Case Studies

The following case studies have been prepared by consortium members of the EC-funded project AAL in order to highlight typical scenarios and solutions which are associated with "Ambient Assisted Living".

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Project website: www.aal169.org

Hearing Aid

Prepared by TEMAS, Switzerland

Involved company: ***Phonak Switzerland***
Company description: The Phonak group is specialized in the development, production and global distribution of technological leading hearing aids. With a global market share of 15%, Phonak belongs to the world leading manufacturers of hearing aids. In Switzerland, the market share is 30%.

Product: ***Hearing aid 'Savia'***

Features of Savia:

- First hearing aid that automatically adapts to the environment in 6 different in-ear and 3 behind the ear applications
- The AutoPilot function continuously and automatically analyses in every hearing environment all tone signals and sounds and automatically selects the most suitable hearing program out of four. The result is an excellent audibility, comfort and speech comprehensibility
- The AutoFocus function comprises the restoration of the natural sound location combined with an active suppression of disturbing background noises
- The sound cleaning function reduces unwanted noise such as wind or echoes, thus resulting in an extraordinary understanding of voices.
- The programs of the hearing aid can be specifically adapted to the user's requirements
- Remote control capability integrated in keys or wrist watches
- Wireless transmission of sound directly into the hearing aid, e.g. for convenient understanding of presentations, by an integrated receiver that simultaneously acts as a remote control for the hearing aid and as a hands-free phone system for cell phones based on bluetooth

The following user's requirements are met by this development

- Hearing and understanding in all situations (usage of cell phone, audio functions on laptop, TV, MP3 player possible)
- Speech comprehensibility in environments with several background noises (e.g. in restaurants or outdoors on busy places)
- Natural sound location (for a better understanding e.g. in meetings or round table discussions)
- Fatigue-proof communication during echo situations
- Elegant and discrete design combined with excellent wearability
- Easy usability provided by autonomous working functions, individually adapted to the customer's requirements
- Discrete remote control functionality for volume control and program switch – manual intervention is still possible despite the autonomous functionalities

Conclusions: The large variety of functionality as well as the design, which allows a specific adaptation to almost all hearing situations makes this product extremely attractive for a broad target group of all ages suffering from a hearing defect. Furthermore with respect to the connection to existing devices such as mobile phones and TV, it serves as a good example for the integration of a new device into an existing infrastructure.

Assistance for visually impaired people

Prepared by TEMAS, Switzerland

Involved company: ***Bones GmbH***

Company description: Bones GmbH develops and markets easy to use portable assistants for blind and visually impaired people to increase their autonomy and integration in everyday life.

Product: ***PAVIP "Personal Assistant for Visually Impaired People"***

Features of PAVIP:

- System of portable user devices for visually impaired people with accompanying counterparts (electronic infrastructure equipment), with which the user may communicate and interact.
- Application to the public arena: For the sub-functions navigation and communication there was a field test in Berne in November 2004. The navigation function of PAVIP leads users from the train tracks to the departure point for the streetcars. This navigation is made possible through the PAVIP user devices that offer multiple interactions with public transport. The user device indicates the direction to take and supplies additional information for path identification through an acoustic output. The desired means of transport is then identified and useful information for entering and exiting the streetcar is supplied. Applications for orientation in public buildings are also considered.
- Application to the private arena: The PAVIP user device may also be used without additionally installed infrastructure equipment. One application is the voice recorder Milestone 310 (portable electronic notepad in credit card format , 11 mm thick). It has been developed in close cooperation with the Swiss National Association of and for the Blind (SNAB). The voice recorder has been tested by visually impaired users in everyday situations and received outstanding ratings. Due to its simplicity it is also well suited for older people.

