Emergency Response: a wearIT@work application field

Wearable Computing for Emergency Response: the Challenge

The application field of emergency response is the ideal test case to push wearable computing to its limits. Fire fighters, paramedics and other emergency response units typically operate under extremely harsh conditions that pose the kind of requirements which allow evolving technologies to their best potential. In emergency response, typically a number of highly trained professionals cooperate in complex, distributed non-standard situations with incomplete knowledge and under high time pressure to control and remedy the effects of calamities such as fires, accidents or attacks.
The underlying objective of our work is to not only design and develop particular technologies but to propose an integrated sustainable solution, composed of the organisation, its individual members and the technology being used. In taking a decidedly user-centred approach we aim to resolve the difficult trade-offs regarding innovative technologies in this particularly unforgiving domain by empowering fire fighters to take part throughout the design process as actively as possible.

Designing Solutions in Collaboration with Fire Fighters

To ensure active participation of fire fighters in the wearIT@work design process, the project carried out a number of different activities as illustrated below.

Empirical Studies

Board Game Simulations

Virtual Simulations

Exercise Simulations

Real Interventions

To gain a reliable understanding of the application domain we conducted 3+ years of extensive empirical studies on emergency response with our project partner, the Paris Fire Brigade (BSPP). To develop and test concepts for solutions we carried out several board game and virtual simulations. Once functional prototypes were available we tested them in exercise simulations at the training site of the Paris Fire Brigade. These different activities are part of an integrated design process to ensure a high level of reliability and sufficient richness of the results for the different stages of design.

Building Wearable System Prototypes

Based on the studies mentioned above a number of particularly important application areas were identified and corresponding prototypes were developed.

wearIT@work was set up by the European Commission as an Integrated Project to investigate "Wearable Computing" as a technology dealing with computer systems integrated in clothing.

The project has 42 partners with a project volume of about 23.7 million € and a funding of about 14.6 million €.

It is the largest project world-wide in wearable computing.

http://www.wearitatwork.com

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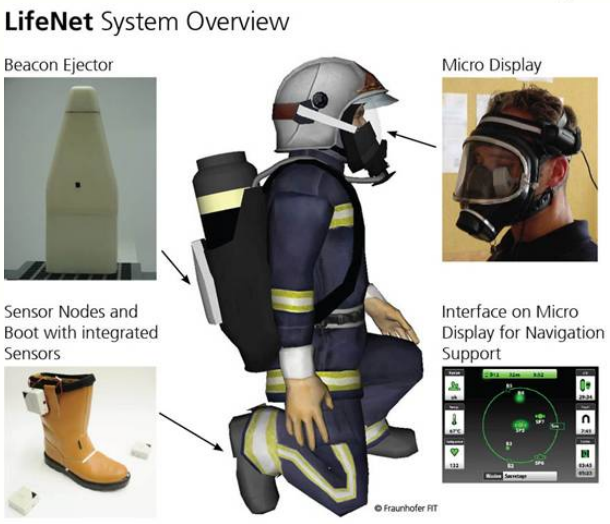
Localization and Navigation Support

In search and rescue operations under reduced visibility, localisation and navigation of fire fighters is a particularly important issue. In the wearIT@work project different technological approaches for localisation have been investigated, including pedestrian dead reckoning (PDR) and different types of sensor nodes. Based on one of the types of sensor nodes a navigation system prototype called LifeNet was implemented (see Figure).



Context-Sensitive Information Services

During active fire fighting missions the amount of information that can be safely processed by is reduced considerably. To present to fire fighters only the information that they can safely process, a software component was developed that selects this information based on contextual data obtained from different sensors and other sources.

Enhanced Communication

Continuous connectivity to enable speech and data communication is one of the most recurrent requirements stated by fire fighters. To support this the wearIT@work project developed a software component (CSM) that allows creating an ad-hoc network between the different actors at an intervention site and communicating over a number of carriers such as WLAN or UMTS that is transparent to the application using the connection. Moreover, to make the best use of a given connection, special codecs for speech and video transmission have been developed. Finally, a speech recognition component was developed enabling fire fighters to control their wearable system with speech commands while using their hands for their primary activities.

Results at a Glance

- Different technologies for ad-hoc in-door localisation
- Prototype for navigation support system LifeNet
- Context-sensitive information services
- Communication Service Module for ad-hoc multi-carrier networking
- Codecs for video and speech transmission over low-bandwidth connections
- Speech recognition for speech commands
- Rich and empirically grounded understanding of human factors relevant for design
- Integrated design and prototyping approach FireSim

Benefits at a glance

- Reducing the risks for fire fighters through more timely and adequate information
- Faster and richer acquisition and communication of information
- More robust communication and awareness
- Faster interventions leading to higher rescue performance
- Improving the capacity of fire-fighters to assess their situation, bodily condition and surrounding team members
- Enhanced monitoring and control of interventions
- Support for automatic or semi-automatic reporting
- Facilitating post-intervention debriefings and analysis

Involved wearIT@work Partners

BIBA
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Fraunhofer FIT
Multitel
Paris Fire Brigade
Rosenbauer
Thales
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