Signposts to Tomorrow's Human-Computer Interaction

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Abstract. The Fraunhofer-Gesellschaft has selected "human-machine interaction" as one of twelve areas of technology with a particular potential for innovation and market-relevance. The paper gives a brief overview of the goals and research topics of the initiative.

Keywords: Human-machine interaction, Fraunhofer-Gesellschaft, enhanced interaction, contextual user interfaces, user experience engineering.

1 Introduction

The Fraunhofer-Gesellschaft undertakes applied research aimed at promoting the innovative capacity of German industry and thus strengthening Germany's status as an industrial location. Our work involves analyzing markets, developing new products, processes and services, and enhancing existing production plant and organizational structures. We play our part in ensuring that German companies are able to gain a competitive edge in the face of international competition, and can maintain and expand that edge.

To help us find our bearings in the fast-moving current of technological trends around the world, our experts have evaluated numerous foresight studies conducted by other industrial nations and roadmaps drawn up by international corporations, and have discussed and further evolved the results with internal and external experts. A comparison of national and international research trends with the present competencies and strengths of the Fraunhofer-Gesellschaft has revealed twelve areas of technology in which we particularly expect to see market-relevant innovations.

These twelve thematic areas have been collected under the title of "Signposts to tomorrow's markets". They are characterized by their outstanding potential for innovation and their remarkable relevance to the market. The Fraunhofer-Gesellschaft is particularly well equipped to meet the great need for research and development in these areas. The Fraunhofer Institutes have therefore joined forces with partners from industry and are vigorously pressing ahead with the corresponding activities. The twelve thematic areas are:

- Internet of things
- Smart products and environments
- Micro power engineering
- Adaptronics

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- Simulated reality: Materials, products, processes
- Human-machine interaction
- Grid computing
- Integrated lightweight construction systems
- White biotechnology
- Tailored light
- Polytronics
- Security

2 Fraunhofer Innovation Topic »Human-Machine Interaction«

In the thematic area "human-machine interaction", the competencies and activities of fifteen Fraunhofer-Institutes are bundled in order to completely cover all major

