

Exploiting Multimodal Interfaces in eLearning Systems

Imad Alex AWADA, Irina MOCANU, Adina Magda FLOREA

Faculty of Automatic Control and Computers, University Politehnica of Bucharest, Romania



April 20, 2018 - Bucharest

Outline

- Introduction
- Existing Solutions
- Proposed Solution
- Evaluation
- Conclusions
- Future Work

Introduction (1)

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Introduction

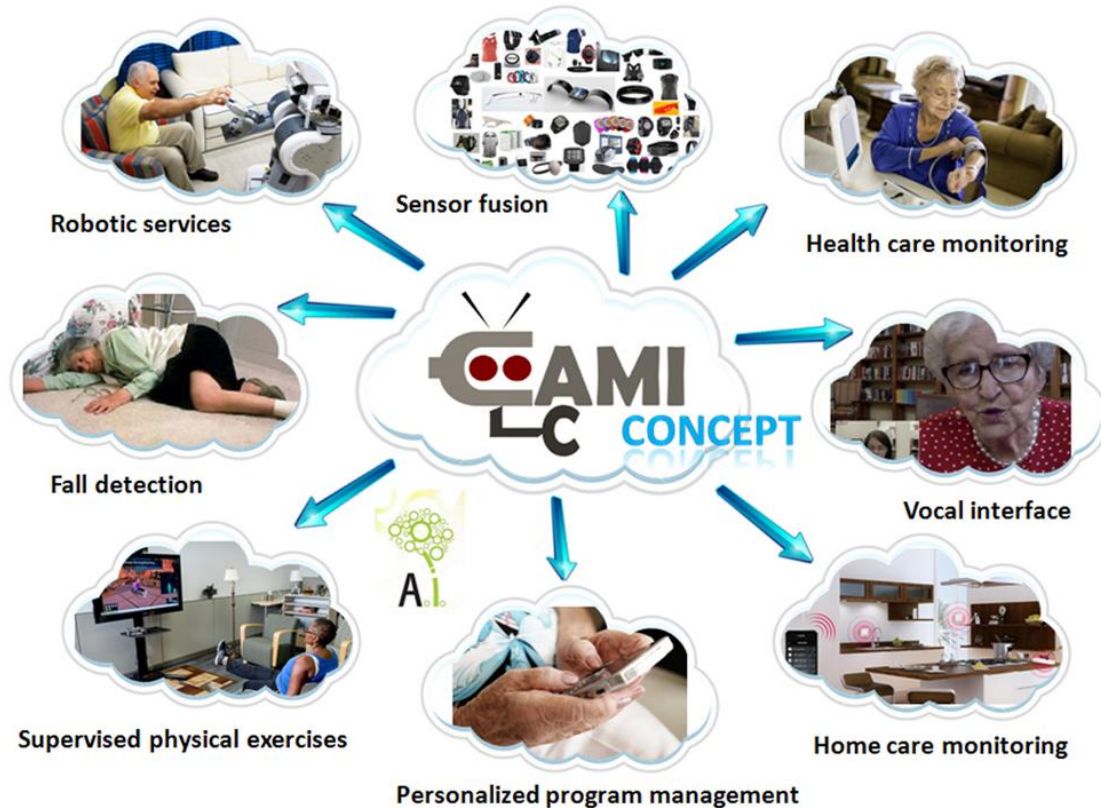
Existing Solutions

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Introduction (2)

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- Traditional Interfaces
 - represented always a barrier for the elderly,
 - overload the visual channel of the user which will decrease the focus of the user,
 - reduce the benefits of any system and especially of eLearning systems,
 - extend the time needed to accomplish tasks.
- During the last years, huge progress was made in the field of interactions between the people and their machines.
- Integrating multimodal interactions into any system will help to eliminate the previous problems



Existing Solutions (1)

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Memphis
Intelligent
Kiosk Initiative
(MIKI)

Developed by the University of Memphis, USA.

Allows the user to ask verbal questions related to four specific topics.

The outputs of the system are texts, graphics, animations and/or video presentation. The visual output is accompanied with a phonetic output.

Touch'n'Speak

Developed by the University of Tampere, Finland.

Allows the user to command the system through voice commands or through a touchscreen.

The outputs of the system are visual (text and graphics) and phonetic.

Existing Solutions (2)

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Multimodal-
Multimedia
Automated
Service (MASK)

Developed by a Consortium composed of French and British partners.

The system integrates speech, pen and touch input modalities.

The outputs of the system are text, graphics, video and sound.

MATCHKiosk
Multimodal
Interactive City
Guide

Manufactured by AT&T Company.

