**AAL Joint Programme**

HOME4DEM

HOME-based ICT solutions FOR the independent living
of people with DEMentia and their caregivers

# D1.3 – Results of the preliminary system evaluation

| | | | |
|---|---|---|---|
| **Project acronym:** | Home4Dem | | |
| **Project name:** | HOME-based ICT solutions FOR the independent living of people with DEMentia and their caregivers | | |
| **Call:** | AAL call 7 2014 | | |
| **Contract no.:** | AAL JP reference: AAL 2014-1-041 | | |
| **Project Duration:** | 01-09-2015 28-02-208 (30months) | | |
| **Co-ordinator:** | 1 | National Institute of Health and Science on Aging (IRCCS-INRCA) | INRCA |
| **Partners in the project:** | 2 | ArieLAB Srl | ARIELAB |
| | 3 | i-Home Lab | i-Home |
| | 4 | University of Lund | ULUND |
| | 5 | Eichenberger-Szenografie | EIS |
| | 6 | DOMO SAFETY | DOMO |
| | 7 | Trelleborg Kommunen | TREL |
| | 8 | Karde AS | KARDE |
| | 9 | AUTOMA Srl | AUTOMA |

Project co-funded by

AAL PROGRAMME

The Research Council of Norway

VINNOVA

Project Partners

DOMO SAFETY

i|Home|Lab

TRELLEBORGS KOMMUN

LUND UNIVERSITY Faculty of Medicine

eichenbergerszenografie

Karde AS

Ulster University

byautoma.com

JP reference: AAL 2014-1-041

# Home4Dem

HOME-based ICT solutions FOR the independent living
of people with DEMentia and their caregivers

# D1.3 – Results of the preliminary system evaluation

Due date of deliverable: 31.12.2016 (M16)
Actual submission date: 20.03.2017 (M19)
Start date of project: 01.09.2015
Duration: 30 months
Organisation name of lead partner for this deliverable: ArieLAB

| Dissemination level | | |
|---|---|---|
| PU | Public | PU |
| PP | Restricted to other programme participants (including the Commission Services) | |
| RE | Restricted to a group specified by the consortium (including the Commission Services) | |
| CO | Confidential, only for members of the consortium (including the Commission Services) | |

| History chart | | | | |
|---|---|---|---|---|
| Issue | Date | Changed page(s) | Cause of change | Implemented by |
| v.1 | 15/11/2016 | | Initial draft of the deliverable | Susanna Spinsante |
| v.2 | 28/12/2016 | | Added section on DomoSafety system | Solene Buet |
| v.3 | 30/01/2017 | | Added part about the depth-based processing for food intake monitoring | Susanna Spinsante |
| v.4 | 31/01/2017 | | Added details to section 2.3 | Paul Schmieder |
| v.5 | 10/02/2017 | | Section 3.1 completed | Solene Buet |
| | | | Section 2.5 completed | Paul Schmieder |
| v.6 | 22/02/2017 | | Section 2.6 completed | Roberta Bevilacqua |
| v.7 | 15/03/2017 | | Section 3.4 completed | Susanna Spinsante |

# Table of Contents

# 1. Introduction

## 1.1 Scope of this document

Technical tests, as obvious, represent an important step in approaching the piloting phase of the Home4dem R&D project. They are aimed at ensuring the proper functioning of the technological devices used, the correct execution of expected operations and data flow, in order to reasonably assume a suitable degree of reliability from the use of the technology itself.
Tests will be performed in different sessions along project duration, to provide continuous refinements before the actual system deployment. On the end-user side, rapid testing techniques will be designed and applied to evaluate the user experience since the beginning, involving, at least, 10 dyads in each piloting country (IT, CH, NO, SE). The results on rapid testing are not covered by this document as they pertain to a different WP and task.

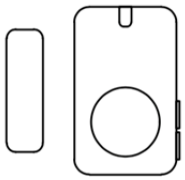
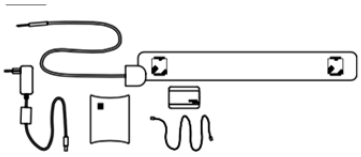
This document focuses mainly on the procedures adopted to test the technical components of the Home4Dem platform, and the associated functions and services related to data transmission and processing. It is intended as a work-in-progress deliverable, as technical tests will be periodically iterated on the system components, being subjected to refinement and update during the execution of the project activities. To this aim, the test methodology to apply is described in a step-by-step fashion, in order to ensure a repeatable set of operations.

# 2. Description of the test methodology

## 2.1 Methodology for the technical test of the DomoSafety platform

The technical tests of the DomoSafety platform aim at verifying the correct transmission of the sensor-generated data to the remote platform, upon which integration takes place, at the service-level.

| What to test | How to test | Expected Outcome |
|---|---|---|
| Test that the Base Unit is properly working.<br>  | Plug the square device with the black charger in the back.<br>  <br>Remove the white cover in the back and insert a valid SIM card that support GSM communication (minimum 50Mo).<br>  <br>The Base Unit will first ask you the language to set up:<br>Push the button 2 to select the language you desire and confirm with the orange circle button. You can change the language by holding the cancel button on the side (orange) until hearing a bip (still hold cancel) and push the 2 button, then release all buttons. You can now re-select the desired language. | The Base Unit should echo that the setup is complete and the connection is working by speaking tree times. |

