D2.2b Report on platform's experimental evaluation and feedback activities (Testing Phase 1)

Ambient Assisted Living Joint Programme

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Version history

Version	Authors	Date	Description
0.1	MATERIA	25.10.2020	First draft
0.4	KARDE, HARPO, PLATUS	19.11.2020	Contribution/input
1.0	MATERIA	20.01.2021	Release of deliverable Version 1
1.1	MATERIA	15.04.2021	High Fidelity Results
1.2	KARDE, HARPO, PLATUS	30.04.2021	Contribution/input
2.0	MATERIA	13.05.2021	Final release of D2.2b

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Abbreviation	
AAL	Ambient Assisted Living
AR	Augmented Reality
DoW	Description of Work
M	Month
QR	Quick Response
SUS	System Usability Scale
TV	Television
UI	User Interface
WP	Work Package

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1 Introduction

This document provides a report on the results of the application testing. It is described in the project's Description of Work (DoW) as D2.2 Report on platform's experimental evaluation and feedback activities (Testing Phase 1) and consists of the full report on the end-user testing of the GUIDed system during Testing Phase 1 Stages 1, 2, 3, and is an output of Task 2.2 of the project. It builds on the older adults' recruitment process and analysis of demands and needs (T2.1) and the platform specification (T3.1), to ensure that the demands are respected throughout the hardware configuration of the device and the development of the software platform and services.

The present deliverable reports on the recruitment, data collection methods and results of the continuous testing of the GUIDed system, from its inception up to the release of the first prototype. Three main stages guide this iterative testing, namely, a) the testing of low-fidelity mock-ups (paper prototypes), b) the testing of high-fidelity mock-ups and c) the testing of the first prototype through a Living Lab approach before the commencement of the real-life trials. According to the plan, this deliverable is due on M18 including the testing procedure and results from all aforementioned Stages. However, the consortium decided that all WPs and especially, the technical one would greatly benefit from three sequential releases of this deliverable reporting the results after each testing phase. This will allow the technical teams to have an easy compilation of the improvements and adjustments needed after each testing, instead of presenting all the results in the end. Thus, the first version of this deliverable is due on M14 containing the procedure and results of Stage 1: low-fidelity mock-ups (paper prototypes) and will be updated to include the procedure and results from Stage 2 (M16) and Stage 3 (M18) as well to reflect the iterative evaluation of the GUIDed system up to the release of the first prototype.

Section 2 provides an overview of the target group through brief situational profiles. Section 3 develops the approach taken with respect to the recruitment of participants and the reception of initial feedback. Section 4, 5 and 6 provide the protocol and results of the testing performed in Stage 1 low-fidelity prototypes employed as the initial user research phase of the project, Stage 2 High-Fidelity Prototypes and stage 3 Living Lab recommendations.

2 Target groups and characteristics

Defining the key-stakeholders and target groups involved in and affected by the use of the GUIDed system is of utmost importance among the consortium members since it guides the activities of all Work Packages (WPs). Task 4.1 is the main activity engaged in defining the user scenarios and personas and this is the reason we decided to commence the task much earlier than was the plan on the original DoW (M6 instead of M15).

Based on desktop research, end-user relevant sites' experiences with older adults and their caregivers, as well as, the results of T2.1 we drafted the first version of the end-user personas and user scenarios. These documents were produced country-specific in order to present cultural differences and will be fine-tuned and enriched throughout the project according to our interactions with users.

The first set of personas are included in D2.2 with adjustments performed based on user feedback obtained during Testing Phase 1 have been reported in D4.1.

Primary user

The primary users of the GUIDed system are older adults. Usually, older adults are defined as people aged 60 and up. Our consortium is aware, as it showed in the focus groups, that the end product could have a significant number of potential users within different age groups, such as those with injuries affecting mobility or other conditions where lessening task effort related to movement would be beneficial. However, these findings, given that our major group focus cannot change, may perhaps be considered in the final stages of the product during the design of the business plan and the eventual promotion of the product to the market.

Personas and user-scenarios of Primary users from Cyprus

Maria (69 years old)

Position (working life, current etc.):
Retired nurse in private hospital in Limassol.

Interests:
Cooking, traveling, visiting museums and art festivals, gardening.

Social setting(s):
Married to Adonis, a retired electrical engineer. Their daughter is working in the UK while their son lives and works in Limassol. The children and the extended family occasionally visit in holidays to spend time together.

Problems (related to ICT or problem solving in daily life):
She is not a competent user of ICTs. She only uses a smartphone to talk with her children, husband and friends. While she would love to be able to use applications like Skype to see her son she somehow never finds the time to learn. She used to travel a lot when she was younger but now hardly ever goes abroad to visit places of interest and museums.

"Working description", what would s/he usually do with the service(s):
She will start using the GUIDed in order to better communicate with her daughter (S5 smart communication service) and the virtual tour capabilities to see places of interest (S3 smart navigation service). Her daughter who found out about GUIDed online will show her how to install and use the AR features on the first interaction with it.

Typical goals, tasks, situations:
Occasionally cooking for friends and family when they visit. Every year she is going to food and art festivals in villages outside Limassol. Enjoys taking care of her garden and flowers.

Needs, frustrations and values:
Feeling nostalgic about the 'good old days' when she and her husband could easily travel around the world. She also misses her son a lot and would very much like to see him more frequently. She definitely is afraid of technology and thinks she will not be able to ever learn it, although she understands the value and the possibilities it offers.

Quotes:
"I am too old to learn how to use all these applications you are talking about"
"This application you are talking about sounds very interesting but difficult"
"Maybe you could teach me how to use the appli[illegible] smartphone sometime"

Figure 1. Primary user persona Cyprus 1

Andreas (65 years)

Position (working life, current etc.):
Owner of real estate agency. Lives in Nicosia and leads a very busy working life.
Interests:
Loves watching football matches and coaches the amateur football team of his village. Very socially active and connected. Enjoys swimming all year round and occasionally goes for fishing with friends.
Social setting(s):
He is married to Marina a school teacher and has a daughter and two grandchildren. They all live in Nicosia in the same neighbourhood and have dinner together on a daily basis.

Problems (related to ICT or problem solving in daily life):
Andreas is comfortable in using a computer in his work. He is also an adequate user of smartphone applications for social communication, navigation applications and other applications related to his job. He hardly uses any other applications on his phone as he finds them difficult and complex which demotivates him. His main problem though is that as years go by he struggles to clearly see the screen on his phone due to his worsening eyesight. As he says he can't see the 'small icons that look like dots on his phone'.

"Working description", what would s/he usually do with the service(s):
Andreas' working life would become much easier by using the navigation service S3 (smart city navigation). As he arranges viewings for clients on a daily basis, he would use the GUIDed navigation service to better navigate and understand where he is at and which is the right direction to go, something that get on his nerves every time he uses other popular navigation apps. Andreas is also fond of automating processes so smart home service S2 (smart home control service) would come in handy in order to control the lights whether in the office or home. Instead of having to get up every time he would just go to the app and switch on or off the lights.
Typical goals, tasks, situations:
Enjoys his working life and social contacts and is trying to dedicate more time to his family and the local football team.

Needs, frustrations and values:
He is frustrated when he 'wastes' time on silly or time-consuming tasks and is always looking to automate things and make his life easier.
Quotes:
"If I had such technology as you have nowadays when I was young I would be a hacker"
"why do they keep making small buttons and icons in these new phones!"

Figure 2. Primary user persona Cyprus 2

Anna (71 years)

Position (working life, current etc.):
Used to work as a public servant in the Ministry of Justice but retired due to health reasons.

Interests:
History, nature and animals, hairstyling and fashion.

Social setting(s):
Recently lost her husband Nikos. Both her sons are working abroad and visit her on holidays in Nicosia to celebrate and spend some time together.

Problems (related to ICT or problem solving in daily life):
She is not a competent user of ICTs. She uses a smartphone for talking to her friends and family. Recently, she started using the tablet her sons bought as a Christmas gift and learned how to use a video conferencing app in order to better communicate with her sons. Since Nikos passed away she has been living alone and sometimes she feels lonely and scared. He was always reminding her to take the blood pressure and diabetes pills and now that he is not around she struggles to remember taking them. Her sons worry about her being alone and sick.

"Working description", what would s/he usually do with the service(s):
She would start using the GUIDed for the smoke detector alarm and the door safety feature (S4 Smart home safety service). The medication support service (S1 Smart nutrition and health service) would be extremely useful to her. Her younger son George who also found out about GUIDed and taught her how to use the videoconferencing app will teach her how to use the services of GUIDed.

Typical goals, tasks, situations:
Always wanted to learn hairstyling techniques and now that she has more time she is seriously considering taking hairstyling classes. During the summer period she always spends time with her grandchildren who stay with her until schools open.

Needs, frustrations and values:
She is still not entirely comfortable living on her own although she is getting used to it. She never had a particularly good memory and now that her husband is not around she is worried she might forget the stove burning. She also needs someone to remind her to take her pills like her husband did.

Quotes:
"Nikos was my alarm clock", jokes
"George when will you teach me how to use more apps on the tablet?"
"Hi George, the videoconferencing app froze again, what should I do?"

Figure 3. Primary user persona Cyprus 3

Scenario 1: Anna, living alone

Its winter time in Nicosia nearing the Christmas holidays. Anna, who recently lost her husband, is patiently waiting for her sons to visit her in the upcoming holidays and spend some time together.

Since she lost her husband, Anna is feeling very lonely living alone in an empty house. This has contributed to her developing a phobia for thieves, although her area is considered very quiet and safe. More than that, her health seems to be getting worse as she was recently found with high blood pressure. This is not the only health problem, she was also diagnosed with type-two diabetes a long time ago and since then she has been injecting insulin shots every day. Although Anna seems to be managing the health issues just fine, nonetheless, lately she has been forgetting to take her pills. As she frequently jokes 'my husband was my alarm clock as he kept reminding me to take my pills every day!' Both sons of Anna are working abroad and have been very worried about their mother lately. Not so much about her safety as her neighbourhood is very quiet but more about her forgetting to take her pills. They are afraid that this new pattern of her forgetting things could even be dangerous as she might forget to switch off the gas stove.

When the two sons visit Anna during the holidays, Charis, the younger one presents her with what he describes as 'the perfect solution for her'. As a Software engineer, Charis is very fond of technology and always tries to 'push' Anna to get used to technology. He is the reason she started using Skype for video calls last year on the tablet he and his brother got her as a present. Although only a novice user, Anna is always up for a new challenge as long as she has Charis to teach her how to use it.

Charis explains to Anna that GUIDed has a multitude of AR/VR functionalities and services and that it will be her 'best friend'. He helps her install the services on the tablet and suggests that she starts with the Smart nutrition and health service (S1) and the Smart home safety service (S4). Due to the AR/VR training features that guide novice users through the navigation, Charis is confident that his mother does not even need him to teach her how to use it. They register together on the platform and he leaves for a week to get familiarised with the services. After a week he checks with her and to his surprise Anna has not only managed to use the services but she also decided to start paying for the premium package in order to access more services on the platform. In addition to this, she now feels at ease with forgetting her pills. By putting info about her pills on the smart nutrition and health service, she gets a notification each time she needs to take the blood pressure pills or have the insulin injection. More than that, whenever she points the tablet on the pill case, she gets information about her pills and sees her schedule. Anna is fascinated by the AR graphics on the screen and when talking to her friends she refers to them as 'magic'. Anna is even more excited with the smart home safety feature. With the sensors on the door she can now sleep without worrying about thieves as the GUIDed system will automatically let her know in case the door opens and ring the alarm. Furthermore, with the gas detector she and her sons feel less worried as the tablet will start making loud noise in case it detects dangerous levels of gas on the house. Anna is now ready and confident as a user to explore the other technological services of GUIDed, especially those who can add something fun to her everyday life. As such, she purchased the premium package and already started experimenting and learning the virtual tours feature (S3) where she can virtually visit various museums as well as the social communication service where she can talk to her friends and family but also meet new interesting people (S5). As Anna now jokes 'Charis was right, GUIDed was the perfect solution for me!'

Figure 4. Primary user scenario Cyprus

Roswitha (70 years)

Position (working life, current etc.):
Housewife, lives in a 2 story house
Interests:
Riding bike, hiking, gardening, cooking
Social setting(s):
Newly widowed. Interested in all kinds of crocheting, 1 Child, 3 Grandchildren

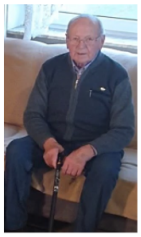
Problems (related to ICT or problem solving in daily life):
Roswitha just got her first PC ever.
She recently got a new IPhone and tries her best to understand it but for her it's just too hard to read and to remember the things she can do with her phone.
She also has a new smarthome installed for controling the temperature and air humidity but she cant remember what app to use because the heating control and the air humidifier both run on different apps.
She is pretty lonely since her husband died.

"Working description", what would s/he usually do with the service(s):
Roswitha doesn't really want to learn a lot of new things when it comes to computers, but she also likes to open the windows witth her phone or to turn the radiators on. It should happen with the GUIDed application S2 (smart home control service). She still struggels with the controls of her pc. Roswitha also wants to be in contact with her grandchildren, which would be possible on the GUIDed smart social communication service S5. But before she can use this software she has to learn how to use the PC properly.

Typical goals, tasks, situations:
Roswitha likes to learn new crafts, also learning how to look for youtube videos
Needs, frustrations and values:
Roswitha is pretty lonely and wants some contact with her children.
Citations:
"I can't read the symbols on the phone they are so damn small!!"
"I want to get in contact with some of my friends and it's really easy with this new GUIDed Software"

Figure 5. Primary user persona Austria 1

Rudolf (94 years)



Position (working life, current etc.):
Farmer on retirement, lives in a 2 story house
Interests:
Electronic stuff, watching tv, riding the electric scooter
Social setting(s):
Widowed, 3 childs, lives alone in the 1st floor.

Problems (related to ICT or problem solving in daily life):
Rudolf is using the PC for 8 years.
He has a old cell phone with keys and he wanna use a new smartphone but he isn't sure if he will understand the using.
He has problems in his movements therefore he is riding outdoor an electric scooter. By the way he has ordered them two years ago by himself through the internet on the PC. Because of the movement problems a big help wood be to have the possibility to open the front door easily from the living room. Another help would be to have the possibility to call help if it is needed.
He is pretty lonely and he is interested to talk to someone else.

"Working description", what would s/he usually do with the service(s):
Rudolf wants to use GUIDed for the service S2 (smart home control service) as well as for the communication to someone else easily (S5). He has to take some pills every day and therefore a reminder and more information could also be very useful. (S1 Smart nutrition and health service)

Typical goals, tasks, situations:
Rudolf likes electronic stuff but it should be very easy to use. Short movies for explaining how to use he will show.

Needs, frustrations and values:
Rudolf needs to open the front door and it is very hard to do this quick because of the disability in movement.

Citations:
"I'm so old and now a lot of lovely technic is available I wish I would be younger to use all of them"

"GUIDed could give me the possibility to speak with other people in my age. Around me I have no one in my age"

Figure 6. Primary user persona Austria 2

Hilde (90 years)

Position (working life, current etc.):
Formerly a teacher, lives in a two-family-house

Interests:
She likes reading, solving puzzles and sudokus

Social setting(s):
She is a widow and lives alone in her apartment on the ground floor in a two-family house. The younger daughter lives on the upper floor and is there to help. One daughter lives outside. 2 grandchildren and 2 great-grandchildren

Problems (related to ICT or problem solving in daily life):
She doesn't like modern PC or mobile phone. She is in a very good mental state but physically very frail and in danger of falling.

"Working description", what would s/he usually do with the service(s):
Hilde has a SOS button to call a rescue organization. She would like to have a reminder that tablets must be taken. She hears very badly and so she would need optical signals that someone is ringing the doorbell or ringing the phone. A button would´nt be bad, so she could open the front door while sitting. Hilde doesn't want to learn new things when it comes to computers. It should happen with the GUIDed application S2 (smart home control service).

Typical goals, tasks, situations:
She would like to remain alone in her apartment and doesn´t want to go in a retirement home, but she absolutely needs support.

Figure 7. Primary user persona Austria 3

Rudolf upgrades his home:

Rudolf was always a hard working Farmer who had done everything by himself. But now since he got older, he wanted to live his retirement at his fullest.

He was always very interrested in Computers and all of that technical stuff, thats why he decided to buy some GUIDed Products to make his life a bit easier. Rudolf was always a healthy man, so he never took any medication before, thats why he always forgets to take his pills. So he bought the GUIDed S1 (Smart Nutrition and health), which he controls with his tablet, so he is always remembered what to take when.

While he was at it he also got his hands on the S2 (Smart home control) to impress his children what he could do all with his tablet or pc. It also has a lot of benefits for him since his pain increases with his age, so he doesn't always has to get up to open the door or the windows.

And since he doesn't have a lot of friends since his beloved wife died, he also got the S5 (Communication) expansion for the software, because he really likes to chat with people but he can't really get the „younger folks".

At first he had some problems to really get into the software and how to install that, but because GUIDed has a lot of short Youtube Tutorials he quickly understood all of the mechanics and how to use the new system.

Now Rudolf can chat and also meet with eldery people in his reach and he made a lot of new friends.

Figure 8. Primary user scenario Austria

Anton (67 years)

Position (working life, current etc.):
Earlier farmer. Lives in a caring home in Oslo because of a severe physical handicap from a tractor accident on his farm in the Alna area.
Interests:
Ecologic and sustainable cattle and farming. Agricultural machines. Italian agriculture products. A devoted fan of Italy.
Sosial setting(s):
Widower since two years ago. Two sons and three grand-children. Both sons live abroad.

Problems (related to ICT or problem solving in daily life):
Anton has just recently started to use a modern PC with a large range of applications and services. He received help to start with this from Seniornett, a Norwegian volunteer organisation to help seniors with ICT.
He struggles a bit with his new smartphone and tablet PC. According to his own words, he "gets lost in the apps and the phone does strange things by itself". In the care home, he should use the phone to steer the available smart-home technology, but he just switched is off altogether in great frustration. He would also like to be better to handle communication with his sons through a video connection, but Anton says the app "sucks".

"Working description", what would s/he usually do with the service(s):
Anton is more or less obliged to learn to handle the smart-home installations in his flat. (He appreciates proper lighting and cool temperatures). It should happen with the GUIDed application S2 (smart home control service). Since he struggles with the smartphone, his current training task is to play solitaire on the tablet PC to learn how to use touch screen and handle smart device navigation. His true motivation is actually to get his hands on the GUIDed smart social communication service S5. Then, contacts with his sons and Italian "colleagues" would be available "just like that", he says. But first, finger exercises on a touch screen!

Typical goals, tasks, situations:
Anton studies Italian by participating in adult education's e-learning courses. His goal is to advance to so fluent speaker that it will be possible to chat with Italian farmers and share images, knowledge of sustainable farming methods etc.
Needs, frustrations and values:
Anton hungers for more social contact both in the family, "professionally" and hobby-wise.
Citations:
"Can't the smartphone just behave normally! It's too small and the buttons are microscopic for my fingers!"
"I want to get into contact with some Italian farmers in the Parma region."

Figure 9. Primary user persona Norway 1

Lena (63 years)

Position (working life, current etc.):
Pre-pensioned crafts teacher.
Interests:
History, interior design, renovating old houses. Passionate about renovating especially her own cottage).
Sosial setting(s):
Married to Henrik, a general practitioner (practicing in his private medical centre in Lillehammer). Two daughters who also live in the Lillehammer area. Her best friend Kirsten visits her each summer for a couple of weeks in Svingvoll.

Problems (related to ICT or problem solving in daily life):
She is not a competent user of ICTs at all. Her husband insists that she uses smartphone applications to remind about medications and to create contact with him in case of fire. She is reluctant to approve, and has resisted "to the bitter end". Henrik has said that the summer residence will be sold out of the family if she does not consent to use safety-supporting applications especially when she is alone at the "cottage" which actually is an old school building in Svingvoll rural area, some 30 km from Lillehammer.

"Working description", what would s/he usually do with the service(s):
She will start using the GUIDed for fire alarm (S4 Smart home safety service) and medication support (S1 Smart nutrition and health service). Her friend Kirsten, who knows GUIDed very well, will teach Lena using the AR-feature of GUIDed services first.
Typical goals, tasks, situations:
Renovating single-handedly the family's summer residence. She also leads a very simple life there by heating the house with wood, cultivating her own summer vegetables and even goes fishing to a lake nearby.
Needs, frustrations and values:
Increasingly insecure about living alone in the family's summer residence rather isolated during the summer months. Her husband Henrik in anxious about this, too, while he is working in Lillehammer, also during the summer months. He is particularly afraid of fire caused by electric tools that Lena uses, as well as heating in the wood-ovens. He also means that Lena shows signs of slight memory loss. Lena is irritated about this " stupid opinion".
Citations:
"I am not going to stay in Lillehammer during the summer months. Nope. Period."
"Don't just talk about your wonderful smartphone, Henrik. Give me one that is easy to learn and use. The one that Kirsten is using, you know?"

Figure 10. Primary user persona Norway 2

Scenario 2: Lena and Kirsten at the Svingvoll cottage

The summer holidays in Norway have started. It is July, the so-called common holiday. Lena arrived at her cottage in Svingvoll already one month ago. She has started with all her usual summer activities, such as cultivating vegetables and fixing the cottage. This year, she renovates the old windows of the building.

At the end of June, a dramatic situation arose at the cottage. Lena uses rather old electric tools. In addition, the electricity in the old school building is mostly out-dated. Supposedly, because of a wiring problem in an old sander that was plugged into an outlet along the old circuits, a fuse blew and caused a fire in the fuse cabinet. (An overloaded circuit has caused a fuse to blow many times earlier at the cottage.) The smoke detector that is connected to the fire alarm was activated. Immediately, Lena called the municipality's fire station in Segalstad Bru 15 km away. They promised to drive up to her cottage immediately. Lena was also promptly called by her husband Henrik who had received a GUIDed smoke alarm message from the cottage. He called Lena who – luckily enough – had control of the situation.

