

THE AMBIENT INTELLIGENCE AND THE ASSISTIVE TECHNOLOGIES FOR ELDERLY, VISUALLY AND HEARING IMPAIRED USERS IN SLOVAKIA

Dušan Šimšík, Alena Galajdová, Zlatica Dolná, Jana Andrejková

Technical University of Košice, Faculty of Mechanical Engineering, Department of Instrumental and
Biomedical Engineering,
Letná 9, 042 00, Košice, Slovak republic
Phone: +421 055 602 2654, Email: Dusan.Simsik@tuke.sk

Abstract: The aging of the human population is becoming a recent problem in European society as well as the population of elderly people is growing also in Slovakia. It became a challenge to think about this, look for the solutions and develop new tools to assure better quality of life for everybody. The main activities, goals and the approach we have in the international project MonAMI (Mainstreaming on Ambient Technology) are focused on the mainstream accessibility in the field of the consumer goods and services, including the public services. This goal should be ensured through the applied research and development, using advanced technologies to support and provide an equal access, independent living and participation for all in the Information Society. The MonAMI project will demonstrate that accessible, useful services for elderly and persons with disabilities living at home can be delivered in mainstream systems and platforms. First step is to search for existing, developed and imported devices and services as tools for environment control respecting the principle of design for all accessible for all end users, to improve or develop the new ones applied in the living environment of users. The selected ambient intelligence tools will be tested in Feasibility and Usability centre that is already in the process of being built and equipped. The human - machine interaction will be evaluated at our university in the lab conditions and also in cooperation with elderly and sensory impaired users at their homes and in several external institutions by involving the key mainstream actors throughout the whole process. A special stress will be applied on Accessibility technology for people with sensorial impairments.

Keywords: Ambient intelligence, e-accessibility, mainstreaming services and technologies

1. Introduction

The information and communication technologies play more and more important role in the life of our society. There are new possibilities, technologies, services but also new requirements of users due to progress have arisen. In some cases people depend on those modern technologies or they are crucial, necessary for their everyday lives from the point of view that touches their personal autonomy, quality of life and satisfaction. The need to use the technologies and services is especially concerning two big groups – elderly people whose physical and mental abilities are constricted due to aging and the people with various type of impairment of all age categories. The aging becomes a recent problem of all the countries in the Europe, world, respectively.

2. Materials and Methods

Ambient intelligence an environment where people are surrounded by intelligent intuitive interfaces that are embedded in all kinds of objects. That type of environment is capable recognize and react to the needs of different individuals, mostly those technologies are seamless, unobtrusive and often invisible. Once they are in the home or work environment of user, it is important to evaluate the efficiency of their usage – how much do they make the life easier, how much are they user friendly, feasible and valuable for the daily life activities.

The main initiative is to build a new laboratory equipped with ambient intelligent tools – Feasibility and Usability centre (FU centre) in Slovakia based on the experiences of the Department of Instrumental and Biomedical Engineering and also the Access Centre at Technical University of Kosice. We need to choose appropriate technologies, services and products that are matching the best the needs of the tentative target group. It includes rather wide selection of the users – elderly, sensory impaired individuals and people with limited mobility.

The FU centre will identify the end user needs in relation to the service to be tested, define the technology sets and services that will be delivered to users according to their special needs, implement technology in tested sites, both in laboratory conditions at University and also at households and residential that means to purchase and to build in all necessary mobile and communication devices. The services will be tested according to the home situation, individual's disability and his/her special needs.

As a first step after the overview about the existing technologies and services is a selection and development of a set of services with focus on mainstream services which can be adapted for e-Inclusion through the Design For All approach. The selected services will first be tested in our Feasibility and Usability centre at TUKE with user tests in lab-like conditions. The work is focused on the improvements of available products and/or new products to bring them into the market in Slovakia. The main direction leads us to assure better conditions of life for people who are elderly and/or with limited mobility, certain level of impairment. The ambient intelligence tools installed in the users' environment (laboratory, home, work, school, etc.) will be a part of the platform and will be embedded into all different types of the objects to create an interactive interface that will help to support the autonomy of the user. This will logically lead to strengthening the individual's position within the society even he/she will first not realize it and will treat the modern technology in various way of understanding, accepting and effective usage.

