



## **VictoryaHome – AAL-2012-5-228**

A robot for integrated care at home and peace of mind  
for caregivers

### ***Deliverable***

#### **D5.2a VictoryaHome system**

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Date of delivery: November 2013

*Contributing partners: NST, Giraff,  
onCaring*



## Document Control

<b>Title</b>	<b>D5.2a VictoryaHome System</b>		
<b>Project</b>	VictoryaHome (AAL-2012-5-228)		
<b>Nature</b>	Report	<b>Distribution level</b>	Public
<b>Responsible partner</b>	NST	<b>WP</b>	5. Development
<b>Editors</b>	Patrik Björkman, Artur Serrano and André Lemos		
<b>Last updated</b>	15-Oct-14		
<b>Doc ID / URL</b>	VH-D5.2a-VictoryaHome_system-20131031.docx		

## Important Dates

<b>Event</b>	<b>Date</b>
Delivered for internal review	31-Oct-2013
In progress under the VictoryaHome Quality Control Board (QCB)	16-Jan-2014
Sent to the AAL-JP Central Management Unit	15-Oct-2014

## Revision History

<b>Date</b>	<b>Author</b>	<b>Summary of Changes</b>
22-10-2013	Giraff	Initial revision
31-10-2013	NST	Revision of the contents
17-01-2014	SMH	Internal review
27-01-2014	Giraff	Updated according to feedback from SMH
10-02-2014	onCaring	Internal review
18-02-2014	Giraff	Updated according to feedback from onCaring

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## Abstract

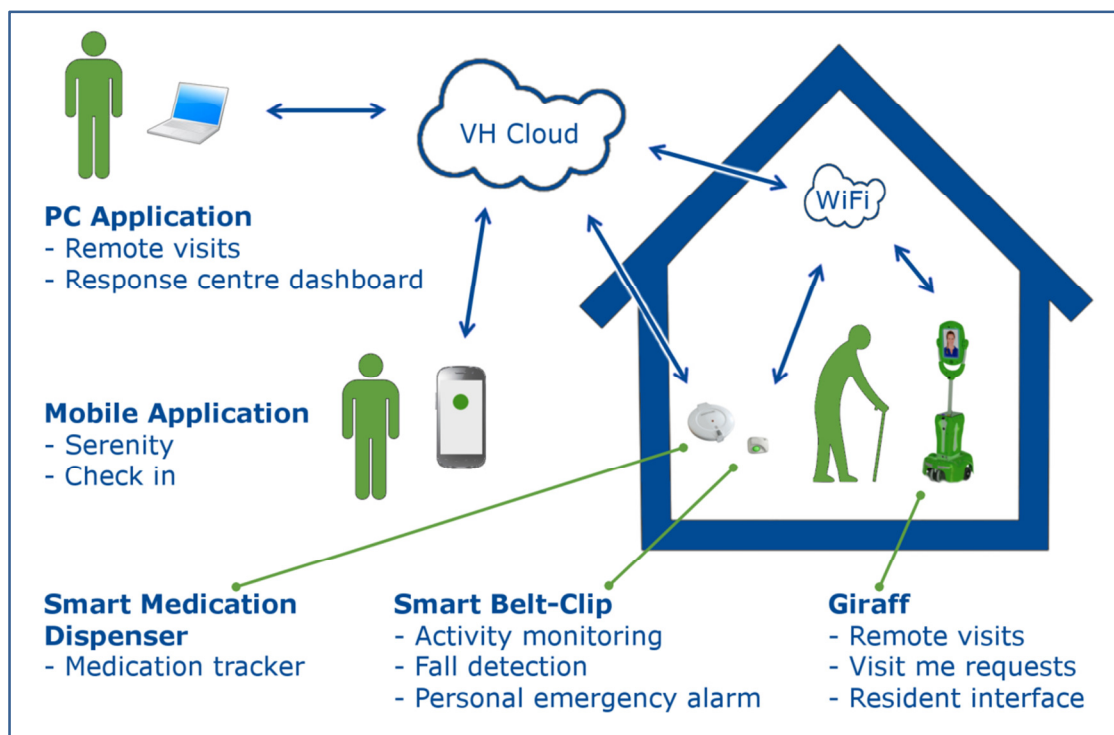
The VictoryaHome system is a tool for caregivers, professional as well as family and friends to create possibilities for older adults to live their life as they always have, in their own home. These are the users of VictoryaHome system that are recipients of care called residents. The system is a combination of already commercially available tools for elderly care and specially developed software and hardware to combine everything in one service package.

This document is an overall description of the components used in the system, how the system works, what sensors are used, what tools the caregivers have, and how the system helps to improve the quality of life for both residents and caregivers.

# 1 Introduction

The VictoryaHome system provides a service package for supporting older adults that live at home and tools for both formal and informal caregivers. The system consists of already commercially available devices made for elderly care and specially developed software and hardware to deliver everything as one integrated service package.

