MOBISERV – FP7248434

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

D2.4 Evaluation Plan – Issue 2

June 2013

Contributing Partners: UWE, SMH, ROBS

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v0.2	February 8, 2013	SMH	Major update and restructuring; incorporated more from D2.4 and T7.2. Removed stuff from D2.2.
v0.3	February 11, 2013	UWE	Updates to Evaluation methodology
v0.4	February 11, 2013	SMH	Tests and updates during integration workshop at Robosoft
v0.5	April 15, 2013	UWE	Evaluation plans updates
v0.6	May 30, 2013	UWE, SMH	Evaluation plans updates
v0.7	June 20, 2013	UWE, SMH	Home trial update based on assessment of functionality available
v1.0	June 22, 2013	UWE, SMH	Finalized

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1 Introduction

This document, D2.4 "Evaluation Plan – Issue 2" presents an in-depth plan for the evaluation of the complete MOBISERV system prototype. It is a full update of D2.4 "Definition of the Evaluation Framework" and including parts of D2.2 "Validation Plan – Issue 3" and of T7.2 "User and Context Modelling Specification and Redesign".

In order to ensure that all MOBISERV components are appropriate and usable for the target users for whom they are designed, it is necessary to carry out comprehensive evaluation which addresses all aspects relating to achieving the desired functionality and usability. This document presents the validation and evaluation plans, methodologies, procedures, participants, time schedules, and foreseen outcomes of the evaluations of the overall integrated MOBISERV system and its subcomponents.

Validation tests take place at the laboratories of the responsible technical partners, and all other evaluation studies will take place in Eindhoven (NL) and Bristol (UK), either in so-called 'smart home environments' or in people's own homes.

1.1 Research Questions

1. Does Mobiserv bring added value to people's lives? How & what is the added value?
    - What is the added value of the robot?
    - What is the added value of the smart home environment?
    - What is the added value of the smart garments?
    - Considering both short term and long term usage.
2. Do users feel empowered? If so, by what exactly? (robot, total system, ...)
    - Primary users
    - Secondary users
    - Secondary professional carers
3. Does regular use of a companion robot have the potential to reduce the need for / changes the role of carer assistance? In what way?
4. Which services and/or functions are most valuable / important?
    - Primary
    - Secondary informal users
    - Secondary professional carers
    - What specific needs do each of the functions meet? "What functions would you use and why?"
        - Measured by: analysis of data logs in longer term field –trials + questionnaires/interviews
5. Which other aspects of Mobiserv are most valuable / important?
    - Primary users

   - Secondary users (informal carers)
   - Secondary professional carers
6. What is the acceptability?
   - Primary users
   - Secondary users (informal) carers
   - Secondary professional users
7. What are practical issues when installing a companion robot and other parts of the Mobiserv system in someone's home? (sensors, robot, garments, camera, ...)
8. What are people's training needs?
   - What is the best introduction strategy? (note demographics)
   - What is the follow-on process for support?
9. How useful do secondary users find the logged data in supporting the user? Anything missing? Information visualisation?
   - Measured by: creating dummy data for personas and getting secondary users to monitor this over a period of time. (4 weeks)
10. Are there specific user groups that find Kompaï's functionalities particularly useful for users with diagnosis of arthritis, multiple sclerosis, motor neurone disease, dementia? Does mild cognitive impairment make it difficult for users to interact with robot ?
11. Will users with mild cognitive impairment manage to consolidate the skills needed to interact with a supportive robot? In progressive conditions will these skills decline more quickly than long-established social skills ?
12. What response will secondary carers have after having seen a demo of the system and after having "played" with Kompaï for a while, in considering appropriateness of the system features
13. After having a long-term experience with Kompaï (3 days to 1-2 week) how does the user response to Kompaï change? what happens in relation to how they interaction with it? how it is used, how adoption grows? all ins and outs will be recorded and analysed. Study should include user diaries as well to have a record of personal/subjective experience.
14. What are the risks and hazards of having Kompaï in a real home?

1.2 Approach

The main approach is as follows; after the *technical validations* by the responsible partners, and the *integration tests* by the technical partners, usability experts of the evaluation partners will perform *heuristic evaluations*. Finally, the *formative and summative evaluations* will be carried out, involving primary and secondary users.

The technical validation will be considered against quantitative key performance indicators (KPIs) in relation to basic requirements identified at the start of the project and in the main MOBISERV project objectives (see deliverables D2.2 volumes II and III).

The user evaluation studies will be considered against mostly qualitative key performance indicators in relation to functional and non-functional requirements identified at the start of the project as part of the user needs assessment (see deliverables D2.3 volumes I, II and III).

The final user evaluation studies comprise the following parts:

1. Usability Studies (of individual components and overall system)
    - Focus Groups
    - Individual Sessions
2. Field Studies (of the complete system, focussing on the overall user experience)
3. Other evaluations, including hazard analysis

The Usability Studies will use methodologies such as pluralistic walkthroughs, task analysis, thinking aloud, and surveys. The Field Studies will use methodologies such as field observations, contextual task analysis, logging actual use, interviews and surveys. For more details, we refer to the respective chapters 6, 7, and 8 in this document.

1.3 Time Schedule

Activities	Dates	Venues	Partners Involved	Users Involved	Reporting
Technical Validation Tests	August 2012 – February 2013	Technical partner laboratories	AUTH, CSEM, LUT, ROBS, SMRTX	Without users	D4.4 D5.4 D6.2
Integration Tests	February – March 2013	ROBS laboratory	ROBS, UWE, SMH	Without users	D7.3
Heuristic Evaluations	March – April 2013	SMH smart home	SMH, UWE	Without users	D2.6
Usability Testing	May 2013 – June 2013	UK test site and people's homes	UWE, ROBS	With users	D2.6
Field Trials and Other Studies	June 2013 – July 2013	Test site at NL and people's homes in NL and UK	SMH, UWE, ROBS	With users	D2.6, D2.7

1.4 Responsibilities

The technical validation studies will be performed locally by work packages (WP) leaders at their site in the laboratory. Details of the Technical Validation Tests were presented in D2.2 volume 3 (Dec 2011). It is the responsibility of the technical WP leaders to ensure that their component meets the required quality/performance level to enable reliable and accurate performance within the integrated MOBISERV system and report all results in WP specific deliverables.

Integration tests will be performed by the WP leader of WP7, ROBS. The heuristic evaluations, usability testing, and field trials will be carried out in the UK and NL by evaluations partners UWE and SMH with support of ROBS.

In working with older persons, all due ethical procedures will be followed, as described in D2.3 issue 1 and D2.4 issue 1. Ethical approval has been obtained for the evaluation studies in both countries.

Final results of the evaluation studies will be documented and reported in WP2 deliverables D2.6 and D2.7, and in WP8 deliverable D8.4 on practical implementation.

2 Mobiserv Functionalities & Usage Scenarios

2.1 Functionalities

The plan is that the final MOBISERV system prototype delivers and enables the following:

- Integrated MOBISERV scenarios for the primary and secondary user
- The (informal) carer's online interface
- Autonomy and intelligence:
  - By using a decision model with rules
  - Detecting and responding to context information and user behaviour (user model, context awareness)
- High-level functions:
  - Human-robot interaction (GUI + Speech + Embodiment)
  - Connections and interactions between these functions

These high-level functions are:

Table 1: Mobiserv High-Level Functions

Main Functions
1. Encouragement to drink – dehydration prevention (suggestion)
2. Encouragement to eat – nutrition coach (suggestion)
3. Encouragement for exercising (suggestion)
4. Video communication with friends and relatives
5. A mobile screen connected to the front door / home control
6. Reporting and communicating to health professionals
7. A tele-medicine / vital signs check platform
8. Games for social and cognitive stimulation
9. Fall detection / panic responder

In practise, the following functions are available, either from the main menu (initiated by the primary user) or hidden (initiated by the system itself, based on rules, context awareness, or external events).

