

Augmented Reality Service Support

Rapid developments in the field of mobile computing have led to a tremendous increase in the performance of pocketcomputers, PDAs, smart phones and other mobile computers in recent years. Even today, there are systems which support applications in the field of 3D computer graphics, and this development will continue in the coming years. These mobile end devices are ideally suited to Augmented Reality (AR) applications, and they will considerably increase the usefulness and acceptance of mobile AR applications.

Fraunhofer IGD, Rittal GmbH & Co. and InnoTeamS GmbH have developed Aug-

mented Reality scenarios, that use the technology developed within the European project ULTRA. Thereby the Augmented Reality system consists of the following three main hardware components:

- the portable computer unit,
- the video camera which records the user's real environment,
- the head-mounted display



Augmented Reality guided service technician

Ultra portable Augmented Reality

Within the European IST project ULTRA (Ultra portable Augmented Reality for industrial maintenance applications) hardware and software has been developed to support mobile service technicians. The developed technology is characterized by the following features:

- **Mobility:** ULTRA is particularly well-suited for mobile applications.
- **Real-time capability:** ULTRA supports the continual alignment of virtual and real objects.
- **Intuitiveness:** ULTRA displays graphic animations which guarantee that information is easy to understand and independent of language.
- **Interactivity:** ULTRA uses innovative interaction paradigms, thus the user is able to act freely with both hands).

From the technical point of view the most challenging part of AR is the realisation of the tracking. The tracking system is used to identify and register the exact position and

orientation of the user. For industrial applications an AR application has to work without the need to adapt the object to the environment, by placing special landmarks or references. This issue is known as markerless tracking.

At Fraunhofer IGD highly stable tracking solutions have been developed realising a markerless tracking based on Computer Vision technology.

Within the cooperation project of Fraunhofer IGD, Rittal GmbH & Co. and InnoTeamS GmbH two different scenarios have been realized:

- AR-supported service instructions
- AR-supported teleconsultation



Augmented Reality
Head Mounted Display



AR-supported service instructions

A service technician equipped with the ULTRA system reaches a machine which has reported an error in order to carry out the necessary maintenance work. To do this, he takes a picture of the machine with the video camera in the PDA. He wears a near-to-the-eye display and headphones. He launches the AR-supported service instructions via voice entry. He is then led step by step through the complex operations.

He is guided by 3D animations which are visualized in the correct position over the machine. The 3D animation can be combined with text and audio output. The 3D animation can be understood intuitively. There is no need for printed manuals, so the technician can always use both hands to carry out the maintenance work.



PDA-based Augmented Reality

AR-supported teleconsultation

A new service employee is given the task of repairing a heat exchanger. To do this, he launches the teleconsultation mode in the ULTRA system and contacts a service expert from RITTAL, who can be reached in his office far away from the machine. The employee at the machine wears the near-to-the-eye display and he is assisted by AR visualizations. Additionally, he can contact the machine expert at any time. The pictures from the video camera are transmitted to the machine expert so that he can continually monitor and comment on the process. For commenting purposes, audio information can be transmitted, or visual information can be created by the machine expert and displayed in the head-mounted display directly in the employee's line of sight.

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Teleconsultation Component

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