Meeting on interior comfort and accessibility, CRF-Torino, 13-12-2013

Age Sensitive ICT Systems for Intelligible City For All

I’CityForAll

2012-2015

Coordinated by CEA

Elena Bianco, CRF

www.icityforall.eu
I’CityForAll Project

Innovative solutions to enhance speech and audio alarms intelligibility for presbycusis people

Ambient Assisted Living Research and Technology Programme

CALL 4 ICT-based solutions for advancement of older persons’ mobility

Europe - National Agencies’ program to help older persons to sustain their optimal level of mobility for as long as possible, as well as enhance their individual sense of confidence, autonomy, competence, security and safety.

Aims at ICT-based solutions to identified user needs:
- Time-to-market perspective of 2 to 3 years after end of the project
- Realistic trial set-up at the end of the project
- Proactive end-user involvement throughout the life of the project
Target group: presbycusis persons

Presbycusis impacting intelligibility perception and ability to localize sound source, physical and social well being ...

3rd impairment of the elderly after arthritis & hypertension

Hearing-impaired persons in Italy

- Approximately 11% has hearing problems
- Approximately 9% wearing hearing aids

(source: Doxa research for AudioNova)
Age Sensitive ICT Systems for 
Intelligible City For All

Aim to reduce urban-related accidents of elderly in urban settings:
(source European Network for Safety among Elderly)
• elderly are involved in 40% of fatal injuries (105,000 deaths/year),
• by walking or with car 1500/day accidents requiring medical assistance

For better attractiveness/intelligibility/mobility in confined public spaces:
supermarket, railway stations, museum, theater, cinema, ....

1. I’City – Loudspeaker in public confined spaces
For better intelligibility of vocal messages and jingles.

2. I’City – Car Embedded solutions for vehicles
For better localization of alarm sounds (e.g. ambulances, police cars) and an appropriate enhancement of in-car alarms (e.g. safety belt warning, lane change warning).

These systems will be “transparent” and embedded in mass products for the large public at reasonable cost for persons with pseudo-normal and presbycusic hearing without impacting normal hearing people: concept “for All”.

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I’CityForAll consortium

Project Coordinator:
French Alternative Energies and Atomic Energy Commission (CEA)

Motivation
Geriatry
Psycho-sociology ORL

In Architectural and Urban Ambient
With ENEA subcontractor

With, as subcontractor,
European Social Cooperative

Solutions
ICT-solutions

Acoustic quality

Age Sensitive Users – Products

ICity – Car
Individual cars, professional vehicles, individual public transport

ICity - Loudspeaker
In railway station, airport, museum, supermarket

Design – Prototypes
Mains steps of l’CityForAll project

**Survey on users’ requirements**
- In France: CENTICH
- In Italy: ESCOOP
- With the collaboration of EPFL, CRF and Active Audio

**Algorithms**
- Audio compensation in Public space/car: LinkLab
- Alarm detection localization: ENEA, TUM, UPD, LinkLab
- Intelligibility criteria: UPD, LinkLab, EPFL

**Integration**
- Car: CEA, CRF
- Public space: Active Audio

**Assessment in Lab / in Vivo**
- In France: CENTICH, CEA, Active Audio
- In Italy: ESCOOP, CRF
## I’CityForAll study on User requirements

### Cohort of users

<table>
<thead>
<tr>
<th></th>
<th>Women</th>
<th>Men</th>
<th>Women</th>
<th>Men</th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>France</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Normal</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>3</td>
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<tr>
<td>Presbycusis people with Hearing Aid</td>
<td>1</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Presbycusis people without Hearing Aid</td>
<td>6</td>
<td>1</td>
<td>8</td>
<td>5</td>
<td>14</td>
<td>6</td>
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<td><strong>Total</strong></td>
<td>10</td>
<td>9</td>
<td>10</td>
<td>9</td>
<td>20</td>
<td>18</td>
</tr>
</tbody>
</table>

**Total**: 19, 19, 38
I’CityForAll study on **User requirements**

Most difficult situations in the Railway station

- To hear and understand vocal announcements during peak hours on a **platform** and in the **main hall** of a railway station especially for users **with hearing Aids**
- **To interact** with teller or desk person especially for users **with hearing Aids**
- **Loud** sounds hurt users **with Hearing Aid** and **normal** users

**But**
- **Jingles** help **all** users to pay attention to the **announcements**

⚠️ **Bad quality of the loudspeakers**
Most difficult situations in the Car

- Most of users drive with **window closed**
- In general, users can perceive **outdoor** alarms
- The **normal** users are able in general to **estimate the distance** of the coming alarm source but the **presbycusis** users suffer from **not** being able to **estimate** this distance especially when they wear hearing Aids
- **Recognizing** if an alarm is coming from the **front** or the **back**, is more difficult for presbycusis users with hearing Aids
- Most of users in general have problem in **Recognizing** if an alarm is coming from the **left** or the **right**, even normal users

**Localization** problem of outdoor alarms for **all** drivers
I’CityForAll study on User requirements

1- Lack of intelligibility of vocal announces
2- Confusion in localizing alarm sources

The design of 2 solutions in For All concept

[ICity – loudspeaker] for better Intelligibility of vocal announces and jingles

[ICity - car] for better localization of alarm sounds and enhancing in-car signals

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I’City – Loudspeaker for better intelligibility

In railway station, airport, museum, supermarket,…
ICity – Loudspeaker  Speech Conformer module

Male voice

Natural voice  Filtered voice

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I’City – Car for enhancing alarm localization

2 solutions for capturing the emergency vehicle alarm sources
3 solutions for enhancing the sense of safety and self-confidence of drivers
Technical details

- Car glass integrated microphones and loudspeakers:

On the car glass a 50 mm outer diameter piezoelectric transducer is hidden in the lower part of the door structure

- Microphone array

Support (Al)  Foam (polyurethane)  Microphone AKG C 417 PP  Wind & Water protection (sintered metal)  Circular Array 20 cm diameter
I’City – Car Sounds alarm database realisation

«TARGET» CAR (measurement equipment)
8 microphones array for source localization, on the car rooftop

Binaural (human-oriented) recording device (at driver’s ears)

«SOURCE» CAR (emitting equipment)
Car equipped with programmable siren

Recordings carried out in lab and in various external scenarios (roads and test tracks): target car noise and test signal-based acoustic characterization, external (traffic) noises and emergency sound signals enter the database
I’City – Car next step
Standard loudspeakers vs. glass loudspeakers – comparison test subjective interviews

External emergency signals from the Audio Database, with directional properties

Internal audio HMI emergency signals, with directional properties

With or without application of pre-compensation algorithms

Activating standard or glass loudspeakers, with controlled directional features

Subjective testing for directional performance evaluation
Thank you for your feedback

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ICityForALL web-site:  http://www.icityforall.eu/