Functions on the main menu: (user-initiated)

- Video communication (*high-level function #4*)
- Exercises (*high-level function #3*)
- Games (*high-level function #8*)
- Reporting to health professionals (*high-level function #6*)
- Photo album (*high-level function #8*)
- Home control
- Robot control

Hidden functions: (system-initiated)

- Encouragement to drink (*high-level function #1*)
- Encouragement to eat (*high-level function #2*)
- Encouragement to exercise (*high-level function #3*)
- Incoming call (*high-level function #4*)
- Notification of visitor at front door (*high-level function #5*)
- Vital signs monitoring (*high-level function #7*)
- Reminders for medication (*high-level function #7*)
- Fall / panic detection (*high-level function #9*)
- Emotion recognition + suggestions (*high-level function #8*)
- Social / companion suggestions
- Reminders (at a specific time, set by the secondary user)

2.2 Types of interaction by the robot

The robot finds and approaches the user when there is a message to be delivered or notification to be communicated to the user. This can be to encourage / motivate the user, to remind, to inform or to suggest something to the user, or to notify of incoming calls. We distinguish between user-behaviour based, context-based and time (scheduled)-based modes of interaction:

- **Suggestion or encouragement**: this is a mode of interaction where the initiative is from the robot, based on the context and/or behaviour of the user (e.g. suggestion to eat, to drink, to be active physically or socially).
- **Reminder**: this is a form of interaction where the initiative is from the robot, based on a predefined time (set in either a rule, or in the agenda specified by the secondary carer, e.g. a reminder to go to the hairdresser or to take medicines).

The content (of messages) for these interactions is pre-determined, defined in xml files or by the carer in the secondary user interface. The content can be text and/or images and/or video, and will be shown on the screen and "spoken" by the robot.

It is expected that the user will acknowledge the interaction/message in some way – either by verbally replying or by touching the screen.

2.3 Cross-Functional Usage Scenarios

MOBISERV has a number of main functions. To achieve a sense of companionship and continuous support, these have been interconnected to work together and realised in the form of two overall scenarios. These help to illustrate the added value of the integrated system as a whole. MOBISERV aims to support not only the aging person with a need for support, but also stimulates and enables informal caregivers to contribute to the independence of their loved one. The first scenario gives some examples of what MOBISERV can do for the person who wishes to prolong their independence in his/her own home, the primary user. The second

scenario shows the support MOBISERV can give the informal carer, the secondary user. Both cross-functional scenarios are described in the next section. These scenarios will form the basis of the field trials. The aim is to assess the high-level user experience as well as the usability and acceptance of the individual functions.

MOBISERV passively monitors how active people are at different levels / areas: on a social level, on a cognitive level, and on a physical level. MOBISERV will continuously check how a person is doing at these levels and give support accordingly. This monitoring is mainly done on the areas of:

- Physical activity during the day and night
- Eating behaviour
- Drinking behaviour
- Social behaviour

Obviously these levels are interdependent and influence each other. For example when people exercise a lot, they also need to drink a lot. When a person had a restless night, s(he) might have to slow down during the day as well and might have longer naps during the day. Therefore, a set of rules have been created to optimise MOBISERV's quality and added value (see deliverable T7.2). These rules help to ensure that the behaviour and dialogue of the robot makes sense and adds value. Therefore the two scenarios do not only show the added value of MOBISERV but also the context awareness and interconnected intelligence in the MOBISERV environment. The first scenario is written from the perspective of the primary user, while the second is seen from the eyes of the secondary user who can "program" or "tailor" MOBISERV's behaviour to their loved one.

People can initiate interactions by giving a voice command or by choosing one of the functions available in the main menu (call someone, control the house, play a game, watch pictures, etc.). However, a lot of the system's behaviour will be triggered by the user's behaviour and the context. Some examples of ideas from recent evaluations of user scenarios of this are:

- *When the user shows low movement around the house, this could signify depression leading to low eating rates, the system could initiate a carer video call.*
- *When the user is doing less and less exercises and asks robot to do actions that they normally do themselves, such as close curtains, the system says "maybe it might be a good idea if you do it yourself" (if it is certain that the user should be capable of this and usually does this themselves) or asks " are you not feeling well today? Would you like to talk to 'your carer'?"*
- *When the user gets no calls and no visitors and/or talks to robot less and less, the system could suggest a call to someone, or something else on his/her preference list (indicated in the user model).*

To show the system's possibilities, the next section describes the two scenarios.

2.3.1 Scenario A: Primary user

Aalbert had a great evening at the party of his brother. There was a lot of food and drinks and many friends joined them to celebrate this special day. When going to bed, he puts on his smart pyjama. Since he drank quite a lot last evening, he has to get up twice during the night to go to the toilet, and also all the conversations and talks are still in his mind during the night, which hinder him from falling asleep quickly. The garments assess his energy expenditure, heart rate, and confirm that he has a restless night. In the morning, Aalbert wakes up a bit later than normally. MOBISERV knows he had a tough night and that his body can use some proper care and attention this day. This means healthy food, a lot of drinks and some fresh air seem like a suitable recommendation. When Aalbert gets up, he takes a shower and reads the newspaper during breakfast. After finishing, the robot approaches him and suggests to him that he might like to get some fresh air outside since the weather is perfect for a late morning walk in the park.

On his return, the robot proposes a cup of tea, which Aalbert appreciates. After a couple of hours, Aalbert gets hungry again and prepares some lunch and a cup of coffee. During lunch, Aalbert loves to look at some pictures that his grandchildren shared with them. He calls his robot buddy and starts viewing the pictures. Some pictures make him smile, some pictures make him smile, some look surprised or sad, while others are quite neutral. His reaction to these pictures is monitored by the robot. The pictures that the robot presents are a selection of the pictures that Aalbert is likely to enjoy (high “enjoyment/laugh value”).

Since MOBISERV knows that there were no visitors today at Aalbert’s place and no calls were made to or by him, the robot is going to suggest to make a video call to one of Aalbert’s favourite contacts. It is important that Aalbert remains active, not only physically, but also on a cognitive and social level. Since the system knows Aalbert already went for a walk today and he had a bit of a difficult night, no more intensive exercises will be suggested today. Tomorrow is another day for physical action.

2.3.2 Scenario B: Secondary user – the carer

John, Aalbert’s son, lives quite far from Aalbert, so he tries to support this father from a distance. They talk regularly (video call by MOBISERV) and John can use the MOBISERV’s carer interface to tune the behaviour of the MOBISERV to the needs and wishes of his dad. He knows very well how his father can be supported and the interface of MOBISERV allows him to fine-tune the support given by the robot.

Since it is important for Aalbert to keep in touch with his three (remotely located) children, John programmed MOBISERV in such a way that Aalbert will be triggered to talk to all three of them at least once a week. Also Aalbert enjoys playing cards with friends, so this is also an option that John can select from the carers interface when the system detects that Aalbert is rather inactive on a social level. For all areas, like the social, cognitive and physical areas

Aalbert's preferences are stored in John's interface. John can simply select from pre-stored "Aalbert specific preferences". John uses these to program the behaviour of MOBISERV. In order to do so properly, John needs some situational awareness about the behaviour of Aalbert. Since a lot of data is being monitored by MOBISERV, this data is visualized in an easy to understand manner so that John knows at a glance how his father is doing in terms of food and drink intake, physical activity, social connections, and the number and nature of encouragements the robot has given him, over a selected period of time.

