MOBISERV – FP7 248434

An Integrated Intelligent Home Environment for the Provision of Health, Nutrition and Mobility Services to the Elderly

Deliverable

D2.5: First Prototype and System Evaluation Report (Issue II)

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Version	Date	Author	Description/Comments
1.0	June 2012	UWE	Results of WHSU
1.1	July 2012	SMH	Results of User-Based Evaluations
1.2	July 2012	UWE, SMH	Results of Secondary User Evaluations
1.3	July 2012	UWE, ALL	Prioritisation of Issues
1.4	July 2012	UWE, SMH	Final Draft
2.0	July 2012	UWE, SMH	Final, Incorporating comments from Internal Moderator (Pekka Jäppinen)

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Glossary

Term	Explanation
DoW	Description of Work – The initial plan for the Mobiserv project
HMI	Human-machine interaction
MOBISERV	An Integrated Intelligent Home Environment for the Provision of Health, Nutrition and Mobility Services to the Elderly
PRU	Physical Robotic Unit
SHACU	Smart Home Automation and Communication Unit
SMH	Stichting Smart Homes (Eindhoven, NL)
UWE	University of the West of England (Bristol, UK)
WHSU	Wearable Health Support Unit
ROBS	Robosoft (France, FR)
CEMS	Centre Suisse D'delectronique et de microtechnique SA (Switzerland)
ST	Systema Technologies (Greece)
LUT	Lappeenrannan Teknillinen Yliopisto

Executive Summary

This document, *D2.5: MOBISERV First Prototype and System Evaluation Report – Issue II*, identifies the outcomes of the second major phase of evaluations conducted on the first MOBISERV prototype. A range of issues have been identified and reported, using both expert review and user-based evaluations. The findings include aspects relating to the user interaction and experience of primary and secondary stakeholders with the first MOBISERV prototype. Field trials have been conducted using the first MOBISERV prototype at Smart Homes in the Netherlands and the WHSU as a standalone component in the UK. The details of the methodology used to conduct the field trials of the first prototype are available in D2.2 Issue 3.

We would like to thank all the participants in our evaluations for the generous contribution of their time and thoughts.

1 Introduction

1.1 Scope of the study

This report *D2.5: MOBISERV First Prototype and System Evaluation Report – Issue II* includes the findings of the second major phase of evaluation studies conducted on the first MOBISERV prototype as part of an iterative design process.

1.2 Aims and Objectives

The purpose of the evaluation is to ensure that all MOBISERV components are appropriate and usable for the target users, both primary and secondary, for whom they are designed, and address all aspects relating to achieving the desired functionality and usability as specified in the requirements deliverables D2.3, issues I, II and III.

The evaluation structure, as well as theoretical and pragmatic details relating to the evaluation study, have been defined in D2.4 and D2.2, issues I, II and III. These specifications underpin the evaluations carried out.

Given the complexity of the MOBISERV system and the components, there are a vast number of evaluation criteria, these have been defined in depth in D2.4, sections 3.1 and 4.1, as well as, in D2.2 issues III, and the reader is referred to these for details.

1.3 Intended Audience

This report provides feedback to MOBISERV technical partners to enable them to further improve the designs, user interaction, and functionalities of the final prototypes, so that the MOBISERV system and components can achieve the project objectives as defined in the DoW. It also provides guidance for considering how best to prioritise improvements to maximise use of resources in the lifetime of the project. The findings in this report also have a broader impact, which is to provide invaluable insights for all future development of similar technologies for older adults, and thereby enabling the design and development of technology to support independent living to be conducted in a more focussed manner.

2 Evaluation strategy

This second phase of the first major evaluation of the MOBISERV prototype continues from the evaluations described in D2.5 Issue I, which has been delivered in December 2011 and described evaluation points 1 until 9. This second phase contains 5 new evaluation points. Table 1 shows these points, at which evaluation studies were conducted, with results being discussed via teleconferences and formally presented and discussed at subsequent project plenary meetings, and described in the next chapter which includes a summary of the key issues identified at each evaluation point. The full reports of the single evaluation studies are available in the Appendices of this document as listed in the table below.

Month	**Evaluation Type**	**Place**	**Evaluation Point**	**Reference**
Feb - April 2012	Overall system integration and installation at test sites	UK + NL	10	Appendix 1
March 2012	Lab testing of speech recognition	UK + NL	11	Appendix 2
April - May 2012	WHSU evaluation and field trials	UK	12	Appendix 3
May - June 2012	First MOBISERV prototype field trials	NL	13	Appendix 4
July 2012	Expert and user evaluation of Secondary User Interface	UK + NL	14	Appendix 5

Table 1: Evaluation History

The issues identified were methodically reviewed by each of the consortium partners as part of a formal process and Chapter 4 gives an indication of priorities, estimations of workload, and planned time scales, in relation to each of the issues identified. The complete list of issues can be found in Appendix 6.

3 Evaluation Findings

This chapter summarises the key findings from each of the evaluation points starting in February 2012 and ending July 2012.

3.1 Evaluation Point 10 (Feb - April 2012): Overall system integration and installation

Over a period of 3 months, a series of observations on the usability of the system were noted during the initial and (partially) unsuccessful attempts to integrate and install the complete MOBISERV prototype in the UK and the Netherlands.

In summary, there were a number of problems particular to the robot in the UK, a few of which also affected the robot in the NL. The main issues found included:

- Voice interaction stopped working in April 2012 (UK only)
- The WHSU integration with the PRU was not implemented; (UK and NL)
- Skype interface was not integrated (UK only);
- PRU localisation problems (UK only);
- Software installation was complex, especially the process of fine-tuning the grammar used by speech output of the robot, speech recognition, and on the GUI; (UK and NL)
- Secondary user interface was not implemented. (UK and NL)

This set of issues led to the decision of adapting the evaluation strategy. Instead of evaluating the complete MOBISERV prototype in the UK and in the Netherlands, it was decided to conduct user-trials of the current MOBISERV prototype in the Netherlands only, excluding the WHSU, and to thoroughly evaluate the WHSU in the UK only as a standalone component due to lack of full integration with the PRU.

There is more information detailed in Appendix 1 – Evaluation Point 10: Overall system integration and installation.

3.2 Evaluation Point 11 (March 2012): Lab testing of speech recognition

During the integration and installation phase, a series of observations and tests on the usability of the speech recognition were performed, both in the UK and in the NL.

In summary, the speech recognition does not work very well at all, requires users to adapt their speaking style, works better at short distances than long and sometimes appears to miss things completely.

The main findings included:

- Overall, it can be said that the closer the speaker is to the robot, the better the recognition rate is, with a maximum of 81%. This however is very far from usable. To be really usable, speech recognition success rates should be approaching 99%.
- There are ways of speaking which are clearer for the PRU to understand than others. (e.g. talking slower, starting and finishing the words entirely and properly, also pronouncing the last character well, clearly separating words.) Users could learn these, so we should define and outline what these guidelines are. The robot could actually instruct the users in how to adjust their speech to that the robot would understand the user better.)
- Successful recognitions were higher in NL than in the UK
- At an expected interaction distance (0.75m – 1m) recognition rates were lower than at very close distances (0.1m);
- There was a higher number of 'nothing' responses at 1m, than 0.1m;
- There was a high number of 'nothing' responses – these are instances where the PRU does not respond and nothing is logged in the console. It is as if the speech utterance was missed or the PRU was 'asleep';
- There was a high level of 'robot does not understand at all' responses;

There is more information detailed in Appendix 2 – Evaluation Point 11: Lab testing of speech recognition.

3.3 Evaluation Point 12 (April – May 2012): WHSU evaluation and field trials

In the UK, a thorough evaluation of the WHSU was carried out with end users and professionals. There were four stages to the evaluation of the WHSU:

- Co-operative evaluation with professional carers
- Expert review
- Co-design evaluation with older adults
- Home trials

Overall, across the four evaluation stages, there was very enthusiastic response to the garments and the usefulness of the vital signs data acquisition system from carers and older people. However, many currently unmet user needs have been identified.

While the garments themselves have undergone significant developments to improve comfort and wearablity, taken as a whole, the number and range of issues illustrates that the current WHSU system design needs further refinement to fit comprehensively with the complexity of the context of real-world use, and key challenges that older people face (as outlined in D2.3 System Requirements Specification Volumes I, II and III). The issues relate to further improving comfort, wearability of the garments, datalogger design, exploitation, form factor, feedback to the user, unrecorded activities, usability, and some issues relating to fall detection.

The current design needs to take the following main findings into account:

- Dataloggers are not securely fixed to the garment (and can fall out easily in certain positions e.g. when the user bends forward);
- Lack of feedback about correcting positioning of the garment (including data quality);
- Concerns about the large size of the datalogger;
- Lack of feedback that the system is recording properly;
- Having to plug in a number of individual components can be cognitively challenging for older adults;
- Preference for WHSU to be the primary means of interaction with the wider MOBISERV functions (e.g. to receive eating and drinking reminders via garments, not robot)
- Older adults in the study have expressed a strong preference for haptic feedback;
- Vital signs data is critically important – people want to know if there is something wrong;

There is more information detailed in Appendix 3 – Evaluation Point 12: WHSU field trials.

3.4 Evaluation Point 13 (May - June 2012): First MOBISERV prototype field trials

In the Netherlands, a thorough evaluation of the complete first MOBISERV prototype has been carried out with end users, informal caregivers, and professional carers. Overall, participants were enthusiastic about the possibilities with a robot and system like MOBISERV. Almost all people see and believe in the added value of a robot and of the high-level services, but there are many issues that need real attention and improvement. These issues are grouped into different categories:

1. Implementation related
2. Design related, and
3. Autonomy and intelligence related

Implementation related

- Speech recognition is not good at normal arm length distance – the expected interaction distance with the older adult seated and the robot next to them. These results correspond to the lab testing for the speech recognition. Almost half of the spoken commands are not recognized at all and do not trigger any feedback. Of the instances that are recognized, 75% has a certainty below the threshold. So in total, only very few commands are understood well.
- Ensure it is possible to integrate individual functions (such as eating/drinking, smart clothes, smart home and robot control) to enable the implementation of useful, real-world scenarios through intelligent system responses across functions. This should operationalize the user model defined by UWE and SMH.

Design related

- There are many small but important issues, both with the GUI as well as with the overall interaction flow, many already found last year that were not fixed (see the appendix for details).
- The voice of Kompaï is not friendly and there is a need for personalisation of the voice.
- The need for content and personalisation has not been addressed. Many of the functions and services need some kind of content (e.g. doorbell, sound signalising a call or a reminder, the pictures shown in the exercises and eating/drinking reminders). This is on the experience level that people will see or hear most of the times and clearly. More effort needs to be paid to the use of proper and effective images, sounds, and videos when delivering the messages, calls, reminders.

Autonomy and intelligence related

- Much more dialogue is needed from the robot; often people have no idea what the robot is doing, or what it wants them to do.
- The system lacks autonomous behaviour which is mandatory for the functions to work as intended. At the moment, the robot does not move by itself, it does not locate the user when it has a message, it does not turn towards the user, etc. We are missing autonomous behaviour of the robot.
- The system architecture does not support autonomous handling and prioritisation of multiple events at all. When two or three things happen at the same time (like an eating reminder, a visitor and an incoming call), a co-ordinating procedure should be invoked.
- We have to develop a persona / character for the robot; to show that Kompaï really knows the person, has intelligence, and cares for this person. More effort needs to be put into exploring the embodiment of the robot to stimulate social interaction and engagement with the system through intelligent and attentive dialogue and behaviour of the robot.

- There is a need for differentiation for the intonation of the voice, which relates to the above point as well.

Main lessons learnt during these field trials are:

- We as developers and the (in)formal carers have to put lots of initiatives into the system, so that people are motivated and guided by Kompaï. A proper and extensive user interface is required so people can "personalise" and "instruct" Kompaï exactly the way they wish (in terms of timing, kind of intonation, way of delivering the message or reminder, and so on).
- The fact that the robot keeps an "eye on you" and physically comes to you to remind / trigger / activate / motivate you is the key selling point of MOBISERV.
- We should focus on enabling carers to really work with our system. Only then will users be able to live with our system. At the moment, we are missing the complete service implementation from beginning to end.

The full report of these field trials can be found in Appendix 4 – Evaluation Point 13: First MOBISERV prototype field trials.

3.5 Evaluation Point 14 (July 2012): Expert and user evaluation of Secondary User Interface

There were two stages to this evaluation: an expert review and a user evaluation.

An expert review by UWE researchers highlighted many issues with the current implementation of the secondary user interfaces, including the following issues:

- Lack of responsive design (e.g. auto-resizing according to different screen sizes used to access the UI);
- It is hard to notice and read the buttons;
- Workflow feedback through navigation menu is lacking;
- Date entry form elements are not easy to use;
- Error messaging does not show errors;
- No confirmation that certain actions have been performed;
- Impossible to setup multimedia reminders;
- Help content has poor legibility;
- Clock is distracting;
- Spatial consistency of main menu button is lacking.

A short user testing evaluation has been conducted with two secondary users – professional carers – in the UK, and have highlighted the following issues:

- Setting up eating reminders and exercise schedules proved quite time-consuming, confusing and were not completed satisfactorily due mainly to unsupportive workflow design and feedback.
- In short, the carers found it hard to know what to do throughout the processes, and when, or if they had done it successfully.
- There were some issues with the logs, and room for improvement, but this test involved unrealistic data which may have detracted from the user experience. One key area of improvement is integrating all the logs together so a carer can see 'at-a-glance' how eating, drinking, exercise and vital signs data stack up for one older person over the course of a day.
- One carer's experience that her inputs might have been lost (though they were not) lead her to feel that she was not confident with the system. This developed into a wider a lack of trust in parts of the system that were not evaluated - that the eating, drinking and exercise detection processes were not reliable.

There is more information detailed in Appendix 5 – Evaluation Point 14: Expert and user evaluation of Secondary User Interface.

4 Recommendations, Priorities and Planning

There are a very large number of issues identified in Issues I and II of D2.5 that the technical partners have to attend to and rigorous and strategic planning will be required in the remaining time before the final evaluation.

Furthermore, in addressing these issues a holistic approach to developing the system needs to be taken, rather that individual components being developed in isolation.
The following section represents a sub-set of issues that have been identified in our evaluations to date. The complete list can be found in Appendix 6

4.1 Recommendations

As a joint exercise, the complete MOBISERV consortium, including technical partners and user partners, ranked some of the issues identified, taking into account a number of factors, including:

- Strategic value (1-low, 5-high)
- Technical feasibility (1-hard, 5-easy)
- Market Exploitation Potential (1-low, 5-high)

These were added together and averaged to produce an overall ranking as shown in the table 2.

