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Florence

Multi Purpose Mobile Robot for Ambient Assisted Living

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0 DOCUMENT INFO

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Table of Contents

1 Introduction

This document outlines how the controlled home environment tests in Florence will be performed. User involvement and testing are an integral part of the Florence philosophy. This is mentioned in the DoW: “The Florence highly user centric approach will be met by executing rapid design cycles that start with focus group sessions and a Wizard-of-Oz test [...]. It continues with cycles of developments and evaluations at the partners" sites and living labs. There will be at least two evaluation steps. The first evaluation will be done in a technical environment to test technical aspects like integration in and communication with an existing home environment (the IDEAAL living lab and the Philips Experience Lab [...]). The second evaluation will be done in with healthy end-users living in the Telefonica AAL living lab in Granada (Spain), with services operated by FASS (now ASSDA).” [Florence Description of Work].

So the tests prepared within this document are the first real user evaluation of the developed system. Since the robot is still in the development phase, no unsupervised tests in user’s homes are performed; instead the concept of controlled home environments is used. The user can interact with the robot system but are accompanied by technical staff and in a known environment.

This document first shows the technical and structural setup and then gives an overview of the planned functionality that will be tested during the tests. Since the robot is still under development, the final setup can change slightly until the tests are performed. Main section is section 5 which gives an overview on which content and functionality should be tested during the tests (and how).

2 Controlled Home Environment

2.1 Controlled Home Environments – Definition

In Florence, two types of end user tests are foreseen: controlled home environment tests and living lab tests. The difference between those two is the environment in which they are carried out. The first tests (which are presented here) use a robot that misses some functionality and may contain erroneous programming etc. To ensure the safety of the test persons these tests will be constantly supervised and take place in a laboratory environment. So the robot is already adapted to it and problems (e.g. stairs) can be cleared beforehand. This enables a quite smooth run of the tests; they can even be tested with Florence staff before inviting test persons. The results of these tests will be used to enhance the robot system and prepare it to the outside world. In the end it will be tested in living labs with people living in real homes.

2.1.1 Limitations regarding Living Lab tests

Within the controlled environment it can be assured that all necessary technology to run the robot at full functionality is available. All equipment can be installed in advance. Trained personnel are on-site to help in case of technical problems. This won't be the case in real homes. So we have to consider that successful controlled environment tests do not mean that the living lab tests will be successful as well.

2.2 Lab Philips

The Philips Home lab is a permanent fully functional home laboratory built to study how people interact with prototypes of intelligent technology in a real-world environment. Through Home Lab, Philips researchers can better understand their needs and motivations to use technology, and bring better products to market in the quickest possible timeframe.

The Philips Home Lab is built as a two-storey house with a living, a kitchen, two bedrooms, a bathroom and a study. The observation room adjacent to the "home" has a direct view into the Home. Signals captured by the cameras can be monitored on any of the four observation stations. Each observation station is equipped with two monitors and one desktop computer to control the cameras and to mark observed events.

The pictures below show the observation room and the living room. The Philips home lab is part of the Philips Experience Labs. In addition to the home lab the Experience Labs consist of a shop lab, a care lab and a hospitality lab.

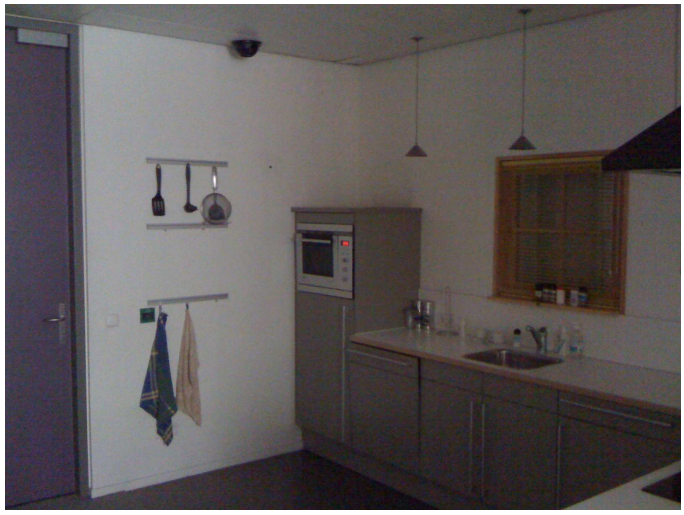


Figure 1 Overview Kitchen in Philips Experience Lab

Figure 2 Overview of the Living room in the Philips Homelab

The user tests will be mainly using the living room and kitchen of the lab. No change in term of furniture movements is necessary. The living room and kitchen do not contain preinstalled sensors (except the A/V sensors for observing the test participants). The home sensors and actuators needed to test the Florence system will be added. These are the doorbell, a window-opened sensor, a wireless temperature sensor, an emergency button sensor and a wireless weighing scale.

2.3 Lab OFFIS

The IDEAAL Living Lab (Integrated Development Environment for Ambient Assisted Living) consists of a senior apartment in the OFFIS institute building. It is a fully functional two room flat consisting of a living room, sleeping/working room, kitchen, bathroom and corridor. The apartment reproduces all areas of normal life. Beside a home automation infrastructure to demonstrate today's possibilities the Living Lab demonstrates research and development results of several AAL projects at the OFFIS institute. The realization of the IDEAAL apartment was geared to the taste of the focus group by including the opinion of an example couple.

It provides a basis for technical test in a real environment as well as feasibility and usability studies. Second it is a showroom for demonstration of ambitious and realistic usage scenarios.

The user tests will be mainly using the living room of the lab. No change in term of furniture movements is necessary. Additional hardware will be installed, have a look at the different service test description which this is exactly (e.g. a weight scale for the LIFIMP service). For home automation tests the already available infrastructure will be used.

The list of controllable hardware includes:

Every Room	Lights (ceiling)
Living Room	Floor lamp (EIB) Floor lamp (HomeMatic) Temperature & Humidity sensor (HomeMatic) Motion Detectors (FS20, EIB, HomeMatic) Door Contact (HomeMatic) Window Opener (HomeMatic)

Kitchen	Cooker (Miele@home) Oven (Miele@home) Fridge (Miele@home) Dish washer (Miele@home) Door Contact (FS20) Motion Detectors (FS20, EIB, HomeMatic) Water flow rate meter (EIB) Light Barrier (FS20)
Bathroom	Washing machine (Miele@home) Light Barrier (FS20) Door Contacts (FS20, HomeMatic) Motion Detectors (EIB, HomeMatic) Water Detector (HomeMatic)
Corridor	Door Contacts (FS20, HomeMatic) Motion Detector (EIB)
Bedroom / Office	Motion Detector (EIB) Light Barrier (FS20) Door Contact (HomeMatic) Desk lights (EIB, HomeMatic)

Table 1: Overview of the OFFIS living lab hardware that can be controlled by either EIB, FS20, HomeMatic or Miele@home

The following pictures show an overview of the lab and some impressions in which settings the tests will take place.

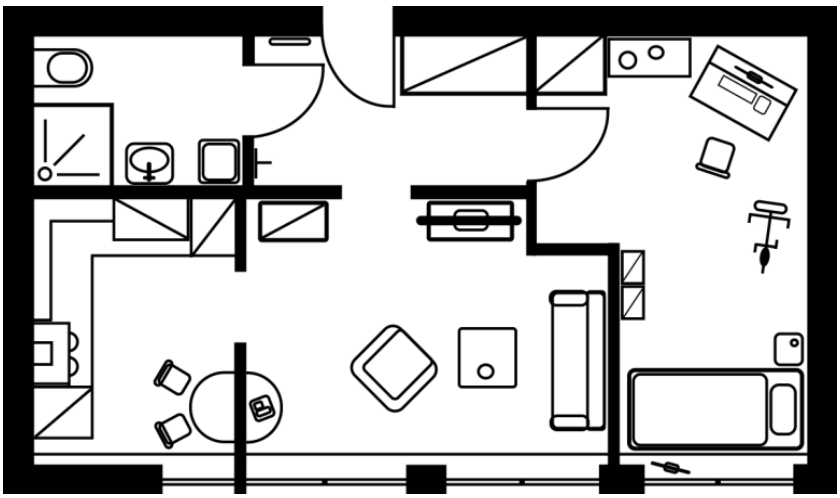


Figure 3: IDEAAL living lab, schematic overview of the complete site

Figure 4: The living room

Figure 5: The kitchen

Figure 6: The sleeping room / office (desk behind photographer)

Figure 7: Office desk

3 Participants

3.1 Selection of people

A good trade-off between the number of test persons (the more the better) and the effort to conduct the tests has to be found. The tests will be more complex than the wizard of oz tests so we calculate to need half a day or a full day for each test. So it was decided to have around 5 test persons per site which require approximately one week finishing all tests.

The age of the test persons is between 60 and 80 years. It was tried to get an equal number of female / male test persons. Former education and occupation is not specifically asked for but ideally both persons with technical background and non-technical background should be included. Some of those people may already have gotten in contact with the Florence project (e.g. in focus groups) and some should be new to be unprejudiced. Basic requirements will be that they are able to live independently and to interact with technology.

To extend the number of participants, we also plan to invite family members and care providers to check out the system (even while running the tests with the elderly). These groups are of interest for Florence as well. So we expect a number of around 15 people per site.