In this carer interface, John can see deviations in the behavioural pattern (in relation to previous behaviour) of Aalbert that have been monitored and visualized by MOBISERV since Aalbert's initial use of MOBISERV. This includes data from several sources: data from Aalbert's smart garments (energy expenditure during the day and during the night, heart rate), number of encouragements given by the robot (to eat, drink, exercise, other suggestions), performance levels on games, activity and vital signs data (during exercises, during nights), home control data (who was at the front door, devices that have been used), and incoming and outgoing video calls. These graphs give John a good overview, since they clearly visualize Aalbert's "normal" pattern and his current pattern. For vital signs and other important measures, some upper and lower boundaries have been set and MOBISERV automatically indicates when something is "abnormal" or when alarming or surprising patterns are detected. A suggestion is made by the in-built rules of MOBISERV (based on knowledge and advice of GP, and/or therapists, physiotherapists, diet experts and other experts) to help John to care for his father. The permissions for who can access and see what data have been agreed by Aalbert, and John has worked cooperatively with his father in setting the various options.

3 Integration Tests

3.1 Aims & Scope

Aim of the integration tests is to verify all overall characteristics of the system and whether the system is in line with the requirements specifications of deliverable T7.2 "User and Context Modelling Specification and Redesign".

3.2 Procedures

Test assumptions / outcomes of previous evaluation studies
Test and verify the following assumptions:

- The robot should be able to locate and go to the user
  - Case 1: Robot in the same room as the user
  - Case 2: Robot in a different room to the user
- The robot should be able to face the user in all interactions
  - Case 1: Person seated
  - Case 2: Person standing
- The robot should be able to charge autonomously
  - Case 1: What happens when the robot starts to run out of battery in the middle of a video call or other interaction?
  - Case 2: What if the person calls the robot and the battery is too low?
- The WHSU should be able to inform the robot in case of a fall
  - Case 1: The person is in the same room as the robot (2 meters away)
  - Case 2: The person is in the same room as the robot (5 meters away)
  - Case 3: The person is in a different room to the robot
- A fully working and integrated secondary user interface should be developed
  - Case 1: The secondary user can set-up all the required parameters and the settings are operational immediately on save
  - Case 2: The secondary user makes a change to the schedule and the settings are updated immediately on save
- The maximum volume of the robot should be increased
  - Case 1: When the user requests the volume to be increased
  - Case 2: When the user uses a physical control on the speaker
  - Case 3: When the background noise is above a certain threshold
  - Case 4: When the robot is more than 2 meters away from the user

Test High-level Functions
Test and verify all functions and their corresponding flowcharts as described in section 2.1 of this document and in deliverable T7.2.

Test Intelligent Rules Set
Test and verify all 35 rules and their corresponding behaviour and user interactions as described in deliverable T7.2.

Test Secondary User Interface
Test and verify the secondary user / carer interface and its effect on the primary MOBISERV system and the resulting user interactions.

Test Usage Scenarios
Test and verify the cross-functional usages scenario as described in section 2.3 of this document.

3.3 Outcome

During the development phase, results of what has been tested, what is good and what needs improvement has been recorded in a living document (maintained as a shared as a Google Doc). Final results can be found in deliverable D7.3.

4 Heuristic Evaluation

4.1 Study Aims & Scope

The aim of this activity will be to ensure the user-system interactions of the complete system (Robot, Smart Environment, Smart Garments, Secondary User / Carer Interface) conforms to best practice in terms of interaction design. Next to all GUI elements and touch interaction, this also covers speech interaction, including speech input from the user and speech output from the robot.

Aspects that will be covered:

- Information Architecture
- Interaction Design
- Visual Design
- Labelling
- Functionality
- Content

For more details about these aspects, we refer to the previous issue of D2.4 “Definition of evaluation framework”.

4.2 Methodology

This activity will be undertaken by HCI experts from UWE and SMH using relevant heuristics for human-computer interaction, human-robot interaction, speech interaction, human-to-human interaction and so on. A cognitive walkthrough will also be performed. Both UWE and SMH will review the interactions for each of the use cases relating to the functions that are in scope.

4.3 Heuristics

The set of heuristics used for the expert evaluation are listed in Appendix 9.4.

4.4 Outcome

Findings will be collated to identify and prioritise key issues that need resolving to ensure the key performance indicators are met. An update to the HRI specification will be produced to include any design improvements that ROBS should incorporate into an updated system.

5 Target User Specification & Recruitment

5.1 General Target Group

Participants will be recruited from the client base of Ananz (NL) and from older people organisations in Bristol (UK). For the primary users, the focus will lie on people aged between 70 and 90 years that speak English or Dutch. For secondary users, both formal and informal carers will be involved.

5.2 Primary

Inclusion criteria

- Hearing: Should be able to hear normal conversation. Check if wearing hearing aids.
- Sight: Should be able to see the primary UI (commands/games) at a reasonable distance
- Speech: Robot should respond to voice (Bluetooth mike, voice training)
- Dexterity/fine motor skill function: Should be able to touch the screen in required place.
- Cognitive Function: Should have the ability to understand and retain information.
- Memory: Should be able to remember instructions after a reasonable number of repetitions.
- Proprioception: User should be aware their body parts in space in relation to the robot.

Exclusion criteria

- Severe medical conditions

Recruitment process

For recruiting participants from the Robotics Lab for trials, we will use the shortened screening form.

5.3 Secondary

Inclusion criteria

- Professional carers
- Informal carers: partners, family, volunteers
- Occupational Therapists
- Gerontology Experts

6 Usability Testing

6.1 Study Aims & Scope

We will perform formative and summative evaluations of all high-level functions, comprising two parts: a) focus groups with users; b) individual sessions on specific components and on the overall system with users.

Using the wizard to control movement, speech, and functionalities, we can simulate a lot of different behaviours and circumstances. With this in mind, we aim to investigate a number of issues in regards to HRI which consider aspects such as impact of conversation style, voice and specific behaviour patterns on situated user response and acceptance as a whole, on a range of different audiences (gender, age, disability, cultural and educational background).

We will also try to link Kompaï to a freely available chatbot so that a person can imagine that the robot is more of a companion (given the limitations of the chatbot's AI algorithm of course). This is in addition to any of the specified "formal" functional scenario evaluations.

Points of attention – Overall
The following main topics will be addressed and measured during all usability evaluation sessions:

- Level of user satisfaction
- Level of function usage by the user
- Level of acceptance by the stakeholders
- Level of ease of use (ergonomic) of overall component
- Level of ease of use (ergonomic) of the input devices for the function
- Level of effectiveness of the messages (do they elicit the desired response?)
- Success of system to adapt to change in environment (e.g. background noises, obstacles, lighting)
- Ease of configurability of function settings
- System response time for the component/function to user input (voice and touch)
- Time for error recovery
- User rating of function output/feedback (in relation to quality, utility and comprehensibility)

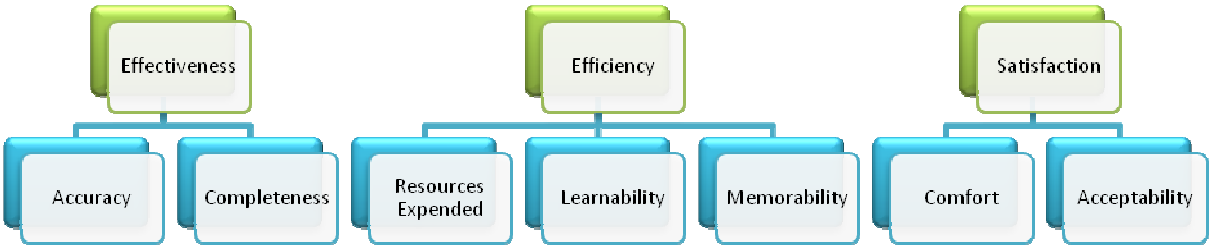

Figure 1: ISO Definition of Usability

Points of attention – Function specific
Sections 4.2 and 4.3.1 to 4.3.14 of the previous issue of this deliverable, D2.4 "*Definition of evaluation framework*", extensively define the evaluation criteria per high-level function of the system. Before the start of the usability evaluations, these lists of criteria will be updated to match with the final system prototype, and will be addressed in the evaluation sessions.

