Summary of the Seminar on Assisted Living Systems - Models, Architectures and Engineering Approaches

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Abstract. The Dagstuhl seminar on Assisted Living Systems (Seminar 07462) took place in November 2007 (14.11.2007 – 17.11.2007). The seminar was attended by more than 40 specialists from 14 nations and 5 continents. The key question was, if assistive technologies based on computer-based Ambience Intelligence Technology can help to substantially extend the period of self-determined life for elderly people. Assisted living systems were discussed from three different viewpoints: the medical/psychologists viewpoint, the outside viewpoint (users and industry), and the inside viewpoint (sensor and software technology). This was reflected in 5 sessions on the phenomena of aging, ambient technology, human interfaces, sensor technology, and software technology.

Keywords: Assisted Living Systems, Models, Architectures, Engineering Approaches, Aging, Ambient Technology, Human Interfaces, Sensor Technology, Software Technology

1 Motivation

All countries of the western hemisphere are more or less facing the fact that their population is continually growing older. In aging societies, an increasing proportion of people are suffering from a general loss of their motor, sensor and cognitive capabilities as well as from age-related diseases such as Parkinson's and dementia. Usually, several capability losses and diseases occur together (multimorbidity). As a consequence, the amount of elderly people who are unable to live an independent, self-determined life in their preferred environment has dramatically increased in recent years, with a tendency to grow even further.

Governmental bodies, hospitals, healthcare and social care institutions have expressed their concern about this development, which

- marks a deep cut in the quality of people's life, frequently ending in isolation and depression, and

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– creates enormous costs for society caused by the need for intensive care or rehabilitation at home or in nursing homes.

Can assistive technologies based on computer-based Ambience Intelligence Technology help to substantially extend the period of self-determined life for elderly people? This was the key question addressed in the seminar on Assisted Living Systems, which attracted 40 specialists from 14 nations and 5 continents who discussed assisted living systems from three different viewpoints:

– the medical/psychologists viewpoint
– the outside viewpoint (users and industry)
– the inside viewpoint (sensor and software technology)

2 Sessions and Presentations

Such a broad coverage of viewpoints requires a highly interdisciplinary group of experts from the medical, psychology, hardware and software fields who share a common vision on Assisted Living. With the three viewpoints listed above in mind, the seminar was structured into five different sessions:

1. Phenomena of aging
2. Living assistance through ambient technology: user and industry view
3. Human interfaces for assisted living systems
4. Sensor technology for assisted living systems
5. Software technology for assisted living systems

Session 1: Phenomena of aging

Session 1 (Phenomena of aging) created the requirements basis for all subsequent sessions. In his keynote, Victor A. Hirth gave an excellent overview on the state of the art in geriatric practices, concluding with a list of electronic services that would be highly desirable from the medical point of view. He pointed out that person monitoring systems that collect behavioral patterns over a long period of time might result in a paradigm shift in medical diagnosis (from instant vitality checking to disease prediction and prevention).

Elisabeth Steinhagen-Thiessen gave an overview of past experience with ICT technology in the TeleReha, Vitanet, and FOG-1 projects. She concluded that ambient technology owns the potential to interrupt the “circulus vitiosus” by limiting age related handicaps, assist age related capabilities, prevent acute or chronic diseases and finally improves the quality of life of the elderly and their relatives.

Keynotes:

- Victor A. Hirth: Functional Changes in Older Adults: Impact on Home Technology Design
- Elisabeth Steinhagen-Thiessen: Assisting age related capabilities by ambient technology to prevent functional decline

Position statements on the following topics were made in this session:
- Shu-Chen Li: Assistive Technology for Successful Aging: Perspectives from Developmental Behavioral and Neuroscience
- Howard Wactlar: Assisted living in the community
- Rosemarie and Edwin Lamm: Aging and Technology
- Mary Shaw: Aging Users are Still Users

Session 2: Living assistance through ambient technology

Session 2 (Living assistance through ambient technology) was devoted to the user and industry view. Art Karshmer raised the privacy issue in his keynote. He pointed out a security problem that is hard to manage: monitored data needs to be interpreted and evaluated by geriatric specialists; they must be compared with other results and aggregated in statistics in order to improve the corresponding assistive technologies. It is currently unclear how to maintain privacy and anonymity in this information distribution and processing process.

