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Coordinator Organisation  AIT Austrian Institute of Technology GmbH, Austria
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Editor  Ben Loke / Noldus
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Reviewed by  Panayiotis Andreou (UCY)
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<th>Author(s)</th>
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**Miraculous-Life Consortium**

Miraculous-Life (Contract No. 611421) is a project within the 7th Framework Programme. The consortium members are:

<table>
<thead>
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<tbody>
<tr>
<td><strong>Partner 1</strong></td>
<td>AIT AUSTRIAN INSTITUTE OF TECHNOLOGY GMBH (AIT, Project Coordinator, AT)</td>
</tr>
<tr>
<td>Contact person:</td>
<td>Andreas Hochgatterer</td>
</tr>
<tr>
<td>Email:</td>
<td><a href="mailto:andreas.hochgatterer@ait.ac.at">andreas.hochgatterer@ait.ac.at</a></td>
</tr>
<tr>
<td><strong>Partner 2</strong>:</td>
<td>UNIVERSITY OF GENEVA (UniGe, CH)</td>
</tr>
<tr>
<td>Contact person:</td>
<td>Dimitri Konstantas</td>
</tr>
<tr>
<td>Email:</td>
<td><a href="mailto:dimitri.konstantas@unige.ch">dimitri.konstantas@unige.ch</a></td>
</tr>
<tr>
<td><strong>Partner 3</strong>:</td>
<td>UNIVERSITY OF CYPRUS (UCY, CY)</td>
</tr>
<tr>
<td>Contact person:</td>
<td>Prof. George Samaras</td>
</tr>
<tr>
<td>Email:</td>
<td><a href="mailto:cssamara@cs.ucy.ac.cy">cssamara@cs.ucy.ac.cy</a></td>
</tr>
<tr>
<td><strong>Partner 4</strong>:</td>
<td>ORBIS MEDISCH EN ZORGCONCERN (ORBIS, NL)</td>
</tr>
<tr>
<td>Contact person:</td>
<td>Cindy Wings</td>
</tr>
<tr>
<td>Email:</td>
<td><a href="mailto:c.wings@ORBISconcern.nl">c.wings@ORBISconcern.nl</a></td>
</tr>
<tr>
<td><strong>Partner 5</strong>:</td>
<td>FRAUNHOFER IGD (Fh-IGD, DE)</td>
</tr>
<tr>
<td>Contact person:</td>
<td>Carsten Stocklöw</td>
</tr>
<tr>
<td>Email:</td>
<td><a href="mailto:carsten.stockloew@igd.fraunhofer.de">carsten.stockloew@igd.fraunhofer.de</a></td>
</tr>
<tr>
<td><strong>Partner 6</strong>:</td>
<td>Noldus Information Technology BV (Noldus, NL)</td>
</tr>
<tr>
<td>Contact person:</td>
<td>Nico van der Aa</td>
</tr>
<tr>
<td>Email:</td>
<td><a href="mailto:n.vanderaa@noldus.nl">n.vanderaa@noldus.nl</a></td>
</tr>
<tr>
<td><strong>Partner 7</strong>:</td>
<td>CITARD SERVICES LTD (Citard, CY)</td>
</tr>
<tr>
<td>Contact person:</td>
<td>Eleni Christodoulou</td>
</tr>
<tr>
<td>Email:</td>
<td><a href="mailto:eleni_christodoulou@cytanet.com.cy">eleni_christodoulou@cytanet.com.cy</a></td>
</tr>
<tr>
<td><strong>Partner 8</strong>:</td>
<td>ZOOBE MESSAGE ENTERTAINMENT GMBH (Zoobe, DE)</td>
</tr>
<tr>
<td>Contact person:</td>
<td>Sascha Fagel</td>
</tr>
<tr>
<td>Email:</td>
<td><a href="mailto:fagel@zoobe.com">fagel@zoobe.com</a></td>
</tr>
<tr>
<td><strong>Partner 9</strong>:</td>
<td>MAISON DE RETRAITE DU PETIT-SACONNEX (MRPS, CH)</td>
</tr>
<tr>
<td>Contact person:</td>
<td>Donato Cereghetti</td>
</tr>
<tr>
<td>Email:</td>
<td><a href="mailto:donato.cereghetti@hotmail.com">donato.cereghetti@hotmail.com</a></td>
</tr>
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# Abbreviations

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<td>AAL</td>
<td>Ambient Assisted Living</td>
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<td>Co-Net</td>
<td>Collaborative care Network</td>
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<tr>
<td>RSS</td>
<td>Really Simple Syndication</td>
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<td>SMS</td>
<td>Short Message Service</td>
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<td>VSP</td>
<td>Virtual Support Partner</td>
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<td>WP</td>
<td>Work Package</td>
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Executive Summary

To bring user context to life, 5 user scenarios are developed and 22 use cases have been defined giving detailed realistic examples of how users will carry out their daily life activities at home based on the Virtual Support Partner (VSP) model. It considers the interaction of the system with different formal and informal care actors. The results will serve as an aid to understand and clarify user requirements and expectations of the system's functionality and to provide a basis for the definition of the different system features.

The analysis of the interaction requirements is presented, that is needed to specify the human-computer interface. As the human-computer interface must be as natural as possible, the VSP should listen to the user, speak back to the user and detect its emotional state. A flow chart is provided that defines how the system must respond to the user. To complete the interaction part of the system, a detailed design of the system's user interface is developed.
1 About this Document

1.1 Role of the deliverable
This deliverable describes the scenarios and the use cases that brings user context to life giving detailed realistic examples of how users will carry out their daily life activities at home based on the VSP model and considering interaction with different formal and informal care actors.

The interaction requirements of the user with the system are fixed to serve as input for the system development as a whole and the interaction module (WP2) specifically.

This first version will not include the interaction between the use case scenarios, dialog management and services. This will be described in D1.2b in M12.

1.2 Relationship to other Miraculous-Life deliverables
The deliverable is related to the following Miraculous-Life deliverables:

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<tr>
<td><strong>D1.1</strong></td>
<td><strong>Specification of user needs analysis and design of VSP model</strong>: This document describes the end user needs and requirements analysis, identifies needed services and safety issues and defines the functional specification of the system. Furthermore the psychological definition of the VSP will be provided with the dialogue pattern together with the specification of the operational model of the VSP including the dialogues. D1.2 will consider the results provided by D1.1 for the definition of the user scenarios, the use cases and the interface definition.</td>
</tr>
<tr>
<td><strong>D2.1</strong></td>
<td><strong>Specification of the user emotion recognition component</strong>: This document presents the design of the human-computer interaction (i.e., facial emotion recognition, gesture-based emotion recognition, emotion recognition from audio speech). D1.2 (in association with D1.1) will be provided as input to D2.1 and will be considered during the design of the components responsible for the human-computer interaction.</td>
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<td><strong>D3.1</strong></td>
<td><strong>Specification of the User Behaviour Analysis and Environment Analysis component</strong>: This document presents the design of the Virtual Support Partner (i.e., design algorithms for environment context analysis and human behaviour understanding, design the overall behaviour and top-level decision making logic of the Virtual Support Partner, design the expressive virtual avatar with human-like facial expression, emotional voice and gestures, etc.) D1.2 will be provided as input to D3.1 and will be considered during the design of the Virtual Support Partner.</td>
</tr>
<tr>
<td><strong>D4.1</strong></td>
<td><strong>Design and specification of ICT-based services and safety services</strong>: This document presents the design of a set of Home Daily ICT services considering the categories of: Care &amp; Wellness, Guidance, and Education/Leisure aiding the elder in the execution of determined daily life activities at home as well as the design of safety services that will fulfil safety needs of the elder in carry out his/her daily life activities at home. D1.2 will be provided as input to D4.1 and will be considered during the design of the Home Daily ICT and Safety Services.</td>
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<tr>
<td><strong>D4.2</strong></td>
<td><strong>Specification of Co-Net</strong>: This document presents the design of the Collaborative care Network (Co-Net).</td>
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D1.2 will be provided as input to D4.2 and will be considered during the design of the Collaborative care Network (Co-Net) database and services that this component will provide.

D5.1 Specification of overall system architecture and security and privacy infrastructure: This document presents overall design of the Miraculous-Life system architecture. D1.2 will be provided as input to D5.1 and will be considered during the system architecture design and specification.

D5.2 Development of the KnowledgeBase: This document specifies the knowledge base where the data is stored. D1.2 will be provided as input to D5.2 and will be considered mainly during the design and specification of this knowledge base data model.

D6.1 Trials specification and design: This document designs the trials and describes the overall evaluation approach that will be used for the trials evaluation. D1.2 will be provided as input to D6.1 and it will be considered during the design and specification of the trials.

D6.4 Pilot acceptance evaluation results: This document assesses the acceptance of the final system based on experiences and evaluation data gathered by the two pilots. D1.2 will provide the use cases that are evaluated in D6.4.

D6.5 Overall system evaluation and initial deployment: This document describes the evaluation of the system and identifies initial deployment possibilities. D1.2 will provide the use cases on which the system is based and, therefore, play an important role as input for D6.5.

1.3 Structure of this document

This document is divided into two parts: Chapter 2 describes the first part about the user scenarios and use cases. Chapter 3 describes the second part about the user interface definition. This definition is split in the human-computer interaction requirements and the human-computer interface specification. In Chapter 4 the interaction between the use case scenarios, dialog management and services will be provided but this is left for the second version of this deliverable (D1.2b). Finally, the main conclusions are provided in Chapter 5.
2 User scenarios and use cases

To bring user context to life, scenarios and use cases are developed giving detailed realistic examples of how users will carry out their daily life activities at home, based on the VSP model and considering interaction with different formal and informal care actors. The results will serve as an aid to understanding and clarifying user requirements and expectations of the system’s functionality and to provide a basis for the definition of the different system features.

Each user scenario will be followed by several use cases. Use cases will be organized in situations and described in a stepwise manner. Use cases will be also presented, focusing on the dialog between the end-user and the VSP; helping thus the development of the dialogues patterns. Note also that in the second version of this deliverable, more dialogues will be proposed for each use case. Importantly, each of the use cases will be described in an exhaustive manner, by presenting all the possible interactions and situations, identified so far, between the user and the system.

At the current stage of the Miraculous Life project, the technology behind the speech recognition and the avatar interaction are not capable of complete natural interaction. Hence, the proposed interaction cases are adapted to cope with the limitations introduced by the interaction components. In D1.2b more advanced interaction scripts will be provided as the speech recognition understands more natural spoken words like complete sentences and the avatar communicates in a more random manner. To illustrate this, the avatar could instead of always saying “Luc, how’s your day?”, it could randomly iterate “Hey Luc”, “What’s up Luc?”, “Luc, how is it going?”, etc.

The illustrations provided in this chapter are ideas of how a screen can be represented. As the user interface is not yet finalized, upon delivery of this deliverable, the final screenshots will be created with the user interface in D1.2b.

2.1 First user scenario: Donato Life

This first user scenario is the one that will be used for the first pre-trial. In the first pre-trial there will be a first version of some integrated services. Some of the services described in this use case are thus repeated in a more extended description in the other scenarios.

The name of the elderly is Donato Life and he is 72 years old. Donato is living alone in the elderly home of Orbis Hoogstaete. He likes to participate with his friends in several activities organised by the care organisation. Donato has a light form of dementia and forgets sometimes his appointments and also where he leaves his objects (e.g., key, wallet, etc.). Furthermore, it is important that the VSP talks loud and clear to Donato because of his hearing problem.

2.1.1 Use case: Agenda Management (Agenda Service - Care & Wellness Service)

Situation: Donato wants to know what his activities are today.

[Daily schedule]:

State 1: Donato asks: “Show me my activities.” Go to next state.

State 2: The VSP asks: “Which date?” Go to next state.
State 3: Donato: “Today”. Go to next state.

State 4: The VSP is showing the list now at the left side of the screen. The VSP is on the right, she points at the list and is saying: “At the screen you see the list with the activities organized by the animation team today. Activity one is drink coffee at 10:00 hrs., activity two play card games at 11:00 hrs., and activity three do yoga at 15:00 hrs.”. “Do you want to participate in one of these activities? Go to next state or 6 or 7.

State 5: Donato answers: “Yes” Go to state 8.

State 6: Donato answers: “No” End of interaction. STOP

State 7: Donato answers: “Can you repeat the activities?” Go to state 4.

State 8: The VSP: “Which activity?” According to numeric response, go to next state or state 11 or state 13.

State 9: Donato: “Activity 1”. Go to next state.

State 10: The VSP answers “You are registered for drinking coffee at 10:00 hrs. today. Do you like to participate in another activity today?” Go to state 15 or 16.

State 11: Donato: “Activity 2”. Go to next state.

State 12: The VSP answers “You are registered for card games at 11:00 hrs. today. Do you like to participate in another activity today?” Go to state 15 or 16.