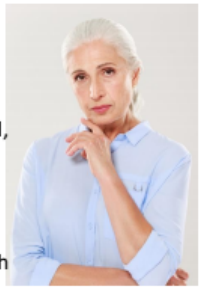
In the beginning of June, Kirsten, a good friend of Lena, visited her for almost two weeks. She had with her the GUIDed service kit. Together, they installed the Guided services S4 (smart home safety service) and S1 (smart nutrition and health service). Kirsten has installed GUIDed services in the care home where she manages the GUIDed installation, training, and use. Lena's husband Henrik has insisted on some kind of an alarm function, and also a little bit medication support for Lena. In collaboration with Kirsten, who Henrik of course knows well, too, he selected the two most important GUIDed services for Lena.

The fire alarm messaging was the first one – already proved useful. The other is medication support "light" which is a functionality in S1. Lena uses ordinary medicine dose boxes which Henrik has filled for her. In fact, Lena has 4 boxes with her, for the whole month. Lena is particularly interested in the effects of the medicines as well as possible side-effects. Most of the pills are vitamins, but Henrik wants Lena to take medicine that is usually prescribed to Alzheimer's patients. Henrik is quite sure that Lena's memory problems are related to beginning dementia. Lena points at the boxes and uses the connected GUIDed service to read about the medication and to find tips to other information sources that cover MCI and dementia. The GUIDed service also reminds Lena about the medication, which is useful every now and then. She realises that perhaps, only perhaps (!), she has some memory problems and it is clever to listen to Henrik who, after all, is a general practitioner.

Together with Kirsten, Lena har trained the use of the GUIDed applications during their togetherness in Svingvoll. Lena admits that learning the GUIDed services was "a piece of cake". The AR/VR features of GUIDed made the training very understandable and "real". She can also repeat the training on her own. Even Lena's earlier refusal to accept ICTs has softened along with her positive experiences with GUIDed.

Figure 11. Primary user scenario Norway

Anna (65 years)



Position (working life, current etc.):
Retired nurse, worked in local hospital.
Interests:
Anna likes cooking and baking, she is very social, often meets with friends and neighbours.
Sosial setting(s):
Anna is a widow, she lives alone. She has a daughter and two grandchildren, unfortunately they live abroad in Switzerland, so they see each other usually only twice a year. From time to time she travels to Switzerland and stay there with her family for a while.

Problems (related to ICT or problem solving in daily life):
Anna has basic knowledge about technology. She has a laptop, but uses it only for Facebook and Skype, mainly to stay in touch with her family. She recently got her first smartphone and still struggling to properly use it. She had a problem with getting used to touch screen at first and complained about multiple functions which she can't use. -"I wish it was simpler, I really mainly use it to talk to my daughter and watch my grandchildren on photos and films" - she says.

"Working description", what would s/he usually do with the service(s):
Anna already learned how to receive messages on her smartphone and feels more secure with using touch screen. The next step is learning how to send films and photos to her family and friends to practise using multiple functions in her smartphone. Now she is really interested in having GUIDed smart social communication service S5 to connect with her family. Her daughter also insists on using the GUIDed for fire alarm (S4 Smart home safety service) because she is concerned about her mother safety.

Typical goals, tasks, situations:
Anna cooks a lot, she always tries new recipies from her friends, it is really easy to forget about the cake in the oven when she start video chat with her family.
Needs, frustrations and values:
Anna wants to connect with her family easier.
Citations:
"I want to see my little grandson on bigger screen while I'm talking to him online, I wish it wasn't too complicated."

Figure 12. Primary user persona Poland 1

Robert (63 years)

Position (working life, current etc.):
He is a former police officer on retirement.
Interests:
Robert spends a lot of time camping with his wife, he loves fishing, skiing and prefers to spend his time actively.

Sosial setting(s):
Robert lives with his wife in a small town. He has a daughter, she lives in Warsaw with her husband. Robert can't wait for his first grandchild.

Problems (related to ICT or problem solving in daily life):
Ganerally Robert likes technical innovations, he uses smartphone and tablet, touch screen is not a problem for him, but lately he feels left out and that novelties pass by him.
Lately Robert wanted to try smart home managing system, but he didn't know where to begin and how does it really works.
Robert suffers from heart disease, his wife is really concerned about his health because he often forgets to take his medications.

"Working description", what would s/he usually do with the service(s):
Robert wants to use GUIDed for the service S2 (smart home control service) as well as for managing the smart-home installations in the housing units (S4 Smart home safety service). Minding his heart problems, Robert also thinks that medication support (S1 Smart nutrition and health service) could be useful.

Typical goals, tasks, situations:
Robert will be able to set proper temperature in his house quickly and easly with an application. He likes it to be cool at night but slightly warmer when he gets up. He could control it without leaving the bed.
Needs, frustrations and values:
Remembering about taking medications is very important issue especially for Robert's wife, who worries that something bad can happen to her husband when she is not around to take care for him.
Citations:
"I wouldn't have to remember to swich off the lights in whole house before going to sleep ever again."
"I really love the idea of controling my house with an application, just think how much time can I save!"
"I always forget about my medications and now I can have application to remind me about them."

Figure 13. Primary user persona Poland 2

Bernard (72 years)

Position (working life, current etc.):
Bernard is retired. He owned his own small company, now his oldest son runs the family business.
Interests:
Bernard likes to work in his garden, he is interested in history and enjoys reading books, especially those about II World War.
Sosial setting(s):
Bernard is married, he has two sons and five grandchildren.
Bernard lives with his wife, his oldest son lives next door, but youngest lives in the United States, so they don't see each other very often.

Problems (related to ICT or problem solving in daily life):
Bernard has an old PC computer, he uses it from time to time mainly to read news or search for new historical publications. His wife wants him to start using smartphone, but he thinks it is too complicated and have to many functions which he won't need.
His oldest son recently bought him an ebook reader and it turned out that Bernard loved it. – "I no longer have to strain my eyes, I can set whichever font size I want " – he said.

"Working description", what would s/he usually do with the service(s):
Bernard wants to learn how to use social communication service S5 to contact his son who lives abroad. Bernard's sons also insist on having GUIDed for smoke detection or fire alarm (S4 Smart home safety service) in case of emergency. Bernard recently started to use a touch screen on his ebook reader so learning to use GUIDed application shouldn't be so hard for him.

Typical goals, tasks, situations:
After reading the next book, he likes to discuss it and share thoughts, unfortunately the only person who is interested in history as much as Bernad is his son who lives abroad.
Needs, frustrations and values:
Bernard wants to contact his family in the United States, he misses his grandchildren very much, he would like to see them more and be a part of their lives at least online.
Everyone in the family also think that it would be great to have some kind of alarming system in case of emergency.
Citations:
"I am really not a fan of the new technologies, but I think It might be really useful to contact my son and his family easier. I could see my grandchildren more often."

Figure 14. Primary user persona Poland 3

Scenario 1: Robert home alone

Robert's dream came true he finally became grandfather. His wife Ewa is going to Warsaw to help her daughter with the new born baby and Robert will stay at home alone for few weeks.

Ewa is really concerned about leaving Robert all alone because of his heart disease and slight memory problems. She is worried that he will forget to take his medications regularly, what is really dangerous for him in his condition. She's afraid that for example if his heart pressure drops he can even faint, and there will be no one to help him. On one side he often forgets to take his meds but sometimes he forgets that he has already taken them and medication overdose could be even more dangerous for him.

Ewa encouraged by their daughter Laura, decided to use GUIDed S1 smart nutrition and health service. She thinks that GUIDed will be useful, not only while she isn't home, but it also will let Robert to be more independent in the future. Along with it Robert installed and adjusted GUIDed S4 (Smart home safety service) and S2 (Smart home control service) for managing the smart-home installations in the house like he always wanted.

They agreed that Ewa will prepare prescribed medications for Robert before leaving and GUIDed service will remind him to take them. He was never interested in details of his treatment before, but now it is much easier, he can point at the medication boxes and use GUIDed service to find out, for example about their possible side effects. What is also really important for him, GUIDed will control and remind when to get new prescriptions when Robert will begin running out of his medications.

It is now three weeks after his wife finally went to Warsaw. Ewa is not so worried anymore knowing that her husband is well cared for by GUIDed services. Robert regularly takes his meds and has well balanced diet what was her main concern.

For Robert personally, smart home managing system is the most useful in his opinion. He controls the lights in whole house from his bed. He switches the lights on at night when he goes to the bathroom avoiding any possible injuries by walking in the dark like he used to. Before going to sleep, he now switches all the lights off in the whole house from his bed. He can now do it all without any effort, just with an application, Robert enjoys it above all.

Figure 15. Primary user scenario Poland

Secondary user

Secondary users of the GUIDed system are family members, formal and informal caregivers who are directly or indirectly involved with the care of older adults or assisting them with everyday life tasks. Secondary users may also be interested in using some of the system's functions as primary users. Though this conclusion does not escape us, the findings were nonetheless concentrated on this target group as secondary users for now with the idea of attempting a similar user research in the future once the system considers broadening its primary audience and incorporating even more functions.

Christina (45 years)

Position (working life, current etc.):
Business Development Manager in a big multinational corporation in London. Responsible for carving out the strategies of the group.
Interests:
Reading and doing yoga. She recently got her certificate to become a part-time yoga instructor
Social setting(s):
Leads a very social life do to her position in her company. She and her husband and children have frequent trips abroad and go in yoga retreats every 6 months.

Problems (related to ICT or problem solving in daily life):
Christina is highly ICT literate. As her position frequently involves researching and trying new ways and technologies that will help her company in the following years, she is more than capable in using ICT technologies. She has a very busy schedule and can rarely take time off to visit her family in Cyprus. What frustrates her the most is the unwillingness of her mother to learn to use the video conferencing app as this would enable them to see each other more often.

"Working description", what would s/he usually do with the service(s):
Christina is interested in all of the services GUIDed can offer although she wants to take a 'step-by-step' approach and introduce them to her mother in stages.
Typical goals, tasks, situations:
After several years working in a corporate environment Christina has already started thinking about a change of plan and direction in her life. Her goal is to become a yoga instructor in the coming years and have more time to spend with her husband, children and the rest of the family in Cyprus.
Needs, frustrations and values:
Christina wants to have more free time to spend with her family and her beloved mother. Until she manages to find the time she is desperately trying to find a way in order to better communicate with her mother in Cyprus.
Quotes:
"Come on mom at least give the video conferencing app a try, it can't be that hard"
"There should be an easier way to get my mother to learn to communicate with me"
"I'm tired of the corporate environment, I think I need a change"

Figure 16. Secondary user persona Cyprus

Scenario 2: Maria and her daughter Christina in Easter holidays

It is Easter holiday in Cyprus. Maria and her husband Adonis are preparing their house as in a few days their children are visiting and will all spend a few days together to celebrate.

Maria is very happy that once again this year the whole family will come together to spend some quality time. She is particularly happy as her daughter Christina was able to take some days off from her job in the UK and will spend time with her. Maria misses her daughter a lot as she only sees her on holidays. Her daughter tried to show her how to use a video conferencing app once but it only made Maria more frustrated as she could not use it.

This year, as the family gathers to eat on Easter Sunday, Christina has a special surprise for her mother. She saw an advert while browsing on the internet about a very interesting platform called GUIDed. The platform is specifically developed to be used by older adults and aims to assist them with their everyday activities. Seeing all the possibilities that GUIDed offers she thought 'enough is enough, this year I am going to teach my mother how to use a video conferencing app!' And so, Christina bought a tablet and installed the GUIDed free services on it.

That day Christina was determined to teach her mother Maria how to use the system. Although Maria was a bit reluctant to start learning the GUIDed system on the tablet at first, she gave it a try as her daughter was very excited and determined to teach her. Another reason that Maria gave GUIDed a try was that it meant so much for her to be able to talk and see her daughter when she is away. Christina showed Maria how to start the communication service (S4 smart communication service), added her number in the contacts and then let her mother give it a try. Maria tried calling Christina a few times and to her disbelief the system was quite simple actually. Maria was over the moon!

Maria was so excited and proud of herself that she asked Christina what other services she could possibly use on the GUIDed platform. Among them, one captured her interest: the virtual tour capabilities (S3 smart navigation service). Maria very often kept moaning about the fact that she misses traveling with Adonis and her friends and visiting places of interest such as museums and monuments. As soon as she saw the service preview on GUIDed and all the virtual tours she could access, she immediately decided to buy the extra service. As traveling is her true passion, Maria did not even hesitate to start learning how to use the service. In fact, the instructions of the GUIDed system on the tablet make it so intuitive to use even from the first time. But the best thing about GUIDed is that even when Maria forgets how to navigate through the app, the AR/VR learning/training functionality enables her to augment information like text and videos on the app just by pointing the tablet to different objects.

Maria just could not ask for a better present. Not only is she able now to see and talk to her daughter, but also spend some of her free time learning about places he hasn't been yet but one day she definitely will. What's more, thanks to GUIDed and her daughter's persistence she is now less afraid to use ICTs and in fact she enjoys the endless opportunities one can get access to thanks to technology.

Figure 17. Secondary user scenario Cyprus

Personas of Secondary users from Austria

Sophie (52 years)

Position (working life, current etc.):
Marketing Manager in a big Austrian company. Responsible for the marketing strategy.
Interests:
Writing and dancing. She is writing her first book.
Social setting(s):
She lives in an apartement in vienna with her child and her husband.

"Working description", what would s/he usually do with the service(s):
Sophie is interested in all of the services GUIDed can offer although she wants to take a 'step-by-step' approach and introduce them to her mother in stages.
Typical goals, tasks, situations:
Sophie would love to present her mother some different places from the places where her mother lived during her childhood. Because of the less time it would be fine to do this virtually.
Needs, frustrations and values:
Sophie wants to have more Time for visiting her mother. Frustrating is sometimes that her mother isn't so happy with the communication app because she would love to have Sophie next to her.
Quotes:
"Let's start GUIDed again wo have see you again"

Problems (related to ICT or problem solving in daily life):
Sophie has very good IT skills because she is using different systems in her job. Her mother lives in upper Austria and because of having less time it is quite difficult to visit the mother as often as Sophie want. Sophie tried to install the GUIDed communication service because she want to see and talk to her without traveling. Her mother has some difficulties with movements and therefore it isn't always so easy to use GUIDed.

Figure 18. Secondary user persona Austria

Sophie wanted to give her mother something special for her birthday, so she went out and bought some GUIDed Products. She wants her mother to really understand everything so she just bought S1 (Smart Nutrition and Health), S2 (smart home control) and S5 (Communication) along with a tablet.

Since Sophie has almost no time to visit her Mother, she at least wanted to know that her mother is safe. After her Husband installled the new Smoke Detector, Sophie started to introduce her Mother a bit in just showing her that she now has a reminder to take her pills and she was just overjoyed.

After that, Sophie introduced her Mother to the Communications App. After letting her figure out that she has to have her face in the camera and all that stuff she just tried calling her after going in the garden and her mother was so happy to finally chat with her Daughter even if she is not here.

With the Addition of the Face Cam her Mother felt like Sophie was sitting right next to her.

Since her Mother has some problems with walking already and there is Corona out there, Sophie showed her mother that she even could order her food with the smart nutritions app from her local shops and services like lieferando, but it seemed like it was a bit too much for the beginning because while telling her, she fell asleep.

So Sophie called it a day, knowing she could now call her mother anytime to chat and also be sure that her mother is safe around the house.

Figure 19. Secondary user scenario Austria

Kirsten (58 years)

Position (working life, current etc.):
Home care leader. Employed by a private elderly care and provider of modern housing in Oslo. Responsible for elderly care in one housing unit. Leader of the staff in the unit.
Interests:
Travel, arts, "day-hiking" in nature, nature photography.
Sosial setting(s):
Kirsten is single. She travels most often in groups and hikes together with friends with similar interests. She regards herself as "soon a tiny little bit senior, too".

Problems (related to ICT or problem solving in daily life):
Kirsten encounters two specific challenges related to ICT: those of the elderly in the housing unit, and those of her own.
For the elderly, it is a bit challenging to get them acquainted with the smart-home technology of the housing unit. And even more importantly, to find a way to steer the lights and heating. Some of them are also quite lonely.
For herself, when she travels or hikes alone, way-finding is important. Because of her shifts, she is longing for rich AR-resources to use when she cannot travel "in real life".

"Working description", what would s/he usually do with the service(s):
For the elderly, she is engaged in making the elderly self-sustained and independent in managing the smart-home installations in the housing units. For this purpose, she "teaches" the elderly by the AR-capacity of the GUIDed application for the service S2 (smart home control service), as well as the service itself. She also provides assistance to engage at least the lonely elderly to utilise the smart social communication service S5.
For her personal use, she is on her travels eagerly using the smart city navigation service S3, especially when walking around. The AR-feature of the service makes "city-trotting" very enjoyable and informative. Sometimes she "S3-visits" cities and sites remotely from her home.

Typical goals, tasks, situations:
She wants to remove "overhead" of all tasks and doings, and concentrate on the "real substance".
Needs, frustrations and values:
Gaining high level of self-sustainability of the elderly.
Experiencing all possible nature and art possible.
Frustrated when these things go slowly.
Citations:
"Oh gosh, think if we had had GUIDed earlier! So much time and effort saved..."
"Look, I am remotely in Amsterdam, in the van Gogh museum!"

Figure 20. Secondary user persona Norway

Scenario 1: Kirsten and Anton at Silverhome residence

This week, Kirsten has scheduled AR/VR-training with the residents of the care and housing enterprise Silverhome. Silverhome has subscribed different plans of the GUIDed services for all its residents. According to the plan, all residents may access maximum of three GUIDed services. It is also possible to switch to other services if one becomes obsolete.

In addition to the service subscriptions, Silverhome has purchased a pool of tablet PCs to residents who need a bit larger device than an ordinary smartphone. All residents have already smartphones of their own. The Norwegian volunteer organisation Seniornett has provided smartphone courses to all residents of Silverhome, so they are all well-equipped to enter the ICT "era". All residents received simple practical exercises to learn how to manage touchscreens if they did not master this before. Kirsten has been the "primus motor" behind this. Today, it is time for the residents to learn GUIDed.

Anton in one of the residents. He has agreed to be one of Kirsten's "guinea pigs" for the endeavour. Anton is often critical about "the modern stuff". He also claims that the small devices are not suitable for him at all. In Kirsten's opinion, this makes Anton a perfect collaborator, meaning that If something works for Anton, it works for everybody.

The GUIDed services are designed with AR/VR-based training features so that for example caregivers as well as primary users can easily learn and adopt the services. Kirsten has herself gone through all services and is now fully able to introduce and personalise these for the individual residents to use. Afterwards, the residents can themselves repeat the training by the same AR/VR-features.

For very many of the residents, managing the smart home features of the apartments, all of them go through this GUIDed service S2 (smart home control service). Kirsten's aim is that all residents can manage the set-up and instant adjustments of lights and temperatures all by themselves (when it is "too hot" or "too cold", "too light" or "too dark"). This will also save the personnel a lot of time.

Another GUIDed feature that practically every resident has wished, is the GUIDed smart social communication service S5. Most of them intend to use it for communication with family. Some of them have ambitions that go far beyond this, namely interest groups related to hobbies and such. Anton is one of these. For Kirsten's perspective, this is a core service. Many elderlies suffer from loneliness and lack of social contact with other people than the personnel and other residents.

In Norway, the government has launched a technology roll-out in municipalities. Many private institutions follow this programme on their own. The roll-out covers, among other things, safety alarms and digital medicine dispensers. Be it private of public care institutions, or individual users living in their own homes, NAV (the Norwegian Labour and Welfare Administration) covers the cost of these technologies for all citizens who need such support (law-enforced, in fact). Therefore, Kirsten has decided not to subscribe the full GUIDed package. The service that Kirsten is considering now to see if it can be useful for Silverhome, is S1 (mart nutrition and health service). The nutrition situation of many elderly is poor in many care homes. There are several projects trying to amend this. Kirsten is monitoring these projects and developing Silverhome' own approach that may include application of the GUIDed service S1.

Figure 21. Secondary user scenario Norway

Monika (39 years)

Position (working life, current etc.):
Social worker.
Interests:
She likes ridding a bike and swimming, and dancing is her passion since she was a child.
Sosial setting(s):
Monika is married and has two children, a boy and a girl. She lives with her family in Switzerland while her mother still lives in Poland.

Problems (related to ICT or problem solving in daily life):
Monika uses smartphone like the rest of her family, she also uses laptop, mainly to work. She is not a big enthusiasts of new technologies, but she tries to keep up and uses several smartphone applications.
She encouraged her mother to start using smartphone because of all the possibilities that it gives and she felt that learning to use touch screen will be useful in the future.

"Working description", what would s/he usually do with the service(s):
Monika is interested in using social communication system herself and by her mother too. She wants to speak with her, to check on her easier and more often. Monika also wants for her mother to use the GUIDed smart home safety service (S4). In case of any emergency, Monika will be immediately inform about it.
Typical goals, tasks, situations:
The most important thing for Monika is that thanks to GUIDed safety services she wouldn't have to worry that much for her mother. Thanks to social communication service in the other hand, she hopes to take part in her every-day life.
Needs, frustrations and values:
I want my mother to be safe and have a feeling that she is well cared for. I want her not to feel lonely, even while I'm so far from her.
Citations:
"I live far from my mother, I can't visit her, usually more than twice a year, so it will be great to have something to make our contacts easier and more frequent."
"My mother lives alone so I'm worried that there is no one to help her in case of an emergency."

Figure 22. Secondary user persona Poland

Scenario 2: Monika visiting her mother

Anna's daughter Monika is coming to visit her mother Anna with her family on summer holidays.

Monika insists, for some time now, on using GUIDed system applications by her mother. Monika lives far from her and she is really concerned about her safety. Anna lives alone and there is no one to help her in case of any emergency.

Monika chose safe home and social communication services for Anna. She is going to use social communication system herself, to speak with her mother every day, to check if she is well or if she needs any assistance, which Monika can arrange, remotely from Switzerland for Anna. Monika chose also to install the GUIDed smart home safety service (S4), for fire alarm and smoke detection. When something is going to happen, Monika will be notified instantly. It is a great solution for an emergency situations.

Monika decided to spend her time in Poland teaching her mother how to use GUIDed applications, which she chose for her. Anna already has her first smartphone, so she only needs to improve her skills a bit.