Recommendation	**Rating**	**Responsible partners**
GUI on the PRU – Buttons to make call are not clear and not usable (the home, video and mobile buttons > not useful, just one button as the face is enough). Buttons in call are not clear (mute camera, microphone, volume)	12	ROBS
Integration of the secondary settings data with the application on the robot needs to be done	12	ROBS
Development of usable settings screens for secondary stakeholders, Ability to set eating and drinking times, Ability to set reminders including addition of different media (audio, video), Secondary UI should be to spec – ref D2.3 vol. III	11.75	ST/ROBS
Need an easy way to configure the Systems settings and User details on the robot	11.75	ST / ROBS
Implements the User model to enable context awareness & intelligence	11.6	ALL
Feedback should based on real data from the other components such as the WHSU, related to what the current activity/context of the user	11.3	CSEM / ROBS
Implementation of Drinking reminders is required	11.3	ROBS

User localisation needs to be implemented	11.3	ROBS
Robot should automatically face the user during direct interaction. The voice-based turn commands do not work.	11	ROBS
Logging / feedback of events for carers is not present	10.8	ST / CSEM
More guidance from the system needed for correct usage of WHSU	10.3	CSEM / ROBS
Prioritisation of triggers from various functions needs to be defined – taking context awareness into consideration	10	ROBS / SMH
Speech interaction needs to be implemented for sub-menus/screens of the GUI on the PRU	10	ROBS
Ensure that we will be able to assess OS2 in final evaluation - Support the elderly in maintaining their social activities. This objective will be measured in relation to the increase in frequency of communication between end-users and their relatives and carers. So need to have context based triggering of encouragements to communicate e.g. when it is detected that a contact is online, when they have been no visitors for a day, when they have not made a call	10	ROBS
Need feedback from the robot that datalogger is recording	9.75	CSEM / ROBS
Need to have more speech output from the robot when exercising using the WHSU (the actual exercise is not spoken)	9.75	CSEM / ROBS
The user should be able to talk to visitors at the front door via the PRU	9.6	LUT
Reminders on the Kompaï GUI need to be consistent (at present some appear full screen, others only in the text balloon)	9.5	ROBS
On/off and red/green buttons need to be clear to users and need to show current status of the devices	9.3	ROBS
Speech recognition from a distance (across a room) should be possible	9.3	ROBS
Recommend an input mechanism to enable the person to add missed activities that occurred when the person was not wearing the garment (for example activities performed when not at home)	9.25	
Need interactive charts of historical activity data (as part of the secondary user interfaces)	9.2	ST / CSEM
Need an easy mechanism to set text in speech bubble on the Kompaï GUI	9	ROBS
Need an easy way to update or install the software	9	ROBS
There needs to be a link between exercises in the PRU GUI menu and in reminders	9	ROBS
User logs should be available in a usable manner for the secondary stakeholders – ref wireframes in D2.3 vol. III	9	ST
Volume on Kompaï needs to be made higher	9	ROBS

Need to develop a smaller datalogger	8.25	CSEM
More home control devices should be added	8	ROBS
Red/green ears on the Kompaï GUI need to be made more visible and clearer. Perhaps this will be superseded by the presence of the new PRU head proposed by ROBS	8	ROBS
There needs to be feedback from the robot whether the garment is correctly positioned (i.e. using processed information about data quality)	7.5	CSEM
The video image should stay visible for a while after opening door	7.3	ROBS
It might be useful for the user if there was some feedback on garment itself that activity is suggested (e.g. haptic, visual, audio)	7	CSEM / SMARTEX
The current volume setting on the PRU should be retained if restarting	7	ROBS
Waterproofed integration of components (i.e. garment and datalogger) is recommended	6.4	CSEM / SMARTEX
Need to set priorities between functions	6	ROBS

Table 2: Prioritised list of main recommendations

4.2 Working towards a successful final project outcome

In addition to the recommendations in table 2 above and additional issues included in Appendix 6, it is important for technical partners to take a more holistic approach to the system concept when addressing these issues in order to reach a successful final project outcome. Many of the issues found require a rethink of the information flow, the interaction flow, the speech interaction and the GUI and the technical partners need to engage fully how they will achieve this. More joined-up and pro-active thinking and action is required.

Taking a whole-system perspective, a number of the key aspects have been highlighted for further discussion in the sections below.

4.2.1 Speech recognition

At the present time, voice interaction is not usable at all in a real context. This is a major concern, because almost all users prefer to talk to the robot. On the other hand, this is a very hard task, and is not within the scope of MOBISERV to actually develop speech recognition software/modules. However this does not mean that we should not actively search for other solutions. Next to this, hardware-wise, we should test two other microphones; an omni-directional one on the head of Kompaï, and/or a wireless microphone that can be attached to user. Moreover, in terms of the dialogue, Kompaï can actually instruct people how to talk to the robot in a way that it is more likely to hear / understand it. This can be done by doing some intelligent data processing of the speech recognition quality data that is already

available. Also, by re-considering the phrases the robot says we can prime certain way of answering by the users (e.g. in the question Kompaï can propose some possible answers or trigger a “yes/no” answer, or Kompaï can ask people to talk slower, louder, use different words for example).

4.2.2 Integration & Installation Process

There have been several major problems with the installation in the UK. These should be solved as soon as possible and there should be a more straightforward and standardised process for software installation, set-up and updates.

Next, the technical partners have to think about the fact that UWE and SMH have had to do lots of fine-tuning of details, the used grammar, and the content of the system. This should not be lost during updates by technical partners.

Third, the WHSU integration with the PRU needs to be completed, as this is not working at the moment.

4.2.3 Companionship

Also the interaction could be designed to simulate more of a feeling of companionship, it remains a ‘cold piece of technology’ that needs manual operation. We could do a lot more by incorporating a few straightforward features. We have a lot of event information, and we have a talking robot, so we need to think creatively and use these valuable affordances. We can use the information that we have defined as part of the user model to show the intelligence and find a much warmer voice for the robot and improve and extend the dialogues. This will highly improve the user experience, and therefore the user acceptability and enthusiasm.

4.2.4 Autonomy

This issue is related to the previous one, the many small issues in the current interaction with overall system and the lack of full integration of the high-level functions give the users the feeling that it is still a demo, not a working prototype. It is missing the finishing touch of being autonomous, flexible, and personalized within the context of the functions being implemented.

4.2.5 Secondary User

The secondary user interface and its functionality for formal and informal carers is far from usable. Therefore, there is no way at present to configure the system for the primary user, to set eating, drinking and exercising encouragements, to set contacts, to fine-tune the

interaction, etc. This is another major concern. If this is not working, the complete system will not work.

It should be noted that basic levels of usability were not achieved in the implementation of the secondary user interfaces – resulting in a waste of professional carer's time in the evaluations.

The secondary user interface should be high priority, together with improving the usability. The informal carer is key! They know the older person best, so they will be the person that will configure and use the system, by setting reminders, setting preferences, etc. If they are not able to do this easily then it will have an impact on the overall acceptance of the system. The potential ability to personalise the system is a key selling point.

4.2.6 Representations of health data for carers

There is considerable work to do to discover more about ways of presenting older people's data in a way that is effective for carers: the tacit knowledge used by carers when assessing an older person's eating, drinking and exercise activities is likely to inform the design of a single log (combining data from different functions) and perhaps ultimately, the design of intelligent rules and machine learning capabilities to enable the system to improve the overall health of the older person.

4.2.7 Acceptance and prior experience

With older people obviously being highly accustomed to clothing, we may overlook the fact that clothing is a form of technology. As a result smart clothes, with embedded sensors and appropriate feedback, are positively embraced by older people who have little or no prior experience of computer technology. This is in contrast to the PRU, which is very novel technology: it is rare to find any older people who have any experience with robots. The PRU takes some getting used to and over the course of a few hours, people's impressions change. A sign of the strength of prior experience in affecting acceptability is reflected in a comment from an older person that their preference was to use the garments as the principal user interface with wider range of MOBISERV functions (i.e. to receive eating reminders via the WHSU), rather than via the PRU.

There was very enthusiastic response to the garments and the usefulness of the vital signs data acquisition system from carers and older people. However, several things should be improved hardware-wise, both on the smart clothes as on the datalogger. Also, the integration software-wise should be fixed.

4.2.8 Representations of health data that older people can understand

There are clear opportunities with regard to the design of information feedback to older people themselves – as people over the age of 80 years old have very low levels of experience with visual displays, and suffer hearing and eyesight impairments. Their preferences for haptic feedback and confusion at separated components offer massive challenges to the technical partners' capabilities within the time-scales of this project.

4.2.9 Standalone system

Many older people conceptualised the smart garments as a standalone system, working without the robot. This presents several key challenges relating to how user inputs are made and system computation and outputs are made. Specific challenges include: how to combine activity data built up while wearing different garments on different days; providing feedback directly on the garment itself (for the exercise function and other functions like eating reminders); accommodating occasions when activity is undertaken without garments by allowing users to input data themselves (e.g. by telling the system 'I just went for a swim for 30 minutes').

4.3 Planning for Future Evaluations

We should aim to get system ready for real usage where we could put this in someone's house and leaving it for a full week or even a few days.

There are a very large number issues identified in both Issues I and II of D2.5 that the technical partners have to attend to before the final prototype deliverable, and rigorous and strategic planning will be required in the remaining time before the final evaluation.

The coordinator needs to take responsibility for monitoring response to all issues, including those outstanding from previous evaluations and prepare a fine-grained schedule for dealing with these.

To enable this to proceed smoothly, we should plan for having a more agile mechanism for evaluating aspects of the system as improvements are made by the technical partners and feeding back the findings to them for prompt action.

5 Appendix 1 – Evaluation Point 10: Overall system integration and installation

5.1 Status Report – April 30th 2012

In the Netherlands, SMH has started evaluation trials with the green Kompaï that has the full MOBISERV prototype, except the WHSU.

In the UK, there have been many installation issues, so from the 16th to 18th of April, An engineer from ROBS visited UWE to help with resolving the pending issues. However, it turned out to be impossible to solve all issues, and even more issues were identified. Therefore, it was decided at the end of April to send back the purple Kompaï to ROBS in France.

Here is a summary issues, mostly regarding the purple Kompaï in the UK.

5.2 Issues as at April 30th 2012 that were unresolved

Issue	Description
Voice Interaction not working	The MOBISERV HMI does not respond to voice input at all.
The WHSU integration with the MOBISERV HMI does not seem to be working	The datalogger is successfully paired with the Kompaï laptop and the software is running. However the exercise touchscreen button on the MOBISERV GUI is still greyed out and there is no indication whether the user is wearing the garment, whether the data is streaming, whether the quality index is being monitored, whether the information regarding user activity is being polled from the data logger or not. No documentation regarding the scope of the integration or process has been provided.
Skype Interface integration	The Skype window does not show the video of the person on the MOBISERV GUI. A better user experience could be achieved by embedding the video within the MOBISERV GUI rather than opening up skype separately – this part of the GUI is not as specified in the HMI – D2.3 vol. 3, Figure 3. This is defined in the D7.2 Figure 22, but this is not implemented.
Additional localisation problems	Mapping/localisation remains an extremely cumbersome process with problems exasperated by the laser getting confused by reflective surfaces (metallic chair legs), glass and objects like tables with spindly legs. The problems with reflective surfaces has never been flagged

	before by Robosoft – it seems that there has not been adequate lab testing with Kompaï to establish a clear operational parameters.
Further lab testing (validation) results required from ROBS and CSEM	ROBS and CSEM need to present lab testing results for validation tests as defined in D2.2 volume 3. There needs to be quantitative data regarding performance characteristics of all technical components in a range of conditions. These include : • Performance results of the speech recognition system (mean confidence levels) at different ambient sound levels (in dBs) • Performance of the navigation sensors at different light levels (including direct sunlight) • Bluetooth range (distance in m) for the data logger • Battery life performance characteristics of the datalogger with different time periods of streaming. This will inform us of the optimal operating conditions of the system.

Issue	**Description**
UK+NL: Wizard installation has proved to be problematic	Very confusing and time-consuming procedure for installation – there are several software components, including drag-and-dropping rather than using an installer programme.
UK+NL: Kompaï Software installation/ update is complex	A version was produced with Microsoft Speech Platform software, enabling EN and NL languages. Very lengthy procedure to install this new version. Some issues with mapping physical space in the UK (‘messy map’) (not documented in manuals)
UK: Technical troubleshooting	Some issues with localisation, object recognition, and resetting after collision (not documented in manuals) Problems with main MOBISERV application window control.
UK + NL: Initial speech input evaluation yields very poor results	Speech recognition configuration is problematic (there are no guidelines documented in the manual on how to do the speech recognition configuration. There are no guidelines for calibration) There are no integrated tools for checking grammar confusability.

	We have tested single word commands using different people and distances from microphone. These results indicate that, as reported in earlier evaluation, speech recognition remains a problematic user issue. Better results appear when user is closer to the microphone.
UK+NL: The WHSU is still not integrated with Kompaï	There is no integration of WHSU with the Kompaï – we have been reviewing this with CSEM and ROBS through Skype meetings and have discussed the relevant process diagrams, UIs required for primary and secondary users. These are needed for the evaluation with secondary stakeholders – as specified in D2.3 vol. III. The current CSEM viewer application is not ready for user trials, and is not integrated with the MOBISERV system at all.
UK+NL: Secondary stakeholder screens are for Nutrition setting and monitoring logs are not to specification	These are needed for the evaluation with secondary stakeholders – as specified in D2.3 vol. III. The current web interface (see p12) implementation is not ready for user trials.

Table 3: Details of Issues

5.3 Issues that were resolved

Issue	**Description**
Kompaï laptop does not have Bluetooth capabilities	No Bluetooth module on Kompaï laptop.
UK+NL: Kompaï Software installation/ update is complex	Installing and configuring the CSEM viewer application is complex Installing web interface for secondary users is complex
UK: Technical troubleshooting	Buggy external third-party audio software failed without resolution.
UK+NL: User data logging needed to enable quantitative evaluation	A set of parameters have been defined for logging of user interaction and events which will enable more thorough evaluation and improved system response/decision making.
UK+NL: Grammar extension and implementation	UWE and SMH to extend the grammar and build back into the configuration

6 Appendix 2 – Evaluation Point 11: Lab testing of speech recognition

6.1 Speech recognition test procedure

Words and phrases were selected from the system grammar (i.e. the commands that the robot is designed to respond to) and were spoken four or five times in a minute. Speech recognition rates were automatically recorded by the system in the interaction log and afterwards downloaded for each word /phrase. This was repeated for different distances.

Words used in UK
A small set of phrases was used:

- Hallo
- Compie
- What time is it please?
- I want to do some exercises
- Robot
- I want to make a video call

Words used in NL
A lot of different phrases were used, including the following:

- kompaï
- robot
- dank je
- bedankt
- hoi robot
- hoe laat is het
- wat voor weer is het
- wat zeg je

6.2 Speech recognition test results

	First UK tests		**Second UK tests**		**First NL tests**
	1m (UK) 0.40 confidence level	0.1m (UK) 0.40 confidence level	1m (UK) 0.55 confidence level	0.1m (UK) 0.55 confidence level	0.75m (NL) 0.45 confidence level
Total	64	16	20	20	600

No response by PRU	16 25%	0	11 55%	0	0
Response by PRU without recognition ('Robot did not understand at all')	14 22%	3 19%	0	1 5%	90 15%
Response by PRU : Wrong recognition	1 1%	0	0	0	13 2%
Response by PRU : Speech registered but below confidence threshold	0	0	0	3 15%	62 10%
Response by PRU : Correct recognition	33 52%	13 81%	9 45%	16 80%	169 73%

Table 4: Summary of speech recognition testing

7 Appendix 3 – Evaluation Point 12: WHSU field trials

There were four stages to the evaluation of the WHSU:

- Co-operative evaluation with professional carers
- Expert review
- Co-design evaluation with older adults
- Home trials

7.1 Co-operative evaluation with Carers (ANNA)

ANNA has a large number of professionals working with older people. Within the scope of the MOBISERV project, several professionals have been asked to give their expert opinion about the smart garment, developed for MOBISERV. Two focus group studies were conducted. The contributing professionals are listed in the following table.

Profession	**Sex**	**Age**	**Years of experience**
Team coach	Female	39	20 years
Team coach	Female	48	25 years
Specialist in geriatric medicine	Female	40	15 years
Carer	Female	27	11 years
Occupational therapist	Female	29	8 years
Nurse	Female	59	30 years
Team coach	Male	49	30 years
Residential coach (day care centre	Female	24	3 years

Table 5: Contributing professionals

During the Open Day of Ananz in March 2012, we also asked several future clients about their opinion of the smart garment as part of a more informal survey.

To present the outcomes of the evaluation, this section is divided into six sub-sections: Comfort, Look & Feel, Advantages, Disadvantages, Additional Information and Questions, Points for Improvement.