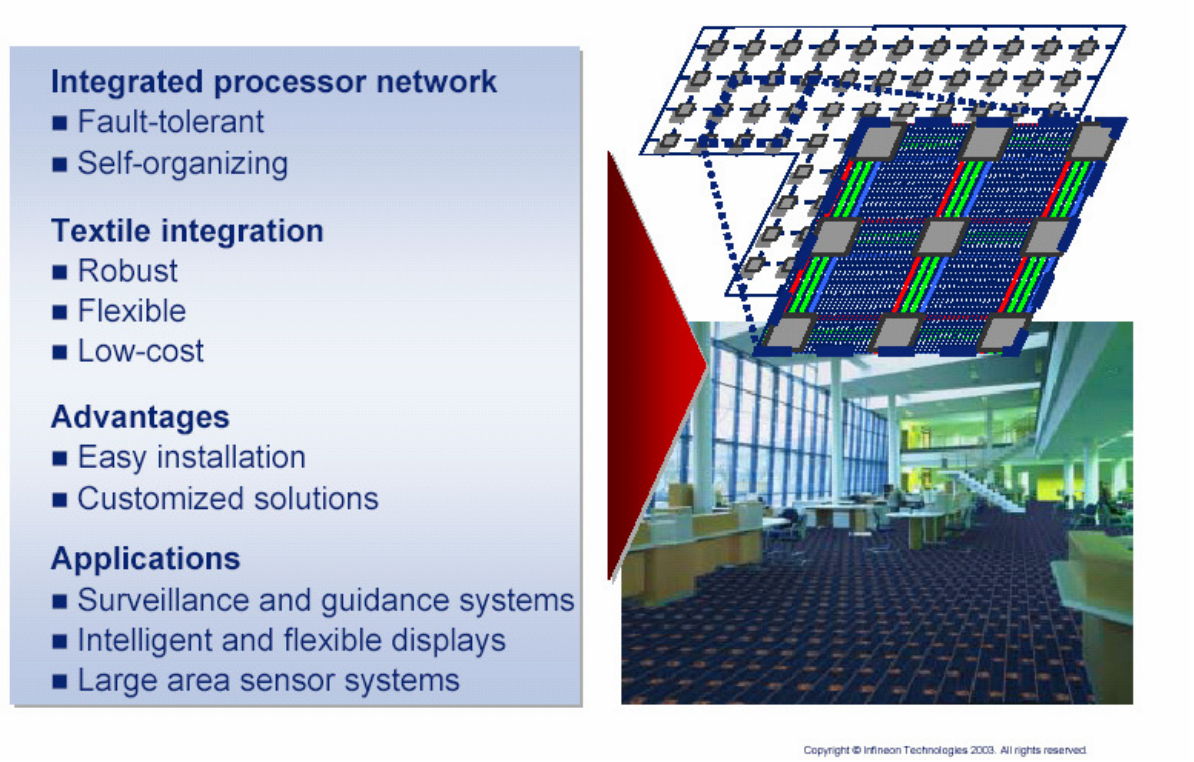
Conclusion: The PAVIP system with the described functionality makes a valuable contribution to increasing the autonomy of visually impaired people. The device offers simple and straightforward operation with a focus on always ready, daily use. Due to its modularity the system can be specifically adapted to the environment.

Smart Carpet - by Infineon / Vorwerk

Prepared by VDI/VDE-IT GmbH, Germany

Short description of product (functionalities, technologies)

Together with Vorwerk Infineon developed a prototype for an intelligent textile floor cloth. The carpet is equipped with sensor functions for monitoring of vibration, pressure and temperature. The data management will be done by a self-configuring network of robust microprocessors. Self-organising means, in case a sensor fails, the processors in the neighbourhood can determine their position and look for another connection around the defect region. In this way it will be possible, to exchange parts of the carpet at anytime. The capacitive, i.e. on contact reacting sensors are incorporated in a textile grid – usually the back coating of the cloth - and connected with thin woven textile cables. The prototype contains only LEDs, which are lighting in a row.



Relevance for customer and society - esp. AAL-target group (which needs and demands are met?)

The possible applications for the smart carpet are multifaceted. In building applications the data gained by the sensors could be transferred to a PC of a security centre. In this way the security guard knows, in which part of the building persons are staying. E. g. in the night time an intruder could be detected. In a cinema the carpet could direct the visitors to their seat. In the carpet or a wall textile integrated gas-sensors could detect smoke and alert the fire brigade.

In the private home or a nurture institution the carpet could monitor walking patterns and detect deviations of the daily scheme or even a fall of the person and alert the nurse or the medicine. Also in this case included gas-sensors could measure the amount of CO2 and if needed open the windows for airing via the home bus network.

Industrial and market relevance (today, future scenario)

Infineon presented first samples in the end of 2004. The cooperation with Vorwerk will help the developer from Infineon to complement their know-how in semiconductor technology with

the well-established industrial expertise of Vorwerk. The main problem now is the fast transfer of developed demonstrators into the textile production line.