State 13: Donato: “Activity 3”. Go to next state.

State 14: The VSP answers “You are registered for yoga at 15:00 hrs. today. Do you like to participate in another activity today?” Go to state 15 or 16.

State 15: Donato answers: “No” End of interaction. STOP

State 16: Donato answers: “Yes” Go to state 8

Situation: Donato wants to see the details of one particular activity.

State 17: Donato: “I like to see the details of an activity”. Go to next state.

State 18: The VSP: “Which activity”. Go to next state, or 21, or 23.

State 19: Donato says: “Show me activity 1”. Go to next state.

State 20: The VSP says: “Okay, here it is” while the list at the left side is now changed into a detailed overview of the activity “drink coffee”. In this detailed overview you see the time of the activity, the location, the price, the accessories needed and for whom it is organized (e.g. all elderly, one department, one individual)

Activity: drink coffee
Time: 10:00-11:00 hrs.
Location: Coffee corner department 1
Price: 0
Accessories: No
For whom: Department 1

These details are read aloud by the avatar and shown on the screen. Go to state 25 or 26.
**State 21:** Donato wants to see the details of one particular activity, card games. Donato says: “Show me card games”. *Go to next state.*

**State 22:** The VSP says: “Okay, here it is” while the list at the left side is now changed into a detailed overview of the activity “card games”. In this detailed overview you see the time of the activity, the location, the price, the accessories needed and for whom it is organized (e.g. all elderly, one department, one individual)

- **Activity:** card games
- **Time:** 11:00-12:00 hrs.
- **Location:** Restaurant
- **Price:** 0
- **Accessories:** Cards
- **For whom:** All

These details are read aloud by the avatar and shown on the screen.

*Go to state 25 or 26.*

**State 23:** Donato wants to see the details of one particular activity, card games. Donato says: “Show me yoga”. *Go to next state.*

**State 24:** The VSP says: “Okay, here it is” while the list at the left side is now changed into a detailed overview of the activity “yoga”. In this detailed overview you see the time of the activity, the location, the price, the accessories needed and for whom it is organized (e.g. all elderly, one department, one individual)

- **Activity:** yoga
- **Time:** 15:00-16:00 hrs.
- **Location:** Gymnastic room
- **Price:** 1 stripe
- **Accessories:** Mat
- **For whom:** All

These details are read aloud by the avatar and shown on the screen.

*Go to state 25 or 26.*

**State 25:** Donato now sees where he has to be, at what time and knows all he wanted to know. Donato says: “Thank you”. *Go to state 27.*

**State 26:** Donato: “I like to see the details of another activity”. *Go to state 18.*

**State 27:** The VSP says: “Okay” and closes the event list / view. Now the VSP is the size of the full screen again. End of interaction. **STOP**
2.1.2 Use case: Appointment Reminder (Agenda Service - Care & Wellness Service)

Situation: Later today at 10:45 hrs.

**State 28:** The VSP says: “Donato you have a reminder. Do you like to hear it now? Go to next state or 31.

**State 29:** Donato answers “Yes.” Go to state 43.

**State 30:** The VSP answers: “In 20 minutes your activity card games starts in the restaurant. “Do not forget to bring your cards.” “This activity is for free.” At the same time a text bubble in the screen is shown the following text:

- **Activity:** Card games
- **Time:** 11:00-12:00 hrs.
- **Location:** Restaurant
- **Price:** 0
- **Accessories:** Cards

Go to state 44 or state 45.

**State 31:** Donato answers “No.” Go to next state.

**State 32:** The VSP: “Do you want the reminder later?” Go to next state or 38.

**State 33:** Donato: “No”. Go to next state.

**State 34:** The VSP: “Are you sure you don’t like to hear the reminder later?” Go to next state or 37.

**State 35:** Donato: “Yes” Go to next state.

**State 36:** The VSP: “This reminder is deleted now”.

**State 37:** Donato: “No” Go to state 39.

**State 38:** Donato: “Yes” Go to next state.

**State 39:** The VSP: “After what time?” Go to next state.

**State 40:** Donato: “After 10 minutes” STOP.

Situation: After 10 minutes…

**State 41:** The VSP says: “Donato you have a reminder do you like to hear it now? Go to next state or state 30.

**State 42:** Donato answers: “Yes”. Go to next state.

**State 43:** The VSP answers: “In 10 minutes your activity card games starts in the restaurant. “Do not forget to bring your cards.” “This activity is for free.” At the same time a text bubble in the screen is shown the following text:

- **Activity:** Card games
- **Time:** 11:00-12:00 hrs.
- **Location:** Restaurant
Price: 0
Accessories: Cards
Go to next state or state 45.

**State 44:** Donato says: “Thank you”. To confirm he received the reminder. End of interaction. STOP.

**[TESTING SPEED OF SPEECH]** (UniGe, as part of the dialogue management)

Situation: Donato didn’t understand the VSP because she talks too fast.

**State 45:** Donato says: “I did not understand you.” “Can you repeat the reminder?” Go to next state.

**State 46:** The VSP repeats state 43 but slower and louder. Go to next state.

**State 47:** The VSP asks Donato: “Did you understand me now?” Go to next state or state 49.

**State 48:** Donato answers: “Yes”. End of interaction. STOP.

**State 49:** Donato answers: “No” Go to next state.

**State 50:** The VSP asks: “Do you like me to talk slower or faster?” Go to next state or state 52.

**State 51:** Donato answers: “Slower” Go to state 53.

**State 52:** Donato answers: “Faster”. Go to next state.

**State 53:** The VSP asks: “Do you like me to talk louder or softer?” Go to next state or state 55.

**State 54:** Donato answers: “Louder.” Go to state 56.

**State 55:** Donato answers: “Softer”. Go to next state.

**State 56:** The VSP adapts her speed and volume to what Donato asks and repeats state 43. End of interaction. STOP

2.1.3 Use case: Object Location Assistance (Guidance Service)

Situation: Donato wants to go to his activity but can’t find his cards.

**State 57:** Donato says: “Where are my cards?” Go to next state.

**State 58:** The VSP answers: “Normally your cards are in the drawer of your closet in the living room”. Go to next state

**State 59:** Donato says: “I found them.” End of interaction. STOP.

2.2 Second user scenario: Luc Petit

Luc Petit is 85 years old. He lives alone in an apartment including a kitchen open on the dining area, a large bedroom, a hall, a bathroom and a balcony (47 square meters) in the Colladon Residence. He feels lonely since his wife passed away one year ago and he suffers
from slightly memory problems. He would like to use the Miraculous Life system (1) to stay in touch with his family and with the caregivers, (2) to obtain shopping assistance, (3) to benefit from the medication reminder service.

2.2.1 Use case: Contact List (Co-Net Service)

**CAREGIVER ASPECT**

First situation: a caregiver adds, modifies or removes a new contact.

*State 1:* Miriam Petit (daughter) access to the Luc's user profile thought the caregiver interface. **Go to the next state.**

*State 2:* Miriam adds a new entry in the contact database. Each entry is defined by nine fields and a photo: (1) First name, (2) Last Name, (3) Address including Residence Type, Street name, City, Country, House number, Apartment number and Zip code, (4) Telephone number and Type (e.g., mobile phone), (5) Email contact, (6) Birthday, (7) Gender, and (8) Email. **STOP.**

**ELDERLY ASPECT**

First situation: the elderly want to see the contact list and call his friend Miguel.

*State 1:* The VSP is in the “full screen mode” and in the “waiting mode”. Luc approaches the device. The VSP begins the interaction (neutral/concerned talking): “Luc, how’s your day?” **Go to the next state.**

*State 2:* The VSP is in the “listening mode”. Luc answer: “I am fine. VSP, I would like to consult my contact list”. **Go to the next state.**

*State 3:* The VSP is on the right, showing the contact list (see Figure 1). Each line of the list is composed by (1) the photo of the contact (if available), (2) the first name of the contact, (3) the last name of the contact. The VSP continues the interaction (neutral/concerned talking): “Luc, here you are. Do you want to see the details of a particular contact?” **Go to the next state.**

*State 4:* The VSP is in the “listening mode”. Luc answers: “Yes VSP, four”. **Go to the next state.**

*State 5:* The VSP is on the right. The contact list disappears; while the details of the fourth entry (Thom Bellamy) are shown on the screen (see Figure 2). The VSP continues the interaction (neutral/concerned talking): “Luc, here you are.” **Go to the next state or to the state 7.**

*State 6:* The VSP in the “waiting mode”. Luc picks up the telephone and calls his friend Thom. After five minutes, the systems automatically close the details of the entry. The VSP is on the “full screen mode”. **STOP.**

*State 7:* The VSP in the “waiting mode”. Luc picks up the telephone and calls his friend Thom. The line is busy. So, Luc continues the interaction with the VSP: “VSP, I want to quit”. The contact list is now closed and the VSP is on the “full screen mode”. **Go to the next state.**
State 8: The VSP concludes the interaction (neutral/concerned talking): “Okay Luc, if you ever need anything; don't hesitate to ask me!” The VSP is on the “full screen mode” and in the “waiting mode”. STOP.

2.2.2 Use case: Establish Video or Telephone Conversation (Education & Leisure Service)

In the Miraculous Life project, there is a need for the elderly to contact someone remotely, e.g., the caregiver. Currently, Skype could fulfil this goal, but Skype has officially closed its developer program. Currently, the possibilities of using Skype or another product are being investigated. Depending on the functionalities that the final solution provides, there may be some adaptations needed to the use cases defined below and the user interface of the Miraculous Life system. In D1.2b this scenario will be updated according to the technology implemented by the technical partners.
First situation: the elderly receives a Skype call.

**State 1:** By default, Skype runs in the background of the Miraculous Life system (see Figure 3), allowing the elderly to receive calls when the Miraculous Life system is turned on. It’s 14.00 PM and Luc receives a Skype call from his daughter Miriam. The Skype window (classical Skype app for windows) appears on the screen, showing the incoming call; while the VSP is on the right in the "waiting mode". Go to the next state or to the state 4.

![Figure 3: Skype showing incoming call in the Miraculous Life system.](image)

**State 2:** Luc heard the default Skype incoming call ring. Luc approaches the device and presses the button “answer with video”. In alternative, Luc tells to the VSP: “VSP, answer with video”. The video conversation starts. The VSP is in the "waiting mode". Go to the next state.

**State 3:** Luc (or Miriam) ends the conversation by pressing the button “end call”. In alternative, Luc tells to the VSP: “VSP, end call”. The Skype window is now closed and the VSP is on the “full screen mode”. The VSP concludes the interaction (happy talking): “I hope you had a nice conversation, Luc. If you ever need anything, don’t hesitate to ask me”. STOP.

**State 4:** Luc don’t hear the default Skype incoming call ring or doesn’t want to answer to the call. He continues to read a book (or watch TV). A notification will be triggered by the system 5 minutes after the missed call (see second situation). STOP.

Second situation: missed call notification. Environment: quiet (i.e., the user is not watching TV or listening to the radio).

**State 1:** Luc is sitting on the couch, reading a book. The VSP is in the “full screen mode” and in the “waiting mode”. A notification is triggered by the system (neutral/concerned talking): “Luc, you have a missed Skype call. Do you want to have a look?” Go to the next state or to the state 5 or 6.

**State 2:** The VSP is in the "waiting mode". Luc ignores the VSP message and continues reading his book. Go to the next state.
State 3: After five minutes the VSP try to initiate a new interaction, but louder than the previous one (neutral/concerned talking): “Luc, I am sorry to bother you… you have a missed Skype call. Do you want to have a look?” Go to the next state or to the state 5 or 6.

State 4: The VSP is in the "waiting mode". Luc continues to ignore the VSP and continues reading his book. The interaction is completed. STOP.

State 5: The VSP is in the "listening mode". Luc answers to the VSP: “Yes, VSP”. Go to the state 7.

State 6: The VSP is in the "listening mode". Luc answers to the VSP: “No, VSP”. Go to the state 8.

State 7: The Skype window (classical Skype app for windows) appears on the screen, showing the list of missed calls; while the VSP is on the right. The VSP says to the elderly (neutral/concerned talking): “Luc, here you have the last missed calls”. Luc can call the concerned person by pressing on his contact icon or quit Skype by the vocal command “VSP, I want to quit”. STOP.

State 8: The VSP concludes the interaction (neutral/concerned talking): “Ok Luc, if you ever need anything; don't hesitate to ask me!” STOP.

Third situation: missed call notification. Environment: noisy (i.e. the user is watching TV or listening to the radio). The system detects that the user is watching the TV or listening to the radio.