At all times, ethical considerations towards the people participating in this research will be prioritised – with a focus on their psychological comfort, physical comfort, personal safety and the security of data recorded about them.

6.2 Methods

We will use triangulation to ensure validity and reliability of the results. A range of techniques will be used which include:

- Focus groups / pluralistic walkthroughs
- Usability testing / task analysis
- Thinking aloud – Cooperative Evaluation
- Co-discovery
- Interviews
- Surveys

The sessions will be completed in stages to ensure users feel comfortable with the technology and understand its scope and limitation. This will also help to reduce any impact of possible "halo" effect.

6.3 Procedures

The usability evaluation studies will be conducted in 2 stages:

6.3.1 Usability Stage 1 – Orientation Workshops

Please note: this is a repetition of the early-2012 user trials – but with updated functions.

The aim of this part is to deepen the understanding of how the updated system fit its context. We will facilitate the co-discovery of the pros, cons, effects, ethics and possibilities of the prototype as real users understand it in context. For each of the following target groups, we will recruit groups of representatives:

- older people
- carers / home-care visitors
- family ('son', 'daughter')
- doctors / care call centre operators (e.g. Good Morning Service, NHS Direct)
- nutrition experts, physiotherapist / fitness coach

Stage 1 Aims

1. Get participants familiar with the project and robot (via live demos – play acting and some minimal interaction)
2. Get their initial views and perspectives on issues regarding features and contextual use .
3. Screen participants to select suitable candidates for the individual trials (stage 2)

Place: BRL Living Lab - a closed room set up as a studio apartment and Smart Home

Each session will last 1.5 - 2 hours. A short introduction to the project will be made verbally. The main activity of the session (45 minutes) will be a small group discussion of the scenarios relevant to each user group starting with a demo of the scenarios.

Demonstration of PRU

Demonstration of Kompaï by UWE/SMH, including:

- Interaction by voice
- Interaction by touch
- Key functions
- Robot control

Demonstration of WHSU

Demonstration of WHSU, including:

- Putting on garments
- Start and stop recording

Volunteers will take the garment home with instructions to enable evaluating their experience of using the garments

- Keeping a diary of their experience with the garments

Interaction

Allow them to try the functions that they want and interact with the robot how they please
The main discussion points include: What else might the system need to be aware of? What is the effect of this situation? How could this scenario be different? (e.g. extend it, change it).

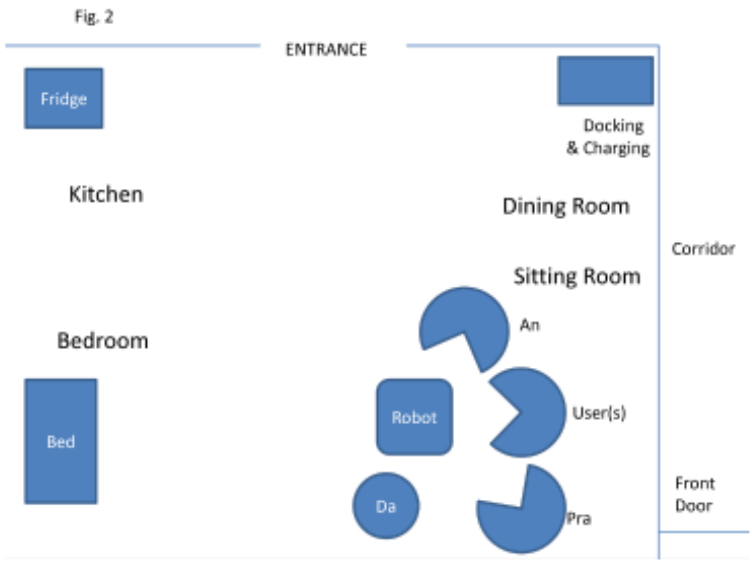

Figure 2: Map of Smart Home Lab in Bristol

6.3.2 Usability Stage 2 – Individual Trials

Please note: this is a repetition of the early-2012 user trials – but with updated functions.

Stage 2 Aims

1. Usability testing in realistic living space
2. Get participants' subsequent views and perspectives on a range of issues

During the individual usability evaluation sessions, we will do the following:

- Gather quantitative and qualitative assessments of users' responses to the MOBISERV system.
- Gather information on users' performance 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.

Place: participant's homes or in the Living Lab section at the Bristol Robotics Lab and Smart Home

Informed consent and explanation of session (10 minutes)

- Very short introduction of their rights
- Overview of the research session

Pre-test interview (10 minutes)
A preliminary discussion in order to assess their experience with technology and some basic demographic data

Questions:

1. How old are you?
2. What is your gender?
3. Where do you live?
4. Do you live with someone or alone?
5. Do you use any technologies on a regular basis?
6. How would you describe your ethnic status?

Voice training (30 minutes)

- Voice training for speech recognition

These sessions will focus on specific elements of the MOBISERV functions being evaluated. Breaks will be incorporated as necessary based on how the participant is feeling.

Test scenarios (45 minutes)
The following sections give details of the tests, with guidelines for timing information to ensure that the session proceeds smoothly, without taxing the participant as best as possible.

For primary users
Primary users will interact with the PRU and WHSU. They will be asked first complete by "thinking aloud and then again with NOT 'thinking aloud' during these scenarios.

Break (5 minutes)
This will be extended if necessary, depending on how the participant is feeling. Refreshments will be provided. Other breaks will be incorporated as necessary based on how the participant is feeling.

Post-session discussion (40 minutes)
For the full list of questions, see appendix **Fout! Verwijzingsbron niet gevonden.** on post-session questions.

6.4 Outcome

The evaluations, its findings and a thorough analysis will be described fully so as to be replicable and reported. In order to conduct a comprehensive analysis of the sessions, there will be careful review of the various elements of the data gathered. This will include data that is logged by the system during the interaction, as well as video recording of the sessions.

Subsequently, UWE and SMH will produce the following:

- D2.6 "*Final Prototype and System Evaluation Report*"
- D2.7 "*User Acceptance Criteria Report*"

6.4.1 Data analysis after sessions

The following sections provide details of the parameters that will be analysed after the test sessions.

Level of function usage by the user
Data logging of:

- responses to drinking reminder
- responses to eating reminder
- voice/video contacts added
- voice/video calls made
- voice/video calls accepted
- voice/video calls rejected
- responses to exercise reminder
- putting on WHSU garment
- WHSU ECG quality
- exercises viewed
- exercises conducted
- front door visitor calls received
- front door visitor calls accepted
- front door visitor calls rejected

Data logging of speech recognition:

- Certainty of known words
- Number of unknown words

System response time for the component/function to user input (voice and touch)
Data logging of:

- Response time for voice output (following end of speech command)
- Response time for visual output (following end of touch interaction)

Success of system to adapt to change in environment (e.g. background noises, lighting)
During trials we will measure the background noise and light levels to analyse the impact of these on the interaction.

6.4.2 Video analysis after the sessions

Overall

- Vocal and facial expressions (using video) (are they impressed, surprised, puzzled, positive/negative, do they seem comfortable, relaxed, anxious, frustrated?)
    - While it is far away / moving closer / nearby
    - When listening to the robot
    - When speaking to the robot
    - When a robot fails in a task
    - When the robot completes a task
- While interacting, when do they need prompts/reminders?
    - Do they know which functions are available?
    - Do they know what to say/do to activate these functions?