| | | |
|---|---|---|
| | The Base Unit will then start to connect itself to the network and will speak tree times before the setup is complete. It is mandatory to wait until this process is finished. | |
| The devices are properly paired with the Base unit.<br>  <br>  <br>  <br>**Important**: the pairing is essential to the installation, but the verification through the sounds of the devices in pairing mode is not mandatory but recommended to check that the devices are at a correct distance of the Base Unit. | For that purpose, put the Base Unit in pairing mode by pushing the cancel button on the side (orange) until hearing a bip (still hold cancel), then push the 1 button, then release all buttons. You are now in pairing mode, and every event produced by the paired device will make a bip sound. This is particularly important to verify the range of a device compared to the Base Unit distance when installed in the apartment/house.<br><br>Put now all batteries in the devices.<br><br>To **pair the devices**. If the device has never been installed, it will automatically pair with the Base Unit. If not new, you will need to reset it:<br><br>a. Motion sensors: Hold the black circle button on the back of the motion sensor so a blue light is appearing until it starts blinking. You will hear a bip from the Base Unit. Test: you can test its pairing by pressing once the black button.<br><br>b. Door sensors: Press the two side buttons at the same time until the LED is blinking red. Then press once on the button the closest to the LED. You should also hear a bip that confirms the pairing. Test: Take the magnet and approach it from the sensor to create a “close” event and remove it to create an “open” event.<br><br>c. Help Button: Press the button for 20 seconds until the red light is blinking fast. You need to see the red light on the button while pressing it. Test: Press on the button to hear the | All devices are triggering bips in pairing mode. |

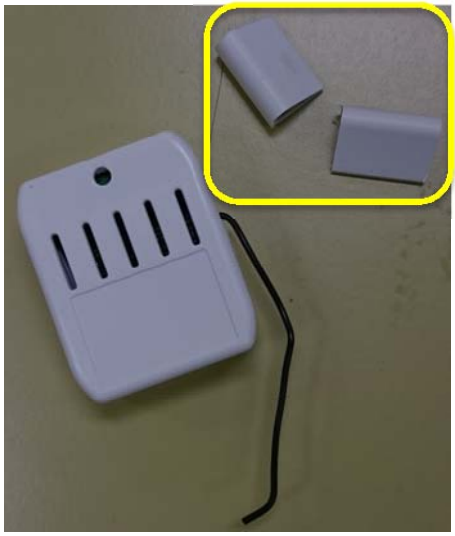
| | | |
|---|---|---|
| | Base Unit producing a bip.<br><br>d. SafeBed sensor: Same as the Door sensor as it is the same device connected to the SafeBed. It does however need to be calibrated.<br><br>Instructions for **Calibration of the bed sensor**:<br><br>The sensitivity to notice correctly that person is in or out of bed, is adjusted in calibration mode. First the person to be monitored should be in bed and resting (not moving, talking or else) at least for one (1) minute until green light starts to blink with same speed as blue light. Control unit should lay on a table or be fixed on a wall. Sensor must be in its correct place under mattress. Start calibration by pressing three (3) times the SW1 switch. You will hear 3 times low and high tone (kind of bu-beep, bu-beep, bu- beep). The calibration takes 18 seconds. If calibration was successful, the confirmation sound is the same 3 times bu-beep again.<br><br>Now that the devices are paired, place the devices in their right location in the apartment and create events by:<br><br>a) opening and closing doors with door sensors (fridge and entrance). You should hear a bip.<br><br>b) Sitting for more than 20 seconds on the bed where the bed sensor is and get up. You should hear a bip.<br><br>c) pressing on the motion sensor black button in the back. | |

| | | |
|---|---|---|
| The devices are registering events properly on the DomoSafety Platform.<br><br>The DomoInstall tests are mandatory to finalize the installation contrary to the previous test. | During the installation, the installer will use the DomoInstall application. Once all devices are paired and manually tested, the installer can launch the finalizing tests on the platform.<br><br>To do so, click on the "Test All" button in the application and repeat the tests a) and b) enumerated above. The motion sensors will be automatically testsed. The tests are running for a maximum of 6 minutes. You also have the possibility to run the tests individually. | All tests on the platform are passed and the DomoInstall application is showing green approval for all devices installed. |
| The devices are correctly sending their events to the data storage Pryv on the anonymized Pryv account of the participant. | 1. Connect to the user Pryv web page at the following address:<br><br>**username(anonymized).domocare.io**<br><br>2. Enter the credentials according to the user account<br><br>3. Create an event for each device:<br><br>a. Open and close the doors with door sensors (fridge and entrance)<br><br>b. Sit for at least 20 seconds and get up from the bed with the bed sensor<br><br>c. Pass by all the motion sensors to create motion<br><br>4. Check in the pryv user account and its streams that the events arrived and have been written in their corresponding streams. If an Emfit QS is installed instead of an Emfit SafeBed (sensor integrated in DomoCare solution), check in the "emfit" root stream instead of the "domocare" root stream. | All events are recorded properly in their stream and can be found on the Pryv account of the participant. |

## 2.2 Methodology for the technical test of the UpTech platform

The technical tests of the UpTech platform aim at verifying the correct transmission of the sensor-generated data to the remote platform (Pryv), on which integration takes place, at the service-level.

