1st International Workshop on Embodied Interaction with Smart Environments (Workshop Summary)

Patrick Holthaus
pholthau@techfak.uni-bielefeld.de

Thomas Hermann
thermann@techfak.uni-bielefeld.de

Sebastian Wrede
swrede@techfak.uni-bielefeld.de

Sven Wachsmuth
swachsmu@techfak.uni-bielefeld.de

Britta Wrede
bwrede@techfak.uni-bielefeld.de

Cluster of Excellence Cognitive Interaction Technology (CITEC), Bielefeld University
Inspiration 1, 33619 Bielefeld, Germany

ABSTRACT

The first workshop on embodied interaction with smart environments aims to bring together the very active community of multi-modal interaction research and the rapidly evolving field of smart home technologies. Besides addressing the software architecture of such very complex systems, it puts an emphasis on questions regarding an intuitive interaction with the environment. Thereby, especially the role of agency leads to interesting challenges in the light of user interactions. We therefore encourage a lively discussion on the design and concepts of social robots and virtual avatars as well as innovative ambient devices and their implementation into smart environments.

CCS Concepts

•Human-centered computing → Interaction devices; Interactive systems and tools; Empirical studies in HCI;

Keywords

Smart environments, human-robot interaction, ambient assisted living

1. INTRODUCTION

Our homes become increasingly smart through modular hardware and software apps controlling home automation functions such as setting the room temperature or starting the washing machine. Also, mobile robots start to enter our homes as vacuum cleaners, mobile cell phone platforms or toys. All of these come with their own interfaces resulting not only in a multitude of different interaction devices with different interaction philosophies. Additionally, the increasingly embodied capabilities of smart devices, ranging from ambient actions (light, sound..) to moving objects (robots, furniture...) yield to the overwhelming amount of information and control that needs to be mastered within such a convoluted environment. Yet, despite large research efforts, the main modality of interaction with smart home devices is often still a challenging graphical interface.

Such a complex situation opens up a range of new research questions pertaining to the interaction with smart environments. How can they be made more intuitive and adaptive? And how to deal with agency or explicit lack of it, i.e. whom to address when specifying a command or a goal situation? In this workshop we want to address the question how the various installments inside a smart environment can be used as intuitive means of interaction.

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2. WORKSHOP CONTENT

This instance of the workshop encourages discussion on embodied interaction with smart environments by considering topics regarding the architecture of smart homes and their robotic inhabitants as well as examining various kinds of interactive situations posing requirements with respect to understanding and keeping the user's attention. Also, less invasive interaction modalities will be discussed that allow interaction in sensitive spaces such as bathrooms. Eventually, an exemplary instance of a smart environment serving as an elderly care facility shifts the focus of discussion towards how to operate such assistive technology and establish it in today's society.

The first contribution, presented by Rasch et al., considers a three-layered architecture for the integration of - possibly simple - service robots into a smart environment that is equipped with advanced sensory technology. The different layers represent hardware abstraction, domain or feature level as more complex functions in the agents, and a planning layer for coordination. This structure is supposed to provide the advantage of being slim and reliable while enabling a unified access to an otherwise unstructured and heterogeneous environment.

When using speech as an interface to control a smart environment, one of the major challenges from a system perspective is to decide which utterance is important to analyze, e.g., to be treated as a command, and which one should be discarded. Especially with multiple users present, a great portion of words is interchanged among the humans

themselves and therefore irrelevant to interpret. As a consequence, Richter and Kummert approach the problem of recognizing the addressee of utterances in a task solving scenario based on attentional visual cues as well as information from the auditory modality. With a corpus of interactions between humans and an interactive robot in a smart home, they analyze human interactive cues and derive a first model that is meant to be integrated into intelligent systems.

In his keynote, Takayuki Kanda illustrates how service robots can enhance our environment with smart features. Initially very limited in functionality, such robots are nowadays in a position to perform rather complex tasks. For example by offering product information in a grocery store, cleaning up ones apartment, or giving directions at an airport, they are able to assist humans in their daily routines. To integrate such autonomous systems into the environment in a consistent way is one of today's challenges in robotics and interaction research.

While most approaches focus on interaction in rather public spaces, Leichsenring et al. focus on a room which constraints smart technology in multiple ways: the bathroom. They discuss particular affordances on intelligent systems that come along with fundamentally different requirements in one of the most personal areas inside an apartment. As a direct consequence, special care has to be taken with regard to the privacy of the user, as it is preposterous to install cameras for example. Furthermore, all hardware has to be resilient to particular environmental conditions, such as humidity. Besides reviewing other bathroom installations, the authors present two ambient systems that not only comply to the discussed restrictions but also demonstrate innovative interfaces to smart technology in bathrooms.

In contrast, Carlmeyer et al. are concerned with the capabilities of interactive agents inside a smart environment. They present a study which explores a strategy to regain a user's attention in spoken dialog. For that purpose, they provide a virtual agent with a self-interrupting dialog system that only resumes speaking when the user is focused on the agent. While not being able to facilitate higher performance with this system in an information recall experiment, the gathered insights allow for improvements of future experiments involving self-interruption.

Finally, Heine et al. provide an outlook on the impact of smart homes in the form of ambient assisted living technology on the society. With their facility "LebensPhasenHaus", they provide insights for the elderly to familiarize with such new and unusual concepts, services, or devices. In order to positively influence acceptance of such technology, they introduce topics like active and healthy aging, energy efficiency and smart appliances. They conclude that acceptance can often be measured only indirectly and consists of a process that highly depends on various factors, for example the participants' age.

Interactions with and in smart environments provide the opportunity for using a range of modalities and devices. Within this workshop not only speech-based interaction is discussed, but also body posture, human-robot interaction as well as robot-robot interaction, and haptic interfaces come into focus. Thereby, the workshop gives a glance onto the numerous options of interaction with our environment in the future. Importantly, one focus lies on different phases of technology acceptance and especially on the experience of elderly people which are massively affected in their willingness to interact. This workshop thus tries to bring together the user perspective with a point of view that arises from taking a more technical approach.