Speech interaction

- Physical distance people prefer
- Range of words and language used.
- Do users know when they should/can talk?
- Do they understand the voice of the robot?
- Do users change their pace/tone/volume of speech?

GUI interaction

- Physical distance people prefer
- Do they struggle to engage with the tablet from a seated position?
- Is it necessary to manually move the robot closer to the participant or does the participant have to get up in order to engage with the tablet PC? What is the preferred distance?
- Do they appear uncomfortable using the tablet while sat in a chair?

Ease of configurability of function settings

We review the video recording for frequency counts of

- Recovered errors made when configuring setting
- Unrecovered errors made when configuring setting
- Requests for help when configuring settings
- Views of ‘guide’ section
- Number of settings not understood – uncertainty of settings
- Appropriateness of default values for settings

7 Field Trials

7.1 Study Aims & Scope

By performing more in-depth field trials we will be able to get more ecologically valid information on user experience. By letting end-users actually use the complete MOBISERV system, in real life situations and environments, preferably in their own home, we will be able to discover actual stories and experiences, and gain a much deeper understanding of the end users' thoughts and experiences, going even beyond findings from the usability tests as discussed in the previous chapter. There will not be a rigorous controlled protocol defined for these studies.

We will undertake summative evaluations of the complete MOBISERV system prototype, including all components, high-level functions, and the secondary user (informal / formal carer) interface.

At all times, ethical considerations towards the people participating in this research will be prioritised – with a focus on their psychological comfort, physical comfort, personal safety and the security of data recorded about them.

Summary of Aims

1. Usability testing in actual homes
2. Evaluation of the overall user experience
3. Get the users' subsequent views and perspectives on a range of issues
4. Risk assessment and hazard analysis of having a robot like Kompaï from an occupational therapy perspective
5. Find out practical implementation issues

Acceptability

The acceptability of the MOBISERV system and its services has special attention during these field studies. It will be reported in a dedicated deliverable D2.7 "*Study of User Acceptance*" and will cover aspects such as usefulness, convenience, social acceptance, cultural acceptance, political acceptance, and economical acceptance.

7.2 Research questions

In addition to the questions listed in section 1.1 of this document, we have the following research questions:

- If left unassisted what different actions do people take when the robot does not respond to their commands? What strategy do they adopt? What are the benefits of letting them try to recover control on their own? How does it make them feel? How

do these aspects differ based on gender, age, background, culture? Can this information help us define more effective training strategies?

- Informally try to identify culturally determined behaviour with groups of same nationality users. (compare English people and Dutch).
- Would it be possible to leave the robot in someone's house for long periods without technical support?
- Can the robot support an individual in their daily routines?
- To what extent can the robot be customized to the needs of the individual and so improve their quality of life?
- Can the robot improve the user's social life/access to communication?
- Can the robot increase safety in the home? Reminders/bogus callers.
- Can the robot reduce the need for carer interventions?

7.3 Methods

The following methods will be used for the evaluation field studies with primary and secondary users:

Pre- and Post-experience

- Interviews
- Questionnaire surveys

During experience

- Contextual task analysis
- Field observations
- Diary study
- Logging actual usage

7.4 Procedures

The field studies will be conducted in 3 stages:

7.4.1 Home Trial – Stage 1

Place: Selected participants own home

Participants: Individuals selected from *Usability Tests – Stage 2* (those who have suitable homes and fit in the garments)

Time: 2 to 3 hours

Participant characteristics: Over 65, no cognitive or physical disability (other than mild/expected age-related conditions affecting mobility, eyesight and hearing)

Trial scenario
During the trial period the participant will be instructed to interact with the robot – using the key functions available on the Kompaï GUI – See some photos, Control the house (SMH) only and move the robot to different rooms/locations and send it to the charger when they finish using it. The participants will be asked to use either voice or touch as they prefer.

Three reminders will be set up using the calendar at specific times; Do some exercise, Call someone; and Have a drink of water. The participants will be asked to respond to the reminders as they wish.

Preparation

- Prior to the trial the users home will be mapped and locations set.
- The robot setting will have their name.
- The Kompaï system will be uploaded with the participant's photos and exercises appropriate to them.
- They will be supported in putting on a smart garment of their choice and the data logger will be synced.
- Video camera and audio recorder will be set up.
- Evaluation and technical researchers will wait in an unused room during the duration of the study.

Research Methods

- Pre- and Post-experience interviews will be conducted to assess against the research questions and usability issues.
- A second researcher will observe all interactions, actions, behaviour, communication and non-verbal signs.
- Recorded data will be analysed as described in section 6.4

7.4.2 Home Trial – Stage 2

Place: Selected participants own home

Participants: Selected individuals (couples of 1 primary + 1 secondary user) from Home Trial – Stage 1

Time: 6 to 7 hours

Participant characteristics: Over 65, no cognitive or physical disability (other than mild/expected age-related conditions affecting mobility, eyesight and hearing)

Trial scenario
During the trial period the secondary participant will be asked to setup (at least) five reminders using the secondary user interface; Do some exercise, Call someone, Have a drink, Eat something, and a Medication reminder.

The primary participant will be instructed to interact with the robot – using the key functions available on the Kompaï GUI – See some photos, control the house only and Move the robot to different rooms/locations and send it to the charger when they finish using it. The participants will be asked to use either voice or touch as they prefer. The participants will be asked to respond to the reminders setup by their partner as they wish.

Preparation

- Prior to the trial the users home will be mapped and locations set.
- The robot setting will have their name.
- The secondary UI will be available on an iPad.
- They will be supported in putting on a smart garment of their choice and the data logger will be synced.
- Video camera and audio recorder will be set up.
- Evaluation and technical researchers will wait in an unused room during the duration of the study.

Research Methods

- Pre- and Post-experience interviews will be conducted to assess against the research questions and usability issues.
- A second researcher will observe all interactions, actions, behaviour, communication and non-verbal signs.
- Recorded data will be analysed as described in section 6.4

7.4.3 Home Trial – Stage 3

Place: Selected participants' own homes

Participants: Individuals (couples of 1 primary + 1 secondary user) selected from Home Trial – Stage 2

Time: 1 week

Participant characteristics: Over 65, no or mild cognitive disability, no physical disability (other than mild/expected age-related conditions affecting mobility, eyesight and hearing)

Trial scenario

During the trial period, both the primary and secondary participant will be asked to setup and use the complete Mobiserv system freely as much as they like, whenever they like. Evaluation researchers will not be present during the majority of this week.

Preparation

- Prior to the trial the users home will be mapped and locations set.
- The secondary UI will be available on an iPad.
- They will be trained in putting on a smart garment of their choice and the data logger will be synced.
- Video camera and audio recorder will be set up.
- Evaluation researchers will monitor the system through tools like TeamViewer and the Secondary UI via the internet.
- Evaluation researchers will make sure there are enough suggestions in the system to keep the primary user occupied every now and then, based on an agreed scheme.

Research Methods

- Pre-, During-, and Post-experience interviews will be conducted to assess against the research questions and usability issues. (before, after, and several evenings during the week)
- Both users will fill out a short diary after every interaction with the system.
- Evaluation researchers will observe all interactions and actions through the software logging and TeamViewer.
- Recorded data will be analysed as described in section 6.4

7.5 Outcome

The evaluations, its findings and a thorough analysis will be described fully so as to be replicable and reported. In order to conduct a comprehensive analysis of the sessions, there will be careful review of the various elements of the data gathered. This will include data that is logged by the system during the interaction, as well as video recording of the sessions.