| What to test | How to test | Expected Outcome |
|---|---|---|
| The UpTech kit is switched on and ready to operate | 1. insert batteries into sensor devices<br>2. connect the upTech box to the power plug<br>3. switch on the UpTech box using the available button on the box<br>  | a. The UpTech box is properly powered: the led located in the front panel is ON<br>  |
| The UpTech kit is connected to the WiFi local network | At present, the network configuration is cabled within the code executed by the RaspberryPi at the core of the UpTech kit.<br><br>Future development: add a network parameters configuration dialogue box to the web interface used to configure the UpTech kit. | Network connection should take place automatically. |
| Sensors' state variations(*) are properly detected by the box and the corresponding events are written onto Pryv | 1. force the state variation of sensor *x*(**)<br>2. check that the event generated by sensor *x* is written into stream *X* in Pryv and available on the platform:<br>2.1 open web page: *arielab.domocare.io*<br>2.2 access with credentials:<br>*user:* ***arielab*** | a. For each sensor type *x*, a specific stream *X* has been created in Pryv<br>b. All the events generated by sensor *x* have been written in *X* (events are grouped by streams):<br>**sensor (stream)** / **state (event)**<br>water / ON |

<table>
<tr>
<td></td>
<td>
password: home4dem<br><br>
2.3 check that the events have been written in the Pryv streams<br><br>
At present, credentials are cabled in the code executed by the kit.
</td>
<td>
<table>
<tr><td>smoke</td><td>ON</td></tr>
<tr><td>motion</td><td>ON</td></tr>
<tr><td>door</td><td>OPEN<br>CLOSE</td></tr>
<tr><td>bed</td><td>IN<br>OUT</td></tr>
</table>
</td>
</tr>
<tr>
<td colspan="3">
(*) Sensors tested in the UpTech kit: magnetic sensor (applied to door or window), smoke detector, water-on-the-floor detector, PIR, bed sensor (under the mattress).<br><br>
(**) How to force the state variation of a sensor x:<br><br>
x = magnetic sensor -> close/open the magnetic contact (highlighted in yellow in the picture)<br>
 <br>
x = smoke detector -> activate the smoke detector by generating artificial smoke<br>
 <br>
x = water-on-the-floor sensor -> activate the water detector by contact with water (in the following picture, the water-sensitive pins on the detector are shown)
</td>
</tr>
</table>


*x* = PIR sensor -> activate the sensor by motion

*x* = bed sensor -> generate artificial events by acting with a pressure/release on the bed sensor lasting for some seconds (more than 3)

The bed sensor needs to be calibrated before use. In fact, with a typical bed sensor, the total weight on the sensor equals the weight of the mattress, plus the weight of the monitored person. The adaptive bed sensor included in the kit cancels out mattress weight, making it usable for most mattresses.

The installation and calibration process take place as follows:

a. connect the bed sensor mat to the control unit by the included cable and connector. Check that the control unit is powered by batteries;

b. using the included black cable, connect the control unit to the UpTech monitoring system;

c. place the bed sensor between mattress and foundation. Locate where most of the person's weight is incident. This is usually anywhere from hips to waist area;

d. the cable should be on the opposite side of where the person gets in/out of bed;

e. to calibrate, verify that the bed is unoccupied. Locate the button on the control unit (see red arrow in the picture below) and hold it down until the LED (highlighted in yellow in the picture below) turns on.

## 2.3 Methodology for the technical test of the integrated H4D platform

The technical tests of the H4D integrated platform aim at verifying the proper functioning of any process or device that has to write or retrieve data to/from Pryv.

Some services write data into Pryv streams; other services retrieve data, process them, and write back new information on Pryv. As the integration of all these services happens at the data level, tests will solely address the functionalities (i.e. reading/writing from/to Pryv) as opposed to the internal workings of specific H4D elements (e.g. fall detection).

At a basic level the tests include:

- Testing the “write sensor data to Pryv” function
- Testing the “retrieve sensor data from Pryv” function
- Testing that services are notified for the events they have registered for.

There are also tests that check the validity of the data as well as its management. This includes checking:

- If the required Pryv accounts exist and all services have access.
- If the expected data streams have been created on Pryv.
- If the data sent from the sensors belonging to DomoSafety, UpTech kits and iHomeLab’s Multisensor have been correctly stored in each stream.
- Testing the Pryv “backend” that reacts to data being read/written to/from Pryv
    - Testing the “push notifications from Pryv” function
    - Testing access control
- If the behavioural analysis engine is able to retrieve from Pryv the necessary data, and to write the generated information.

## 2.4 Methodology for the test of the Depth-based analysis

### (applicable only to those cases where the Depth processing component of the system is foreseen)

In some specific installations, the presence of a depth-based food intake monitoring system is foreseen, as a part of the H4D platform.

In the configuration designed for the H4D platform, a Microsoft Kinect sensor is installed on the ceiling in top down view, to monitor an area of interest in which a table is located, where the monitored person has meals.

Kinect can provide different types of data, but only the depth stream is exploited. In this configuration, the sensor located at an height of 3 meters from the floor allows to have the area of interest included in a frame:

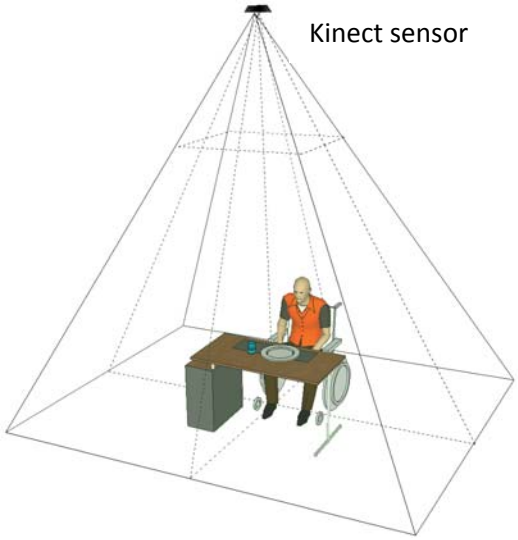



Figure 2.4.1: Top view installation of the kinect

The algorithm that processes the depth signal generated by the sensor needs the person to be in a specific position at the start of the acquisition phase, i.e. with his/her legs located on the table, as shown in the following picture:

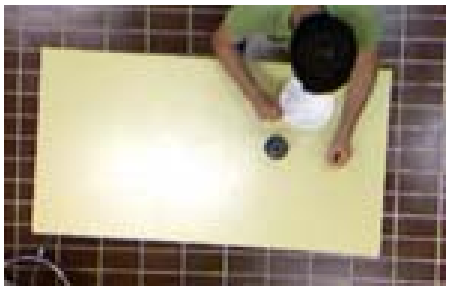


Figure 2.4.2: Position requested to the user for the initial acquisition step

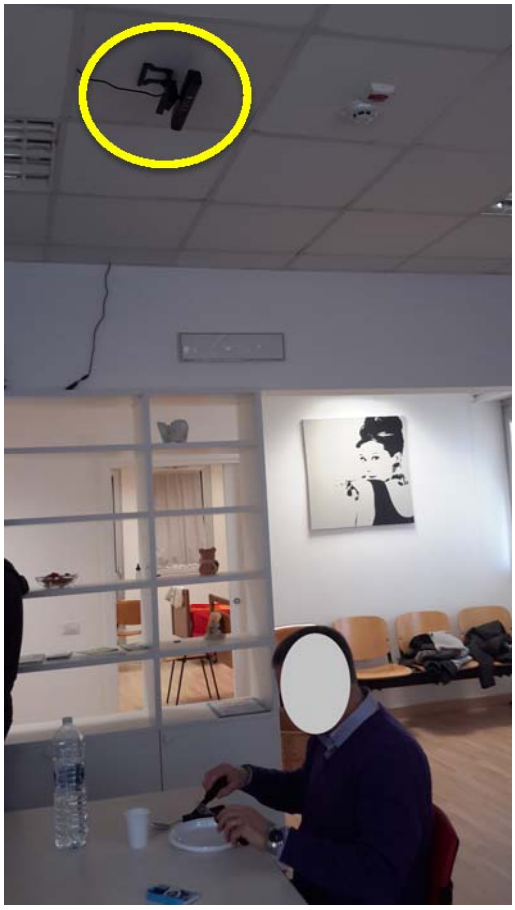
As a consequence, when testing the correct execution of the depth-signal acquisition, the test user should adopt the aforementioned initial position before starting the data capturing process.

Test methodology steps:

1. check the correct location of the sensor on the ceiling, with respect to the table
2. ask the test user to adopt the correct initial position
3. a dish, some cutlery and a glass can be located on the table
4. the test user simulates drink and food intake actions, without any restriction

Once the depth frame capturing operation stops, the data stream should appear in the folder configured to save the collected streams, in the PC connected to the sensor. Successful acquisition gives a non-empty folder once the process ends.

The following picture shows the setup installed at the CasAmica apartment in Ancona (Italy), where preliminary tests with the users have been planned. The Kinect device located on the ceiling is clearly visible; it is set up in order to cover the area where the table is located and the person is going to sit to have lunch or dinner.



## 2.5 Methodology for the test of the multisensor component

The Multisensor platform will be installed at selected apartments. The platform consists of a data hub (Raspberry Pi) and up to 13 Multisensors. The Multisensors is placed at key locations in the apartment and measure several environmental variables like humidity, temperature, luminosity etc. Data from the Multisensors are through a Bluetooth-LE connection to the data hub.

| What to test | How to test | Expected Outcome |
|---|---|---|
| Data hub for Multisensor | 1. Insert a SD-Card with the Image of the data hub Linux distribution into Raspberry-Pi<br>2. Connect the Bluetooth-LE Antenna to a free USB-Port on the back of the Raspberry Pi<br>3. Connect an Ethernet-Cable from the back of the Raspberry-Pi to the Router<br>3. Connect the 5V-Power to the side of the Raspberry-Pi<br>  | a. The Data hub is properly powered: the red led, located on the front panel, is lit and a green led at the front is flashing<br>b. The Ethernet connection to the router is properly established: yellow-green led at the Ethernet port will blink rapidly<br>c. The Bluetooth-LE dongle was properly detected and initialized: the blue led on the Bluetooh-LE dongle is lit permanently.<br>  <br>  |
| The Data hub is connected to the WiFi local network | At present, network access is provided by a Ethernet connection. | Network connection should take place automatically. |

| | | |
|---|---|---|
| Multisensor messages(*) are properly detected by the box and the corresponding events are written onto Pryv | The Multisensor is powered by an internal battery and is always active. The Multisensor does not have to be switched on.<br>1. force the state variation of the Multisensor *x* or wait 30s till a sensor message is automatically triggered(**)<br>2. check that the event generated by the Multisensor *x* is written into stream *X* in Pryv. | a. For each Multisensor *x*, a specific stream *X* has been created in Pryv<br>b. All the events generated by sensor *x* have been written in *X* |
| (*) The Multisensor implements the following sensors: humidity, temperature, luminosity, pir, acceleration and a door sensor.<br>(**) All sensors on the Multisensor are read at an interval of 20s. Additionally a state change can be triggered by the following sensors:<br>*x* = magnetic sensor -> close/open the magnetic contact<br>*x* = pir sensor -> activate the sensor by motion (waving a hand in front of the sensor)<br>*x* = acceleration sensor -> gently shake the sensor in one hand | | |

## 2.6 Rapid test methodology with the user

The aim of the technical test with the user is two-folds: on one side, we would like to check the acceptability of the system in terms of impact in the home environment, on the other one, we would like to get information on the user experience, most of all in relation to the easy of making adjustments and to deal with common problems that may occur during the use.