The complete VictoryaHome system is shown in Figure 1. The core component of the system is the **VictoryaHome Cloud**, which is a cloud-based component that connects all parts together. Since people all have different needs, the VictoryaHome cloud is made flexible to give the ability to add/remove peripheral devices and services. The cloud has decision making functions to give caregivers an easy interface for all sensors and data at the same time. As a caregiver you simply have a colour indicator called “serenity”, which displays the status of all residents you have contact with. If the colour is green, everything is okay but if the light changes to yellow or red, some actions are needed. The decision making of the cloud will determine which colour to change the serenity state to, depending on what currently happens but also considering what has happened earlier.



**Figure 1: Overview of the VictoryaHome system.**

For both formal and informal caregivers the system has two PC applications, an online **dashboard** for viewing data and alarms, and an application for making **remote visits**. The VictoryaHome **mobile app** was specially created for the caregivers; next to the ability to see if everything is okay with the resident with the “serenity” indicator, they also have the ability to notify the resident where they are, and whether they are available to make a visit or not.

For the residents, there is a touch interface on their Giraff, which they can use to send a “visit me” request to a caregiver, this way inviting him/her to make a visit. Next to this, residents will have several devices in their home with different functionalities. These devices and sensors will provide help to the resident and confidence to them and to their caregivers that someone will be there whenever an accident might occur. Examples are a smart medication dispenser, an activity monitor, and a fall detection device.

## 2 Individual component description

This chapter describes all components of the complete VictoryaHome system. This includes:

- The VictoryaHome Cloud
- The VictoryaHome Giraff
- The VictoryaHome PC applications
- The VictoryaHome Mobile Application
- The Smart Belt-Clip
- The Medication Dispenser

### 2.1 VictoryaHome Cloud

One of the key things in the project is the quick development phase and the focus on user-driven development. It is important that the cloud development is as simple as possible and not too time consuming. The VictoryaHome cloud is therefore developed using Parse which is a tool for creating a cloud service focusing on the user experience without spending time on server maintenance and other things the user will never see.

The cloud is designed as an event based system where the events are triggered by a caregiver, a resident or equipment. Events are classified within two different categories depending on the type of event. Table 1 lists the first category, “caregiver action” which is used for events that do not require a follow up action. These events are mainly used for log purposes.

Abbreviation	Description
Phone call started	A phone call between the activity unit (resident) and a caregiver (usually response centre) is initiated
Remote visit started	A caregiver has started a remote visit
Noted	A caregiver has noted an event
Solved	A caregiver has solved an event
Remote visit with key started	A caregiver started a visit were the resident did not have to approve (answer with green button)
Remote visit finished	A remote visit is finished

Phone call finished	A phone call between activity unit (resident) and a caregiver(usually response centre) is finished
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**Table 1. List of “caregiver action” events which does not require follow-up actions.**

Table 2 lists all other events. These require a follow-up action and have 3 possible states: “needs follow-up”, “noted” and “solved”. If a caregiver goes in and reads the event in the mobile application it will change the status to “noted” for that caregiver, multiple caregivers can note an event, and when a caregiver solves an event the status will show “solved,” so only one caregiver needs to solve an event. When an event is solved, the status of the event will update on all caregivers’ mobile phones.



Abbreviation	Description
Call me	A “call me” request generated by the resident gets sent to the selected caregiver
Fall	A fall is detected by a sensor
Missed medication	Medication is not taken by the resident
Hydration value	New hydration value
Device upside down	Medication dispenser is upside down (not in use for new units)
Device error	Sensor not working properly
Battery low	Sensor battery is low
SIM card balance low	Sensor SIM card balance is low, need re-fill
Giraff offline	A Giraff that is supposed to be online is offline
Giraff not answered	A resident tries to call out from the Giraff but no one answered
Panic button	Resident pressed the panic button on the activity unit



Out of range	Activity unit is out of range
Disconnected	The Activity unit is disconnected by the resident

**Table 2. List of events which need a follow-up action in the VictoryaHome system.**

The events above will affect the serenity status the caregivers see in the mobile app. The status is defined as follows:

- Green if number of unsolved event is 0.
- Yellow if number of unsolved event is 1\*.
- Red if number of unsolved sensor events is more than 1 or a critical safety event happened\*.

\* At the moment there is only one critical safety event, the detection of a Fall. To note that the classification of events as critical is easily changed in the software. The event of a resident pressing the “Panic button” can in future be considered critical; at the moment it has not been considered critical as to take into account the fact that in caregiving institutions people usually press the button to ask for a glass of water, or to go to the bathroom and when at home they are likely to feel lonely and just want to talk, so not only in emergency situations. If it is an emergency a second press normally happens.

