



ROBOTS IN ASSISTED LIVING ENVIRONMENTS

UNOBTRUSIVE, EFFICIENT, RELIABLE AND MODULAR SOLUTIONS FOR INDEPENDENT AGEING

Research Innovation Action

Project Number: 643892 Start Date of Project: 01/04/2015

Duration: 36 months

DELIVERABLE 6.10

User evaluation report II

Dissemination Level	Public
Due Date of Deliverable	Project Month M21, December 2016
Actual Submission Date	12 January 2017
Work Package	WP6, <i>Piloting and evaluation</i>
Task	Task 6.4, <i>User evaluation</i>
Lead Beneficiary	FSL
Contributing beneficiaries	-
Type	R
Status	Submitted
Version	Final



Abstract

This deliverable reports the findings of User Evaluation of the Intermediate Phase of Pilot Trials. The ultimate goal is to evaluate the usability (for both the end-users and the caregivers) and the satisfaction expressed by the caregivers, based on the 1st RADIO prototype. The report includes a description of the measured variables, the analysis methods used, the results, and a discussion section describing the main findings and their implications

History and Contributors

Ver	Date	Description	Contributors
00	25/11/2016	Document structure	NCSR-D
01	21/12/2016	Final draft	FSL
04	12/01/2017	Internal peer review	NCSR-D
05	12/01/2017	Addresses peer review comments	FSL
Fin	12/01/2017	Final preparation and submission	NCSR-D

Abbreviations and Acronyms

ADL	Activities of Daily Living
ASQ	After-Scenario Questionnaire
IADL	Instrumental Activities of Daily Living
interRAI	International collaborative to improve the quality of life of vulnerable persons through a seamless comprehensive assessment system. Cf. http://www.interrai.org
interRAI HC	The interRAI Home Care Assessment System
interRAI LTCF	The interRAI Long-Term Care Facilities Assessment System
MMSE	Mini Mental State Examination
PIADS	Psychosocial Impact of Assistive Devices Scale
SUS	System Usability Scale
GUI	Graphical User Interfaces

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1 INTRODUCTION

1.1 Purpose and Scope

The purpose of this document is to report the *user evaluation* of the execution of the Intermediate Phase controlled pilot study. The scope of the study was to run the second round of controlled pilot study at FSL premises. The objectives of this pilot were (a) to provide data for the formative evaluation of early RADIO components for usability and fitness for purpose; and (b) to refine the piloting plan itself into its third. Early RADIO components include the first version of RADIO user Graphical User Interface (GUI), the first RADIO robotic platform prototype and the first set of Activities of Daily Living recognition methods.

Specifically, this document provides details about the usability of the first RADIO prototype from both the end-users and the caregivers perspectives and also the satisfaction expressed by the caregivers and their opinion about the realistic possibility to integrate the system into the home environment. The document describes the analysis methods used, the results, and a brief summary discussing the main findings.

1.2 Approach

RADIO studies are conducted in three phases:

1. Formative phase; first pilot at FSL
2. Intermediate phase; second pilot of RADIO components at FSL
3. Summative phase; final RADIO pilots

This deliverable reports the *user evaluation results of the Intermediate Phase* pilot study at FSL premises that realized with the first versions of user interfaces, devices, and the robotic platform.

This report is public. The procedures followed (without any reference to the particular subjects or deployments) are documented in public deliverable *D6.2 Piloting plan*. The execution of trials and details about piloting, its outcomes and technical details are reported in *D6.6. Controlled pilot trials report II*.