Subsequently, UWE and SMH will produce the following:

- D2.6 "*Final Prototype and System Evaluation Report*"
- D2.7 "*User Acceptance Criteria Report*"
- D8.4 "*Technology Implementation Plan*"

8 Other Evaluations

8.1 Show and tell sessions in (day) care centres

Session Aims: Let the users interact with the robot after a demonstration and get feedback on a range of issues from a wide range of primary and secondary stakeholders.

Place: Selected day care centres and church groups

Participants: those attending these places

Time: 2 hours including a break

Participant characteristics: Over 65, wide range of conditions (will be noted)

8.1.1 Plan details

1. Preparation

- Arrange pairs of chairs in a semi-circle.
- Map room area and define locations as follows:
    - Points in front of each pair of chairs – in between – within easy reach
        - First group
        - Second group
        - Third group
    - Living room – Researcher will stand next to this spot designated for her demo – robot orientation to face the semicircle of seated participants.
    - Bedroom
    - Kitchen
    - Front door
- Get the Wizard going
- Get Lync going – remember to turn 3G on
- Make sure the Bluetooth microphone is working
- Have name badges, questionnaires, pens and clipboard ready
- Place the video camera in position and check battery and SD card capacity.

2. Presentation

- Introduce researchers.
- Explain what the project is about
- Why we are there
- How they can help us, give us advice on what we can improve and what they like or do not like. This will help us to make improvements.

- Explain the format of the workshop
- Researcher will give a demonstration.

3. Demonstration

- Tell the participants that we have named the robot **Molly**
- Demo interaction with the robot showing that this can be through speech or touch – touch the pictures or buttons or say the words under the pictures.
- Remember to remind them that
    - They have to wait for the green listening button before speaking.
    - Don't speak when the red button says Not Listening
    - To make the robot listen to you, you should say Molly. To stop it listening say Hush
    - Do not worry if you have to repeat things – Molly doesn't hear very well sometimes
- Briefly describe each of the features
- Demonstrate
    - sending the robot to the kitchen room
    - Simon Game
    - The movement commands – Turn left, Turn right, Turn Around
- After the demo – Move the robot to First Pair

4. Interaction

- Each pair of users will get an opportunity to interact with the robot .
- Let users decide what they want to try and how they want to interact with it.
- The others can watch and see how the they are interacting and think about ideas for improvements. Everyone will get a chance to try out the features.
- There will be a questionnaire which is optional. Blank paper will also be available for people to draw their thoughts if they prefer not to write.
- Every pair will have 5 - 15 minutes (depending on individual ability and willingness) with the robot and then they will send it to another pair.

8.2 Show and tell sessions with secondary / tertiary users

Session Aims: Get feedback on a range of issues from experts

Place: BRL Living Lab Area, Ananz Care centres

Participants: Carers + members of gerontology groups

Time: 1.5 hours

Participant characteristics: Range of experts

8.2.1 Plan details

1. Present aims of the workshop (5 minutes)
2. Present MOBISERV overall aims and objectives and our specific aims and objectives within this (PCS Introduce some Current research areas within the field of assistive robots - Embodiment, Presence, Proxemics, Ethical Issues, UTAUT (Acceptance of technology) (10 minutes)
3. Demonstration of robot features and their relevance to different groups of people (explained using scenarios) (10 minutes)
4. Let them interact with Secondary UI from a stationary position for the following scenarios: (they will be instructed to 'think aloud' during these scenarios) (20 minutes)
    - Set-up eating suggestion for an older person
    - Set-up a medicine reminder
    - Review an example exercise data log
    - Set-up exercise regime for an older person
    - Add a new contact that an older person could call
5. Workshop questions – based on your individual experience within the field of gerontology:
    a. Provide feedback on the current system.
        - From a primary user's perspective
        - From a carer's perspective
    b. Consider further opportunities for making use of the available functions (10 minutes) (post-it notes)
    c. Report back to group for discussion (10 minutes)
    d. Consider barriers in deploying the technology for specific groups and frame these as problem scenarios (15 minutes)
    e. Each group select 1 problem scenario (5 minutes)
    f. Brainstorm ways (solutions or processes or opportunities for research) to address the selected problem scenario in order to meet the care and social needs of the ageing population. (20 minutes)

8.3 Hazard Analysis Study

Safety requirements will be derived from a functional hazard analysis that will be performed on a high-level requirement specification of the MOBISERV system. Requirements derived from the functional hazard analysis must be satisfied if the MOBISERV system is to achieve an acceptable level of risk. Functional safety requirements for the MOBISERV system are of two distinct categories:

- Functional safety requirements for each component
- Requirements for safety of each identified task

Of all MOBISERV components, Kompaï robot presents a highest risk. Several safety requirements have been identified that apply to the mechanisms of the robot, and hence apply to all mission and safety tasks in which those mechanisms are used, e.g. speed control: robot speed shall be a function of proximity (safe values to be determined in the detailed design), robot speed shall be sufficiently slow at moment of contact that injuries are only minor at worst; or environment sensing - the robot is required to sense the location of itself, significant persons and terrain features in order to avoid collisions correctly, as well as to perform mission task. In order to do a hazard analysis assessment and specify safety requirements, a task model will be initially compiled.

We will get the robot moving around participants' home as they get on with their daily activities and then see use a repertory grid technique or similar to identify and categorise hazards in the home. This will also take into account disability of the user and their activity levels/patterns.

Specifying tasks:

- Task Title (name of operation)
- Goal state(s) or conditions to be achieved
- Behaviour type: convergence, maintenance, avoidance
- Characteristics of the environment in which the task is to be performed (location, interacting agents/features)
- State(s) / condition(s) to be avoided (hazards) - we will only identify obvious examples here.

Many methods exist for specifying the externally-observed functionality of a system, including Use Case Design, User Stories, and Viewpoints-based Requirements Engineering. However, for this design study, a method called Hierarchical Task Analysis has been chosen.

Hierarchical Task Analysis (HTA) is a system analysis method that has been developed by the Human Factors Analysis community as a method for eliciting the procedures and action sequences by which a system is used by human operators. System and procedural models identified by HTA are then used as the basis for operator error analyses to determine whether the system functional or user interface design has an increased potential for of hazards due to human error.

HTA proceeds by the identification of the *tasks* required of the system, and identification of *plans*, which describe the order in which tasks are to be performed. Tasks are described by the general activity to be performed and/or the desired end state of the system and its environment at the end of the activity. Each task is then successively decomposed into sub-tasks by the same procedure, as far as is reasonable for the purpose of the analysis. Each task is accompanied by its own plan specifying the ordering of the sub-tasks. The results can also be used in the construction of a *hierarchical task diagram* that presents the organisational structure of the tasks in a graphical format.

HTA Procedure

1. Begin with the highest level task objective / goal this is usually the ultimate goal to be achieved
2. Identify the set of sub-tasks needed to achieve that goal keep the sub-task titles/descriptions as simple as possible
3. Develop a plan that specifies the order of processing of sub-tasks
    - identify the main sequence of sub-tasks
    - identify exception cases, conditional sub-tasks, alternate sequences etc., and note the enabling/initiating conditions
4. For each sub-task, repeat steps 2 and 3, identifying further hierarchical levels to the task decomposition, until a suitable stopping point is reached
    - Stopping rules: common sense, ethological guidelines

When the MOBISERV tasks are defined using the HTA, a list of potential failures and consequences that could be caused will be derived. The hazards will be also be categorised based on their severity and frequency. Preliminary hazard analysis will include:

- Failure Type
- Failure Description
- Operating Phase
- Consequence Description
- Consequence Severity
- Cause Description
- Initial Frequency

Functional safety requirements for the MOBISERV functions will serve as input to the technical partners when refining the components' design.