State 1: Luc is sitting on the couch, watching TV. The VSP is in the “full screen mode” and in the “waiting mode”. A reminder is triggered by the system. The VSP know that Luc is potentially annoyed by this interruption (neutral/concerned talking): “Luc, I am sorry to bother you… you have a missed Skype call. Do you want to have a look?” Go to the next state or to the state 10 or 11.

State 2: The VSP is in the "waiting mode". Luc doesn't hear the VSP and continues to watch TV. Go to the next state.

State 3: Five minutes later, the VSP initiates a new interaction, but louder (neutral/concerned talking): “Luc, I am sorry to bother you… you have a missed Skype call. Do you want to have a look?” Go to the next state or to the state 10 or 11.

State 4: The VSP is in the "waiting mode". Luc doesn’t hear the VSP and continues to watch TV. Go to the next state.

State 5: The VSP is in the "waiting mode". Five minutes later, the system triggers a bell alarm. By its nature, this alarm differs from environmental sounds, maximising the probability that the elderly hear it. Go to the next state or to the state 7.

State 6: The VSP is in the "waiting mode". Luc doesn’t hear the alarm or doesn’t want to answer to the VSP and continues to watch TV. The interaction is completed. STOP.

State 7: The VSP is in the "listening mode". Luc hears the alarm, decreases the volume of the television and says to the avatar: “Yes, VSP” Go to the next state.

State 8: The VSP knows that Luc is potentially annoyed by this interruption (neutral/concerned talking): “Luc, I am sorry to bother you… you have a missed Skype call. Do you want to have a look?” Go to the next state or to the state 10 or 11.
**State 9:** The VSP is in the "waiting mode". Luc ignores the VSP and increase the volume of the television. The interaction is completed. **STOP.**

**State 10:** The VSP is in the "listening mode". Luc answers to the VSP: “Yes, VSP”. **Go to the state 12.**

**State 11:** The VSP is in the "listening mode". Luc answers to the VSP: “No, VSP”. **Go to the state 13.**

**State 12:** The Skype window (classical Skype app for windows) appears on the screen, showing the list mist of missed call; while the VSP is on the right. The VSP says to the elderly (neutral/concerned talking): “Luc, here you have the last missed calls”. Luc can call the concerned person by pressing on his photo or quit Skype by the vocal command “VSP, I want to quit”. **STOP.**

**State 13:** The VSP concludes the interaction (neutral/concerned talking): “Ok Luc, if you ever need anything; don't hesitate to ask me!” **STOP.**

Fourth situation: the elderly calls a caregivers or a friend.

**State 1:** The VSP is in the “full screen mode” and in the “waiting mode”. Luc approaches the device. The VSP begins the interaction (neutral/concerned talking): “Luc, how's your day?” **Go to the next state.**

**State 2:** The VSP is in the "listening mode". Luc answer: “I am fine. VSP, launch Skype”. **Go to the next state.**

**State 3:** The Skype window (classical Skype app for windows) appears on the screen, showing the list of Skype contacts; while the VSP is on the right on the "waiting mode" (see Figure 4). **Go to the next state.**

![Figure 4: Skype showing contacts in the Miraculous Life system.](image)

**State 4:** Luc sees that his son Jean is online. He presses on Jean's contact icon in order to call him. In alternative, Luc tells to the VSP: “VSP, call Jean”. The (video) conversation starts. **Go to the next state.**
**State 5:** Luc (or Jean) ends the conversation by pressing the button “end call”. In alternative, Luc tells to the VSP: “VSP, end call”. The Skype window is now closed and the VSP is on the “full screen mode”. The VSP concludes the interaction (happy talking): “I hope you had a nice conversation, Luc. If you ever need anything, don’t hesitate to ask me”. **STOP.**

### 2.2.3 Use case: Shopping Assistance (Guidance Service)

**Remark:** as the items on the shopping list are not clear at the finalization of this deliverable, the complete shopping list will be in D1.2b.

#### ELDERLY ASPECT

**First situation: the elderly wants to add an item in the shopping list.**

**State 1:** The VSP is in the “full screen mode” and in the “waiting mode”. Luc approaches the device. The VSP begins the interaction (neutral/concerned talking): “Luc, how’s your day?” **Go to the next state.**

**State 2:** The VSP is in the “listening mode”. Luc answer: “I am fine. VSP, launch the shopping list”. **Go to the next state.**

**State 3:** The VSP is on the right, showing the shopping list and the possible user actions (see Error! Reference source not found.Figure 5). The VSP continues the interaction: “Luc, at the screen you see your shopping list. What do you want to do? Choose an option.” **Go to the next state.**

**Figure 5: Main screen of the shopping list service.**

**State 4:** The VSP is in the “listening mode”. Luc answers to the VSP: “Option 1, VSP”. **Go to the next state.**

**State 5:** The VSP continues the interaction (neutral/concerned talking): “What item do you want to add on the list?” **Go to the next state.**

**State 6:** The VSP is in the “listening mode”. Luc answer: “Two aubergines”. The system recognizes the vegetable (and the relative quantity) and adds a new entry at the beginning of the list. The VSP continues the interaction (neutral/concerned talking): “I added the item to the shopping list. What do you want to do now? Choose an option”. **Go to the next state.**
State 7: The VSP is in the "listening mode". Luc answers to the VSP: “Option 5, VSP”. Go to the next state.

State 8: The shopping list is now closed and the VSP is on the “full screen mode”. The VSP concludes the interaction (neutral/concerned talking): “Ok Luc, if you ever need anything, don’t hesitate to ask me!” STOP.

Second situation: the elderly removes an item from the shopping list.

State 1: The VSP is in the “full screen mode” and in the “waiting mode”. Luc approaches the device. The VSP begins the interaction (neutral/concerned talking): “Luc, how’s your day?” Go to the next state.

State 2: The VSP is in the "listening mode". Luc answer: “I am fine. VSP, launch the shopping list”. Go to the next state.

State 3: The VSP is on the right, showing the shopping list and the possible user actions (see Figure 5). The VSP continues the interaction: “Luc, at the screen you see your shopping list. What do you want to do? Choose an option.” Go to the next state.

State 4: The VSP is in the "listening mode". Luc answers to the VSP: “Option 2, VSP”. Go to the next state.

State 5: The VSP continues the interaction (neutral/concerned talking): “What item do you want to remove from the list?” Go to the next state.

State 6: The VSP is in the "listening mode". Luc answers to the VSP: “Item two, VSP”.

State 7: The second item of the shopping list is removed from the list. The VSP continues the interaction (neutral/concerned talking): “I removed the second item from the list, Luc. What do you want to do now? Choose an option”. Go to the next state.

State 8: The VSP is in the "listening mode". Luc answers to the VSP: “Option 5, VSP”. Go to the next state.

State 9: The shopping list is now closed and the VSP is on the “full screen mode”. The VSP concludes the interaction (neutral/concerned talking): “Ok Luc, if you ever need anything, don’t hesitate to ask me!” STOP.

Third situation: the elderly removes the whole shopping list.

State 1: The VSP is in the “full screen mode” and in the “waiting mode”. Luc approaches the device. The VSP begins the interaction (neutral/concerned talking): “Luc, how’s your day?” Go to the next state.

State 2: The VSP is in the "listening mode". Luc answer: “I am fine. VSP, launch the shopping list”. Go to the next state.

State 3: The VSP is on the right, showing the shopping list and the possible user actions (see Figure 5). The VSP continues the interaction: “Luc, at the screen you see your shopping list. What do you want to do? Choose an option.” Go to the next state.

State 4: The VSP is in the "listening mode". Luc answers to the VSP: “Option 3, VSP”. Go to the next state.
**State 5:** The VSP continues the interaction (neutral/concerned talking): “Luc, are you sure that you want to remove all the items contained in the shopping list?” Go to the next state or to the state 8.

**State 6:** The VSP is in the "listening mode". Luc answers: “Yes”. Go to the next state.

**State 7:** The shopping list is now empty. The VSP continues the interaction (neutral/concerned talking): “I removed all the items from the shopping list, Luc. What do you want to do now? Choose an option”. Go to the state 10.

**State 8:** The VSP is in the "listening mode". Luc answers: “No”. Go to the next state.

**State 9:** The VSP continues the interaction (neutral/concerned talking): “Ok. What do you want to do now? Choose an option”. Go to the next state.

**State 10:** The VSP is in the "listening mode". Luc answers to the VSP: “Option 5, VSP”. Go to the next state.

**State 11:** The shopping list is now closed and the VSP is on the “full screen mode”. The VSP concludes the interaction (neutral/concerned talking): “Ok Luc, if you ever need anything, don't hesitate to ask me!” STOP.

**Fourth situation: the system sends the shopping list by SMS**

**State 1:** The VSP is in the “full screen mode” and in the “waiting mode”. Luc approaches the device. The VSP begins the interaction (neutral/concerned talking): “Luc, how's your day?” Go to the next state.

**State 2:** The VSP is in the "listening mode". Luc answer: “I am fine. VSP, launch the shopping list”. Go to the next state.

**State 3:** The VSP is on the right, showing the shopping list and the possible user actions (see Figure 5). The VSP continues the interaction: “Luc, at the screen you see your shopping list. What do you want to do? Choose an option.” Go to the next state.

**State 4:** The VSP is in the "listening mode". Luc answers to the VSP: “Option 4, VSP”. Go to the next state.

**State 5:** The VSP continues the interaction (neutral/concerned talking): “Should I send the shopping list to your cell phone [Option 1] or to a caregiver cell phone [Option 2]?” Go to the next state or to the state 12.

**State 6:** The VSP is in the "listening mode". Luc answers to the VSP: “Option 1, VSP”. Go to the next state.

**State 7:** The VSP says (neutral/concerned talking): “Luc, I just sent to you the list. Do you want that I remove the whole shopping list?” Go to the next state or to the state 10.

**State 8:** The VSP is in the "listening mode". Luc answers: “Yes”. Go to the next state.

**State 9:** The shopping list is now empty. The VSP continues the interaction (neutral/concerned talking): “Ok, I removed all the items contained in the shopping list. Don't forget your cell phone when you will go shopping!” The shopping list service is now closed and the VSP is on the “full screen mode” and in the “waiting mode”. Luc received the list by SMS and goes shopping with his cell phone. STOP.
State 10: The VSP is in the "listening mode". Luc answers: “No”. Go to the next state.

State 11: The VSP continues the interaction (neutral/concerned talking); “Ok, don’t forget your cell phone when you will go shopping!” The shopping list service is now closed and the VSP is on the “full screen mode” and in the “waiting mode”. Luc received the list by SMS and goes shopping with his cell phone. STOP.

State 12: The VSP is in the "listening mode". Luc answers to the VSP: “Option 2, VSP”. Go to the next state.

State 13: The VSP is on the right, showing the contact list. Each line of the list is composed by (1) the photo of the contact, (2) the first name of the contact, (3) the last name of the contact. The VSP continues the interaction (neutral/concerned talking): “Who should I send the shopping list to?” Go to the next state.

State 14: The VSP is in the "listening mode". Luc answers: “Two, VSP”. Go to the next state.

State 15: The VSP says (neutral/concerned talking): “Luc, I just sent the list to John Bowes [second contact of the list]. Do you want that I remove the whole shopping list?” Go to the next state or to the state 18.

State 16: The VSP is in the "listening mode". Luc answers: “Yes”. Go to the next state.

State 17: The shopping list is now empty. The VSP continues the interaction (neutral/concerned talking): “Ok, I removed all the items contained in the shopping list. If you ever need anything; don’t hesitate to ask me!” The shopping list service is now closed and the VSP is on the “full screen mode” and in the “waiting mode”. STOP.

State 18: The VSP is in the "listening mode". Luc answers: “No”. Go to the next state.

State 19: The VSP continues the interaction (neutral/concerned talking): “Ok, if you ever need anything, don’t hesitate to ask me!” The shopping list service is now closed and the VSP is on the “full screen mode” and in the “waiting mode”. STOP.

2.2.4 Use case: Medication Reminder (Medication Service – Care & Wellness Service)

First situation: a caregiver add a new medicament in the agenda

State 1: François Fournier (MRPS caregiver) access to the Luc’s user profile thought the caregiver interface. Go to the next state.

State 2: François adds a new medication in the agenda. Each entry is defined by two fields: (1) Medication (what), (2) Timing (when) (3) Frequency of the reminder (daily, every other day, weekly). STOP.

ELDERLY ASPECT

First situation: the system reminds the elderly to take pills. Environment: quiet (i.e., the user is not watching TV or listening to the radio).

1 For future development of the Miraculous Life system, note that the site http://ch.oddb.org/en provides an open drug database for Switzerland.
**State 1:** Luc is sitting on the couch, reading a book. The VSP is in the “full screen mode” and in the “waiting mode”. A reminder is triggered by the system (neutral/concerned talking): “Luc, it’s 10.00 am. Have you had your pills?” Go to the next state or to the state 5 or 7.