The rules above follow from previous experience from project partner Bluecaring were the following rules have been developed:

- Fall: critical
- Panic button: non-critical
- Fall + Panic button: critical

More research will be done regarding this topic during the VictoryaHome project.

## **Sentry**

Next to the newly developed part of the VictoryaHome cloud described above, the existing Sentry cloud will also be part of the VictoryaHome cloud. Sentry is used as management system for Giraffs and their users.

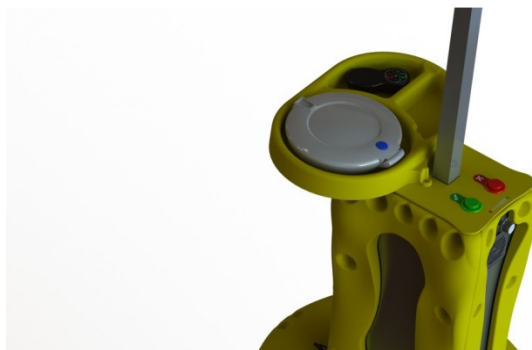
## 2.2 VictoryaHome Giraff

The Giraff allows you to virtually enter a home from a computer via the internet and conduct a natural and secure visit, just as if you were physically there. You can move freely about the home simply by moving your computer mouse, and you can interact with the residents there via videoconferencing. Those in the home do not have to do anything except sit back, relax and enjoy the visit.

In the VictoryaHome project the existing Giraff is being further developed to improve the user experience both for the residents and the caregivers. Early tests of the new service show that this takes remote visits to a completely new level. The following sections describe what is improved or added in terms of hardware and software.

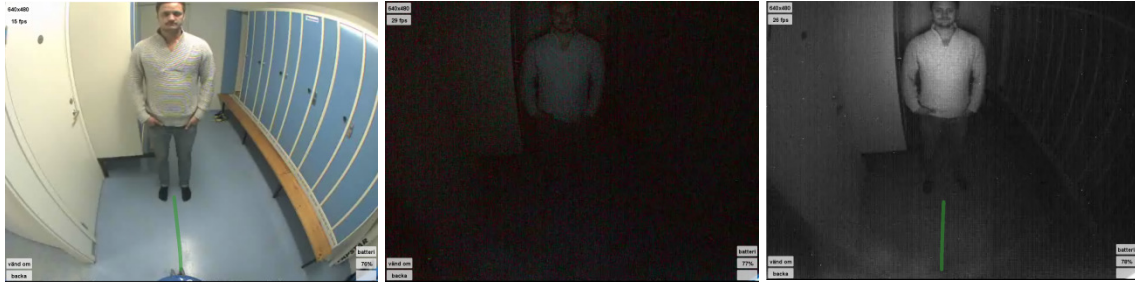
### Hardware

- Visitor has ability to sit down – If the resident sits or lay down, the visitor now has the ability to lower the head of the Giraff to be on the same level and not look down at the resident.
- Carrying tray accessory – Carrying tray were the medication adherence device can be put in.



**Figure 3: Carrying tray with medication adherence device.**

- Night vision – Makes it possible to operate the Giraff in a dark room. This is important if doing visits at night for example. The images below shows the importance of this function. The left picture is when the light is turned on in the room. The middle picture is when the light is turned off but with the normal camera image. In the right picture the light is still turned off but night vision is activated in the Pilot application. Note that there is no light source at all in the room except for the Giraff screen.



**Figure 4: Night vision comparison.**

- HD video camera – The visitor now can experience much more detail in the video, for example when looking for facial expressions.
- Touch screen – The Giraff has been equipped with a touch screen, which gives the ability for an interface for the resident.
- 180 degree screen flip – When the Giraff is in the charging station the screen is facing the wall. Therefore this head flip capability is important to be able to use the touch screen, when in the charging station.

## Software

- User interface for the resident – The resident will now have a touch screen based user interface, for instance to be able to send “visit me” requests to caregivers. This is a simple interface that will be available when the Giraff is resting in its charging station. Later, more services could be added to this screen.



**Figure 6: Image from Giraff UI application mock-up.**

## 2.3 VictoryaHome PC Applications

### 2.3.1 VictoryaHome Remote Visits – Pilot

The Giraff Pilot is the actual software application that allows caregivers and family to virtually enter a home from a computer via the internet and conduct a visit. Within the VictoryaHome project, this software tool will be improved on two main aspects:

- Assisted docking – Some visitors say the single hardest thing about making a Giraff visit is docking the Giraff in the charging station when the visit is over. With the new docking assistance the visitor will get help to dock the Giraff.
- Video zoom – The visitor will have the ability to zoom in the video image, for example to see a pill in a pill box. The image below is for looking in the Careousel medication dispenser laying on a table, the pill in the box is a white 7mm diameter pill.