Using GUIDed safety service paid off for Monika and Anna really quickly. Just a few days after her daughter left to Switzerland, Anna left for the store around the corner just for a moment, leaving her telephone at home and apple pie baking in the oven, which she was famous for in whole neighbourhood. Unfortunately she ran into her friend at the store and a moment turned into almost an hour. Forgetting about the pie completely, Anna was unaware what was happening at her house at that time.

After an apple pie burned down completely, smoke begin to coming down from the oven. The smoke detector that was connected to the fire alarm was activated and Monika received message on her GUIDed application immediately. Monika was terrified because she couldn't contact her mother, Anna wasn't answering her phone. Monika alarmed fire station and asked her mother's neighbour Maria to check on her.

Happily, everything ended up well, just with a little fear. Monika was really proud of herself for starting using GUIDed services just in time.

Figure 23. Secondary user scenario Poland

Tertiary user

Tertiary users are people and entities not directly involved in the use of the GUIDed system who however, benefit somehow from its use by other stakeholders. The consortium concluded that the tertiary users are slightly different for each country. Therefore, each partner-organisation has

researched their country's market and provided their definition on tertiary users in regards to the GUIDed system.

In Poland, tertiary users constitute: day care centres, non-public caregiver agencies or centers for seniors and social workers. Also, the best types of businesses and organisations that would be interested in a B2B with GUIDed include centers for senior initiatives and non-governmental organizations, homes for seniors, care and rehabilitation centers for the elderly, nursing homes, universities or local seniors' clubs.

In Norway tertiary users constitute: customers/buyers of technology devices such as the NAV (Norwegian Labour and Welfare Administration) which is the national organ that purchases through framework contracts large amounts of "almost all available" assistive technology for any imaginable disability. Beyond this, other types of users include large technology providers who sell large ICT solutions and municipalities/municipality cities, regional hospitals, rehabilitation providers, small, specialised companies providing assistive technologies and chains of retailers. The best types of businesses and organisations that would be interested in a B2B with GUIDed include institutions and organisations delivering housing services to the elderly, as these do purchase equipment that are not necessarily subject to European procurement rules and restrictions, especially if the total amount does not exceed the threshold values of public purchase. Beyond these municipalities and municipality cities which purchase assistive technology to the inhabitants of the municipality/city would be suitable candidates as would occupational therapists and community organisations such as Seniornett and Rotary club , Lions club as well as large retailer chains of home electronics.

In Cyprus tertiary users constitute: electronic chains that provide people with home solutions, elderly homes, medical supply stores, day care centers and senior citizen centers, municipalities and technology-based government entities. The best types of businesses and organisations that would be interested in a B2B with GUIDed include healthcare providers, physiotherapists including occupational therapists, retiree homes, medical centers that focus on older adult recovery as well as interest groups that cater to third age adults whether nonprofit or for profit.

In Austria tertiary users constitute: social counseling centers, non-profit associations, medical supply stores, day care carers, as well as care for seniors at home, non-public caregiver agencies or centers for seniors, municipal social welfare center or municipal family support center and universities of the third age. The best types of businesses and organisations that would be interested in a B2B with GUIDed include non-profit associations and for B2B on medical supply stores and companies who have smart technical equipment.

Michalis (50 years)

Position (working life, current etc.):
CEO of Aktida retirement & nursery home in Larnaca, Cyprus. Inherited the company by his father 20 years ago.
Interests:
Technology nerd and early adopter. Wants to use and try all new technologies in the market first. Loves playing video games with his friends
Social setting(s):
An introvert by nature, Michalis enjoys spending time with family and close friends and most of the time he avoids big gatherings and events unless they relate to his interests.

Problems (related to ICT or problem solving in daily life):
Early adopter of ICT technologies and highly ICT literate. Constantly tries to find the 'next big thing' in technology that will help his clients and his company grow. Already integrated several assistive technologies in his organisation but none in the last three years as the new technologies for older adults seem to be a bit repetitive by focusing solely on the health problems. Wants to find something 'new'.

"Working description", what would s/he usually do with the service(s):
Michalis will be interested in becoming a reseller of the GUIDed services. He would promote and sell the services directly to former and current clients.
Typical goals, tasks, situations:
Having managed to maintain his father's company for 20 years, Michalis now feels ready to expand his organisation and by opening a technology department dedicated to research technologies. That would enable him to exercise both his passions: assisting older adults and developing new technologies.
Needs, frustrations and values:
Michalis really wants to find a new technology to integrate it with the existing services of his organisation. For the last three years he hasn't been able to find something completely 'new'.
Quotes:
"I'm sure there must be a better technology than that"
"We are still using technologies of the previous century!"
''My father would be pride of how well I am managing the company''

Figure 24. Tertiary user persona Cyprus

Scenario 3: Aktida retirement & nursery home

Aktida is one of the largest Care, Retirement and Nursing Homes in Larnaca, Cyprus. The organisation provides a range of high-quality care services for older people including residential care, dementia care, nursing care and palliative care. Moreover, the organisation also invests in assistive technologies (AT) that aim to facilitate the everyday life of older adults.

The organisation always strives to be a step ahead and upgrade its services and technologies used. As a matter of fact, Aktida is already a reseller for several European assistive technologies for older adults. The organisation usually takes a one-off commission from selling the products or a recurring one for technologies that work with memberships. However, it has already been three years since the organisation introduced a new assistive technology. In the last few years the new technologies have been either too specific (e.g. for people with arthritis) or closely related to previous technologies (e.g. for people with dementia) and always covering health-related aspects.

One day Michalis, the CEO of Aktida, received a phone call from the representatives of GUIDed in Cyprus to arrange a meeting for a potential collaboration. Although reluctant at first as he thought that it will be an "application like the other", Michalis agreed to meet the representative when he found out that GUIDed is actually a lifestyle line of products and not health related. After the meeting with the representative Michalis decided to incorporate the GUIDed system in the organisation's services and become a reseller. What drew his attention the most was the simplicity of the system as well as the 'fresh' point of view on the everyday problems the older adults face. In fact, Michalis could see himself using some of the services like the navigation feature although he is not considered to be an older adult at the age of 50.

A few months later Michalis couldn't be happier with his choice to integrate GUIDed into his organisation's services. Michalis decided to promote and GUIDed in all his former and existing clients with a special 2-month trial offer for all the services covered by his company. The reception of GUIDed by his clients is so good that he considers hiring 2 more people to be working entirely on promoting, installing and selling GUIDed. The system has been a great hit especially for the clients who leave the organisation at the end of their therapy to return home. While at Aktida the clients have the chance to test and learn how to use the GUIDed system and services for free which is also a great way to spend time productively. When they leave Aktida they can decide on whether to 'take' the 2-month trial offer by Aktida and then buy the full membership.

GUIDed has been a great success financially for Michalis' organisation. However, he is more happy and fulfilled when his clients and their family members call to thank him for introducing such a great and helpful lifestyle product to them.

Figure 25. Tertiary user scenario Cyprus

David (50 years)

Position (working life, current etc.):
David has his own training business and he hasa part-time job in a facility for disabled people in Hartheim.

Interests:
David loves travelling especially to Croatia.

Sosial setting(s):
David has two children and live with his wife in Upper Austria. The two adult daughters are studying. The younger one wants to become an ergotherpist.

Problems (related to ICT or problem solving in daily life):
David likes new technologies and he is using the smartphone and Notebook daily. David use almost every day his iPad because he has here the possibility control his devices in his house.

"Working description", what would s/he usually do with the service(s):
David heard from GUIDed services while looking for simple way to use smart home for handicapped people. He began to use GUIDed smart home control service (S2) and decided to test S5 to get in touch with one resident of the Hartheim.
David will implement the S1 – service (smart nutrition and health service) for the same resident in Hartheim as he is using S2.

Typical goals, tasks, situations:
Nutritional supplements could improve the health condition of elderly handicapped people.

Needs, frustrations and values:
Give the residents the possibility to have more self-determination.

Citations:
"GUIDed could help a lot of residents in Hartheim."

Figure 26. Tertiary user persona Austria

Scenario 1: Special Attention Patients

A new facility for disabled people is opening in Hartheim.

It is planned to heavily integrate the GUIDed Products into the home, so they can be fully there for their people.
There is planned to put a fixed Tablet on the walls of each room, so they can instantly check in the morning what they have to do, like taking their medication on time, to shower or even simple things like an automated message when the breakfast is ready for example. (S1 Smart Nutrition and health services)

It is also planned to integrate Home Control Services (S2), so the residents can turn on the lights or to open the blinds without any physical strength.

The next they plan to integrate are the Navigation Services, with the integration of some kind of a Tracker, so when the residents decide to go outside and they dont come back anymore, the Staff can Track the resident and bring him back home. (S3?)

What also would be nice to have is the integration of the AR System so the caregivers can easily look for dosage of a medication or to just scan the tag on the door of the resident, so they can see for example what kind of medication the resident needs or if he/she was already washed and things like that.

Figure 27. Tertiary user scenario Austria

Carl (58 years)

Position (working life, current etc.):
Senior advisor in Drammen municipality in Norway. Responsible for procurement of assistive technologies to Drammen's inhabitants.
Interests:
Fishing. Carl also prepares his own salmon flies for fishing in the Drammenselva river.
Sosial setting(s):
Fishing happens together with other members of the fishing club Drammen's Sports-Fishers (DSF). Carls wife thinks he spends more time in the river than at home.

Problems (related to ICT or problem solving in daily life):
Carl is highly ICT literate. All product research and procurement is based on the use od advanced ICT systems. The purchase of assistive technologies (ATs) in bulk usually exceeds the EU's threshold for national tenders. Therefore, Carl is also a frequent user of European ICT systems for tenders and bids. He is struggling to make NAV (the Norwegian Labour and Welfare Administration) accept to provide (pay for) ATs that are based on apps on smart devices. In NAV's view, any AT can only be used for *the* one purpose that ergo therapists recommend the AT for. (Apps on smart devices can be used for multiple purposes.)

"Working description", what would s/he usually do with the service(s):
Carl want the whole spectre of GUIDed services to be provided to the elderly inhabitants.
Typical goals, tasks, situations:
Carl wants NAV to provide GUIDed service apps to the elderly people in Drammen municipality, even though NAV has the one-and-only-purpose rule. He is often in meetings in the NAV administration In Oslo, trying to convince them about the new technology developments in the society. He works hard for new rules and regulations concerning the provision of assistive technologies that the Norwegian law *guarantees* free of private payments for all citizens who need support for medication, nutrition, home safety, fall detection etc.
Needs, frustrations and values:
Carl fights for cheapest possible, good quality technology for all. He wants to achieve app approval by NAV before he becomes a pensioner (by 67 years of age).
Citations:
"I will not give up. If NAV can pay for medicine robots, it must also be able to accept medication apps and smart devices. I'll take care of that!"
"I'm sure there are technology manufacturers in the background who do not want cheap standard technologies to be accepted for provision by NAV. They want to sell their proprietary gadgets to NAV for a lot of money instead."

Figure 28. Tertiary user persona Norway

Scenario 3: Carl at work in Drammen municipality

Drammen municipality is committed to invest in assistive technologies (AT) for its inhabitants. They also educate caregivers – both formal and informal – in the application of different ATs for a variety of end user requirements. Moreover, they have a strategy to recommend private purchase instead of always waiting for the provision of AT solutions by NAV (the Norwegian Labour and Welfare Administration), free of charge as the Norwegian healthcare law dictates for certain cases of functional decline.

Several types of apps are on their list of "municipality-approved" ATs, together with a large range of different household appliances and robots that can support daily life (i.e., consumer electronics). The apps that Drammen recommends cover such areas as social contact, nutrition, medication support, monitoring of physical activity and (map) services with accessibility information about physical environments.

For the private purchase, the municipality has created a brochure that exemplifies the cost and benefit of commercially available technologies. One of the benefits is receiving the AT now, not after formal requirement analyses, decision making processes and finally, provision by NAV. That might mean months. Another perspective that the brochure offers, is comparisons with the cost of different subscription services. People pay a lot for telecom services, streaming and digital newspapers and magazines. So, why not pay for incredibly useful app support? The brochure also describes that the smart devices that the end users already have, can be used for the apps. Carl also makes a great effort to influence NAV to accept apps on the list of AT that can be provided free of charge.

Carl has been the primus motor behind the AT strategy of Drammen. He himself attends the monthly meetings with the citizens and supports his co-workers in the technology strategy and dissemination of information.

The meetings are often arranged in the Helpful Home showroom with "loads" of different ATs, including – needless to say – apps. The newest addition is the GUIDed family of services. The showroom is open daily, and the personnel at the health care and citizen support department are always available for demonstrations. Larger groups can book a meeting room and demonstrations during the evening hours at a cost of 50 NOK per person. This week, GUIDed is the theme for an evening meeting with demonstrations of the setup, modes of use and the AR training facility. Many technologies have a "super user" among the employees, so that the demos can be arranged as realistically as possible. For GUIDed, Carl does this job himself.

After the GUIDed meeting, which was a great success, several families decided to subscribe GUIDed services. They would also receive a visit by the municipality's home service to set up the GUIDed services, and to train them at home. Carl will do as many such visits as possible, partly because of personal interest, partly to promote such solutions among the inhabitants. For many, receiving a visit from the "techy boss" of Drammen is a treat!

Figure 29. Tertiary user scenario Norway

Personas of Tertiary users from Poland

Alicja (49 years)

Position (working life, current etc.):
Alicja is a medicine doctor, she works in a hospital in Poznań and she has a part-time job in Private Caring Home in Konin. She specialises in diabetology.

Interests:
Alicja loves to travel, to Africa the most. She is a passionate photographer and yoga practitioner.

Sosial setting(s):
Alicja is divorced and lives alone in Poznań. She has two adult daughters. The younger studies law in Germany and oldest works as an intern in a hospital in Warsaw.

Problems (related to ICT or problem solving in daily life):
Alicja likes new technologies. She owns a smartphone and a tablet, and uses them on a daily basis. Alicja says that she prefers using tablet instead of her laptop because it's easier to use, it is lighter, she can take it everywhere and it can do almost everything just like a PC computer.

"Working description", what would s/he usually do with the service(s):
Alicja found out about GUIDed services while looking for simple way to manage her smart home. She began to use GUIDed smart home control service (S2) for a while now and also decided to S5 to contact with her daughters. Alicja has an idea to implement S1 (smart nutrition and health service) in Konin's Care Home where she works as a diabetologist.

Typical goals, tasks, situations:
Proper nutrition is a key to maintain good health condition of elderly people and in many cases even improves it.

Needs, frustrations and values:
There are often too many residents in care homes who require special attention, like people with diabetes for example. The nutrition situation of many elderly is poor in many care homes.

Citations:
"I hope to implement all of GUIDed services one day in our care home."
"Any help we can get with looking after our patients would be just great."

Figure 30. Tertiary user persona Poland

Scenario 3: Alicja working at care home in Konin

Alicja works as a diabetologist in Care Home in Konin. Many of its residents are her patients. She works there only part time so she is not able to monitor their condition on daily basis. Alicja is wondering if there is a way to do that, when she is not around to do it herself.

Her patients constantly have to check their glucose level, many of them have to receive insulin injections. Alicja knows that in diabetes, as well as medicine taking, proper nutrition is a key to maintain their good health condition and in many cases even improve it.

The need for a better managing care home residents health condition is crucial and not only in Konin's Care Home but in other homes as well. One of the caring homes problems is that they are understaffed, there are too many residents who require special attention, the nutrition situation of many elderly is quite poor in many care homes.

She was searching, for some time now, the way to solve this issue that was until she found out about GUIDed services. She decided to immediately inform Konin's Care Home management to implement some of them at their facility. Alicja strongly believes that GUIDed applications will not only save time and money but also, what is the most important for her, will improve health condition of many residents.

She did some research and she wants to implement S1 (Smart nutrition and health service) on a trial for some of the residents.

The group of volunteers signed up for trying them out cooperating with Alicja. She is going to use GUIDed service to her diabetes treatment plan, different for every patient and properly adjusted for each of them, depending of their needs. Nutrition and medication plan with GUIDed smart nutrition and health service S1 will be personalized and can be changed any time.

Few of the residents already have their own touchscreen telephones. Those who wouldn't have their own smartphones will get small tablets for the time of trial. Some of the residents already received basic training of managing smartphones and their touchscreens. For those who didn't master this before, additional lessons will be provided.

Alicja has no doubt that the trial will be a great success and she wishes that in the future other GUIDed features could be implemented as well, for example Smart home control service (S2) or Smart social communication service (S5) which she already uses herself and thinks that it would be a great way for residents to contact their families.

Figure 31. Tertiary user scenario Poland

Conclusions

The different personas and scenarios exhibit some differences between countries with respect to the end-users' lifestyle, choices, education, access to products and services and socioeconomic level. However, common needs arise between all user categories including the need for more frequent

communication between primary and secondary users, the need for older adults to have age-appropriate user-friendly products and access to a variety of services, as well as the need for tertiary users to have available innovative and high-end products to provide high-quality services.

The drafting of the personas and user scenarios followed a very detailed approach in order to comprehensively record differences between users of the same category (e.g., the 'active' older adult, the 'techie' older adult, etc.), between categories (primary, secondary and tertiary users) and finally, between countries and cultures. This detailed approach allowed us to collect a large amount of data to guide our developmental efforts in all WPs. The personas and scenarios reflect the current situation but will be reviewed and updated if needed throughout the project and following the obtaining of end-user feedback to remain up-to-date.

These profiles were most useful in all the development stages of the testing. The low fidelity paper testing took into account these varied profiles and reinforced the assumption of the researchers and developers that the elder adults age group is indeed a very vivid and varied environment that features a number of different personas and lifestyles. The same is true with respect to their caregivers and professionals that relateto them. This translates to a number of different needs and wants that the system must be set against so as to derive a true and usable user expectations and specifics average. The High-fidelity mock-ups as well as the living lab that followed served to further support the overall system in meeting the demands of its much-varied users.

3 Experimental evaluation & feedback activities (Testing Phase 1)

The key objective of *Task 2.2: Experimental Evaluation and User Feedback (Testing Phase 1)* is to guarantee that the demands and needs of the older adults will be reflected in the hardware configuration of the device and the development of the software platform and services, which also derives from the results of the D2.1 and D3.1 objective. In order to adequately monitor, discuss, evaluate and provide feedback based on the platform development activities, the project team decided to divide the Testing phase 1 into three stages (see Table 1), namely:

1. Low Fidelity Paper prototypes
2. High fidelity Mock-ups
3. Living Labs with First True Prototype.

Testing phase 1 stages	Method to be utilised
1. Paper prototypes	Focus groups/interviews
2. Mock-ups (semi-functioning)	Questionnaires
3. First prototype	Living lab approach

Table 1. Testing phase 1: Stages and methods of testing

3.1 End-user involvement

Testing phase 1 involved 20 primary, 10 secondary and 1 tertiary user in each end-user site (see Table 2). For the 1st stage, namely, the paper prototypes, the end-user organisations in Norway, Poland, Austria and Cyprus involved 8 primary and 2 secondary users in Focus Groups.

Table 2. Numbers of users in Testing Phase 1

Task	Leader	Partners	M	Sample numbers per country/partner
T2.2 Experimental Evaluation and User Feedback (Testing Phase 1)	MAT	PLATUS, KARDE, HARPO	6-18	• 20 primary users per end-user site (5 out of them for the Living Lab) • 10 secondary users per end-user site • 1 tertiary per partner country (Cyprus, Austria, Poland, Norway)

The end-user involvement target groups, inclusion/exclusion criteria, recruitment techniques and exit strategy remain the same as per D2.1 Report on user recruitment procedures, and older adults demand analysis and as such, they are only briefly mentioned on this report.

3.1.1 Inclusion criteria

For the first phases of the project's end-user involvement, the partners have developed a set of simple inclusion criteria. These are for the primary end-users:

- 60+ years
- Willing and able to participate (no health-related or functional decline that makes participation difficult or impossible, according to [the informant's] own evaluation)
- Provided informed consent
- Some level of ICT-literacy (e.g., has and uses smartphone or tablet or PC)
- Cf. exclusion criteria.

For secondary and tertiary end-users:

- Minimum level of computer literacy required
- Autonomous and capable of providing consent
- Willing and able to participate.

3.1.2 Exclusion criteria

For the primary end-users, exclusion criteria that will be applied are:

- Presence of terminal illness that according to the informant's own evaluation might prohibit participation or cause early drop-out.

Severe impairment prohibiting the use of the system including visual, motor and audio impairment. To test and pilot the GUIDed product and services, it is important the user to be able to see what is written on a smartphone (for example text instructions and buttons, or hear normal voice alerts on

such devices (for example beeps and speech), or use the touch screen devices (for example hit and press buttons on it).

4 Stage 1: Paper prototypes

The general idea for the system was first tested through paper prototypes. Low fidelity prototypes are widely used in the user-centred design process and utilised in the early design stages in order to test the functionalities and layouts of a graphical interface before programming begins [1]. Paper prototypes (e.g. sheets of paper or in online format) are an easy method for the end-users to understand the functionalities of a system/platform and provide valuable feedback, insights and report issues with regards to its usability [2]. As such, the functionalities of the system were presented to the selected end-users in this form encouraging them to comment on these by "talking out loud" while the researchers kept detailed notes. Thus, paper prototyping assisted the project team in pinpointing and optimising design issues of the GUIDed platform for the end-users and optimising its functions early on. This enabled the researchers and developers to make alterations. These alterations collectively would then be presented back to the participants during the second stage of this high-fidelity prototype phase and eventually on to stage three of the testing the true prototype that is to be examined in the living lab. While there are several techniques for conducting the paper prototyping method, the one utilised in this phase was wireframes. A wireframe is a paper prototype used to demonstrate the page layout of the interface. As seen below in Figure 32, the design of the paper prototypes was based on a set of 'rules' so as to facilitate the end-users and the focus groups activities.