7.1.1 Comfort

The garment has zippers and buttons to open and close it. This is fine according to comfort. It is nice to use a long zipper that open and close from top to bottom.

For older people that lie in bed most of the time, it is desirable to make the closure on the back and to avoid seams that are not necessary.

The female shirt has dark brown ties around the middle. All the professionals placed a question mark and wondered why they were made and what is their function. The ties are also very tight and not very comfortable.

7.1.2 Look & feel

In general, the garment is elastic, stretchy, loose and soft. These characteristics are very important for the elderly to experience the clothes as comfortable.

Some professionals did not like the print of the female pyjamas. Older people that saw the female pyjamas liked the print.

The pocket on the pyjamas where the data logger is kept is open and has no closure. This is a bit clumsy because the data logger can easily fall out of the pocket while the client is stooping or bends over.

7.1.3 Positive Characteristics

Summarized, the positive characteristics of the smart garments are:

- The material of the garment is elastic, stretchy, loose and soft
- Zippers and buttons are fine to open and close the garment

7.1.4 Negative Characteristics

Summarized, the negative characteristics of the smart garments are:

- On the pyjamas the closure is only halfway
- Seams can cause discomfort so use as little seams as possible
- Make a closure on the pocket of the pyjamas

7.1.5 Additional Information and Questions

Several professionals asked questions, related to the practice of their profession:

- Is it possible to use only the wrist and ankle bands, not integrated into the pyjamas? This could be a good solution, as lots of elderly people do not wear any trousers in bed or wear shirts with short sleeves during the summer
- How reliable is the measurement of blood pressure measurement while someone is trembling a lot, or restless? For example for clients suffering from Parkinson's Disease.

To complete the ideas of garments, you can have a look at www.4care.nl . This website gives an impression of how to develop garments and dress people with care.

7.1.6 Points for Improvement

To improve the smart garment, the following points should be taken into consideration:

- The closures of the pyjamas is only halfway with three buttons. To make it easy for clients it is desirable to make the closure of the pyjamas from top to bottom.

- Instead of buttons or zippers you can use Velcro to open and close the garments easily.

7.2 Expert review (UWE)

This section includes the findings of evaluation studies conducted by an expert at UWE who is programme leader for the Applied Ageing Studies (MSc) and trained and practiced as a registered nurse and health visitor. She works with the independent sector, particularly care homes for the elderly. She currently works with these organisations to develop care home learning networks, facilitate the care home network groups and is a member of Action on Elder Abuse group, amongst others. The evaluation was conducted on the second versions of the garments and data loggers (version delivered to UWE in September 2011) .

Garments used:

- Pyjama (female and male)
- Band (female and male)
- Vest (female and male)

7.2.1 Issues with the garments

7.2.1.1 Pyjama (Female)

- Good comfortable, stretchable material
- Good loose – fit
- Ankle/wrist band is very restrictive and may require an older person to seek assistance when putting the garment on. *Recommend – where there is a wide Velcro band on one wrist, remove the smaller Velcro band (if possible)*
- The pockets for the dataloggers are open and the dataloggers could easily fall out during exercise, when older person is putting garment on or taking it off. *Recommend - Top pocket needs a velcro fastening to enclose it.*
- Connecting the red datalogger is fiddly. *Recommend – Improve the form factor of the connecting pieces.*
- It is easy to try and connect the red datalogger to the cable for the white datalogger. *Recommend – Provide instructional guidance (e.g. two sets of coloured dots) to ensure the right match is made of cables and dataloggers.*
- Putting it on correctly requires some motor control ability (e.g. putting top over shoulders, fixing the velcro at the sides) – and should be tested with an agile older person initially. The garment alignment may also move during use. *Recommend – Provide positional feedback (e.g. right or wrong, based on data quality).*
- There is some concern about how firmly the metal skin sensor is pressed against the skin (this may cause an issue for some people who are fat)

7.2.1.2 Pyjama (male)

- The issues identified with the female pyjama apply to the male pyjama, but also...
- Why can't the top open down the front. *Recommend – use a velcro fastener.*

7.2.1.3 Band (female)

- Good soft, cosy material
- Could be invisible under clothes (important)
- It is unclear where exactly it should be positioned on the body. *Recommend – Provide instructions.*
- The datalogger may cause some discomfort due to its size. *Recommend – Add padding on pocket, or reduce size of datalogger.*
- It is not clear what is inside or outside of the band. Could be put on inside-out. *Recommend – Provide instructions on the garment.*
- It is not clear how the garment should be aligned (e.g. front and back). *Recommend – Provide instruction on the garment.*
- Putting it on correctly requires some motor control ability (e.g. arms around the back) – and should be tested with an agile older person initially.
- The pocket for the datalogger is open and the datalogger could easily fall out during exercise, when older person is putting garment on or taking it off. *Recommend – Pocket needs a velcro fastening to enclose it.*
- Applying water to the sensor to moisten it is likely to prove a hassle for people or their carers. It could rub off when the older person tried to put the garment on (e.g. dragging it behind their back). Does the sensor require abdominal moisture or warmth to ensure data quality?
- Older people typically wear vests (in the UK, at least) to preserve body heat and may try and put band on over the vest. *Recommend – Provide instructions to wear next to the skin, under any clothes*
- It requires fine motor control to connect the datalogger. Older people may require a carer to do this for them.
- Many older people (particularly those in care homes) are likely to need 2 garments (one to wear while the other is in the wash).
- Is there an annual repair service for the garment to maintain it?
- Who is paying for it?

7.2.1.4 Band (male)

- The issues identified with the female band apply to the male band, but also...
- This is neater than the female band.

7.2.1.5 Vest (female)

- Good – front fastening is easy to get on.
- Good – mostly invisible.
- Good – white material
- Zip – double zip is confusing. *Recommend – Use a single zip.*
- Label is on outside. *Recommend – Put label on inside.*
- The pocket for the datalogger is open and the datalogger could easily fall out during exercise, when older person is putting garment on or taking it off. *Recommend – Pocket needs a velcro fastening to enclose it.*
- Brown tightening band is not adjustable. *Recommend – Provide adjustable band to enable comfortable fit when body sizes change throughout the day.*
- How do you know it is positioned correctly? *Recommend – Provide instruction on the garment.*
- Washing guidance is absent. *Recommend – Provide instruction on the garment.*

7.2.1.6 Vest (male)

- The issues identified with the female vest apply to the male vest, but also...
- Good – soft, looks like a vest.

7.2.2 Issues with the Datalogger

- How do you know if it is working? Recording properly? *Recommend – Provide haptic feedback status signal (vibration once a minute when recording) and haptic/audio feedback when recording stops (on stopping).*
- Function buttons (to enable recording) could be missed or accidentally pressed during use. *Recommend – Remove button and enable instantaneous recording of data when the datalogger is connected to the garment.*
- Removal before washing may be forgotten. *Recommend – Make datalogger waterproof.*

7.3 Co-design evaluation with Older Adults (UWE)

This section outlines the findings from a series of co-design evaluation sessions and home trials (May 2012) carried out in the England (UK) in order to evaluate the MOBISERV Wearable Health Status Unit (WHSU). 17 older people took part representing primary users, in 1 focus group and 8 individual sessions.

7.3.1 Aims

The aim of this part of the evaluation was to deepen the understanding of how the WHSU system should fit its context and help in refining the system design. The aims of this evaluation of the Mobiserv smart clothes (WHSU) were:

- Gather information on users' interactions and expectations in relation to the range of functionalities.
- Find usability errors and interaction problems.
- Gather qualitative information on users' priorities for alterations and additions to the future concepts.

7.3.2 Functionalities evaluated

Of the five main MOBISERV functions, we undertook an evaluation of the components involved in monitoring of behaviour and vital signs. This research was conducted using the WHSU (and also the CSEM Viewer application), as the main MOBISERV application - running on the portable robotic unit (PRU) - was not showing real-time vital signs data.

7.3.3 Method

We recruited representatives from the primary user target group – namely, older adults.
Nine sessions were held: eight one-to-one sessions; and one group session with nine people.

In order to discover gaps and enhancements with the current design of the WHSU, we facilitated the older adults to co-design smart clothes for real users in context. This was achieved by demonstrating real-time sensor data acquisition and showing the range of smart clothes, then allowing the participants to design what it should do and it should work. The results of these sessions were captured either as sketches or verbal scenarios. These were compared to the current design of the WHSU and through analysis gaps and enhancements were identified. Ultimately, a series of 23 requirements are made.

Face-to-face session
Each session lasts 30-45 minutes. There were several parts to the sessions:

- A demonstration of the current WHSU, including real-time streaming of sensor data
- Presentation of one of the current WHSU scenarios (use case 1 of the function for encouragement for exercising was chosen from D2.3 MOBISERV System Requirements Specification Vol. II)
- Envisioning activity by older adults, covering what they could be useful for and how. The activity was supported by a design facilitator.

Full details are available in the session plan in Appendix 6. Following these sessions, three participants agreed to take part in a home trial. More details about this follow in the next section.

7.3.4 Participants

The older adults who took part in this research presented a range of chronic age-related impairments, including reduced vision, reduced fine motor control (such as writing), reduced

mobility (e.g. bending down to pick things up, arthritis), hearing difficulties (ameliorated using hearing aids), reduced speech capabilities and partial paralysis (due to stroke), reduced cognition (e.g. poor memory, Alzheimer). Data was captured for only 14 of the 17 participants.

The following participants took part:

Age	**Male**	**Female**
50-59 years old	0	1
60-69 years old	1	3
70-79 years old	2	1
80-89 years old	0	5
90+ years old	0	1
TOTAL	**3**	**11**

Table 6: Participants, by gender

With a mix of ethnic backgrounds:

Ethnicity	**Male**	**Female**
White	3	5
Black Caribbean	0	4
Mixed parentage	0	1
Rather not say	0	1
TOTAL	**3**	**11**

Table 7: Participants, by ethnic background

With a mix of living situations:

Living status	**Male**	**Female**
Living alone	1	1
Living at home, with someone	2	6
Living in a residential care home	0	4
TOTAL	**3**	**11**

Table 8: Participants, by living status

With a range of prior technology use:

Age	**Email**	**Web browsing**	**Internet shopping**	**Facebook or Twitter**	**Skype**	**Word**	**PC games**	**Keep fit videos**
50-59 years old	1 / 1	1 / 1	0 / 1	1 / 1	1 / 1	0 / 1	0 / 1	1 / 1
60-69 years old	3 / 4	2 / 4	1 / 4	1 / 4	1 / 4	1 / 4	0 / 4	0 / 4
70-79 years old	2 / 3	1 / 3	1 / 3	0 / 3	0/ 3	1 / 3	1 / 3	0 / 3
80-89 years old	0 / 5	0 / 5	0 / 5	0 / 5	0 / 5	0 / 5	0 / 5	0 / 5

90+ years old	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1

Table 9: Participants, by prior technology experience

This small sample of demographic data shows that:

- Older people aged 80 years old and more have no prior experience with screen-based computer technologies. (This data is consistent with findings from previous samples.)
- Older people aged 50-79 years old do show some prior experience with screen-based computer technologies. (This data is consistent with findings from previous samples.)
- Technology use declines with age, but it maybe that people aged 70-79 years old are recent adopters and that this change is stimulated by life factors such as loss of partner, friends and the capacity to physically carry heavy food shopping bags and so on.

7.3.5 Findings and Emerging Requirements

7.3.5.1 Activity monitoring

The findings have been grouped into the following themes – exploitation, form factor, feedback, non-recorded activities and usability.

7.3.5.1.1 EXPLOITATION

There were many co-design proposals for an activity "recorder" that supports “taking responsibility for your own health.” Older people saw the garment as “a recorder of your daily life and activities,” in the words of one older lady.

And older man said: “Monitoring what is going on in my body is only half the story. There has got to be something that goes ‘oi, mate or an alarm goes off: slow down or ding-dong, this would be a good time to do some exercises, I noticed you have been inactive for half an hour, how about wiggling your toes?’. But where would that come from it would have to be programmed in, wouldn’t it? That does not exist does it, but I suppose it could do. You wear something unobtrusive ... doesn’t something like this exist already? But probably it doesn’t...”

> *Requirement 1: Ensure the smart clothes are exploited with the benefits of learning healthy behaviour from recording your daily life and activities. <must>*

7.3.5.1.2 FORM FACTOR

The current separation of garment and datalogger results in complexity as multiple pieces of equipment are confusing. Older people were unsure how it all fitted together. An instruction sheet with photographs was provided in the home trials but one trial was delayed because these instructions were not followed.

Requirement 2: Integrate garment and datalogger. (This will require a waterproof enclosure for the datalogger.) <should>

7.3.5.1.3 FEEDBACK

It was conceptualised that the garment should provide feedback during use. "What's the point otherwise?" reported one older person. There was also an assumption that it would work as a standalone item.

Information from the different data sensors was welcomed. One older man reported: "Energy used is obviously important. Heart Rate is must obviously be very good because that tells you medically and goodness knows what you are doing in an everyday situation that must only be good for you and it must be information that is not only good for you but obviously good for medical people and anybody who is observing you or doing anything with you at all. Body temperature also important, I suffer from bad circulation so I am always getting cold"

Regarding the type of information presented, common proposals were that it should provide weekly trends to encourage progress and remind. It should also provide 'problem' prompts to warn a user about irregularities.

Regarding the form of feedback, vibrational (or haptic) feedback was very strongly proposed in the group session (9/9 older people voted for this). This was also proposed in two of the one-to-one sessions with older people on account of the participants' visual and auditory impairments. There was also some preference for visual feedback.

Requirement 3: Provide in-use feedback, via the garment itself. <must>

Requirement 4: Provide vibrational feedback, via the garment itself. <should>

Requirement 5: Provide feedback visually, via garment itself (such as colour-changing fabric or surface-mounted LED) or via a separate visual display unit. <should>

Requirement 6: Provide content feedback on the garment itself showing more/less activity required to achieve set targets (i.e. variance in the data, not energy expenditure totals.) <could>

Requirement 7: Provide alerts to user when vital signs data is unusually irregular. This should be presented across all available modes – visual, auditory and haptic. <should>

There were some co-design proposals concerning using the self-care garment as a collaborative tool with an informal carer, healthcare advisor or doctor. It was proposed that this feedback be done visually.

Requirement 8: Provide a means for users to share longer term historical chart data (e.g. 3 months or more) with a named third-party. Provide the ability to view and

interact with vital signs data totals by choosing by month, by week, by day or by hour.<must>

7.3.5.1.4 UNRECORDED ACTIVITIES

Older people pointed out that they may not wear the garments all the time and that there may be activities which are missed, resulting in a partial or incomplete data. For example, this happened with a swimming activity in one of the home trials on account of the garment and datalogger not being waterproof and therefore not being worn during the activity.

Requirement 9: Provide users with the ability to manually enter activity data that they have undertaken when not wearing the garments (for example, via an activity diary which estimates energy expenditure). <should>

7.3.5.1.5 USABILITY

Older people pointed out that it is not clear what actions should be taken with the datalogger. They might not always have the instruction sheet at hand and they are likely to forget the instructions.
Also they found the feedback is unclear.

Requirement 10: Provide a larger button, with a label 'Record' within a larger recessed area. <must>

Requirement 11: Remove all LEDs from the datalogger, except for a red LED on the 'record' button. <must>

7.3.5.2 Fall detection

There were some co-design proposals for a fall detector. This was very enthusiastically proposed by two older people, one of whom lived alone and has personally experienced a number of serious falls. Automatic detection of a fall was highly attractive to this older person as he was alone and unconscious when he suffered a fall. His life was saved only because a neighbour's son happened to be awake in the middle of the night and heard the fall. A very precarious situation!