Place: Student Flat on UWE campus

Participants: Occupational Therapist and Electronics Engineer

Time: 3 to 4 nights

Participant characteristics: User experts and technical experts

The system will be customised for the participant via the secondary user interface following a pre-session interview. Training on using the system will be provided in a one-hour workshop.

Trial scenario

During the trial period the participant will be instructed to interact with the robot as frequently as they wish – using the key functions available on the Kompaï GUI – See some photos, Control the house (SMH) only and Move the robot to different rooms/locations and

send it to the charger when they finish using it. The participants will be asked to use either voice or touch as they prefer.

Nine reminders will be set up using the calendar at specific times – Do some exercise, Call someone, have a drink of water, eat something and medication reminder. The participants will be asked to respond to the reminders as they wish.

Preparation

- Prior to the trial the users home will be mapped and locations set.
- The robot setting will have their name.
- The Kompaï system will be uploaded with the participant's photos and exercises appropriate to them.
- They will be supported in putting on a smart garment of their choice and the data logger will be synced.
- Video camera and audio recorder will be set up.
- Evaluation and technical researchers will wait in an unused room during the duration of the study.

Research methods

- Pre- and Post-experience interviews will be conducted to assess against the research questions and usability issues.
- Recorded data will be analysed as described in section 6.4

9 Appendices

9.1 Information Letter

MOBISERV – An Integrated Intelligent Home Environment for the Provision of Health, Nutrition and Well-Being Services to Older Adults

For the last 3 years, University of the West of England (UWE) researchers from the Bristol Robotics Lab Praminda Caleb-Solly and Sanja Dogramadzi, and Faculty of Health and Life Sciences, Tina Fear, have been working with a European team of universities, research institutes, commercial companies and care organisations, on a new type of helper: a robot assistant for older adults. Integrated together with smart garments and vision systems, this social robot works in partnership with them, reminding them about eating, drinking and medicines, offering structure throughout the day, and helping people stay active by suggesting a variety of activities. The main goal of the MOBISERV project is not only to keep people independent and boost their quality of life, but also to support and empower their social carer, often the partner, in providing care.

In the upcoming months, UWE, the Smart Homes institute in Eindhoven (NL) and the care organisation Ananz in Geldrop (NL) will perform extensive user evaluation studies with the robot assistant to find out how people experience and feel about this helper in their home. The studies will include usability tests in a home lab, to full-day experience trials in a test home, to multi-day experiences in participants' own homes.

Enabling Technologies

The technical partners in the team have developed cutting-edge technologies to meet the objectives of MOBISERV project. The Aristotle University of Thessaloniki in Greece developed algorithms to detect eating and drinking activities. The manufacturer of intelligent clothing Smartex in Italy, together with research institute CSEM in Switzerland, developed smart clothes for older people that monitor heart rate, respiration, temperature, posture and physical activity. The Lappeenranta University of Technology in Finland supervised all communication by the system and its components and provided algorithms to secure confidential and personal information gathered by the system. The French company Robosoft developed the personal robots, including sophisticated algorithms for navigation, obstacle avoidance, person detection, human-robot interactions and the actual services.

Services Provided

Researchers from UWE and Smart Homes, Netherlands, have been working with end-users, carers and medical staff from the start of the project to ensure that the MOBISERV components meet a real need in helping older adults maintain active independent lives. The set of services available include event-triggered reminders, suggestions, and encouragements that address key physical, cognitive and social needs. For example, if a person does not drink for a certain time, which can lead to dehydration, the robot will approach the person and encourage him/her to drink, or even suggest a specific drink, based on the person's preferences or needs. The same holds for food, physical exercises, activities, and also for social contact; when a person does not communicate with anyone for a while, the robot will suggest they make a call, or to go out and visit someone, helpful for those at a risk of social isolation. In addition to this, the robot keeps an eye on vital signs and sleeping patterns, and it can detect a fall. In case of an emergency, it will automatically contact a carer. The robot works in partnership with the person, offering nutrition and activity coaching, and it is expected that it will contribute to a healthier and more enjoyable life, not only for the end user, but also for the social carer.

Final User Evaluations

Currently, the MOBISERV team is focussed on the preparations for the final user evaluation studies. Based on the findings from user studies in the previous years, the MOBISERV robot and services are being improved and fine-tuned to be useful, acceptable, and fun to use. In the upcoming evaluation studies, people will freely use their robot assistant, and carers will personalize and use the system to support their loved ones. The purpose of the evaluations is to enable end-users and caregivers to experience what MOBISERV system can do for them, to further improve MOBISERV services, and to find out how to proceed in bringing this robot and its services to market - working towards realising the ultimate goal, which is to enable people to support themselves, and others, in their wellbeing and independence.

The user evaluations will take place from May to July 2013, both in the UK and in The Netherlands. In the period from June to August, the Mobiserv project and its companion robot will be presented and demonstrated at several events throughout Europe, open to a wide audience and press, in all seven partner countries of the project. For the latest information about these public events and the project, or ideas to organise a demo at your premises, please visit www.mobiserv.info.

9.2 Information Sheet

1. Invitation to participate

You are being invited to take part in a research project called MOBISERV (An Integrated Intelligent Home Environment for the Provision of Health, Nutrition and Mobility Services to Older Adults).

Before you decide whether to take part it is important that you read this information sheet to understand why and how the research is being carried out.

2. What is the purpose of the research?

The goal of the project is to develop ways of supporting older people and their caregivers through the use of a **robot**, **intelligent clothing** and a **smart home**.
Our priority is to ensure a people-centric approach to the design and implementation of the MOBISERV technology, striving towards creating an engaging interactive experience that not only addresses real needs and is easy to use, but is also acceptable from emotional, cultural and social perspectives.

3. Why have I been chosen?

You have been invited to take part in this research because you fit the profile of a potential user of this system. We would like your views on how this technology can be developed to suit the needs of people like yourself in the future.

4. Do I have to take part?

It is entirely up to you whether to take part or not. If you do decide to take part, we will ask you to sign a consent form before we can begin.

Please ask us if you would like any clarification concerning any of the items contained within this document.

Your participation in this study is totally voluntary. If you want to, you can withdraw at any time without any consequences whatsoever.

5. What will happen if I decide to take part?

We would like you to provide us with some information to help us with our research. The aim of this preliminary study is to obtain feedback from older adults on key aspects of the functionality of the Kompaï Robot. This is an intelligent robot system that is intended to support older adults. In particular the data gathered will enable an evaluation of the extent to which the Mobiserv system will be of value.

For this study you will be asked to ask the robot some questions, give it some commands and listen to its responses. We will video or record your interaction with the robot.

These will include:

- Calling the robot, so it listens – getting its attention
- Command the robot to go to a pre-defined location
- Exploring some of the interactive features on the robot

We will then ask you about your impressions of the robot. This will help us to develop a greater understanding of how the MOBISERV technology could be used in the home of a typical person. If you need clarification on any of the questions then please ask one of your research team who will be able to assist you.

6. Can I change my mind about taking part?

If you agree to take part in this study and then change your mind when the researcher visits or while he/she is conducting the session then that is absolutely fine and he/she will leave straight away.

You can also withdraw your data from the study for up to 7 days after you have taken part in the session by contacting the Principal Investigator. After this point it will not be possible to withdraw your data.

7. Will what I do be kept confidential?

All the information collected during the research project will remain strictly confidential and will be handled in line with the UK Data Protection Act.

All data gathered will be stored securely and your anonymity will be preserved.

8. Are there any disadvantages to taking part in the study?

No risk or serious inconvenience is anticipated during this study. The researchers' intention is to not disrupt you or interfere with your normal daily routine.