"Rules" (ref. editable template beside):

1. Simple, elegant colour scheme, the same one in all 5 service paper prototypes. Distribute colour codes to the project team.
2. No red against green, or the other way around.
3. Screen font Calibri or similar (i.e. sans serif – no small "feet" as e.g. in Times).
4. Large text, short expressions.
5. High contrasts between text colour and background.
6. No all-caps words, and no ordninary words with a single capitalised letter. Use first capital letter only in a sentence or a button, or names of persons, cities etc. when grammatically correct prose).
7. Left-adjusted text (no centre-adjusted except in buttons and the like).
8. No abbreviations, at least without explanation.
9. GUIDed set of navigation application specific icons – in-house design.
10. Same main basic action buttons in all 5 service paper prototypes (Start, Quit, Exit, Save, Home, Back, Reload, etc.).
11. Always a short way "home", possible to go "back" and Exit without any disaster.
12. Suitable illustration icons in "one family of expression", with transparent background to avoid ugly white square backgrounds (icons "borrowed" before final purchase).
13. Short guidance texts when assumed necessary.
14. Easy-to-read "normal" language. Short sentences
15. Error messages in clear everyday-language. No "techie phrases".
14. If possible, no horizontal scrolling, minimal vertical scrolling.
15. No unnecessary decorations or disturbing animations
16. Identical example branding in all 5 service paper prototypes (GUIDed logo).
17. No "bells and whistles", such as decoration elements, childish animations, clip art humour / cartoon style, smileys etc.
18. Avoid over-loading the app screens.
19. All text in native languages.
20. Enable for native ways of expressing time, date, day as well as order and decimal figures.

Consistency between features and functionalities.
Minimalistic clean design and functionality.
Prepare for responsive design.

Tool and format:

- PowerPoint.
- One screen pr. page (vertical), to allow printing to larger posters for co-creation.
- Page size A3 or A2 to provide group-work posters.

Figure 32. Rules guiding the design of paper prototypes

4.1 Method: Focus Groups

The paper prototyping method was delivered through focus groups. These originally involved one-hour sessions, with five participants per group. However, the number of participants for each focus group was allowed to be decided independently by the end-user testing sites for the purpose of complying with the national social distancing measures against COVID-19. These focus groups were a valuable qualitative research technique as they took place in an interactive interview setting through semi-structureddiscussions that enabled participants to freely express their opinions, perceptions and beliefs. During this process, end-users together with other participants interacted and shared ideas and opinions which in turn assisted the researchers in data collection as intended [3]. Due to the group setting, for many end-users focus groups constitute a more pleasant and stress-free process compared to one-to-one interviews [4] and this was the overall feeling received by researchers. Furthermore, the group dynamic as a process facilitated discussion that led to more in-depth and spontaneous conversations, debates and ideas regarding the service/ system. As such, this technique assisted the GUIDed project team to acquire valuable feedback in these early developmental stages of the platform with regards to its services.

4.2 Protocol

This section provides guidance and instructions for the end-user organizations with regards to the protocol that was followed in the paper prototype stage. The protocol is presented as given.

The researchers in each end-user organisation are advised to familiarise with the paper prototypes before testing them with the end-users. Furthermore, the end-user organisations should translate (if needed) to their local language (Greek, Norwegian, Polish and German) the informed consent, the image descriptions and questionnaires before providing them to participants. Below, the detailed instructions and procedures to be followed during the focus groups and/or the one-to-one sessions to support the researchers are described.

Due to the COVID-19 restrictions and social distancing measures in place in the different end-user countries, the end-user organisations had the freedom to conduct focus groups, face to face meetings or entirely online meetings depending on the country situation. For this reason, all the relevant material is also provided online.

Guidelines and instructions for end-user organisations

1 Introduce the GUIDed project and inform the participants with regards to its aims, purpose and what is required by them in this testing phase.
2 Provide and collect the signed informed consent sheets to end-users before commencing. The paper format for the informed consent can be found in Annex 2 and alternatively the online Google Form can be accessed here:
https://forms.gle/AfS4oA1NMHxHTayC6
3 Collect their demographic data (age, sex, IT literacy, etc.) and insert the information provided in Annex 1. For participants who do not wish to provide their demographic information please insert ‘n/a’.
4 Use the paper prototyping method to demonstrate the platform’s interface and the functionalities of each service. Throughout the session, the researchers should:

4a. Present the functionalities for each of the five services by showing the participants the paper prototypes in Annex 3 or alternatively the paper prototypes provided in PDF or PPT format.

After demonstrating each service, ask the respective questions for each one of them (see Annex 3), initiate discussion by encouraging the participants to comment on them (talking aloud technique) and note down their answers.

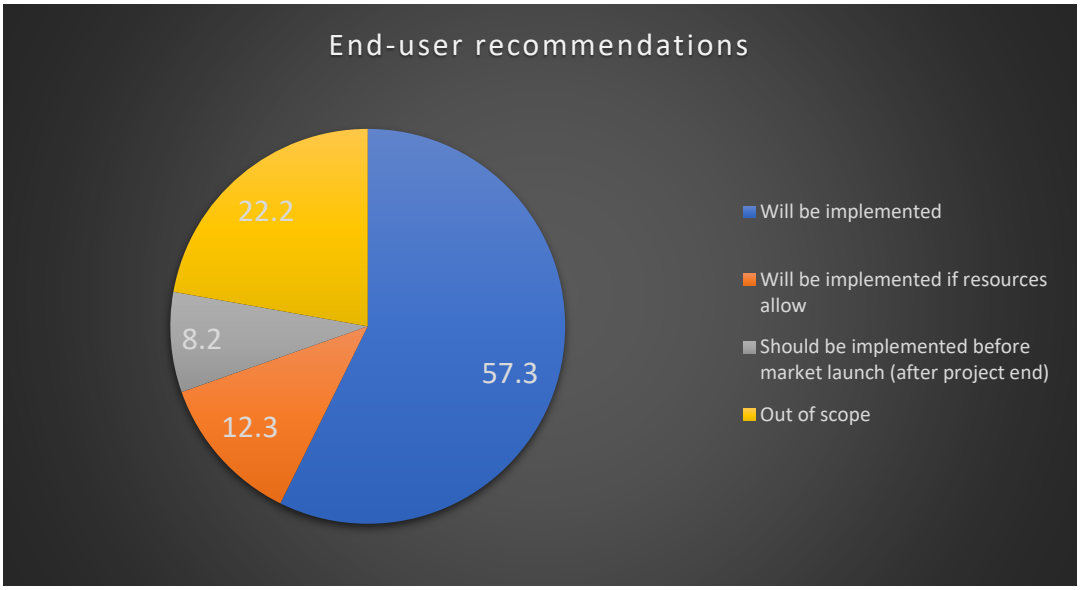
4b. Repeat step 4a for each service and note down the answers and feedback from the participants.

4.3 Paper prototype testing results

In total, 39 older adults (mean age=72.74, SD=9.12, range=59-94) and 9 caregivers (mean age=48.55, SD=10.05, range=34-64) evaluated the prototypes. The majority of older adults were female (59%), had "little" technological literacy (41% stated that they used technological devices only sometimes) and resided in urban areas (51.3%). Their caregivers were mostly 55.6% male, 66.7% resided in urban areas and most (44.4%) had "great" technological literacy (stating they used technological devices all the time).

The focus groups were very successful. The participants overall embraced the concept of the system and were very much engaged in providing valuable feedback at this early stage of testing. Overall, 137 points were identified by participants and addressed by the partners. Out of these 57.3% were decided to be implemented, 8.2% should be implemented before the market launch of the final product following its commercialisation, 22.2% were considered to be out of the scope of the current product or cannot be implemented due to security concerns, requiring very high-level technology (e.g., natural language analysis, identifying the pill without any packaging, etc.) while another 12.3% of recommendations are meant to be taken up should time and resources allowed. Thus far, 77.8% of user recommendations have been/are being implemented.

In general, the overall sentiment is that the application is user friendly and navigable. This is especially welcomed given to a large extent the sample's overall low technological literacy and familiarity with such applications. Most suggestions were centred around the app aesthetics and overall appearance as well as the spectrum of services offered with a number of participants requesting a broader range to be included. To this we may also add the requirement for further training in using the app which although user friendly, participants still felt their confidence level would rise even higher should they receive such relevant training. A significant number also requested that the navigation menu be enlarged so that the application would work equally well in both tablets and phones. Section 4.4. and 4.5 provide further details into the various suggestions made by participants and the consortium findings. Wherever possible, suggestions from partner countries were generalised into the application.



4.3.1 Results from Cyprus

Despite the COVID-19 limitations, the paper prototype testing (two physical focus groups) in Cyprus were successfully completed. In total, 13 participants (11 primary and 2 secondary users) of various ages, IT literacy and areas of residence were involved in the testing phase and were divided in two physical focus groups (see Table 3). The researchers presented the GUIDed project and demonstrated the paper prototypes both on hardcopies and as a digital presentation.

GUIDed two main User Interface options:

With regards to the participants' answers on the GUIDed two main User Interface options the results were mixed. While all the participants of the 1st focus group preferred the second layout, the participants in the 2nd focus group leaned more towards the first one. Furthermore, both groups confirmed the workability and overall aesthetics of the screen's brightness, colours and fonts as well as the buttons' size chosen. However, it should be noted that a small minority of the participants, 2 out of the 13 specifically, stated that although the fonts are big enough it would be even better if they could access the GUIDed app on a tablet rather than a smartphone.

GUIDed services

In general, both groups were content with the services GUIDed provides. Out of the 5 services, S1 Smart Health/ Nutrition service was the most popular among the participants in terms of usefulness for their everyday routines. All participants understood what the service does and did not identify any features missing or anything that might be difficult to perform within the service. One of the participants of the 2nd focus group however debated the usefulness of the smart health/ nutrition service noting that he/she has no problem taking the pills on his/her own and does not need assistance by the app.

The participants' remarks regarding the S2 Smart Navigation and S3 Smart Home service were equally positive. Participants in both focus groups noted that they understand what the services do and could not identify something out of place, unnecessary or missing. Six primary users in both focus groups

argued that the service looks easy to use, however, they would still need some training to be provided before they will be able to adequately use it.

Both focus groups had increased interest in S4 Smart Safety service. While most participants did not identify anything out of place or unnecessary, two participants did argue that the addition of a fall detection feature would be very useful in case of an emergency. The participants' perception for the service was positive and most of them noted that it would be a great help especially for people living on their own.

With respect to the last service S5 Smart Communication, participants' answers were somewhat mixed. While the participants understood what the service does and did not identify anything missing, they did however perceive the navigation of the service as difficult and more complex especially compared to the previous services. In addition, while all the participants were very positive regarding the first aspect of the app, that is communicating with friends and family, two of them nevertheless expressed their reservation regarding the 2nd aspect of the service, that of meeting with strangers. As they further elaborated, that would entail safety risks for them and maybe it's more suited to younger people. However, the rest of the participants did not appear to agree with that argument.

General questions on visualisation:

The answers of the participants on the visualisation of the GUIDed system provided interesting insights. Both focus groups identified the GUIDed app as easy to use and navigate, user-friendly and said they understand what the services do. Most participants described the GUIDed app as 'an App that provides several services for our everyday activities'. Moreover, both groups indicated that although the system looks easy to navigate and services seem easy to understand, it would greatly help if they will be provided a thorough training before they start using it. An interesting point raised by one of the secondary users was to include games divided in stages depending on the users' level of IT literacy as a way of encouraging older adults to learn how to use the GUIDed app. Finally, 2 of the 13 participants reiterated the need to be able to also use the GUIDed App on tablet as the buttons and icons would be bigger and clearer to see.

Table 3. Demographic data for participants testing the paper prototypes in Cyprus (13 total)

Country	Type	Gender	Age	IT-literacy *	Area of residence *
Cyprus	Primary user	F	75	1	Rural
Cyprus	Primary user	F	83	2	Semi-rural
Cyprus	Primary user	F	64	2	Urban
Cyprus	Primary user	F	76	1	Semi-urban
Cyprus	Primary user	F	80	2	Urban
Cyprus	Primary user	F	75	2	Rural
Cyprus	Primary user	F	77	1	Urban
Cyprus	Primary user	F	82	1	Semi-urban
Cyprus	Primary user	M	77	2	Urban
Cyprus	Primary user	M	63	2	Urban
Cyprus	Primary user	M	73	2	Rural
Cyprus	Secondary user	M	40	4	Semi-rural
Cyprus	Secondary user	F	64	2	Rural

**IT literacy: 1-no, 2-little, 3-good, 4-great, 5-outstanding*

4.3.2 Results from Norway

The paper prototypes were successfully conducted in Norway. Due to the social distancing restrictions, three physical focus groups and two individual interviews took place. The demonstration of the GUIDed features and services was accomplished through online presentations. Overall, a total of 10 people (8 primary and 2 secondary users) participated of varied demographic backgrounds such as age, IT literacy and area of residence.

GUIDed two main User Interface options:

The participants' thoughts and feedback regarding the UI options were mixed with two focus groups preferring the second one and one focus group along with one individual interview saying they prefer the first one. In general, most participants felt the layout in both UIs is clear and understandable, however, they thought that the size of the communication button should not be bigger than the other as that can indicate that it is more important or more frequently used than the rest of the services. Participants did not have any apparent problem with the screen brightness nor colours neither the fonts and buttons' size except from the colour of the Communication service icon as it can be difficult to distinguish. Some participants also had different ideas regarding the names of the services with some suggesting to change the term "Navigation" as it can be misinterpreted as the art of navigating to "Moving around", the "Home control", if this is only for lights, with "Light control" and the "Communication" as this can mean a lot, to "Contact with others". Moreover, some participants inquired why the 'exit' button is not renamed to 'log out' since there is no other option named as such while also inquiring on where the data of the application will be stored. In addition to this, they also questioned the need to use the web in order to register.

GUIDed services

S1 Smart Health/ Nutrition service

Generally, the participants were content with the Smart Health/ Nutrition service. Participants in two focus groups debated the role of the camera in Screen 2 as someone can go directly from Screen 1 to Screen 3. Furthermore, many participants had questions regarding the mechanics of the service such as 'where does the input come from' and 'how does the GUIDed app recognise the pillbox? Is it a label with a bar or Quick response (QR) code or something else'? Some participants also felt that the display functions on Screen 2 were very unclear and confusing as there were also notifications which are not related to the GUIDed system.

There were a lot of interesting suggestions and ideas for the service by the focus groups and the interviewees. The participants suggested the following additions: a. to be possible to turn off the notifications, b. to add training programs, c. dietary information, d. reminders for appointment with medical doctor, e. information about diabetics like a notification to take blood test, f. to have a more advanced and configurable pillbox like a matrix with several intake times per day (e.g. take your own picture of your pillbox), g. to be able to count steps through the service, h. to have a more explicit and clear back-button, i. to add activities such as museums visits so as to connect to persons with similar interests, play games with real persons, j. to be able to make healthy and nutritious food together and eat together, and finally k. to add a self-assessment of mental health and well-being to be shared with someone, e.g. secondary users or peers via the Communication service.

S2 Smart Navigation service

Most participants in the focus groups and the interviews appreciated the value and the usefulness of the Smart Navigation service. As many of them commented, they have at times problems walking in the right direction when they come out of underground at unknown places, something the service helps with. Some participants asked whether the application will track where the user is located as this will be important if the primary user has memory problems. Secondary users should see the position of the primary user. Users also noted that the service will be even more useful when someone visits a new place or city. In terms of suggesting changes to the service, some participants suggested to replace the "go" button with "start" in Screen 2 and to be able to point to something and get information about it while using the service.

S3 Smart Home service

Both participants in the focus groups and the individual interviews, found the Smart Home service to be highly useful and with a lot of potential for adding more features and integrating with more devices. Most participants felt that the list with the smart home devices is more convenient than the Augmented reality (AR) functionality. Additionally, many users struggled to understand how the service exactly works and the functions of the 'AR' and 'UI' buttons. Thus, some guidance or training is advised for new users.

Nevertheless, the participants had a lot of suggestions to make the service better and more useful. These were: a. to be able to check if you remembered to lock the entrance door when you are away, check if the stove is on, check if the iron is on, b. turn on light automatically when it gets dark, remote control for heating, check garage door is locked, c. to be able to control coffee machine, d. to be able to integrate different systems so you do not need 4-5 different apps, e. to be able to manage music, f. to be able to see who is ringing on your door bell and g. to have a list of compatible devices which can be operated.

Finally, a number of participants had questions regarding the service. One participant asked whether GUIDed gets access to APIs from smart home equipment as Integration to everyone's home system would be nice, but probably difficult. Another participant enquired where the devices can be bought while another one asked whether all commercially available devices will be controllable by the service. A last question regarded the relation between GUIDed and the build in apps of smart home systems. All questions were evaluated and answered by the GUIDed technical team.

S4 Smart Safety service

Most participants felt that the Smart Safety service is very closely related to the previous service. As such, most suggestions were the same as for the previous service (e.g., to have the ability to control the stove, the garage door etc.). Similarly, to the previous service, some participants struggled to identify the meaning and the functions of the 'UI' and 'AR' buttons. Some participants in the first focus group felt that the humidity and temperature sensors are not related to safety and should instead be moved to the Smart Control service. On the contrary, they identified the gas and smoke alarms to be serious safety issues.

Some participants enquired if Screen 3 aims to show that the sensors are working well (e.g., tell if a battery needs to be changed). Another questioned the importance of the smoke and gas alarm since many users will either way get a notification from the in house alarm system. In that case the users would have two alarm systems?

With regards to the additions and suggestions many participants pointed out: a. the importance of adding more sensors like water leakage and maybe a fire alarm, b. to also send a notification to the

secondary user in case of an emergency and c. to automatically call the emergency services in case of serious incidents like gas leakage, and d. include documentation of maintenance (e.g., when did you change battery last time) to help the user keep the devices in good working order.

S5 Smart Communication service

The responses regarding the Smart Communication were mostly positive by the participants, however, some of them had several concerns over the added value of the service. Participants identified the service as useful as it simplifies the user interface. Many of them pointed out that the service resembles other popular communication apps like FaceTime, Skype, Tinder etc. and that the service interface should be made extremely simple in order to appeal to older adults and provide added value to them. Most participants inquired whether there would be a possibility to add more people in the video call, and if not, they suggested adding it. Moreover, it was suggested to have the most frequent contacts at the top of the screen and also to be able to directly import all the contacts from the phone. Finally, some participants asked where persons come from in the 'Meet others' option of the service.

Table 4. Demographic data for participants testing the paper prototypes in Norway (10 total)

Country	Type	Gender	Age	IT-literacy*	Area of residence	Focus gr
Norway	Primary	Male	71	4	Urban	1
Norway	Primary	Male	69	4	Urban	1
Norway	Primary	Female	72	3	Urban	2
Norway	Primary	Female	69	4	Urban	2
Norway	Primary	Male	72	4	Urban	2
Norway	Primary	Male	73	4	Urban	2
Norway	Primary	Female	70	4	Urban	3
Norway	Primary	Male	73	3	Urban	3
Norway	Secondary	Male	49	5	Urban	Individual
Norway	Secondary	Female	60	4	Urban	individual

**IT literacy: 1-no, 2-little, 3-good, 4-great, 5-outstanding*

4.3.3 Results from Poland

Due to the COVID-19 social distancing measures in Poland, the paper prototypes were conducted as online interview sessions and individual face-to-face meetings. As such, the demonstration of the GUIDed features and services was accomplished through online presentations. Overall, a total of 11 participants (8 primary and 3 secondary users) of varied demographic backgrounds such as age, IT literacy and area of residence were involved in the user sessions.

GUIDed two main User Interface options:

Regarding the GUIDed two main User Interface options, 8 out of the 11 participants said they prefer the second interface as the tiles are more visible, transparent and readable. However, some participants noted that all the tiles should have the same size to avoid confusion. Most participants

were content with the brightness of the screen with only 2 out of 11 noting that the screen is too bright for them.

In terms of the colours of the application, the participants had several comments and recommendations. One participant noted that there should be options for users with visual impairments while another one proposed a voiceover function to assist older adults with voice notifications e.g., to take their pills. Moreover, several participants noted that the colour of the Communication service icon should be different in order to be able to distinguish it better with the background and one participant stated that the ''welcome to GUIDed'' phrase is not visible enough. Two out of the eleven participants noted that the colours of the application are not suitable for older adults and/ or are dull.

Most participants were content with the fonts and button size of the paper prototypes, whereas three of them stated that they should be as large as possible and another one proposed an additional function to enable the user to adjust the font. With respect to understanding the functions of the buttons, three out of the eleven participants suggested to replace the icon of the health/nutrition service with a 'heart', to replace the home service icon with a 'home' icon and the communication service icon with a 'telephone' icon in order for them to be clearer. Lastly, one participant stated that it would be better to stay logged-in instead of logging out so easily as it would be difficult for older adults to log-in again since they might require help from other members of their families.

GUIDed services

S1 Smart Health/ Nutrition service

Overall, the participants were content with S1 Smart Health/ Nutrition service with 10 out of 11 stating that they understand what the service does, however, some participants questioned the 'nutrition' part of the service as it is not developed yet. Regarding the missing features, the participants stated that the paper prototypes do not show the number of medicines to be taken by the user and the dose for each medicine. Furthermore, one participant suggested a text to be sent to the caregiver when the end-user takes a pill and clicks 'done', while another participant said that there should be more options for the 'remind me later' feature such as 10 minutes later. However, one participant stated that there should only be options to take the pills 20 minutes before or after to avoid mistakes. Participants also proposed that it would be good if the service would be integrated with a smartwatch and add further information (such as blood pressure, weather information etc.) were provided and further recommended to make the return button visible.

When asked whether they would add or remove anything, some of the participants' recommendations were to have different colours depending on the time of the day (e.g., morning, noon, evening) and to split the screen (slide 9 of the presentation) in order to be more understandable. Moreover, one participant debated the usefulness of the camera in order to check the pills, while another one debated the use of the pillbox as it is not widely used in Poland and suggested instead for the app to be able to read the medicines' packaging.

The participants identified as potentially difficult the presentation of the box with the pill information (slide 10 in presentation) and suggested instead a table in which the end-user will be able to scroll down. Furthermore, they suggested adding a notice in the box (slide 9 in the presentation) to indicate that the box can be enlarged and said that an end-user might forget to press the 'done' button. A participant also raised an interesting question regarding the service when asked who will add the medicine information in the GUIDed system as this can potentially be difficult for some older adults. On the other hand, participants identified as easy the notifications and the simple steps required 'take the pill and click done'. Several participants also mentioned that the service as a whole is easy to use

and helpful, and will minimise the danger that an end-user might take the pill twice as all the information regarding their pills will be found on their phones. Lastly, the participants suggested that the current day should be highlighted on the app in case the end-user forgets, a loud noise for the notification and the possibility to 'uncheck' the pill in case of a mistake.