The system integrates speech and touch input modalities.

The outputs of the system are graphics and text outputs.



Most of the previous solutions are integrating speech with another modality as input modalities. Mostly are devices dependent and support one language (mainly the English language). Moreover, neither solution offers any customizable capabilities or tracks the emotional status of the user.

Proposed Solution (1)

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- Two interfaces that are designed to be integrated within an ambient assisted living system, that target the elderly people as its the main users.
- Works across platforms, device independent, multilingual, fully responsive and respect the requirements of the elderly.
- Automatically customizable based on the preferences of the user that are stored in each user profile (*filled in the first use & updated automatically*).
- Mainly developed using HTML5, CSS3 and JavaScript.

Proposed Solution (1) - Interfaces

Introduction

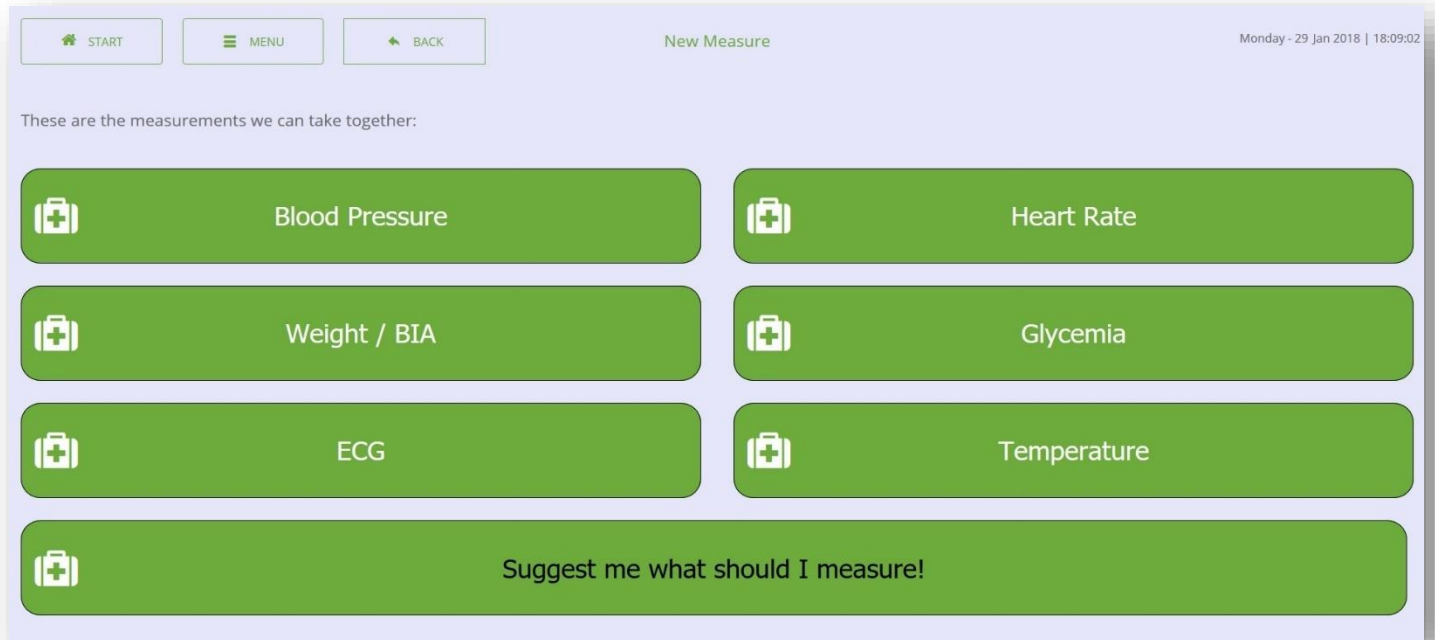
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Interface A (Based on text with icons)

Proposed Solution (2) - Interfaces

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The interface is titled "CAMI LC English" and shows a date and time of "29 - 01 - 2018 | 18:34:36". It features a "Start" and "Stop" button at the top left. The main content is divided into three columns: "Health Status", "Measurements", and "Profile".

Health Status	Measurements	Profile
 108 / 70 BP (S/D) Blood Pressure	 62 BPM Heart Rate	 73.82 KG Weight

Below the measurements section, there is a notification: "You have 20 reminders!" and a message: "Your Diastolic Blood Pressure decreased by 13 BP."

On the right side, there are several buttons for measurements: "Blood Pressure", "Pulse / Oxygen", "Weight / BIA", "Glycemia", "ECG", and "Temperature". A button labeled "Suggest me what should I measure!" is also present.