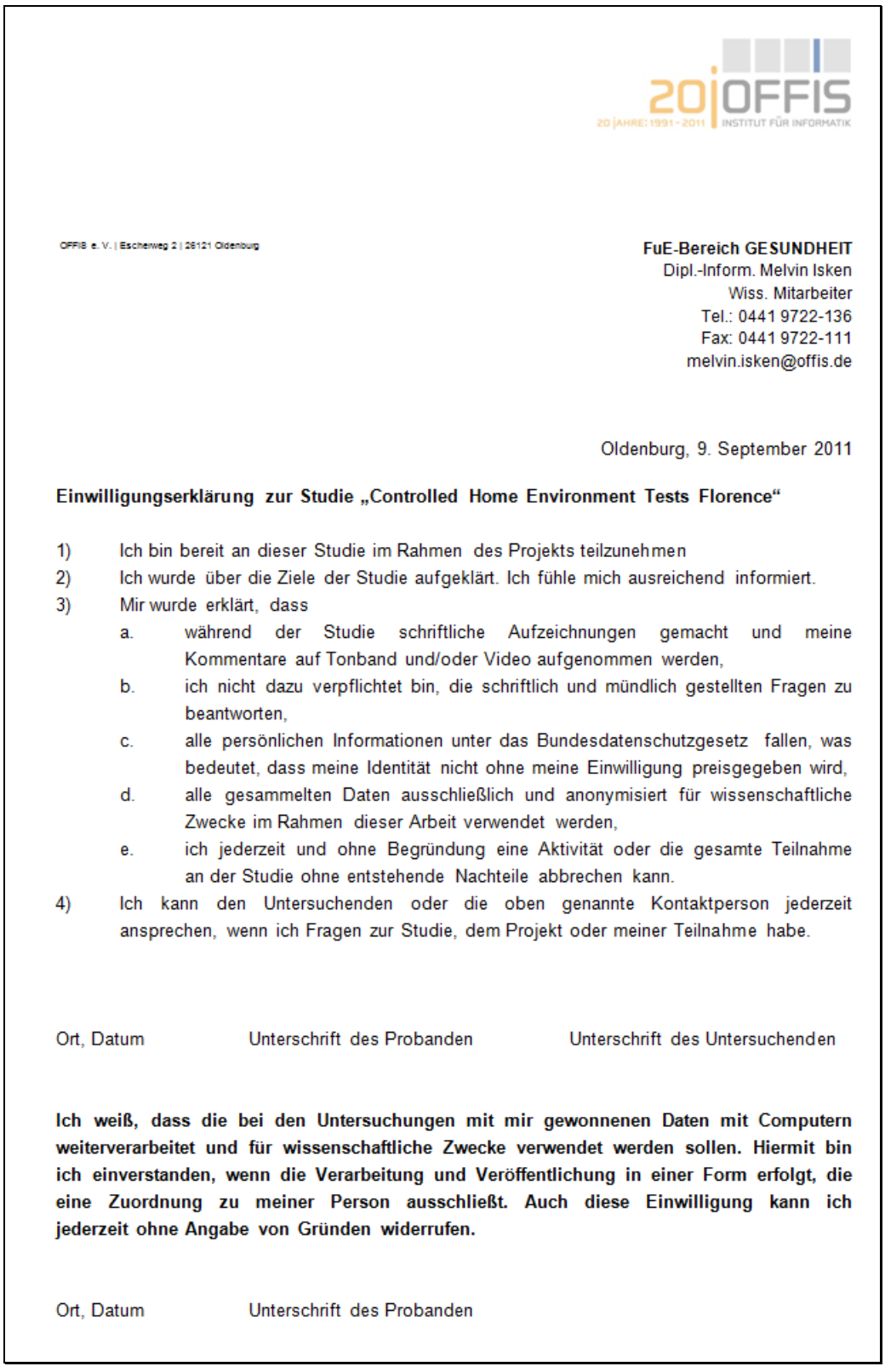
3.2 Informed consent / release

To conduct the tests, the users have to give their informed consent. Therefore documents were created to inform about the project, the test itself, which data is collected and how it is handled.

In case of Germany, the following aspects are included in the informed consent document (Figure 8):

1) I am willing to participate in this study
2) I was told about the goals of the study, I feel instructed sufficiently
3) I was told that
    a. During the tests written, acoustic and video recording notes are taken
    b. I am not bound to answer any question
    c. All individual information is covered by the “Datenschutzgesetzt” (German law of data protection) which means that without my consent no data is published
    d. All collected test data is collected anonymously and only used for scientific use in this project
    e. I am allowed to end my participation at any time without negative outcomes.
4) I can contact the contact person at any time if I have questions regarding the study, the project or my participation.

I know that the collected data is to be processed with computer technology and used for scientific purposes. I hereby agree, if the processed and published data is in a form that precludes an assignment to my person. This agreement can be revoked at any time without giving reasons.



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Oldenburg, 9. September 2011

Einwilligungserklärung zur Studie „Controlled Home Environment Tests Florence“

1) Ich bin bereit an dieser Studie im Rahmen des Projekts teilzunehmen
2) Ich wurde über die Ziele der Studie aufgeklärt. Ich fühle mich ausreichend informiert.
3) Mir wurde erklärt, dass
   a. während der Studie schriftliche Aufzeichnungen gemacht und meine Kommentare auf Tonband und/oder Video aufgenommen werden,
   b. ich nicht dazu verpflichtet bin, die schriftlich und mündlich gestellten Fragen zu beantworten,
   c. alle persönlichen Informationen unter das Bundesdatenschutzgesetz fallen, was bedeutet, dass meine Identität nicht ohne meine Einwilligung preisgegeben wird,
   d. alle gesammelten Daten ausschließlich und anonymisiert für wissenschaftliche Zwecke im Rahmen dieser Arbeit verwendet werden,
   e. ich jederzeit und ohne Begründung eine Aktivität oder die gesamte Teilnahme an der Studie ohne entstehende Nachteile abbrechen kann.
4) Ich kann den Untersuchenden oder die oben genannte Kontaktperson jederzeit ansprechen, wenn ich Fragen zur Studie, dem Projekt oder meiner Teilnahme habe.

Ort, Datum Unterschrift des Probanden Unterschrift des Untersuchenden

Ich weiß, dass die bei den Untersuchungen mit mir gewonnenen Daten mit Computern weiterverarbeitet und für wissenschaftliche Zwecke verwendet werden sollen. Hiermit bin ich einverstanden, wenn die Verarbeitung und Veröffentlichung in einer Form erfolgt, die eine Zuordnung zu meiner Person ausschließt. Auch diese Einwilligung kann ich jederzeit ohne Angabe von Gründen widerrufen.

Ort, Datum Unterschrift des Probanden

Figure 8: Informed consent document in German for the tests at OFFIS

The following consent form is used by Philips:

INFORMED CONSENT

V I agree to participate as a volunteer in this research project.

Name	Signature	Date

Responsible researcher
I have answered all questions about the research project and discussed the meaning and scope of this informed consent and signed it in the presence of the volunteer.

Name	Signature	Date

CONFIDENTIAL

3.3 Ethical approval of studies

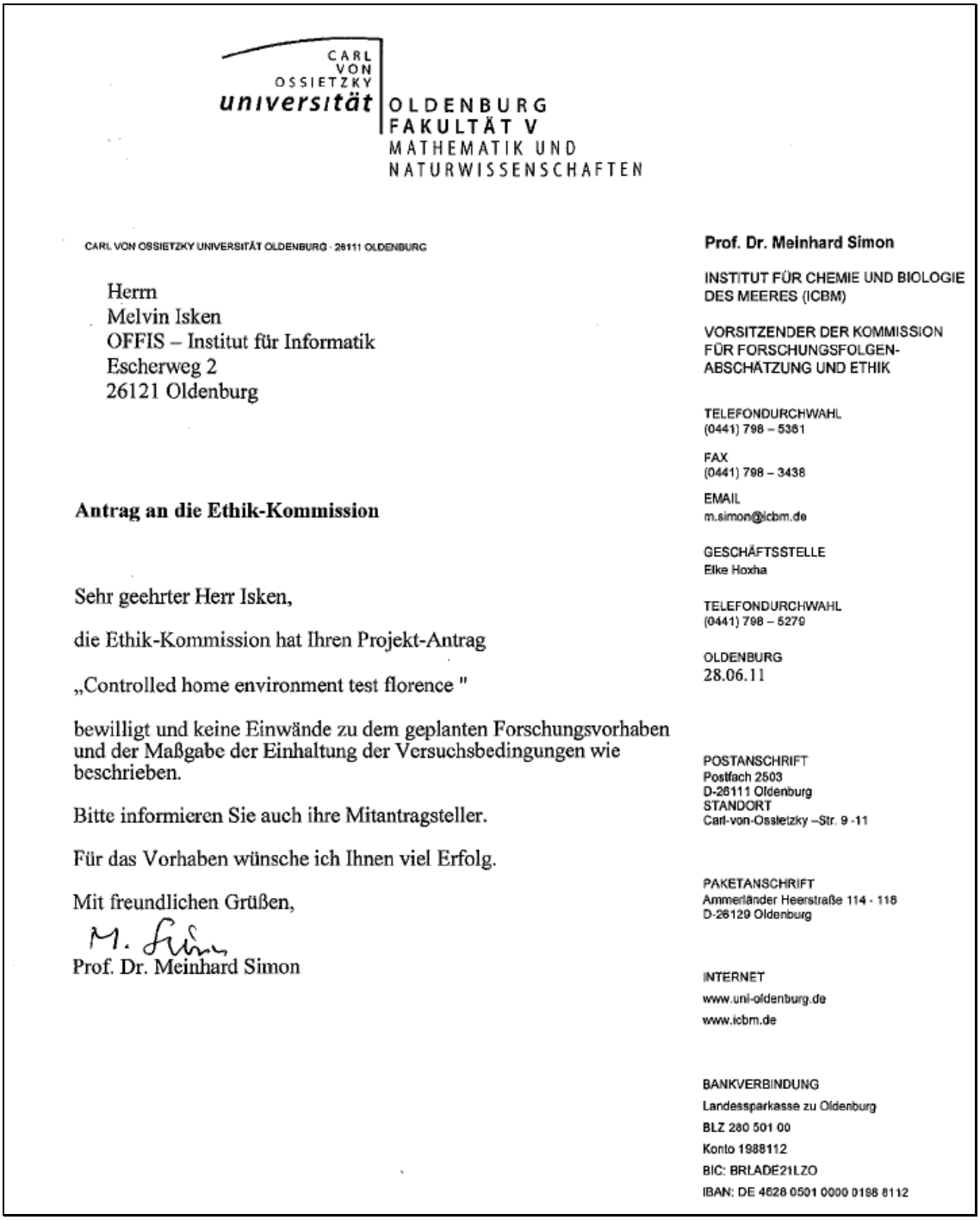
To conduct studies including real users, the ethical boards of the particular sites have to give permission to the tests. Therefore, a document describing the tests as a whole as well as the evaluation strategy and data collection guidelines has to be presented and approved. Those documents are provided here.