**State 2:** The VSP is in the “waiting mode”. Luc ignores the VSP message and continues reading his book. Go to the next state.

**State 3:** Five minutes later, a new reminder is triggered by the system. The system detects that the elderly didn’t move from the couch. The VSP knows that Luc is potentially annoyed by this interruption (neutral/concerned talking): “Luc, I am sorry to bother you… Have you had your pills?” Go to the next state or to the state 5 or 7.

**State 4:** The VSP is in the “waiting mode”. Luc continues to ignore the VSP. The interaction is completed. STOP.

**State 5:** The VSP is in the "listening mode". Luc answers to the VSP: “Yes, VSP”. Go to the next state.

**State 6:** The VSP looks happy (happy talking): “Great! I’m glad to hear that.” STOP.

**State 7:** The VSP is in the "listening mode". Luc answers to the VSP: “No, VSP”. Go to the next state.

**State 8:** The VSP looks concerned (neutral/concerned talking): “Luc, I think you should take yours pills”. Go to the next state or to the state 11.

**State 9:** The VSP is in the "listening mode". Luc gets up from the couch and takes his pills, by answering the avatar: “Thank you, VSP”. Go to the next state.

**State 10:** The VSP concludes the interaction (happy talking): “You’re welcome, Luc”. STOP.

**State 11:** The VSP is in the "waiting mode". Luc ignores the VSP. Go to the state 3.

**Second situation:** the system reminds the elderly to take pills. Environment: noisy (i.e., the user is watching TV or listening to the radio). The system detects that the user is watching the TV or listening to the radio.

**State 1:** Luc is sitting on the couch, watching TV. The VSP is in the “full screen mode” and in the “waiting mode”. A reminder is triggered by the system. The VSP knows that Luc is potentially annoyed by this interruption (neutral/concerned talking): “Luc, I am sorry to bother you… Have you had your pills?” Go to the next state or to the state 10 or 12.

**State 2:** Luc doesn’t hear the VSP and continues to watch TV. Go to the next state.

**State 3:** Five minutes later, the VSP initiates a new interaction, but louder (neutral/concerned talking): “Luc, I am sorry to bother you… Have you had your pills?” Go to the next state or to the state 10 or 12.

**State 4:** The VSP is in the “waiting mode”. Luc doesn’t hear the VSP and continues to watch TV. Go to the next state.

**State 5:** The VSP is in the “waiting mode”. Five minutes later, the system triggers a bell alarm. By its nature, this alarm differs from environmental sounds, maximising the probability that the elderly hears it. Go to the next state or to the state 7.

**State 6:** The VSP is in the “waiting mode”. Luc doesn’t hear the alarm or doesn’t want to answer to the VSP and continues to watch TV. The interaction is completed. STOP.
State 7: The VSP is in the "listening mode". Luc hears the alarm, decreases the volume of the television and says to the avatar: “Yes, VSP” Go to the next state.

State 8: The VSP knows that Luc is potentially annoyed by this interruption (neutral/concerned talking): “Luc, I am sorry to bother you... Have you had your pills?” Go to the next state or to the state 10 or 12.

State 9: The VSP is in the "waiting mode". Luc ignores the VSP and increase the volume of the television. The interaction is completed. STOP.

State 10: The VSP is in the "listening mode". Luc answers to the VSP: “Yes, VSP”. Go to the next state.

State 11: The VSP looks happy (happy talking): “Great! I’m glad to hear that.” STOP.

State 12: The VSP is in the "listening mode". Luc answers to the VSP: “No, VSP”. Go to the next state.

State 13: The VSP looks concerned (neutral/concerned talking): “Luc, I think you should take yours pills”. Go to the next state or to the state 16.

State 14: The VSP is in the "listening mode". Luc gets up from the cough and takes his pills, by answering the avatar: “Thank you, VSP”. Go to the next state.

State 15: The VSP concludes the interaction (happy talking): “You’re welcome, Luc”. STOP.

State 16: The VSP is in the "waiting mode". Luc ignores the VSP. Go to the state 5.

2.2.5 Use case: Wake-up Calls (Agenda Service – Care & Wellness Service)

ELDERLY ASPECTS

First situation: the elderly set the alarm clock

State 1: The VSP is in the “full screen mode” and in the “waiting mode”. Luc approaches the device. The VSP begins the interaction (neutral/concerned talking): “Luc, how’s your day?” Go to the next state.

State 2: The VSP is in the "listening mode". Luc answers: “I am fine. VSP, I want to set the alarm clock”. Go to the next state.

State 3: The VSP continues the interaction (neutral/concerned talking): “This is a good idea. At what time do you want to get up?” Go to the next state.

State 4: The VSP is in the "listening mode". Luc answers: “At 7.00 am”. Go to the next state.

State 5: The VSP concludes the interaction (neutral/concerned talking): “the alarm has been set and will sound at the time selected. If you ever need anything, don't hesitate to ask me!”. STOP.

2.3 Third user scenario: Nicole Framboise

Nicole Framboise is 68 years old. She lives alone in a big apartment in the Colladon Residence. Nicole leads a semi-independent life. Nicole suffers from depression. She also doesn't eat and drink sufficiently. Finally she’s anxious about daily living in her apartment. She would like to have a system that can meet her safety needs.
2.3.1 Use case: Tutorial (Education & Leisure Service)

CAREGIVER ASPECT

First situation: an informal caregiver create a ‘tutorial’

**State 1:** Mireille Framboise (daughter) visits Nicole. Nicole asks her that she would like to learn how to send emails using her new Lenovo ThinkPad PC. *Go to the next state.*

**State 2:** Miriam creates an account in live.com. *Go to the next state.*

**State 3:** Miriam records with a camera three videos. In the first video, she explains how to access to the browser. In the second video she explains how to access to the email account. In the third video she explains how to write and send an email. *Go to the next state.*

**State 4:** When she gets home, Miriam access to the Nicole’s user profile thought the caregiver interface. *Go to the next state.*

**State 5:** Miriam adds a new entry in the guidance database. Each entry is composed by (1) the title of the tutorial, (2) an image and (3) a series of videos guiding the elderly ‘step by step’. Each of the images is accompanied by a short description (in this case: “Step 1: access to Chrome”, “Step 2: access to the email account”, “Step 3: write and send an email”).

ELDERLY ASPECT

**State 1:** Nicole want to write an email to his friend Jean-Pierre, but she doesn’t remember the procedure explained last Monday by the daughter. The VSP is in the “full screen mode” and in the “waiting mode”. Nicole approaches the device. The VSP begins the interaction (neutral/concerned talking): “Nicole, how’s your day?” *Go to the next state.*

**State 2:** The VSP is in the “listening mode”. Nicole answers: “I am fine. VSP, launch the guidance service”. *Go to the next state.*

**State 3:** The VSP is on the right, showing the ‘tutorial’ list (see Figure 6). Each line of the list is composed by a tutorial uploaded by caregivers. The VSP continues the interaction (happy talking): “Welcome to the guidance service, Nicole. What do you want to learn?” *Go to the next state.*
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State 4: The VSP is in the "listening mode". Nicole answers: “One, VSP”. Go to the next state.

State 5: The VSP is on the right, showing the videos contained in this tutorial (see Figure 7). Each line of the list represents a video (first frame of the video + short description of the video). The VSP continues the interaction (neutral/concerned talking): “Nicole, here you are. Which video do you want to see?” Go to the next state.

State 6: The VSP is in the "listening mode". Nicole answers: “One, VSP”. Go to the next state.

State 7: The video is played in a full screen mode. The buttons ‘play’, ‘stop’, ‘rewind’ and ‘forward’ buttons are available to the user. Go to the next state.

State 8: After viewing the video, the menu of the tutorial is displayed on the screen once again: the VSP is on the right, showing the videos contained in the tutorial. The VSP continues the interaction (neutral/concerned talking): “Nicole, do you want to see more videos?”. Go to the next state or to the state 11.
State 9: The VSP is in the "listening mode". Nicole answers to the VSP: “Yes, VSP”. Go to the next state.

State 10: The VSP continues the interaction (neutral/concerned talking): “Ok Nicole, which video do you want to see?”. Go to the state 6.

State 11: The VSP is in the "listening mode". Nicole answers to the VSP: “No, VSP” or “I want to quit, VSP”. Go to the next state.

State 12: The guidance service is now closed and the VSP is on the “full screen mode”. The VSP says (neutral/concerned talking): “If you ever need anything, don't hesitate to ask me!” STOP.

2.3.2 Use case: Lunch / Dinner Reminder (Agenda Service – Care & Wellness Service)

First situation: a caregiver actives or deactivates the dinner reminder functionality

State 1: François Fournier (MRPS caregiver) access to the Nicole’s user profile thought the caregiver interface. Go to the next state.

State 2: François activates the “dinner reminder” functionality and sets the reminder time to 6.00 p.m. STOP.

ELDERLY ASPECT

First situation: the system reminds the elderly to dining. Environment: quiet (i.e., the user is not watching TV or listening to the radio).

State 1: It is 6.00 p.m. Nicole is sitting on the couch, reading a book. The VSP is in the “full screen mode” and in the “waiting mode”. A reminder is triggered by the system (neutral/concerned talking): “Nicole, it’s 6.00 p.m. Did you plan for dinner?”. Go to the next state or to the state 5 or 7.

State 2: The VSP is in the "waiting mode". Nicole ignores the VSP message and continues reading his book. Go to the next state.

State 3: Five minutes later, a new reminder is triggered by the system. The system detect that the elderly didn’t move from the couch. The VSP know that Nicole is potentially annoyed by this interruption (neutral/concerned talking): “Nicole, I am sorry to bother you… Did you plan for dinner?”. Go to the next state or to the state 5 or 7.

State 4: The VSP is in the "waiting mode". Nicole continues to ignore the VSP. The interaction is completed. STOP.

State 5: The VSP is in the "listening mode". Nicole answers to the VSP: “Yes, VSP”. Go to the next state.

State 6: The VSP looks happy (happy talking): “Great! I’m glad to hear that.” STOP.

State 7: The VSP is in the "listening mode". Nicole answers to the VSP: “No, VSP”. Go to the next state.

State 8: The VSP looks concerned (neutral/concerned talking): “Nicole, I think you should eat something”. Go to the next state or to the state 11.
State 9: The VSP is in the "listening mode". Nicole gets up from the cough and goes to the kitchen, by answering the avatar: “Thank you, VSP”. Go to the next state.

State 10: The VSP concludes the interaction (happy talking): “You’re welcome, Nicole”. STOP.

State 11: The VSP is in the "waiting mode". Nicole ignores the VSP. Go to the state 3.
Second situation: the system reminds the elderly to dining. Environment: noisy (i.e., the user is watching TV or listening to the radio). The system detects that the user is regarding the TV or listening to the radio.

**State 1:** Nicole is sitting on the couch, watching TV. The VSP is in the “full screen mode” and in the “waiting mode”. A reminder is triggered by the system (neutral/concerned talking). The VSP know that Nicole is potentially annoyed by this interruption (neutral/concerned talking): “Nicole, I am sorry to bother you… Did you plan to dinner?”. Go to the next state or to the state 10 or 12.

**State 2:** Nicole doesn’t hear the VSP and continues to watch TV. Go to the next state.

**State 3:** Five minutes later, the VSP initiate a new interaction, but louder (neutral/concerned talking): “Nicole, I am sorry to bother you… Did you plan for dinner?”. Go to the next state or to the state 10 or 12.

**State 4:** The VSP is in the “listening mode”. Nicole doesn’t hear the VSP and continues to watch TV. Go to the next state.

**State 5:** The VSP is in the “waiting mode”. Five minutes later, the system triggers a bell alarm. By its nature, this alarm differs from environmental sounds, maximising the probability that the elderly hear it. Go to the next state or to the state 7.

**State 6:** The VSP is in the "listening mode". Nicole doesn’t hear the alarm or doesn’t want to answer to the VSP and continues to watch TV. The interaction is completed. STOP.

**State 7:** The VSP is in the "listening mode". Nicole hears the alarm, decreases the volume of the television and says to the avatar: “Yes, VSP” Go to the next state.

**State 8:** The VSP know that Nicole is potentially annoyed by this interruption (neutral/concerned talking): “Nicole, I am sorry to bother you… Did you plan for dinner?” Go to the next state or to the state 10 or 12.

**State 9:** The VSP is in the "listening mode". Nicole ignores the VSP and increase the volume of the television. The interaction is completed. STOP.

**State 10:** The VSP is in the "listening mode". Nicole answers to the VSP: “Yes, VSP”. Go to the next state.

**State 11:** The VSP looks happy (happy talking): “Great! I’m glad to hear that.” STOP.

**State 12:** The VSP is in the "listening mode". Nicole answers to the VSP: “No, VSP”. Go to the next state.

**State 13:** The VSP looks concerned (neutral/concerned talking): “Nicole, I think you should eat something”. Go to the next state or to the state 16.

