

Defining Active and Assisted Living Use Cases for IEEE 1872.2

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Abstract—This paper addresses the understanding and conceptualization of use cases related to the use of autonomous robotic systems, such as social robots, in applications for Active and Assisted Living (AAL). Additionally, working on these use cases aims to contribute to the adoption IEEE 1872.2 in the proposed application domain. The paper presents a revision of related R&D projects and the involvement of key stakeholders, which concludes with a list of user needs and the analysis of the survey presented to collect additional opinions. The paper concludes with a description of a set of user stories that shall be further explored in the adoption of IEEE 1872.2 in the AAL domain.

Index Terms—Use cases, Social Robotics, Active and Healthy Ageing, Standards, Ontologies

I. INTRODUCTION

As robots are expected to become more companions and helpers taking over tedious or dangerous tasks, extending human capabilities and providing services to humans, they will be a key enabling technology to develop smarter, safer and healthier environments. In applications where robots are expected to have an assistive function, for example in the field of Active and Assisted Living (AAL), the capabilities required to deliver Human-Machine Interaction functionalities motivate the integration of features associated with several technological challenges, including active perception features, mobility in unstructured environments, understanding human actions, detecting human behaviours and predict human intentions, access to large repositories of personal and social-related data, adapt to changing context.

In spite of the sophistication of individualized solutions, there is still a lack of standardization in the Robotics and Automation (R&A) field in terms of the way some core components are implemented and this acts as one of the barriers that are preventing robotic solutions from increasing their technological maturity. Specifically, the approaches used to represent knowledge in such robotic solutions.

A. Relevance of standardization to the topic

The European population of adults aged 65 and above is estimated to correspond to 20% in 2030 and is expected to reach nearly 30% by 2060. The increasing demand for healthcare and quality-of-life services to support the ageing

population has inspired researchers worldwide to explore the applicability of new intelligent technologies to support older adults to cope with the challenges of ageing and live independently for longer periods of time. Home care emerges as a potentially cost-effective solution to the challenges that health and social care systems need to face due to actual demographic trends, as most older adults desire to stay at home as long as possible, with independence and autonomy and integrated into the community. New intelligent technologies, including robotics, are being developed aiming to support older adults to remain longer independent and active at home. However, their adoption has been slow and erratic overall due to a lack of standardised, interoperable and certified solutions.

B. Facilitating the adoption of standards

Part of the activities of the IEEE 1872.2 working group includes defining use cases to validate the standard in scenarios covering several application domains that would be likely to adopt the standard. In the scenarios tailored to active and healthy ageing applications, they anticipate the operation of autonomous robotic systems (e.g. social robots) in environments where commonly older adults or carers require assistance to perform tasks (e.g. routines, activities of daily life, looking for danger in the environment, etc.). However, the development of new technological solutions for Active and Assisted Living (AAL) often becomes a challenging task, as it requires the adequate involvement of relevant stakeholders in the process of understanding and validating needs and expectations, which could contribute to the definition of the use cases benefiting from standards and guidelines.

II. REVISION OF RELATED RESEARCH AND DEVELOPMENT PROJECTS

The AAL domain has been maturing in Europe for the last 12 years¹. Some of the most remarkable concepts proposed the adoption of interactive semi-autonomous and autonomous systems (i.e. interactive artificial agents) to address end-user needs, including the form of virtual assistants and social robots. Among the most familiar solutions/products with interactive artificial agents based on virtual assistants, we can list the well-known Google Assistant (Google), Alexa (Amazon),

This work was conducted in collaboration with StandICT.eu 2023 and ActiVas projects.

¹<http://www.aal-europe.eu/about/>

Project	Description	Website
LIFEBOTS Exchange	LIFEBOTS Exchange aims at enhancing cross-sector, international and interdisciplinary collaboration in the area of social robotics technology. The project will particularly focus on the health and care sector, and examines how social robots can be included into people's life.	https://lifebots.eu/
GrowMeUp	GrowMeUp's main aim is to increase the years of independent and active living, and the quality of life of older persons (age of 65+) with light physical or mental health problems who live alone at home and can find pleasure and relief in getting support or stimulation to carry out their daily activities over the ageing process.	https://cordis.europa.eu/project/id/643647
CaMeLi	A coherent user-centric technological solution will be provided based on an innovative practice-oriented Virtual Partner (ViP) care model that considers established behaviour communication patterns/ways of an older person with a human partner when carrying out daily activities at home.	http://www.aal-europe.eu/projects/cameli/
COGNIVITRA	COGNIVITRA developed an interactive ICT-based solution for cognitive vitality training at home. The solution includes an artificial agent that delivers sessions of dual-task training exercises.	https://cognivitra.las.ipn.pt/
ActiVas	ActiVas aims to research and develop a virtual artificial agent solution and a robotic artificial agent solution, allowing to provide of different interactive artificial agents and taking advantage of virtual and robotic solutions for AAL applications	http://activas.pt/portal/