Once the services and applications have been found to be feasible, usable and appropriate to user needs, large-scale validation will be carried out in Validation centres in four countries. Hundreds of users will try out the services in their homes and the impact and consequences will be analysed. The economic viability and long term sustainability of the services will be addressed in order to facilitate real mainstream implementation.

Most of the projects done in the field of e-accessibility, support of autonomy of elderly and impaired people and their inclusion into the information society approved that the technical support of life environment can really help people to meet the needs for daily life activities. The implication of intelligent technologies that help people to control the environment /fully or partially/ reduced the need of institutional and social care and move it more into the home care and self-treatment. On the other side even the ambient devices and services were successful, the results of the study and research mostly stay in the laboratory conditions on the level of the experiments or they are applied into the praxis only on the local level, so they are not widely spread and accessible, available and accepted by all potential users. This is the main initiative we have – to show, approve and apply the useful smart technologies and services within the mainstream products offered to wide range of population.

The realisation will be therefore done in the close cooperation with the real conditions and end-users in following areas:

- Environment Management
- Communication and information
 - Communication via telephone /land lines, cell phones, internet calls/
 - Inside intercommunication, video interphones
 - News, information

- Data transfer
- Data transfer for professional and educational purposes
- Safety and Security
 - Control of domestic appliances using alarm systems with indicators of unwanted visitors, fire, flood, smoke, gas, camera systems
 - Personal safety
- Individual's special needs and requirements
 - Teleassistance
 - Telemedicine/Hospital control
 - Daily life activities support
 - Design for All - access to control systems
 - Entertainment – leisure activities
 - E-government
 - E-shopping, E-banking
 - Household activities

3. Existing Technologies and Services Available in Slovakia

We have analysed the situation on the Slovak market with services intended to support daily life of aged population. Slovakia has some delay in the development and implementation of ICT. We have found only a few services on the market. On the other hand our market is well prepared with the Assistive technology that often has to be a part of the interface enabling a good communication environment for services with ambient intelligence.

In Slovakia there are some ambient intelligent technologies already in the practical use - e.g. voice interactive information about weather, railways, traffic on the road provided from internet, information about railways via phone – automatic answering system via calling centre, voice recognition – pilot service – intelligent system, they can recognize what person is asking-even still not automatic but it's interactive.

One example of a good and important already running service is Distress calling centre– available so far in three regions Bratislava, Nitra and Banska Bystrica. The users use the portable device equipped with the button placed on the bracelet or necklace worn by user on the neck or wrist – and in case of an accident or in emergency situation after pressing the button there is the call centre. Operator investigates the situation and then he/she calls the nurse, family, neighbour, relatives. The call centre can have also information about the user health condition and communicates with user about what happened and what's the problem. It works mostly for users whose diagnosis is known but we tend to apply it also for cases when accident happens to person without known diagnosis so in any situation or position user can communicate with emergency. On the basis of that Centre, we plan to build a home monitoring/control system.

One part of the home ambient intelligent system shall be an accessible control of environment – using simple graphical “language” - pictures, letters, or other Assistive technology tools for people with sensorial impairments. That system will work with sensors based on Zigbee radio technology, and broadband systems that connect user with computer and use the embedded and intuitive tools and interfaces. Sensors should be controlled by PDA or PC and it'll be monitoring a room, user and supervisor will have information about the facilities, and their quantitative values about gas, fire,, etc.

The long-term function of the Slovak FU centre is to serve as the Demonstration and Training Centre for new EU countries. Different kind of technologies, services and devices will be installed and maintained.

We understand a psychological dimension of the testing services with elderly and people with disabilities. Therefore we put much effort in the ethical legislation and work with professionals / psychiatrists, geriatrics, reahbilitation staff and social medicine staff. This is very important in the phase of selection of the external testing sites. It is also the question of the acceptance of the services by users. Different testing sites will be equipped with different technology. For communication goals, we have already an experience in using videocommunication system - Skype for regular contact with our quadriplegic client. He has been involved in several research and education projects with us.

