



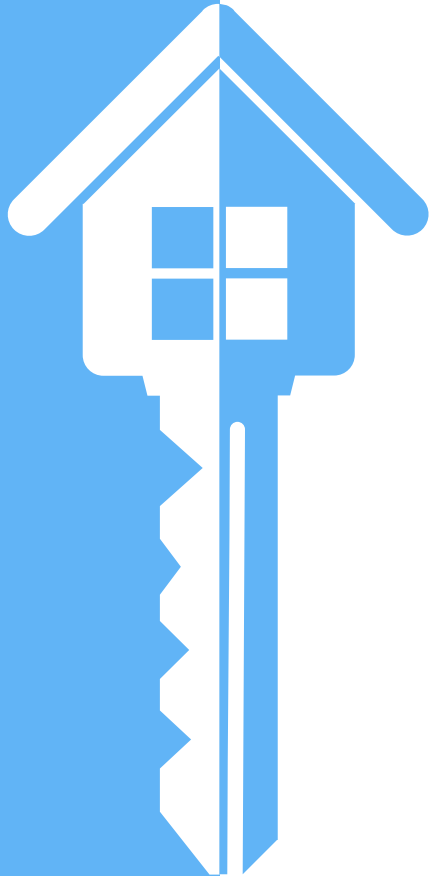
Adaptive User Interface for Healthcare Application for People with Dementia

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Dementia

Dementia is a syndrome due to a disease of the brain, usually of a chronic or progressive nature.

Symptoms

The symptoms of dementia may vary, however, each of the following main mental functions must be significantly affected to be considered dementia:

- Decline in memory and thinking to an extent that impairs daily activities, or makes independent living either difficult or impossible;
- Initially preserved awareness of the environment, including orientation in space and time;
- Decline in emotional control or motivation, or a change in social behavior evidenced by:
 - emotional lability,
 - irritability,
 - apathy,
 - worsening of daily activities (eating, dressing and interacting with others).

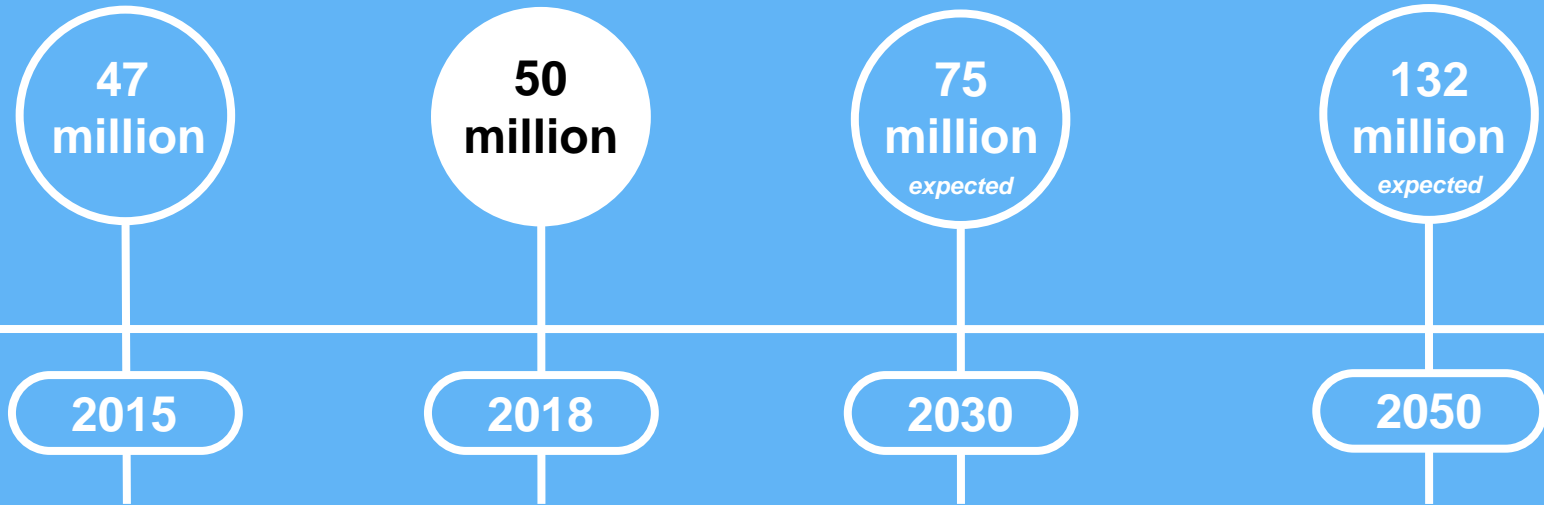


Although dementia mainly affects older people, it is not a normal part of ageing



Dementia in Numbers

Someone in the world develops dementia every 3 seconds, which means that each year 9.9 million new-cases of dementia are registered.