The application for ethical approval at the University of Oldenburg had the following structure:

- Title of the Study: “Controlled Home Environment Tests Florence”
- Applicant name
- Description of the study
- Quality control plan / short protocol
    - Goal of the study
    - Scientific background
    - Design / Implementation
    - Recruitment of test persons
    - Possible risks for test persons
    - Biometry
    - Archiving and data protection
    - Involved personnel

This document is not shown here because it is written in German completely. In Figure 9 the approval letter is depicted. It states “[...] Dear Mr. Isken, the ethical board approved your application ‘Controlled home environment tests Florence’. There are no objections regarding the study and the compliance with test conditions. [...]”.

For Philips Netherlands the ethical approval is still pending and will be released just before the tests take place because a detailed test description is necessary to get the approval. As already stated, the robot system is still under development and such detailed descriptions cannot be given by now.



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Herrn
Melvin Isken
OFFIS – Institut für Informatik
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Antrag an die Ethik-Kommission

Sehr geehrter Herr Isken,

die Ethik-Kommission hat Ihren Projekt-Antrag

„Controlled home environment test florence "

bewilligt und keine Einwände zu dem geplanten Forschungsvorhaben und der Maßgabe der Einhaltung der Versuchsbedingungen wie beschrieben.

Bitte informieren Sie auch ihre Mitantragsteller.

Für das Vorhaben wünsche ich Ihnen viel Erfolg.

Mit freundlichen Grüßen,

M. Simon

Prof. Dr. Meinhard Simon

Prof. Dr. Meinhard Simon

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Figure 9: Approval of user tests by the ethical commission of the University of Oldenburg

4 Procedure

This section describes the overall procedure on the tests will be performed.

4.1 Testing protocol / schedule / plans

For every service to test a testing protocol is made. Figure 10 shows how such a protocol will look like. The exact contents for each service will be defined if the services reach the final test-prototype status. At this point not every function that will be tested may be implemented so this will be updated before the tests actually take place.

In general a schedule like the one in Figure 10 will be created. This format has proven its use in the Wizard of Oz tests. Each test will be separated into phases which are divided into tasks. A phase can include multiple tasks. For each sequence, a duration time is estimated to get a feeling of how much time the tests will take. A description of each task enables the researcher to get an idea what should be done and which outcome may be expected.

The general setup will be as follows:

- The test person is welcomed and introduced into the facility / project etc.
- The initial questionnaire is handed out
- Then a sequence of the different scenarios will be performed. During the testing, the researcher will take some notes about the behaviour of the system and the behaviour of the tester with the system.
- Every ~45 minutes a short break will be included to avoid congestion
- After the scenarios have been tested, the final questionnaire will be filled
- The test has finished. If the test person has additional comments, these will be noted as well.

phase#	phase	task	duration total	item duration	description
			00:15		***Before the robot enters***
				00:02	Researcher welcomes participant to the room. The robot and wizard are out of sight. Researcher explains goal and structure of the session (also tells that the wizard is in the next room to monitor the robot and make sure nothing goes wrong. the researcher but does NOT reveal that the robot is actually operated by a human).
				00:03	Inform participant and ask to sign consent form.
				00:10	Pre-robot meeting interview by researcher, based on survey.
0	robot enters room	none	00:05	00:05	***Robot enters room***
				00:05	Researcher explains about the robot: looks of this prototype are not final (show picture how it might look), explains roughly what it can and can't do. Explain movement, camera (microphone), touch screen. If the robot is on the extension cord, explain that it will move without cord in a later version and ask user to imagine the cord is not there.
					Briefly talk with participant about robot (what do like, what don't you like, what do you expect). In the end ask user to imagine it looks better (like the picture).
1	voice only	commands	00:05		***1st interactive task: activity suggestion / voice only***
				00:02	researcher explains
					We've implemented some voice commands. If you want the robot to listen, you always need to say "Florence" first. This will cause the robot to turn towards you. Then you give a command.
					Let the participant try this command and robot responds by movement
					Tell participant there are commands like (note: in native language)
					"Florence: here"
					"Florence: stop"
					"Florence: go"
					"Florence: left / right"
				00:03	interaction
					Ask user to call the robot and read what's on the screen (weather report). Ask the participant to reflect briefly on how this went.
2	voice + movement	approaching	00:05		***2nd interactive task: approaching the user***
				00:01	researcher explains next task: now try to get the robot in front of you, we will try different positions, to test which fits best **(researcher presses some buttons on the base of the robot "to switch to a different mode").**
				00:04	Ask user to call the robot and read what's on the screen (weather report). Try to touch screen, which angle is good etc.
					Ask the participant to reflect briefly on how this went.

Figure 10: Exemplary schedule of Wizard of Oz tests

4.2 Testing personnel

To conduct the tests, at least three people are necessary. One person will be in charge of leading through the session. One person has to take the notes of the feedback of the test person and during the testing will also take some notes about what she observed. A third person will be incorporated to act as third party side in some scenarios. Some of those e.g. use video conferencing which needs a partner to react.

In general no technical staffs are required but it is advisable to have one person (that can have one of the other roles too) who is able to deal with technical problems of the robot which are likely to appear in this early design status. If any technical problem appears, it will be taken into account in the post-process of the data, so notes about this kind of problem should be taken.

4.3 Forms

During the testing notes about the behaviour of the system and the behaviour of the tester with the system will be taken. The staff will have a form in which observation notes can be taken (see annex).

4.4 Questionnaires

More detailed questionnaire examples can be found in the annex of this document. Every service has its specific questions to the user. To avoid confusion and too many documents for the user, only two combined questionnaires will be handed out, one at the beginning and one at the end of the tests. The length of both will be limited.

Questions at the beginning will cover general relevant demographic information, use of new technology (see questionnaire in annex) and expectation. Questions at the end here will cover all services respectively and the functionalities that will be tested.

To avoid confusion with filling out the questionnaires an interviewer might ask the questions and fill in the answers.

5 Content to be tested

This section describes the content that will be tested in the controlled home environments. Be aware that this depends on how far the software development has been completed to test the functionalities.

5.1 Scenarios

5.1.1 Common aspects (over all scenarios)

General aspects to be tested include the overall acceptance (look, size, etc.) and the handling of the robot (interface design, movements etc.)

An important aspect will be the question how the user reacts if the robot does not work as expected. The robot is in early development states and some functionality may contain errors. If the user experiences a lot of errors or one erroneous function repeatedly the overall interest in the system could be decreased.

In case of movements, different aspects have already been discussed in the Wizard of Oz tests. These aspects include the avoiding mechanisms of the robot, what happens if it is trapped and how the user should be approached. These elements have been integrated into the current system and will be evaluated.

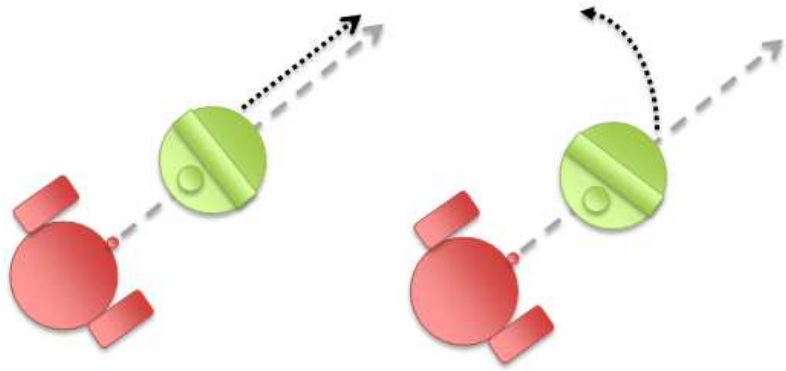

Figure 11: WoOz-Test of avoiding collisions with the user; escaping out of the path was preferred

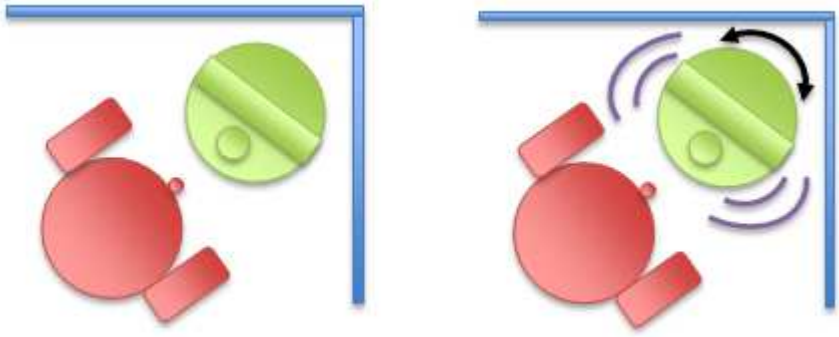

Figure 12: WoOz-Test of trapping the robot; a moving robot (that shows that he doesn't know what to do) has been preferred