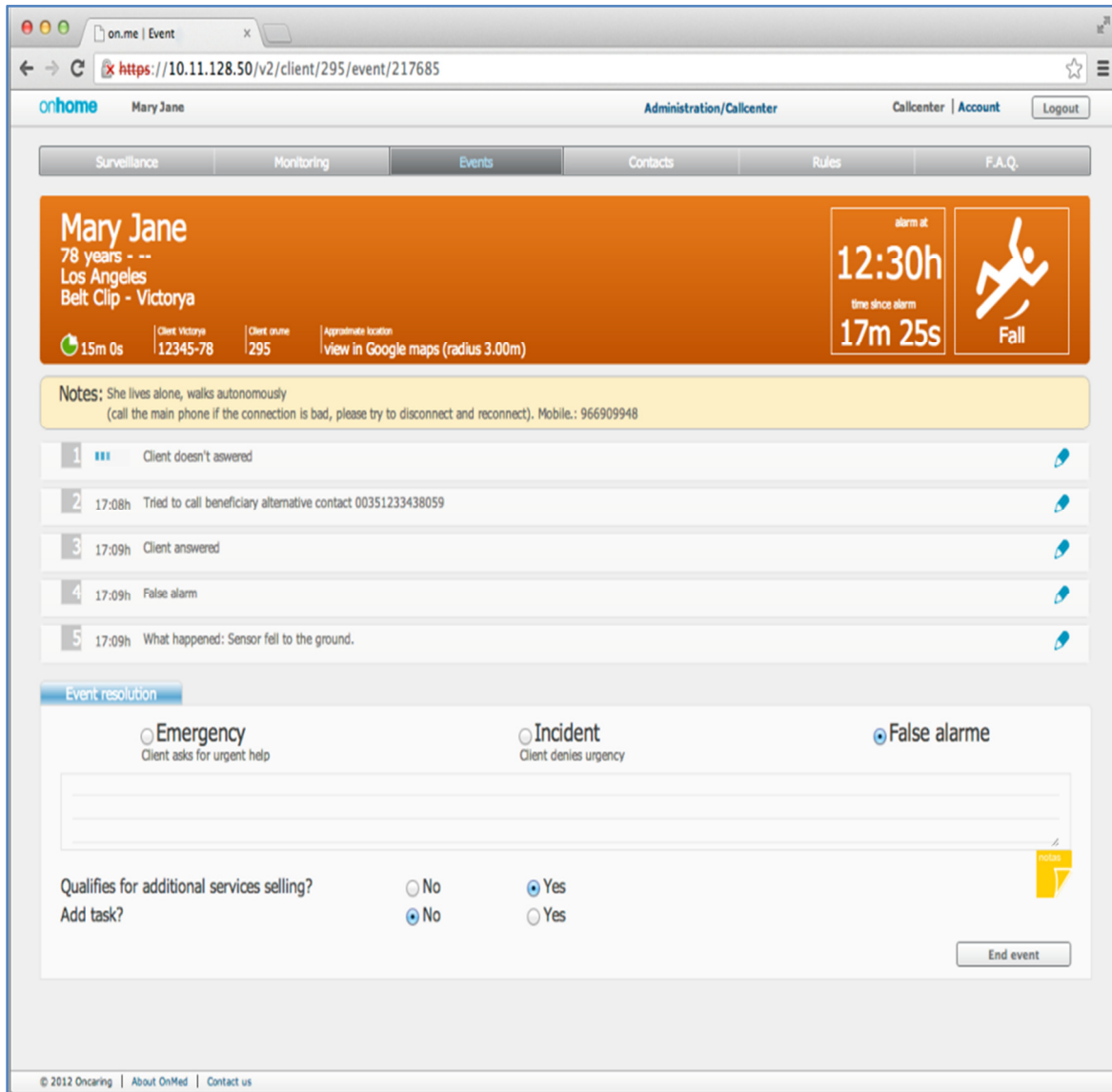
**Figure 5: The Giraff zoom capability. The left image is of the Giraff side, the right is from the Pilot application.**

### 2.3.2 Response Centre Dashboard

The response centre dashboard is a web-based application to see and respond to events, and to view and edit data of the clients. In the VictoryaHome project some formal caregivers are response centre employees. The response centre's main objective is to respond to alarms from connected devices. In the current version two devices are integrated, the activity monitoring unit and the medication adherence device.