**State 14:** Nicole gets up from the cough and goes to the kitchen, by answering the avatar (neutral/concerned talking): “Thank you, VSP”. Go to the next state.

**State 15:** The VSP concludes the interaction (happy talking): “You’re welcome, Nicole”. STOP.

**State 16:** The VSP is in the "listening mode". Nicole ignores the VSP. Go to the state 5.
2.3.3 Use case: Drink Reminder (Agenda Service – Care & Wellness Service)

**CAREGIVER ASPECT**

First situation: a caregiver activates or deactivates the drink reminder functionality

**State 1:** François Fournier (MRPS caregiver) access to the Nicole’s user profile thought the caregiver interface. Go to the next state.

**State 2:** François activate the “drink reminder” functionality and set the time interval between successive recaps to 4 hours. STOP.

**ELDERLY ASPECT**

First situation: the system reminds the elderly to drink a glass of water. Environment: quiet (i.e. the user is not watching TV or listening to the radio).

**State 1:** Nicole is sitting on the couch, reading a book. The VSP is in the “full screen mode” and in the “waiting mode”. A reminder is triggered by the system (neutral/concerned talking): “Nicole, did you drink a glass of water recently?”. Go to the next state or to the state 5 or 7.

**State 2:** The VSP is in the "waiting mode". Nicole ignores the VSP message and continues reading his book. Go to the next state.

**State 3:** Five minutes later, a new reminder is triggered by the system. The system detects that the elderly didn’t move from the couch. The VSP knows that Nicole is potentially annoyed by this interruption (neutral/concerned talking): “Nicole, I am sorry to bother you… did you drink a glass of water recently?”. Go to the next state or to the state 5 or 7.

**State 4:** The VSP is in the "waiting mode". Nicole continues to ignore the VSP. The interaction is completed. STOP.

**State 5:** The VSP is in the "listening mode". Nicole answers to the VSP: “Yes, VSP”. Go to the next state.

**State 6:** The VSP looks happy (happy talking): “Great! I’m glad to hear that.” STOP.

**State 7:** The VSP is in the "listening mode". Nicole answers to the VSP: “No, VSP”. Go to the next state.

**State 8:** The VSP looks concerned (neutral/concerned talking): “Nicole, I think you should drink a glass of water’. Go to the next state or to the state 11.

**State 9:** The VSP is in the "listening mode". Nicole gets up from the cough and goes to the kitchen, by answering the avatar: “Thank you, VSP”. Go to the next state.

**State 10:** The VSP concludes the interaction (happy talking): “You’re welcome, Nicole”. STOP.

**State 11:** The VSP is in the "waiting mode". Nicole ignores the VSP. Go to the state 3.

Second situation: the system reminds the elderly to drink a glass of water. Environment: noisy (i.e. the user is watching TV or listening to the radio). The system detects that the user is regarding the TV or listening to the radio.

**State 1:** Nicole is sitting on the couch, watching TV. The VSP is in the “full screen mode” and in the “waiting mode”. A reminder is triggered by the system (neutral/concerned talking).
The VSP knows that Nicole is potentially annoyed by this interruption (neutral/concerned talking): “Nicole, I am sorry to bother you... did you drink a glass of water recently?” Go to the next state or to the state 10 or 12.

**State 2:** Nicole doesn’t hear the VSP and continues to watch TV. Go to the next state.

**State 3:** Five minutes later, the VSP initiate a new interaction, but louder (neutral/concerned talking): “Nicole, I am sorry to bother you... did you drink a glass of water recently?” Go to the next state or to the state 10 or 12.

**State 4:** The VSP is in the “waiting mode”. Nicole doesn’t hear the VSP and continues to watch TV. Go to the next state.

**State 5:** The VSP is in the “waiting mode”. Five minutes later, the system triggers a bell alarm. By its nature, this alarm differs from environmental sounds, maximising the probability that the elderly hears it. Go to the next state or to the state 7.

**State 6:** The VSP is in the “waiting mode”. Nicole doesn’t hear the alarm or doesn’t want to answer to the VSP and continues to watch TV. The interaction is completed. STOP.

**State 7:** The VSP is in the “listening mode”. Nicole hears the alarm, decreases the volume of the television and says to the avatar: “Yes, VSP”. Go to the next state.

**State 8:** The VSP knows that Nicole is potentially annoyed by this interruption (neutral/concerned talking): “Nicole, I am sorry to bother you... did you drink a glass of water recently?” Go to the next state or to the state 10 or 12.

**State 9:** The VSP is in the “waiting mode”. Nicole ignores the VSP and increases the volume of the television. The interaction is completed. STOP.

**State 10:** The VSP is in the “listening mode”. Nicole answers to the VSP; “Yes, VSP”. Go to the next state.

**State 11:** The VSP looks happy (happy talking): “Great! I’m glad to hear that.” STOP.

**State 12:** The VSP is in the ”listening mode”. Nicole answers to the VSP: “No, VSP”. Go to the next state.

**State 13:** The VSP looks concerned (neutral/concerned talking): “Nicole, I think you should drink a glass of water”. Go to the next state or to the state 16.

**State 14:** The VSP is in the ”listening mode”. Nicole gets up from the cough and goes to the kitchen, by answering the avatar: “Thank you, VSP”. Go to the next state.

**State 15:** The VSP concludes the interaction (happy talking): “You’re welcome, Nicole”. STOP.

**State 16:** The VSP is in the ”waiting mode”. Nicole ignores the VSP. Go to the state 5.

### 2.3.4 Use case: Fall Detection (Safety Service)

**Remark:** similar as in the use case 2.2.2, we depend heavily on the availability of existing libraries like Skype, to make remote connections. As this kind of technology is still under investigation, this use case will be updated in D1.2b.
CAREGIVER AND ELDERLY ASPECT

**State 1:** The system is in the “sleep mode” – i.e., no reminder or notification is triggered, the VSP is inactive, but the system still continues to collects and process data from sensors for safety concerns. In the middle of the night, Nicole wakes up to go to the toilet. She stumbles and falls on the floor causing noise. \textit{Go to the next state}.

**State 2:** The Miraculous Life system interprets the noise as potential danger and detects the figure of the elderly on the floor. The Miraculous Life system is automatically switched on the “alert mode” (i.e., the system switches automatically on, without the intervention of the primary end-user). The VSP asks to the elderly (neutral/concerned talking): “Nicole, do you need help?”. \textit{Go to the next state or to the state 7 or to the state 8}.

**State 3:** The VSP is in the "listening mode". Nicole stands up. She feels good and answers: “No, VSP”. \textit{Go to the next state}.

**State 4:** The VSP continues the interaction (neutral/concerned talking): “Should I switch into the sleep mode?” \textit{Go to the next state}.

**State 5:** The VSP is in the "listening mode". Nicole answers: “Yes, VSP”. \textit{Go to the next state}.

**State 6:** The system comes back into the sleep mode, while Nicole goes back to sleep. STOP.

**State 7:** The VSP is in the "listening mode". Nicole answers: “Yes, VSP” or “Call for help, VSP”. \textit{Go to the state 9}.

**State 8:** The VSP is in the "waiting mode". Nicole is lying on the ground and she doesn’t answer to the VSP. \textit{Go to the state 9}.

**State 9:** The VSP continues the interaction (neutral/concerned talking): “Do not worry, Nicole. I warned the caregivers. They will be here soon”. The Miraculous Life system plays music, aiming to calm the elderly. The Miraculous Life system automatically makes a call to predefined contacts (in a predefined order of priority). \textit{Go to the next state}.

**State 10:** Sylvie Rousseau (MRPS caregiver) answers the call of the Miraculous Life system. An automatic audio message is triggered: “This is a pre-recorded message provided by the Miraculous Life system: Nicole is in her apartment and she needs help immediately. Can you intervene in the next minutes in order to provide support to her?” \textit{Go to the next state or to the state 12}.

**State 11:** The caregiver answers: “Yes”. \textit{Go to the next state}.

**State 12:** A new pre-recorded message is triggered by the system: “This is a pre-recorded message provided by the Miraculous Life system: you have confirmed that you can intervene to assist Nicole Framboise. Thank you. Nicole is waiting for you”. The call ends automatically. Sylvie goes to Nicole’s apartment to assist the elderly. STOP.

**State 13:** The caregiver answers: “No”. \textit{Go to the next state}.

**State 14:** A new pre-recorded message is triggered by the system: “This is a pre-recorder message provided by the Miraculous Life system: you cannot intervene to assist Nicole Framboise. Don’t worry, I will call someone else”. The call ends automatically. The Miraculous Life system makes a new call to the following predefined contact. \textit{Go to the state 10}.
2.3.5 Use case: Dangerous Objects Adviser (Safety Service)

**ELDERLY ASPECT**

**State 1:** The system is in the “sleep mode” – i.e., no reminder or notification is triggered, the VSP is inactive, but the system still continues to collects and process data from sensors for safety concerns. Nicole is in the sitting room. Nicole gets up from the couch and goes to the bathroom. *Go to the next state.*

**State 2:** The system recognizes an unknown object at the ground in her walking direction and interprets this object as potential danger for the elderly. The Miraculous Life system is automatically switched on the “alert mode” (i.e. the system switches automatically on, without the intervention of the primary end-user). The VSP starts a new interaction (neutral/concerned talking): “Nicole, I see an object at the ground in your walking direction. Please be careful!” *Go to the next state or to the state 7.*

**State 3:** The VSP is in the “listening mode”. Nicole sees the umbrella on the ground. She picks it up and places it on the umbrella stand, by answering the avatar: “Thank you, VSP”. *Go to the next state.*

**State 4:** The Miraculous Life system detects that the potential risk has been raised. The elderly VSP continues the interaction (happy talking): “You’re welcome Nicole. Should I switch into the sleep mode?”. *Go to the next state.*

**State 5:** The VSP is in the “listening mode”. Nicole answers: “Yes, VSP”. *Go to the next state.*

**State 6:** The system comes back into the sleep mode, while Nicole goes to the toilet. *STOP.*

**State 7:** The VSP is in the "waiting mode". Nicole does not react to the advice provided by the VSP and she goes to the toilet. *Go to the next state.*

**State 8:** Nicole comes back on the sitting room. A new advice is triggered by the system. Note: the Miraculous Life system will continuously trigger advices until such time as the elderly moves the object. *STOP.*

2.3.6 Use case: Danger Situations Adviser (Safety Service)

**Remark:** at finalizing the current deliverable, the full list of dangerous situations is not available yet. Use cases of how the dangerous situations are addressed by the VSP will be added in D1.2b.

**ELDERLY ASPECT**

**State 1:** The system is in the “sleep mode” – i.e., no reminder or notification is triggered, the VSP is inactive, but the system still continues to collects and process data from sensors for safety concerns. Nicole is cooking lunch. The phone rings and Nicole goes to the sitting room in order to answer the phone. She also forgets her lunch on the stove. *Go to the next state.*

**State 2:** The system evaluates this situation as being potentially dangerous for the elderly. The Miraculous Life system is automatically switched on the “alert mode” (i.e., the system switches automatically on, without the intervention of the primary end-user). The VSP starts a new interaction (neutral/concerned talking): “Nicole, you forgot your lunch on the stove!” *Go to the next state.*
State 3: The VSP is in the "listening mode". Nicole leaves the phone on the sitting room, comes back in the kitchen and shuts off gas to the stove by saying “Thank you, VSP”.

State 4: The Miraculous Life system detects that the potential risk has been raised. The elderly VSP continues the interaction (happy talking): “You’re welcome Nicole. Should I switch into the sleep mode?” Go to the next state.

State 5: The VSP is in the "listening mode". Nicole answers: “Yes, VSP”. Go to the next state.

State 6: The system comes back into the sleep mode, while Nicole comes back to the sitting room and continues to talk with her friend on the phone. STOP.

State 7: The VSP is in the "waiting mode". Nicole does not react to the advice provided by the VSP and she continues to talk with her friend on the phone. Go to the next state.

State 8: Two minutes later, a new advice is triggered by the system. Note: the Miraculous Life system will continuously trigger advices until the elderly answers to the advice. STOP.

2.4 Fourth user scenario: Debora De Jong

Debora De Jong is 88 years old. She lives alone in the elderly care centre of Orbis Hoogstaete in an apartment including a living room with a small kitchenette, a bedroom and bathroom (46 square meters). She suffers from Chronic Obstructive Pulmonary Disease (COPD) and needs oxygen. For long distances, she uses a mobility scooter.

She feels lonely, especially in the evening, since her husband passed away two years ago. She needs physical and emotional support. She needs help with showering and getting (un)dressed considering her oxygen supply and she needs reminders for taking her medication. Emotionally, she needs to be supported by a person in the morning and evening to start and close the day.