European Dimension (why European co-operation for this topic/ product?, Good European position in world-wide competition?)
The potential of the smart carpet (or wallpaper or …) is high. To spread the results a kind of European standard has to be developed. Infineon will produce the ICs, Vorwerk the carpet – but who will write and sell the software for the different applications?

Innovation barriers still to overcome (that require public funding)
One major problem is how to enter the market. The smart carpet will be e. g. 20 % more expensive than the traditional one. If it is presented on a fair like ORGATEC it is simple for the facility manager: He will calculate how much more he has to pay for the carpet and what he will gain, then he decides to buy it or not.

But what the older customer will do? Where does he get the information about the smart carpet? Where can he buy it? Who will install it or offer this as a service? The carpet can only be useful in connection with a PC. Elderly people not often have a PC and the ability to connect it with the carpet.

Case Studies on AAL

Prepared by MSTA, Italy

Some interesting projects on assistive technologies for elderly and disabled people have been carried out in Italy by the research laboratory ***"Imagelab"*** at the University of Modena and Reggio Emilia (http://imagelab.ing.unimo.it/imagelab), together with other research centres. The research in Imagelab covers topics of pattern recognition, computer vision, video analysis for indoor/outdoor surveillance and multimedia.

Two important research projects have been recently completed by the Imagelab: the project ***V.A.D.A. ("Artificial Vision for Disabled and Aged people")***, sponsored by European Social Fund, Region Emilia-Romagna and Ministry of Social Affairs in 2004, and the project ***D&D ("Domotics for disability")*** sponsored by the Cassa di Risparmio di Modena Foundation (2003-2004).

The projects V.A.D.A. and D&D studied new automated systems in order to facilitate the interpersonal communication and the interaction of disabled and elderly people with the home environment, mainly using personal computer. In particular, basing on artificial vision, the projects studied human machine interfaces (HMI) adapted to various pathologies of mobility disablement. These interfaces do not require any application of sensors to the user's body, differently from other systems.

A disabled person, the engineer Simone Soria recently graduated in computer science, worked for the projects V.A.D.A. and D&D: he developed the software and tested it by himself. People like him (unable to use their limbs) have strong difficulties to interact with the world, especially if they also have problems to speak. Often, non-automated aids are used, to allow communication with gestures of the head and through another person able to understand these movements. Human-machine interfaces are alternatively used, but they demand a good coordination of the movements, therefore they are only suitable for soft disabilities. Moreover, many of the aids currently in commerce are too expensive and not customizable enough to the requirements of the user; therefore they only partially resolve the problems.
These projects had the goal of developing a human-machine interface that is simple, cheap and easily adaptable to various pathologies of mobility disablement, also the heavy ones. Two systems have been developed for this purpose:

"FaceMOUSE" and ***"LaserHOME".***

These devices are patented and will be commercialized very soon.

FaceMouse is an innovative software planned and patented by the engineer Soria (disabled person) and developed by the company AIDA1 in Modena. FaceMouse allows the disabled person to communicate with his computer and with the home environment (in order to phone, to open/close windows and doors, to switch on/off lights, etc.) without hands, voice and sensors. In this system the mouse pointer can be simply controlled by moving the head or another body part in front of a web-cam. FaceMouse is based on Artificial vision technology, so the system is very flexible and easily adaptable to the specific requirements of the disabled user by means of additional software (in fact, the system has been tested by people with very heavy motor disability at the ANFFAS Onlus in Modena and fine-tuned according to their requirements). A new system, called "FaceETRAN" is currently under development to replace the well-known communication device for disabled people ETRAN.

LaserHome allows the user to communicate with other people and to interact with his automated home by pointing symbols and letters (printed on a common paper) with a simple and light laser pen, like the ones used by teachers during their presentations. Disabled person that cannot pilot the laser pen with the hands, can easily fix it on a hat or a helmet.
LaserHome is an easy and cheap interface between the disabled person, his computer and his home environment (it can also be used as a remote control system). The paper boards with symbols and letters have been prepared with the cooperation of the Ausilioteca, an association for disabled people (see Figure 1). For example, the user can point the symbol of an opened door if he wants to open the door.