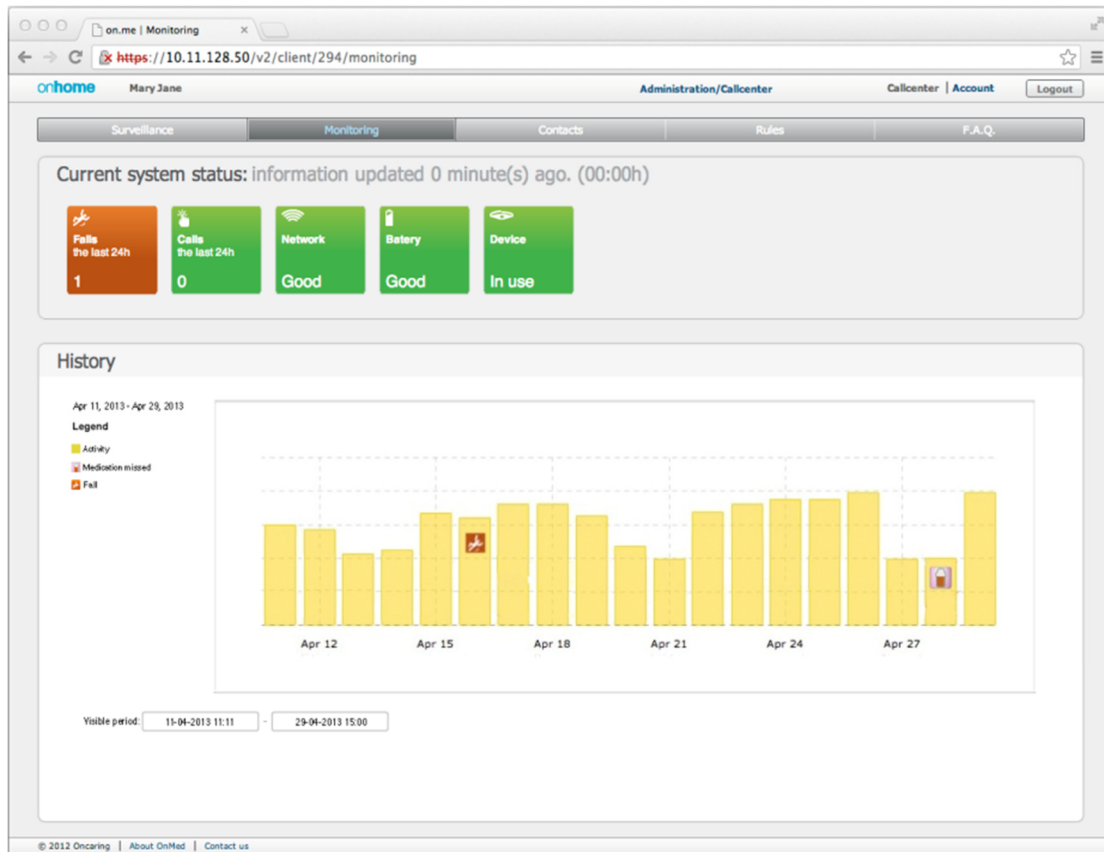
When an event is detected, for example a fall, the response centres will be able to react actively by contacting the person directly, either by calling them on the phone or entering the home via the Giraff. If the response centre is unable to contact the resident, they will contact a relative. If that relative is unavailable, then they will contact the next relative contact shown in the dashboard, and so on, or may enter the home via Giraff if they have been given permission.

The image below shows an example where a fall occurred and the response centre personnel go through a pre-programmed set of questions (workflow). During the workflow, text messages are sent to other caregivers informing them about what just happened.



**Figure 8: Response Centre Dashboard work-flow example when a fall has occurred.**

In the dashboard all caregivers, including the response centre attendants, with permission can login and see a history log. In the log activity levels, falls and missed medication can be seen.



**Figure 9: Response Centre Dashboard history log view.**

In the Dashboard functionality to configure the medication adherence device will also be added during the project to make it simpler for the caregiver to reduce the number of interfaces.

## 2.4 VictoryaHome Mobile Application

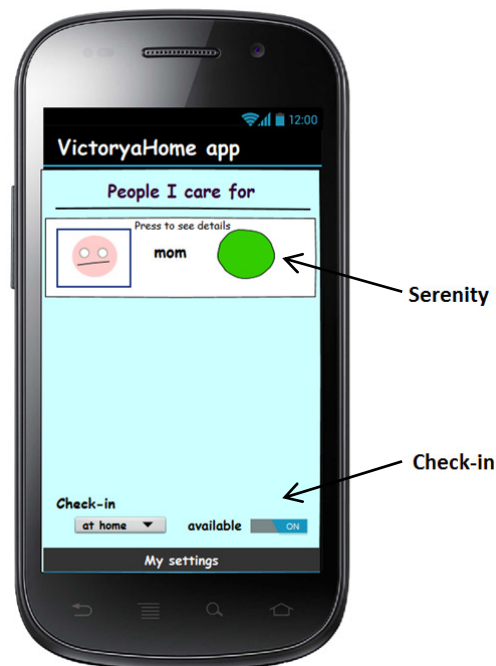
A mobile application is being developed for caregivers. Currently the app will run on Android phones, and expansion to other types of smart phones/tablets will be discussed in future phases of the project.

