

MEETING REPORT

2nd Focus Group on Embedded Technology



HIDE PROJECT

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2nd HIDE Focus Group Meeting on Identification and Classification in Embedded Systems and Ambient Intelligence

On 26th February 2010, the Infonomics and New Media Research Centre at Zuyd University organized the 2nd HIDE Focus Group meeting on Embedded Systems and Ambient Intelligence in Maastricht, The Netherlands. For background documents, agenda and list of participants please visit the HIDE web-site at: http://www.hideproject.org/events/fg-embedded_technology.html

The Focus Group explored the ethical and social issues related to embedded technologies, one of the four technological areas of Work Package 3 on Critical Issue Identification. As only a limited number of embedded systems actually involve (personal) identification, the partly overlapping technological areas referred to as ‘Ambient Intelligence’ (AmI), ‘Pervasive technology’, ‘Ubiquitous Computing’ (UbiComp) and ‘The Internet of Things’ (IoT) are also included within the scope of the focus group.

Irma van der Ploeg opened the half-day session, welcoming participants and introducing the theme and ambition of the focus group as well as the invited speakers. These speakers included Dr. Michel Klein (Free University of Amsterdam) who discussed the new ways in which human knowledge can be integrated into complex (AmI) technologies, and Dr. Maarten Hogervorst (Netherlands Organization for Applied Scientific Research known as TNO, Defence and Security division) who demonstrated some of the particularities in defining ‘abnormal behaviour’ in an EU 7th framework programme security project called ADABTS (Automatic Detection of Abnormal Behaviour and Threats in crowded Spaces). Irma van der Ploeg encouraged the participants to comment as well on the draft Ethical Brief that would be discussed during the afternoon round table discussion, drawing from concerns, questions, and issues that may or may not have been highlighted by the presentations.

Expert Presentations

The purpose of the expert presentations was to inform participants on state of the art technical developments in fields relevant to the Focus Group topic (http://www.hideproject.org/events/fg-embedded_technology.html). Dr. Michel Klein is an assistant professor in the Agent System Research group in the Department of Ambient Intelligence at the Free University of Amsterdam. His research focuses on the intelligent technological support for humans, sometimes called “human ambience”. In his presentation, ‘*Human Ambience integrating human knowledge in ubiquitous computing environments*’, he introduced several of the research conceptions and findings of research projects carried out by himself and his colleagues in the Department of Ambient Intelligence. The approach of the department toward ambient intelligence is one which focuses on the application of AI technology to support human functioning. The relevance of this for HIDE lies in the possibility of extending this approach to security and crime prevention contexts, where human knowledge will then be embedded in systems for detection of ‘abnormal’ or ‘criminal’ behavior.

Klein first described what his research group considers as human ambience: “*a human-like understanding of (supportive) environments*” through the needs and interests of humans. This suggests both a narrow and a wide understanding of human ambience, with the narrow perspective involving the application of computational models about human functioning in order to create supportive environments, and the wider perspective including the use of knowledge about human functioning to create intelligent environments. To define human needs and interests, Klein noted that certain measurements are required. These measurements were said to be developed through three steps: first, the assessment of the human state, second, the reasoning about this state and an attempt to categorize and interpret it into different quantifiable measurements, and third, an analysis of the consequences of these measuring techniques, which they call ‘support measures’.

Klein then introduced four contexts in which they try to define and operationalize human ambience. These were attention support, depression therapy, emergency scenarios, and medicine intake monitoring. He explained that they take an interdisciplinary approach involving human-directed sciences, such as artificial intelligence and computer science, and rely on the conception of “*reflective coupled human-environment systems*” (Teur, J., 2008). This means that humans and environments are considered as mutually reflective of each others’ current ‘state’, which occurs through interactive processes. In these processes, Klein argued that hardware infrastructures create possibilities for AmI by using models of cognitive processes and that these can mould, shape, and change human behaviour. He referred to this process as persuasive computing, in part because it considers human emotions as a variable in the process and because it can render an augmented cognition to particular computerized systems.

In the presentation, Klein also explained how this understanding of human ambience was put into practice at his research department. First, the team uses (informal) models about human processes from other domains, such as psychology, neuro-psychology, sociology or criminology. Second, they formalize these informal models into computational models (e.g.: variables, mathematical formulas) and use observations/sensors as input to measure these. As an example, he mentioned the “trainer project” in which heart-rate measuring sensors give advice to the user about how fast or hard he/she should train in order to remain effective and without getting too tired. Third, the team examines the necessity for a model which could help in assessing whether the computer’s decision satisfies the required support for humans.

Klein then focused on his department’s research into depression therapy as part of an FP 7th programme project called ICT4depression. He described that in this project AmbI systems were developed to facilitate patients in making decisions about whether a certain therapy was a good fit for them and then provided in certain cases further input about what therapy might be an even better fit. In order to assess this, the research project used new ICTs to monitor the activities of patients with depression (in relation to other people) and to detect changes in these patient’s moods. These patients were required to send information via internet and mobile phones about how they felt and as a response they received relevant messages in electronic form that were formulated by psychologists and other professionals.