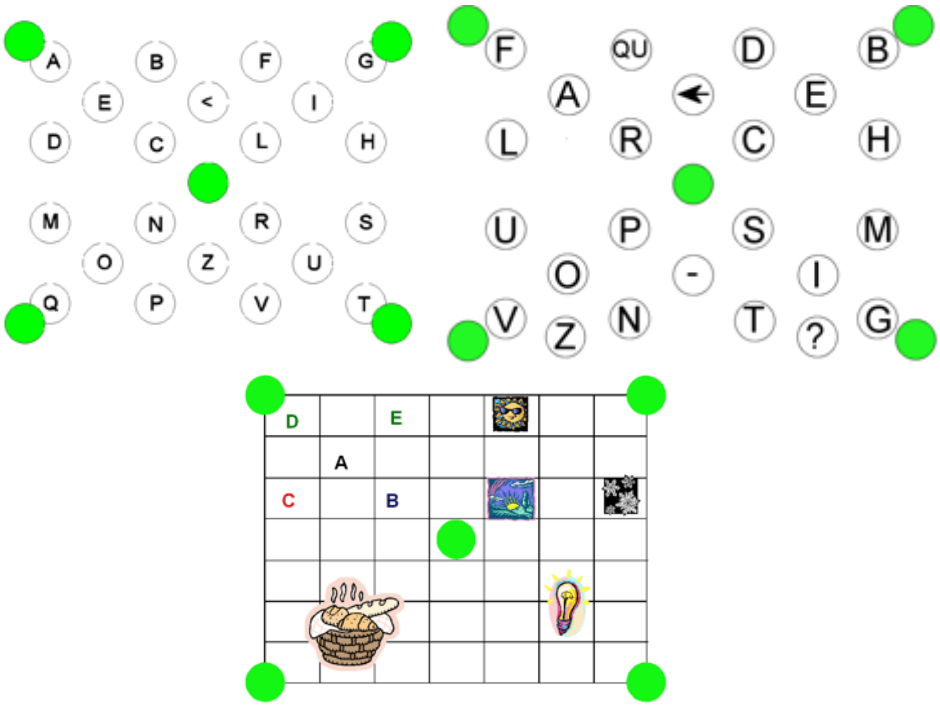


Figure 1 – Examples of LaserHome boards

[1] AIDA (Ausili ed Informatica per Disabili ed Anziani – Assistive and Information Technologies for Disabled and Elderly People) is a company founded and directed by engineer Simone Soria. For information see www.aidalabs.com.

FRR Friendly Rest Room

Prepared by TU-Wien, Austria

General

Toilet facilities often do not meet the specific needs of older people. In many cases public rest rooms form obstacles of such magnitude that their usage is avoided altogether. For older people the point of needing assistance in the bathroom represents a main turning point in their perception of personal limitations.

Using the rest room is part of everyone's daily routine, and people usually do not think too much about it until their routine is disturbed because they cannot see, move, hear, understand or act as they are used to or would like to. This can be caused by illness, an accident or, in most cases, by simply getting older.

The Friendly Rest Room Project aimed at developing a user-friendly rest room for elderly and persons with limited abilities, allowing them to (re)gain greater autonomy, independence, self-esteem, dignity, safety, improved self-care and, therefore, enjoy a higher quality of life.

Research conducted in the FRR project served two goals. The first goal has been to gather general knowledge about the problems elderly and disabled encounter in the toilet area. The second goal has been to study whether the design solutions that should be developed will fulfil the user requirements and preferences and thus design satisfying solutions which will enable old and disabled persons to use the toilet more independently.

The final part of the research process consisted of testing the prototypes in 5 different test sites in Europe (Lund in Sweden, Vienna in Austria, Athens in Greece, Milan in Italy, Delft in the Netherlands).

Relevance for user group

The products currently available in the market only meet very few of the users' needs. Especially in (semi)public environments these products are too specific to be useful to a variety of users. Suitable products often end up in special toilets for disabled people which are generally not accepted by people who do not consider themselves to be disables (but who could do better with a little help).

