Hearing at Home

J.-E. Appell[1], V. Hohmann[2], A. Schulz[1] and A. Hein[1]

[1] *OFFIS - Institut für Informatik, Oldenburg, Email: appell@offis.de*

[2] *Universität Oldenburg und Kompetenzzentrum HörTech, Oldenburg, Email: v.hohmann@hoertech.de*

Summary

The Hearing at Home (HaH) project [1] focuses on the needs of the hearing impaired in home environments. Formerly separated devices like personal computer, HIFI-systems, TV, digital camera, telephone, fax, intercom and services like internet access, VoIP, Personal Information Management (PIM), pay TV and home automation grow together to be accessible via a TV set connected to a PC or set-top box that implements interfaces to network gateways as well as to home automation scenarios. Thereby, the TV becomes the central Home Information and Communication (HIC) platform of the household linking together most of the acoustic inputs listened to by the hearing impaired in his home environment. The HIC platform to be researched and developed in the HaH project will support the hearing impaired with easy to fit Supportive Audio Signal Processing (SASP) and visual support for lip reading on the TV screen. HaH is an IST FP6-STREP project executed under the strategic objective Ambient Assisted Living (AAL) for the Ageing Society. Members of the Consortium are OFFIS (coordinator, Germany), KTH (Sweden), HörTech (Germany), Viataal (Netherlands), Telefonica I+D (Spain) and ProSyst (Germany).

Motivation

The increase in the number of persons having hearing deficiencies is strongly connected to the demographic change in the European Union. The sense of hearing begins to degrade from the age of 40 onwards and estimates indicate that more than 50 % of people over the age of 60 have some degree of hearing loss. The demographic change and age related hearing losses will result in an increasing number of hearing-impaired people in the European Union. Estimates of the number of people in the EU with various hearing disabilities in the early 1990s report a number of 6 % of hard of hearing and 0.1 % of deaf people. A study of the Institute of Hearing Research (UK) estimates that 81,536 thousand adults will have a hearing loss in Europe by 2005. By 2015 the figure will increase to be 90,588 thousand. This means that more than 14 % of adults in Europe will have hearing problems. This makes people with hearing disabilities one of the largest groups facing the challenge that communication is mainly audio-based.

Challenges and goals

The HaH project aims at integrating hearing support technologies within common digital TV/STB-like Home Information and Communication (HIC) platform devices. This way, the acceptance barrier is lowered to a minimum. At the same time the available TV screen can be used to support speech intelligibility by visual support. However, pure audio signals (e.g. telephone conversation) do not deliver extra visual information which makes lip-reading impossible. Even video and TV streams, like news documentaries with background voice-over, do not provide this support in general. To overcome the lack of missing visual support, the HaH Project will integrate KTH's "Synface" technology, an animated artificial face showing natural lip movements based on speech input signals [2].

Challenging are scenarios where more then one speaker is talking at the same time (e.g. dispute in TV talk-show) or when other loud, competing background sounds are present, like it is the case for example in action movies. In such situations the hearing impaired – and potentially also the normal hearing - can benefit from signal classification and noise reduction algorithms as they are researched and evaluated by HörTech (Fig. 1, [3]). The HaH project will advance HörTech's algorithms and technologies to account for the specific needs in processing audio signals of videos and TV films. Thereby, the major challenge is to develop algorithms that optimally support the hearing impaired in different and potentially fast changing scenes, which requires faster adaptation of the algorithms compared to real-life situations.

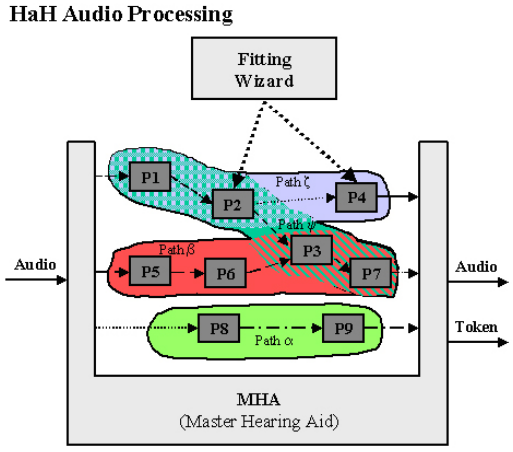

Figure 1: Schematic diagram of the Master Hearing Aid (MHA) framework [3]. Several signal processing blocks (Pn) are combined to form processing chains.

Whereas conditioning of the sound signals by e.g. noise-reduction supports the user independent from his or her specific hearing impairment, fitting and processing of sounds in a personalized way to account for the specific hearing loss of the user is also addressed by HaH and respective research will be carried out by OFFIS. Thereby, the goal will be to develop an optimization scheme using carefully selected video scenes as stimuli that can be executed by the user himself without support from specialists.