S2 Smart Navigation service

Similarly, to the previous service, participants stated they understand what the S2 Smart Navigation service does. In terms of what is missing from the service the participants suggested a. to add the distance and time of arrival at the destination, b. add voice assistance as it would be very helpful while navigating, c. add a sign to warn users when they face the wrong direction and d. to be able to detect the traffic lights so that the service can notify the user when to cross the road. While the participants did not find anything out of place, one participant nevertheless suggested that it would be helpful to be able to switch between the map and the AR camera and also to add more places such as the clinic, the pharmacy or the doctor. Another participant also noted that the Navigation service is similar to other apps currently on the market, for example the one from Google.

With regards to the difficulties that the end-users might encounter, some participants stressed the difficulty of holding the phone while holding other things such as bags or moving on crutches and the danger of walking while using the Navigation service. As a solution they suggested adding voice assistance to guide the users. Another participant stated that it would be very helpful to integrate the app with other public transportation apps in order for the end-users to be able to see for example the timetables of the buses on their phone. On the contrary, participants identified as helpful and easy the options with the selection of destination, the presentation of the map on the phone and the interface of the service. One of the participants also commented on the 'arrows' of the AR function as 'great'.

In the 'comments' section, one participant stated that should time and distance to destination be added to the service there will not be any need to use other navigation apps. Another participant also suggested adding voice command functions in order to assist the end-users. Lastly, two participants raised two questions for clarification: a. whether the service will always guide the user through the shortest way/ main routes and b. who will add the preferred destinations on the service.

S3 Smart Home service

The Smart Home service was well received by most participants. Regarding any features missing from the service one participant stated voice control while another one suggested to be able to check whether the gas is on and close the shutters in the house. In terms of what they would change, one participant proposed to change the name of the 'UI' button to ''List of room/devices'' or just ''List'' and the name of the ''AR'' button to ''Back" as they would be clearer to the end-users. A second participant suggested enlarging the ''on/off'' button while a third one highlighted the need for some kind of guidance for the end-users as they would not necessarily know what they can do with this service. In respect to what would constitute a difficulty for the end-users, one participant mentioned that the slider could prove difficult to move while another one stated that the first-time configuration of these devices could prove a daunting task. Despite that, most participants were content with how easy the service looks such as turn on/off a light and navigating. Some final comments for the service consisted of the need for the bulbs to be affordable for the end-users and maybe a re-arrangement of the slides 19 and 20 (in the presentation) as it makes more sense for the end-user to see the UI screen first (slide 20) and then the AR functionality (slide 19).

S4 Smart Safety service

All participants understood what the Smart Safety service does and identified a number of features that could be added to the service such as sensors for floods, windows and doors. Regarding the things they would change or remove, one of the participants suggested changing the name of the 'UI' button to 'Sensor status' and the 'AR' button to 'Back' in a similar manner to the previous service. Another participant also proposed the UI screen to come first instead of the camera view. As pointed out, there is not too much value in the camera view since you can also check the status from the list. Responding to what could prove difficult in the service, some participants stated the camera view control while others said that adding the sensors in the app would be challenging. In general, though, participants stated that it seems easy to check the status of the sensors, check the notifications and were contend that they could have all the sensors in one place. In the last question (question 6), some participants suggested that voice control would be of some value and maybe to be able to automatically call the emergency services. Lastly, a participant questioned the reliability of the sensors and asked what would happen if the sensors stop working or present wrong data.

S5 Smart Communication service

As with the functions of the previous services, the Smart Communication was easily understood by participants. The responses regarding the configuration of the service were mixed with some participants suggesting this should take place within the application itself and others on a web interface by them or their guardians. Most participants identified as missing a) the ability to make normal calls in case the other person does not have the application installed in her/his phone, b) voice commands, and c) the names of the contacts under their pictures. Moreover, one participant stated that the wide-angle lens will be unnecessary while another one stated that meeting with strangers will not be of use to them. Concerning the possible difficulties, two participants mentioned the creation/ adding of the contacts list while another one said that the buttons seem rather small. Further to this, one participant said that searching for new contacts might prove difficult while another one stated that the sidebar is very thin and needs to be more visible. The participants found the service simple as WhatsApp application and identified as easy the video call function and finding a contact. As final comments some participants said they would prefer the service to have a. larger buttons, b. a favourites screen for the most commonly contacted users and c. the option to be able to turn off the camera. Lastly, two of the participants debated the 'meet a stranger' function due to safety concerns.

General questions on visualisation:

The participants' answers with regards to the visualisation of the GUIDed system were equally interesting as the previous ones. Most participants identified the navigation as 'easy' and 'intuitive' except for some minor changes that they have already suggested (e.g., to change the name of the 'UI' and 'AR' buttons). The participants felt that the GUIDed system will be easy to use for older adults but that highly depends on their familiarity with technology. Nevertheless, most of them agreed that if some kind of training is provided then the system will be easy to use. Furthermore, almost all participants thought that the layout of the system is quite clear and did not become confused except for the functions of the buttons 'UI' and 'AR'. As such most of them agreed that the architecture and navigation of the app makes sense provided that the aforementioned changes are materialised. The participants described the GUIDed product as 'a product that makes everyday life easier', an 'innovative, comprehensive gadget' and 'great'. However, one participant debated the value of the

Smart Communication and Smart Navigation services as he / she felt that the Smart Safety service is the most needed.

Table 5. Demographic data for participants testing the paper prototypes in Poland (11 total)

Country	Type	Gender	Age	IT-literacy *	Area of residence *
Poland	Primary user	F	85	2	Urban
Poland	Secondary user	M	52	5	Urban
Poland	Primary user	M	60	2	Urban
Poland	Primary user	F	82	1	Semi-rural
Poland	Secondary user	M	34	5	Urban
Poland	Primary user	F	67	2	Urban
Poland	Primary user	M	61	3	Urban
Poland	Primary user	F	67	2	Urban
Poland	Primary user	F	59	2	Rural
Poland	Primary user	M	60	2	Rural
Poland	Secondary user	M	37	3	Urban

**IT literacy: 1-no, 2-little, 3-good, 4-great, 5-outstanding*

4.3.4 Results from Austria

Due to the COVID-19 social distancing measures in Austria, the paper prototype tests were conducted in online sessions-interviews or up close where possible while respecting COVID-19 safety measures. A total of 11 participants (10 primary and 1 secondary users) of varied demographic backgrounds such as age, IT literacy and area of residence were recruited for Austria.

GUIDed two main User Interface options:

Regarding the GUIDed two main User Interface options 6 out of the 11 participants said they prefer the second interface as the tiles were clearer. Two participants stated that they liked equally both and the rest preferred the layout No 1. in terms of graphics and accessibility. All participants were pleased with the appearance of the interface including font size, brightness, contrast and buttons. One participant mentioned that square buttons may be preferable because of their “cleaner” look and feel. Also, two participants requested a greater level of contrast between the buttons and background (maybe having a soft blue or soft yellow background) while this suggestion was especially indicated for the last button concerning S5. Some further suggestions coming from older participants included the need of including an “emergency button” in the Home screen, the ability to adjust the font size according to the user’s preferences and the need to consider colour-blinded people while choosing the final colours of the app.

The rest of the functions were rated as clear and easy to understand by all except for two older adults who stated that they might need assistance from their caregivers or family members to learn how to use the app. This factor arose again in other participants’ ratings who said that although it is easy for them to use the app, this is so as they do possess some experience in using smartphones in their everyday lives, but there are other people who don’t and for them it may be more difficult.

GUIDed services

S1 Smart Health/ Nutrition service

Overall, the participants were content with S1 Smart Health/ Nutrition service with all of them stating that they understand what the service does and rating it as easy to use. Two participants commented on the appearance of the pill dispenser stating they could not grasp how it would work (e.g., with QR codes or labels) in the final product and mentioned that in the current paper prototype picture the days of the week are not clear enough for them. Also, one person stated that the Health icon could be replaced with a first aid kit. Austrian participants also stated that the use of this service could be overwhelming for people taking multiple pills in terms of the many different notifications, alerts and information provided by the app. One suggestion given by two participants was that the provision of alerts should be customizable depending on user preferences (e.g., option to activate/deactivate some of the reminders or info provided). In terms of accessibility, an interesting remark concerned the described need for audio reminders for medication.

When asked whether they would add or remove anything, three participants recommended adding the option to measure their blood pressure or sugar levels either by connecting directly a sensor to the app or by receiving app reminders to do so through other means and insert this info to the app in order to be viewable to their caregivers or doctor. Two people suggested that it would be really helpful for them to have information about each medication (e.g., heart medicine) and one stated that it would be useful to have a reminder when a medication is about to finish in order to renew their prescription on time.

S2 Smart Navigation service

Similarly to the previous service, participants stated they understand what the S2 Smart Navigation service does and rated it as very helpful. One participant said that he/she already uses a similar navigation assistant. Overall, there were no objections to the current interface except for one person stating that the slide bar would be difficult for them to use and one person recommending to change the navigation icon to a walking pedestrian icon. This comment type was indeed recurring and repeated by other users with respect to the rest of the services. In terms of what is missing from the service the participants suggested adding a voice output for the directions and guidance which is understandable since voice guidance is more helpful and easier to use than reading screen outputs when walking outdoors. Furthermore, many people suggested having the option to customize their routes (e.g., ability to add directions to and from their favourite supermarket).

S3 Smart Home service

The Smart Home service was welcomed as very helpful by most participants, especially people with mobility problems who said that it would be very useful for them to be able to control home devices remotely. Comments for improvement included the need to change the AR and UI buttons names as they are not so understandable by older adults. Regarding any features missing from the service, three participants stated that they would like to be able to control their TV as well as their front door (opening, closing, locking) for safety reasons.

S4 Smart Safety service

All participants understood what the Smart Safety service does and rated it as very useful. One person stated that he/she does not understand the purpose of the AR mode (camera use) when it comes to sensors such as smoke detectors. In terms of usability participants mentioned that a) the colour bar is difficult to understand, b) that the “green telephone” icon is not well understood and should be replaced by another icon and that c) the pop-up alert in case something is detected by the sensors

should be in bigger font and even have a loud sound notification. This is reasonable considering that it is a priority to be able to understand a safety notification. Other concerns were raised about the utilization of an alert as for example who would be able to see this information (e.g., a caregiver) and also it would be useful if the system could automatically trigger a call alert to an emergency service. These concerns can be addressed by the technical team in order to add a level of customization where the user selects what happens when a potentially dangerous situation is detected.

S5 Smart Communication service

As with the functions of the previous services, the Smart Communication service was easily understood by participants. In fact, one participant mentioned that "it is pretty easy for 60 year old plus people and I imagine it would be even easier for future generations". A confusing factor for older adults was whether they could register through a web interface or the app with some stating that they imagine the web login to be easier and others stating that they find it very confusing. Another issue raised was the option to meet strangers which was found to be worrisome for safety reasons or rarely to be used due to preferences. Some suggestions for improvement included the need to a) add an option to switch the camera on/off or to mute the microphone, b) be able to define some time window for call availability and c) start a call only by tabbing on a user photo.

General questions on visualisation:

Overall, users rated the app as a "simple and useful senior product", "a companion", an "assistant in everyday life" and a "helper". All users stated that they would like to use the app (or at least some of the services) and rated it useful as it would be "supporting them in their home", "offer a lot of services in one" and would be "supporting them in self-determination".

Table 6. Demographic data for participants testing the paper prototypes in Austria (11 total)

Country	Type	Gender	Age	IT-literacy *	Area of residence *
Austria	Primary user	F	82	2	Semi-rural
Austria	Primary user	F	61	4	Urban
Austria	Primary user	M	65	4	Urban
Austria	Primary user	F	94	1	Rural
Austria	Primary user	F	85	1	Semi-rural
Austria	Primary user	M	60	3	Rural
Austria	Primary user	M	67	3	Semi-rural
Austria	Primary user	F	72	2	Rural
Austria	Primary user	F	67	3	Rural
Austria	Primary user	M	67	4	Rural
Austria	Primary user	F	87	3	Rural
Austria	Primary user	M	92	2	Rural
Austria	Secondary user	F	50	4	Urban
Austria	Secondary user	F	51	4	Semi-rural

**IT literacy: 1-no, 2-little, 3-good, 4-great, 5-outstanding*

4.4 Paper prototypes testing: The brief output

This section provides a brief presentation of the adjustments and provisions needed to fine-tune the GUIDed system based on the feedback obtained by end-users during the 1st stage of testing phase 1. This output served as an easy guide for the technical team to view the requested adjustments in order to suit end-user needs.

General remarks:

- People from diverse sex, age, IT and residence backgrounds understand the services and think it will be relatively easy to start using the App with some training
- No apparent problem/ issue with the screen brightness, colours and the fonts and buttons' size, only minor disagreements
- Trying to motivate some older adults to use the services will be a challenge
- Some participants questioned the need to use the web used in order to register in the GUIDed services
- Participants in Norway struggled to understand the Smart Home service, some kind of training is advised
- Smart Communication service is found by participants to be or should be comparable to Face time, Messenger (Facebook, chat) and other mainstream applications. GUIDed must strive for extreme simplicity in HCI in order to have added value for the end-user.
- The process could be further simplified as with, enabling the relevant service to automatically activate the service instead of the user having to choose Home control/lamp control/AR mode. Invent more creative use of AR. The AR in navigation is ok.
- Disclaimers concerning data usage, privacy and safety should be added in the app.

UI recommendations

- Both screens are easy to use with a slight preference to design No 2
- Make the tiles size even
- Square tiles should be cleaner
- To add high contrast for persons with visual impairments (lighter background)
- To change the colour for communication service icon
- 'Welcome' is not visible enough
- To have the option to make the font bigger
- Add an emergency or panic button
- When choosing colours take into account colour blind people (e.g., avoid using green and red together)
- Change the Health icon with a 'heart' or 'first aid kit' icon, the home icon with a 'home' and the communication icon maybe with a 'phone' icon, navigation with "pedestrian" icon
- To change the colour of the Communication service icon as it is difficult to see
- Have it available on a tablet also (accessibility issue)
- To change the "Navigation" as it can be misinterpreted as the art of navigating in an application to "Moving around", the "Home control", if this is only for lights, to "Lights control" and the "Communication" to "Contact with others".
- To rename the 'exit' button to 'log out'
- The app should remember the password
- Application should be functioning in both a smartphone and a tablet
- Users' requested the availability of a training, maybe through a gamified component

- Addition of a fall detection service would be an added value (especially for people living alone).

Smart services

1. **Smart Health /Nutrition**

- Doses and number of medicines taken to be included
- More options for reminding me later such as different times (15 minutes, 20 minutes etc.)
- To send a text message to the caregiver that the pill was taken
- To make the return button more visible
- To add information for appointments with doctors or steps taken in a day
- To integrate the service with a smartwatch along with other functions like blood pressure, weather, etc.
- The service to be able to scan and identify the medicines' packaging
- To split the screen in two in slide 9
- To add different colours for morning, evening, etc.
- Something to indicate that the box in slide 9 can be enlarged
- Where does the input for the pills come from? Who needs to put in the information?
- Will the app be able to recognise the pill outside of the packaging?
- In slide 10 to add a table to scroll instead of a box
- Who would add the medicines in the system? If it is the caregiver, it means that it will be too difficult for the end-users.
- User might forget to press 'done' when selecting a pill
- Highlight the current day on the box as users might get confused
- To have loud sounds for the pill notifications
- The caregiver to be able to reset the selection of the older adult
- To be able to uncheck the selection of the medicine in case of mistake
- How does the camera/app know it is a pillbox you are pointing at?
- Must have a more advanced pillbox, a matrix with several intake times per day. Should be configurable (e.g., take your own picture).
- More functions than pill intake, e.g., count steps, give an overview when carer is expected
- Screen 3, do not use the back-button on phone or tablet. More explicit back-button, not click on the picture to come back (text 7).
- Where does the information about the medicine come from? Who updates the database? Certainly not the professional carers.
- Suggestions to add activities such as roundtrip at a museum, connect to persons with similar interests, play games with real persons, make healthy and nutritious food together, count steps and maybe a self-assessment of mental health and well-being. Must be shared with someone, e.g., secondary users or peers via the Communication service.
- More suggestions: a. to be possible to turn off the notifications, b. to add training programs, c. to add dietary information, d. add reminders for appointment with medical doctor, e. information about diabetics like a notification to take blood test, f. to have a more advanced and configurable pillbox like a matrix with several intake times per day (e.g. take your own picture of your pillbox), g. to be able to count steps through the service, and finally h. to have a more explicit and clear back-button.

- Add a reminder to take blood pressure or measure sugar levels and the option to add those measurements to the app for future reference
- Add a reminder to renew the prescription when a medicine is about to finish.

2. Smart Navigation

- To add the time to destination
- To be able to get a signal when facing the wrong way
- It would be great if the service could be able to detect the lights in the crossings
- To be able to change between the map and the VR
- Add clinic, doctor, pharmacy as destinations
- Training will be needed for end-users
- The service is similar to other apps that exist like Google
- The map is rather small
- To have the option of voice commands instead of holding the phone while walking
- To integrate the service with public transport apps that provide timetables for buses, etc.
- How will you indicate forward and backward?
- Does the app track where you are? Important if the primary user has memory problems. Secondary users should see the position of the primary user.
- Replace “go”, with “start” in Screen 2
- Point to something and get information about it
- Modify slide bar it could be difficult to be used by many older adults
- Insert a voice output option as it could be more useful while moving around.

3. Smart Home

- To add voice control for the service
- To be able check whether the gas is on
- To be able to close the shutters in the house
- Enlarge on/off button
- To change the UI button to ‘Room list’ and the AR button to ‘Back’ (or to more general labels like “Buttons mode” and “Camera mode”)
- Add option to control TV or front door
- Option to control devices when user is not home (e.g., switch off the stove)
- Some guidance on what you will be able to do will be needed
- Will be difficult to move slider
- Who will add and synchronise the devices on the service?
- Training will be needed for end-users
- To be able to see Slide 20 first and then slide 19 when opening the service
- To be able check the radiators and doors
- What is the AR and UI mode? Confusing, needs explanation.
- Unclear how to access devices in other rooms if you are at home. If you are not at home, can you then access the devices at home?
- Must be expensive since you need to buy a lot of smart devices. Where can I buy these devices? Will all commercially available devices be controllable by the app? What is the relation between GUIDed and the build in apps of smart home systems?

- AR seems artificial. Better to control the devices from the app, not by pointing.
- To be able to turn on light automatically when it gets dark, remote control for heating, check garage door is locked
- How many devices can be controlled by the app? From different vendors/producers?
- Do the GUIDed team get access to APIs for smart home equipment? Integration to everyone's home system would be nice, but probably difficult.
- Should be able to control coffee machine, stove, lock, garage door
- Must have a list of devices which can be operated
- Other suggestions could be to integrate different systems so you do not need 4-5 different apps, manage music and see who is ringing on your door bell, also when I am not at home.

4. Smart Safety

- To be able to reset or cancel the sensors in case of mistake
- To add flood sensors in the service
- Make sure that the pop-ups in case of an alert are in big font size and have a sound notification as well
- Add some customizable options about the handling of an emergency alert for the user (e.g., when smoke is detected, I want to notify the fire department via an automatic call or I want to notify my daughter)
- Colour bar should be modified as it was deemed difficult to understand by users
- "Green telephone" icon was deemed inappropriate
- To have a sensor for opening windows
- To see the UI first when open the service and then camera if needed
- Change the UI button to 'sensors status' and AR button to 'back'
- Camera view (AR) is a bit confusing
- To add more sensors
- Training will be needed for end-users
- Concern in the case that the sensors are wrong
- To be able to automatically call emergency services
- Voice notifications for the service
- Add sensors for doors for burglars
- Why point to get status? The app should give information about maintenance of devices without you asking for the status.
- Secondary users need to get notified when something is wrong.
- For certain emergencies calls to someone should be placed automatically. The "someones" should be configured in the web service.
- Temperature and humidity do not concern the safety and should be put in Smart control service
- To add sensors for water leakage and fire alarm
- To include documentation of maintenance (e.g., when did you change battery last time)
- Consider a backup plan or a liability strategy if sensors stop working.

5. Smart communication

- Normal telephones to be reachable as well if the other user does not have the app installed

- Add names under photos
- Add voice commands
- Adding contacts and contact list creation in web interface is not shown and will probably be difficult for older adults
- Side bar too thin
- Add bigger buttons
- Add a favourites section
- To be able to turn off camera and mute the voice
- Ability to define some availability windows
- Tap on a picture of a contact should initiate a call
- To transfer the contact list directly from the phone
- To have a list of people you contact more often. Also, to import telephone lists or manual registration on administration websites?
- Can more than two persons be part of the conversation? If so, how many people, cannot be too many. E.g., family meeting. Must everyone have the same app?
- Where do people come from in the 'Meet others' option?
- Screen 1, "Meet Others" should be "Meet others"
- Web or in app registering was found to be conflicting by users as to why this is different or what they prefer
- Contact with strangers was worrisome for many people. Maybe add a safety disclaimer in the app (related to Ethics and Safety).

General questions:

Visualisation:

- Change UI and AR buttons as their meaning is confusing
- Add more sensors
- Layout and architecture are easy to understand.

4.5. Conclusions for technical adjustments needed

The results of the paper prototype testing showed that all of the users found the application understandable and easy to use, which is an encouraging finding considering older participants' low technological literacy. Some suggestions for improving usability included increasing the contrast of the screen colours and taking under account colour blindness when choosing the palette, changing the labels of some buttons (e.g., replacing the term 'user interface' with something more intuitive), and replacing some of the icons with more appropriate ones (e.g., replace the icon of S1. Health and Nutrition service with a 'heart' or a 'first aid kit'). Despite the fact that participants rated the app as intuitive and easy to use, most of them requested an introductory training to support them while using it. The training component has already been planned to be incorporated in the GUIDed application via an innovative assistant, utilizing AR technology. In regards to appearance, most participants showed a preference towards user interface design No2 since, according to them, it seemed cleaner with larger buttons than user interface No1.