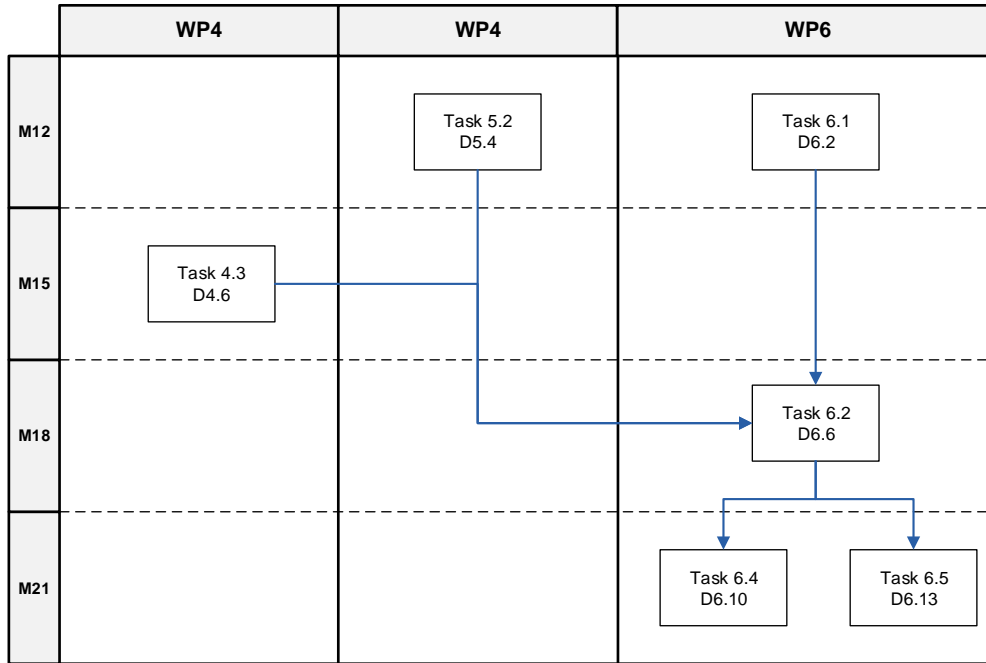


Figure 1. Dependencies between this deliverable and other deliverables.

1.3 Relation to other Work Packages and Deliverables

This document reports the user evaluation results of the Intermediate Phase Controlled Pilot Trials. These trials were executed at FSL premises during July – September 2016.

The study included testing the usability of the first version of RADIO user GUI (D5.4), the first integrated robot platform (D4.6).

The data collected during the trials reported were reported in *D6.6. Controlled pilot trials report II*. These data were analyzed in the context of Task 6.4 and analysis results are reported in the current deliverable. Moreover, the data collected are used for *D6.13 Medical evaluation report I* in the context of *Task 6.5: Medical evaluation*.

2 METHODS

This section provides a brief description of the participants and the set-up. It goes on with reporting the testing scenarios. It then briefly presents the comprehension and usability evaluation data collected as well as the feedback received from participants during personal interviewing. It goes on with a detailed description of the statistical methods used.

2.1 Participants

2.1.1 RADIO End-users

Thirty-six (36) elderly participants were recruited. All the participants fulfilled the inclusion and exclusion criteria described in details in *D2.1 Early detection methods and relevant system requirements*.

Table 1 reports demographic data and global cognitive status of participants at the time of the recruitment. Consistently with the inclusion and exclusion criteria, all the subjects were older than 64 years and no subject reported a MMSE [1] score ≤ 18 (they all had a minimum adjusted MMSE score of 22).

Regarding the need of supervision in IADLs, according to the inclusion criteria specified in D6.2 Piloting Plan II, each subject needed supervision in at least two IADLs. *Figure 2* shows the distribution of population for each item of the IADL scale [2].

Table 1. Demographic data of the participants.