TABLE I
LIST OF SELECTED EU PROJECTS RELATED TO ROBOTICS FOR AAL OR SOCIAL ROBOTICS

Siri (Apple), Cortana (Microsoft). In terms of robotic artificial agents, some brands have launched solutions on the market that are still not very versatile in terms of capabilities, and that in practical terms work as virtual agents with some movement, as is the case of systems from LG (LG Hub), Sony (AIBO), Bosh (Kuri from Mayfield Robotics, a startup backed by Bosh), and others that were the result of crowdfunding campaigns (e.g. Jibo and Buddy). In addition to these brands, there are some well-known platforms in the area, such as PARO, Mykie, ASIMO, Care-O-Bot, REEM, Hector, Kompai, Scitos G5, Giraff, NAO, Pepper, Romeo – but which still they are too expensive or require additional development to respond more specifically (and with added value) to user needs [2].

In table I, we present a summary of some selected EU projects related to Robotics for AAL or Social Robotics, and in table II the main conclusions after considering their findings, including the results of a focus group that collected the opinions of 20 participants aged +65, active, fully independent or partially independent, using social care services at daycare centres or domiciliary services.

A. Survey to stakeholders

Involving key stakeholders (i.e. KOLs) in the use case definition is an essential part of the process. One common approach is to organize surveys, workshops or focus groups. Additionally, conducting informal interviews and short surveys to collect answers in a more structured format is also a complementary approach in this domain.

In summary, a survey with 7 questions was shared with a selected group of KOLs and collected 13 complete replies. The participants included a variety of profiles (e.g. older adults, healthcare professionals, technologies developers and entrepreneurs). Also, the age range covered a wide spectrum [25 - 66]. From the education/literacy perspective, most participants have higher education. All are familiar with technologies. The summary of the aggregated results is shown as

Need ID (UN_U##)	End-User Needs
UN_U01	Organize all information about family events
UN_U02	Be in touch with friends at a distance and simply
UN_U03	Remember birthdays and medical appointments
UN_U04	Combating sedentary lifestyle through physical activities
UN_U05	Avoid unnecessary hospital trips
UN_U06	Assistance in daily tasks
UN_U07	Distance games that allow contact with other players
UN_U08	Detect falls
UN_U09	Detect drives inside the house
UN_U10	Daytime sleep control to prevent insomnia and trouble sleeping at night
UN_U11	Monitor the evolution of health situations at a distance
UN_U12	Games controlled through gestures and/or voice commands
UN_U13	Remember taking medication and meals/hydration
UN_U14	Instructions for use by voice
UN_U15	Presentation of didactic content
UN_U16	Assistance in the movement of small objects

TABLE II
SUMMARY OF IDENTIFIED END-USER NEEDS

follows for the “Survey on adopting artificial agents in smart spaces”, figures 1 to 7.

III. USE CASE CONCEPT AND MODEL

Taking into consideration the information collected from the previous steps, the next actions consist in defining scenarios, personas and user stories that could relate to the needs expressed by end-users, all the way, until we can have a model and its representation in an ontology, as proposed in [1].

Starting from the end-user needs, we want to define a Scenario and a Persona before we can identify associated User Stories. For example, based on H2020 project “GrowMeUp” and referred in [1]–[4].

Persona: George is an 81 years old man having some light memory problems and also some difficulties in balancing by walking used to stay alone at home. After a fall, during the night, George decided that it was better for him to stay in an elderly care centre since the only person who could take care of him was his daughter, who lives far away in another city,

In your day-to-day, tell us 3 things that are important to you/that you like to do, and that you would like to keep during your senior life.