One of the proposals for a fall detection system was produced as a sketch by one of the participants. It was proposed that the vital signs data of '86-year-old Mrs Jones' is sent via the internet to a control centre, which works out the most appropriate level of alert of the crisis at hand. A concerned family member pays a fee for 'piece of mind' that 'she is okay'. One of the proposed crisis responses was to call NHS Direct, a telephone helpline run by the national health service in the UK; another was to call the undertaker (which was meant as serious joke).

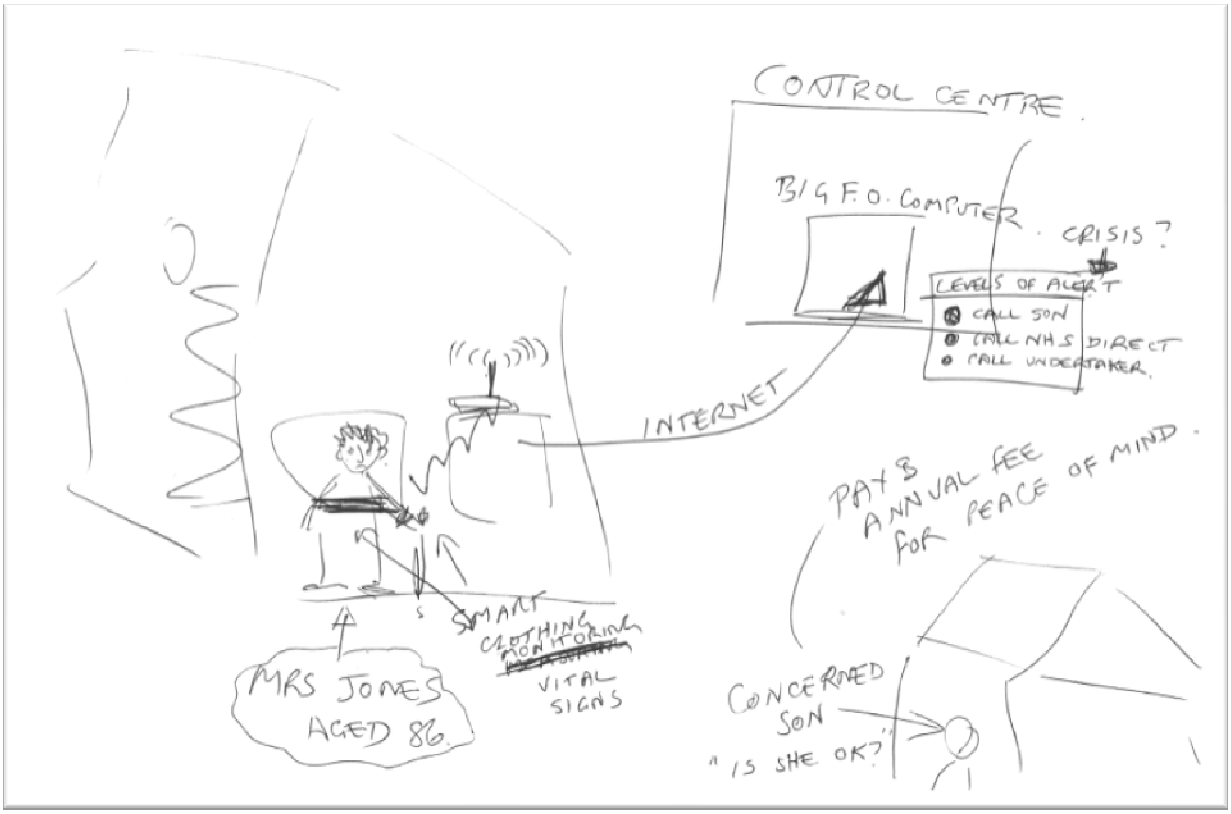

Figure 1: Co-designed sketch for fall-detection scenario.

7.3.5.2.1 CRISIS MANAGEMENT

It was proposed that there should be some sort of means of estimating the level of crisis (e.g. time spent lying on the floor, heart rate, breathing rate); followed by the sending an appropriate crisis alert (e.g. to family, neighbour, emergency services, etc.).

> *Requirement 12: Provide a means for an older person or secondary user to set up/edit/view a crisis procedure. <must>*

7.3.5.2.2 CARE RESPONSE

It was noted that this fall detection service should request help from someone nearby (e.g. care provider, neighbour). The requested helper's availability may be time-dependent – for example, the system might need to send the alert to a neighbour during the evenings and a carer during working hours (when the neighbour is out at work).

> *Requirement 13: Provide a means for an older person or secondary user to set up preferred crisis responders (depending on time of day). <must>*

> *Requirement 14: Provide a means for carers to update their availability as crisis responders (depending on presence in home, e.g. they may be out). <could>*

7.3.5.2.3 HOME CONTROL

It was also noted that in some falls, where the older person is alone and unconscious, access to an older person and their home is needed by a third-party such as a neighbour or the emergency services.

> *Requirement 15: Integrate WHSU and Smart Home - provide a means for the fall detection to make an automatic video-call between the front door camera and a remote care provider. On verification of the emergency services or neighbour by the remote care provider, the system could automatically open the front door. <could>*

7.3.5.2.4 EXPLOITATION

It was also proposed that the falls detection system was worth an annual fee to a relative. One older man said: "The idea that this person is being monitoring all the time... say irregular heart activity... the computer know what to do.. people would be prepared to pay for that for an annual service, not just buy the device but so much per year.. a premium service for people with elderly parents who don't want to go into a home. The security that that person is being constantly being monitored... they are wired into a network, you can relax ... for that peace of mind."

> *Requirement 16: Ensure this benefit is part of the exploitation plan. <must>*

7.3.5.3 Additional scenarios

An outcome of the co-design evaluation session was the identification of several additional scenarios which would be useful for the consortium to consider from utility and exploitation perspectives.

7.3.5.3.1 STANDALONE SYSTEM

This was a proposal of using the garments to provide eating reminder from the wider MOBISERV system, without the presence of a robot.

> *Requirement 17: Provide access to the MOBISERV application via alternative output devices (such as visual display units, interactive voice response systems etc.) <must>*

7.3.5.3.2 ENABLING SOCIALISING

This was a proposal of using the garments to encourage socialising: sharing an abstraction of vital signs data among other older adults so as to 'match-make' two people who did not know each other based on their data similarities.

> *No requirements made.*

7.3.5.3.3 WAYFINDING SUPPORT

This was a proposal of using the garments to provide support for older people when they get lost while out and about in public. This was proposed by an older person with Alzheimer's.

No requirements made.

7.4 Residential care home one-to-one sessions (UWE)

Older people in care home residents showed very low interest in the garments at all. Indeed, there was little interest in possessions in general. They were happy to be looked after by institutional carers. They reported little interest in motivating themselves for exercise (as health care assistants do this for them when there is an exercise session arranged).

No requirements made.

7.5 Home Trials (UWE)

Following the co-design evaluation sessions, three participants agreed to take one of the garments home for several days and complete a diary. They were given a sheet of instructions and a short demonstration of how to put on the garment and start recording. They were also interviewed on completion of the trial.

Full details are available in the session plan in Appendix 6.

The findings from each of the three home trials are presented below, grouped into themes with corresponding emerging requirements.

7.5.1 Home Trial 1 Findings and Requirements

Participant 1 (male, lives at home with someone, aged 70-79 years old) wore the belt for 4 days for approximately 10-12 hours a day.

Activities included:

- having breakfast,
- sitting at a table,
- walking to doctors,
- walking to shops,
- having lunch,
- driving a car,
- eating dinner,
- sitting on sofa in the evenings watching television.

7.5.1.1 COMFORT

- He reported no problems with comfort.

7.5.1.2 USABILITY

- He reported no problems with usability.

7.5.1.3 PRIVACY and UNRECORDED ACTIVITIES

- There was one evening social occasion where he reported he removed the garment because he did not want to share his data for this activity. On another occasion, he reported going swimming and that he took the belt off for this activity.

Requirement 18: Provide the ability for users to record data for self only, but not others <could>

Requirement 19: Ensure garment is waterproof to enable wet activity to be recorded <should>

7.5.2 Home Trial 2 – Findings and Requirements

Participant 10 (female, lives at home with someone, aged 70-79 years old) wore vest for 1 day for approximately 30 minutes.

Activities included:

- having breakfast,
- washing up,
- walking around kitchen,
- hanging out washing in the garden.

7.5.2.1 PRODUCT ADVISORY INFORMATION

- She reported feeling "a bit faint" while wearing the garment. A few days later she suffered a stomach bug and reported that this was the likely reason.

Requirement 20: Provide an information tab showing size of each garment (this is missing on the male vest and belt)and a reminder to contact someone if feeling uncomfortable. <must>

7.5.3 Home Trial 3

Participant 11 (male, lives at home alone, aged 70-79 years old) wore pyjama overnight for approximately 8 hours.

Activities included:

- sleeping.

7.5.3.1 MATERIALS

- He reported a personal preference for cotton clothing such as the pyjamas and rejected the vest and belt due to their materials.
- He also reported a preference loose nightwear and that in the unusually hot weather, he would not wear nightwear.
- He wore the pyjama top but not the bottoms.

Requirement 21: Provide an information tab showing what materials each garment is made of (this is missing on the male vest and belt). <must>

7.5.3.2 USABILITY

- Initially in the trial, he failed to follow the instructions and repeatedly tried to connect the white datalogger to the cable for the red datalogger. After a brief demonstration a few days later, he successfully resumed the trial.
- He awoke the next morning to discover the white datalogger had detached from its cable, was lying separately in the bed and the jack at end of the cable was bent. No injuries were sustained.

Requirement 22: Provide a more robust fixing between datalogger and cable (which would require greater physical force to detach): for example, as per the smart belt. <must>
Requirement 23: Provide visual colour coding and clear physical affordances to ensure that matching the right cables to the right dataloggers is the only possible way of connecting them together. <must>

8 Appendix 4 – Evaluation Point 13: First MOBISERV prototype field trials

8.1 Aims and Objectives

The purpose of the iterative evaluations of the Mobiserv system and robot is to ensure that all components are appropriate, valuable and usable for the target users for whom they are designed, including older people, their informal carers and professional carers.

8.2 Trials setup

8.2.1 Focus groups

Two focus groups have been organized with different user groups (older people, informal carers and professional carer). Each session started with explanation and administration of an informed consent and a short pre-questionnaire to collect basic data of the participants, followed by the explanation and presentation of the project and system, a demo of the system, and then concluding with the most important part of the session; the group discussion.

8.2.2 Individual sessions

Eight individual sessions have been performed, covering specific tasks focussed on the overall interaction and on the 5 high-level functions currently available in Mobiserv;

- supporting eating habits;
- supporting drinking habits;
- supporting exercising;
- offering security and comfort by front door control and home control;
- offering video communication.

A think aloud protocol was used and observation was done while people performed the tasks. In between these tasks, we held a semi-structured interview about the function and task they just had experienced. All sessions were observed by a second researcher and taped on video. The sessions were concluded by a post-questionnaire with closed questions.

8.3 Participants

A total of 8 persons participated in the user trials. All these participants came to the smart home twice (once for the session with the introduction and the focus group and once later on for the individual session to test the high-level functions). It was quite interesting to see that despite of the age, people did not seem to be reluctant to the use of technology and even a robot in the home environment. Table 10, Table 11 and Table 12 show demographic information about the participants. They are all more or less familiar with using the pc and related applications. Some live alone in and some with a partner.

Sex	Age	Using							
		E-mail	Internet	word	Skype	Online shoppin	Faceboo k / Twitter	Games	Fitness videos
F	50-59	X	X	X	-	X	-	X	X

Table 10. Basic information of the professional home care provider.

Sex	Age	Housing	Living	Using							
				E-mail	Internet	word	Skype	Online shoppin	Faceboo k / Twitter	Games	Fitness videos
M	70-79	own house	with partner	X	X	X	-		-	X	-
M	70-79	own house	with partner	X	X	X	-	X	-	-	-

Table 11. Basic information of the informal carers.

Sex	Age	Housing	Living	Using							
				E-mail	Internet	word	Skype	Online shoppin	Faceboo k / Twitter	Games	Fitness videos
F	80-89	care home	alone	X	X	X	-	-	-	X	-
M	70-79	own apartment	with partner	X	-	X	-		-	X	-
M	70-79	own house	alone	X	X	X	X	-	-	-	-
M	70-79	own house	with partner	X	X	X	-	-	-	-	-
M	60-69	own house	with partner	X	X	X	-	X	-	-	-

Table 12. Basic information of the older people.

8.4 Findings

8.4.1 General – primary users

Status

- Speech is only implemented in the main menu, not in sub-menus. Users do not understand why.
- Messages by the robot are not consistent. Some are full screen (eating, drinking). Others are only in the top balloon (visitor, exercises, incoming call).
- The up and down arrows are currently not in use and confuse people at the moment (nothing happens when you click on them).
- Sometimes the text in the balloon is not updated according to the submenu's.

Figure 2: Main screen of the Mobiserv robot

User comments

What do you think about seeing and using this robot?

- "It is fascinating, but I can understand the resistance. The idea that it is going to touch you physically."
- "Nice, I am enthusiastic. But it has to be useful for me. "
- "It already has a lot, but you could get even more out of it."
- "I am not really impressed."
- "It is a bit 'naked', you should dress it a bit more."
- "It is very user friendly."
- "I find it a pretty device."

What is it like talking to the robot?

- "I think speech recognition is a must. For instance for people with Parkinson's. They will call the wrong person when using the screen hahaha."
- "Everything should be voice controlled, like in a new car nowadays."
- "Very bad intonation. Fast, but dull." (almost all users mentioned that the voice needs to be improved drastically)
- "Intonation of speech output is not nice, should be like talking to a human. Should be recorded by a nice voice, a friendly nurse."
- "It should be linked to an inductive loop, for people with hearing aids."
- "Yes, very nice!"

What do you like and dislike about it? What would you change or improve?

- "The functions are super!"
- "Eating, drinking, exercising is important. A video calling aid is also useful. But it should all be speech controlled."
- "It should just monitor and signal things when needed. Nothing more. Medicines, nutrition, exercises, things like that."

- "You have a lot already. I do not know what to add."
- "It should be used for guarding, signalling, stimulating, exercising, keeping me awake, etc."
- "The robot calling the emergency, that is most important."
- "Improve speech recognition very much."
- "Such a robot is very useful, but also has big drawbacks; I spend about 2 hours at my pc, reading and answer mails, printing, etc. So ICT also closes people off from the community. You can play with it for ages. This robot will replace lots of personal care and will lead to isolation. It should not replace personal care."
- "It should say nicer things every now and then, a little more playful, and with more variation. A nice expression, something original, something you do not hear every day."

Comments regarding the GUI

- "The screen is very crowded now."
- After explaining the red/green ears; "Quite hard. It is a very complicated device, particularly for the people it is targeted at, I think."
- "How do I get back to the main screen?"
- "The logo should be removed, the little head and balloon should be removed, the clock should be bigger. Clock and date is very good!"

Can you imagine this in your home?

- "Yes very handy, if I could take it with me now, I would."
- "Absolutely! And it is not problem that it costs some money. This is much better than going one holiday. I would even choose to buy it once, instead of paying a monthly fee. Lots of people forget about their own responsibility and always point at their insurance. We should more go towards a USA system, where people take care of themselves. You have to decide yourself about smoking, drinking, etc., but also about the care you need."
- "Such a robot in your home is great! It gives a good feeling."
- "Who is the target group? Now it looks like it is for general older people that forget some things, but what about people that really need care, and that cannot go to a care centre, because it is full?"
- "What about the costs? And it has to be set up to my preferences. And the house should be adjusted I think."
- "For me, I would not need this."
- "Yes, the basic functions are there. This robot does not have to play a movie, or turn on the TV. We have a remote for that. It is a very useful device, but you really have to see it as an addition to normal care."
- "I think you have to adjust a lot in your home for this."
- "I think the project is in a very early stage, isn't it?"
- "I think many of this is possible with an iPad?"