She participates in several activities organized in the care centre and she loves to play cards with her neighbour Susan. She is always looking for social contacts and her daughter visits her twice a week. With all these various activities Debora’s calendar is quite full and she sometimes misses some appointments with friends or organized activities. Therefore she would like the device to remind her of her appointments and show her the daily schedule of her activities.

2.4.1 Use case: Event Management/Creator, Group Activities (Education & Leisure Service)

Situation: Debora wants to see the activities organised, register to an activity, invite her neighbour Susan to join her and receive a reminder before the start of the activity.

CAREGIVER ASPECT

The caregiver needs to add the activities organised by the care organisation into the system via his work computer which is connected to a remote server which sends the information to all local servers of the elderly.

The caregiver needs to add, edit and delete activities in the system.

In adding activities we need the following fields:
• Activity
• Price of activity
• For whom the activity is (individual, department, all)
• Location
• Date
• Time
• Duration
• Frequency

If an activity is added and it overlaps with another earlier added activity the caregiver needs to receive a pop up which shows with which activity it overlaps and if the caregiver still wants to add this new activity.

**ELDERLY ASPECT**

**State 1:** Debora wants to know what her activities are today. She asks: “VSP, show me the activities of today”. *Go to the next state.*

**State 2:** VSP is showing the list now at the left side of the screen. VSP is on the right, she points at the list and is saying: “At the screen you see the list with the activities organised by the animation team today. Option one is drink coffee at 10:00 hrs., option two play card games at 11:00 hrs., and option three do yoga at 15:00 hrs.”. “Do you want to participate in one of these activities? *Go to the next state or state 4.*

**State 3:** Debora answers: “Yes, option 2”. *Go to state 5.*

**State 4:** Debora answers: “No”. The interaction is completed. **STOP**

**State 5:** VSP answers “You are registered for card games. “Do you like to invite a friend to join you?” *Go to next state or state 7.*

**State 6:** Debora: “Yes” *Go to state 8.*

**State 7:** Debora: “No”. The interaction is completed. **STOP**

**State 8:** VSP: “Who?”. *Go to the next state.*

**State 9:** Debora: “My neighbour Susan”. *[Subscribing and inviting to activities] “Go to the next state.*

**State 10:** VSP:” Shall I send the invitation to Susan?”. *Go to state 11 or 12.*

**State 11:** Debora: “Yes”. The invitation is send via the system and Susan receives a message. *Go to state 16.*

**State 12:** Debora “No”. *Go to next state.*

**State 13:** VSP: “Do you like to invite someone else?”. *Go to state 14 or 15.*

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2 The system cannot and will not check if Susan is already registered for the activity mentioned. Debora is always free to invite someone and Susan can indicate at that time she is already participating.
State 14: Debora: “Yes”. *Go to state 8 and add another name in state 9.*

State 15: Debora: “No”. The interaction is completed. **STOP**

State 16: VSP of Susan: “You have a message from your friend Debora. Do you like to hear it?” *Go to next state or state 18. When there is no respond from Susan repeat this text again when the Kinect registers activity in the room.*

State 17: Susan says: ‘Yes”. *Go to state 21*

State 18: Susan says: “No”. *Go to the next state.*

State 19: VSP: “When do you like me to remind you again for this message?”. *Go to next state.*

State 20: Susan: “In 30 minutes” **STOP. After 30 minutes go to step 16.**

State 21: The VSP of Susan says: “Debora invites you to join her in card games today at 11:00 hrs. at location department 1, duration 60 minutes, no accessories needed”. “Do you like to go to this activity with Debora?”. *Go to next state or state 23.*


State 23: Susan: “No”. *Go to next state.*

State 24: VSP: “Do you like to add a text to this answer?”. *Go to next state or state 26.*

State 25: Susan: “No”. *Go to state 29.*

State 26: Susan: “Yes”. *Go to next state.*

State 27: VSP of Susan: “What message do you like to add?” *Go to next state.*

State 28: Susan: When she is able to join: “I am looking forward to see you”; When she isn’t able to join: “I have another appointment and can’t join you” *Go to next state.*

State 29: Avatar of Susan: “I will send the message now”. The interaction is completed. **STOP.**

**Situation: A message is send back from Susan to Debora.**

State 30: VSP: “You have a message from your friend Susan do you like to hear it?”. *Go to the next state or 32.*

State 31: Debora says: ‘Yes”. *Go to state 36.*

State 32: Susan says: “No” or doesn’t respond at all. *Go to the next state.*

State 33: VSP: “When do you like me to remind you again for this message?”. *Go to next state.*

State 34: Susan: “In 30 minutes”.

State 35: VSP of Susan: “I will remind you in 30 minutes. “**STOP. After 30 minutes go to step 30.**

State 36: VSP: “Susan accepts your invitation to join you in the activity card games at 11:00 hrs. today”. The interaction is completed. **STOP.**

State 37: VSP: “Do you like to participate in another activity today?”. *Go to the next state or 39.*
State 38: Debora answers: “No” The interaction is completed. STOP
State 39: Debora answers: “Yes”. Go to state 3 and enter another option. STOP

Situation: Debora wants to see the details of one particular activity, card games.
State 40: Debora says: “Show me card games”. Go to the next state.
State 41: VSP says: “Okay, here you can see it on the screen” while the list at the left side is now changed into a detailed overview of the activity “card games”. In this detailed overview you see the time of the activity, the location, the price, the accessories needed and for whom it is organised (e.g., all elderly, one department, one individual). These details are also read aloud by the avatar. Go to the next state.
State 42: Debora now sees where she has to be, at what time and knows all he wanted to know. Debora says: “Thank you”. Go to the next state.
State 43: VSP says: “Okay” and closes the event list / view. Now the VSP is the size of the full screen again. The interaction is completed. STOP

2.4.2 Use case: Agenda Reminder (Agenda Service – Care & Wellness Service)

ELDERLY ASPECT
Later today at 10:45 hrs.
State 44: VSP says: “Debora you have a reminder do you like to hear it now? Go to next state or state 46.
State 45: Debora answers “No.” Go to state 47.
State 46: “Yes”. Go to state 52.
State 47: VSP: “Do you want to hear the reminder later?” Go to next state.
State 48: Debora: “Yes”. Go to next state.
State 49: VSP: “After what time?”. Go to next state.
State 50: Debora: “After 10 minutes” Go to the next state.
State 51: VSP: “I will remind you again after 10 minutes” STOP.
After 10 minutes…. Go to state 43.
State 52: VSP answers: “In 10 minutes your activity card games starts in the restaurant. “Do not forget to bring your cards.” At the same time a text bubble in the screen is shown the following text:

Activity: card games
Time: 11:00-12:00 hrs.
Location: Restaurant
Accessories: Cards

Go to next state
State 53: Debora: “Thank you”. This confirms that Debora received the reminder. The interaction is completed. STOP

2.4.3 Use case: Add Agenda Items (Agenda Service – Care & Wellness Service)

Remark: The current use case does not handle recurrent events. In D1.2b a scenario will be added for handling such events.

State 54: Debora: “I like to add an appointment in my agenda”. Go to next state


State 56: Debora: “Hairdresser.” Go to next state.

State 57: VSP: “What date?”. Go to next state.

State 58: Debora: “15 July.”. Go to next state.

State 59: VSP “What time?”. Go to next state.

State 60: Debora: “13:00 hrs.”. Go to next state.

State 61: VSP: “For how long?”. Go to next state.

State 62: Debora: “One hour.”. Go to next state.


State 64: Debora: “At the hairdresser in the lobby.” Go to next state.

State 65: VSP: “With somebody?”. Go to next state or state 67.

State 66: Debora: “No.”. Go to state 74.

State 67: Debora: “Yes”. Go to next state.

State 68: VSP: “With whom?”. Go to next state.

State 69: Debora: “Neighbour Susan.”. Go to next state.

State 70: VSP: “Shall I send Susan a message?” Go to next state or state 72.

State 71: Debora: “No”. Go to state 13 in paragraph 2.4.1 and end with state 74.

State 72: Debora “Yes”. The invitation is send via the system and Susan receives a messages. Go to next state.

State 73: VSP: “The invitation is send to Susan.”. The process of Susan receiving a message and answering back is described from state 16 in paragraph 2.4.1 on. Go to next state.

State 74: VSP: “This appointment is added in your agenda.” End of interaction. STOP.
2.4.4 Use case: Object Location Assistance (Guidance Service)

Situation: Debora wants to drink and play cards with her friends in the restaurant but can’t find her wallet and glasses.

**ELDERLY ASPECT**

**State 1:** Debora tells the VSP: “I can’t find my wallet”. *Go to next state.*

**State 2:** The VSP detects with the camera an object similar to a wallet on her couch and sends a picture of the room with the wallet marked with a circle in the picture and says: “Your wallet is marked with a circle in this picture of your room.” *Go to next state.*

**State 3:** Debora says ‘Found it’, picks it up and wants to leave. End of interaction. *STOP.*

**State 4:** She asks her VSP: “Can you find my glasses too?”. *Go to next state.*

**State 5:** The VSP scans the room again but can’t find an object similar to glasses. The VSP tells: “I can’t detect your glasses via the camera.”. The VSP now automatically switches over to the object location service. *Go to state 6 in paragraph 2.4.5.*

2.4.5 Use case: Object Location Reminder (Guidance Service)

Situation: As mentioned above in the object location assistance Debora is looking for her glasses which weren’t found by the object location assistance service. When objects aren’t found by this service it automatically switches to object location reminder to help the elderly find the object. Search for object location reminder.

**ELDERLY ASPECT**

**State 6:** The VSP tells: “You normally store your glasses in the second drawer of your cabin in your living room.”. *Go to next state.*

**State 7:** Debora answers “I found them”. End of interaction. *STOP.*

**State 8:** Debora: “I like to add another item to the object reminder list” *Go to next state.*

**State 9:** The VSP shows the screen to add an item (the user can select options either by voice or touch command) and asks “What item?” *Go to next state.*

**State 10:** Debora “Keys”; Free text field with speech to text. *Go to next state or state 38.*

**State 11:** The VSP answers “You already have this item in your list, do you like to hear the details?”. List of object details. *Go to next state or 13.*

**State 12:** Debora: “No”. *Go to state 35.*

**State 13:** Debora: “Yes.”. *Go to next state.*
**State 14:** The VSP answers “Keys are located in the second drawer of the cabin in your living room.” “Do you like to change this information?” Option for edit object location reminder. *Go to next state.*

**State 15:** Debora: “No.” *Go to state 35.*

**State 16:** Debora: “Yes.” *Go to next state.*

**State 17:** VSP: “The items is called keys, do you like to change the name of the item?”

**State 18:** Debora: “No”. *Go to state 23.*

**State 19:** Debora: “Yes.” *Go to next state.*

**State 20:** VSP: “What name do you want to use instead of keys?”. *Go to next state.*

**State 21:** Debora: “Car keys.”. *Go to next state.*

**State 22:** VSP: “Keys is changed to car keys now”. *Go to next state.*

**State 23:** “The location room were the (car) keys are stored is the living room, do you like to change the location room?”. *Go to next state or state 25.*

**State 24:** Debora: “No”. *Go to state 29.*

**State 25:** Debora: “Yes.” *Go to next state.*

**State 26:** VSP: “What room do you like to use instead of living room”. *Go to next state.*

**State 27:** Debora: “Kitchen.”. *Go to next state.*

**State 28:** VSP: “Living room is changed to kitchen now”. *Go to next state.*

**State 29:** VSP: “The location in this room is, second drawer of the cabin, do you like to change the location in this room?”. *Go to next state or state 31.*

**State 30:** Debora: “No”. End of interaction. STOP.

**State 31:** Debora: “Yes.”. *Go to next state.*

**State 32:** VSP: “What location do you like to use instead of second drawer of the cabin”. *Go to next state.*

**State 33:** Debora: “First drawer on the left.” *Go to next state.*

**State 34:** VSP: “Second drawer of the cabin is changed to first drawer on the left now”. End of interaction. STOP.

**Situation: Possibility to add another item.**

**State 35:** VSP: “Do you like to add another item?” *Go to next state.*

**State 36:** The VSP asks “What item?”. *Go to next state.*

**State 37:** Debora answers “Mobile phone”. *Go to next state.*

**State 38:** VSP: “Which room?” Predefined list to choose from with option “others” which is field with speech to text.”. *Go to next state.*

**State 39:** Debora “Bedroom”. *Go to next state.*

**State 40:** VSP “What location in this room?”. *Go to next state.*
State 41: Debora: ‘Nightstand”. Predefined list per room with option “others” which is field with speech to text. End of interaction. STOP.

Situation: Debora wants to see an overview list of the stored objects

State 42: Debora: “Which objects are stored in your system?”. Go to next state.