Participants rated positively all of the services included in the GUIDed system. As they stated, the GUIDed system combines "all important services in one" constituting it an "everyday life companion" and "assistant". Two of the services rated as most useful included the Smart Home Control service and

Smart Safety service as they simplify everyday procedures and offer convenience and safety, respectively. Some participants valued less some of the services due to personal lifestyle preferences. For example, older adults who did not take medication stated that they would not use the Smart Health and Nutrition service so much. Moreover, all participants provided the GUIDed team with suggestions for additions and improvements in order to suit their individual needs. More specifically, participants requested the addition of an emergency button in the GUIDed application home screen to provide an easy means to call for help in case of an emergency. Regarding Smart Health and Nutrition service, participants requested the addition of a reminder to measure their blood pressure or sugar levels and fields to insert those measurements in the app. For Smart Navigation Service, people requested the implementation of voice guidance apart from visual notifications as it seemed easier for them to have auditory assistance while walking around. With regards to Smart Home Control Service, users stated that it would be helpful for them to have the ability to control their TV or front door. Finally, for Smart Safety Service and Smart Communication Service users requested the incorporation of anti-theft devices and the simplification of the calling process (e.g., a call should be initiated when the user touches the photo of a contact stored in the app).

In conclusion, the results from the first end-user testing of the GUIDed paper prototypes were very promising and insightful. The GUIDed system was rated as easy, intuitive and valuable which will provide a great level of self-confidence, independence and convenience to older adults with some modifications, additions and adjustments.

4.6. Implications of the open ethical dialogue

During these initial testing stages, the open form of questions allowed users to freely reflect on their thinking process. Because of this, except for technical adaptations needed, the process creates an open ethical dialogue with all types of users and allows us to draw inferences on ethical and lifestyle aspects which should be given equal importance and addressed by the GUIDed consortium.

To begin with, several points emerged with regards to the ethical principle of ‘justice’ and developing equal products for all. Participants stated for example that even though the application is intuitive and easy to use, we should include a training course for people who are not so technologically competent. Under the same principle, participants suggested being able to have many configuration options, such as adjusting the volume of the notifications and choose how to handle emergency signals from the Smart Safety Service. Another principle that emerged was that of ‘consent’. Participants requested for example to be able to turn on and off their camera or mute their microphone through the Smart Communication Service and be able to turn off the option to meet strangers through the app. This was deemed as an important issue as though a large number of participants thought this as very useful others were sceptical towards this feature. Furthermore, several points arose with regards to the principle of the ‘fidelity’ of the system. Users requested to check the reliability and functionality of the sensors in the Smart Safety Service, check their battery status and have information on their maintenance history. Finally, another principle that emerged during Stage 1 of Testing Phase 1 was the ‘right to information’. For example, participants requested to know how exactly will the app recognise their pillbox and how does the camera receive input from the environment to translate it to actions. This shows that it is very important to thoroughly inform the users using simple and understandable language about the technology underlining the GUIDed app, as well as, its pros and cons.

All the aforementioned ethical principles have already been taken under consideration by the GUIDed consortium and we plan to address them by employing specific strategies: a) implementing both an in-system training feature and a live training programme offered by clinicians, b) enabling many

configuration options for each user, c) adding detailed in-app disclaimers about specific services, and d) allowing users to choose the level of information-sharing they wish to engage with through the GUIDed application.

5. Stage 2: High-fidelity mock-ups

The inception of the idea for the system was first tested through paper prototypes. A full analysis of this, including the results thereof can be found in section 4 of this document. Following this Low Fidelity paper prototypes testing stage and addressing the issues identified, as described in the relevant section, the partners proceeded to the second phase of the testing. This stage 2 of testing was performed through a high-fidelity prototype that was very close to the end prototype. A High-fidelity wireframe was used that looked and felt very close to the final product.

The same data collection method as before was also followed here. Focus groups were utilised for much of the same reasons described in the previous section. Responses were elicited from participants using the "Imagine if" method. Through this method, participants were asked to imagine they assumed the role of the application's editor and they could very easily swipe away and add any feature they wished on to the device. The questions revolved around the interface of the application and the service provided while a number of ethical issues, such as privacy and safety were addressed. The guided discussion questionnaire can be found in the annexes. Through this method, the partners were allowed to check not only if the issues discovered during the first testing stage were resolved while allowing participants to bring forth other issues and recommendations, but also if the user recommendations were implemented in a manner satisfactory to the potential users within a broad sphere of considerations including marketing, ethics, usability, convenience and more.

This stage informed the developers and consortium of their progress. Beyond this it helped derive the final prototype to be tested in the living lab before released to be tested in real world conditions.

5.1 Participants

At least 10 participants per centre (40 in total) were included in the Stage 2 of Testing Phase 1. The participants belonged to primary, secondary and tertiary groups, in order to ensure the collection of comprehensive feedback. Furthermore, since this phase concerns the co-creation and development of the GUIDed system, end-user sites were encouraged to engage experts (e.g., IT experts, healthcare professionals, developers, engineers, etc.) whenever and to the degree possible. The planned number of participants to be included in this phase can be found in the table below:

User group	Austria	Cyprus	Poland	Norway
Primary	5	5	5	5
Secondary	3	3	3	3
Tertiary	2	2	2	2
Experts	Per centre's availability			

5.2. Protocol

This testing phase is the first contact of end-users with a 'tangible' product of WP3. Thus, this is the first stage that allows them to better understand the essence of the GUIDed system and its objectives and subsequently, better reflect on their wishes, needs and requirements from a technological, ethical and lifestyle perspective compared to the previous phases. Hence, this phase aims to initiate an open dialogue during which people can exchange ideas, hear one another and be heard. This is the reason

it is best to include more than one user from more than one category in the same testing session. For example, a nice setup could include two primary users, one secondary and one tertiary or one expert**.** Participants could be recruited via telephone, email or other methods utilising each site's contacts and network. The application of the protocol could be conducted physically or virtually depending on the national rules and regulations amid COVID-19. In any case, the testing protocol should follow the pattern of a hands-on demonstration, a simulation of how the 1st prototype is intended to function, followed by a semi-structured interview (Annex 3).

The main instrument for the testing is the GUIDed app (.apk file) released by WP3 which includes all the material to be viewed by participants during the testing process. The GUIDed app had a login feature and 5 clickable main buttons, corresponding to the five GUIDed services. Each button had the possibility to switch to the camera mode which will include the AR functionality on the final prototype. The camera mode did not have any functionality at the moment of testing but using a special picture marker corresponding to each service, the researchers could simulate the ultimate functionality and show to the participant how they will be able to scan the devices in each service once the prototype is released. This way the participant had a more complete and representative picture about the functionality of the GUIDed app. Since the GUIDed app had to be downloaded and installed in a compatible device in order to conduct the testing, we have identified three possible implementation scenarios according to participant availability and resources which can be found in table below:

Scenario 1	**Scenario 2**	**Scenario 3**
Participant is reached physically	Participant is reached remotely and can download the .apk file	Participant is reached remotely and cannot download the .apk file
Action 1	**Action 2**	**Action 3**
Download and install the .apk on researcher's device and show the corresponding picture markers on a computer screen as images to conduct the simulation	Share the .apk link with the participant for them to download and install on their devices and show the markers via the ''share screen'' option on Skype, Zoom, etc. to conduct the simulation	Download and install the .apk file on researcher's device, download the sharing app in order to share the mobile's screen on the virtual platform and print the markers to conduct the simulation

In detail, testing steps can be found below:

1. Check that the participants comply with the inclusion/exclusion criteria as defined in D2.1.
2. Briefly explain to the participants the objectives of the GUIDed project and system and the purpose and procedure of this testing phase.
3. Obtain participants' informed consent (applicable if the participant has not already participated in previous testing phases).
4. Obtain the participants' demographic data through the demographic questionnaire found in Annex 5.
5. According to the participant's availability and resources available, follow one of the scenarios 1, 2 or 3 described above.
6. Click on this link from the Android Smartphone or Tablet (Note: Android Version 9.0 and above for the AR to work). This opens the GDrive application from where you can click on the three dots and choose Download to save this on your/participant's device.
7. Locate this file at the location you have saved it. Click on it and choose to install it. A popup appears where you choose Settings and click enable to install.
8. When the installation is complete you can open the GUIDed App. At the login screen the username is "offline" and the password is "123456" in case you would like to try it manually.
9. Once you log in you can see the main screen of the GUIDed App. Clicking on the top right allows you to logout, if you would like.

10. The AR image recognition works for Health, Home and Safety (keep a bit back for the smoke sensor to be recognised) currently using the demo images attached, while a GIF file is also included to help you provide the experience of the navigation service. The communication service (backend and Android frontend) is fully functional but not integrated yet in the main app. The recognition shows at the moment that the right object (e.g., pillbox, smoke sensor, light) was detected based on the demo images.
11. You can also go from Camera (AR) mode to Menu (UI) mode.
12. The picture markers can be found here.
13. In order to download and use the sharing screen application: Connect with your smartphone to the PC using the USB cable.
14. Download scrcpy from here: https://github.com/Genymobile/scrcpy. Unzip to your preferred location and run scrcpy-console.bat to see your smartphone or tablet screen on the PC in excellent quality. When using the application whatever you do on your smartphone or tablet is mirrored onto the screen.
15. There are other tools like scrcpy, e.g., Vysor (free version the mirroring quality not great - https://www.vysor.io/) or Samsung Dex (only for specific Samsung devices - https://www.samsung.com/us/explore/dex/).
16. Start the protocol by explaining what each GUIDed service does and simulate the AR recognition using the camera mode and the picture markers:
    - Smart Health/Nutrition service: Open the camera mode and 'scan' the pillbox marker
    - Smart Navigation: Open the camera mode and 'scan' the place marker
    - Smart Home: Open the camera mode and 'scan' the lamp marker
    - Smart Safety: Open the camera mode and 'scan' the sensor marker
    - Smart Communication (no further actions available at the moment of testing).
17. Ask the participant(s) to answer the questions presented in Annex 6.
18. Record the results.

5.3. Testing Results from High Fidelity Mock-ups

5.3.1. General findings and considerations

The total number of participants for the stage 2 testing was 58 for all four countries. This represented more than a 35% surplus over the minimum number that was intended at 40 participants. The sample was diverse and comprised of 31 primary, 17 secondary and 10 tertiary users, representing 57.41%, 29.63% and 12.96% of the sample, respectively. The average age of the participants was 67.40 years old, and most resided in rural areas. Specifically, 35.19% resided in urban areas, 14.81% in semi urban and 50.00% in rural areas. The majority of participants or 55% were female while the average IT skills of the sample was reported as medium to high. Specifically, 18.52% reported their IT skills as low, 38.89%, medium, 40.74% high and just 1.85% as having no IT skills.

This large and diverse sample pool gave researchers the opportunity to test the application broadly. All target groups are major stakeholders of the application and the numbers of each group represent the envisioned adoption breakdown rate for the product when available to the market. As to this and with the intention of clarifying the relationship of each group to each other and the application as emanating from our research results it is good to point out that the average primary user is an older adult over the age of 60 able to care for themselves and make personal use of the application services.

These are our primary users and indeed our sample's average age was that of 67. However, we do recognise and this has been verified from our collected results, that a number of users will not wish or be able to operate the application independently. They may, with several enough participants stating thus much, instead either operate some or even in some cases no services themselves having these or all services, as the case may be operated on their behalf by a caregiver of various degrees.

By the term various degrees, we refer to the relationship of the primary and secondary user. We also refer to the degree of care and overall time provided to the primary user. This much has been shown through our research with a significant number of both primary and secondary users stating that they intend the application to be used by a secondary user on behalf of the primary with various degrees of access, meaning partial access on either side or complete. This finding can be useful not only to the researchers but also to the tertiary users which can help building a relevant marketing and business model to accommodate this in the sense that the application can be used both independently and on behalf of a user by someone else they trust. Besides this and on a related topic, notifications are desirable to be sent to secondary users as well. This would involve for example a notification to the secondary user of a fire alarm or that a pill was taken on time. Naturally, the same notification would be sent to the primary user. Both these scenarios present ethical challenges, if only in terms of privacy which ought and will be addressed in the privacy and terms of use policy.

Beyond this, the sample from all four countries showed a high further degree of convergence. Though the focus meaning the general thematic area the discussion centred on of each of the four test groups was different, the 74 recommendations offered by participants may nonetheless be implemented, where administratively feasible, without necessarily excluding one another and in the interest of all involved so as to derive at a commonly accepted and improved application.

Beyond this, these recommendations help prepare for the next testing steps. This is so, as they assist researchers in deriving useful insights that can aid them to prepare the consortium for the stage 3 of the testing, this being the leaving lab. For example, they helped in informing of its protocol that should thusly include, as became apparent, both primary and secondary users as participants with varied degrees of access and test along with the application the administrator portal as well with the relevant adjustments made to it as per these recommendations. Furthermore, and beyond the general feedback given with respect to the application itself, these suggestions, where convergence was not observed, help to further ensure the relevance of the Business and Marketing plan to the intended users once the final product is ready. This is so as for example the application can be offered in different countries with a different mixture of free and on demand services based on the participants evident preferences. The specifics of each country are presented in their dedicated section. However, a general short summary is provided here to give the context of each of the recommendations.

For Cyprus, the main focus was on safety issues. This includes for example granting the ability of the secondary user to lock certain services or features such as the "meet strangers" option in the Smart Communication Service or ensuring that a navigable user registration and deletion process is available. The two most useful services among those offered involve the Smart Health and the Smart Communication Service.

For Norway, the main focus was using the application when not home. This would also imply lower costs as a result. For example, allowing one to control the Home and Safety services when away could enable that person to turn on and off the lights when away on holidays or receive information about the levels of moisture in the house and act accordingly. The services that participants did consider to be most useful were the Smart Safety and Smart Navigation Service.

For Poland, the main focus was that of accessibility and design for all. For example, the colours, fonts and specific features of the services, like the meet others function of the Smart Communication service, could be selected by the user themselves to suit their situation and needs. Of the services

offered through the application, participants included the Smart Home Service and the Smart Safety Service among the most interesting to them.

For Austria the main focus was the inclusion of further functions enriching the overall experience. For example, with respect to the Smart Navigation service, participants would like to see it expanded so as to include a tracking feature where the primary user could alert the secondary user of their location in case they got lost. The two most important services for participants were the Smart Navigation and Smart Communication Service.

The suggestions per country are available in the Annex 4 in the form of a table.

As a note we would like to point out that we have adapted the demographic questionnaire in the section of IT literacy. From five IT literacy levels now there are three from stage 2 and onwards. Having three levels namely Low, Medium and High was agreed as more helpful in providing guidance towards the application design. The former levels 1 and 2 were merged as low, level 3 refers to medium and levels 4 to 5 as high. Given that our application is intended to be user friendly, these three levels simplify the process and assist us to better understand our users.

5.3.2. Results from Cyprus

In Cyprus a total number of 15 participants were interviewed at this second stage. The sample involved a rich mix of primary, secondary and tertiary users. The High-Fidelity Mock-ups also involved 2 tertiary users and an expert participant, allowing for a more in-depth view of the application. Overall, the participants were very happy with the services offered in this second stage of the High-Fidelity mock-ups though they did make a number of recommendations that could improve these services even more.

Most of the recommendations revolved around safety issues. These included such suggestions as offering the caregiver options to lock and modify certain features of the application, relevant disclaimers that ought to be put in place, FAQ and options to provide support to be available to users. Beyond these participants would like to see a very simplified user deletion process. As to functionality participants would like to have the application include voice commands and notifications. The two most useful services among those offered involve the Smart Health and Smart Communication Service.

As to the overall application participants thought it to be very navigable and user friendly. However, they did notice that given the overall older adult IT literacy, they can foresee some training might be necessary. Furthermore, as noted during the testing, if online support could be offered that would be a very high selling point for the application. Participants also noted that in their opinion those that would find the application most useful are going to be older adults with memory or mobility issues.

Country	Group (Primary, Secondary, Tertiary, Expert)	Gender	Age	IT literacy	Area of residence
Cyprus	Primary	F	82	Medium	Semi-rural
Cyprus	Primary	M	86	Low	Rural
Cyprus	Primary	M	87	Medium	Urban
Cyprus	Primary	F	79	Low	Urban
Cyprus	Primary	M	89	No	Semi-rural
Cyprus	Secondary	F	56	Medium	Semi-rural
Cyprus	Secondary	M	61	High	Semi-rural
Cyprus	Secondary	F	24	High	Semi-rural
Cyprus	Secondary	M	48	High	Semi-rural
Cyprus	Secondary	F	34	High	Urban
Cyprus	Secondary	F	45	High	Semi-rural
Cyprus	Secondary	F	63	Medium	Rural
Cyprus	Tertiary	M	42	High	Urban
Cyprus	Tertiary	M	35	Medium	Urban
Cyprus	Expert	M	38	High	Semi-rural

User Interface

With respect to the User Interface, participants' reception was very positive. Despite this, several suggestions were offered that could help improve user experience. A back button was recommended to be inserted when in camera mode and ensure that the device can switch smoothly between portrait and landscape versions. Both the colours and the contrast that raised some disagreements in stage 1 were found to be improved by users. One important feature that was strongly argued in favour of was the login credentials that ought to be stored on the device. Beyond this some security configuration features were recommended to be provided. For example, in the case of caregivers, they should be given access to lock or release certain services, such as restricting or limiting access of the Health service to only the caregiver thus preventing mistakes. Furthermore, the suggestion was made for the application, once installed on a device to allow the storing of other users' credentials. If so, then this

will have to be balanced with the request of locking specific services and providing access to these only by caregivers.

S1 Smart Health/ Nutrition service

The provision of this service was well received by participants. The emphasis was placed on both the services ability to remind users to take their medication as well as preventing them from taking the same pill twice. The provision of information for the purpose of the pills was also found as a positive feature. However, participants did note that it would be beneficial if the application would be able to recognise a broad spectrum of pillboxes as well as providing for the ability to receive phone notifications of pill intake as opposed to being limited to email alone. A further recommendation dealt with the adverse effects of pills as well as banned pills, suggesting that it would be good if the application could somehow stay informed on these issues. However, it should be noted that this request does fall beyond the scope of the intended application as it is not meant to be a medical device and adding this feature would risk blending the waters.

S2 Smart Navigation service

The Smart Navigation service was also found to be highly wanted by participants. Though participants confirmed the existence of similar services in the market they did stress out both its accuracy and the older-adult-friendly design. This being said the service could improve by making it more practical for those users that wish to add more than one destination on the path chosen. This is further so because once a large number of places is added the dropdown menu becomes less usable. To this the recommendation was put forth that voice commands be offered as alternatives to tabbing on a destination. Furthermore, the location of the buttons does somewhat still interfere with the overall experience, especially the camera. Once more, the need for voice commands as opposed to looking at the street to navigate was very much supported by the participants. The same was true with respect to driving, in that the application should be compatible with driving as well.

S3 Smart Home service

The Smart Home service was found to be very popular by participants. Though they recognised the existence of similar apps on the market, still the fact that this service is offered in a bundle of services was seen as a very positive feature, one that would be very helpful and increase the competitiveness of the product. The service was further recognised as more user friendly than most of the applications out there. The participants further recommended for the application to include as many similar services as possible pointing out that these will help maintain a competitive advantage over the rest of the applications. Furthermore, some of the participants were worried that this app might reduce the incentive to walk, which could be something very much needed for the user and as such suggested the service come with notices encouraging the user to walk and be physically active.

S4 Smart Safety service

The Smart safety service is crucial to the application and this much all participants agree. Though they thought of the device as highly developed and well thought out, a number of suggestions were put forth to help improve it further. This included deactivating the camera view when using this service and having the ability to customise the service by adding and removing control buttons for various safety devices. However, after setting up a safety device on the application, some participants recommended that user control should be limited so that the user, in case of older adults, would not

accidentally change the setting or even deactivate the application. Furthermore, participants would like to see a loud sound notification accompany the notification sent to the phone in case the device attached to the service is running low on battery or requires some sort of maintenance.

S5 Smart Communication service

This service was very much liked by participants. Participants were especially impressed by the meet others function as well as the big tiles with photos of contacts which made it much more user friendly with respect to the specific age group. However, most participants agreed that the fisheye lens was redundant and not very easy to use and predicted users would eventually lose or damage it. Furthermore, they recommended that the meet others and talk with trusted contacts should be separate as functions to not confuse the user into mixing trusted and untrusted connections in the sense of people they know and people they don't know. Thus, the user would be able to deactivate the "meet with strangers" option and keep the connection with a trusted contact function. To this at the very least disclaimers warning of the dangers should be added to the service. Another recommendation relevant to this was that the caregiver should be given a notification if the user attempts to use the function to meet a stranger.

5.3.3. Results from Norway

In Norway a total of 10 people participated in the study. This involved 5 primary users, 3 secondary users and 2 tertiary uses. The sample was richly diverse and included a proportionate number of potential users at all levels, which enabled the reception of a well-rounded picture with respect to the application. Participants were of a diverse demographic background and varied level of ICT literacy which enabled the testing of the application at different levels.

The main focus of participants in Norway were using the application when not home. As such this would imply a lowering of costs. For example, the user could turn the light on and off when away on holidays giving the impression that someone is home without having to leave the lights on for the duration of the holidays. The services that participants did consider to be most useful, though not by much, were the Smart Safety and Smart Navigation service. Beyond this, participants did enjoy the interface of the application with a few exceptions and provided suggestions for improvement while considering that the overall application is most suited to the intended age group. Beyond this, participants did note that based on lifestyle choices the degree to which the services will be used may differ with some of them not being used at all. As such participants did find that it would be very beneficial if a service could be deleted by the user at will. Furthermore it would be good if the user could configure the language used in the application as well as the types and recurrence of notifications they will receive.