13 responses

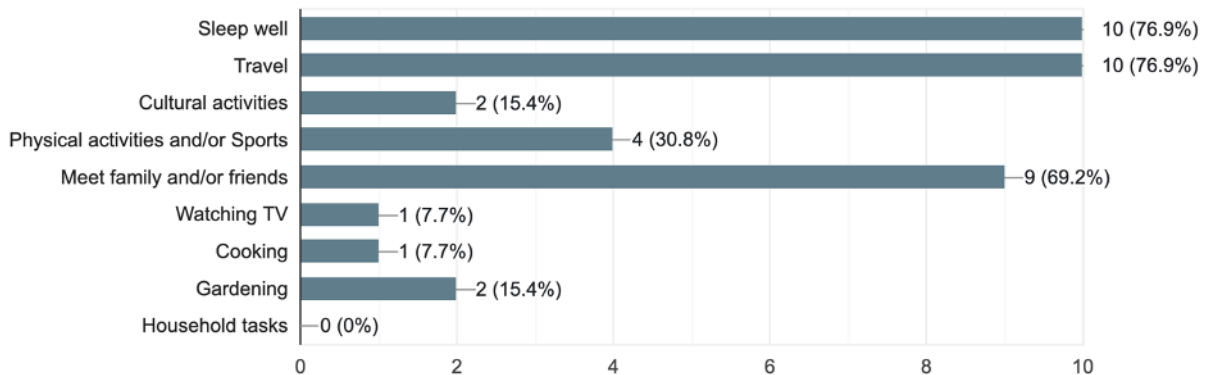


Fig. 1. "Survey on adopting artificial agents in smart spaces" - Question 1

Do you have technologies in your day-to-day life? Select all that apply.

13 responses

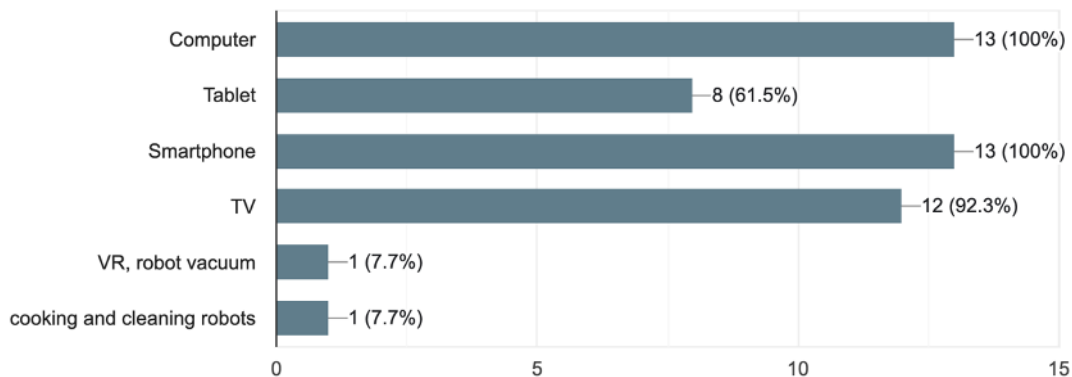


Fig. 2. "Survey on adopting artificial agents in smart spaces" - Question 2

and he is not a very communicative person to ask for support from his neighbours.

User Scenario: In the elderly house one morning George decided to walk to the small, sunny and warmer living room instead of going to the big and colder one at the main entrance. SocialRobot identified him sitting there alone, and ask him if he would like to tell his friend Kostas to join him. George responded that yes, he would like to have his friend Kostas around. SocialRobot went around the elderly centre and found his friend Kostas, a 78 years old man who has similar disabilities and behaviour ways as George. Both became friends in the elderly care centre. SocialRobot asked

Kostas if he wants to join George in the small living room because he is sitting there alone. Kostas answered yes and SocialRobot accompanied him in the small sunny living room. George and Kostas were happy to be together discussing and enjoying the sun. SocialRobot recorded that they both like this room and next time it will inform them again if it finds one of them sitting there alone.

IV. CONCLUSION

Overall, the main objective and scope proposed for this work were to perform a revision of related R&D work provided sufficient materials to understand the landscape and outlook

Thinking about your day-to-day life, do technologies help you to ...?

13 responses

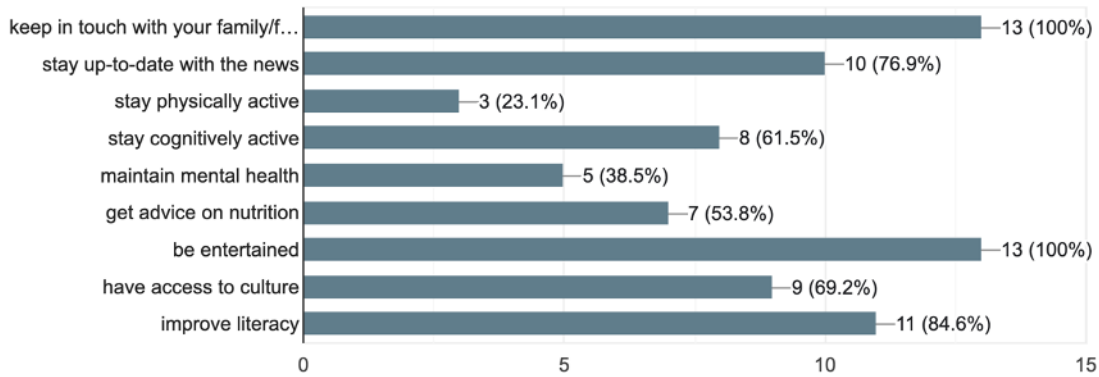


Fig. 3. "Survey on adopting artificial agents in smart spaces" - Question 3

What is your idea about an artificial agent?