State 43: The VSP shows the list of items on the screens and reads aloud the different items: “Wallet, keys, mobile phone, library card…”. List of all objects. Go to next state.

State 44: Debora “I would like to delete the library card from the list” Remove objects. Go to next state.

State 45: VSP: “Are you sure you like to delete the library card?” Go to next state or state 48.

State 46: Debora: “Yes”. Go to next state.

State 47: VSP: “Library card is deleted from the object list.”. End of interaction. STOP.

State 48: Debora: “No” Go to next state.

State 49: VSP: “Do you like to delete another object?”. Go to next state or 51.

State 50: Debora: “No.”. End of interaction. STOP

State 51: Debora: “Yes”. Go to state 44 and add another object or delete.

2.4.6 Use case: Notification Service (Co-Net Service)

Situation: A package is delivered at the reception of Orbis Hoogstaete for Debora.

State 1: The receptionist sends a text message to the VSP with the text “A package is waiting for you at the reception please pick it up before 5:00 PM.” Go to next state.

State 2: The VSP: “Debora, I have a message from you from the reception. Do you like to hear it?”. Go to next state or state 4 or state 10.

State 3: If there is no response to the call, the VSP will repeat the sentence in state 2 when the Kinect detects that Debora enters the room. Go to state 2 after Debora is detected by the Kinect.

State 4: Debora: “No”. Go to next state.

State 5: VSP “Should I ask you again in 15 minutes?”. Go to next state or state 7.

State 6: Debora: “Yes”. After 15 minutes go to state 2.

State 7: Debora “No”. Go to next state

State 8: VSP “When should I remind you?”. Go to next state

State 9: Debora “In 25 minutes.”. After 25 minutes go to state 2.

State 10: Debora: “Yes”. Go to next state.

State 11: The VSP reads the message “A package is waiting for you at the reception please pick it up before 5:00 PM.” and Debora leaves her apartment to pick up the package. End of interaction. STOP.
2.5 Fifth user scenario: Gunter Robertson

Gunter Robertson is 78 years old. He lives alone in an apartment including a kitchen open on the dining area, a large bedroom, a hall, a bathroom and a balcony (47 square meters) in the Colladon Residence. For two years now, Gunter slightly suffers from urinary incontinence. This disorder affects his sense of dignity, self-esteem, emotional wellbeing and leads gradually to his social isolation. Gunter also use a calendar to write down friends’ and family’s birthdays. Since he doesn’t consult his calendar daily, he often forgets to send greetings to his friends.

2.5.1 Use case: Toilet Reminder (Care & Wellness Service)

**CAREGIVER ASPECT**

First situation: a caregiver actives or deactivates the toilet reminder functionality

State 1: François Fournier (MRPS caregiver) access to the Gunter’s user profile thought the caregiver interface. Go to the next state.

State 2: François activates the “toilet reminder” functionality and set the time interval between successive recaps to 2 hours. STOP.

**ELDERLY ASPECT**

First situation: the system reminds the elderly to go to the toilet. Environment: quiet (i.e., the user is not watching TV or listening to the radio).

State 1: Gunter is sitting on the couch, reading a book. The VSP is in the “full screen mode” and in the “waiting mode”. A reminder is triggered by the system (neutral/concerned talking): “Gunter, have you been to the toilet recently?”. Go to the next state or to the state 5 or 7.

State 2: The VSP is in the "listening mode". Gunter ignores the VSP message and continues reading his book. Go to the next state.

State 3: Five minutes later, a new reminder is triggered by the system. The system detects that the elderly didn’t move from the couch. The VSP know that Gunter is potentially annoyed by this interruption (neutral/concerned talking): “Gunter, I am sorry to bother you... have you been to the toilet recently?”. Go to the next state or to the state 5 or 7.

State 4: The VSP is in the “waiting mode”. Gunter continues to ignore the VSP. The interaction is completed. STOP.

State 5: The VSP is in the "listening mode". Gunter answers to the VSP: “Yes, VSP”. Go to the next state.

State 6: The VSP looks happy (happy talking): “Great! I’m glad to hear that." STOP.

State 7: The VSP is in the "listening mode”. Gunter answers to the VSP: “No, VSP”. Go to the next state.

State 8: The VSP looks concerned (neutral/concerned talking): “Gunter, I think you should go to the toilet". Go to the next state or to the state 11.

State 9: The VSP is in the "listening mode". Gunter gets up from the couch and goes to the bathroom, by answering the avatar: “Thank you, VSP”. Go to the next state.
State 10: The VSP concludes the interaction (happy talking): “You’re welcome, Gunter”. STOP.

State 11: The VSP is in the "waiting mode". Gunter ignores the VSP. Go to the state 3.

Second situation: the system reminds the elderly to go to the toilet. Environment: noisy (i.e., the user is watching TV or listening to the radio). The system detects that the user is watching the TV or listening to the radio.

State 1: Gunter is sitting on the couch, watching TV. The VSP is in the “full screen mode” and in the “waiting mode”. A reminder is triggered by the system (neutral/concerned talking). The VSP know that Gunter is potentially annoyed by this interruption (neutral/concerned talking): “Gunter, I am sorry to bother you… have you been to the toilet recently?” Go to the next state or to the state 10 or 12.

State 2: The VSP is in the "waiting mode". Gunter doesn’t hear the VSP and continues to watch TV. Go to the next state.

State 3: Five minutes later, the VSP initiate a new interaction, but louder (neutral/concerned talking): “Gunter, I am sorry to bother you… have you been to the toilet recently?”. Go to the next state or to the state 10 or 12.

State 4: The VSP is in the "waiting mode". Gunter doesn’t hear the VSP and continues to watch TV. Go to the next state.

State 5: The VSP is in the "waiting mode". Five minutes later, the system triggers a bell alarm. By its nature, this alarm differs from environmental sounds, maximising the probability that the elderly hear it. Go to the next state or to the state 7.

State 6: The VSP is in the "waiting mode". Gunter doesn’t hear the alarm or doesn’t want to answer to the VSP and continues to watch TV. The interaction is completed. STOP.

State 7: Gunter hears the alarm, decreases the volume of the television and says to the avatar (neutral/concerned talking): “Yes, VSP” Go to the next state.

State 8: The VSP knows that Gunter is potentially annoyed by this interruption (neutral/concerned talking): “Gunter, I am sorry to bother you… have you been to the toilet recently?” Go to the next state or to the state 10 or 12.

State 9: The VSP is in the "waiting mode". Gunter ignores the VSP and increase the volume of the television. The interaction is completed. STOP.

State 10: The VSP is in the "listening mode". Gunter answers to the VSP: “Yes, VSP”. Go to the next state.

State 11: The VSP looks happy (happy talking): “Great! I’m glad to hear that.” STOP.

State 12: The VSP is in the "listening mode". Gunter answers to the VSP: “No, VSP”. Go to the next state.

State 13: The VSP looks concerned (neutral/concerned talking): “Gunter, I think you should go to the toilet”. Go to the next state or to the state 16.

State 14: The VSP is in the "listening mode". Gunter gets up from the cough and goes to the bathroom, by answering the avatar: “Thank you, VSP”. Go to the next state.
State 15: The VSP concludes the interaction (happy talking): “You’re welcome, Gunter”. STOP.

State 16: The VSP is in the "waiting mode". Gunter ignores the VSP. Go to the state 5.

2.5.2 Use case: Birthday Reminder (Agenda Service – Care & Wellness Service)

**CAREGIVER ASPECT**

First situation: a caregiver adds or removes or modifies an entry in the birthday database.

State 1: Nicole Robertson (daughter) access to the Gunter’s user profile thought the caregiver interface. Go to the next state.

State 2: Nicole adds a new entry in the contact database. Each entry is defined by seven fields: (1) First name, (2) Last Name, (3) Address, (4) City, (5) Telephone number, (6) Email contact, (7) Birthday. STOP.

**ELDERLY ASPECT**

First situation: the system draws the attention of the elderly on the friend’s birthday (three days before the birthday). Environment: quiet or noisy.

State 1: Gunter is sitting on the couch, reading a book or watching TV. The VSP is in the “full screen mode” and in the “waiting mode”. A reminder is triggered by the system (neutral/concerned talking): “Gunter, in two days will be the birthday of Miguel Petit. Did you plan to make a gift?”. Go to the next state or to the state 3 or to the state 4.

State 2: The VSP is in the "listening mode". Gunter answers: "Yes, VSP". Go to the state 5.

State 3: The VSP is in the "listening mode". Gunter answers: "No, VSP". Go to the state 11.

State 4: The VSP is in the "waiting mode". Gunter ignores the VSP message and continues reading his book or watching TV. Go to the state 12

State 5: The VSP looks exited. He continues the interaction (happy talking): “This is a great idea! Did you plan to buy something? Go to the next state or to the state 7.

State 6: The VSP is in the "listening mode". Gunter answers: "Yes, VSP". Go to the state 8.

State 7: The VSP is in the "listening mode". Gunter answers: "No, VSP". Go to the state 11.

State 8: The VSP asks to Gunter (happy talking): “When do you plan to buy the gift?” Go to the next state.

State 9: The VSP is in the "listening mode". Gunter answers: “tomorrow, at four o’clock”. Go to the state 10.

State 10: The system treats this information as being a new entry in the agenda. Tomorrow, at three o’clock, a new reminder will be triggered (neutral/concerned talking): “Gunter, don’t forget to buy the gift for the birthday of Miguel Petit”. For the moment, The VSP concludes the interaction (neutral/concerned talking): “I am sure that Miguel will be pleased with your surprise, Gunter”. STOP.
State 11: The VSP concludes the interaction (neutral/concerned talking): “Ok Gunter, if you ever need anything; don’t hesitate to ask me!” STOP.

State 12: The VSP is in the "waiting mode". The VSP doesn’t want to bother Gunter. The VSP will wait until the elderly approach the device in order to remind him the birthday of Miguel Petit. Go to state 1, knowing that state 4 will not be available anymore in the workflow.

Second situation: the system draws the attention of the elderly on the friend’s birthday (the day of the birthday). Environment: quiet (i.e. the user is not watching TV or listening to the radio).

State 1: Gunter is sitting on the couch, reading a book. The VSP is in the “full screen mode” and in the “waiting mode”. A reminder is triggered by the system (neutral/concerned talking): “Gunter, today is the birthday of Miguel Petit. Did you congratulate him?” Go to the next state or to the state 5 or 7.

State 2: The VSP is in the "waiting mode". Gunter ignores the VSP message and continues reading his book. Go to the next state.

State 3: After five minutes the VSP try to initiate a new interaction, but louder than the previous one (neutral/concerned talking): “Gunter, I am sorry to bother you… Today is the birthday of Miguel Petit. Did you congratulate him?” Go to the next state or to state 5 or 7.

State 4: The VSP is in the "waiting mode". Gunter continues to ignore the VSP. The interaction is completed. STOP.

State 5: The VSP is in the "listening mode". Gunter answers to the VSP: “Yes, VSP". Go to the next state.

State 6: The VSP looks happy (happy talking): “Great! I’m glad to hear that.”. STOP.

State 7: The VSP is in the "listening mode". Gunter answers to the VSP: “No, VSP". Go to the next state.

State 8: The VSP looks concerned (neutral/concerned talking): “Gunter, I think you should call him”. Go to the next state or to the state 11.

State 9: The VSP is in the "listening mode". Gunter gets up from the cough and takes his phone, by answering the avatar: “Thank you, VSP”. Go to the next state.

State 10: The VSP concludes the interaction (happy talking): “You’re welcome, Gunter”. STOP.

State 11: Gunter ignores the VSP. Go to the state 3.

Third situation: the system draws the attention of the elderly on the friend’s birthday (the day of the birthday). Environment: noisy (i.e., the user is watching TV or listening to the radio). The system detects that the user is regarding the TV or listening to the radio.

State 1: Gunter is sitting on the couch, watching TV. The VSP is in the “full screen mode” and in the “waiting mode”. A reminder is triggered by the system (neutral/concerned talking). The VSP know that Gunter is potentially annoyed by this interruption (neutral/concerned talking): “Gunter, I am sorry to bother you… Today is the birthday of Miguel Petit. Did you congratulate him?”. Go to the next state or to the state 10 or 12.
State 2: The VSP is in the “waiting mode”. Gunter doesn’t hear the VSP and continues to watch TV. Go to the next state.

State 3: Five minutes later, the VSP initiate a new interaction, but louder (neutral/concerned talking): “Gunter, I am sorry to bother you… Today is the birthday of Miguel Petit. Did you congratulate him?”. Go to the next state or to the state 10 or 12.

State 4: The VSP is in the “waiting mode”. Gunter doesn’t hear the VSP and continues to watch TV. Go to the next state.

State 5: The VSP is in the “waiting mode”. Five minutes later, the system triggers a bell alarm. By its nature, this alarm differs from environmental sounds, maximising the probability that the elderly hear it. Go to the next state or to the state 7.