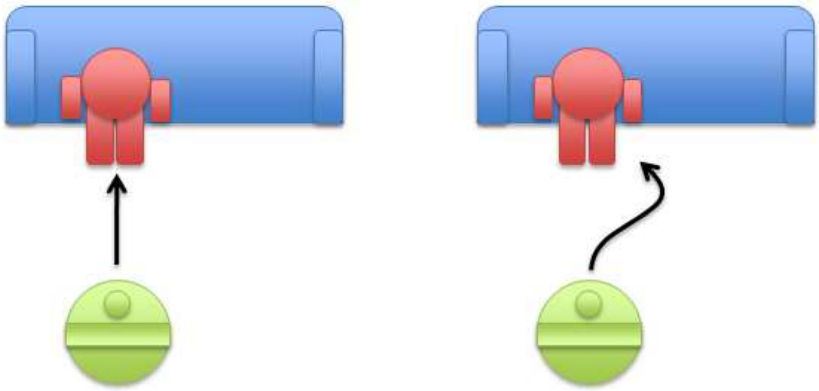

Figure 13: WoOz-Test of approaching the user; the result was not very exact, no single way was preferred over all others

5.1.2 KEETOU

The KEETOU service provides a robotic telepresence service is to increase the social connectedness of the elderly. In addition, the service will also provide a measure of the need for social connectedness by providing information to the children (number and time) about the visits the elderly receives. For privacy reasons, no distinction is made about who is visiting. To smoothen the remote navigation of the

This is based on the following hypotheses that we want to verify/validate by means of user tests:

- Robotic telepresence provides an increased feeling of presence with respect to phone and traditional video chat, both for the elderly as well as for the visitor (child, grandchild, good friend, etc.).
- The “guided remote control” provided by the robot helps in navigating the robot around preventing that the visiting person has to concentrate too much on the navigation.
- “Visits overview” is useful for children to optimise their visiting moments and to increase peace of mind.
- “Visits overview” is not seen as an intrusion of privacy by elderly people?

Test persons

Preferably elderly who have limited mobility problems, e.g. who are not able or comfortable to drive anymore, with children who cannot visit them as often as they would like to, e.g. because of distance or busy time schedules.

Phase 1: Elderly accepts an incoming telepresence call

When this tests starts, it is assumed that the elderly is busy with some activity, e.g. reading the newspaper or watching TV. When there is an incoming call, the Florence robot will make a ringing sound and the face of the calling person (e.g. son, daughter) will be shown on the screen. The robot will also move towards the elderly. The elderly can accept the call either by voice (saying “accept”) or via the touch screen of the robot by pressing the “accept” button.

Elderly moves to robot and can use either voice or touch to answer the incoming call.

- Incoming call is established. Both child (mimicked by someone from test team) and elderly

Phase 2: Scenario: Elderly establishes a call.

The elderly can initiate the robotic telepresence session by first calling the robot with its name (e.g. “Pekee or Max). On hearing its name, the robot will ask “How can I help you”. At the same time, if the robot is not close to the person, the robot will also approach the elderly person. The

actual call can be initiated in two ways: via voice or via the touch menu. In case of voice, the elderly can say “Call Anja". The robot will respond with asking for a confirmation: *“Do you want to make a call to Anja?”* the elderly can than answer “Yes” or “No”. The touch screen will show what the elderly can say. The elderly can also choose to start the session via the touch menu: by first selecting the “video call” option on the touch screen of the Florence robot and subsequently selecting the right person.

Phase 3: During the call, moving around

The elderly test person will go from the living room to the kitchen to show something in the kitchen to her son or daughter. The son or daughter should steer the robot to follow the elderly going to the kitchen.

The goal is to test the “ease of remote navigation” of the robot while communicating with another person, and to find out whether such a scenario is perceived as an advantage over static video chat or video chat via a mobile phone.

Phase 4: Family checks status of elderly

In a last phase of testing the KEETOU service, the son or daughter will use a browser to view the calendar of his/her parent and get an overview of the status of the parent, i.e. “a time-based overview of the visits of the elderly”. The test persons will be asked whether they find such an overview useful and whether they estimate that it will help them in optimising their social contact with their parents and if it would give them more peace of mind. In addition, the overview will also be shown to the elderly test person. The elderly test person will be asked their opinion on this functionality. More specifically whether they think it intrudes on their privacy too much or not and whether it also gives them a piece of mind that their children are (too a limited extent) able to track their wellbeing.

5.1.2.1 Concluding Questions to be asked

At the end of the testing of the KEETOU service, the following questions will be asked:

- Would elderly like to have an easy to use video chat solution? With whom and when would they use it (e.g. family, friends, doctor, nurse)?
- What do the family members think of the KEETOU service?
- Would elderly and their family members appreciate this communication over a traditional phone call? And over video conferencing?
- Does the senior or family member have a stronger feeling of presence?
- Is it important that you can move the robot around? That you can follow the user? In which situations is this useful?
- Does wide-angle video enhance the experience compared to normal small-angle webcams? How strong?
- Does the senior accept visitor detection? Does he/she not perceive it as an invasion of privacy? Does the family/relative appreciate the function?
- What are the main concerns?
- What other applications it could it be useful for?

5.1.2.2 Technical validation

The following technical aspects of the KEETOU are tested

- *How reliable does the current implementation of visitor detection work?*
  Test: It will be tested how well the robot can distinguish between one or two persons in the room.
- *How well does the “assisted remote control” work? How well does it prevent the robot from hitting obstacles during remote control?*
  Test: A test person will try to drive the robot around and drive the robot into obstacles.

It will be tested whether the robot will always prevent being driven into obstacles and how well the robot tries to find a suitable path around an obstacle.

- *What is the latency for the remote control?*
  Test: This will be tested by testing a robotic telepresence session over a large distance (e.g. 50 kilometres) and not only in the lab. The roundtrip latency of a robot steering command will be measured.
- *How good is sound quality especially with respect to echo cancellation and background noise?*
  Test: The maximum distance will be tested of how far the person at the robot can be while still being understandable to the other side. This will be done in different conditions:

5.1.3 LIFIMP

The lifestyle improvement (LIFIMP) service assists the user in adopting and maintaining a healthy lifestyle. The evaluation of the first implementation of this service focuses on two use-cases: (i) weighing the user and providing feedback about progress towards weight goals, and (ii) motivating the user to start a physical activity. The goals of the evaluation comprise testing the usability of the service and validating whether the robot is able to motivate the user. In addition, the evaluation is expected to generate suggestions that can be used in shaping the future behaviour and content of the service.

Execution of the test procedure requires a Pekee II robot on which the LIFIMP service and all supporting components (i.e. CMF, ROS bridge, user localization, robot navigation and planner) are installed and configured. In addition, a Withings scale must be present and configured. Prior to the start of the test, the robot is positioned away from the user and the weight scale is positioned in the bathroom. The test procedure consists of two phases.

Phase 1

In the first phase, the robot assists the user in performing a weight measurement by executing the following steps:

1. At a preconfigured time, the robot approaches the user and asks if he would like to weigh himself now. If the user responds negatively, then the robot returns to his starting location and tries again later. Otherwise, the robot accompanies the user to the weight scale.
2. At the weight scale, the robot asks the user to step on the scale and wait for the results to appear on the screen.
3. When a successful weight measurement has been taken, the robot shows the user's current weight, target weight and weight history.
4. After the user indicates that he has seen the results, the robot returns to his starting location.

At the end of this phase, the user is asked to fill in a questionnaire with the following questions:

- How do you feel about the robot approaching you on its own initiative?
- Did you feel that the robot approached you in a pleasant way?
- What do you think about the robot asking you to weigh yourself?
- How do you feel about the robot accompanying you to the weight scale?
- Did you feel that that robot accompanied you in a pleasant way?
- What is your current weight according to the robot, and how did you see that?
- Do you weigh more or less than the previously measured weight according to the robot?
- Do you think that this service could help you lose weight? Why (not)?

Phase 2

In the second phase, the robot attempts to motivate the user to start a physical activity by executing the following steps:

1. At a preconfigured time, the robot approaches the user and asks how he is feeling. Depending on the user's response, an activity is suggested.
2. The robot asks the user whether he would like to know more about the suggested activity, would like a suggestion for another activity, or would not like to do any activity.
    a. In case the user chooses to see more details on the suggested activity, the robot shows the details on the screen, waits for the user's confirmation of seeing the information, and then returns to his starting position.
    b. In case the user would like to receive another activity suggestion, step 2 is repeated with an alternative activity. If the list of preconfigured activities is depleted, then the robot informs the user of this situation, waits for the user's confirmation of seeing this information, and then returns to this starting position.
    c. If the user chooses not to perform an activity, then the robot returns to his starting location and tries again later.

At the end of this phase, the user is asked to fill in a questionnaire with the following questions:

- Do you feel that the robot approached you in a pleasant way?
- What do you think about the robot asking you how you are feeling?
- Was it difficult to answer the question about how you are feeling?
- Would you really perform the suggested activity?
- Which other activities could the robot suggest to do?
- Do you think that this service could help you to perform more physical activities?