13 responses

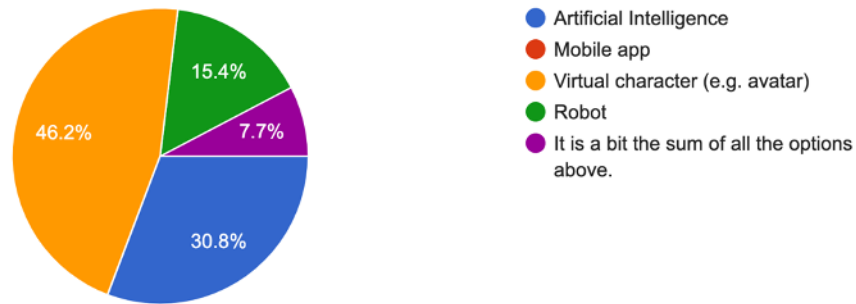


Fig. 4. "Survey on adopting artificial agents in smart spaces" - Question 4

for the application of Robotics in the AAL domain and Social Robots expected functionalities and features. The preliminary information was further confirmed involving external stakeholders, which represented potential end-users (e.g. in their different roles). Finally, the consolidation of the previous finding resulted in maturing the original use case and extending the model with new information. The future work will include the update of the resources available in a shared repository to facilitate the reuse and integration of ontologies based on IEEE 1872.2 in robotic solutions for AAL (i.e. the concepts used to model use-cases are aligned with the ontology from IEEE 1872.2).

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What is your idea about a social robot?

13 responses

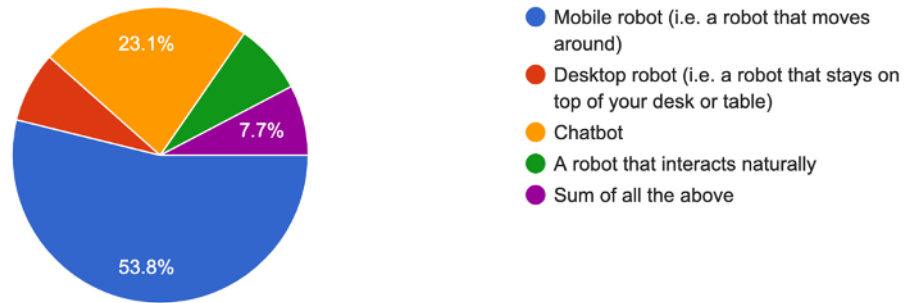


Fig. 5. "Survey on adopting artificial agents in smart spaces" - Question 5

What would be your expectations for a social robot's capabilities?

13 responses

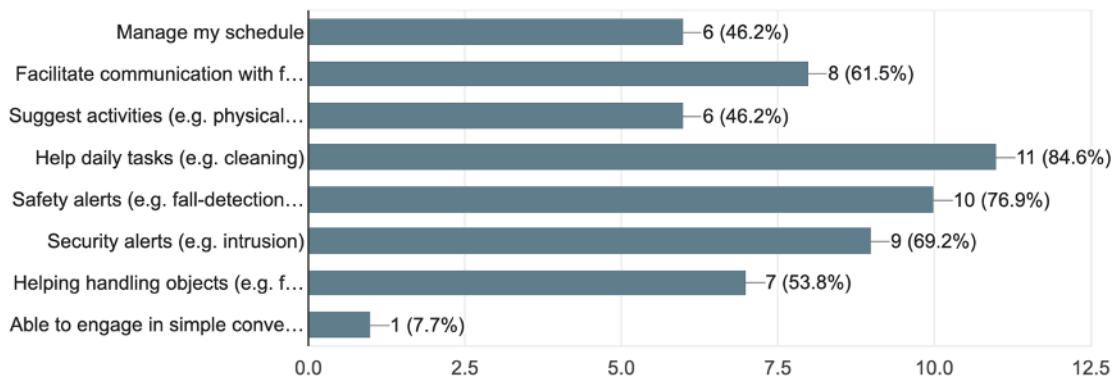


Fig. 6. "Survey on adopting artificial agents in smart spaces" - Question 6

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In the future, would you be willing to adopt a mobile social robot for your home?