- "I still ask myself whether we need a robot for this. Can't this be done in another way, with screens and home automation. I think that if you get used to the fact that your house speaks, in a way your house is the robot. But on the other hand, I think that such a thing, or a smaller version, could be useful, yes."
- "You should make the design a bit more thinner / slimmer. And for me, it does not need this resemblance with a puppet. If should be functional, but in a nice shape. Right now, it has the effect of a cheap scooter."
- "Do you need two robots? Because it cannot climb the stairs? It should be able to function upstairs."

Do you have any other ideas?

- "Falling is most important. Where my mother (92) lives, they have 2 carers on 110 older people. There are cases of people that were laying on the floor for hours. Would it be possible that a robot serves a whole corridor, visiting and guarding multiple apartments?"
- "People are very afraid of falling. So if after a couple of minutes of no movement, the robot comes and is able to call for help, that is a very good story."
- "Say you do not feel well, dizzy. Then it should ask you what to do. Or if you think you blood pressure is too high, or you heartbeat. And medicines; did you take your medicines?"
- "What about an alarm clock to wake up, and a tick-tack sound to fall asleep."
- "You look a bit sad. Should I play a nice song for you? Or sounds of nature."
- "If you did not drink the whole day, in the evening it will call your daughter. Many people throw their diner in the toilet. And every day you have to call at least one person."
- "Help the partners / informal carers: the robot should have some kind of program, so the partner can easily go out for an hour, with a simple option for the user to call the partner, when something is wrong. Assurance and security."
- "It should remind me of my favourite TV programs."
- "It could also warn when you call a person that you have already called several times today."
- "Please add the functionalities of a smartphone or tablet, like quickly looking something up on the internet, or quickly checking the weather info."

Observations

- Speech recognition hardly works for all users. Very bad, especially because this is what people really like.
- Sometimes, the message of Kompaï in the top does not disappear, when the user does something else in the main menu/screen.
- It is not clear to people when the robot is listening to them or when it is not.
- Colour of robot's ears is not clear (red/green) to users. Some users ask "how do I see whether it is listening or feeling?" (when to use speech or touch).

- Sometimes, there is not text on certain buttons. (bug)
- Sometimes, at random, the robot says “Sorry, I cannot update the weather now”, but there is no weather function in the robot. This did cause confusion.
- User responds to question by the robot, but it does not respond; his ears are red, because it just moved to the user. Bad design!
- Up and down arrow in main menu not clear. User thinks they are for scrolling.
- The purpose or function “Help” button is not clear; some people think it is an emergency button to receive (emergency) care.
- The ‘help’ button and volume slider are too close together.
- In main menu: text under the icons should be clickable as well. User clicks on text, not on the icon in main menu.
- Games are still in English.
- During one session, it said “Here is the video of the front door”, so speech is sensitive sometimes. Should be thought about how to handle or solve this. About this specific message; it is not necessary to be able to see the video when there is no visitor.

8.4.2 General – secondary users

Status

- Only a few secondary user interfaces are implemented.
- There is not one secondary interface, but functionalities are spread over two totally different applications, even with some overlap. (Robosoft application, Systema website)
- Both applications are not functional. We cannot set an actual encouragement that will be shown to the primary user.

User comments

- “Reminders should be personalized. The way of addressing, whether to use expressions like ‘delicious’, ‘nice’, ‘tasty’, etcetera, because this could also lead to irritations. Pictures do much more than words, but they have to be very clear.”
- “A person that has this system, wants to be helped.”
- “Name of the user; different for when the robot is ‘happy’ or ‘angry’ – that is how people talk, when they are angry, they address you by another name, ‘my dear…’ versus ‘Peter!’.”
- “Ask design students to come up with say 5 versions, small, big, other colours, so people can choose.”
- “I think you should not be surprised that after using it for a year, there will grow some kind of relationship. The sound of the wheels, the voice, the movements. It is really inviting, I would not change anything about it.”

About introducing such a system

- "Family will say; we are concerned about you, but you want to stay in this home, which is possible, but then we will have to use a couple of things like this."
- "At the start of getting such a robot service, I think you should have a big form, to be filled out by the informal carer / family / home carer / helper, possibly with the client present, to gather lots of information, names, favourites, etc."
- "Setting up the robot: not by the home carers, but let them write everything down in the care plan, so a technical person (or an informal carer) can set the system up. Or a neighbourhood nurse, or home care coordinator, or service person. Talk to the municipality, they have to pay (through the WMO – social support act)."
- "Train the user, show how to do it, let them do it, no problem!"

About dissemination of our project / system

- "This is extremely good. Everyone should know about this."
- "People have the idea that this will replace people, but it is the way how you bring it, that makes people enthusiastic and good-natured about what is possible nowadays."
- "Let people see, feel and smell what it is, what kind of sounds it makes, what it does. Show it in open days, exhibitions, conferences, shop windows of home care shops, waiting rooms of general practitioners, gyms, etc. Involve the people. The whole country should think along. Educate the Netherlands!"

8.4.3 Main Issues

8.4.3.1 Navigation

Status

- Good

User comments

- "It is a bit wobbly, not so fluent." (almost all users)
- "All the doorsteps have to be removed. And what about carpets?"
- "Why do I have to click twice to send it somewhere?"
- "Maybe add a light on its head when it is moving."
- "How can I call it over here? Do I have a remote? Or should I call?"
- "Does it listen to 'stop'? This is important."

What do you think about being able to send it to locations in your home

- "Good that it can go everywhere."
- "Okay, not weird"
- "Ideal, but what is it supposed to do there?"
- "What will it do when I fall down here?"
- "Depends what it can do at the different locations"

What about the speed?

- "The speed is okay, nice and slow." (3 users)
- "For me, it is too slow, should drive faster."

Should the robot be allowed to go everywhere in your home?

- "Why not!"
- "It should go everywhere, but can it open the door of the toilet?"
- "It is a choice between functions and privacy. Yes it is my companion, so it should be able to help me anywhere."
- "It should go to all places that I go. Especially bedroom and bathroom, that is where I could fall. But can I call it then? Or how does it find me?"
- "For me, it is allowed to go everywhere."

Observations

- Users do not understand that they have to click twice to send the robot somewhere.
- Sometimes when moving to the user, the stop button does not disappear.
- In one session, the robot said "I am about to drive" but did not move. Even after restarting, and re-localizing. (bug)
- In another session, it said "Sorry I cannot go there" three times after another. And then it said "I am about to drive" three times, without actually driving.
- The map has no added value, locations are not visible, map is not understood.

8.4.3.2 Video communication

Status

- Good

User comments

- "Why don't you use an icon of an old phone?" (in main menu)
- "There is no ringtone!"
- "Nice toy."
- When accepting the call: "But you were calling me, didn't you? So why does it ask 'who do you want to call?'" (in the top balloon)

What do you think about the robot letting you make and receive video calls with other people?

- "Ideal!"
- "Interesting function, but people have to be able to understand this."
- "The quality is good enough for me."
- "I think that the robot should always answer the call with a message 'I am looking for the person', because otherwise, it will take too long, so the system will disconnect. If you do not want to answer the call, the robot should say 'I cannot find him/her' and go to the voicemail."

- "This can break the loneliness of people with physical disabilities. Would be a great convenience."

Who would you call?

- "Family, carers, volunteers, friends."
- "My children, grandchildren, brothers, sisters, many people, but I am not sure I want to call all of them by then, when I am in need of care."
- "My wife, 911, carers, family, friends."
- "Standard contacts, family, friends."
- "My children, grandchildren, important social contact, from clubs for instance, and also neighbours. It is important that you can call the neighbours directly. On my bedside table, I always have a list with numbers I can call. And to an alarm number. I am afraid for a break-in. So clicking an icon on the robot is much faster than typing in a number."

Observations

- Calling buttons (button on a button) are not understood. Clicking twice on the person to make a call is not clear and weird. Unfamiliar. (all users)
- Different icons for home/mobile/video are unneeded. The system should find out where to reach the callee. So just one picture with the face is enough (remove the home, mobile icons).
- Greyed out buttons not clear.
- Use other icons for volume and mute.
- On an incoming call, when touching / saying "do not answer", there is no feedback at all, it immediately goes back to the main menu. Confusing, users expect something.
- In one session, during a video call, the robot said "Who do you want to call?" and "Yoann is not available now". Speech recognition should be off during a call.
- User tries to enlarge his own video image, while in the call.
- The help button does not do anything, while calling.
- Users try to increase the volume of the voice connection, in vain.
- Text in the balloon is not context dependent, does not show proper text when using this function.

8.4.3.3 Front door / Home control

Status

- Good

User comments

- "Huh? It is the other way around, isn't it?" (when controlling the lights)
- "Oh, now I get it. It is exactly the other way around as my smartphone."
- "What does this mean?" (icon for curtains)

- "It is like a miracle! But it took a while, haha." (after turning on the lights by voice)
- "He is not listening very well."
- "Can I also talk to the person or do I only see him/her?"
- "I would like to see the person just a bit longer, then I know if he/she is really coming in and if more people follow". (this is important for people because of security reasons and for context awareness).

What do you think about this function, seeing who is there and opening the door?

- "I would like to have a confirmation after opening the door."
- "I would like to see who is coming in. The image disappears too fast."
- "The video should be shown a little longer, so you know that only your visitor comes in, no more people."
- "Would be good to see how many people come in, so the video should not disappear immediately. Also, I should be able to make alarm. And if I do, it should record the video of the visitor. This would be an added value."
- "I cannot hear who it is, or what he is coming for."
- "Speech would be useful."
- "Nice"
- "A big plus"
- "Can this be done by speech? Directly from the main menu? I think that everything should be done by speech. For touch, you have to bend over to the screen every time."
- "Nice – it does not have to be complex."
- "I would like to have this right now. At the moment, I never open the door in the evening, because I do not know who it is. I want to see who it is first, and when I know them, I do not have to talk to them, I can let them in. If I do not know them, I do not open. During the day, I would like to talk maybe, but only to strangers, others I let in right away."
- "can I also have an "open the door button" on the menu? Not only when there is someone who rang the doorbell first"

What do you think about using the robot to control your home?

- "Handy, but this way, I will not get out of my chair anymore. What I miss here is an option to say 'I am going to bed, turn everything off'."
- "The problem is that there still is not enough attention for home automation when building new homes."
- "Why would you need a robot for this?"
- "Depending on the needs, this is useful, but if you are in need for this, I think you have to move to a sheltered home anyway."
- "Overall, it should be much simpler, the icons."

What kind of things would you like to control in your home?

- "Opening heavy doors. People have to be able to move around, as they live alone."
- "Heavy doors, turning doors."

- "Heating, TV, radio."
- "My fireplace has a valve, that would be nice to control haha."

What do you think about technologies to control your home?

- "This is nice, but it demands for quite some adaptations of your home"
- "What I would like to see is when I turn on the alarm, it checks that all doors are closed and locked. Because if not, the alarm goes off. This is extremely important. A friend always leaves is back door and kitchen window open, and he just got burgled. Older people need to get more aware of security issues."

Observations

- User likes to be able to speak to visitor.
- Users expect feedback when opening the door.
- User want to see the visitor(s) coming in, so the video should be shown a bit longer.
- When switching lights and curtains, the buttons are not clear. What does on/off and red/green mean; the current state, or the action of the button? (almost all users)
- Active/inactive buttons are hard to distinguish (in home control menu). Inactive buttons should not be there at all.
- Back button is not clear, one user pushes the light bulb (which is not a button)
- Difference between icons and buttons is totally unclear.
- Some users speak and use touch at the same time. (no problem)
- Text in the balloon is not context dependent, does not show proper text when using this function.

8.4.3.4 Eating

Status

- Secondary user interface is not functional, so all triggers are activated by the wizard.
- Three eating reminders are shown:
    - Hello <user name>, are you hungry? Would you like to eat something?
    - If I am correct, you have not eaten for a while. Would you like a nice vegetable soup?
    - A nice vegetable soup is good for your blood pressure. Do you want to have some?

User comments

- "So who will bring me this soup?"
- "Oh, now it is gone." (user expects more) "If yes, the robot should do an offer, or tell me where to go at least."
- "Okay, but how do I get this soup? A carer should have prepared this. In other words; you still need help. In any case, the robot should take the initiative to prepare or warm up a meal."

- "The buttons should have the same colour, not red and green."
- "'Yes, I am hungry' would be the right answer, but I have to say 'good idea'. The questions and answers should be logically linked together."
- "Is there some kind of link to an informal carer with a diary/log?"

What do you think about the robot giving you reminders and suggestions to eat?

- "Yes, this function is very welcome. This is why you would get such a system."
- "Very good."
- "I sometimes forget to eat around lunch. Then, a reminder is enough. But this very much depends on the cognitive state of the person."
- "Yes, very useful, this big stick will motivate people, especially for nutrition."
- "For the answers, use yes and no, instead of these 4 options. And green and red is bad, this points at good and bad, like a pointing finger. What sounds good is 'I think you have…', this creates a bond, as if the robot cares about me. Keep the questions short."
- "If I say yes; then what happens… If I say no; it should ask why not. Or does it come back after 15 minutes?"
- "People recognize by intonation whether something is said in a accusing or in a worried manner. The robot misses this."

Which version would you prefer?

- "Third option is the best." (pointing at benefits for your health)
- "The third version, in which it gives a specific hint."
- "The first that just says 'I noticed you have not eaten much' because the extra suggestions have not so much influence."
- "It shows me a picture, but I have to prepare it myself. So the picture doesn't make sense. This really has to be adapted to every individual."
- "The robot should also point at the consequences of not eating enough. So the third option, with argumentation."

What would work for you in order to motivate you?

- "It would be nice if it would keep track of what I had in the last couple of days, do I do not eat the same every day. Variation is important."
- "Instead of an image, a video, would that be possible? Like a steaming cup of soup. Or with smell. And sound! Ticking spoons for instance. Background noise from a restaurant."

What do you think about being observed by a camera to detect eating?

- "I think you cannot do anything about it, you have to live with it."

Observations

- "Good idea" (user repeats 4 times, does not work, no feedback). After 4th time, robot answers "sorry, can you repeat that please?" (very bad)

- Users expect the robot to bring the food, or at least some guidance, after answering the encouragement. It does not do anything. User expects more feedback and guidance; where to get the food, how to prepare, etc.

8.4.3.5 Exercising

Status

- There are two different implementations of encouragements for exercising, and there is the button in the main menu.

User comments

- "That black text should be white."
- "Why black text? Hard to read!"
- "Oh, now I have to go on reading." (user not happy, because exercises are not spoken out)
- "First it says 'Find an exercise you like', which is good, it activates you, but then it stops talking, no guidance what so ever."
- "Is there something behind this?" (user clicks on 'cycling' image in activities)
- About the activities: "I am not sure whether people that need this will go cycling. I am not sure this is the best method to support people outside. For inside the home, this is great, combine it with some animation, and adjusted to the person."
- "Yes, cycling, that is what we like to do."
- "Use another icon for activities. Nobody is going to hockey/golf. The other icon (for exercising) is good."

What do you think about the robot giving you reminders and suggestions to exercise?

- "Very good for people. Move, move, move."
- "Good for fitness, and for health in general."
- "It should have much more output, guidance, etc."
- "Yes, great"
- "Yes, I like it. Good job."
- "For exercises, this robot is ideal, a screen that comes to your chair, where you can do the exercises."
- "Are these exercises defined by a physiotherapist?"
- "Just 'yes' instead of 'yes please'. I do not like to do it, but I have to. Leave out the subjective things."

What do you think about the robot knowing how active you are, and acting as a coach?

- "This is very important, 'living is moving', I like to be active"
- "Very nice!"
- "Does it know that I had a walk outside?"
- "Does it see whether I do the exercise or not?"