Demographic data for participants testing the High Fidelity Mock Ups in Norway (10 total)

Country	Group (Primary, Secondary, Tertiary, Expert)	Gender	Age	IT literacy	Area of residence

Norway	Primary	F	61	Medium	Urban
Norway	Primary	M	69	High	Urban
Norway	Primary	F	68	Medium	Urban
Norway	Primary	F	72	High	Urban
Norway	Primary	M	72	High	Urban
Norway	Secondary	M	50	High	Urban
Norway	Secondary	*F*	47	High	Urban
Norway	Secondary	F	49	Medium	Urban
Norway	Tertiary	M	69	High	Urban
Norway	Tertiary	F	65	High	Urban

User Interface

As to the User Interface, participants thought it to be well suited to their needs. Nevertheless, participants did provide a number of points where this could improve even more. Among the suggestions made was for the background and colours to change from black with green to white with green as this would provide better contrast. Some of the icons were a bit darker than the others (Smart Home) or in a different style with participants noting this as slightly confusing and the same holds true with respect to the use of the red colour for icons which might lead them to believe that one should pay special attention to this. Moreover, participants suggested that not all services should be available from the beginning but that participants should be able to choose which services should appear or at least allow the user to configure this at their discretion. Participants did also note that they would prefer the application to be available in their local language as well.

S1 Smart Health/ Nutrition service

The Participants were very happy with the Smart Health service. Most of these believed the pillbox to be a very important aspect of the application and were happy to suggest ways of improving it. For example, participants would like to receive information relative to the risks of the pills they are taking and would like to see the planner expand into other areas such as noting and informing about doctor appointments and exams they need to take. As to the first, meaning the risks related to pills it should be noted that this falls outside of the scope of the current service which is meant to act more as a planner than anything else. Participants did also recommend combining the application with electronic dispensers for more accuracy. Alternative and on the other extreme some participants thought it would be useful if the user would confirm the whole arranged pill intake for the day as opposed to every individual pill. Perhaps this can be offered as an alternative configuration for the application.

S2 Smart Navigation service

The Smart Navigation service was well received by the participants. They noted that the application would be most useful for those who have memory issues as well as those that travel to unknown places for the first time. Beyond this, participants did point out some risks, such as the potential to be distracted by the screen and offered a number of insights on how the service could be improved. Among these were that the system could provide a return to origin function where the person's home would always show on the map and the application could guide them back there or that audio notifications could be used to help the user not be distracted on the screen.

S3 Smart Home service

The Smart Home service was among the most important for participants. Here they noted that the application if used and expanded correctly to include more services and the ability to be operable when not home would become quite indispensable to them. Furthermore, participants did consider that the application could save time for its users and provide them with ease of mind. Being able to use the application to turn off and on the light is considered useful and overall easy to perform through the app whether using the menu or the camera. However, a number of participants do suggest that the menu function alone is enough, and the camera might be a bit confusing to some. Beyond this, participants did recommend being able to pre-programme the lights so as to turn off and on at specific times and did note the danger that someone might lean out of the bed too much when pointing the application towards a device and end up hurting themselves. Moreover, participants would like to see the application be compatible with different brands of smart devices.

S4 Smart Safety service

The smart safety service was also rated among the most important services for the application. Participants were very happy with the functions offered within this service but would have liked to see even more functions included in it such as smart locks and oven checkers. Participants would also like to have this service made available to them even when not inside the house and to be made compatible with different manufacturers of smart devices such as the ones already employed. Participants would also like to see that the service offer more types of notifications such as when the devices meant to be controlled by it need their batteries changed or general maintenance. Beyond this it would be useful to include audio warnings within the application and inform or not allow a user to set extreme values such as adjusting for very high temperatures or moisture levels. Furthermore, participants recommended notification be sent not only to the primary user but also the secondary so as to ensure that when a problem was detected this was further communicated to their caregiver.

S5 Smart Communication service

The Smart Communication service was received with mixed feelings by the participants. Though participants are satisfied with the communication between family members or trusted contacts, this is indeed the main reason that most participants would use the service and where happy with the age-appropriate appearance of the service, they remain sceptical of the "meet strangers" function. As such they would like to see the two separated or at least be given the ability to lock the meet strangers option of the service. Beyond this, participants recommended adding a call log with a history and duration of activity with other users.

5.3.4. Results from Poland

In Poland a total of 22 people participated in the study. This involved 17 primary users, 3 secondary users and tertiary user as well as an expert. The background of the participants was richly mixed and included diverse elements such as age and IT skills. This was most helpful and desirable as the sample became broader and more representative of the application target audience. Furthermore, the inclusion of an expert and tertiary users in the sample helped the team to derive conclusions closer to the industry and market standard than they would have absent these.

The main issues around which the discussion revolved were those of accessibility and design for all. For example, participants recommended that the colours of the user interface could be inverted per user choice so as to make them more accessible to people with visual impairments. Of all the services available through the application, participants selected the Smart Home Service and the Smart Safety service to be the most interesting to them. Beyond this, participants did note that the application might require, for a large number of people, to be accompanied by some sort of training as are for example workshops and YouTube videos to accommodate the cases where the older person is not very much accustomed to smart devices and similar applications. They did consider however that the application will be very useful as an additional tool among those that do use or are fond of such tools. Furthermore, participants did notice that audio notifications would be one of the most valuable additions that could be made to the application itself. On the issues of privacy and security participants did note that they would like to have the option to be able to select what content would be visible and accessible to others such as is the case with wireless access to sensors and photos to strangers.

Demographic data for participants testing the High-Fidelity Mock Ups in Poland (22 total)

Country	Group (Primary, Secondary, Tertiary, Expert)	Gender	Age	IT literacy	Area of residence
Poland	Primary	F	86	Low	Urban
Poland	Primary	F	67	Low	Urban
Poland	Primary	F	67	Low	Rural
Poland	Primary	M	80	Medium	Rural
Poland	Primary	M	71	Medium	Rural
Poland	Primary	F	79	High	Rural
Poland	Primary	F	90	High	Rural
Poland	Primary	F	87	Medium	Rural
Poland	Primary	F	79	Medium	Rural

Poland	Primary	F	68	Medium	Rural
Poland	Primary	F	70	Medium	Rural
Poland	Primary	M	64	Low	Rural
Poland	Primary	F	88	Low	Rural
Poland	Primary	F	68	Medium	Rural
Poland	Primary	F	68	Medium	Rural
Poland	Primary	M	60	Low	Urban
Poland	Primary	M	69	High	Rural
Poland	Secondary	F	67	Low	Rural
Poland	Secondary	M	52	High	Urban
Poland	Secondary	M	35	High	Urban
Poland	Tertiary	F	40	High	Urban
Poland	Tertiary	M	44	High	Urban

User Interface

With respect to the User Interface, participants thought it to be overall good but also that it could be improved. Among the suggestions made were that the fonts could be bigger and more contrasting colours be used. Some of the icons were reported as darker than others, as with the home icon while some were a bit confusing as with the navigation icon. Beyond this, participants suggested having the ability to invert colours so as to take into consideration those users with visual impairments and the same could be likewise beneficial with regards to making the icons bigger or smaller at the user's command.

S1 Smart Health/ Nutrition service

The participants were most happy with the Health service. They were very happy with the functioning of the pillbox and were very eager to provide feedback to help improve it more. They thought that beyond older adults, the pillbox service would be most useful to caregivers to keep better track of the person in their care with respect to medication. Among the recommendations participants provided were the inclusion of an audio alert notifying the user when it is time to take the pill. Furthermore, the application should also notify the user when a pillbox has been detected.

S2 Smart Navigation service

Participants were also happy with the smart navigation service. They thought of this as a very useful service that can help the user reach their destination. However, participants did note a number of problems they would like to see resolved. Among these, the most important ones included the fact that it could be dangerous to look at the device while walking and that perhaps it would be best if this function were added audio instructions guiding the user to their destination. Moreover, when the service is used in areas with lots of sunlight the screen may become unreadable while there is also a need to be able to include more destinations than the ones appearing on the list by typing them in.

S3 Smart Home service

The Smart Home service was rated as overall very good by the participants. Being able to use the application to turn off and on the light is considered useful and overall easy to perform through the app whether using the menu or the camera. However, a number of participants do suggest that the menu function alone is enough and the camera might be a bit confusing to some. Beyond this, participants did recommend to be able to preprogramme the lights so as to turn off and on at specific times and did note the danger that when pointing the application towards a device someone might lean out of the bed too much and end up hurting themselves.

S4 Smart Safety service

The smart safety service was rated among the most important services for the application. Beyond the obvious risks the service helps reduce it and also provides an ease of mind for the participants. Among the recommendations made by participants, one of the most often met one is with respect to making the service available even outside of the home. This would entail the user being able to access the service and check that everything is fine even when not at home. Beyond this, participants did in fact point out the need for ensuring that the system works independently of the application to prevent misuse. Also, participants suggested for the application to inform the user when the safety system is malfunctioning. Other than this, participants recommend that the application should be able to inform the user on how to check and maintain the system and sensors.

S5 Smart Communication service

The Smart Communication service is among the most controversial ones for participants. This is so as though many find it useful and would be willing to try it, others are fearful about some of its functions. These concerns regard both the “meet others” function, which count entail a number of risks as participants reported but also of the wide-angle lens that though does enable for example caregivers to have a better look at the surroundings of the person in their care it does further allow for concerns of privacy especially when the older person does not wish for their home to be too visible.

5.3.5. Results from Austria

From Austria, 11 people participated in this second stage. This included 5 primary users, 3 secondary and 3 tertiary users. These came from a varied demographic background and experience while the inclusion of the tertiary users enabled the researchers to receive more market-based feedback.

The discussion included several points but centred mostly around the inclusion of further functions. For example, participants would like to add a tracking feature in the Smart Navigations service and the addition of more sensors in the Smart Safety service. The two most important services for participants were the Smart Navigation and Smart Communication service. Though not to great extent, participants did recommend that the inclusion of a local language option would benefit the application and to a larger extent so would the provision of relevant training. Having a backup function in case of accidental deletion of relevant data would also be desired by some of the participants and so would the provision of direct online assistance and troubleshooting with respect to the application. Participants also suggested data security as one of their most important considerations.

Demographic data for participants testing the High Fidelity Mock Ups in Austria (11 total)

Country	Group (Primary, Secondary, Tertiary, Expert)	Gender	Age	IT literacy	Area of residence
Austria	Primary	M	94	Medium	Rural
Austria	Primary	F	66	Low	Rural
Austria	Primary	F	83	Low	Rural
Austria	Primary	M	75	Medium	Rural
Austria	Primary	M	77	Medium	Rural
Austria	Secondary	M	53	High	Rural
Austria	Secondary	F	50	High	Rural
Austria	Secondary	F	35	Medium	Rural
Austria	Tertiary	M	54	Medium	Rural
Austria	Tertiary	M	60	Medium	Rural
Austria	Tertiary	M	38	High	Urban

User Interface

As to the user interface, participants provided many useful comments. Though most considered the colours chosen to meet their demands and present no problem to them, some suggested that perhaps

they should be changed at the user's request to accommodate people with colour blindness. Beyond this a small number of participants recommended using or making available the local language as some had and perhaps others will have some difficulty navigating the application in English.

S1 Smart Health/ Nutrition service

The Smart Health service was critically reviewed by participants. As such and within the context of helping improve the service participants did note that it would be useful for the service to include notifications on when the pills within the pillbox run out or come close to running out. Participants were also worried whether their existing pillbox could be identified by the application or whether they would need to purchase another pillbox. Beyond these participants requested that the pillbox should also provide information on the specific pills contained and wondered who would be responsible for restocking the box and marking down when a pill was taken.

S2 Smart Navigation service

The Smart Navigation service was very much welcomed by participants. Overall, they considered this as very easy to use and appreciated the big arrows pointing to the destination as very age appropriate. Beyond this, participants did provide a number of interesting points that could help improve the application, such as including a point of interest function whereby a user could mark down a specific location that interests them for the future to make it easier to navigate there. Other than this, participants would like to see a help me I am lost function whereby the user could send their location on the map to another person, such as their caregiver to help them understand where they are or come and pick them up. Beyond this, participants believed a tracking feature could be useful to them.

S3 Smart Home service

The Smart home service was agreed as important by the participants. The service was thought to be especially useful for people with mobility issues but did raise questions on the ease of installing the smart lights and the cost associated with it. Beyond this, participants to some small extent believed that the service would benefit more if the function would be performed solely through the application as opposed to also having the camera option available.

S4 Smart Safety service

The Smart Safety service was also considered as a valuable addition by participants. This is so as it can provide them with an extra layer of security and peace of mind. As to ways to improve the service, participants focused on two issues. These involved the ability for the service to work with the already installed sensors and to allow more and different types of sensors to be installed as for example an oven sensor.

S5 Smart Communication service

The Smart Communication service holds much promise for participants. A number of them have already claimed to be interested in using it and found the meet others function to be very intriguing to them. Beyond this, the participants appreciated the large fonts used for the various icons of the application which makes it much more age friendly as compared to other similar services available on

the market. However, participants did claim a relevant hesitation with respect to using the wide-angle lens of the application and pointed to the need for their relatives to also have the service installed.

5.4 Ethics

The second stage of the testing remained true to the same ethical principles observed in stage one. The end result of all testing remains to deliver a "product that is trusted, responds to life goals and health needs of older adults and is adopted by the market at scale" (AAL, 2013) and this guides all actions.

The inclusion and exclusion criteria were preannounced and made known to applicants. Beyond this the same criteria were applied uniformly to all applicants that wished to participate in this stage 2 of testing, fully respecting the principles of justice and equality of access. If any applicant was not selected for the trials, this was politely and respectfully communicated to them in a way that was understood by the applicant.

During the second stage, open-ended questions were used, targeted, to help guide the focus group. Only essential demographic data were collected minimizing data collection to the absolute necessary. The questions themselves, beyond demographics, were phased in an open and empowering manner ensuring that the participants felt as comfortable as possible in answering them. For example, when inquiring about how the users felt with respect to the application's interface, this was phrased as "Imagine that you had many colourful markers and an eraser on your hands and you could correct the interface of the app. How would you do it?" enabling users to answer it even though they may not have possessed, nor needed to, any technical skills.

The same approach was utilised with respect to the other questions. For example, when inquiring about the usefulness of the smart home service, the question was phrased as "Imagine that you are using this service every day to control your lamp or other devices. How would that be helpful for you? What is the most important benefit you identify?". This type of phrasing of the issues, enabled participants to fully express their opinion to the extent that they wished, discussing with other participants while receiving a minimum amount of intervention from the researchers that were for the most part noting down the responses and key points of the discussion. The project goals and the purpose of this stage 2 of testing were explained to participants and informed consent forms were signed and collected. All participants found the experience enjoyable and confirmed that they would be interested to participate in similar groups with respect to other future initiatives.

As such this second stage of testing fully embraced the open ethical dialogue concept. All major stakeholders, primary, secondary and tertiary users were represented in the analogy expected by the targeted groups of users, once the product enters the market, meaning those we believe will make most use out of the solution. To this healthy mixture of stakeholders, experts were added that were able to guide the discussion to even greater depths. Naturally, the experts were advised and showed the same level of professional ethics as the researchers, refraining from any sort of unethical behaviour such as drowning out voices, taking over the discussion or insisting too highly on their views.

In general, the following principles were observed:

- ✓ Context: Following predefined standards in research
- ✓ Experts: Utilising expert advice
- ✓ Learning: AAL Guidelines & Course

✓ Users: Learn from the users.

This allowed interesting points and the deeper concerns of the participants to emerge freely. The researchers coordinating the focus group, as mentioned only intervened seldomly and as needed to bring the discussion back on track and help participants clarify their views.

Participants raised a number of concerns and provided interesting points. Some of the concerns raised by participants involved issues such as negative potential side effects and misuse of the application. For example, a participant was worried that some of the functions of the app, such as the pillbox, might not be appropriate for primary users to function themselves, due to for example severe cognitive decline, that leaves the person more prone to mistakes. As such it might be best if the secondary user, for example a caregiver, could operate it instead. Others were worried about potential negative side-effects from the application, as for example the convenience provided by the app which might lead its primary users to move around less where this might not be warranted. Beyond this, participants were worried about the types of data that would be collected and inquired about the need to register online. Furthermore, participants expressed their concern with regards to the "meet others" function of the communication service. To be fully accessible by all, participants did note that despite the user friendliness and age appropriateness of the application that there is still the need for basic training to be provided as a number of intended primary users might be less familiar with this type of application.

All these questions touch upon important ethical issues. These involve such concepts as safety and decency (meet others), equal access (training), potential for misuse as well as safety (pillbox) and more. All of these issues, as well as other similar points raised, are developed in section 5.3 with respect to the consortium as whole and each partner individually, have been taken under consideration by the GUIDed consortium and Ethics committee. They are to be resolved, as in stage one, with specific strategies: a) implementing both an in-system training feature and a live training programme offered by clinicians, b) enabling many configuration options for each user, c) adding detailed in-app disclaimers about specific services and d) allowing users to choose the level of information-sharing they wish to engage with through the GUIDed application.

In specific, the ethical dialogue findings centres on six main themes to which specific considerations are been made, that of 1) Customization-Respecting Preferences, 2) Accountability-Right to information, 3) Accessibility and Justice, 4) Anonymity-Consent, 5) Fidelity/tolerance, 6) Right to be forgotten and Safety.

With respect to **Customization-Respecting Preferences**, we are examining options to:

- Include ability to deactivate the Meet People function
- Add notification sounds and volume
- Choose which notifications we need or not (checklist)
- Add more sensors for services
- Lock some services
- Add navigation for driving as well as
- Automatically switch on the lamp at a certain time
- Enable different language/date/time/font
- Choose if UI or AR mode appear first or deactivate one of them
- Include 2-3 variations for icons where the user can choose from.

With respect to **Accountability-Right to information**, we are examining options to:

- Add a help line
- Add data privacy policy
- Add disclaimers on risks
- Send SMS to notify caregivers for pill taking, etc.
- Add a FAQ
- Add Terms and Conditions
- Add up to date info about pills
- Emphasize the fact that no data is shared with 3rd parties.

With respect to **Accessibility-Justice**, we are examining options to:

- Provide training
- Add places as tiles on Navigation
- Add ability to voice the place on Navigation
- Make it work on both a tablet and phone
- Add a clear ''BACK'' button.

With respect to **Anonymity-Consent**, we are examining options to:

- Option to show only first name to Meet New People
- Ability to turn/off camera and microphone in communication
- Ability to hide identity-photo.

With respect to **Fidelity/tolerance**, we are examining options to:

- Double-opt for important actions
- Add a help line
- Add disclaimers on risks
- Low battery signal sound
- Don't be able to switch off important sensors
- Save login info
- Warn about abnormal choices (e.g., temperature at 16 degrees).

With respect to the **Right to the Right to be forgotten and Safety**, we are examining options to:

- Add a full-deletion button
- Add voice guidance on Navigation to avoid falling
- Add recommendations to move more to counterbalance for Home Control (might reduce mobility).

5.5 Change of services' names

After the feedback received, the consortium decided to rename the services for the benefit of the users. The Smart Health/ Nutrition service has been renamed as the Medication planner service, the Navigation service remained the same, the Smart Home changed into Home control service, the Smart Safety renamed to Home Sensors service and the Communication service remained also the same. These changes were necessary so as to better convey the functioning thereof. These will not affect the referencing of them in the stage 2 results which kept the same names and the new names were used from Stage 3 on.

7 References

[1] AAL website. (2019). Toolbox. Methods of end users integration. Accessed on 20th of October 2020: http://www.aal-europe.eu//wp-content/uploads/2015/02/AALA_ToolboxA5_online.pdf

[2] AAL (2013). The Art and Joy of User Integration in AAL Projects. Ambient Assisted Living Association. Accessed on 21st of October 2020:

http://www.aal-europe.eu/wp-content/uploads/2015/02/AALA_Guideline_YOUSE_online.pdf

[3] Morgan, David L. (1996). "Focus Groups". Annual Review of Sociology. 22: 129–152.

[4] Chen, Senlin. (2012). Chapter 16: Interviews and focus groups.

Annexes

Annex 1: Demographics

[Instructions for researchers] Please collect the following demographic information from the participants

Country	Type	Gender	Age	IT-literacy *	Area of residence *
Austria					
Cyprus					
Norway					
Poland					

**IT literacy: 1-no, 2-little, 3-good, 4-great, 5-outstanding*

**Area of residence: rural, semi-rural, urban.*

**1. The IT literacy levels used are the following:*

1. No (I don't use internet or devices like smart phone, computer)
2. Little (I use some devices like smart phone, computer, tablet and internet)
3. Good (I use a lot of devices like smart phones, computer, tablet, internet and apps)
4. Great (I use devices like smart phones, computer, tablet, internet and apps all the time)
5. Outstanding (I perfectly use devices like smart phones, computer, tablet, internet and apps and I am capable of resolving any technical issues that might arise).

Annex 2: Informed consent

Full title of project: GUIDed - Assisted-Living and Social Interaction Platform

This document provides all the necessary information that you need to know in a simple and understandable way should you decide to participate in the GUIDed project.

What is the GUIDed project?

GUIDed is a European Union funded project which aspires to help and improve the lifestyle and well-being of older adults at home for as long as possible by facilitating important activities of daily living through IT solutions.

GUIDed aims to develop services in five different areas of daily activities. Although the project is still in early stages, indicative examples of the features that will be available in the system are:

1. Smart nutrition and health service (S1): Reminders and information about taking medication.

2. Smart home control service (S2): Turn lights on and off without getting up.

3. Smart city navigation service (S3): Get helpful instructions to navigate through the city

4. Smart home safety service (S4): When certain changes are detected (e.g., smoke/temperature changes) a relative will be notified

5. Smart social communication service (S5): Communicate with loved ones and see them in "real time".

What will GUIDed look like for users?

Participants will be able to test the GUIDed features on their existing tablet or smartphone. If no device is available, one will be provided in the test phase. The operation of the system will be simple and intuitive and will include an augmented reality guide but also explained by us. If you have any questions or are unsure about something, you will receive immediate support by your local team of researchers.

Why do we need people to test our system?

