W3C MMI Architecture as a Basis for Enhanced Interaction for Ambient Assisted Living

António Teixeira, Nuno Almeida, Carlos Pereira, Miguel Oliveira e Silva

DETI/IEETA University of Aveiro, Aveiro, Portugal (www.ieeta.pt)
{ajst,nunoalmeida,cepereira,mos}@ua.pt

1) Introduction

Ambient Assisted Living (AAL) software creation presents a number of challenges to researchers and developers alike. On one hand the necessity of including a wide number of devices such as sensors or actuators, each following their own proprietary protocols; the distributed focus of AAL; and the requirement of constant connection. On the other, the character of AAL applications, with a strong focus on contextual usage, usability, pervasiveness, and the user. Combined, this leads inevitably to highly heterogeneous environments.

In truth, this heterogeneity is a serious issue for user-aware development. Good AAL applications require constant adaptation to the user, not only to its position, time of day, or to environment characteristics but also to its mood, preferences, or even disabilities.

Our research focuses on AAL development with a strong focus on interaction with users and exploration of multimodality. We believe that multimodality can not only increase user usability but also lead to more natural and suitable ways of interaction. Within AAL's objectives, multimodality can provide an important push in shortening the gap between the user and its ambient.

2) Adoption Advantages

The W3C MMI architecture presents itself as a good solution to some of our issues. To achieve truly adaptable solutions, we believe that the environment must constantly evolve. This obviously includes input and output characteristics of our interfaces. With the inclusion of the MMI architecture, especially through the usage of MMI Lifecycle Events and the EMMA standard, we have been able to make advancements on some of our difficulties:

<u>Heterogeneity is now a smaller issue</u>. The inclusion of a new sensor/adaptor/modality does not provoke changes in business applications or in the overall AAL environment. Each new device requires only that its functionalities be converted into the appropriate format.

<u>Autonomy was increased</u>. Given its focus on interaction, the W3C MMI architecture allowed us to include into our input/output modalities some degree

of autonomy and intelligence, by being capable of receiving updates and adapting themselves to the present conditions.

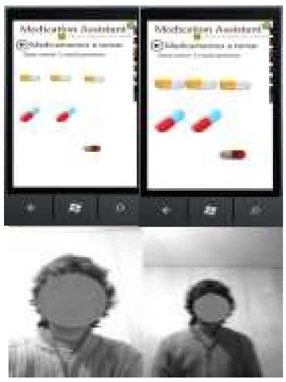
Usability through choice. Applications can now communicate with multiple modalities such as speech, gestures, keyboard, and touch among others, without changes on the core programming. New modalities can be added at any time. Users can now use several methods to interact with applications, increasing their overall usability.

3) Concrete Recent Work

At this time, we have used the W3C MMI Architecture in several AAL projects in which we are currently involved, with interesting results.

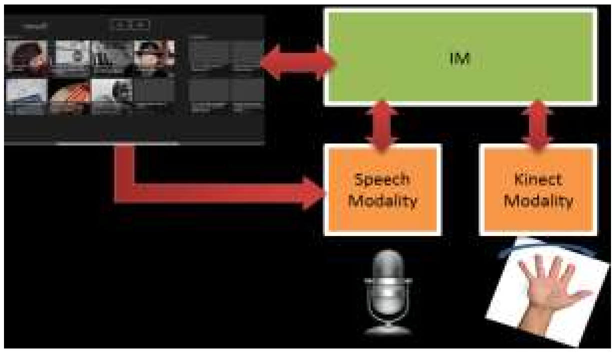
We have developed an MMI Framework following W3C recommendations, by developing the Interaction Manager (IM) in Java using Apache SCXML and support for communication between IM and modalities via HTTP. Modalities are platform independent, and include input modalities such as a speech recognizer supporting different languages, touch and a basic gesture recognizer. On the output, the framework includes text synthesis, natural language generating capabilities (NLG), image synthesis, and a GUI module.