5.1.4 FALHAN

The FALHAN service describes a safety functionality of the Florence system. The robot will be used to handle a fall alert. This alert can be detected by different specialized detection systems (which are not developed within the Florence context). The service is designed to increase the actual and perceived safety of the elderly. In the case of a sudden fall, most people are not able to call for help. The robot can act as a mobile monitor and actor and though is able to clarify the situation. The robot can locate the person, try to establish contact and trigger further handling of the situation. Another aspect is the view of the care givers which are able to do a remote check of the fall situation to decrease false alarms. This is done via a tele presence session which is established automatically. So the care giver is able to remotely control the robot and check the environment and the elderly status.

Within the Focus Groups and Wizard of Oz tests, this functionality was appreciated very much by the elderly. Now it is the question if the behaviour of the robot is developed in a right way. The movement of the robot should not be annoying or frightening. So different aspects will be primarily tested:

- Does the robot approach the user well (without scaring or frightening the user)
- In which way should the user be approached
    - At the head
    - At the feet
    - From behind
    - From the front
    - ...
- How does the tele presence session works best:
    - Use just audio contact

- Use both audio and video

- From the view of the care giver
  - Does this ease the situation handling
  - Is the remote control easy to use

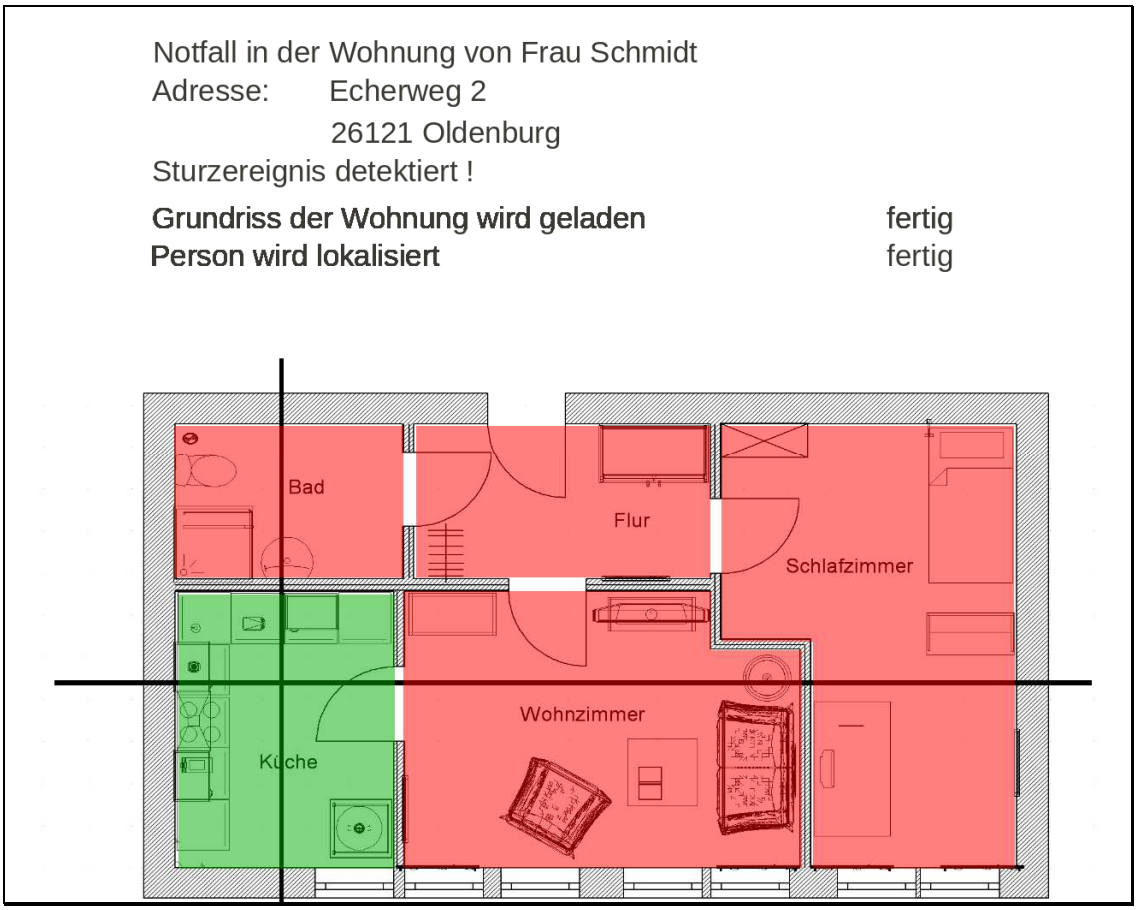

Figure 14: Screenshot of a potential care giver's view of a fall alert

Test persons

This test will be done with one elderly person and one professional person. This is because the scenario includes both the end users and the care givers perspective. It is not necessary to run the test with both parties at the same time (the respective partner can be replaced by Florence staff).

Phase 1: Fall has happened, robot handles situation

The elderly is asked to lie on the floor (this would be best for a realistic impression but if this is not possible, the elderly can stay seated on a chair). Then the alert should be triggered. This will be done by pressing an emergency button.

The robot will then approach the elderly and try to check the situation. Afterwards it will try to establish contact to the user. If this is successful and the user is ok, the alert is deactivated. If the user doesn't react, the robot will call the emergency contact (tele care centre, phase 2).

Phase 2: Tele care centre takes over control

This phase tests the interaction of the tele care personnel with the robot and the user. The tele care person will check the situation and talk to the elderly. During this talk he may steer the robot to a different position to get a better view etc.

Technical Validation

The technical validation will mostly answer the questions on

- *How intuitive is the remote steering interface*
- *How well works the integration of tele presence and FALHAN service*
- *How does the user react on the movements of the robot*
- *How should the robot approach the user*

5.1.5 LOGSYS

The LOGSYS scenario is less user interaction orientated in comparison to the other scenarios. The service logic tries to collect data and analyse it. So in this case we want to test the gait analysis that can be done by the service. To do this, the service is running all the time and collects sensor data.

Test cases that influence the user are robot-movement based. We will test how the robots movements are recognized by the user, e.g. if they are disturbing.

The analysis of the gait data is potentially not very interesting for the normal user. We plan to integrate professional users (medical personnel) as well; these can have a closer look at the data visualization interface.

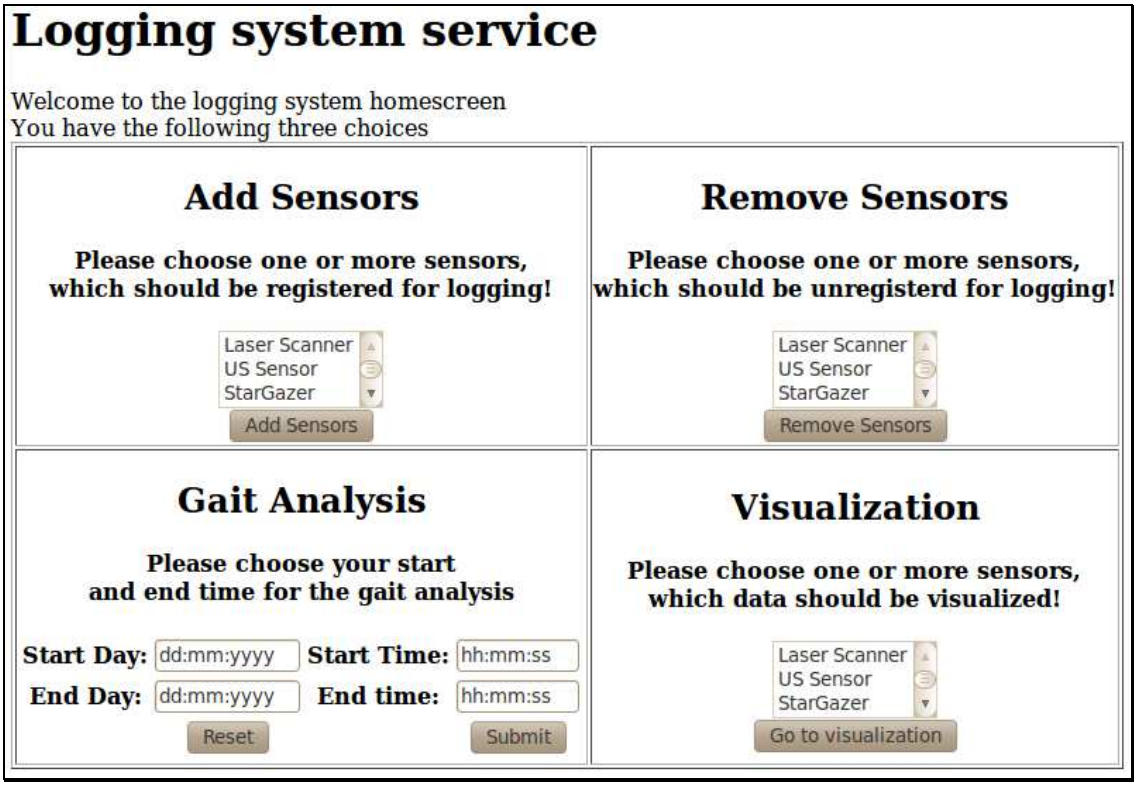

Figure 15: Administrators interface for the LOGSYS service

Test persons

The test person is the elderly that moves within the experiment setup (rooms). No other person is needed. To check the increase of use of the collected data we will have to include professional personnel. This can be included in the tests as well.