	Age	Education	MMSE adj.	Sex
Mean	69.1	12.3	27.5	
SD	5.6	4.2	2.3	
F/M				22/14

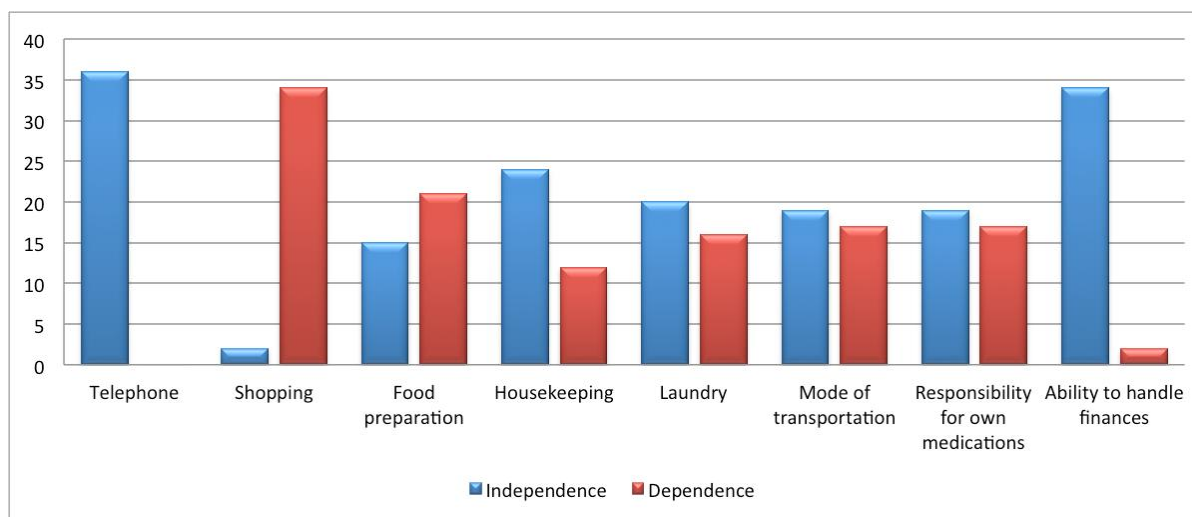


Figure 2. Need of participant population for supervision in IADLs.

2.1.2 Caregivers

Twenty-four (24) caregivers were also involved into the study as specified in *D6.2 Piloting Plan I*. Each caregiver was a person related to the respective participant and had a known role in the care of him/her. Also, each caregiver had enough autonomy to contact with the elder participant in case of need and contribute to the decision making process in case of emergency.

Table 2 reports demographic data of all the caregivers at the time of the recruitment.

Table 2. Demographic data of the caregivers.

	Age	Education	Sex
Mean	63.6	13.2	
SD	15.8	4.2	
F/M			15/9

2.2 Evaluation Variables

2.2.1 RADIO End-users

As detailed in *D2.1 Early detection methods and relevant system requirements I*, at the baseline personal demographic data (birth date, age, education, sex) of each participant were collected, and each participant underwent an assessment on:

Functional status

- section G of interRAI LTCF
- IADL [2]
- ADL [3]

Mood-behavior

- section E of interRAI LTCF

Cognition

- section C of interRAI LTCF
- MMSE [1]

After the experimental sessions, each user was interviewed about the usability of the early RADIO components through:

- System Usability Scale (SUS) [4];
- Psychosocial Impact of Assistive Devices Scale (PIADS) [5];
- After-Scenario Questionnaire (ASQ) [6];

All the three scales were used to assess the usability of the ADL recognition system (*D4.6*), whereas only ASQ was used to assess the usability of the user GUI (*D5.4 User interfaces I*).

Detailed information about these scales are provided in *D6.2 Piloting Plan II*.

2.2.2 Caregivers

After the experimental sessions, 24 caregivers were interviewed (only on the usability of ADL recognition system performed by the robot platform prototype).

The post-scenario assessment was performed through:

- a dedicated SUS [4] adapted for the caregivers
- a custom-made questionnaire (see below) developed in order to investigate the level of satisfaction expressed by the caregivers and their opinion about the realistic possibility to integrate the system into the home environment. The questionnaire consisted of 6 statements each one to be judged through a 6 point-Likert scale (1= total disagreement, 6= total agreement)

Statement	Disagreement<---->Agreement					
	1	2	3	4	5	6
1. I am satisfied with the operation of the robot						
2. I think it could be helpful in the home environment						
3. I think it could have a psycho-social impact on the user						
4. I think it could decrease my burden of care						
5. I feel very feel confident in using a control device and a computerized monitoring system						
6. I would recommend it also to other people						

2.3 Statistical Analysis

2.3.1 RADIO End-users - Usability

- SUS [4]: the mean score of the whole sample of 36 participants was calculated and compared with the cut-off score of 68 (see *D6.2 Piloting Plan I*);

