

ARVIKA: Augmented-Reality for Development, Production, and Service

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Figure 1: ARVIKA consortium

ARVIKA

ARVIKA is an Augmented Reality research project funded by the bmbf (German Ministry of Education and Research), which started mid 1999 and which ended this year in June. The consortium consists of 23 partners from the industry (Volkswagen, BMW, DaimlerChrysler, Airbus, Siemens...), research institutions (Fraunhofer for Computer Graphics, ZGDV) and academia (University of Munich and Aachen). It represents the world's largest research project on Augmented Reality.

The goal of ARVIKA was to develop the »Augmented Reality« technology for the industrial application area and,

in particular, to offer new solutions to the design, production, and maintenance of products. After the definition of application scenarios and an extensive analysis of the user requirements, a first AR-prototype was developed at Fraunhofer IGD. The system was built on a web-based architecture, which was adopted in order to facilitate the introduction and integration of the AR-system into already existing IT-infrastructures of companies. This choice was confirmed and all ARVIKA application scenarios could be implemented on this unique platform, fulfilling the very different needs of the users.

Examples of AR-scenarios

Augmented Reality for development
An AR-scenario example for product development is given by Volkswagen's »crash-test« scenario. Crash tests are carried out in an early phase of the car design. One major difficulty of this approach consists in the validation of the simulation results, for example by comparing them with reality, i.e. with real, crashed cars. Through the visualization of the simulation results onto a real car, the user can easily identify eventual errors or deviations and thus tune or confirm the computation.

German Abstract

Das Ziel des BMBF-geförderten Leitprojektes ARVIKA ist die Entwicklung der neuen Technologie »Augmented Reality« (AR) für die Industriebereiche der Produktentwicklung, Produktion, sowie Wartung. Am Fraunhofer IGD wurde eine flexible Augmented-Reality-Plattform, der »AR-Browser«, entwickelt. Diese ermöglichte die Umsetzung aller AR-Szenarien der Projektpartner. Der AR-Browser ist ein plattform-unabhängiges VR-System, das über spezielle AR-Funktionalitäten verfügt und als Plug-In in einem Internet-Browser realisiert wurde. Dadurch ist es möglich, z. B. einem Service-Mitarbeiter die einzelnen Arbeitsschritte im Sinne eines Workflows direkt ins Sichtfeld einzublenden. Der web-basierte Ansatz erlaubt darüber hinaus die Anbindung beliebiger Dienste und Informationssysteme an das AR-System.

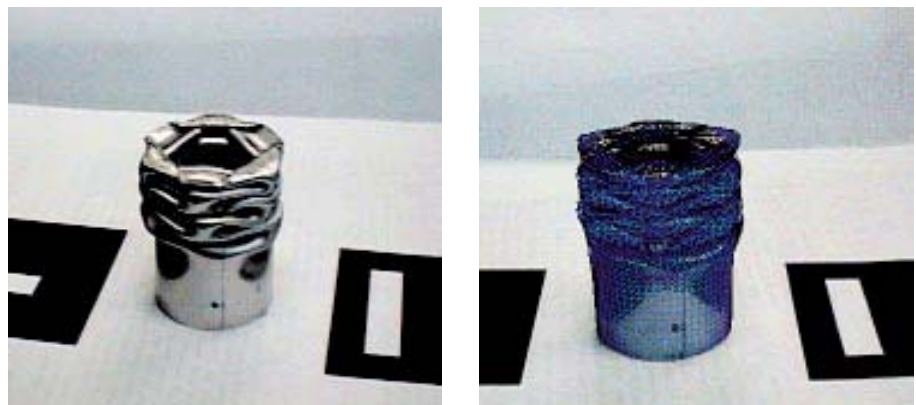


Figure 2: Comparison of real and computed deformations with augmented reality (with courtesy of Volkswagen)



Figure 4:
AR-Browser
architecture

was built with the open-source scene-graph OpenSG (see www.opensg.org). The VR/AR-system was designed in a scalable way and it can deal with small mobile computers. While vision based tracking is an integral part of our augmented reality core component, other tracking devices can be easily integrated into the system using a device interface layer.

Conclusion

The acceptance and the interest of end-users in augmented reality are evident. The possibility to present computer-generated information attached to real objects corresponds to a strong need in the industry, in particular in the area of service and maintenance. ARVIKA enabled the first in-depth evaluation of augmented reality for the industrial sectors of design, production, and maintenance of products. The project had a strong impact on the research community as well as on the industry, and it made a major contribution to this field. Commercialization opportunities are currently under examination.

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As crash-test data are highly confidential, we show here, in figure 1, the comparison of the deformation of a virtual and a real tube. The FEM-simulation matches the real object very well. The simulation can in this case be confirmed.

Augmented reality for production and service

In production and service scenarios virtual information is shown directly in the field of view of the user via a head-mounted display (cf. figure 3 and 5). This information appears in 3D, overlaid onto the real scene. It is organized in form of a workflow and it guides the user step by step during his production or maintenance task. The advantage of the AR-approach is twofold. Firstly, the information is presented on-site directly where it is needed. Secondly, the user does not necessarily need to be an expert or to know the machine he has to repair.

It comes out that the time spent with documentation is reduced dramatically. The efficiency gain has been estimated at around 30 to 40%.

The AR-System »AR-Browser«

The whole AR-Browser can be regarded as a complete VR-System, expanded with special augmented reality capabilities and encapsulated in an Internet Plugin. The AR-Browser itself consists of two major parts: a thin interface layer, providing the scripting interface and HTTP-Access, and the Augmented Reality core functionality itself. The scripting interface allows for an easy configuration of the system and for a definition of application specific functionalities. Large parts of the application logic were built with standard Javascript functions embedded in the web-page. While the interface layer was implemented on the basis of Microsoft ActiveX technology, the system-core



Figure 3: Augmented reality manual for service task



Figure 5: Application scenario