The high cost of the disease will challenge health systems to deal with the predicted future increase of cases. The costs are estimated at US\$ 818 billion per year at present and are set to increase even more quickly than the prevalence (expected to be US\$ 2 trillion by 2030).

Numbers source: World Alzheimer Report 2015

Related Work (1)

- Three main factors should be considered when designing interfaces :
 - accessibility;
 - usability;
 - user experience.

- Two more factors must be considered when designing interfaces for people living with dementia:
 - personalization
 - user_acceptance

- A dynamic interface is needed to respond to the progress of the disease with a gradual increase in the amount of support which is required from the system.

Related Work (2)

- A set of criteria that an interface should address in order to be suitable for people with dementia are defined:
 1. support easy start-up;
 2. support intuitive navigation;
 3. elicit memories to prompt and support reminiscence, communication and social contact;
 4. promote 'non-immersive' engagement;
 5. support an enjoyable shared experience;
 6. support the cognitively impaired person in having a more proactive and equitable role in conversations;
 7. relieve caregivers of the pressure of constantly needing to 'prop up' conversations;
 8. promote 'failure-free' activity (in this context 'failure' refers to both technical and emotional 'failures' such as frustration due to poor technical performance and emotional distress caused by, for example, inappropriate/distressing data content);
 9. support customization of content, for example to accommodate individual personalization and/or different geographical requirements;
 10. promote and support good practice in reminiscence intervention.



IONIS

IONIS

Indoor and Outdoor Solution for Dementia Challenges

Project Code : AAL2017-AAL-2016-074-IONIS-2 (No. 52 and 53/2017)

IONIS

- Strategies for developing solutions that help elderly people to live independently for longer time are being supported through national and multinational programs such as the Active and Assisted Living (AAL) program.
- AAL program is funding the emergence of innovative ICT-based products, services and systems for ageing well at home, in the community, and at work. Its goal is to increase the quality of life, autonomy, participation in social life, skills and employability of elderly people, but also to reduce the costs of health and social care.
- THE IONIS SOLUTION addresses the needs of people with dementia, and is motivated by the successful work and excellent final evaluation of the NITICS (Networked InfraStructure for Innovative home Care Solutions).
- IONIS intends to exploit NITICS innovation and extend the platform with new technologies and services for both indoor and outdoor support.
- The IONIS platform is a flexible and modular system that will provide a viable solution for AAL by contributing to the development of a next generation of AAL intelligent frameworks.



IONIS - Features



**indoor &
outdoor
localization**



**health &
home
monitoring**



**smart data
aggregation**



multilingual

English, French,
Romanian, Polish
and Italian.



**easy
communication**

through one
button calls



**multimodal
interactions**

traditional, touch
and speech



**adapted
interfaces**

for different
devices

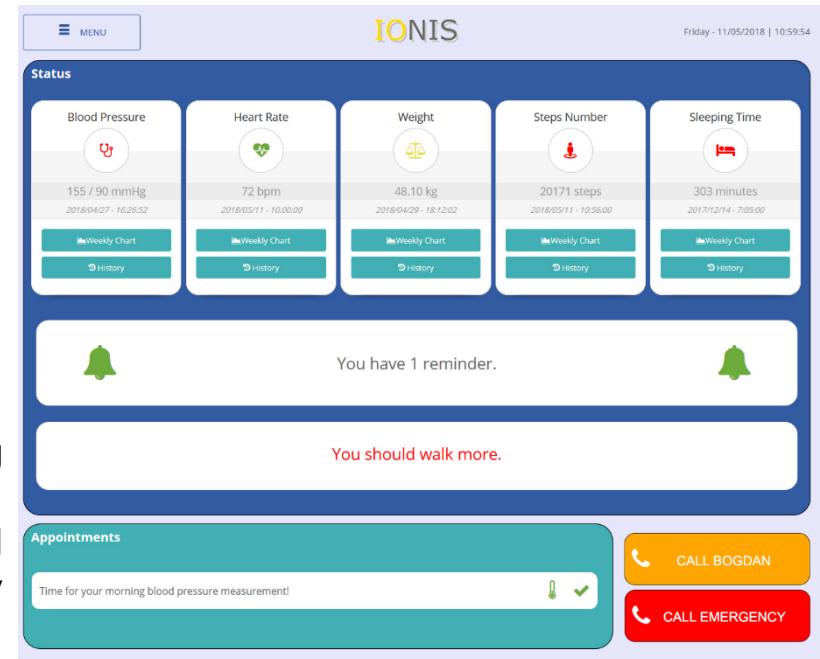


and more

home automation,
fall detection
...

IONIS – Interface (1)

- The interface:
 - is designed by respecting the requirements of the elderly,
 - is developed by HTML5, CSS3 and JavaScript,
 - supports 5 languages (vocal module support just 2),
 - allows natural way of interactions,
 - works across platforms.
- The home-page displays:
 - the last health measurement results,
 - the daily number of steps,
 - the sleep duration,
 - the daily appointments of the user,
 - the number of reminders,
 - some smart notifications regarding the user's health status and activity,
 - two buttons that allow the user to call directly a relative and the emergency service.