In the mobile app the caregiver will have access to two main functionalities: The “serenity” indicator and the “check-in” functionality. The Serenity gives the informal caregiver a quick view on the situation of the resident(s) he/she cares for. The Serenity status can be green, (when everything is okay), yellow (when something occurred or needs attention, like missing medication) or red (when a more serious event such as a fall has happened).

The caregiver has the ability to read details of the events, and to indicate that they are solved. Once an event has been fixed by the caregiver and it has been marked as “solved” in the app, the Serenity state will turn to green again for all caregivers.

Using the “check-in” capability the caregiver can set where he/she is and whether he/she is available to make a visit. This information will be displayed on the Giraff user interface to the

resident, when he/she wants to send a “visit me” request. When a caregiver is not available, his/her picture and name will not be shown on the Giraff.



**Figure 14: Image from mobile application mock-up.**

## 2.5 Smart Belt-Clip

Two Smart Belt-Clip units have been developed to be used in the VictoryaHome project. For both units users simply clip them on to their pants.

The difference between the two devices is the way they communicate – one uses GSM and the other one uses WiFi. They have a slightly different set of functionalities, and this might affect which one to choose for each care organisation.



**Figure 7: GSM activity monitor (left) and WiFi activity monitor (right).**

The complete functionalities of the two devices can be seen in table 3. There are mainly two differences between the devices:

- The GSM version has a built-in speakerphone, so the response centre can call to the resident checking that everything is okay.
- The GSM version also works outside the home, while the WiFi version only works inside the resident's home.

Because the GSM version uses the mobile phone network, a SIM card needs to be provided by the care organisation for the device to work. The WiFi unit requires an access point that needs to be placed in the home, and it needs an internet connection in the home it is placed in.

GSM version	WiFi version	Function	Description
X	X	Activity monitor	Is used to detect how the resident moves throughout the day, which can be used to detect unusual decrease in movement.
X	X	Disconnected	The devices know whether it is attached / worn or not.
X	X	Panic button	<p>When a user presses the panic button, the device blinks red, and it vibrates, while informing the server that the alarm has been pressed.</p> <p><b>GSM:</b> The only way to solve this alarm is for the response centre to call the device. When the call is made, the device answers the call automatically, and puts it in speakerphone.</p> <p><b>Wi-Fi:</b> The only way to solve this alarm is for the response centre to solve the alarm in the online dashboard.</p>
X	X	Fall detection	The device will detect if the resident has fallen. The behaviour is identical to the Panic button case.
X	-	Works outside	The unit works wherever a mobile phone network is available, so outside the home.
X	-	GPS	The response centre can see where the patient fell/pressed the call button, when outside the home.

**Table 3. List of functionalities of the two activity monitoring units.**



## 2.6 Smart Medication Dispenser

Taking the right dose of medication at the correct time can be of crucial importance. The consequences of forgetting to take the medicine, or taking too much medicine can be big. This could become a worrying issue for the resident as well as family and professional caregivers. A smart medication dispenser can help both the resident and caregivers to keep track of medicines, giving them all a more secure feeling and an increased quality of life [1].

There are many different medication dispensers already established in the market that provide help for taking medication. In the VictoryaHome project we listed specific requirements that we have considered when selecting the best device to use. After collecting all possible devices that could be used and verifying each one against the requirements there was only one medication adherence device that met all requirements. See the component analysis [2] for more detailed descriptions.

The selected medication dispenser has different names in different countries, including Pivotell, Careousel and Pilly. It is a 28-compartment disc in the box, which can be programmed to spin up to 28 times, for example twice or three times/day. It can also be locked, which makes over-medication impossible. The battery life of the device is 1 year, meaning that one does not have to change batteries often. There are different versions of this medication device and to be able to communicate with the VictoryaHome cloud, the GSM version that communicates via SMS will be used.



**Figure 10: Careousel Advanced GSM.**

The full medication dispenser service consists of three parts; the box itself, a SIM card and the administration centre, to be integrated in the VictoryaHome Dashboard. The box itself is designed to be simple to use. There are basically two things that need to be done when starting to use it; a SIM card needs to be bought, and the device needs to be programmed with the times the medication needs to be taken.

For day-to-day use, medicine needs to be put in the compartments by the caregiver. The resident simply waits for the box to notify that it is time to take medicine. Then, the disk

inside will spin, making a new compartment accessible. The resident can then “pour out” the medicine (see figure 11).



**Figure 11: Pill box in use.**

In the online administration centre, one can change the settings of the medication dispenser. When the changes are made, one needs to press a button on the physical box to make it download the new settings – note that the changes are not synced automatically. For early tests of the medication dispenser, caregivers will use this online interface for configuring the box but for the real tests the configuration will be integrated in the VictoryaHome Dashboard.