Phase 1: Service collecting data

The service should be started in the beginning and run throughout the whole testing period. This will create a greater data set to be analyzed in the end. The only thing the user will notice is that the robot will follow the user in case to always collect the best data (only in case that no other service is active and takes control of the robot). This behaviour will be tested if it is annoying or disturbing the user.

Phase 2: Analysis of data

This phase will not be conducted with the elderly as test person. This will normally not be interesting for them because it includes mostly medical statistics data. Professionals will be asked to judge if the data is useful.

5.1.6 HOMINT

The HOMEINT service tests two use case scenarios: DoorGuard Use Case and EnergySaving Use Case. In the DoorGuard Use Case, when the doorbell is pressed the service notifies the user about the event. Next, the robot moves to the location of the user and displays user interface, which includes video stream showing person at the door. The user may select from the user interface to open the door.

In the EnergySaving use Case, the service monitors the temperature in the bedroom and state of the bedroom window. Every time temperature changes the service is notified. If the temperature falls below defined threshold, the service checks the state of the window. If the window is open the service concludes that the state of the window is responsible for the fall in bedroom temperature. In this event, service moves the robot to the user locations and uses user interface to inform the user about the problem. User may choose to close the window.

The goal of the test is to verify the correctness of the implementation and the acceptance of proposed solution by end-user.

Technical requirements:

- CMF deployment
- Doorbell sensor
- Window sensor
- Temperature sensor
- Pekee II robot
- Depending services (Dialog Manager, Florence Planner)

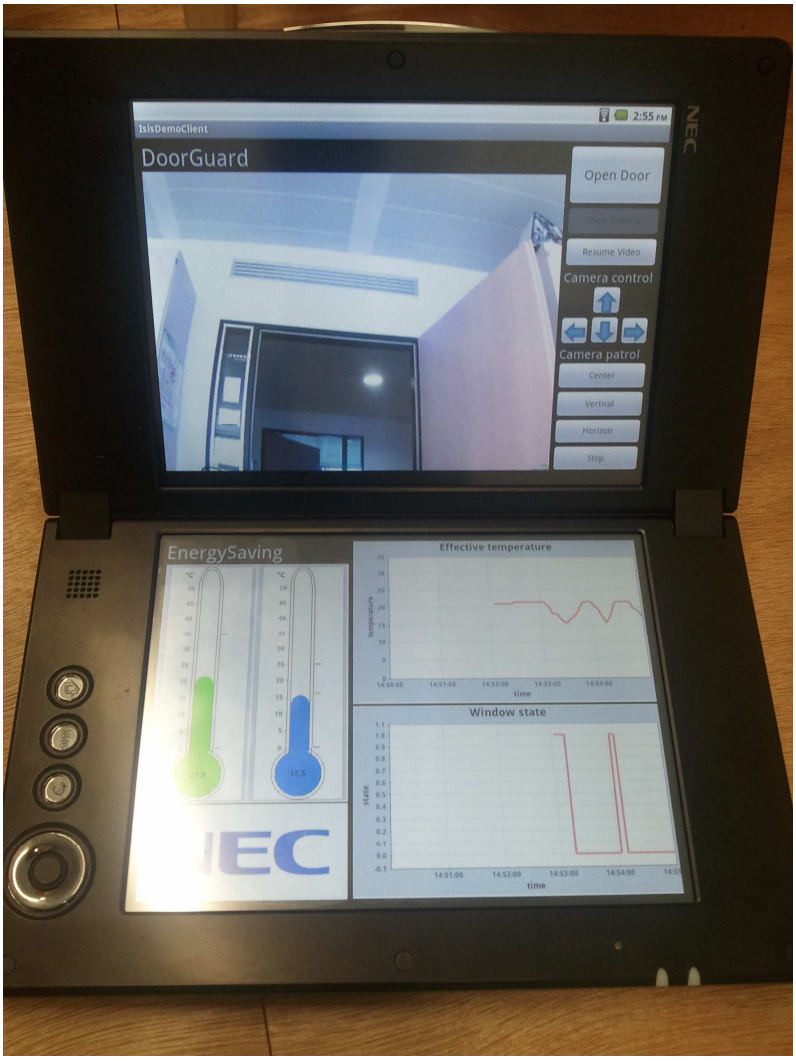

Figure 16: HOMEINT initial user interface

5.1.7 AGEREM

The AGEREM service is an AGEnda REMinder that is used to help elderly people and caregivers to know the diary routine status and the remainder for the appointments. In the case of forgetting any action the tele-assistance team can contact the assisted people enabling detecting problems in a pro-active way. AGEREM is a web service-based application that allows the Florence platform to include events in the agenda and save, edit and init the view in the robot display. We suppose for this test that in the scenario a Florence robot and a mobile Smartphone (connection by wifi or 3G) will be available for testing. It is encouraged to use the own Smartphone if the test person owns one. A fake profile will be used in order to avoid any problems with data confidentiality, also hypothetical events will be included in agenda, no real medical data or any other type will be used.

The connection for the robot (done for the tester) will be:

http://demotelecarespain.healthtid.com/telecare/index.html

The faked user will be:

User: TID

Password: 1234567

This simplifies the explanation of the service and allows observing the reaction of the user and taking notes of his doubts. The service should be as **intuitive** for elderly as possible.

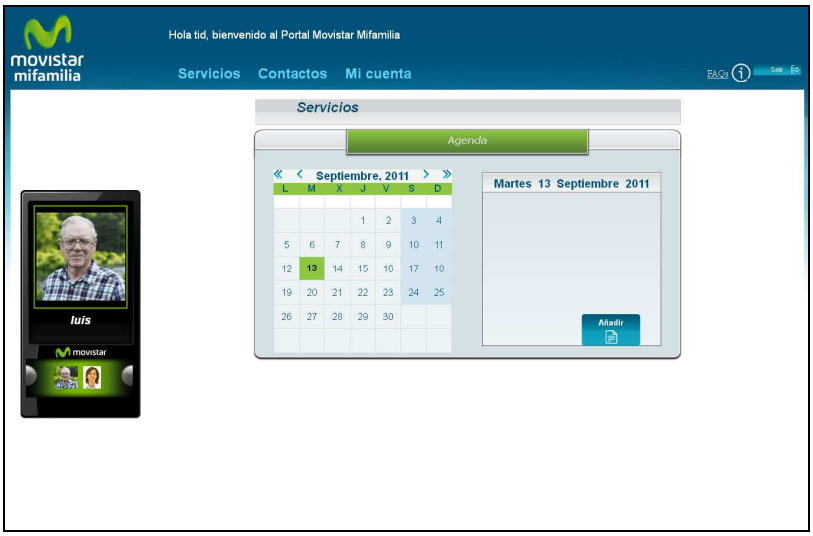

Figure 7: Screen shown to the participant. The idea is that the user tries to include an event, the interviewer will propose a "medical date" as exercise to achieve

The actual version will be translated to English but this is ongoing work. The interviewer will propose to include an event "medical date" in the calendar to the tester and takes notes for questions received and time to solve the dare. The figure 7, figure 8 and figure 9 show the screen that will allow to the elderly to include, edit and consult an event in the agenda.

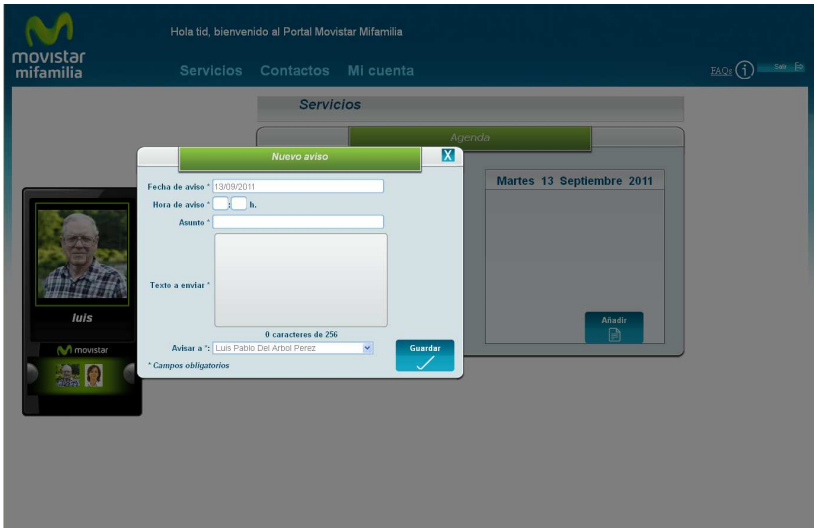

Figure8: screen to include an event

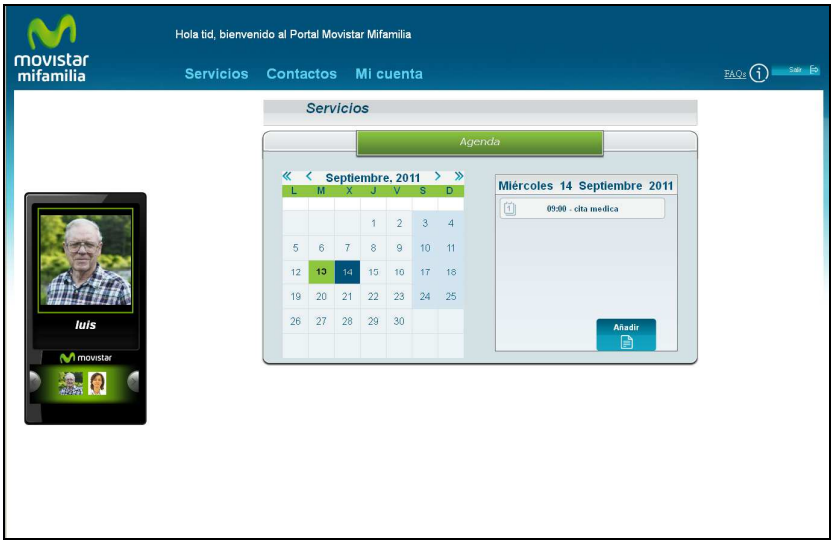

Figure 9: Event on September 14th successfully included

After the consecution of this objective the interviewer will ask to use a Smartphone mobile to consult the event. It will be noted in the interviewers notes if the elderly uses his own Smartphone or the provided one to do the test, also if he/she is able to connect by him-/herself to the web asking the URL, user, password.