During the question and discussion time at the end of the presentation, the ethical aspects of human ambience applications were raised. Klein described these AmI technologies as looking “through” people, as they assist in discovering hidden emotional/cognitive states. However he acknowledged that the personal data traces gathered through these systems became almost omnipresent. This, he stated, does have the potential for a number of unintended implications and ethical concerns with their continued use and development and that further research into these concerns was necessary.

The **second expert presentation** was by *Dr. Maarten Hogervorst*. Hogervorst, a scientific researcher with TNO Defence, Security and Safety, and TNO Human Factors in Eindhoven, introduced the FP 7th security project called ADABTS (Automated Detection of Abnormal Behaviour and Threats in Crowded Spaces). TNO is a partner organization with ADABTS, a project which *“aims to facilitate the protection of EU citizens, property and infrastructure against threats of terrorism, crime and riots by the automated detection of abnormal behaviour.”* Hogervorst described how automated detection of ‘threat behaviour’ happens within the security context, noting the major problems and concerns currently affecting the development of abnormal behaviour detection. First, he explained that expert operators (humans) interpret and detect what constitutes the notion of ‘abnormal behaviour’ by the help of networked detection technologies. Second, he added that in the *“use of massive amounts of sensor data, manual detection is not feasible”*. However, methods for automatic detection often produce many false alarms. Hogervorst said that in order to prevent or minimize chances for such false alarms, it is necessary to increase the capabilities and infrastructure of the systems – something that often involves procuring expensive new hardware and software technology. However, TNO is focused on developing a less expensive supportive system for the operators that allows these operators to focus on “interesting data”. To define what constitutes ‘interesting data’, TNO draws upon ‘expert knowledge’ of current camera operators. Their expertise will be implemented into a combination of video and audio surveillance methods facilitated by low-cost software technology.

In their current research, TNO focuses on large-scale events and on mass transportation, and Hogervorst explained that their project analyzes several elements of the detection process such as: what the users’ needs are; what the norms are that serve to distinguish normal and abnormal behaviour; how experts define normal and abnormal behaviour and how these parameters can be interpreted and implemented into the operation of various sensor technologies and systems. In order to test certain applications in the design phase, his project observes and uses the experiences of the gaming industry as an exemplar (e.g.: casino security systems that detect cheating.)

Hogervorst further explained that the ADABTS research considers the legal and ethical restrictions on certain technologies and the implications for privacy, but the research does not involve specific personal identification features and techniques such as face or voice recognition. He suggested that automated detection without human operators is currently impossible and would lead to an extremely large number of false positives. Therefore, he added that the *“ultimate judgement will always be done by humans”*. However he emphasised that it became clear through research that these human operators need to be increasingly “enhanced” by supportive, detecting technologies, since the continuous picture and data analysis is an extremely labour-intensive activity.

Round Table Discussion: critical issues and Ethical Brief

Prior to the focus group meeting participants received a draft copy of the ethical brief by Dr. Irma van der Ploeg as well as critical questions to generate and steer the debate. These critical questions were posed in light of the expert presentations and aimed at informing the ethical brief by generating input through the round table discussion. Van der Ploeg outlined some of the major critical issues and concerns of identification and detection technologies. Amongst these she emphasised the covert and distant nature of data capture; the sensitivity of using ‘body data’; the “black-boxing” of contestable and sensitive categorizations; and the normative nature of “normality” during various classificatory processes – *“if classification has inherent normativity, how can you contest the norms?”* In addition, she pointed to the potential contradictions and frictions with existing EU legislations and general principles.

How happens user empowerment, users' awareness and how can they consent about the transfer of their data if processes get increasingly embedded (hidden) and automated? These are important ethical starting points for several other principles, including proportionality, non-discrimination, the presumption of innocence and bodily integrity.

Drawing on what was raised in the expert presentations; another principle seemed especially interesting and generated heated debate: "the freedom from automated decisions". Van der Ploeg noted the massive amount of automated steps involved in identification processes, the severity of which steps are often overlooked. Geert Munnichs (Rathenau Institute) emphasised the need to make technology-intensive processes as transparent as possible. This was criticised by other participants that suggested that too much openness could in itself result in unintended consequences (e.g.: breach of confidentiality or trust relations). Maarten Hogervorst added that from the point of view of a technical feasibility algorithms are almost impossible to be made transparent. Irma van der Ploeg then asked: "*What are then the possibilities to defend ourselves as citizens from accusations?*" and elaborated how in the case of security measures implemented to combat terrorism, more 'grandiose' security measures are seen as acceptable because the fear of terrorism has increased. René von Schomberg (European Commission, DG Research) emphasised that by the time very complex identification technologies are implemented for security purposes, they are seen to overshadow other legal and ethical principles.

Results

After an enlightening session and vigorous discussion, the contributions from the expert presentations and the participants in this focus group meeting will be used to inform the draft ethical brief as the main focus group deliverable. The input from this workshop will be combined with the results of the previous meetings and will assist in planning the forthcoming meetings.

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