9. Are there any advantages to taking part in the study?

You will probably not experience any direct benefit in return for your participation in this study but any data that we do collect will result in a better general understanding of older adult's lives and habits so that we may help them with the technology that we are developing.

10. Who is organising and funding the research?

The research is part of a large three year project funded by the European Commission within the 7th Framework Programme. The research is being carried out across Europe by nine different project partners. The part you have been asked to take part in is being conducted by researchers at the University of the West of England, in Bristol.

11. Who has checked to make sure that this study is being conducted properly and what should I do if I have any concerns during the study?

This research has been approved by a research ethics committee at the University of the West of England in Bristol. If you have any concerns about the study or would like any further information

please contact Praminda-Caleb-Solly who is the lead investigator for this part of the study. Her contact details are below.

Dr. Praminda Caleb-Solly
University of the West of England
Room 3Q73, Frenchay Campus,
Bristol BS16 1QY, UK
Telephone: 0117 32 83178
e-mail: Praminda.Caleb-solly@uwe.ac.uk

If you wish to make a complaint about any aspect of this project please contact:

Prof. David James, Deputy Chair, Research Ethics Committee,
School of Education, Room 2S406
University of the West of England,
Coldharbour Lane, Bristol BS16 1QY.
Tel. 0117 3284215;
email: David.James@uwe.ac.uk

Thank you for taking the time to read this information.

9.3 Informed Consent Form

Please read and sign this form.

I state that I have read the information sheet and am willing to participate in the evaluation study being conducted by Praminda Caleb-Solly, Sanja Dogramadzi, Anne Allardice and Daniel Davies, all employees of the University of the West of England, Bristol. The purpose of the study is to assess the usability of the MOBISERV Components.

In this usability study:

- I will be asked to perform interact with the Kompaï Robot.
- I will also be asked a few questions before and after I interact with the robot regarding my views of the robot.
- The evaluators will observe my interaction with the robot and will video and take notes.

All information will remain strictly confidential. The observation videos and findings will be used to write a report on the usability of the MOBISERV System and help the evaluators identify improvements.

At no time will my name, the video or any other identification be used externally. I understand that I am free to ask questions and can withdraw my consent to the experiment and stop participation at any time.

By signing the following consent form, you will be authorising us to collect and analyse your personal information. If you do not sign this form then you will not be able to participate in the study.

Please tick the appropriate boxes:

I have read and understood the project information sheet. (or it has been read to me by .....so that I understand it sufficiently)	☐
I have been given sufficient opportunities to ask questions about the project.	☐
I agree to take part in the project.	☐
I understand that my decision to take part in the study is voluntary and that I may withdraw from the study at any time until the survey data has been analysed and that if I do this I will not be asked any questions about why I no longer want to take part.	☐
I understand that the data I provide may be used in publications, reports or web pages, but that my name will not be listed and that any identifying features will be removed from the data to preserve my anonymity.	☐
I agree for the data I provide to be archived at the UK Data Archive.	☐
I understand that other researchers will have access to this data only if they agree to preserve the confidentiality of that data and if they agree to the terms I have specified in this form.	☐
I understand that other researchers may use the data that I provide in publications, reports, web pages, and other research outputs according to the terms that I have specified in this form.	☐
The signing of this form does not imply the renunciation to any legal right. I understand that I am entitled to and will be given a copy of this signed consent form.	☐

Your name and surname

Date

Your signature

(Only if it is necessary, in case of legal disability):

Name and Surname of legal authorized representative
Relation with participant
Signature of representative Date

Name and surname of researcher

9.4 Heuristics

1. Consistency Icons, labels, buttons, and menus (i.e., elements) displayed on screen should be consistent in, location, terminology and meaning.	Do the elements follow platform conventions? (do as everyone else does)
	Are the elements directly understandable (i.e., not ambiguous), in language and visuals?
	Is a particular system action always displayed in the same manner and always achievable by one particular user action?
2. Simplicity Elements displayed on screen should not contain functionalities or information which is rarely needed or irrelevant.	Do the rarely needed or irrelevant elements compete with and diminish the visibility of relevant units of information?
3a. Feedback Elements displayed on screen should keep you informed about the past, current, and future system status.	Do these feedback elements keep you informed about what is going on within a reasonable time?
	Do these feedback elements provide an answer to the questions: Where am I? Where have I been? & Where can I go?
3b. Feedback Elements displayed on screen should keep you informed about the past, current, and future system status.	Do these feedback elements also provide information about how you've got here, how you can go back, and how you can go somewhere else?
	Are the responses of elements that provide feedback for minor and frequent actions modest?
4. Control Elements displayed on screen should provide you with control and freedom.	Is there are a clearly marked 'emergency exit' to leave an unwanted state?
	Are there undo and redo options?
	Do the elements respond to your actions?
5. Error Elements displayed on screen should help you recognize, diagnose, and recover from an error.	Do these elements display the error in natural language, indicate the problem, and suggest a solution and what the effect of this will be?
	Are the displayed errors blaming the problem on user deficiencies? (the user is always right)

6a. Overload The elements displayed on screen should minimize the memory load of the user.	Are there elements that provide instructions for use of the system and are these instructions simple and understandable?
	Are the elements on screen static or at least low in motion frequency?
	Are there more than 7 elements within (wide) an action sequence, and more than 3 action sequences necessary to perform a task?
	Do the elements and action sequences contain metaphors that are known by you?
	Do you have to remember information from one part of the system to another?
	Are there elements that provide shortcuts to frequently made actions?

Table 2: Heuristics for the Heuristic evaluation by Experts

9.5 Usability Evaluation Questions

General questions:

- What is it like being with a robot like this?
- What do you like and dislike about it?
- Can you imagine this in your home?
- What would you change?
- What would it have to do/not do to become a useful buddy for you?

Questions related to eating:

- Do you understand the idea and implications?
- What do you think of the fact that you are observed by your home and robot?
- What do you think about the robot giving you reminders and suggestions to eat?
- What kind of reminders would you prefer? (content, by voice, on screen, …)

Questions related to drinking:

- Do you understand the idea and implications?
- What do you think of the fact that you are observed by your home and robot?
- What do you think about the robot giving you reminders and suggestions to drink?
- What kind of reminders would you prefer? (content, by voice, on screen, …)

Questions related to controlling home:

- What do you think of these functionalities?
- What kind of things would you like to control in your home?
- What could be improved?

Questions related to exercises:

- Do you understand the idea and implications?
- What do you think about the fact that the robot knows how active you are?
- What do you think about wearing special clothes?
- What do you think about wearing a small monitor?
- What do you think about measuring your heartbeat, temperature, respiration and blood pressure?
- Would you like to get suggestions to stay fit?
- What if other people could see these data?
- What do you think about doing exercises coached by the robot?

Questions related to video communication:

- What do you think about this function?
- Who would you call?
- What about an automatic video call when something is wrong with you?
- What could be improved?

Performance Expectancy:

- Using the system in my home would enable me to accomplish things more quickly

Effort expectancy:

- Learning to operate the system would be easy for me
- I would find the system easy to use
- I would find the system to be flexible to interact with
- I believe that it is easy to get the system to do what I want it to do

Social influence:

- People that influence my behaviour think that I should use the system
- People that are important to me think that I should use the system
- Having the system is a status symbol

Facilitating Conditions:

- I have control over using the system
- I have the resources necessary to use the system (e.g. AT to help get out of chair and fetch a drink, or go to toilet etc.)
- I have the knowledge necessary to use the system
- I think the system fits well with the way I live
- Guidance was available to me in the selection of the system
- Specialised instruction concerning the system was available to me
- A specific person/group is available for assistance with system