What do you think about the exercises and how they are shown?

- "Yes, it is very clear what to do. An animation could be nice too yes. Perfect."
- "Use an analogue clock! Not a digital one. Start/stop: this running clock makes me very nervous!"
- "The picture could also be an animation. A picture does not say very much."
- "Combination of picture and text is okay, but image alone should be enough, or an animation."

What would work for you in order to motivate you?

- "Positive messages are most useful, but sometimes negative is okay."
- "It should suggest lots of walking, going around, not too much on a same square meter."
- "Tell a story around the exercise."
- "Put some music on in the background. And make it a challenging."
- "You should add nice music. That will motivate and stimulate people!"

What do you think about wearing special clothes? And a small monitor?

- "No problem."
- "Only when it has a purpose. What about incontinence?"
- "It is almost a must."
- "Yes, I would like that. But I think it should go even further. With a log for yourself and others. Blood pressure and other measurements in the morning, etc. The robot could help here, so people do not have to go to the doctor for this."
- "I like the odometer on my bike, it is very useful and motivating. If I go slower than 12 km/h, we have to go faster. Is that the same with smart clothes?"
- "Put GPS in the clothes."

What do you think about measuring your heartbeat, temperature, respiration and blood pressure?

- "Very good I think."
- "When it has a purpose!"

What if other people could see these data?

- "I do not mind very much. It is the care centre's job to take care of me, so they have to do it."

Observations

- People do not understand the start or stop button.
- Texts explaining the exercise should be lager and in white (like the text at the top).
- Exercises should be spoken out.
- When the reminder comes (in the top balloon) the user pushes the exercises button in the main menu (more than half of the users). This also implies that the user did not see

the top message, but only responded to the spoken message of the robot, not the on-screen message.

- User expects much more; when I go for a walk, it should monitor this, and when I come back, I want some feedback like 'well done' and 'let's go on tomorrow'.
- Feedback 'hope you liked it', user responds with 'yes!' but the robot does not respond.
- User wants more coaching, like "You have done enough now."
- When scrolling through the activities (cycling, walking, swimming) there is not speech output at all. That does not create a nice experience. It has to tell something. It stays very silent.
- Maybe integrate with existing exercise programs people already use (in the Netherlands, for example, quite some people are watching "TV MAX, Nederland beweegt" every morning and the do the exercises in their living room).

8.4.3.6 Drinking

Status

- Secondary user interface is not functional, so all triggers are activated by the wizard.
- Drinking is not fully implemented, the buttons say "I have eaten, I am not hungry, etc.". This has confused many users.
- Three drinking reminders are shown:
  - Hello <user name>, are you thirsty?
  - If I am correct, you did not drink for a while. how about some fresh orange juice?
  - Fresh orange juice has lots of vitamins C, and boosts your immune system. Do you want a glass?

User comments

- "What should I drink? Where can I get it?"
- "What about offering choice? Or making it personal."
- "Reminding about medicines is also very important."
- "Who will squeeze those? Leave out the oranges. If someone still can do it, this is a good idea, but it is quite some work."

What do you think about the robot giving you reminders and suggestions to drink?

- "I am not sure you should make a distinction between eating and drinking."
- "Yes, I clicked on the orange juice, and she said it was a good idea, haha. Drinking is very important, every morning some glasses of water."

Which version would you prefer?

- "Just a reminder, like 'you have not eaten, so do something about it' without an example like orange juice. It should not raise expectations."

- "For me, such a suggestion would not help. I do see the need for people to drink enough, but some people just do not do it because then they have to go the toilet a lot. But a reminder is good. Not in a form of 'Would you like this or that' but 'Please remember to drink'."
- "A demented/depressive person wants everything as small and simple as possible; yes/no, drinking or not, etc. No hassle. If you want to excite these people, you should add a game."

Observations

- Exercise encouragement stays visible in top balloon, while drinking encouragement is shown below.
- *See the section on eating for more comments/observations.*

8.5 Summary

8.5.1 Findings

Overall, all participants were enthusiastic about the possibilities with a robot and system like Mobiserv. Almost all people see and believe in the added value of the high-level services. But there are many issues that need real attention and improvement.

Added Value

- Yes, the high-level services are valued, but…
- … missing integration
- …missing the complete service implementation from beginning to end
- …missing autonomous behaviour of the robot

So, we have to make some end-to-end scenarios that make sense. Deploy integration with eating/drinking, smart clothes, smart home and robot in useful and realistic scenarios. And we have to put much more initiative in the system, so that people are triggered / motivated / stimulated by Kompaï, and know what to do next.

Usability

- Many issues, both in the GUI as well as in the overall interaction flow, many already found last year that were not fixed.
- Speech recognition is not good. Almost half of the spoken commands is not recognized at all and do not trigger any feedback. Of the instances that are recognized, 75% has a certainty below the threshold. So in total, only very few commands are understood well.
- Voice of Kompaï is not friendly and volume has to be adjustable (louder maximum).
- Much more dialogue needed, often people have no idea what the robot is doing, or what it wants them to do.

Concluding, we have nice functions, we can give a very nice demo, but now we have to integrate and make it really work, without the use of a wizard!

This is not a demo anymore, we have to move beyond this state. Carers really have to work with this, and people have to live with it. So adding/updating/settings should be top priority, together with highly improving the usability.

We have to think about more intelligence, more support for the older person, more functions, autonomous behaviour, much more conversation, and getting it up-and-running without the need for any support while using it.

8.5.2 Status of system & holes

The system is not autonomous at all. It does not move by itself, it does not locate the user when it has a message, it does not turn towards the user, etc. Many things that we cannot have in coming tests.
The informal carer's / settings interface is the MAIN point for coming trials! Informal carer is key! They know the older person best, so they will be the person that will configure and use the system, by setting reminders, setting preferences, etc.
Priorities and multi-tasking; no solution for this. What if two or three things happen at the same time, like an eating reminder, a visitor and an incoming call? What is more important, what is stored in the background?

- Put much more initiative in the system, this is what is appreciated. Things like games, or home control, people do on a tablet, not a robot, but the fact that the robot keeps an eye and comes to you to remind / trigger / activate / motivate you is the key selling point of Mobiserv.
- Integrate with all other parts of Mobiserv, so that end-to-end usage is possible.
- Develop a user model and a persona / character for the robot; show that Kompaï REALLY knows the person, has intelligence, and cares for this person.
- Get system ready for real usage! Imagine putting this in someone's house and leaving it for a full week. The system should be able to monitor actions and should be able to be "programmed" by a very simple interface so it can support people without the need of a controller/wizard.
- Consider and design the robot as part of care eco system, informal carer primary end user who "instructs" Kompaï and uses it as his/her right hand. The care giver needs an extensive interface to program and setup the robot's behaviour, style and moment of notification, kind of reminders, and make sure the triggers and reminders are in line with the preferences, needs and behaviours of the user.

8.5.3 Process of development

Installing, updating and support

- Trial partners UWE and SMH cannot be responsible for updating / installing software and hardware. This needs to be done by the technical / integrations partners timely before the trial starts.

- Plan installation days, on site at the trial site; technical partners prepare and install technology and systems and instruct trial partners.
- During the trials, remote support by the technical partners should be arranged.

Iterations of "test & update" need to be much more agile

- Technical partners need to work much more closely with UWE and SMH. We need to know their availability to respond to issues and they should be available every day, every week for making (small) software updates in response to our findings.
- TeamViewer and Skype as main tools for intermediate communication and updating and improvement.
- This will result in a much more agile and flexible process, leading to a much better overall Mobiserv experience, boosting the results of our project.

8.5.4 From experience with trials in CompanionAble

CompanionAble is a very similar robot project (FP7 IP 216487), for which SMH has been work package leader of the final trials. Some lessons learned:

- The autonomous behaviour and initiative that comes from the system are key selling points of robotic and smart home support environments. People could use tablets, smart phones, iPads with many applications that can potentially support them, but they do not use them. Why not? Results from trials with the robot in a smart home indicate that it is the initiative and the embodiment that a robot gives that are very powerful in motivating and supporting people. This means that:
    - The robot should give meaningful messages to people by himself and/or based on user behaviour or profile information;
    - The robot should be able to start a dialogue with the person;
    - The robot should be able to localise and navigate to the user to deliver the messages;
    - People should be able to interact and react by voice.
- We have to aim for real free usage for longer period of time (weeks). This is a big challenge!
- Fast and quick improvements can be made when trialling often en fast. Get the system ready for real usage and trial, update, trial, update, etc.
- In the final months, or preferably earlier: reserve much more time for demos and promotion of the results. This will also lead to valuable feedback from stakeholders, and might lead to follow-up projects.

9 Appendix 5 – Evaluation Point 14: Expert and user evaluation of Secondary User Interface

9.1 Expert evaluation

A brief expert review by UWE highlighted many issues with the current implementation of the secondary user interfaces, including the following issues:

- Lack of responsive design
- Poor legibility and affordance of buttons
- Help content has poor legibility
- Clock is distracting
- Spatial consistency of main menu button is lacking
- Workflow feedback through navigation menu is lacking
- Date entry form elements are not easy to use
- Error messaging does not show errors
- No confirmation that certain actions have been performed
- Impossible to setup multimedia reminders

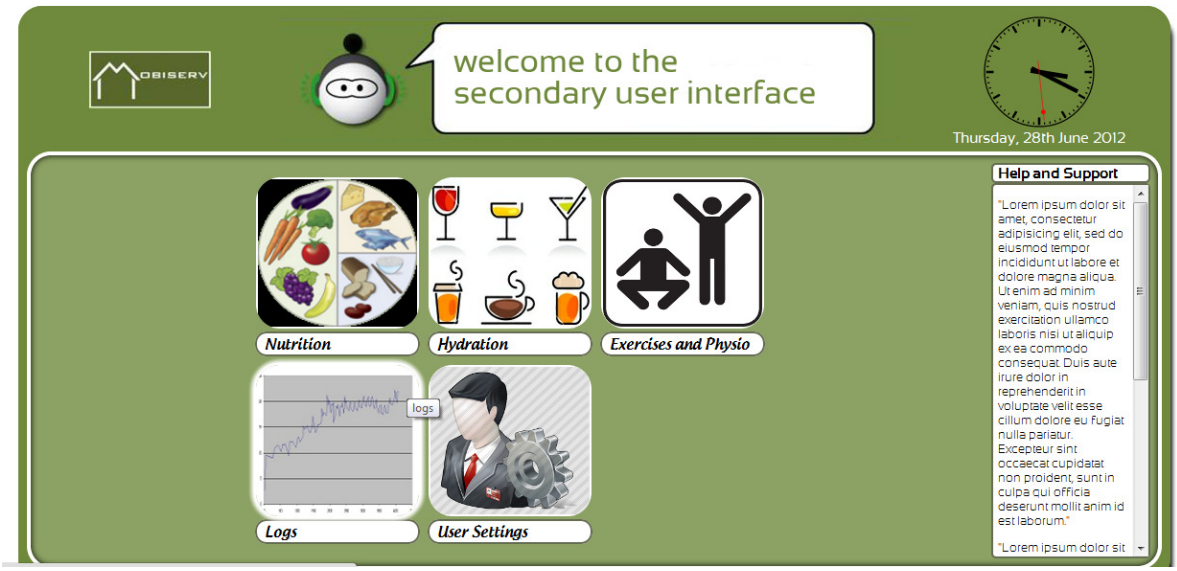

Figure 3: Secondary User Interface – main screen

9.2 Responsive design

Users are likely to access the secondary user interfaces on a variety of computers with differing screen sizes and resolutions. The layout needs to be fluid to change dynamically in relation to the size of the browser window. *Provide a responsive design that resizes elements according to the user's screen sizes.*

9.3 Buttons and labels

Figure 4: Secondary User Interface – main screen button style

Italicised text in the button label is hard to read. The text element box is not clickable. People are likely to conceptualise the button and the label as one object and consequently try and click it. *Make the label clickable and not italic.*

9.4 Help and Support bar

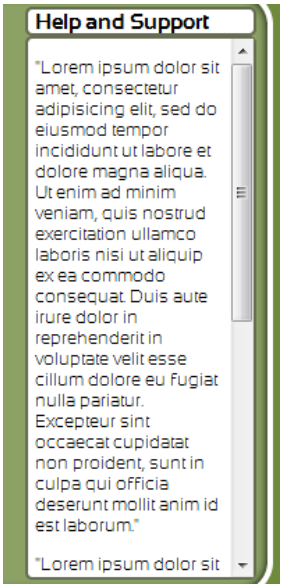

Figure 5: Secondary User Interface – Help and Support bar

The heading Help and Support appears similar to the button style used in the main screen (although not with italics). This is likely to cause people to think it is a clickable button. Additionally, the narrow column presentation of the text may inhibit readability, require considerable scrolling actions from the user and also prevent the use of appropriate typography (e.g. lists) or other types of content (e.g. pictures or video). *Remove help content to a separate screen.*

9.5 Clock

Figure 6: Secondary User Interface – Clock display

The animated second hand in the clock is a visual and cognitive distraction from the likely tasks the user will be expected to undertake. *Remove the second hand.*

9.6 Spatial consistency

In the primary user interface the Mobiserv logo (on the initial screen) becomes the main menu button (on subsequent screens). This consistency, which is likely to be learnt by secondary users while observing or using the primary user interface, will be expected when using the secondary user interface screens. However, the secondary user interface does not meet this expectation. *Retain the main menu button position on the left hand-side of the screen.*

Figure 7: Secondary User Interface – main screen (left) and example of other screen (right)

9.7 Navigation menu design

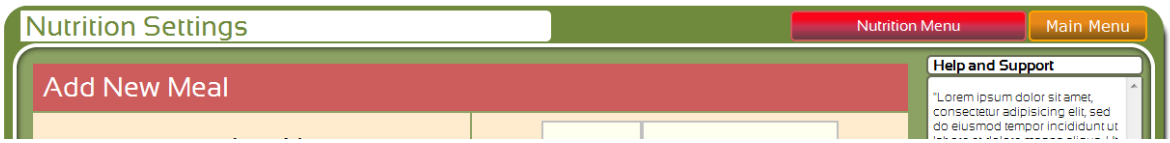

Figure 8: Secondary User Interface – Relation between nutrition section and main screen

The screen does not employ a clear navigation – instead the hierarchy of main menu and nutrition menu are displayed right-to-left, not according to cultural norms of left-to-right reading. This is likely to make it hard for people to learn where they are in the system. *Remove the nutrition menu button and enforce the workflow process; do this lightly with an additional cancel button beside the Add button.*

9.8 Date entry form elements

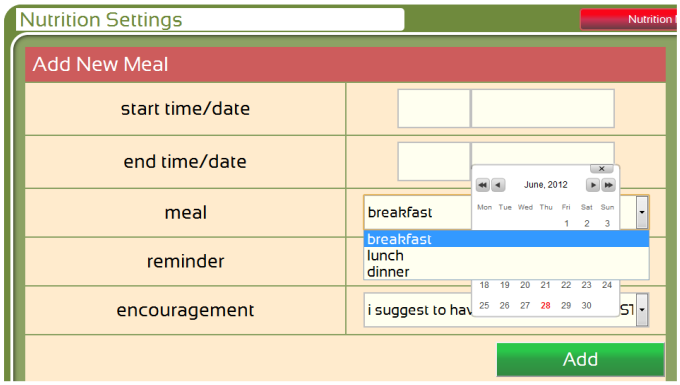

Figure 9: Secondary User Interface – time and date form elements on Add New Meal

The time/date entry form elements are not optimal: while times can be different, dates should not be presented, only days of the week. These are specified in the recurrence 'box' in this wireframe from D2.3 vol. III (figure 23, p59).