Hartmut Raffler from Siemens gave an overview of the potentials of ambient intelligence technologies in different application domains. He pointed out the need for and importance of clear business models as a major prerequisite for producing, marketing, selling, and operating assisted living solutions.

Keynotes:
- Art Karshmer: Assisted & Independent Living: The User Perspective
- Hartmut Raffler: Living Assistance through Ambient Technologies: An Industrial View

Position statements on the following topics were made in this session:
- Martin Flöck: Integration of home automation technology into an Assisted Living Concept
- Klaus-Hendrik Wolf: The impact of sensor-enhanced regional health information systems
- Vasileios Spyropoulos: About Ambient Intelligence supported Home Care
- Johnell O. Brooks: Assisted Living Systems: Human Factors Considerations
- Thomas Kleinberger: Establishing the market for Assisted Living Solutions

Session 3: Human interfaces

In session 3 (Human interfaces), the requirements for the layout of user interfaces of assisted living systems were discussed from different perspectives by Veikko Ikonen and Wolfgang Zagler in their keynotes. It was pointed out that besides user acceptance, other aspects such as ethics, privacy aspects, etc. have to be considered as well. It was also emphasized that the invisibility of user interfaces, although generally desirable, might cause undesirable side effects such as increasing dependency of costumers on the assisted living technology and loss of control. A balance between user comfort on the one hand and preservation of independence and control on the other hand is considered essential.

Keynotes:
- Veikko Ikonen: Ethical Assessment in the Design of Ambient Assisted Living
- Wolfgang Zagler: Ambient Assisted Living Systems - The Conflicts between Technology, Acceptance, Ethics and Privacy

Position statements on the following topics were made in this session:
- Jakob Bardram: Experiments in designing Assisted Living technologies
- Max Mühlhäuser: Multimodal Interaction for Ambient Assisted Living
- Hartmut Raffler: Human Computer Cooperation
- Vasileios Spyropoulos: Aspects of the contemporary House-Call Medical Practice
- Michael Berger: Integrated Human Behavior Modeling
- Stephen Viller: Interaction design for Assisted Living technology

Session 4: Sensor technology

Session 4 (Sensor technology) was devoted to sensor technology as an enabling requirement for assisted living systems. Gerhard Troester gave an excellent overview of wearable micro-sensors embedded in clothing and other utilities. The pros and cons of the instrumentation strategy (person vs. environment) were extensively discussed and it was concluded that both strategies should complement each other.

Keynotes:
- Gerhard Troester: Sensors for AAL – what is actually missing?

Position statements on the following topics were made in this session:
- Tamil S. Lakshman: Health monitoring
- Paul Lukowicz: Real life deployment
- Vasileios Spyropoulos: Adapting biomedical technology to support Home Care
- Bart Jansen: Telemonitoring - a too limited view on the wellbeing of the patient
- Bart Jansen: Physical activity monitoring of elderly patients: 3 tricks to advance the field?

– Roc Berenquer: Sensor Technologies for AL Systems Integrated Health Monitoring and Emergency Call System

Session 5: Software technology

Session 5 (Software technology) was devoted to the software technology for assisted living systems. In his keynote, Martin Becker proposed an open software architecture that supports the smooth integration of different sensor technologies, the interoperability of heterogeneous middleware platforms, and the incremental growth of system functionality, performance, and accuracy. Software customizability and adaptivity were considered to be the most challenging software requirements for coping with the individualization of the software that is necessary even at runtime.

Keynotes:
– Martin Becker: Software Architecture Trends and Promising Technology for Ambient Assisted Living Systems

Position statements on the following topics were made in this session:
– Nikolaos Georgantas: Dynamic Services for Assisted Living Environments
– Max Mühlhäuser: Software Development Support for Ambient Assisted Living
– Vasileios Spyropoulos: Software supporting medical-managerial aspects of Home Care
– Vasileios Spyropoulos: Some important aspects of Medical and Nursing House Call sustaining Assisted Living of Aging Population
– Feng Wang: Policy-based Home Care Systems
– Rainer Wichert: Dynamic multimodal IT ensembles
– Reiner Wichert: Reference Architecture for Ambient Intelligence
– Chi-Sheng Shih: Workflow based models for Assisted Living device design

3 Conclusion

In the closing session, all participants agreed on keeping this group together by establishing an international competence network on assisted living systems. The next meeting of the group is planned for 2009 at Carnegie Mellon University.