At the bottom right, there is a section for "take a new health measurement" with a text input field "What health measurement do you want to take?" and an "Avatar" icon of a person.

Interface B (Based on multimodal metaphors)

Proposed Solution (3) - Interfaces

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Interface B

- The voice module allows the users to give speech commands and supports three languages: English, French and Romanian, it has two modes of working: online mode and offline mode (limited).
- The gesture module allows the user to give commands to the system through body movement
- The touch module allows the users to command the system through tactile commands, including multi-touch commands (*such as pinch to zoom*).

Proposed Solution (4)

Testing Platform

- During each session, the system tracks:
 - the task difficulty,
 - the emotional status of the user,
 - the number of interactions needed to accomplish the task,
 - the time needed to accomplish it,
 - the final result of the session.
- The collected data will be added to the user's profile and will be used to customize the interface.

Users Questionnaire

- To enhance the collected results for each session, a standard questionnaire regarding the user's experience during the session was created. The questionnaire contains multiple-choice questions

Evaluation (1)

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Interfaces Test

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Testing Platform

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Users Questionnaire

Evaluation (2) - Interfaces Test

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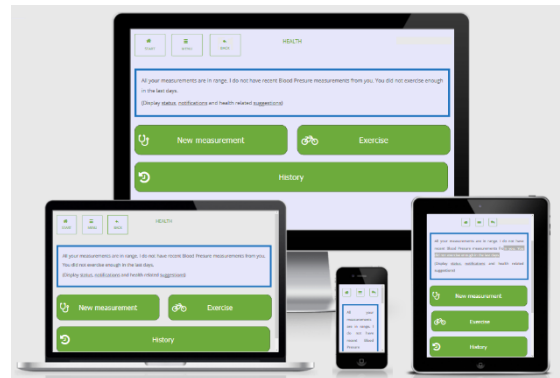
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- Both interfaces have been evaluated by 26 people (14 Male & 12 Female), aged between 58 and 60 years old over multiple devices: desktop computers, laptops, tablets (iOS and Android) and mobiles (iOS and Android).
- They both were fully responsive and compatible across the devices used during the test.
- The users preferred the interface that combine different multimodal metaphors but also the possibility to interact with the system through speech, gesture and touch commands (interface B).
- The different modules of the multimodal interface have been tested and we obtained satisfying results.



Fully responsive interface (Interface A)