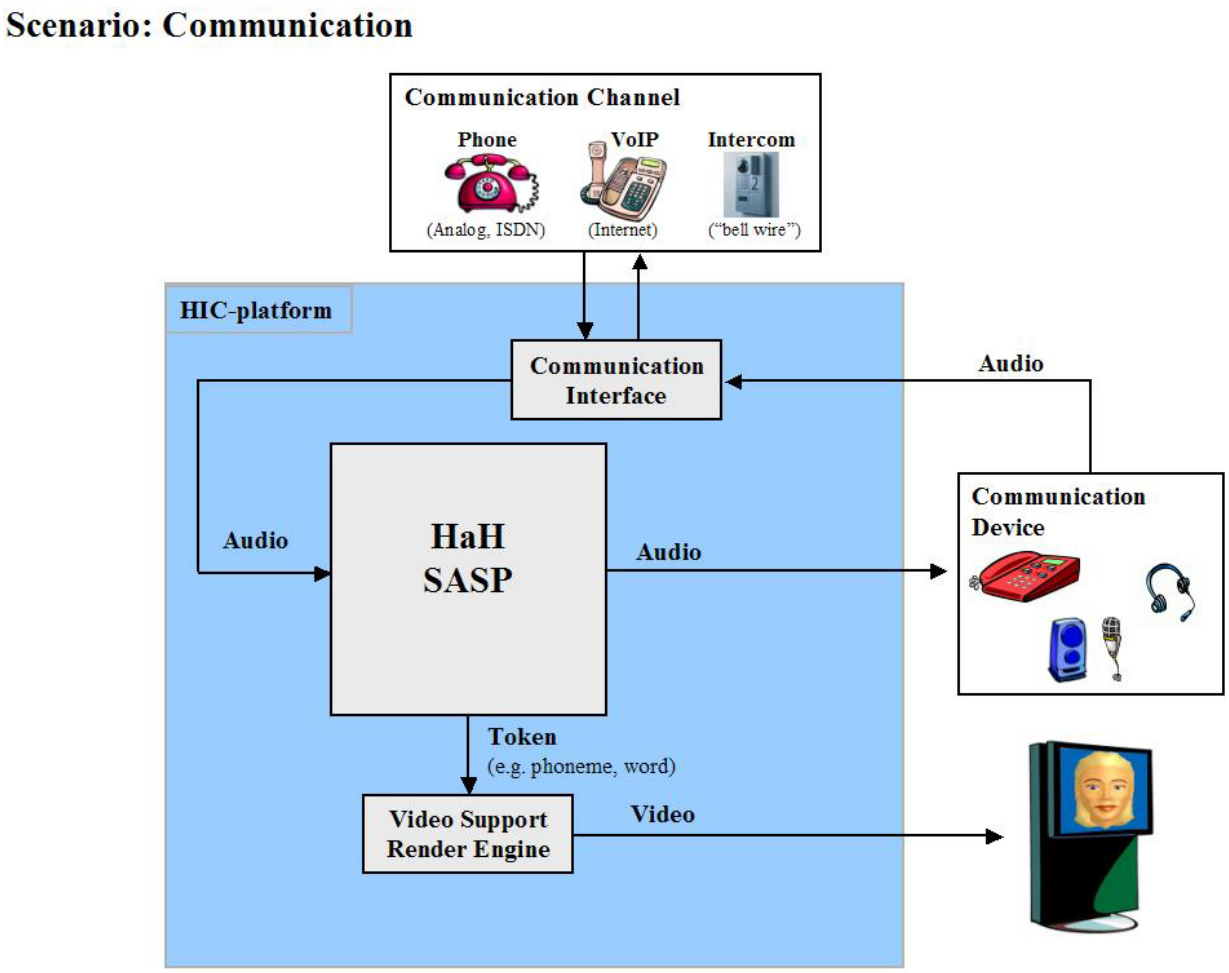

Figure 1: Communication scenario based on the Home Information and Communication (HIC) platform. Signals are input from different communication channels (phone, VoIP, Intercom), processed using the Supportive Audio signal Processing (SASP) and output to the communication device (e.g., headset or phone receiver). In parallel, an animated synthetic face is rendered for supporting lip-reading.

Next to audio input from TV, radio, video and phone, home event detection is audio based, too. A ringing doorbell or finishing alarm of a microwave oven or washing machine are events of this kind. Especially the latter being quite often high-pitched beeping signals are often missed by the elderly. A seamless integration of such events on the HIC platform combined with appropriate prioritisation of the different input streams will be another goal in HaH. The respective work will be based on the Multi-Services Home-Platform, an OSGi-based software architecture for residential gateways developed by OFFIS.

Scenarios

The HaH project will address three different scenarios (see Fig. 2), which address typical home living situations with the need of massive communication. All scenarios will be based on the core SASP system embedded in a residential gateway. Besides the phone communication scenario, a scenario for TV, video and radio Media (handling the entertainment and infotainment part of the home living) and a home automation scenario (for the integration of different sensors like washing machine, fire detectors, cooking oven etc.) will be realized and evaluated. All scenarios will be designed based on the results of questionnaires (end-users, organizations representing hearing-impaired people and professionals in the field) in order to ensure practical relevance of the technical work. The developed demonstrators will be carefully evaluated with end-users in order to ensure usability.

- Supported by the EC, FP6-2005-IST-6 project 045089 -

Literature

[1] Project website: http://www.hearing-at-home.eu
[2] Beskow J, Karlsson I, Kewley J and Salvi G (2004) SYNFACE - A Talking Head Telephone for the Hearing-impaired. In: K Miesenberger, J Klaus, W Zagler, D Burger (Eds.) Computers helping people with special needs, p. 1178-1186.
[3] Grimm, G., Herzke, T., Berg, D., Hohmann, V. (2006) The master hearing aid: a PC based platform for algorithm development and evaluation. Acta acustica united with Acustica, 92, p. 618-628.