Chapter 81
AsTeRICS:
A Framework for Including Sensor Technology into AT Solutions for People with Motor Disabilities

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ABSTRACT

The authors outline the potential of sensor technology for people with disabilities and those people with motor disabilities in general. First the authors describe how people with disabilities interact with the environment using specialized Assistive Technologies (AT) to interface modern Information and Communication Technology (ICT) via the standardized Human-Computer Interface (HCI). The authors discuss the state-of-the-art and emerging sensor technology and how it enhances the potential of AT facilitated interaction with ICT/HCI regarding two domains: a) Sensor technology embedded in the environment providing flexible and adaptable means of interaction and b) sensor technology for better, more flexible and efficient application of skills of people with disabilities as AT solutions. Based on this analysis the authors advocate for changing AT practice in terms of assessment and service provision, but also R&D to recognize the extended potential provided by sensor technology to exploit presently unused or neglected skills of users. The authors underline the need to make AT solutions more flexible, adaptable, and affordable. the authors argue, in view of the potential of sensor technology, that there is an increasing need for an efficient software framework allowing an easy integration of sensor technology into AT solutions or even individual AT service provision. Finally the authors present the AsTeRICS framework as an example of an extendable AT construction set for an open source and crowed sourcing approach for a more user-centered, easy, fast, and economic implementation of sensor based or sensor enhanced AT solutions.

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INTRODUCTION: SENSOR TECHNOLOGY, HCI AND DISABILITIES

Some label the 21st century as the "sensor age" (Wilson, 2005). This might read unfamiliar but it has a profound value as the progress in the information or knowledge society (Webster, 2006)–a label used much more often for our times–in many aspects is based on sensor technology. Sensor technology forms the fundamentals for integrating and transferring more and more domains and aspects of our world into "smart, pervasive and ambient" environments (Weiser, Gold, & Brown 1999) and including them into a state of the art wireless, web based interaction and communication.

Sensor Technology therefore, is a very fast growing market at a level of $62.8 billion in 2011 and expected to increase to nearly $91.5 billion by 2016, at a Compound Annual Growth Rate (CAGR) of 7.8% and an even higher CAGR for bio- and chemical sensors at 9.6% and image/vision sensors at 8.5%. (BBC Research, 2011) This let us expect, in terms of impact on a small niche domain like AT and eInclusion, that high quality sensor technology will become available as cheap mass-market products providing a broad range of functionalities for solutions based on intelligent and supportive environments (Ambient Assisted Living–AAL [European Commission, 2012], as it is called in the domain of services for people with disabilities). This fact motivates to analyze and reconsider AT practice today and develop approaches able to better exploit this existing and emerging potential for user centered AT.

A second aspect related to the progress in AT are developments in Information and Communication Technology (ICT), which has been the key access point for AT and (e)Inclusion over the last decades. Today ICT is "going beyond the desktop" (Miesenberger & Darzentas, 2005) and entering the environment, demands for information about the environment, the situation, objects, living creatures and even human beings. Like living creatures use their senses to acquire information, to "make sense" out of it and become active in the environment, ICT uses sensor technology to interact with and influence the environment and to enhance and support the socope of interaction of people in their environment. Sensor technology supports modern ICT to (Buchberger, 1991)

- Build abstract and computable models of the environment.
- Permanently get up to date data on the status of these abstract models and the environment.
- Do reasoning and add meaning to these models as the basis to.
- Adapt the interaction and processes to the individual needs and situation.
- Become active and influence reality with appropriate "actuators".

With ICT and sensor technology we can build real time virtual representations of reality, adapt the interface to these representations to individual needs, do reasoning, and become active in reality directly or with help of appropriate actuator technology.

The Human-Computer Interface (HCI) is the entity where users get access to these virtual representations of real world processes. HCI separates the interface from the actual activity and makes it an own and independent entity. HCI uses two instances of flexibility and independence – towards the user and towards the environment - and provides an enhanced, independent, adaptable and almost universal freedom in designing and implementing the interaction with the environment. This for sure has been one of the core enablers for the ICT revolution "at the desktop" and remains the central point for success in emerging domains like mobile and embedded systems. Almost each application uses the standardized HCI, integrates into it to allow the user to apply existing skills and known concepts of interaction for more and more applications.

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