Step 1 [Phone number and user info](#) / Step 2 **Dispenser settings** / Step 3 [SMS Services & SIM-card](#) / Step 4 [View settings](#)

<p><b>Sound</b></p> <p><input checked="" type="radio"/> None (00)</p> <p><input type="radio"/> Low (01)</p> <p><input type="radio"/> Mid (02)</p> <p><input type="radio"/> High 1 (03)</p> <p><input type="radio"/> High 2 (04)</p> <p><b>Light</b></p> <p><input type="radio"/> On</p> <p><input checked="" type="radio"/> Off</p> <p><b>Battery type</b></p> <p><input checked="" type="radio"/> Alkaline</p> <p><input type="radio"/> NiMH</p> <p><b>Secure</b></p> <p><input checked="" type="radio"/> On</p> <p><input type="radio"/> Off</p>	<p><b>Current Date and Time</b> (select your local time)</p> <p>09 Oct 2013, 10:56</p> <p><b>Daylight saving time</b></p> <p>Europe</p> <p><b>Hours</b></p> <p><input checked="" type="radio"/> 24</p> <p><input type="radio"/> 12</p> <p><b>Filled</b></p> <p>28</p>	<p><b>Doses / Alarms</b></p> <p>1</p> <p>00:00</p> <p>After</p> <p><b>Dispenser start</b></p> <p>YYY MM DD</p> <p>HR</p> <p><b>Dispenser stop</b></p> <p>203€ 01 19</p> <p>04</p>	<p><b>Dosage time</b></p> <p>Hour Minute</p> <p>1: 13 : 00</p> <p>Numerals only</p>
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Save / Next step

**Figure 12: Pharmacell administration centre.**

The smart medication dispenser has a pre-defined set of warning messages that can be sent; these are what the VictoryaHome Cloud will use as events. These events are then distributed by the cloud to the selected caregiver's mobile equipment. The messages are:

- Dose not taken
- Device error
- 4 doses remaining
- Device upside down
- Battery low
- SIM card balance low

### 3 Use cases

During the first year of the project, use cases have been made to describe and verify the functionality of the system. Below is a list of the initial use cases and a summary of them. For the complete and up-to-date list of use cases, see document [4].

Use case	Summary
Fall detection	<p>Jane has eaten. Afterwards she feels drowsy. While entering the bedroom she trips on a mattress. The activity unit she wears detects the fall and gives the resident a visual and audible feedback that a fall has been detected. It also notifies the Cloud and sends an alarm to the response centre. The response centre calls the device which rings but Jane has passed out so she does not answer. The next step for the response centre is to quickly get in the home. They make a Giraff visit and find Jane on the floor. In the Dashboard, the response centre personnel types in that this was a real fall, and the Dashboard will then display whom the personnel should contact that lives nearby. The response centre contacts the neighbour that is at home and will immediately take care of the situation.</p>
Visit me	<p>Robert just got back from work and uses the VictoryaHome mobile app on his smartphone to check-in at home and indicate that he is available. A bit later that afternoon Robert's father Daniel, who has a VictoryaHome system at home, has trouble with his coffee machine. He gets really frustrated and walks up to the Giraff. The Giraff flips the screen and displays the currently available caregivers. He picks his son Robert from the list. Robert receives the message in his mobile app and soon makes a Giraff visit. Robert can quickly figure out what is wrong with the coffee machine, guides his father to fix it, while having a chat.</p>
Serenity & medication reminder	<p>Helen is sitting at home watching TV. She is fully focussed on the TV so she forgets to take her medicine even though the medication device makes both audible and visual warnings. The medication dispenser then sends a warning to the VictoryaHome Cloud, which changes the serenity status for the caregivers to yellow. Her husband Per, who is out of town, sees the warning and tries to call Helen but does not get an answer. He then calls their daughter Amber to see if she can check on Helen. Amber is at home so she decides to make a visit with the Giraff. She "knocks" but Helen does not hear the ringtone of the Giraff, so she enters</p>

	<p>with a key, which means she can use the Giraff without Helena having to accept the visit. She goes to Helen and gets her attention and reminds her to take her medicine, which she then does. Amber changes the status in the mobile app, so Per will see that things are solved.</p>
Movement alert	<p>Helen has not been feeling very well lately. She has become more lethargic. After some days, the activity unit detects this. The VictoryaHome system changes the serenity state to yellow, and the response centre is notified about the lack of motion. They decide to contact Helen through the Giraff and help her to book a doctor's appointment.</p>