4. Feasibility and Usability Centre Design Specifications and User Controls

The aim is to concern on an integration of useful domestic appliances and services that can be delivered in mainstream systems and platforms directly to end user in the ambient intelligent environment. Controlling of the kitchen environment provides independence, self-activity to elderly, disabled person in general and the entire community in the home environment is one of the services that will be provided in FU centre 5 Slovakia. The creation of possible scenarios facilitates conception of daily activities in the home environment shows an overall view of development of mutual human–user and intelligent environment relationship according to home automation requirements and the principles of design for all. The result is providing comfort and security to elderly and disabled people, who are ageing in their smart homes and do not have to stay in the institutional care. The services will be selected among the following types of envisioned services:

- Home safety and control (e.g. intrusion detection, home automation, videoconferences, emergency alarm handling, heating, lighting, inactivity detection, etc.)
- Safety and security (e.g. fall detection, unusual behaviour detection, technical alarms management, visitor validation, etc.)
- Activity detection (e.g. permanent human location and recognition, etc.)
- Household appliances (e.g. refrigerator, washing machine, oven, cooker, dishwasher, microwave)
- Home appliances (e.g. set top boxes, DVD player / recorder, TV sets, etc.)
- Communication devices (e.g. telephones, Internet access, wireless connection etc.)
- Activity planning (e.g. agenda and reminders, palm-tops, etc.)
- Support to wheelchair navigation & navigation for sensory impaired (e.g. assistance in passing doors and automatic or semi-automatic navigation, opening and closing windows, doors, switching on/off the devices in distance or not easy-reachable, etc.)
- Health (e.g. monitoring of intake of medication, health monitoring, telemedicine, etc.)
- Information (e.g. community video-on-demand, conference-calling, building community, translation, education, e-Democracy, video telephony, specialist TV channels, etc.)
- Entertainment

As an example for the Home environment deconstruction of services we present the next picture and table describing one service.

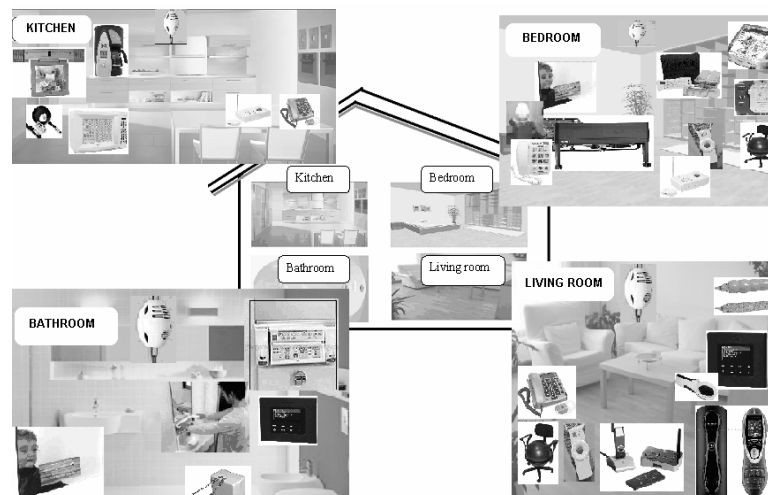


Figure 1 Ambient Intelligence Tools and Assisitive Technologies Applied in the Home Environment

Possible scenario for using a Talking microwave: Miss Green has low vision ability. She tries to reheat her food in talking microwave oven. She selects button of the asked program for preparing her food and microwave oven talks her through pressing the buttons. She puts her dinner into microwave oven and hears current power level and each step of the microwave cooking process. She likes to reheat potatoes too. She opens the microwave door and puts potatoes there. After closing the microwave door, she selects button of the asked program for preparing her food again and she is able to hear all announcements of microwave cooking process. Finally, her potatoes are reheated.



Figure 2 Talking Microwave Oven I

Service Name		Controlling of kitchen environment S1.1	
Field		Comfort application: home control	
Main target		Elderly, disabled person in general, the entire community	
Service Description			
Service description for everyone: Ability to control kitchen environment			
Service description for elderly and disabled: Access to common facilities in the kitchen environment, ability to control electrical appliances as everyone else.			
Illustrative playlet: Miss. Green is an old lady with low vision ability. She is preparing food in her kitchen. She is using commonly available and used technologies and electrical appliances such as talking microwave oven.			
Comments: Controlling of the kitchen environment and providing independence, self-activity to elderly, disabled person in general, person with low vision ability, the entire community and their family members.			
Value for the customer		Value for the provider	
Independence and self-activity during daily activities in the home environment.		Much larger market.	
Actors on the customer's side		Actors on the provider's side	
Actor	Role	Actor	Role
End user Family	Beneficiary Potential subscriber	TUKE Whirlpool GoldStar The Hamilton Beach products	System integrator Technology supplier Technology supplier Technology supplier
Needed technologies		Others	
Existing	To be developed	Success-key factors	Risks
Talking microwave oven T1.1 Compact Microwave Oven with Tactile Touchpad T1.2 Talking microw. T1.3	Sensors informing about the device status	Users satisfaction	Devices compatibility Users acceptance High price
Technology Name		Talking microwave oven	
Brief description		The existing service enables an end-user to provide convenient meal preparation using talking feature.	
Detailed description		The user can set five programs using five memory setting buttons for usual cooking process. Talking microwave enables an end-user to hear each step of the microwave cooking process and provides comfortable food preparation.	
Field		Electrical appliances	
Main target		Elderly, person with low vision ability, disabled person in general, the entire community	
Services		Controlling of kitchen environment S1.1	