For this reason, it was decided to enroll in a short technical analysis, five end-users that deserve the same characteristics of the informal caregiver Persona, developed during the first activities of the WP1 (see D1.1).

After the introduction to the project aims and to the purposes of the study, it will be asked to the users to move around the CasAmica smart home. In each room, the users will find a card, containing information on the tasks to do, in a free way.

During the testing phase, two independent observers will take notes of the users' activities, in order to collect information on problems encountered and free statements reported by the users. The procedure will be detailed as follows.

*"Ok let's start! Now I would like you to move freely in the home. You will find some cards in each room, asking you to perform a task. Please, feel free also to talk during the tasks."*

The tasks to be performed are the following:

| **Room** | **Task** | **Equipment** |
|---|---|---|
| Hall | Look at environment and see if you notice the technologies all around. | All the kit sensors |
| Hall | Please, try to open and close the window | Magnetic sensor |
| Bedroom/Corridor | Please, try to open and close the door | Magnetic sensor |
| Bedroom | Please, rearrange the bedroom | Bed sensor |
| Toilet | Please, enter in the toilet and look at the water sensors in the floor. | Water sensor |

After this first round of activities, the following questions will be asked to the participants:

*"Now I'm going to ask you some very general questions on your experience with the system, if you have liked or not some of the components and what are your feeling during the use of the system and more.*

*Let's start! Please, rate your opinion as follows."*

| **DOMAIN** | **METRICS** | *Which image better represent your agreement with the following statements?* | | | | |
|---|---|---|---|---|---|---|
| | |  |  |  |  |  |
| **1. AESTHETICS** | 1.1. Overall comfort in use | | | | | |
| | 1.2. Feeling of innovation | | | | | |
| | 1.3. Perceived economic value | | | | | |
| | 1.4. Dimensions | | | | | |
| **2. LAYOUT** | 1.5. Overall spatial organization | | | | | |
| | 1.6. Design | | | | | |
| **3. MATERIALS** | 1.7. Durability (i.e. endurance to hurts, to the time, etc…) | | | | | |

*"Now, I'm going to ask you to operate some simple tasks with the sensors, to check if they are easy to be self-managed, in case of minor technical failures. Don't be worried to hurt the equipment during the test!".*

The tasks to be performed are the following:

1. Try to fix a magnetic sensor fallen from the window or the door

2. Re-locate the water sensor in the right position if it gets moved (for example during toilet cleaning operations)
3. Switch-on the box if it needs to be restarted (for example due to unexpected power black-out)

A specific task is related to calibration of the bed sensor: once the bed sensor has been located under the mattress, it has to be calibrated in order to recognize when the monitored person is in the bed or out of it. Calibration is needed every time the bed sensor is removed and then re-located under the mattress, for example because of operations related to bed cleaning/maintenance.

a. The operator (not the user) removes the bed sensor

b. The user is asked to re-locate the bed sensor under the mattress

c. The user is asked to push a button on the small box that controls the sensor

d. The user has to wait for a "click" from the box. Once the click happens, the sensor is ready to detect the in bed/out of bed condition of the monitored person.

After the completion of the second group of tasks, the following questions will be asked:

*"Now I'm going to ask you some very general questions on your experience with components and of the interface, what are your feelings during the use of the system and more.*

*Let's start!*

*Please, mark on this line what do think about each question".*

1. *Overall, using the system was:*

Very difficult Very easy

2. *Overall, adjust the window/door sensor was:*

Very difficult Very easy

3. *Overall, adjust the water sensor was:*

Very difficult Very easy

4. *Overall, the calibration of the bed sensor was:*

| |
|---|
| |

Very difficult Very easy

*5. The impact of the system in the home, is:*

| |
|---|
| |

Very disturbing Not disturbing at all

*6. I think I could use this system by myself:*

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Completely disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Completely agree |

*We are now at the end. Can I ask you something about you?*

1. How old are you?_____

2. What is your gender? (not to ask)

❑ Female

❑ Male

3. How would you consider your vision capacity? (ability to see in adequate light (with glasses if used)

❑ Excellent

❑ Good

❑ Fair

❑ Poor

❑ Very poor

❑ Don't know

4. What is your level of education?

❑ No education

- ❑ Primary education
- ❑ Secondary education
- ❑ Tertiary education (further higher education level or university)
- ❑ Other _____
- ❑ Prefer not to say

5. Can you indicate to what extent you are familiar with each of these technologies? You can choose from the following statements:

   1 = I don't know this technology

   2 = I know this technology but I'm unable to use it myself

   3 = I can operate this basically and often need help

   4 = I can operate this, I rarely need help

   5 = I know the possibilities of it well, I use it and I never need help

| | | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| a. | Computer | ❑ | ❑ | ❑ | ❑ | ❑ |
| b. | Smartphone | ❑ | ❑ | ❑ | ❑ | ❑ |
| c. | Tablet | ❑ | ❑ | ❑ | ❑ | ❑ |
| d. | Digital television | ❑ | ❑ | ❑ | ❑ | ❑ |
| e. | Internet | ❑ | ❑ | ❑ | ❑ | ❑ |

6. Have you got some general opinions on the experience, you would like to report?

*Many thanks for your support!"*

## 2.7 Iteration of tests during system deployment

Tests on the technical components of the Home4Dem architecture will be first run in the lab, being the platform still subjected to changes and additional developments. Once the pilot installations start to be deployed, technical tests will be periodically iterated, to exploit the feedbacks gathered from the first installation, to improve the outcomes of the following ones.