**Table 4: Use case summaries.**

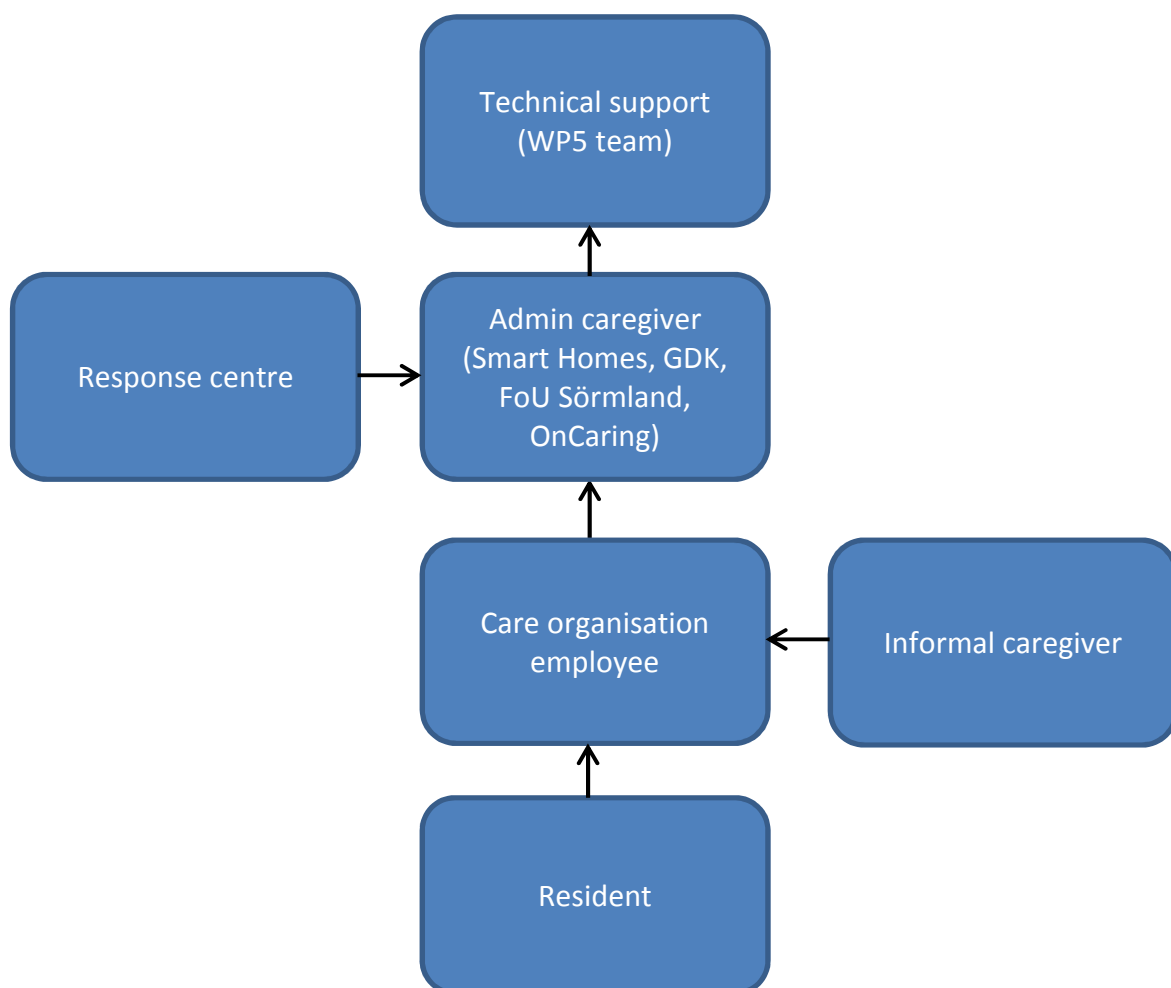
## 4 Technical Support

What kind of support a user of the VictoryaHome system needs depends on which role this user has. Let us see which users there are and how a possible support flow could look. There will be variations of this flow but the following overview has been created as a starting point. Also note that this support flow is based upon questions derived from this work package, such as “My medication dispenser does not work” or “How do I configure the Giraff”.

### List of users

- Resident – The person living with a VictoryaHome system.
- Caregiver – A person that provides care, formal or informal.
- Response centre employee – Type of caregiver that will not physically visit the home.
- Admin caregiver – Person that manages the system, installs it in a home, and teaches personnel how the system works locally.
- Technical support personnel – Persons that knows how the system works and what to do if the something does not work.

The figure below illustrates the suggested standard support flow:



**Figure 15: Suggested standard support flow.**

As a main support channel e-mail (mail@victoryahome.eu) is going to be used. Behind this e-mail address, a system called Mojo will be used that automatically generates trouble tickets when an e-mail is received. The benefit of this is that the right support person who is suitable for the problem can work on it, since all support personnel are notified when a new trouble ticket is generated.

## **Manuals**

User manuals will be divided into two main categories; administration and operational documentation. Administration documentation will include things that are not involved with the day-to-day routines. It will for example include how to assign a new device to a person.

The operational documentation on the other hand includes the day-to-day documentation, for example how to make a remote visit or how to make a call me request. Some of the operational documentation will be multilingual, but management documents will only be in English.

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