13 responses

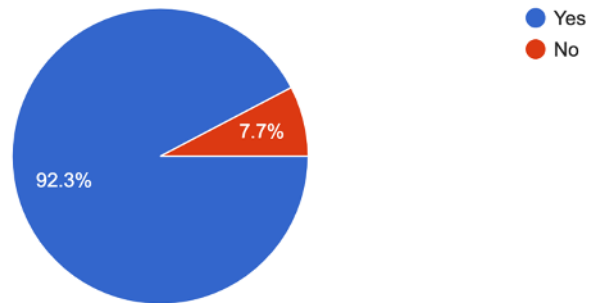


Fig. 7. "Survey on adopting artificial agents in smart spaces" - Question 7

Fig. 8. User Story US_U01 Videoconferencing

User Story ID : US_U01

Title : Videoconferencing

As: User

I want the system to allow me to perform video conferences in a simple way

So you can: Be in touch with my friends and family

Acceptance criteria

Given that: It sometimes becomes confusing to use Facebook or Skype

When: I start the system and want to make a video call

After: I must have an application exclusively to find my contacts

and start/receive a video conference

Fig. 9. User Story US_U02 Stimuli for Physical Activity

User Story ID : US_U02

Title : Stimuli for Physical Activity

As: User

I want: The system to present me with suggestions for activities

So you can: Combat a sedentary lifestyle and maintain physical activity

Acceptance criterion

Given that: I like to walk outdoors

When: I access the system area reserved for physical activities

After: The system should suggest some routes to me and should contain information such as distances and walking times

Given that: I don't do much physical activity throughout my day

When: Long periods are identified in rest positions

After: The system should suggest that you stretch through videos that illustrate the exercises

Fig. 10. User Story US_U03 Cognitive Stimulation Games

User Story ID : US_U03

Title : Cognitive Stimulation Games

As: User

I want: The system to encourage me to perform cognitive and physical stimulation activities

So you can: Break the sedentary lifestyle

Acceptance criterion

Given that: Sometimes I realize memory failures

When: I access the system area reserved for activities

After: The system should provide me with cognitive stimulation games with control commands via gestures and/or voice commands

Fig. 11. User Story US_U04 Multiplayer Games

User Story ID : US_U04

Title : Multiplayer Games

As: User

I want: The system allows you to play games with my friends

So you can: Maintain an active social activity

Acceptance criterion

Given that: I've always had a habit of playing games with my friends

When: I access the game-reserved system area

After: The system must have a multi-player feature

Fig. 12. User Story US_U05 Motion Detection

User Story ID : US_U05

Title : Motion Detection

As: User

I want the system to stop my behavior, and if there's anything strange, let my caregivers know.

So you can: Get help as soon as you need

Acceptance criterion

Given that: There are days when I don't feel very well

When: In a short period of time I often go to the bathroom

After: The system should alert my caregiver and should make it easier for me to contact my caregiver

Fig. 13. User Story US_U06 Voice Instructions

User Story ID : US_U06

Title : Voice Instructions

As: User

I want: The system to indicate your instructions with voice

So you can: Get more out of technology tools

Acceptance criterion

Given that: I have reading difficulties

And I want: To have the ability to use all the tools of the system

When: I access a feature/app

After: The system should tell me the instructions

And: Enable them to be transmitted using voice

Fig. 14. User Story US_U07 Didactic Content

User Story ID : US_U07

Title : Didactic Content

As: Caregiver

I want: The system has a collection of didactic content, such as forms of account payments

So you can: Help the user to perform these tasks

Acceptance criterion

As: Many users still have the ability to learn

When: Need to perform tasks through online platforms

Then: It should be possible to have didactic content that helps them accomplish these tasks, such as payments and/or schedules

Given that: Older users often suffer from attempts at fraud

When: Access the feature of textbooks

After: The system should have videos that alert the user to the most used schemes today

Fig. 15. User Story US_U08 Handling small loads

User Story ID : US_U08

Title : Handling small loads

As: Caregiver

I want: The mobile platform has a small load capacity

So I can: Help me move some objects and facilitate my home cleaning/maintenance work so I can pay more attention to the wearer

Acceptance criterion

Since: The time of coexistence with the user is always scarce due to the needs of cleaning/maintenance of the home

When: I need to move something and ask for the platform's help

After: This should have the ability to move this object to where I want to