera (Toshiba IK-MX1)

Software

- SVG-based information system
- Marker-based tracking with embedded AR-Browser/Amire
Outcome

None of the prototypes has been deployed in productive setting!

WHY?

Missing user acceptance
Maturity of HMDs not high enough
Unsolved cabling issues
Too expensive
(hardware, software, training, support, service, etc.)

Difficult tracking conditions inside an aircraft
General tracking restrictions

• Due the length of fuselage global stationery systems are not suitable

• Electro-magnetic systems are not compatible with the metallic environment

• No temporary tracking equipment can be installed (e.g. on a tripod)

• Markerless video tracking is difficult because...
  ... state of construction is always changing
  ... geometry data is not complete (e.g. screws and isolation)
  ... of bad lighting conditions (movable lamps and hard reflections)
  ... many identical looking parts (e.g. stringers)
Future Scenario 1: Manufacturing

Cable plugging support

Scenario characteristics

- All work inside the fuselage
- Most work beneath the ceiling (on a ladder)
- Many workers inside fuselage at this stage
- Many viewpoints movements

Needed Tracking Quality

- High accuracy: < 1 mm
- High response frequency: < 80 ms

Tracking Approach

Prototype approach (marker based tracking) not allowed and too time-extensive
Future Scenario 2: AR Quality management

Compare state of construction (As-Designed vs. As-Built)

Scenario characteristics
- Check the correct installation of harnesses by superimposing the virtual model on the real built environment
- Tablet PC instead of HMD usable
- Only few viewpoints movements

Needed Tracking Quality
- Medium/Low accuracy: < 1 cm
- Low response frequency: < 200 ms

Tracking Approach
Only inertial tracking methods could be used today.
Future Scenario 3: Service

Fresh Water Tank Maintenance

Scenario characteristics
- AR maintenance information system
- Short distance to the augmented object
- Very narrow environment
- Many viewpoint movements

Needed Tracking Quality
- Medium accuracy: < 5 mm
- Response frequency: < 40 ms

Tracking Approach
Today there is no solution available
Recent work on tracking

RFID study in cooperation with EADS research center and Technical University of Munich (TUM)

*Background:* More and more parts in the aircraft have RFID chips attached for maintenance reasons

*Idea:* Use the RFID chips for tracking purposes!

*Study Results:*
- Tracking possible but very unprecise
- Standalone usage of RFID tracking not advisable
- Combination of RFID tracking with precise methods which need initialisation like markerless tracking or a gyrospic approach

→ EADS research was engaged to develop a tracking framework allowing sensor fusion
Less restrictions – Mockup Scenario

Use Augmented Reality to overlay parts of a sales/design mockup with a virtual configuration or design concept.

**Design Mockups:** Substitution of expensive and inflexible prototypes

**Sales Mockups:** Fixed Sales Mockups can be augmented with customer specific solutions

**Less Tracking Restrictions:**
- No metal: only wooden mockups
- Fixed state of construction
- Limited small number of people

**Tracking approach:**
Combine inertial sensors with:
- Video-based Markerless Tracking
- Infrared „Inside-out“ Solution (maybe)
Open discussion

How do you think tracking for AR will develop in the coming years?

What are the key technologies solving our problems?

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