# 3. Results of the technical evaluation

This section will be iterated and added to new releases of this deliverable each time a new round of tests is carried out.

## 3.1 Technical test results: DomoSafety platform

Tests once the system is installed on field.

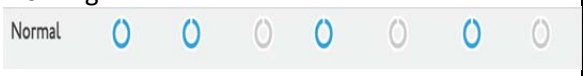
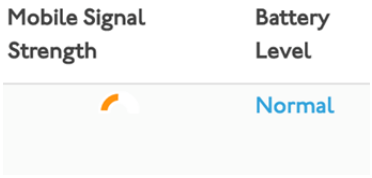
| Test | Flow | Result |
|---|---|---|
| Check that the whole DomoSafety system is up and running. | All sensors installed should be displayed with blue circles on the DomoAdmin platform, in the System check page at the user ID registered. | All tests and vitals for each sensors are working:   |
| Check that the DomoSafety system is properly receiving data and battery is OK. | Signal strength of the Base unit should be at least orange in the gauge and its Battery level has to be “normal” in the DomoAdmin platform. |   |
| Check that the Pryv account has been created. | Connect on the Pryv platform with the user ID and the password generated by the system at: userID.domocare.io | The login must allow access to the streams of the user platform. |
| Check that the streams from the sensors are created and receive the data. | All the streams should be displayed in the platform or reachable with the API calls and the tokens related to the “Slides” created by Pryv. As an example, access the events of the stream of the 163288 ID device: https://161428-i.domocare.io/events?streams[]=dbuid-163288-D&auth=authtoken | The platform should display the values collected as in Figure 3.1.1 below. The API call to a certain stream should show JSON formatted data corresponding to the stream events. |


**Figure 3.1.1 - The Pryv system connected to the user installed with the DomoSafety sensors. Streams are displayed on the left while the events are on the main dashboard, displaying all events for each stream.**

## 3.2 Technical test results: UpTech platform

Test session #1: tests executed in a LAB environment

<table>
<tr><th>Function under test</th><th>Outcome</th><th>OK/KO</th></tr>
<tr><td>The UpTech kit is switched on and ready to operate</td><td>The led located in the front panel is ON</td><td>OK</td></tr>
<tr><td>The UpTech kit is connected to the WiFi local network</td><td>Network connection in the LAB takes place automatically</td><td>OK</td></tr>
<tr><td>Sensors' state variations are properly detected by the box and the corresponding events are written onto Pryv</td><td>a. For each sensor type x, a specific stream X has been created in Pryv<br>b. All the events generated by sensor x have been written in X (events are grouped by streams):
<table>
<tr><th>sensor (stream)</th><th>state (event)</th></tr>
<tr><td>water</td><td>ON</td></tr>
<tr><td>smoke</td><td>ON</td></tr>
</table></td><td>a. OK. The following streams are created in Pryv:<br>BED_STREAM<br>DOOR_STREAM<br>MOTION_STREAM<br>SMOKE_STREAM<br>WATER_STREAM<br><br>b. OK. As the following Figure 3.2.1</td></tr>
</table>

| | | | |
|---|---|---|---|
| | motion | ON | shows, events simulated in the LAB have been properly written in each stream on the remote platform |
| | door | OPEN<br>CLOSE | |
| | bed | IN<br>OUT | |