- PIADS [5]: for each of the three main outcomes of the scale:

- Competence: measuring feelings of competence and usefulness
- Adaptability: indicating willingness to try new things
- Self-esteem: indicating feelings of emotional wellbeing and happiness,

the mean score of the whole sample of 36 participants was calculated and compared with the score reported in Wiklund Axelsson et al., 2013 [7] (a comparable study assessing the psychosocial impact of various web-based health services on a sample of 154 older adults, mean age 71.9 years) through three unpaired t-tests;

- ASQ [6]: for each of the three main outcomes of the scale

- Satisfaction with the ease of completing the task
- Satisfaction with the amount of time it took
- Satisfaction with the support information provided when completing the task

the mean score of the whole sample of 36 participants was calculated and valuated as positive or negative taking into account that the closer the score to the lowest scores, the higher the subjects' satisfaction with the system.

2.3.2 Caregivers

- SUS [4]: the mean score of the whole sample of 24 caregivers was calculated and compared with the cut-off score of 68 (see *D6.2 Piloting Plan I*);
- custom-made questionnaire: for each item of the questionnaire the mean score of the whole sample of 24 caregivers was calculated and valuated as positive or negative taking into account that the closer the score to the highest scores, the higher the caregivers' satisfaction with the system.

3 RESULTS

3.1 First RADIO robot platform prototype (D4.6)

3.1.1 RADIO end-users -Usability

Table 3. Results of usability assessment of the ADL recognition system (end-users)

Scale	Outcome	RADIO's score	Cut-off/ Comparison score*	p
SUS		62.9	68	na
PIADS	Competence	1.31	0.75	=0.0001
	Adaptability	2.04	0.84	< 0.0001
	Self-esteem	0.96	0.75	na
ASQ	Ease of completing	1.2	na	na
	Time it took	1.3	na	na
	Support information	1.1	na	na

Legend

*cut-off score of 68 is provided for SUS; comparison scores taken from Wiklund Axelsson et al., 2013 [7] are provided for PIADS. na= not applicable

3.1.2 Caregivers – Usability and Satisfaction

Table 4. Results of usability assessment of the ADL recognition system (caregivers)

Scale	Outcome	RADIO's score	Cut-off/ Comparison score
SUS		63.65	68
Custom-made questionnaire	General satisfaction	4.9	6
	Helpful	4.9	6
	Positive impact	5.2	6
	Decrease of burden of care	5	6
	Feeling confident	4.6	6
	Recommend it to others	5.7	6

3.2 Usability of RADIO end-user GUI

The following results are based on the GUI described in D5.4 User interfaces I.

Table 5. Results of usability assessment of RADIO User GUI

Scale	Outcome	Score
ASQ	Ease of completing	5.2
	Time it took	5.5
	Support information	1.6

4 DISCUSSION

4.1 Usability of first RADIO prototype

4.1.1 RADIO end-users

Overall, the assessment of usability and psycho-social impact of RADIO robot platform prototype performing the ADL recognition shows positive results. Indeed, with the exception of SUS, results from PIADS and ASQ suggest that the use of the system might positively impact quality of life of the end-users, thus indicating that the system is likely to be integrated into the home environment not compromising but improving daily living of elderly users.

4.1.2 Caregivers

The post-scenario assessment administered to the caregivers and aimed at evaluating the usability and psycho-social impact of RADIO robot platform prototype performing the ADL, shows quite positive results. Indeed, although SUS results are below the cut-off score, similarly to end-users, however the feedbacks provided by the administration of the custom-made questionnaire suggest satisfaction with the system. Particularly, it seems that the system has a positive psychosocial impact on the user. Moreover, it might be effective at helping the caregivers, thus reducing their burden of care. Therefore, most of the caregivers expressed they would recommend the use of the system to others.

4.2 Usability of RADIO end-user GUI

We observed that it was easy for the subjects to use the GUI, and that negative comments referred to the underlying functionality rather than to the GUI per se. Specifically, most of the times the robot platform was not able to guide the subject to the indicated place or the time needed to complete the task was too long. Positive feedback was also received about support information.

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