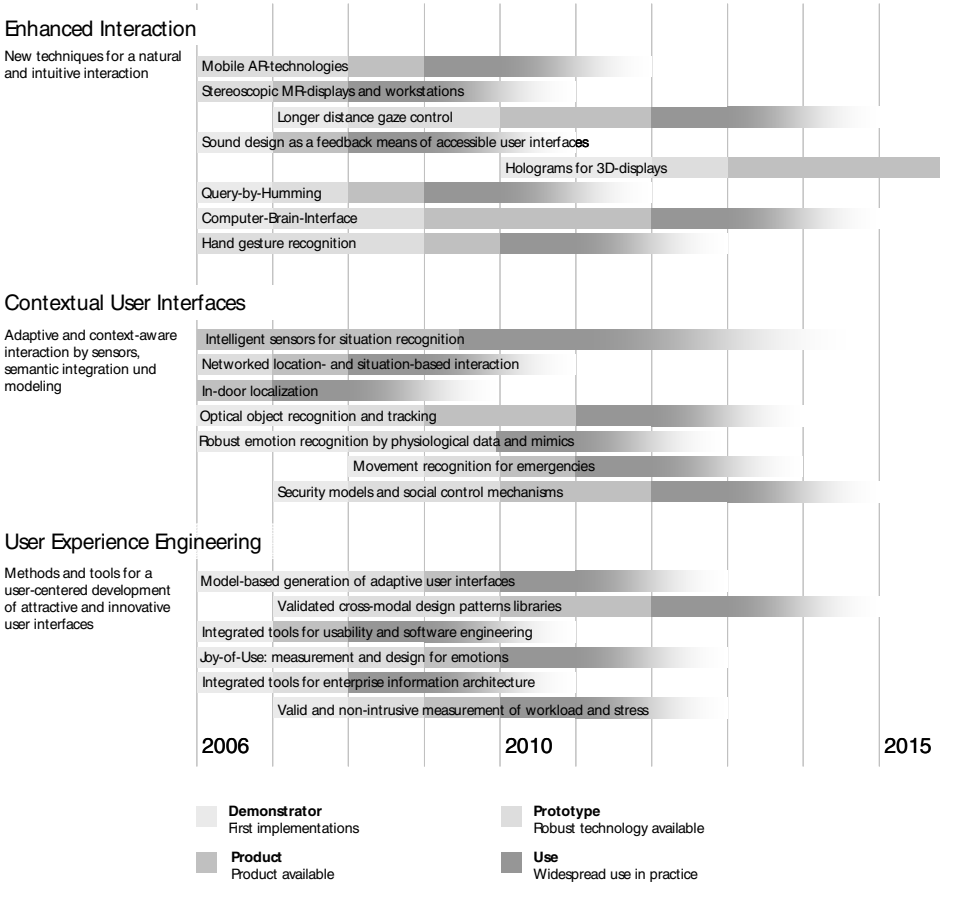

Fig. 1. Extract from the 2006 research roadmap for human-machine interaction at Fraunhofer

aspects of the field. Towards the market and external partners, the consortium enables the participating institutes to act as one strong player with experts from diverse areas. For the partnering institutes, the consortium provides a valuable network that supports multidisciplinary cooperation and knowledge sharing. Fraunhofer experts in the field come from diverse disciplines, including computer science, microelectronics, surface technologies, psychology, production and industrial engineering.

According to the Fraunhofer principle of a direct transfer of new technologies and recent results from research to the market, the institutes are involved in research projects as well as in cooperation with the industries. Fraunhofer researchers are working on the design and development of interactive systems in many fields of application: from ticket vendor machines to service robots, from in-vehicle systems to multimodal telecommunication services and intelligent production environments. Moreover, Fraunhofer has been recognised as a beacon of cutting edge research in human-machine interaction. Fraunhofer developments in the fields of brain-computer interfaces, virtual and augmented reality, 3D-displays and optical recognition systems receive attention all around the world.

3 Research Agenda

As a major activity, the consortium members have identified research topics which will be focused on in the future. They have worked out a roadmap for central technologies and developments. The discussions and workshops with experts of the participating institutes yielded three main research areas (see figure 1 for an excerpt of the roadmap):

- **Enhanced interaction**
  This topic includes the development of new techniques for a natural and more intuitive interaction. This encompasses, for example, the adoption and refinement of recognition technologies, such as continuous speech recognition, optical recognition and eye tracking technology as a means of user input. New developments in the field of mobile technologies for Augmented Reality (AR) and stereoscopic Mixed Reality (MR) displays will lead to a higher level of immersion and will support virtual engineering in an effective manner.
- **Contextual user interfaces**
  In the future, user interfaces will not only respond to explicit user actions but they rather will also incorporate information from the context of use. Intelligent sensors will be able to recognize certain situations. In combination with a localization of the user it will be possible to provide context-aware services and adaptive user interfaces.
- **User Experience Engineering**
  Modern approaches to user-centred design go beyond the traditional concepts of ergonomics and usability. In order to systematically engineer a pleasant user experience, new methods will be needed for considering the “soft” human factors of emotions, branding, trust, etc. while designing and evaluating interactive products. As a link to software engineering, design patterns will help to assure a consistent interaction across various user interfaces and will reanimate the idea of a partly automated generation of ergonomic user interfaces.

4 Conclusion

The importance of research in the field of human-machine interaction will continue to increase in the near future. New technologies require and allow for new forms of interaction. At the moment, we are on the brink of a paradigm shift in interactive systems. The realisation of smart environments will change the way humans interact with technical systems. Besides working on the needed technological groundwork, it will be a major challenge to develop a coherent metaphor for human-machine interaction in smart environments. This metaphor will be necessary in order to concretely communicate the benefits and opportunities of the new technologies to a broader public and to facilitate an intuitive and trustworthy interaction.