Table 1 Controlling of Kitchen Environment

Above mentioned service - Distress calling centre described in the same table. Safety and security services will be delivered to end user to prevent from fallings and other risk situations. Service of Distress calling centre and ambient intelligence tools such as emergency help dialers, security phones and panic buttons will be mainstreamly delivered to elderly end users to provide their safety and security. Similar and more other tables describe all other testing services. Those tables create a development tool for the MonAMI project - Deconstruction of existing, derived and new services.

5. Conclusions

The MonAMI integrated project main goal is to improve life of the ageing population and people with various impairments in Slovakia and in this way to contribute to better life in Europe generally. This document states the main objectives, current state and future directions of the project MonAMI we are involved in. It is very important to implement the mainstream intelligence tools that become accessible available and acceptable for all the users in the unified technology&service platform. MonAMI has a responsibility to address the needs of elderly and disabled people in the context of an aging population that increases the financial burden on public services and also the personal life of the target group is more dependent on the surroundings.

To ensure the difficulties encountered by the individuals concerned are alleviated, the services we use are sustainable; our initiative is to make existing services cheaper, more widely available and not necessary used in the first place. It would be an ideal situation if the elderly and disabled users were self-sufficient in the terms of provided services and so fully participating in the society. Based on the existing technologies and services and its analysis we plan to adjust and modify them into the technology platform according to the current situation and the needs of users in Slovakia respecting the Community Criteria for Social Integration.

Elderly and disabled people will be able to use the mainstream technologies and services to avoid the institutional care and replace it with home care that is more acceptable, comfortable and emphasize the preferences of individuals as well as society – to support living at home, communicate and have own life. Testing process in our FU centre will be focused on the human-machine interaction between user and technology (existing, derived, innovated or new, developed). Another important goal is to create a unified control systems for easier provision and more effective application, spreading and using the services. The wider the range of intelligent technologies and services will be on the market, the more universal the covering the sources of the ambient intelligence tools will be. The project follows the three basic priorities – unified European informatics market, innovation and investment development and inclusive European information society.

References

- Andrich R., D. Šimšík D. and A. Galajdová (2002) *Podporné Technológie. Rovnaké Príležitosti Pre Osoby so Zdravotným Postihnutím*, Edition of Technical University of Košice, ISBN 80-7099-953-5.
- EDEAN (2007) European Design for All e-Accessibility Network-Newsletters and internal sources, www.edean.org.
- MonAMI (2007) Mainstreaming on Ambient Intelligence - project internal sources, <http://monami.info/>
- Šimon, P.(2007) *Services and Technologies for Ambient Intelligence in Home Environment*. Masters thesis. Department of Instrumental and Biomedical Engineering, Faculty of Mechanical Engineering, Technical University of Kosice, 92p.
- Šimšík D., A. Galajdová, G. Ara, A. Micangeli and A. Annan (2004). *ATTRAIN Assistive technology*, Edícia Vedeckej a Odbornej Literatúry, Faculty of Mechanical Engineering, Technical University of Kosice, ISBN 80-8073-231-0.
- Zeľaňáková, J.(2007) *Ambient Intelligence Tools Applied in Everyday Activities in the Home Environment*. Masters thesis, Department of Instrumental and Biomedical Engineering, Faculty of Mechanical Engineering, Technical University of Kosice,102p.

Acknowledgements: The authors would like to thank for the support of the grant of European Commission as the research is done within the 6th Frame Program that we are involved in as one of the contractor of the integrated project within the priority 2.3.2.10 *e-Inclusion* with an acronym MonAMI - Mainstreaming on Ambient Intelligence IST-5-0535147.