State 6: The VSP is in the “waiting mode”. Gunter doesn’t hear the alarm or doesn’t want to answer to the VSP and continues to watch TV. The interaction is completed. STOP.

State 7: The VSP is in the “listening mode”. Gunter hears the alarm, decreases the volume of the television and says to the avatar: “Yes, VSP” Go to the next state.

State 8: The VSP knows that Gunter is potentially annoyed by this interruption (neutral/concerned talking): “Gunter, I am sorry to bother you… Today is the birthday of Miguel Petit. Did you congratulate him?”. Go to the next state or to the state 10 or 12.

State 9: The VSP is in the “waiting mode”. Gunter ignores the VSP and increases the volume of the television. The interaction is completed. STOP.

State 10: The VSP is in the “listening mode”. Gunter answers to the VSP: “Yes, VSP”. Go to the next state.

State 11: The VSP looks happy (happy talking): “Great! I’m glad to hear that.” STOP.

State 12: The VSP is in the “listening mode”. Gunter answers to the VSP: “No, VSP”. Go to the next state.

State 13: The VSP looks concerned (neutral/concerned talking): “Gunter, I think you should call him”. Go to the next state or to the state 16.

State 14: The VSP is in the “listening mode”. Gunter gets up from the cough and takes his phone, by answering the avatar: “Thank you, VSP”. Go to the next state.

State 15: The VSP concludes the interaction (happy talking): “You’re welcome, Gunter”. STOP.

State 16: The VSP is in the “waiting mode”. Gunter ignores the VSP. Go to the state 5.

2.6 Other services retrieved from the user needs interviews

The following services are retrieved from the end user interviews and will be analysed more thoroughly in use cases in D1.2b:

a) **Learning new objects**: The elderly can enter new objects in the list of finding objects (see use case in paragraph 2.4.5 Object Location reminder). For “learning new objects” the system automatically registers an object to this list when the camera detects these objects most of the times in the same location.

b) **Guidance and motivation for physical and relaxing activities**: Most elderly (almost 70%) don’t do their prescribed exercises. Furthermore, there are questions
about the way they do their exercises (quality). Guidance and motivation by the VSP in physical and relaxing activities is thus important for both the elderly and (in)formal caregivers.

c) **Loneliness identification:** Loneliness is one of the biggest problems among elderly living at home, in care apartments and in elderly homes. This can cause mental and health problems for elderly. The VSP should detect if and when the elderly is lonely and give a proper response to help the elderly to overcome this problem. The response depends on the preferences of the elderly and thus must be adaptable per elderly.

d) **Turn off devices reminders:** For the pre-trial we will test the possibility to delete the reminder. During the pre-trial we will ask the elderly and caregivers how the workflow of the reminders should be designed. There are three possibilities:

- The VSP automatically triggers the reminders
- The VSP asks to the elderly if he want to skip the reminders
- Important reminders are automatically triggered by the VSP, while the end-user can chose to skip for less important reminders and notifications (which reminder is important or not should be also defined)

e) **Meal preparation, food alert and dietary requirements:** When an elderly is preparing a meal and doesn’t remember the receipt the avatar should help the elderly by providing the receipt. If ingredients in this receipt aren’t in agreement with his dietary requirements the VSP should warn the elderly. Furthermore the VSP should remind the elderly to fill in the form to order the meal for the next day when the elderly uses his meals in the restaurant of the care organisation.

f) **Household adviser:** The VSP should provide advises to the elderly like open the window when you wake up, wash your teeth etc.

g) **Teacher:** The VSP should advise the elderly by chatting of how to prepare different meal recipes or teach the elderly how to play a specific game, etc.

h) **Safety service:** Except for the fall detection and dangerous objects/situation adviser also services like mistaken fire alarm trigger, theft awareness, detection of immobility, monitoring system and continuous location tracking are mentioned in the user needs.

i) **Social bonding:** The system will try to improve its performance by chatting & learning with the elder. There are two possibilities: a) The system will periodically (for example when the elder is relaxed on the couch) seek advice (confirmation or rejection) of the user by asking if he/she liked the way how a certain VSP support action had been carried out. The elder will provide for a simple ‘yes’ or ‘no’. According to the answer, stepwise changes in the parameters controlling the system behaviour with regards to the service related to the specific action will be made. This kind of empathetic and affective human-user communication and interaction mechanisms will result in a sort of social bonding between the elder and the VSP; b) for the second way of learning the initiative is taken by the user who may present an object to the VSP. The VSP will show curiosity and asks the user to show different views of the object and give it a name. The system will store a 3D-representation of the object shown, and also its name, and later be able to recognize it again;
3 User Interface definition

This chapter presents the analysis of the interaction requirements needed to specify the Human-Computer interface that is planned in Task 1.3, providing input to the multi-modal interface to be defined in WP2. The majority of information collected in Task 1.2 describes how emotion is used in human-to-human communication. This will need to be adapted to how humans will interact with the VSP.

3.1 Human-Computer Interaction analysis

To make the interaction of the elderly person with the VSP as natural and easy as possible it is the common thought that the main interaction will be based on the speech of the elder person. Commands will be filtered from the spoken words and will be used to control the interaction with the VSP. The VSP will use speech as the main interaction with the elderly person, using text to speech technology, to support and simulate the natural spoken interaction between two persons as much as possible. To enhance and support the interaction the spoken text of the VSP will also be shown on the screen(s).

As mentioned in the outcome of the user needs the VSP should have a first name of how the elderly can call him. The elderly prefers also to be addressed by the VSP by his first name. This makes the interaction more natural and intuitive between the elderly and the VSP.

The avatar has 3 different interaction modes as described in D1.1a:

a) Listening mode
b) Waiting mode
c) Talking mode

The avatar should not only be able to speak (active, talking mode) but also have passive states to appear as attentive (listening mode) and to be present without being engaged in a conversation (waiting mode).

The system should be adaptable for the elderly. Meaning the elderly will decide at the beginning and during the use of the system which services, described in the above scenarios, are active in his personal VSP and which services are not.

The expression of the avatar in response to the emotion of the elderly will be described in this paragraph.

The facial expression of the VSP should be correspondent with the emotion of the elderly, e.g., when the elderly is sad the VSP should have a neutral expression, when the elderly is happy the VSP should have a happy (smiling) expression. For the eight basic emotions of the elderly which can be detected by the system the corresponding expression of the VSP is described in the top of Figure 8.

When the emotion of the elderly changes to a negative emotion, the avatar should, besides responding with a corresponding expression, also respond with an action/service. When the emotion doesn't change or changes to a positive emotion, no response of the VSP is needed in terms of an action except for changing the facial expression of the avatar as described above. The response of the VSP depends on the following criteria:

a) The detection of the emotion
b) The emotion of the elderly

c) The individual elderly

The system detects an emotion from the face with the face reader technology with a certain confidence value. This value indicates the level of confidence the system has for recognition of the emotion. It is expected that when the rate is between 0.75 and 1.0 the detected emotion is in agreement with the emotion of the elderly. When the rate is between 0.75 and 0.5 the system asks first for a confirmation if the detected emotion is correct. If the rate is below 0.5 the certainty is too low to detect any correct emotion and this is not registered as change in emotion.

Per emotion of the elderly, maximum three pre-defined actions will be programmed in the system. Depending on the elderly, these actions will be given in a fixed predefined order or at random. Before installing the system in their home the elderly will be asked what the predefined action per emotions (6 basic emotions) must be for them.

The process what the response of the VSP should be is described in Figure 8 with some example actions. But as mentioned, this should be adaptable per elderly. This information will be entered in the system before installing the system in the home of the elderly but also should be adaptable when this system is already installed in the home and the elderly prefers to have another response of the VSP.

Last but not least, the VSP should be able to instantiate spontaneous interaction. At random (at least when the user is present), the VSP could ask “How are you?”, to stimulate interaction.
Figure 8: Response of the avatar on emotions.
3.2 Human-Computer interface specification

The VSP consists of two screen layouts; (1) a main screen layout (see Figure 9) and (2) a services screen layout (see Figure 10). As can be seen, some of the components have a fixed position. The fixed position of the services menu, emergency button and analogue clock gives users a steady interface in which orientation is easy.

![Figure 9: VSP main screen layout.](image)

![Figure 10: VSP services screen layout.](image)

The top-left services menu in Figure 11, consists of 11 items. The first item is an “assistant” item followed by ten “service” items. In general these items serve two goals: first of all they give feedback to users on which terminology to use in order to interact with the VSP and secondly these items serve as touch screen buttons in case the speech recognition fails. If in the progress of Miraculous Life system, the number of items needs to be larger, sub categorization is recommended to ensure the readability of the screen. Services should be
categorized according to their nature and upon calling the category, a submenu should appear.

Because the “assistant” item is added to the services item list, it is always possible to highlight the active service. In the figure below, the assistant item is highlighted (darker button colour, light text colour).

In the bottom-left corner an emergency button can be found. This button stands out with a red background colour and light text colour so that when this button is needed, it can be found easily. The button is put to the bottom of the menu to prevent activation by accident in case of touch screen interaction.

![Figure 11: VSP main screen.](image)

When new messages or notifications are available, the user is informed about this. The messages button will light up in a bright colour (e.g., orange) so that the attention of the user is attracted (see Figure 12). Between brackets the user is informed about the number of new messages.

![Figure 12: VSP main screen - 1 new message.](image)
In case a service is activated, the avatar will move from its central position to a smaller position below the services menu (see Figure 13). Note that the Miraculous Life logo disappears to make space for the avatar. The activities services item is highlighted in the services menu and the title of the service is shown to the user at the top of the central position.

Since the VSP is mainly a speech based system, the user should receive some feedback on what texts / commands to use. The activities service in the figure below shows 7 options / weekdays to the user. The possible options are presented to the user in a similar button style as the top-left services menu uses. By presenting commands in a consistent button style manner, users will recognize easily which commands can be used to proceed.

Using a consistent button style is particularly handy when the choices are “dynamic”. For example an activities list can be different each day (see Figure 14 and Figure 15 for examples) and possibly the system will not recognize all speech commands for all activities. In that case it is clearer for users to apply a button style with generic commands like: Activity 1 and link it to dynamic content as done in the figure below.
Figure 14: VSP - Activities screen with dynamic content.

Figure 15: VSP - Activity details.

Reminders like: *use medication, visit toilet, lunch, etc.* all belong to the Agenda service. These (recurring) appointments are in the agenda of the user (see Figure 16 and Figure 17). If the agenda service is opened to see what is in today’s agenda, it can be a choice / option to leave out some of the recurring appointments so that only “main events” are shown in a list to the user.
Deliverable 1.2a Use case scenarios and User Interface definition

**Figure 16: VSP – Reminder.**

**Figure 17: VSP - Took notice of reminder?**
4 Interaction use case scenarios, dialog management and services

Once the initial requirements analysis and specification has been completed in Task 1.1 and Task 1.2, and the use case scenarios have been identified, a modelling approach has to be pursued to guarantee the reliable design of the information models that will represent the data collected and generated by the system. The design requires a thorough analysis of the concepts to be represented. The use case scenarios will be analyzed to guarantee that the resulting models will contain consistent data. These models will continuously evolve, be verified when requirements or specification are updated so as to serve as input in the realization of the Knowledge base in WP5.

For the second version of the deliverable the interaction of each step of the use case scenarios with Dialog Management (WP3) and services (WP4) will be provided.
5 Conclusions

To describe the way users will carry out their daily life activities at home based on the VSP, 5 user scenarios are developed and 22 use cases have been defined. The use cases illustrate in detail how the user interacts with the VSP for a specific service. As the speech recognition and buttons in the screen provide the way for the user to give input to specific questions of the VSP, the use cases show how this interaction works.

As the Miraculous Life project is work in progress, both the end-user organizations and the technology partners will contribute to a more realistic set of use cases. From the user need interviews, end-users identified other services that need to be included in the Miraculous Life project. Technology providers will improve state-of-the-art sensor technology and reasoning applications to make the interaction more natural. Therefore, in D1.2b we expect even more realistic and natural use cases.

An important aspect of the VSP is its user interface as it determines the way the elderly or caregiver interacts with the system. Although we have quite some advanced sensor technology available to recognize activities, capture speech and the emotional state, the VSP should respond to these measurements. We described the priority of responses, the type of responses and the appearance of the avatar. The interface of the VSP that is visible on the screen must support the natural interaction. If speech recognition fails, the screen must provide buttons such that the user can still indicate his or her desire.

From the trials with the elderly and caregivers, and the improvement of features in the sensor technology, our insight in optimizing the interaction will grow. Both the interaction flow between the user and the VSP and the usability of the system by the user will be changed according to these insights and the result will be presented in D1.2b.