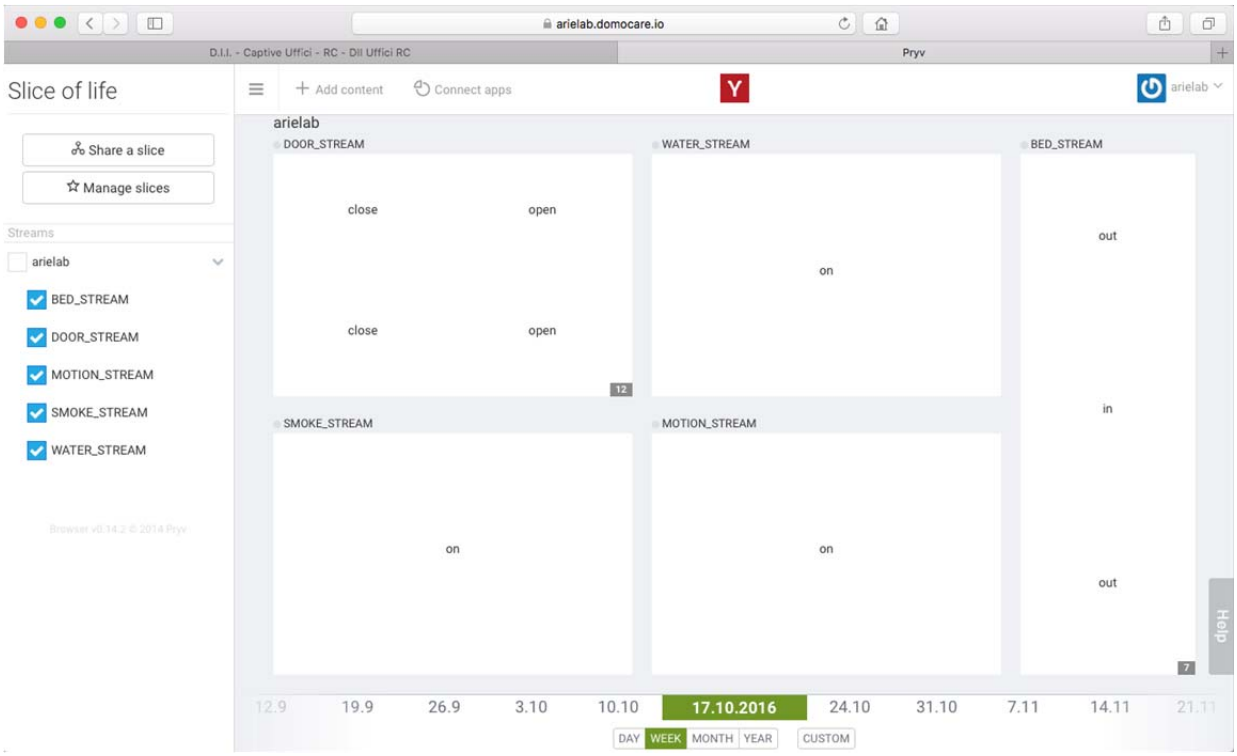



Figure 3.2.1: Sensor events due to the UpTech kit tested in the LAB, properly written in corresponding streams on Pryv

## 3.3 Technical test results: integrated H4D platform

This section will be iterated and added to new releases of this deliverable each time integration tests are carried out.

### 3.4 Rapid test with user results

| Cg | Task with cards | | | | |
|---|---|---|---|---|---|
| | **1.Look at environment and see if you notice the technologies all around.** | **2.Please, try to open and close the window** | **3.Please, try to open and close the door** | **4.Please, rearrange the bedroom** | **5.Please, enter in the toilet and look at the water sensors in the floor.** |
| 1 | Kinect, Megnetic contact, unit control (recognised like a router). | ok | ok | The person Recognizes something under the mattress, he is not sure about the durability of the sensor (Because During this task is possible to hurt the cables) | The person recognizes the water and pir sensor |
| 2 | Pir, smoke sensor, magnetic contact | ok | ok | The person Recognizes something under the mattress, he is not sure about the durability of the sensor (Because During this task is possible to hurt the cables) | The person recognizes the water and pir sensor |
| 3 | Magnetic contact (Door, window, fridge). Unit control as a router | ok | ok | The person Recognizes something under the mattress, but is not a problem for this task. She suggest to tell at the pwd that the sensor is an object to increase the confort. | The person recognizes the water sensor |
| 4 | magnetic contact, pir, kinect | ok | ok | The person Recognizes something under the mattress, but is not a problem for this task. | The person recognizes the water and pir sensor |
| 5 | kinect, pir, magnetic contact | ok | ok | ok | The person recognizes the water sensor |

| Cg | Task to be performed | | | | | |
|---|---|---|---|---|---|---|
| | **1.Try to fix a magnetic sensor fallen from the window or the door** | **2. Re-locate the water sensor in the right position if it gets moved (for example during toilet cleaning operations)** | **3. Switch-on the box if it needs to be restarted (for example due to unexpected power black-out)** | **4b.The user is asked to re-locate the bed sensor under the mattress** | **4cThe user is asked to push a button on the small box that controls the sensor** | **4dThe user has to wait for a "click" from the box. Once the click happens, the sensor is ready to detect the in bed/out of bed condition of the monitored person.** |
| 1 | please, help the caregiver to understand the right position of the sensor: tape side, magnetic side. | The caregiver puts the sensor in the correct position but not near to the wall. | First the caregiver turns on the notification button, after he completes the task without any problems. | ok | It is very difficult to calibrate the bed sensor without a correct visualization of the led (the clic is not enough loud). So the caregiver counts the seconds when he pressed the button. He suggests to fix the control of the bed in a way that is possible to see the light without going under the bed. | |
| 2 | Difficult to understand the correct installation side | The caregiver puts the sensor in a wrong way, he suggets to indicate the correct installation side with some icons printed on the sensor. | First the caregiver turns on the notification button, after he completes the task without any problems. | The caregivers re-locate the sensor in the midlle of the bed. He suggests to indicate where to put the sensor on the bed. | It is very difficult to calibrate the bed sensor without a correct visualization of the led (the clic is not enough loud). So the caregiver counts the seconds when he pressed the button. He suggests to fix the control of the bed in a way that is possible to see the light without going under the bed. | |

| | | | | | |
|---|---|---|---|---|---|
| 3 | She puts the sensor in a wrong way. She suggest to indicate the correct installation side with some graphical elements. | ok, but she suggest to indicate the correct installation side with some graphical elements. | The caregiver completes the task with some help. She suggest a manual or a training. | ok | It is very difficult to calibrate the bed sensor without a correct visualization of the led (the clic is not enough loud). He suggests to fix the control of the bed in a way that is possible to see the light without going under the bed. |
| 4 | He puts the sensor in a wrong way. He suggest to indicate the correct installation side with some graphical elements. In addition he is not sure if the cable (antenna) must be inside or out of the case. | ok, but he suggest to indicate the correct installation side with some graphical elements. | ok, easy | The caregivers re-locate the sensor in the midlle of the bed. He suggests to indicate where to put the sensor on the bed and the correct installation side. | It is very difficult to calibrate the bed sensor without a correct visualization of the led (the clic is not enough loud). So the caregiver counts the seconds when he pressed the button. He suggests to fix the control of the bed in a way that is possible to see the light without going under the bed. |
| 5 | He puts the sensor in a wrong way, he justifies the orientation of the sensor on the basis of the available space. | ok | first he disconnect the power supply, after he turns off the notification button, finally he turns off the power button. | The caregivers re-locate the sensor in longitudinal way. | It is very difficult to calibrate the bed sensor without a correct visualization of the led (the clic is not enough loud). So the caregiver counts the seconds when he pressed the button. |