Evaluation (3) - Testing Platform

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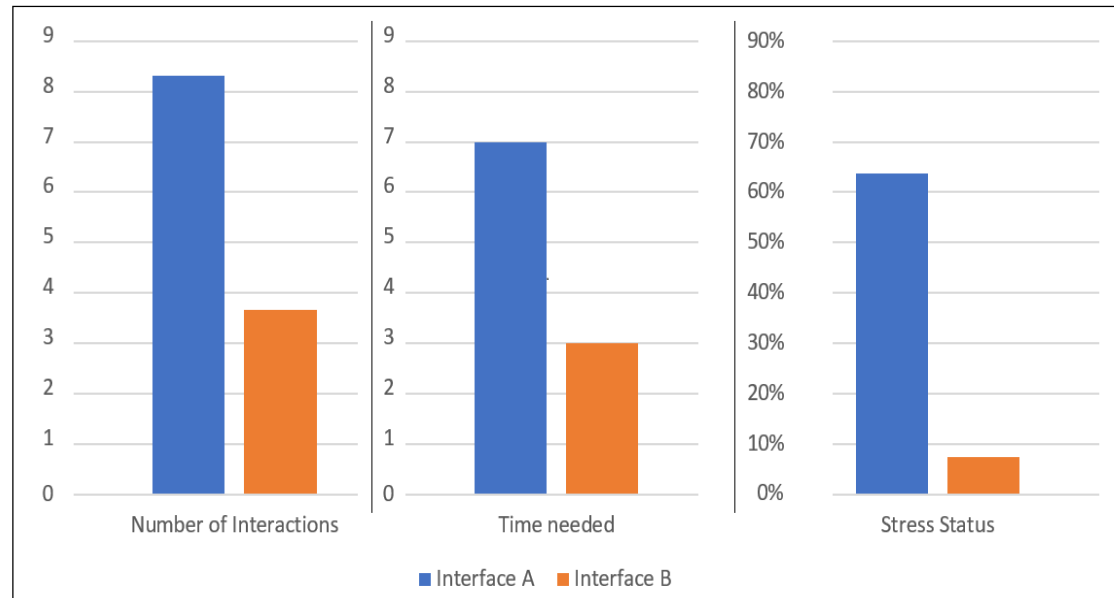
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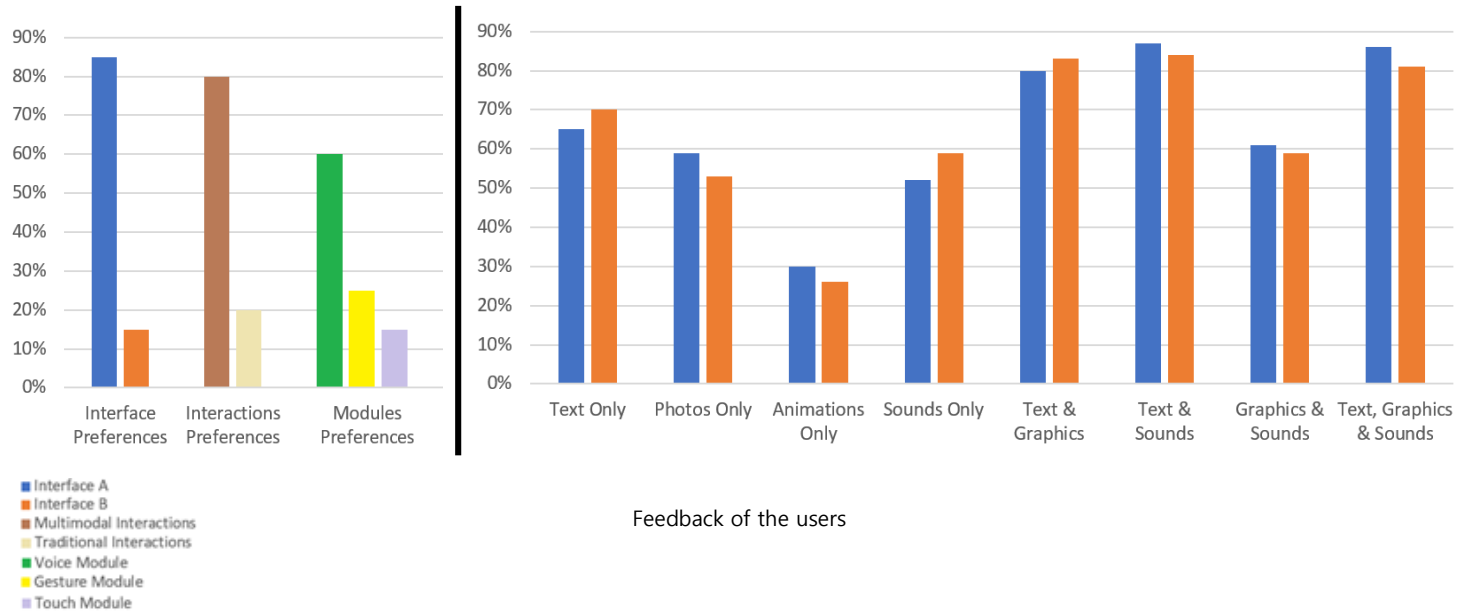
- 26 users were divided equally in 2 Groups.
- For the interactions in which the users from the first group used the interface A, the users of the second group used the interface B, while in the interactions where the users from the first group used the interface B, the users of the second group used the interface A.



Collected Data – eLearning module of the blood pressure measurement

Evaluation (4) - Users Questionnaire

- After each session, each user filled a standard questionnaire that is formed from multiple-choice questions regarding different aspects of the previous session.



Feedback of the users

Conclusions

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- Integrating multimodal metaphors into an interface:
 - engage multiple human senses into the interaction,
 - lead to preserve a high degree of focus during the session,
 - reduce the time needed to accomplish a task,
- Integrating multimodal interfaces:
 - helps to achieve tasks faster and easier,
 - removes barriers that separate some users from the machines.
- The test results illustrate that the users clearly prefer the interfaces that combine multiple multimodal metaphors and allows them to interact with the system through more natural ways of interactions.

Future Work

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- Extensive tests for the gesture and motion recognition modules,
- make the automatic speech recognition available offline for the Romanian language,
- improvement to the customizable properties of the interface,
- implement some rules for the contradictory inputs received in the same time through different input channels,
- apply some errors prevention methods.

Acknowledgements

This work was co-founded by:

- a grant of the Romanian National Authority for Scientific Research and Innovation, CCCDI – UEFISCDI, CAMI – “The Artificially intelligent ecosystem for self-management and sustainable quality of life in AAL”, project number AAL-2014-1-087,
- national project SPARC – “Customer Services Support through Robotic Platforms | Servicii Performante de Asistență a Clienților prin Platforme Robotice”, PN-III-P2-2.1-BG-2016-0425.