In projects Living Usability Lab (www.livinglab.pt) and AAL4ALL (http://www.aal4all.org) we included this framework into development. One of the results was a new Telerehabilitation Service with multimodal interaction [2, 4] that allows a patient to interact with a health professional via speech, touch and textual input. The service allows for patients to be able to perform rehabilitation sessions at home under remote supervision by a health professional (e.g. a physiotherapist). The service includes adaptation of some of the output (e.g. font size) to the user based on distance, noise or ambient luminosity.



For a mobile scenario, in Smartphones for seniors (http://www.smartphones4seniors.org) project, we created an interesting test bed for multimodal interaction for a Medication Assistant**,** a smartphone app that alerts the user to remember to take its medicine, and provides other information about the drugs such as secondary effects or dosage recommendations in case the user forgets to take it in the right time. Interaction is managed via MMI Architecture definitions. Figure 1 shows the application's general aspect undergoing adaptation (left to right) based on the user's distance to the screen. It was recently presented at MOBACC Workshop integrating CHI 2013 in Paris [1, 5]

In the European AAL Joint Program project Paelife (www.paelife.eu), following our demo and proposal, the W3C architecture was adopted as the basis for project interaction. This demo, called NewsReader, is directed towards giving older adults access to news feeds. The demo consists on a Windows 8 application that supports different languages as input (Portuguese, English, French, and Polish) and allows users to directly control the news via speech or full body gestures modalities. Its main novelty involves generating dynamic grammars based on the news content.



Acknowledgements

The work presented is part of the COMPETE - Programa Operacional Factores de Competitividade and the European Union (FEDER) under projects AAL4ALL (www.aal4all.org), Smartphones for seniors (www.martphones4seniors.org) and Living Usability Lab for Next Generation Networks (http://www.livinglab.pt/). Authors also acknowledge the funding for project PaeLife (www.paelife.eu) from AAL JP and national agencies: Part of the work presented was funded by FEDER, COMPETE and FCT in the context of AAL/0015/2009 and IEETA Research Unit funding FCOMP-01-0124-FEDER-022682 (FCT-PEstC/EEI/UI0127/2011). Special thanks to all our partners.

References

[1] - António Teixeira, Flávio Ferreira, Nuno Almeida, Ana Filipa Rosa, José Casimiro, Samuel Silva, Alexandra Queirós, André Oliveira. Multimodality and Adaptation for an Enhanced Mobile Medication Assistant for the Elderly. Third Mobile Accessibility Workshop (MOBACC), CHI 2013 Extended Abstracts, France, April 2013

[2] - António Teixeira, Carlos Pereira, Miguel Oliveira e Silva, Joaquim Alvarelhão, Anabela Silva, Margarida Cerqueira, Ana Isabel Martins, Osvaldo Pacheco, Nuno Almeida, Catarina Oliveira, Rui Costa, António J. R. Neves. New Telerehabilitation Services for the Elderly. Handbook of Research on ICTs for Healthcare and Social Services: Developments and Applications, Isabel Maria Miranda, Maria Manuela Cruz-Cunha (Ed.), IGI Global, 2013

[3] - António Teixeira, Carlos Pereira, Miguel Oliveira e Silva, Osvaldo Pacheco, António J. R. Neves, José Casimiro. AdaptO - Adaptive Multimodal Output. 1st Int. Conf. on Pervasive and Embedded Computing and Communication Systems, Vilamoura, Portugal, March 2011

[4] - António Teixeira, Carlos Pereira, Miguel Oliveira e Silva, Joaquim Alvarelhão, António J. R. Neves, Osvaldo Pacheco. Output Matters! Adaptable Multimodal Output for New Telerehabilitation Services for the Elderly. AAL 2011 - 1st Int. Living Usability Lab Workshop on AAL Latest Solutions, Trends and Applications (In conjuction with BIOSTEC 2011), Rome, p. 23-35, January 2011

[5] - Flávio Ferreira; Nuno Almeida; José Casimiro Pereira; Ana Filipa Rosa; André Oliveira; António Teixeira. Multimodal and Adaptable Medication Assistant For The Elderly CISTI 2013, Portugal. June 2013