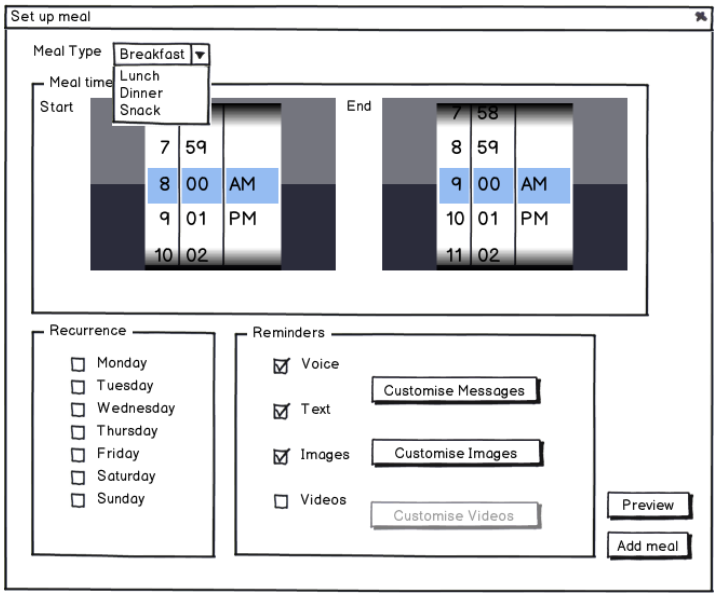

Figure 10: Secondary User Interface – original wireframe design for setting up meal.

Also, these elements do not display any affordance that they contain selectable items (e.g. that they are drop-down menus) and instead appear to be free text input fields. Users are likely to try and type text into them. Finally, the drop-down elements do not appear or disappear correctly.

9.9 Editing meals

It is not possible to edit existing meals in the "Available Meals" Option.

9.10 Error messaging

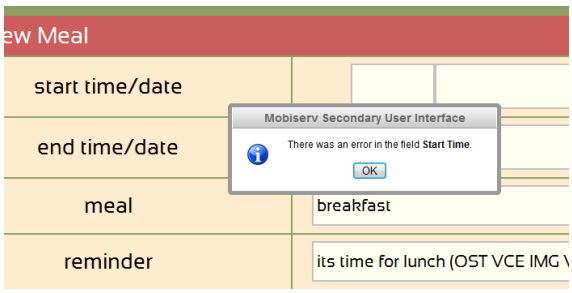

Figure 11: Secondary User Interface – error message model dialogue window

The user-error messages are displayed in an additional dialogue window requiring users to remember the field where a mistake was made. Users are unreliable at memorising multiple errors and can get trapped in a cycle of being unable to remember all their errors, and ultimately become unable to proceed.

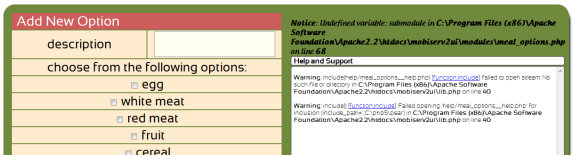

Figure 12: Secondary User Interface – error message handled in screen

Elsewhere, server-error messages are not handled elegantly or meaningfully at the user interface. *These should display an understandable message for secondary users (i.e. "Oops, something has gone wrong. We will take a look at it")*

9.11 Action confirmation

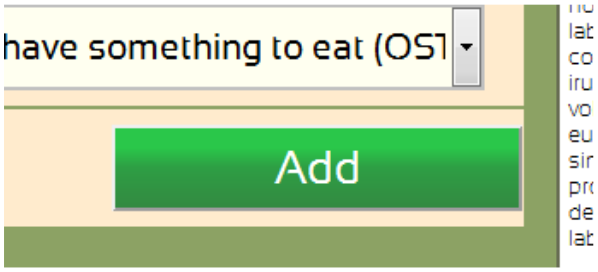

Figure 13: Secondary User Interface – Add new meal action (does not get confirmed)

There is no confirmation when a meal has been added. The screen returns to the meal input screen. This is likely to lead the erroneous assumption that the meal was not added (when it was) and could lead to a user to repeat their action, resulting in adding a meal twice. *On selecting the Add a meal button, display the available meals screen (showing the recently added item!)* This interaction problem is repeated in the adding exercises workflow.

9.12 Meal settings

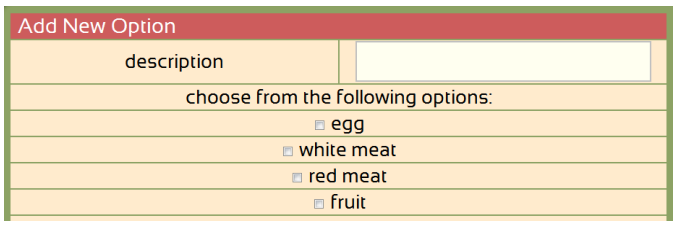

Figure 14: Secondary User Interface – Add New Meal Option form

After selecting Add New Meal Option, there is a series of food options which are highly restrictive. Secondary users may wonder how they add in different options. The form title ('Add New Option') is also very vague and this is likely to make the system harder for users to learn initially and also use irregularly. *Provide more recognisable and concrete terms to describe the workflow stages.*

9.13 Working with media assets

With 'Add New Exercise' and 'Add new message' the user should not need to type in a path. This is likely to lead to input errors. *Provide a 'select file' button.*

9.14 Reminders

It is not possible to set up a range of different media for reminders. There should be different modes of reminders and encouragement available for the user to select/browse/choose. *These are specified in the reminders 'box' in this wireframe from D2.3 vol. III (figure 23, p59).*

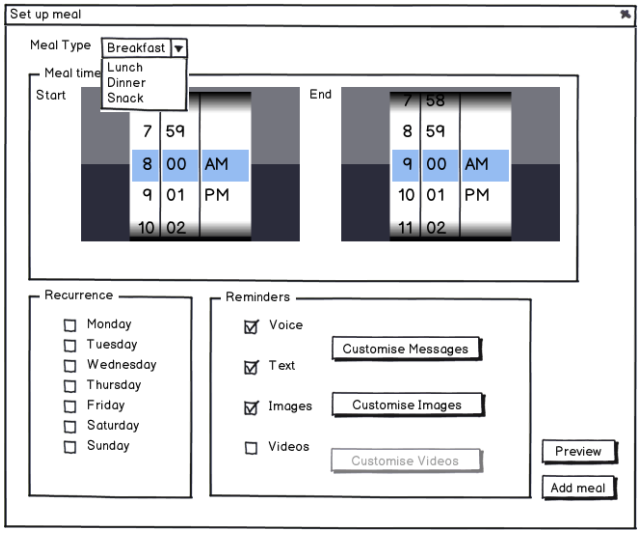

Figure 15: Secondary User Interface – original wireframe design for set up meal.

9.15 Updating

The message says the details have been updated – but they have not. This is possibly a bug?

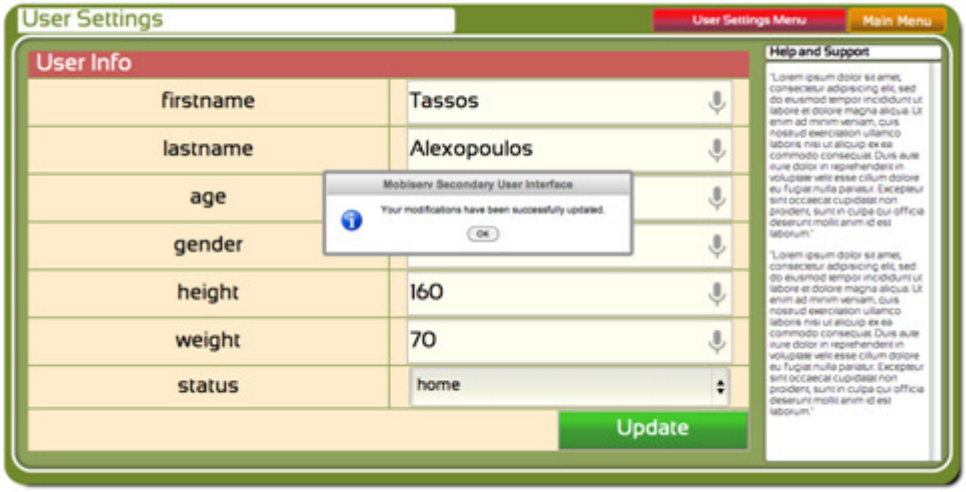

Figure 16: Secondary User Interface – user info bug

9.16 User evaluation

Summary
Two carers took part in a usability test in the UK and tried to complete four short tasks in 20 minutes using the Mobiserv secondary user interface prototype.

Setting up eating reminders and exercise schedules proved quite time-consuming, confusing and were completed satisfactorily due mainly to unsupportive workflow design and feedback. In short, the carers found it hard to know what to do throughout the processes, and when, or if they had done it successfully.

There were some issues with the logs, and room for improvement, but this test involved unrealistic data which may have detracted from the user experience.

Overall, Carer B reported the secondary user interfaces to be “convenient” but that she needed to trust that what it is telling me is true: namely, that the eating, drinking and exercise detection is reliable. Given her experience that her inputs might have been lost (though, of course, they weren’t), she reported that she was not confident with the system.

Eating and drinking reminders
This activity caused some issues for both carer A and carer B.

Carer A was unsure where to start this task, explores the available meals before returning (using the back button) to the add new meal section. She mistakenly selects a start time of 4am, then struggles to find the drop down control to correct it (which she manages). She wants to call the meal tea (not lunch or dinner) and does not realise this must be set elsewhere in the system.

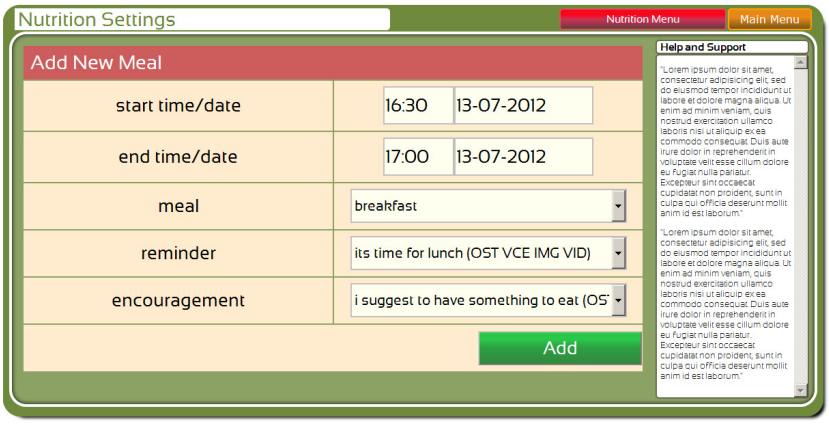

Figure 17: Secondary User Interface – Add New Meal

When asked to select a reminder, she does not understand the terminology of (OST VCE IMG VID). On adding a new meal, she gets returned to a blank form and panics, using the back button again to try and find the information she just entered, checking the available meals and nutrition settings.

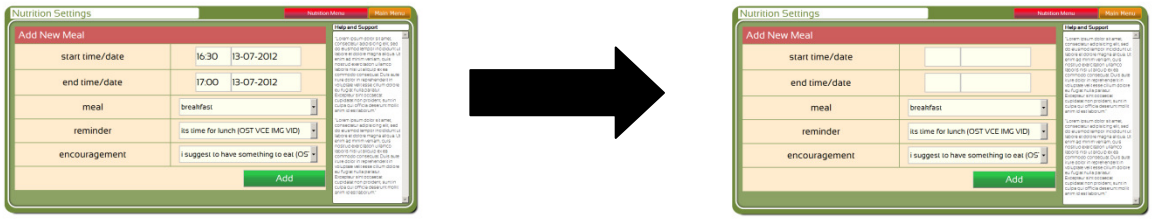

Figure 18: Secondary User Interface – flow from Add New Meal to Add New Meal

She then explores the add meal option (it is here that a meal type – e.g. tea – can be specified) but get very confused by the range, relevance, terminology and customisability of the options presented (e.g. red meat).

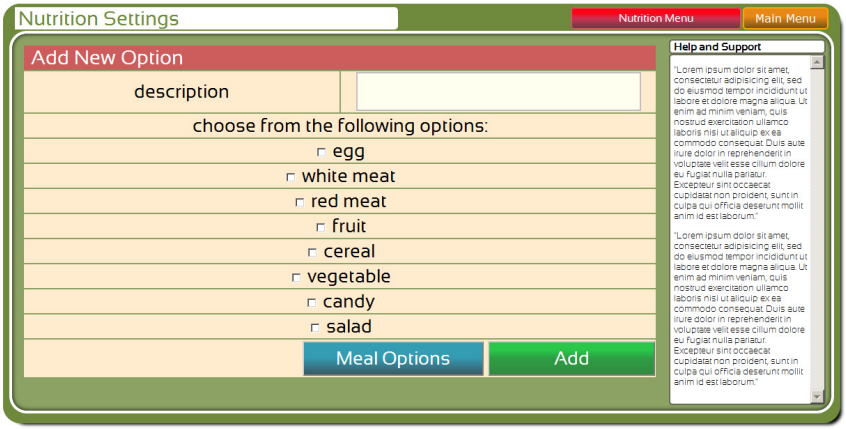

Figure 19: Secondary User Interface – Add New Option form

She begins typing into the description field, then says "I am lost". After submitting a new meal option, she encounters two errors –an undefined variable error in line 68 of

meal_option.php and error opening help and support PHP file. Neither are understood. She uses the back button a lot to recover from this situation and get back to the main menu.

Setting up an drinking reminder caused some issues for carer B. Adding a new message resulted in an error which was not understood. There were unmet needs following the action of adding a new message: the user wanted to see confirmation that the information she just typed in was properly in the system. "I haven't seen what I expected to see," she said. "I don't trust it, I am disappointed". What actually happens is a blank form is reloaded, rather than the list of messages added.

Set up exercise regime

Setting up an exercise regime was not well received. Carers A and B were both unsure where and how to begin.

Figure 20: Secondary User Interface – Exercise Settings

Carer A got successfully into the exercise area but was then unsure about the difference between activities and exercises. After a pause, she selected activities and selected add new schedule, filling out the form and submitting it quite well. On submitting the form, she was taken back to the main menu (not even back to the blank form as in the previous workflow) and this caused some consternation that the information had disappeared.

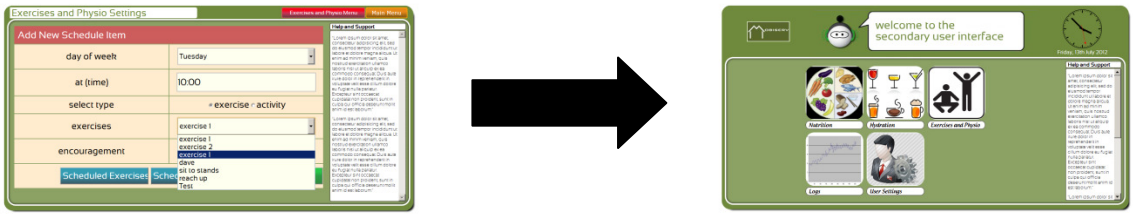

Figure 21: Secondary User Interface – Flow from Add New Schedule to Main Screen

After entering the exercise and physio section, carer B was unsure to choose exercises or schedule. After exploring both sections, she selected exercises and went to add a new exercise. The add new exercise form screen caused several errors. Duration was typed in as '2 minutes' causing an error, subsequently corrected to 2. The carer also typed in a lot of information describing the exercise. The path to image and path to video were ignored but the carer stated an expectation that she could browse to the specific file she wanted to be used.

As with the drinking reminder, there were unmet needs following the action of adding a new exercise: the user wanted to see confirmation that the information she just typed in was properly in the system. What actually happens is a blank form is reloaded, rather than the list of available exercises added. When the user realised this, she navigated to the available exercises section and reported she wanted to "put them on a schedule". She navigated back to the exercises menu and selected schedule, add new schedule.