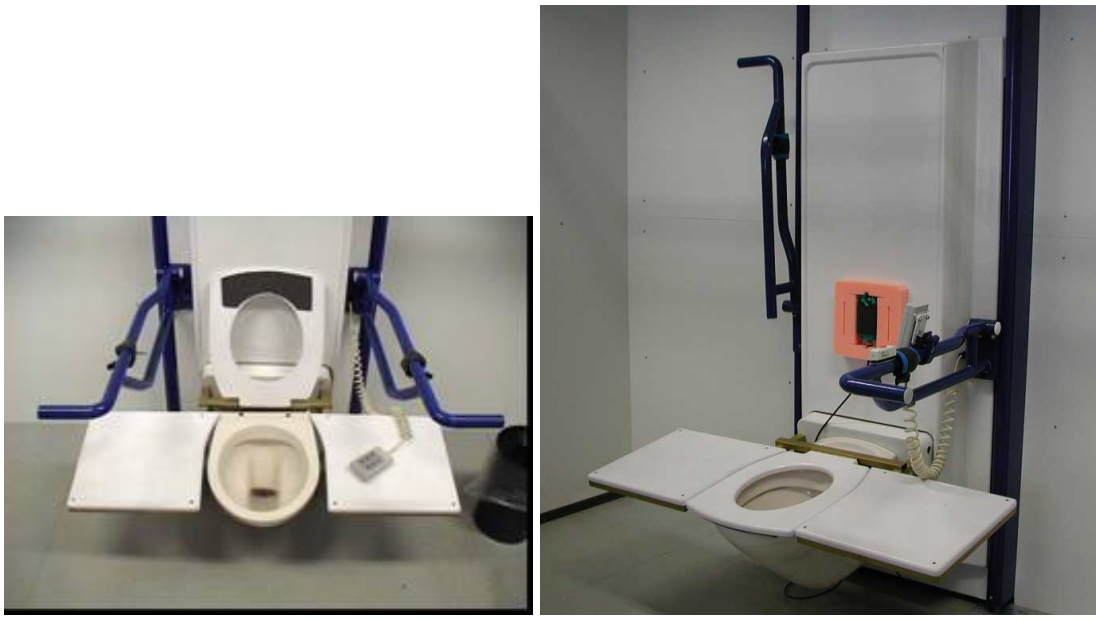
The FRR was designed with a variety of users in mind - suitable for "all". Depending on the user and his/her possible limitations, the FRR environment adapts itself to the specific needs of the user with the help of assistive (and invisible) technology. A user with no specific needs will find a standard toilet, a user with specific needs will find an environment which suits his/her needs in the best possible way.

Even if an intelligent toilet can enhance independence in toileting there will still be users who cannot use the toilet without help. Therefore, the system also supports the so called 'secondary users' (i.e. persons who assist in the process of toileting).

Features of the intelligent toilet prototype developed in the FRR-project are:

- Innovative toilet seat design for improved safety and stability
- New designed horizontal and vertical grab bars to support the users while transferring to and from the toilet.
- Adjustable toilet seat in height and tilt

- Remote control of the toilet by speech recognition in addition to manual control (hand held unit)
- Acoustic feedback to the user about changes in the toilet's actual status (e.g. if the toilet starts moving)
- User recognition (contactless via smart card technology) so that the toilet can adapt itself to the users' needs already when the user enters the toilet room.
- Fall detection system to generate alarms if the user falls off the toilet and cannot get up again.



One of the prototypes of the FRR-toilet as used for tests with users in the laboratory

Europe wide Dimension

The design of the FRR tries to create a coherent environment in which the user feels at ease and in control, masking the technology which is used to make the environment adaptable to special needs. An intelligent toilet has to be culturally neutral because it should be used all over Europe, making it possible for travellers to also use "their" toilet when travelling. Last but not least, it had to be accessible for as many users as possible.

Barriers still to overcome

Speech recognition of different toilet users still causes problems and has to be developed further, especially as there are considerable requirements regarding safety of the system.

More intelligence shall be built into the system by developing means to detect the users intentions while she is using the toilet. E.g. to automatically change the toilet position when the intention to stand up is recognized by the system.

User guidance through the toileting process (prompting) could be helpful for people with mild dementia. In this case each next step could be announced to the user by the system to guide him/her through the toileting process.

Industrial and market relevance

A market for intelligent toileting systems already exists. Especially the public and semi-public area (sheltered homes, day care centres, schools ...) forms a large group of possible customers. Further development in the area of an intelligent toilet system will expand the group of possible customers.

Up to date, there exists no product that is directly comparable to the FRR. In Asia some research is done on the field of intelligent toileting, yet the focus is not necessarily on user needs and user centred design.

Disclaimer

The FRR project was partially funded 2002-2005 by the European Commission as project QLRT-2001-00458 in the Quality of Life program.

Information about the project can be found on the project homepage:
http://www.frr-consortium.org/