In order to be as simple as possible we recommend using a tool to reduce the URL by the way: TinyURL (http://tinyurl.com/) where the following URL:

http://demotelecarespain.healthtid.com/telecare/auth/auth.html

has a length of 62 characters and results in the following TinyURL which has a length of 26 characters:

http://tinyurl.com/5rngs7y

That will be simpler to type for the elderly in his Smartphone. The objective is to observe if the elderly is capable to consult his previous date included in the agenda via web.

After the consecution of these two objectives the interviewer will present a questionnaire considering the following aspects:

- Evaluation of the profile
- Learning
- Look for the user
- Usability
- Perception of the service
- Global evaluation

Also the interviewer will take notes about questions, interest for the service, comments, time to solve the dares, and any observation that helps to offer a more intuitive agenda reminder as possible.

5.1.8 COLGAM

5.1.8.1 Introduction

The COLGAM service, whose use cases and the underlying implementation have been already described respectively in deliverables [D1.3] and [D5.3], aims to provide a transparent tool to perform a collaborative application, in this particular case a gaming application, in between two persons, the Florence system owner, and a remote partner.

The service itself aims at providing a platform through which collaborative activities can be performed. If the current application is focused on gaming activities, other collaborative activities could also be considered with some modifications. It has to be mentioned that, contrary to most traditional computer-based games, the game is here a physical one, located within the equipped environment.

Even if the service scenario embeds the complete procedure, including operations such as the autonomous platform motion towards the local user to propose the activity, the person localization within the video flow, or the autonomous motion towards the playing site, for the first trials we have decided to focus onto the core of the COLGAM scenario, which is the gaming activity itself. This corresponds mainly to the COLGAM_PLAY_SERVICE state machine of the COLGAM complete scenario, as described within [D5.3]. With respect to the complete scenario, we thus suppose that:

- On the local site, the person and the Florence robot are nicely located around a table where the game is taking place (see **Figure 17**).
- On the remote site, the person is in front of a computer equipped with a camera, and connected to the Florence website.
- Both sites (Florence robot's Touch PC and remote computer) are connected through a videoconferencing system.

Figure 17: Illustration of the local playing site. The person is seated at a table onto which the game components are available. The Florence robot is located in front of the person, enabling a videoconference to take place with the remote user. The positioning of the different components in the space (distance robot-table, distance robot-user, game's position on the table, table dimension,…) is still to be defined. The remote site, more conventional (person seated in front of a PC screen, with access to a mouse) is not represented.

5.1.8.2 Special requirements on the target group

The target group should fulfil the following requirements:

- Have enough understanding of the proposed games[1] or capabilities to understand the game rules.
- Be able to locate itself in front of the robot on the table (accessibility should provided if the user suffers from mobility impairments).

It would be good if some of the users are in a context in which social activities do not occur as often as wished, which could be caused by several parameters:

- Friends and family living far away.
- Home restricted for any reason.
- Fewer daylight hours than in other seasons.

5.1.8.3 Special requirements on experimental site and equipment

The following equipment is required in the controlled environment:

- A table and a chair where the user can sit to play, This equipment is to be placed within a room presenting enough place to have the robot positioned in front of the user, at the opposite side of the table (see **Figure 17**). .
- In another room (at least in a site located out of the user's field of view), a standard computer with a sufficiently sized screen, equipped at least with Google Chrome and of a standard webcam for performing videoconference. This PC should be able to connect to the Florence system.
- Different games (memory cards, big size playing cards)
- A coloured cardboard onto which the game will take place (i.e. the game components like cards will be placed onto this sheet). Naturally, this cardboard will be placed onto the table previously mentioned.

It has to be mentioned that any restrictions onto the location of the robot, the game position on the table, will be specified before the experiments,

The robot must be equipped with the devices broadly used in the project, such as the Kinect sensor or the fish-eye camera used by the KEETOU service for teleconferencing[2]. In addition to these components, the robot must be equipped with an additional camera with a narrow field of view, and mounted onto a support providing pan and tilt motion capabilities. This sensor will enable the remote user to get a more précised view of the game site (and the remote interface will enable to control this camera, as illustrated onto **Figure 18**). This sensor and its support will be provided by the COLGAM service owners.

5.1.8.4 Test configuration and presentations

As mentioned in the introduction, we suppose that the environment (robot, local and remote users) is in the configuration related to the gaming context:

- As illustrated onto **Figure 17**, the local user and the robot are nicely positioned around the table onto which the game is located and the gaming activity is taking place.
- The gaming components (like cards) are positioned onto a coloured cardboard

[1] To improve the involvement of the tester, several games (mainly card games) will be proposed, so that the user will be able to choose the one he prefers to play with. The list of games to propose is still to be defined, in collaboration with the persons in charge of the tests.

[2] The use of the fisheye camera from the KEETOU service is not mandatory, a regular camera, or the camera of the touch screen could also be used. This aspect is still to be decided in collaboration with the KEETOU service owners, depending on the ease of mounting such physical devices onto the robots used for the tests.

- The two persons are playing together through the extended videoconference medium provided by the robot.
- The local person can see on the touchscreen PC the remote player. She can also visualize some indications provided by the remote player onto this screen. She is in charge of the game: she handles the game components when needed (depending on the game, move a piece, move a card).
- The remote person visualizes two views on its screen: one corresponds to a wide field of view of the local site, enabling to discuss with the local person. The other view corresponds to a narrow view of the gaming location, enabling to have a more precise view of the game components. Through a web page, the remote user can give motion orders to the narrow camera, and also display some simple boxes to indicate specific information she would like to share with the local user (such as a specific position, or a card to move, …) (see **Figure 18**). This information is then transmitted to the local user, and shown as an image onto the touch screen.

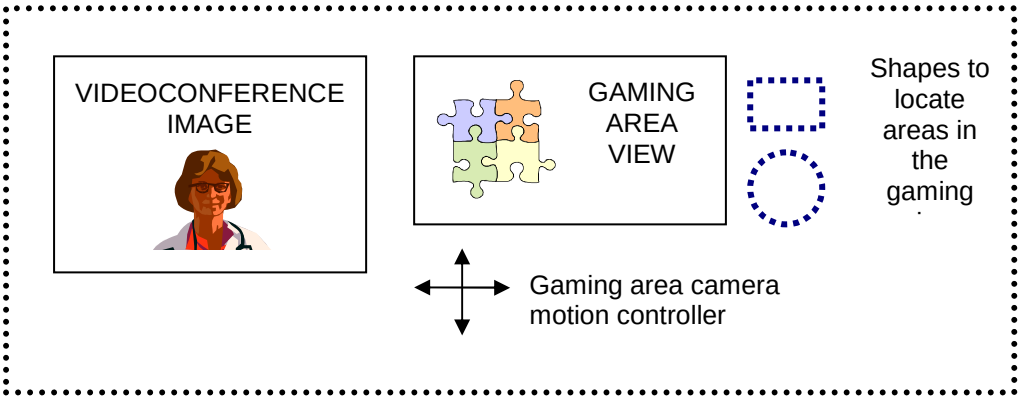

Figure 18: Draft schema of the remote user's view on the PC screen

The game to use is to be selected by the user in between several games, so that he can choose the game he is more confident and/or happy with. For the first testing the games proposed might be limited to cards-based ones.

It can also be mentioned that two persons are involved in this activity: the local user and the remote person. We would propose to use a person from the technical staff to act the second partner. Furthermore, it would be also appreciated to have the user playing the local partner, during 5 to 10 minutes, and then playing during a similar time the role of the remote player, so that the service can be evaluated onto the two sides. As an introduction, the previous text could be presented to the user, and then, the videoconference media could be used to provide, in a collaborative way of course, a description of the current scenario, and of the capabilities it provides.

5.1.8.5 Interesting topics for questionnaire

The objectives of these tests are to evaluate and validate the current state of the scenario, the acceptance, usefulness and usability of the application, and to evaluate the extensions that have been already envisioned for the next and final version

During the testing the staff will observe and check the following relevant points to measure the usefulness and usability of the application:

- Is the application easy to use for the user? (Easy to use = No more than 3 tries to perform each action)
- Can the user perform the actions without problems? If not, which are the problems?
- Can the user learn easily how to perform the actions?

- Is the user entertained or is the user bored?
- Is the user concentrated in the task being developed?
- Does the user stop playing before finishing the test?
- Are the instructions (written, spoken, etc.) understood by the user?
- Does the user need external help during the test?
- Does the user make gestures to communicate with the robot? Which ones?