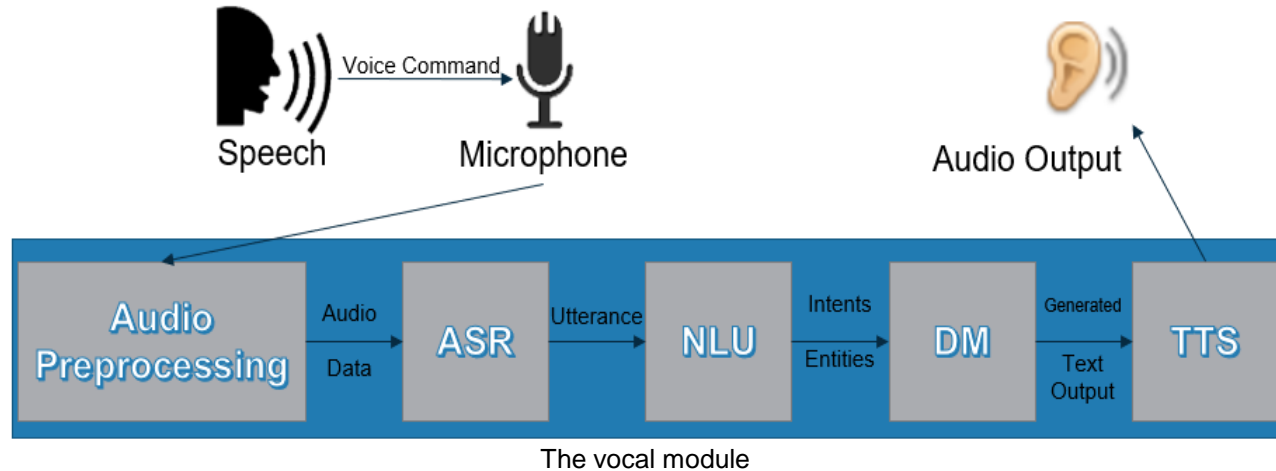


IONIS home-page

IONIS – Interface (2)

Vocal Module

- The vocal module supports English and French languages with the possibility of adding new languages. It is composed of 5 main:
 - Audio Preprocessing,
 - Automatic Speech Recognition (ASR),
 - Natural Language Understanding (NLU),
 - Dialog Management (DM),
 - Text to Speech (TTS),



IONIS – Interface (3)

Adaptation

- In order to make navigation and content-based adaptation of the interface, users are classified based on their preferred options, type of navigation (gestures or voice commands), emotional state.
- We create a set of different user classes with different types of preferred interface configuration: health status, preferred gestures, system configuration, language preferences, type of speech commands, emotional state.
- Each class has an associated set of rules that describes the interface properties.
- Users classification is done using decision trees, computed with the C4.5 algorithm
- **In the case of a new user**, the default version of the interface will be displayed in order to extract his preferences based on his interactions with the system (preferred gestures and type of speech commands). After this step, the user will be classified based on the already built decision tree and the interface will be generated based on the rules associated with the user's class, e.g. in case of a bad health measurement result, the interface will display the value of the measurement if the user is happy, but the interface will display a message that accompany the value of the measurement if the user is unhappy.

Interface Adaptation Evaluation



- The adaptation was evaluated in the laboratory by 25 elderly people with cognitive and memory problems (indicative of dementia onset).
- Each user interacted with the system during 8 sessions to perform 4 scenarios.
- Each scenario was performed twice, once with the adaptation feature of the interface turned off and once turned on.
- During each session we monitored the number of interactions and the time needed to perform the scenario as well as the emotional status of the user.
- To reinforce the collected data, after each session, each user was asked to fill a multiple-choice.
- The questioner answers validated the collected data and all the users reported improved navigation and easier evaluation of the scenario by 30% with the adaptation feature turned on.

Conclusions & Future Work

Conclusions

- IONIS addresses the needs of people with dementia,
- the multimodal interface makes the interaction easier between the system and the user,
- the adaptive capability of the system enrich the users experience and optimize the benefits of the system,
- the interface is adapted based on the user's profile: health status, preferred gestures, emotional status, system configuration, language preferences and type of speech commands.

Future Work

- Test the interface adaptation on our target users,
- Adding new languages to the vocal module.

Acknowledgment

This work was supported by a grant of the Romanian National Authority for Scientific Research and Innovation, CCCDI – UEFISCDI and of the AAL Programme with co-funding from the European Union's Horizon 2020 research and innovation programme project "IONIS - Improving the quality of life of people with dementia and disabled persons", project number AAL2017-AAL-2016-074-IONIS (Contracts 52/20017 and 53/2017)

and by the project GEX2017, No. 28/25.09.2017, AU 11.17.15.



Thank You

Questions?