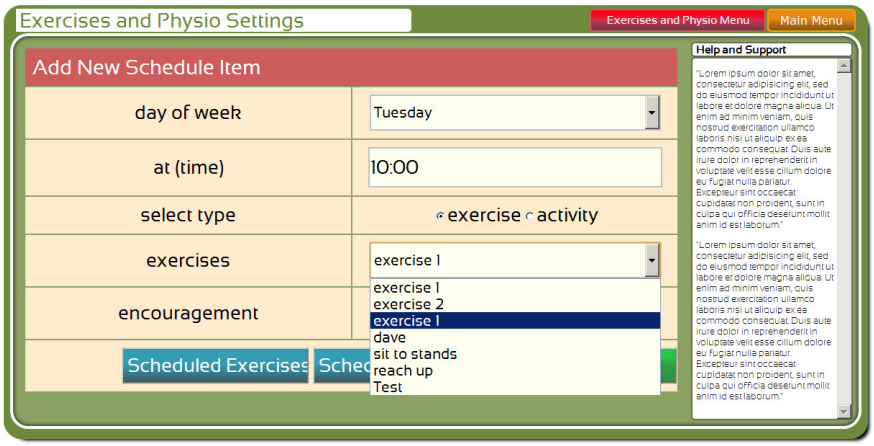

Figure 22: Secondary User Interface – Add New Schedule form

When presented with the form for adding a new schedule, she was confused by not immediately seeing the exercise she just added. "I was expecting to find my exercise," she said. After beginning the form, she found it in the fourth form item, in the drop-down list. While doing this form, she reported that she wanted the regime to be daily (i.e. to select all days, not just a single day). Again, after submitting a schedule, there is no confirmation that the action has been received correctly or the status of the schedule.

One enhancement carer B suggested was a preview feature – which enables the carer to see exactly what the older people would see when the reminders or messages get issued.

Nutrition log

Finding the eating log was successfully completed by carers A and B.

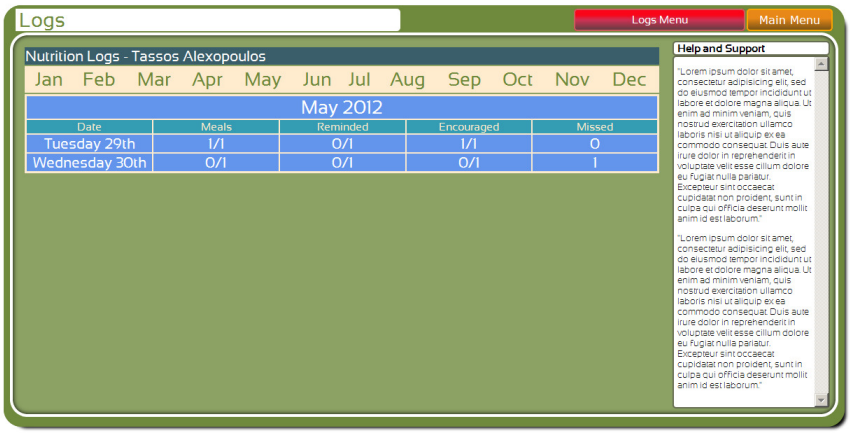

Figure 23: Secondary User Interface – Nutrition Log May 2012

The carer A reported she understood it quite well. Carer B said she was confused by the difference between a reminder and an encouragement. Also the 0/1 representation was unclear.

However, carer A said that it would be more effective to see all the logs for one older people across a single day within one screen. For example, to see relationships between different activities (exercises and eating).

Exercise log

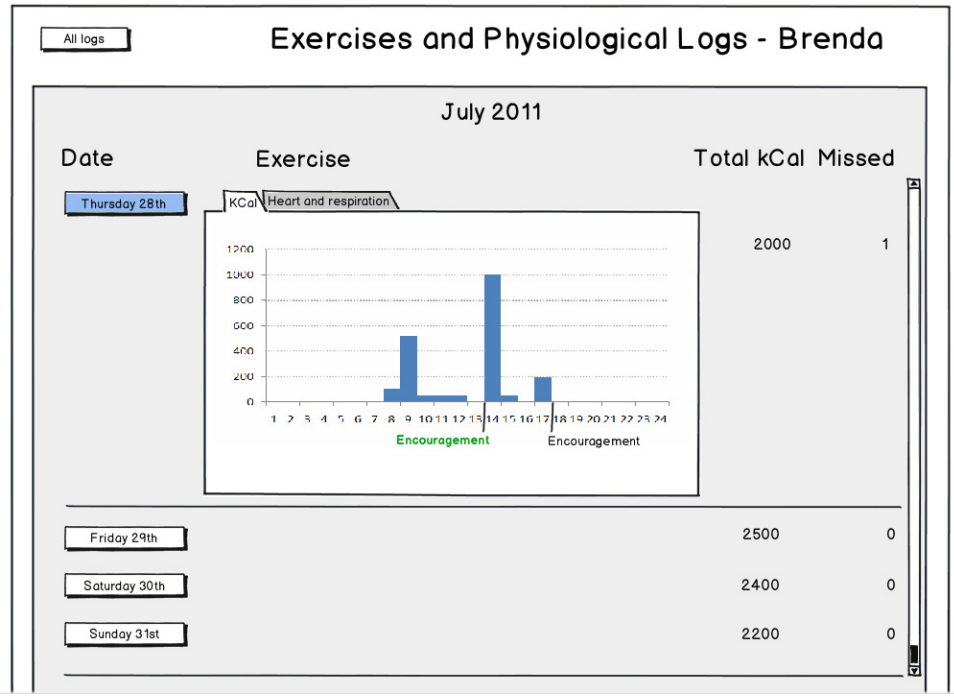

Figure 24: Secondary User Interface – original wireframe for Exercise Logs

Carer A liked this as it visually showed four things:

- Unprompted exercises
- Prompted exercises
- Prompts which worked
- Prompts which did not work

Carer B did not have time to look at this area.

10 Appendix 6 – Issues summary

10.1 Problems & recommendations based on 2011 findings

The following sections contain issues that were found in previous evaluations, but have not been solved. Many have been solved, but these have not. This list covers 9 evaluation studies, performed between June 2010 and November 2011.

10.1.1 Overall: Integrated system

#	Problem
1	The voice should be adjustable. More friendly, not so dull. Improve robot's voice.
2	You have to be close by to talk. Many older people speak very quietly. Voice recognition often does not work. Improve speech recognition.
3	The robot does not go to the person. You should be able to say "please come over here" when you are in the kitchen.
4	The robot does not know where the user is in the home.
5	The robot does not face the user correctly when standing in front of the user.
6	The dialogue needs to be improved and extended dramatically. Improve turn taking.
7	For a person that starts to be forgetful, the robot should come to the person, and remind him of certain things. The initiative should be with the robot. Create really autonomous system with many initiatives.
8	Reminders for medication should be possible.
9	Add an agenda, appointments and multiple reminders (1 day before + in the morning + 1 hour before).
10	Make it possible to add reminders for things to do (unscheduled).
11	Giving instructions on ADL activities (how to cook, turn on the lights, brush your teeth, call someone…).
12	The GUI should be very simple and clean. Current GUI is too crowded and unclear. Get rid of all distracting non-functional elements, and do not use small buttons. Make sure it is clear what is a button and what is not.
13	People did not seem to understand the environment mapping image. This has no function, so it could be removed completely.
14	Introduce a consistent visual style for all buttons.
15	Improve how the PRU displays its listening/non-listening status.
16	Improve visual display of speech output
17	Introduce a consistent style for visual imagery

10.1.2 Overall: secondary user interface

#	Problem
18	It should store the user's data and have pattern recognition for care professional. This could give a safe feeling. Carers or doctors should be able to see the data it collects.
19	It should store and show whether people have eaten / had a drink or not, so the professional can have a look at the results and possibly suggest adjustments.
20	Improve the display and controls for privacy settings.

10.1.3 Hardware: Robot (PRU)

#	Problem
21	People have very little space (both at home as in care homes), so the height is okay, but width and depth should get smaller
22	The screen should be bigger because it is quite small now.
23	For speech recognition, you have to be in front of the robot and very close. Use an omnidirectional microphone.
24	The robot's sensors do not see thin legs of chairs and tables.

10.1.4 Hardware: Smart clothes (WHSU)

#	Problem
25	The robot should tell the older person they are not wearing the WHSU
26	Improve the ruggedness of the connection between WHSU smart garment and datalogger.

10.1.5 Function: Eating / Drinking

#	Problem
27	It should be tailored to the individual, based on preferences, preferred times, etc.
28	How much fluid is drunk is very important, not just frequency. Keep track of this, and adjust reminders accordingly.

10.1.6 Function: Exercising

#	Problem
29	If the robot would remind me of this, it could work preventive as well. Good for people that sometimes need a "kick in the pants". The robot should take the initiative. People will not go to the robot to do exercises
30	People do not need numbers, they want to know whether it is good or not.

10.1.7 Function: Video communication

#	Problem
31	Add reminders to call somebody. It would be good if he gave a suggestion to call people.

10.2 Problems & recommendations based on 2012 trials

The following sections contain issues that were found in the user evaluation of the first Mobiserv prototype. This list covers evaluation studies in the UK and in the Netherlands, performed in April, May and June 2012.

10.2.1 Overall: Integrated system

#	Problem	Recommendation	Responsible partner
50	Missing the complete implementation from beginning to end. Informal carers have to work with this, set it up, and primary users have to be able to use it on their own.	Make some useful and realistic end-to-end scenarios that make sense (deploy integration of eating/drinking, smart clothes, smart home and robot)	
51	Missing autonomous behaviour of the robot	Put much more initiative in the system, so that people are triggered / motivated / stimulated by Kompaï, get guidance, and know what to do.	ROBS
52	User does not have a feeling of an intelligent being.	Develop a user model – leading to context awareness & intelligence	ROBS
53	Interaction between user and robot does not give an affective feeling	Develop (more than one) persona / character for the robot; show that Kompaï REALLY knows the person and cares.	ROBS
54	Learnability is low	Much more dialogue is needed, often people have no idea what the robot does or wants them to do.	ROBS

55	PRU can't find or track user	User localisation needs to be implemented to make any of our functions really work.	ROBS
56	Human-robot gaze interaction	Robot does not automatically face the user. And the voice-based turn commands do not work.	ROBS
57	System responses from different functions are issued without any regard for each other and some messages get stacked up	Priorities of triggers from various functions need to be defined, taking context awareness into consideration	ROBS
58	GUI not well designed	Reminders on the Kompaï GUI are not consistent, some appear full screen, others only in the text balloon	ROBS
59	Many usability issues, both in the GUI as well as in the overall interaction flow	See recommendations on xx.	ROBS
60	It is not always possible to set text in speech bubble on the Kompaï GUI	Provide this feature	ROBS
61	Speech recognition does not work well enough	Improve the recognition	ROBS
62	Voice of Kompaï is not friendly	Provide a range of other voices	ROBS
63	Volume on Kompaï is too low	Provide better speakers	ROBS
64	Volume setting is not retained on Kompaï	Provide a global control	ROBS
65	System status (listening or not listening) is not clear	Red/green ears on the Kompaï GUI are not visible / not clear	ROBS
66	Software maintenance	Need an easy way to update or install the software	

10.2.2 Overall: Secondary user interface

#	Problem	Recommendation	Responsible partner

68	The secondary UI needs to be implemented according to the information and interaction designs	See D2.3 Vol. III for the interaction design, information flow, and wireframes Input from a graphic designer is mandatory	ST
69	No usable settings screens for secondary stakeholders. It is not easy to configure the settings and user details on the robot	We need the ability to set eating and drinking times; to set reminders including addition of different media (audio, video). See wireframes in D2.3 vol. III	ST
70	User logs should be available in a usable manner for the secondary stakeholders –	See D2.3 Vol. III for the interaction design, information flow, and wireframes	ST/ROBS
71	No integration of the secondary settings data with the application on the robot	Integrate this	ST/ROBS
72	Exercise logging / feedback to carers is not present	Integrate this	ST/CSEM
73	Exercising: need an interactive charts of historical activity data (i.e. secondary user interfaces)	Integrate this	ST / CSEM

10.2.3 Hardware: Robot (PRU)

#	Problem	Recommendation	Responsible partner
74	Speech recognition from a distance is not possible	Consider alternative technologies	ROBS

10.2.4 Hardware: Smart clothes (WHSU)

#	Problem	Recommendation	Responsible partner
76	The WHSU integration with the MOBISERV HMI does not seem to be working – The WHSU is still not integrated with Kompaï.	Integrate this	CSEM / ROBS
77	Datalogger may be uncomfortable when being	Need to develop a smaller datalogger	CSEM

	worn		
78	User may wash clothes in washing machine or do exercises which are wet, e.g swimming	Waterproofed integration of components (i.e. garment and datalogger)	CSEM / SMARTEX
79	User may not have PRU only WHSU	Feedback on garment itself that activity is suggested (e.g. haptic, visual, audio)	CSEM / SMARTEX

10.2.5 Function: Eating / Drinking

#	Problem	Recommendation	Responsible partner
80	Incomplete build	Implementation of Drinking reminders – now only eating is implemented (see responses on buttons)	ROBS
81	GUI is not well designed	GUI needs attentions: Remove the 4 options, just go for Yes and No. Remove red/green colours of buttons.	

10.2.6 Function: Exercising

#	Problem	Recommendation	Responsible partner
82	There are 2 different implementations of reminder and it is not clear why There is no link between exercises in menu and in reminders	See wireframes in D2.3 vol. III	ROBS
83	Users are missing speech output of the actual exercise. Robot says “here I have an exercise for you” and then stops. Users expect the exercise instructions and some guidance.	Needs to have more speech output (the actual exercise is not spoken)	CSEM/ROBS
84	Users not only expect more guidance from the system bus also feedback about correct	Give feedback, based on real performance, measured by the smart	CSEM/ROBS

	usage and how they are doing	garments and datalogger	
85	Feedback should be real, related to what the user does	Integrate the smart garments and extract some parameters to base feedback on	CSEM/ROBS
86	Impossible to tell datalogger is working with PRU	Feedback from the robot that datalogger is recording	
87	Impossible to tell if datalogger is working at good quality	Feedback from the robot that garment is correctly positioned (i.e. data quality)	
88	Smart clothes may not always be worn and some exercises may be done without them	There is need for an input mechanism to enable the person to add missed activities that occurred when the person was not wearing the garment (for example activities performed when not at home)	

10.2.7 Function: Video communication

#	Problem	Recommendation	Responsible partner
89	GUI not well designed	GUI needs attention: Buttons to make call are not clear and not usable (the home, video and mobile buttons > not useful, just one button as the face is enough) Buttons in call are not clear (mute camera, microphone, volume)	ROBS
90	Current system does not address OS2 effectively enough (“Support the elderly in maintaining their social activities”) This objective will be measured in relation to the	Need to have context based triggering of encouragements to communicate e.g. when it is detected that a contact is online, when they have been no visitors for a day,	ROBS

	increase in frequency of communication between end-users and their relatives and carers.	when they have not made a call.	

10.2.8 Function: Front door / Home control

#	Problem	Recommendation	Responsible partner
91	It is hard to evaluate who the visitor is without speaking to them	Provide the ability to talk to visitor	LUT / SMH
92	It is hard to ensure the visitor is able to get in	Video image should stay visible for a while after opening door	ROBS
93	It is hard to understand the 'state' of the house from the GUI	On/off and red/green buttons are not clear to users and do not show current status of the devices	SMH / ROBS
94	Speech interaction not implemented on 2nd level	Integrate this	ROBS
95	Not all devices / scenarios of the smart home are linked to the robot. Next to lights and curtains, we can add more.	More home control devices should be added, including 'scenarios' combining for instance lights, heating, curtains, and radio.	SMH / ROBS