| Cg | Closing | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **1.Overall, using the system was:** | ***1comment*** | **2. Overall, adjust the window/door sensor was:** | ***2comment*** | **3. Overall, adjust the water sensor was:** | | **4. Overall, the calibration of the bed sensor was:** | ***4comment*** | **5. The impact of the system in the home, is:** | **6. I think I could use this system by myself** |
| **1** | 120 | | 77 | | 111 | | 54 | It is quite difficult to push the button when the mattress is on the sensor | 137 | 5 |
| **2** | 114 | | 94 | | 130 | | 91 | | 158 | 5 |
| **3** | 16 | It is very difficult to replace the sensor without a training | 18 | It is very difficult to replace the sensor without a training | 83 | | 16 | It is very difficult to calibrate the bed sensor without a correct visualization of the led (the clic is not enough loud) | 147 | 1 |
| **4** | 115 | | 40 | It is very difficult to replace the sensor without a training | 119 | | 36 | It is very difficult to calibrate the bed sensor without a correct visualization of the led (the clic is not enough loud) | 137 | 2 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 126 | | 45 | It is very difficult to replace the sensor without a training | 158 | | 158 | | 158 | | 5 |

| Cg | General | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **7. How old are you?** | **8. What is your gender?** | **9. How would you consider your vision capacity?** | **10. What is your level of education?** | **a** | **b** | **c** | **d** | **e** | **12. Have you got some general opinions on the experience, you would like to report?** |
| 1 | 47 | M | Good | Tertiary education | 5 | 5 | 1 | 5 | 5 | Overall, try to hide sensors and try to reduce the dimensions. An Instraction manual is very appreciated. |
| 2 | 33 | M | excellent | Tertiary education | 5 | 5 | 5 | 4 | 5 | It is better to place the led more visible |
| 3 | 50 | F | Good | Secondary education | 5 | 5 | 4 | 5 | 5 | A training should be mandatory |
| 4 | 47 | F | excellent | Tertiary education | 5 | 5 | 5 | 5 | 5 | Add icons (arrow…) on the sensor to help the replacement action |
| 5 | 33 | M | excellent | Tertiary education | 5 | 5 | 5 | 5 | 5 | Please, suggest the correct position of the sensor with specific image or icons printed on the sensor. |

| Cg | Aesthetics | | | | Layout | | Materials |
|---|---|---|---|---|---|---|---|
| | 1.1. Overall comfort in use | 1.2. Feeling of innovation | 1.3. Perceived economic value | 1.4. Dimensions | 1.5. Overall spatial organization | 1.6. Design | 1.7. Durability (i.e. endurance to hurts, to the time, etc…) |
| 1 | 5 | 3 | 2 | 2 | 3 | 3 | 1 |
| 2 | 4 | 4 | 4 | 4 | 4 | 2 | 1 |
| 3 | 5 | 5 | 3 | 5 | 5 | 3 | 5 |
| 4 | 5 | 4 | 4 | 5 | 5 | 4 | 3 |
| 5 | 5 | 5 | 4 | 5 | 5 | 3 | 5 |

### 3.5 Feedback from tests and concluding remarks

The test was conducted with 5 informal caregivers, 3 males and 2 females, with a mean age of 42 years old and a good or excellent vision capacity. Four person out of 5 declared a tertiary education level while all are quite skilled with technology like computer, smartphone, tablet, smart tv and internet.

Related to the tasks, it is possible to state that the sensors of the system are well recognized by all the persons even if they are not disturbed from it. In fact, they are able to open doors and windows without any problem. Concerning the task "Please, rearrange the bedroom" most of the persons are not able to detect the presence of a sensor under the mattress but they recognize something.

Overall, using the system was almost easy (with a mean value in the evaluation bar of 98mm) but a user manual is recommended by all the caregivers. The window/door sensor replacement was quite difficult (55mm): a training and graphic indications on the sensor are recommended. The water sensor replacement was easier (120mm) than other sensors. Same issues are also recognized in the calibration of the bed sensor due to the impossibility to see the led light of the sensor during the task (71mm). The impact of the system in the home is perceived as not disturbing at all (147mm). Three persons out of five declared their ability to use the system by theirselves.

Concerning the execution of the different tasks, in particular, the following problems were detected:

1) **Try to fix a magnetic sensor fallen from the window or the door.**
   All the persons are not sure about the correct position of the magnetic sensor. They are not sure about the correct orientation of the two parts of the sensor. They suggest to print an arrow or a graphical sign on the sensor to easily identify the correct position.

2) **Re-locate the water sensor in the right position if it gets moved** (for example during toilet cleaning operations).
   As for the magnetic contact also the water sensor needs some graphical sign to show the correct way to install it.

3) **Switch-on the box if it needs to be restarted** (for example due to unexpected power black-out).
   All the persons complete this task, even if they performed other action before turning off the right switch, they agree with the choice to hide the power switch to avoid unintentional shutdown.

4) **The user is asked to re-locate the bed sensor under the mattress.**
   All the caregivers perform this task without particular problems. Only one person re-located the sensor in the middle of the bed in a vertical way.

5) **The user is asked to push a button on the small box that controls the sensor. The user has to wait for a "click" from the box. Once the click happens, the sensor is ready to detect the in bed/out of bed condition of the monitored person.**
   It is very difficult to calibrate the bed sensor without a correct visualization of the led (the "click" is not loud enough). So the caregiver counts the seconds when he pressed the button. They suggest to fix the control of bed in a way that is possible to see the light without going under the bed.