After the two consecutive trials, the person will be presented a questionnaire, considering the following aspects:

- User experience with new technologies:
  - Does the user regularly use television, HIFI,…?
  - Does the user regularly use mobile phones or smart phones?
  - Does the user regularly use computer?
  - Does the user regularly use any other kind of new technologies (hard-drives, pen-drives, video-games,…) ?
- Evaluation of the videoconference flow convenience for discussing with the partner (from both local and remote site).
  - Could you talk easily to your gaming partner?
  - Did you like talking to your gaming partners?
- Evaluation of the sensation of being playing with the other player.
  - How much do you feel you interacted with the other player?
  - How much do you think the other player helped you when performing the game?
  - Did you feel close to the other player?
  - Is there anything you missed that would make you feel closer?
- Evaluation of the contribution of the second camera (gaming area view) *(remote player)*
  - Is the view provided useful? Could you follow the game easily?
  - Is the camera easy to control? Would you prefer to click on the screen and have the camera directed to that spot automatically?
- Evaluation of the appearance of the second camera *(local player)*
  - Is this second camera moving disturbing you while playing?
  - Taking into consideration its role in the application, is it acceptable for you?
- Evaluation of the “send suggestion” relevance, locally and remotely. Focusing on the objective of this operation.
  - *(local player)* Did you like it when the remote user sent you suggestions? Was it helpful?
  - *(remote player)* Did you enjoy appreciate sending suggestions yourself? Do you think it was useful? Do you think it was easy to do?
  - *(both)* Does it add significant content to what can be shared through speech? Does it make communication easier?
  - *(remote)* Comments on other ways if any to “send suggestions”.
  - *(local)* Would you like to have similar tools to send visual information to the remote user (like “look here”)?
- Evaluation of the pointing detection capability (still to be implemented). In the future the Florence system will be able to understand pointing gestures. When playing, the local

player will be able to point to certain areas and the system will immediately focus the camera onto that area for the remote player to see.
    - Would you like to test this?
    - Did you feel the need as a remote or local user of such a capability?
- Evaluation of the local and remote interface content (without considering the current light implementation).
    - In your point of view, is there any functionality missing?
    - Was the interface easy to use? Was it difficult or easy to learn how to use it?
    - Was the information on the screen clear enough to see?
    - Are the icons used appropriated? Is the meaning of the icons understandable?
- The variety of games to choose from is limited at this stage. Depending on the first impressions and the users preferences:
    - What are the other games you would like to have implemented?
- In comparison with a classical computer game application:
    - Does the fact of playing to a real (physical) game instead of a computer-based one change the experience? If yes, how? Which one do you like best?
    - Does the activity remain interactive and collaborative despite the distance?
    - Would you like to have such system to play with friends or with grand-children?
    - Would you like to have such kind of activity with more than one person (like two or three other persons), or do you prefer to just play with one person?
- In comparison with a classical game:
    - Even if it is of course more traditional to have the two players located onto the same site, in comparison to a real game, do you feel that playing this way is a nice experience?
- Usefulness of the service.
    - If you had the Florence system at home, would you use this service every day? Every week? Every month? Never?
    - Would you appreciate that the robot proposes you to start a game, or do you prefer to decide every-time when to do it?
    - Is this kind of service useful for you?
    - Do you think this service could help you increase your social connectedness?
    - Can you see which other tasks you could share along this service? (if user does not express new activities suggest if they could see themselves sharing pictures or helping grandchildren with homework through this service)

The main points of the evaluation described here are meant to evaluate the collaborative gaming idea without focusing onto the current implementation. We also expect to ask the opinion of the person on components still to be implemented, taking advantage of their first impressions to better evaluate and confirm the extensions we are planning to implement. It can be added that in this first description of the scenario, the way to rank the answers (as it is done in the example provided in Annex) is still to be defined. Indeed, we prefer to let it open right now, with the objectives to use a common graduation with the other service questionnaires.

6 Evaluation

For the evaluation the data will be divided into two different groups: data from observation (collected using the form) and data from interview (collected using the questionnaires). Both groups will be divided into two different sections: quantitative data and qualitative data. Qualitative data transformed into quantitative will be taken into account as quantitative.

In the case of data collected during the interview it also will be divided into two different sections: data collected before testing, and data collected after testing. The data collected before testing will be used to classify the testers into different groups: people with a lot of experience using new technologies, people with no experience, etc.

6.1 Templates for result collection

In the case of quantitative data the mean and the percentages of number of users that answer each option will be calculated.

Qualitative data will be transformed into quantitative in the cases that it is possible. For example, trying to transform answers into three groups: negative, positive and neutral. Using this information, qualitative data could be then processed as quantitative data using the same templates.

6.2 Perspective for living lab tests (real homes)

The controlled home environment tests are preliminary tests for the real home trials next year. Technical issues should be raised and solved before the real home experiments are conducted. These controlled tests will provide valuable details which aspects are specifically interesting within the real user tests. The simulated real environment will give hints on which problems may arise in the real test and how to counter these.

7 Conclusions

This document describes the process and preparation of the controlled home environment tests to be conducted by the Florence project. These tests include a first setup with a working prototype and real users that test the system in a controlled environment which means that the tests take place in the OFFIS and Philips living labs. Ethical approval has been obtained and the overall planning and setup is finished. The scenarios have presented the test cases that will be checked with the elderly participants. Since the final testing-robot-system is still under development, different aspects mentioned here can slightly change in the real tests (to be done in November 2011). This is the reason why no final schedules and forms could be presented; they depend on the final status of the robot system.

8 Annex I

8.1 Observation form

Observation form	
Reactions: first impression (please note if users had seen it before in sketches, in real or not at all; note also all comments made by them)	
Rejection to use the platform? (reasons)	Yes
	No
Interaction (specially in services, touch screen, audio and via gestures; try to observe mental logic behind the interaction, users may be asked to use the 'think aloud' technique http://en.wikipedia.org/wiki/Think_aloud_protocol)	
Number of tasks to be performed	
Tasks performed correctly	
The user finds very difficult to make the tasks (very difficult = more than 2 attempts needed)?	
Someone has to help the user (num. of times)	
The height of the robot is	Low
	Correct
	High
The size of the screen is	Small
	Correct
	Big
The instructions can be properly understood given through	Speech synthesis/TTS
	the screen
Are there any problems with the interaction with the screen? Which kind of problems?	
Are there any problems with the interaction with the voice? Which kind of problems?	
Are there any problems with the interaction with the gestures? Which kind of problems?	
Can the user follow a conversation with the robot?	
Does the user use the name of the robot to call it?	
Does the user use pet words to call the robot?	
Does the user make gestures to communicate with the robot? Which gestures?	
Interaction: User approaching robot	
Distance between robot and user (approx.)	

Interaction: Robot approaching user	
Related to the tasks, the movements of the robot are	Slow
	Proper
	Fast
Reactions to: **a. Episodes that made the user frustrated** **b. Episodes that made the user happy/ sad/ angry/surprised** c. **Episodes where the robot malfunctioned**	
Is the user anxious to use it? (reasons)	
Is the user sceptical to use it? (reasons)	
Does the user fell intimated by the robot? (reasons)	
Features of the room that can influence the experiment	
Are there any visibility problems? Which kind of problems?	
Are there any sound/acoustic problems? Which kind of problems?	

8.2 Questionnaire documents

Experience with new technologies	
Do you have mobile phone?	
What kind of task do you do with your mobile phone?	Only calls
	SMS
	MMS
	Photo/Video camera
	MP3/radio
	Internet
Do you use TV/radio usually?	
Do you have computer/laptop?	
What kind of tasks do you do with the computer?	Manage photos
	Documents (word, excel, …)
	E-mail
	Surf on internet
	Video/audio conferences (Skype)
	Watching video/listening music

Do you have any other new technology (multimedia hard-disk, video-camera, digital photo camera, video, etc.)?	

Exemplary Questionnaire for *some* aspects of AGEREM:

AGEREM web		
Profile		
How often do you connect to internet?		Several times
		At least one time
		None
Do you use some social network in internet		
How many relatives do you contact		
Look		
Does he like the menu's options and the portal?	Emergency	Much
		Few
		Nothing
	Localization	Much
		Few
		Nothing
	AGEREM	Much
		Few
		Nothing
	Contacts	Much
		Few
		Nothing
	Send changes to the terminal	Much
		Few
		Nothing
	Change photo to the asisted	Much
		Few
		Nothing

8.3 Questionnaire contents

These are some questions that could be asked per service within the user interviews. Since the time for these interviews is limited, we can't ask a huge number per service. So a selection of questions that are related to more than one aspect are desired.

KEETOU

- Is this action an intrusion to your privacy?
- Is it useful to make the robot move while talking to a relative with this service?

LIFIMP

- Has the approach been appropriate?
- Would you like to be weighted often?
- Will this service help you lose weight?
- Will you follow Floras indications and advices?

FALHAN

- Do you think it is safe when the robot approaches you?
- Are you worried of your privacy in this situation?

HOMINT

- Would you like to hear an alarm every time something wrong is detected?
- Will you feel relief knowing that with this service you house is under control?

COLGAM

- Is it comfortable using this service?
- Would you arrange meetings in order to play with relatives?
- Would you like to leave the option open for your relatives to call you anytime they want to play?

AGEREM

- Do you like the way to program your reminders?
- Do you like the way in which it notices you?

FAMILY

- How do you consider the overall movement of the robot?
- Do you think the overall interface of Flora is good? (sounds, display)
- Is the movement safe for your relative?
- Would you feel safer for your relative if Flora is functioning at your relative's home?
- Do you think Flora design is friendly?
- Are the functionalities shown really useful?
- Apart from its functionalities, do you consider Flora would be a burden at the beginning?
- Do you think that one month is enough time to get your relative and yourself used to Flora?

PROFESSIONALS

- Will Flora help you to deliver your service?
- Will the quality of your service improve with Flora?
- Will your work be easier for you?
- Do you think the way in which Flora moves is good?
- Do you see risks at the Flora system?
- Do you see Flora as an easy to use system?