Since the GUIDed team is still working on the implementation of the above solutions, we need people who agree to test our solutions and give us their valuable feedback. As this is still the initial phase of the GUIDed project, your participation regards your feedback on the potential services (in pictures) that will be incorporated in the GUIDed system. With your help, we can determine how well GUIDed can be used in everyday life and what could be improved. Therefore, we kindly ask you to test our product and to express your wishes and concerns as well as possible. Your feedback will be anonymous and will be utilised in our reports in order to enhance and improve the GUIDed system.

Participation in the project

Your participation in the GUIDed project is voluntary and free of charge. You will not have any economic or material benefit by participating in the GUIDed project. You can cancel your participation at any time without giving a reason and without any consequences. If you would like to end your participation, please let us know by fax, email or telephone. For this, your name and your wish to end participation are sufficient.

Details of any potential danger or discomfort

No direct or indirect danger or discomfort is expected during your participation in the GUIDed project. There will be no change on any medical prescriptions or medical instructions given by your doctor.

Details regarding the data collected, access of information and duration of access

No personal information will be used for the purposes of this research and all your data will be anonymous. Any personal data you provide (name, phone, age etc) will only be known to the researchers of your country who participate in the study and will not be made known to any third party. During your participation in the GUIDed project a four-digit identification number will be assigned to you in order to guarantee your anonymity.

All data are locked and safely stored in dedicated spaces where access is only permitted to the local researchers. All stored data are being stored for up to 5 years after the end of the research and then safely destroyed.

Project coordinator: xxxxx

User Research Manager of the project: xxxxxxx

Duration of the project: 30 months

The GUIDed project is funded by the European Union - Active Assisted Living Programme - Ageing Well in the Digital World.

1. Have you participated in any other research in the last 12 months?

☐Yes ☐No

2. Have you read and understood the information provided regarding the project and your participation in it?

☐Yes ☐No

3. Did you have the chance to discuss any arising questions related to the project?

☐Yes ☐No

4. Were you satisfied with the answers provided (if any) to your questions?

☐Yes ☐No

5. Are you aware that you have the right to withdraw from the project at any point and without providing any justification for your decision?

☐Yes ☐No

6. Are you aware that there will be no consequences for you should you decide to withdraw?

☐Yes ☐No

7. Who was the researcher you spoke to?

Additional information

Full contact details of the person to whom participants can file a complaint related to the GUIDed project.

[Please insert your organisation's details]

Full contact details of the person to whom participants can refer to for any further information and/or any clarifications regarding the project.

[Please insert your organisation's details]

8. Full name:

9. Date:

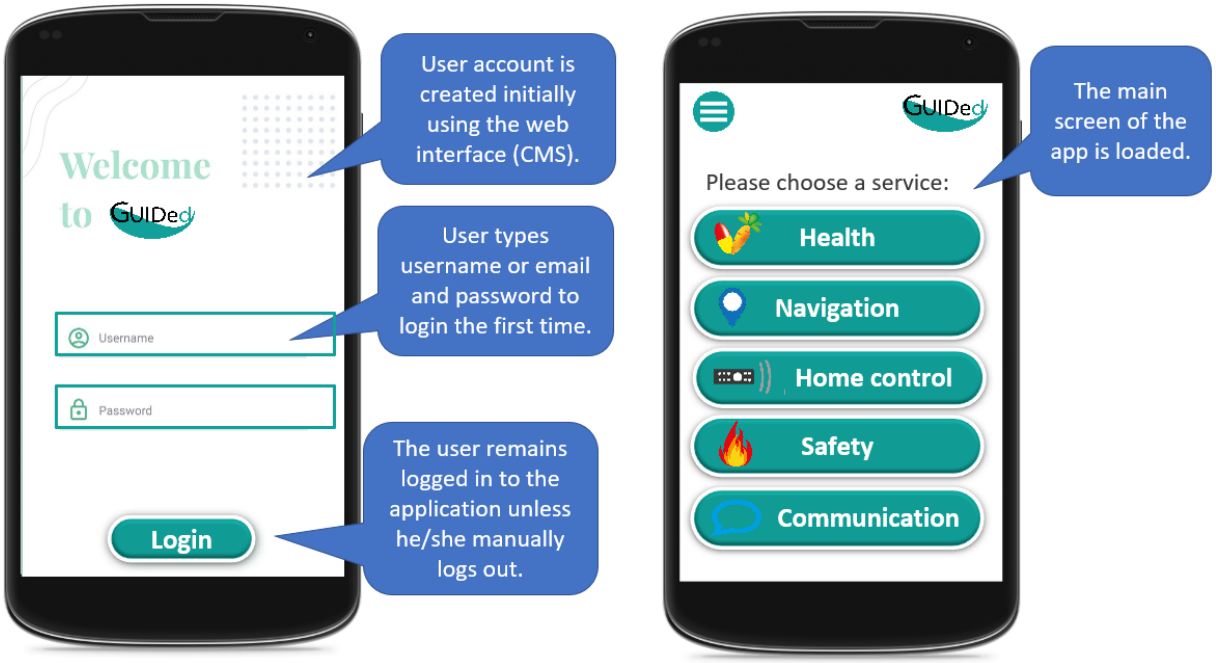
10. Do you agree to voluntarily participate to the GUIDed project;

☐Yes, I agree ☐No, I do not agree

Annex 3: Stage 1- Paper Prototype User Interface & Questionnaires

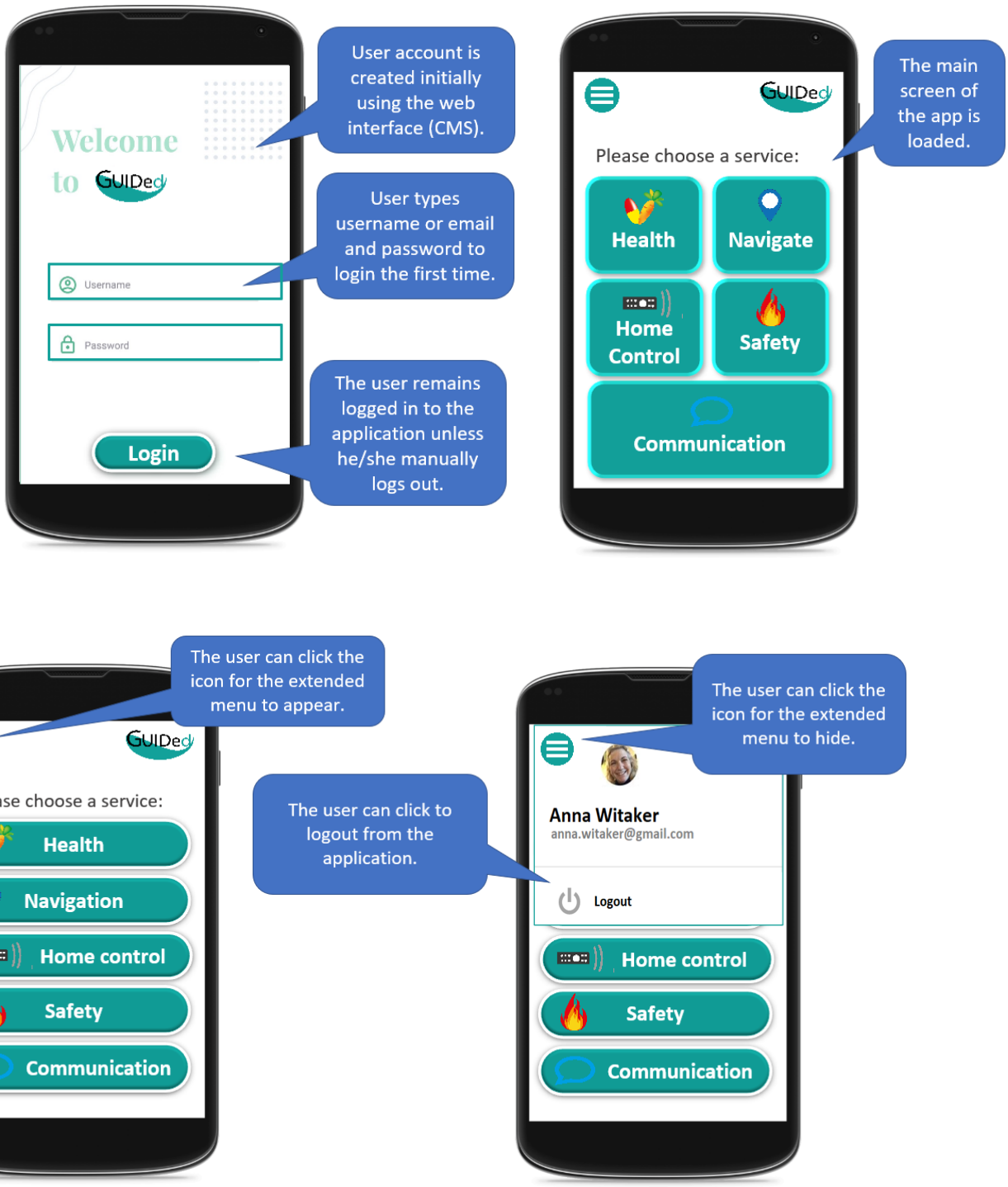
GUIDed Main UI
Two proposals

Main UI – Button Design (1)



OR

Main UI – Tiles Design (2)



Questions on the UI options

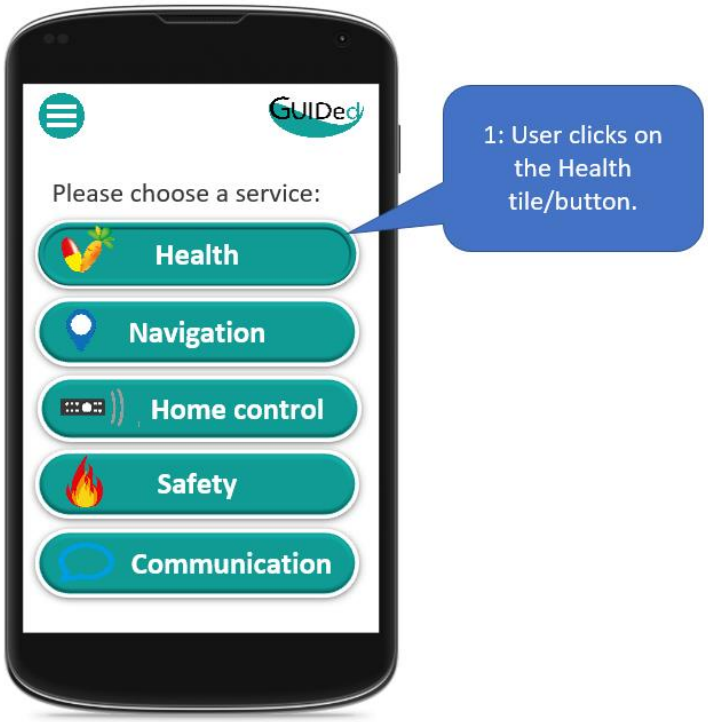
1. Which of the two UIs do you prefer and why?
2. What do you think about the screen brightness?
3. What do you think about the screen colours?

4. What do you think about the font and buttons size?
5. Do you understand what the icons/buttons mean and their functions?

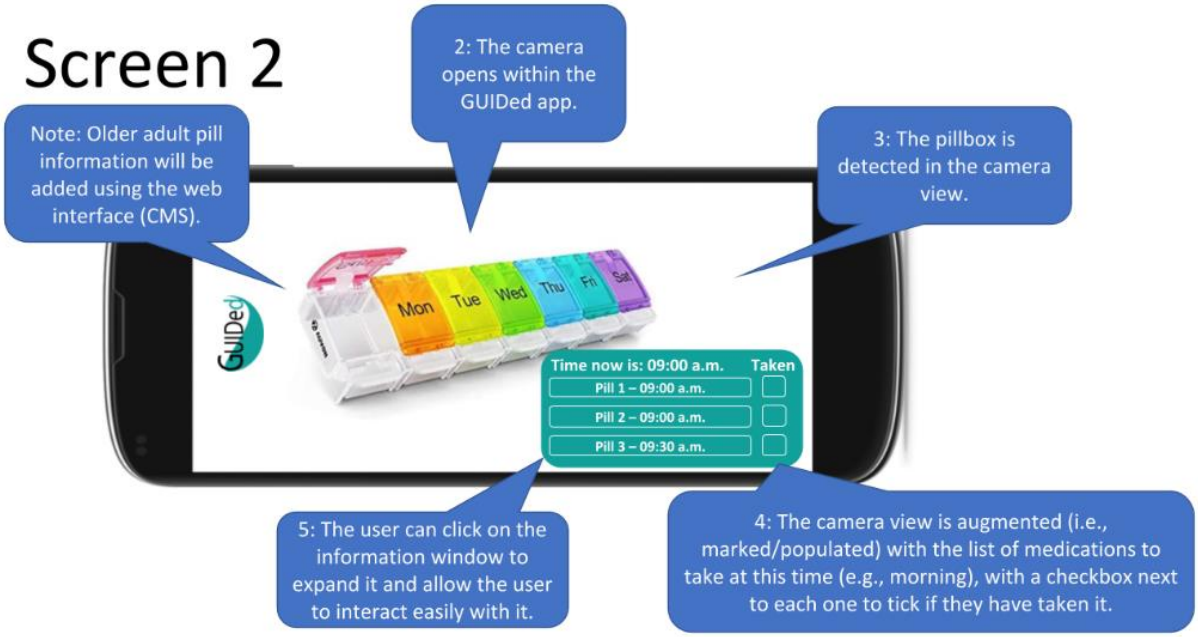
Researchers' notes

Smart Health/Nutrition Service

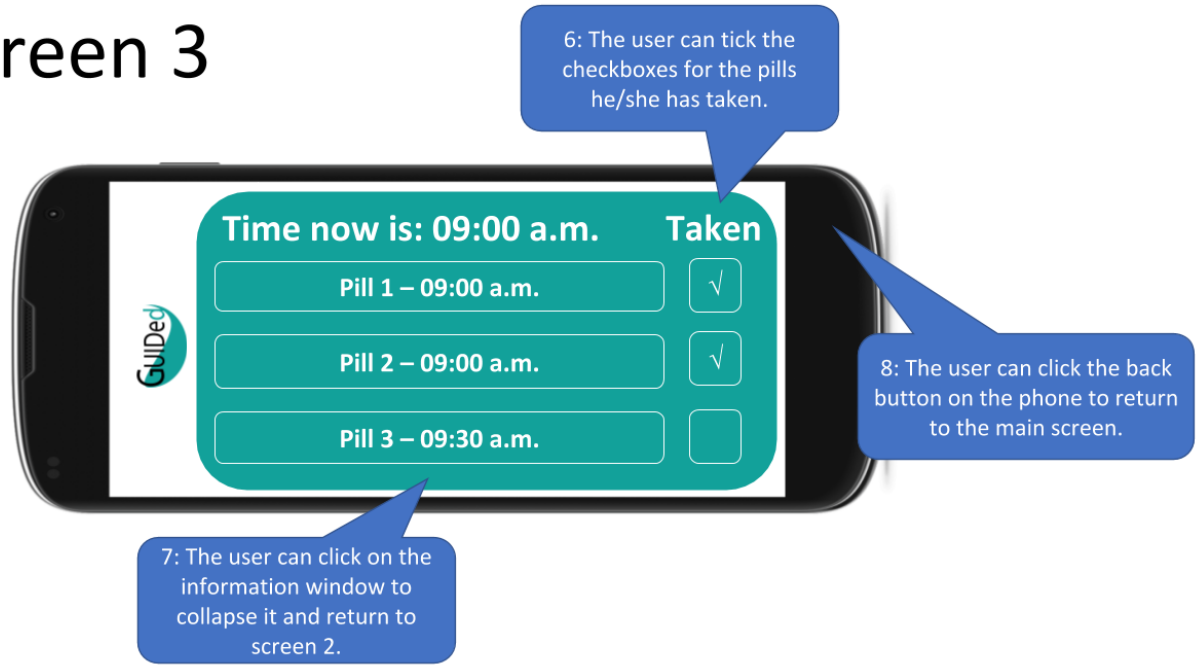
Screen 1



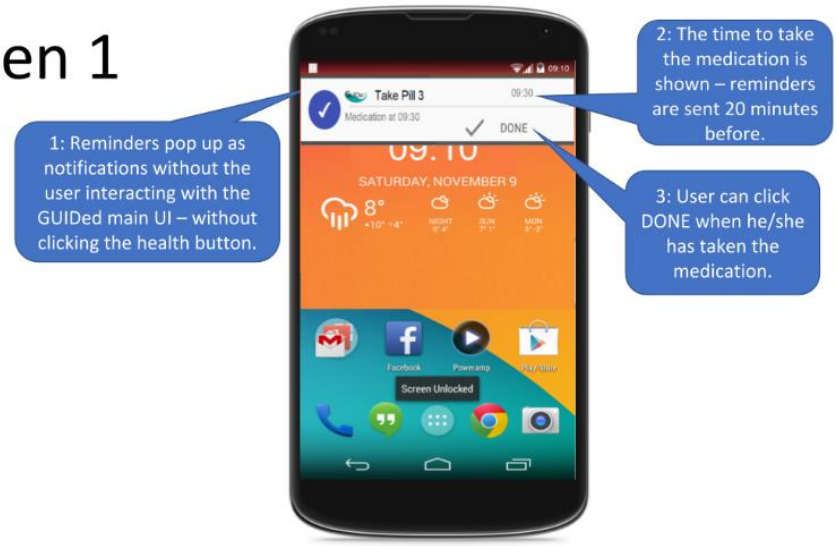
Screen 2



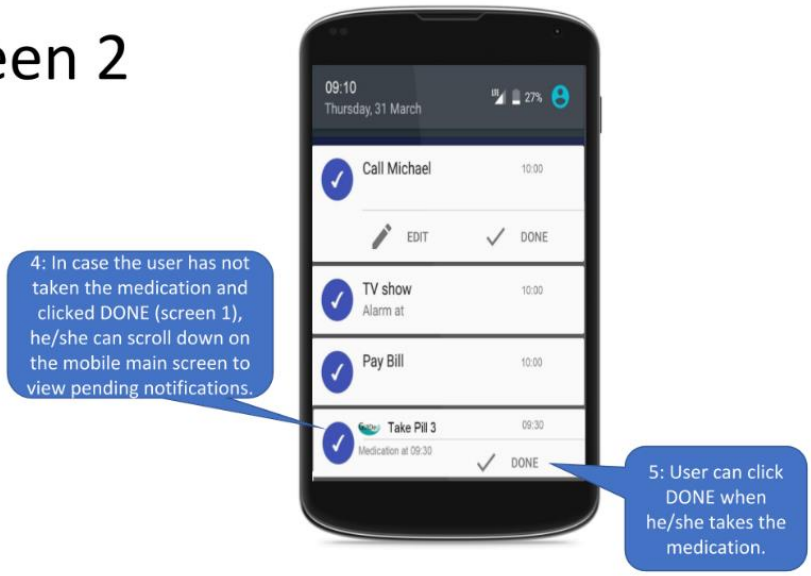
Screen 3



Screen 1



Screen 2



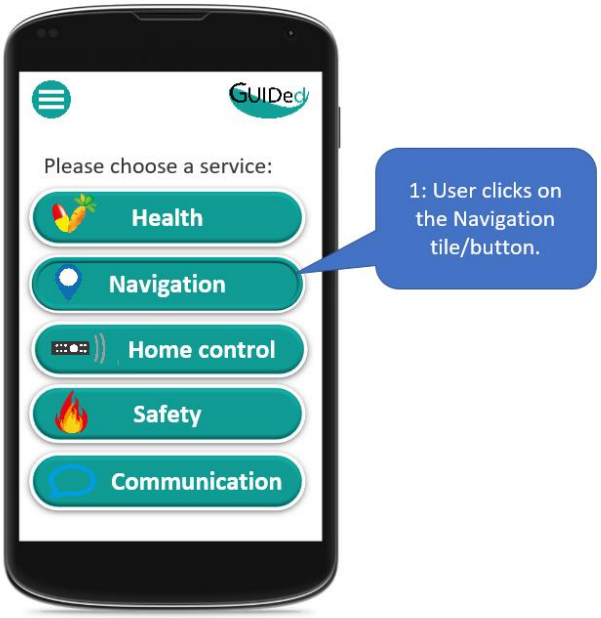
Questions on the Smart Health/ Nutrition service

1. Do you understand what the service does?
2. What features are missing? (if any)
3. Does anything seem out of place or unnecessary? Would you add or remove anything?
4. What do you think might be difficult when using this service? (if anything)
5. What do you think will be easy when using this service? (if anything)
6. Any comments?

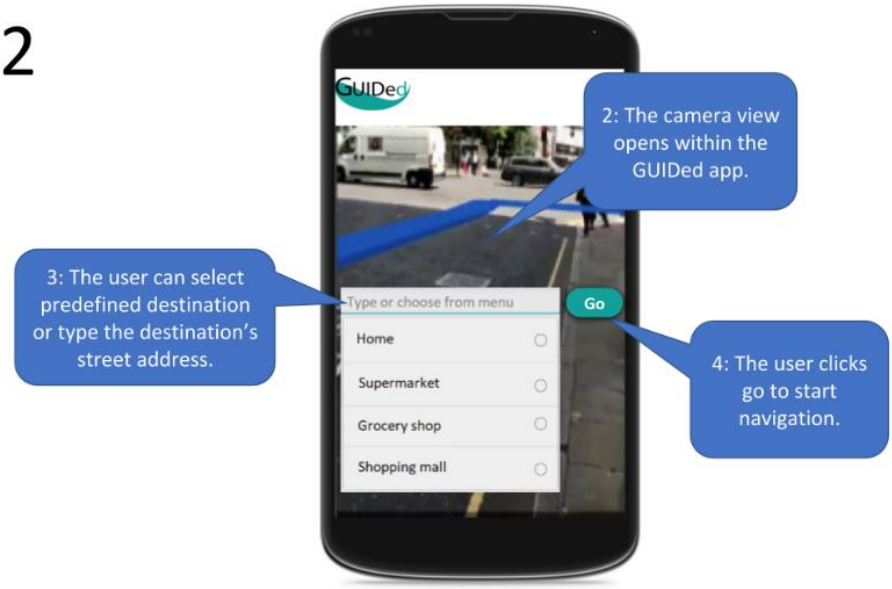
Researchers' notes:

Smart Navigation Service

Screen 1



Screen 2



Screen 3

Questions on the Smart Navigation service

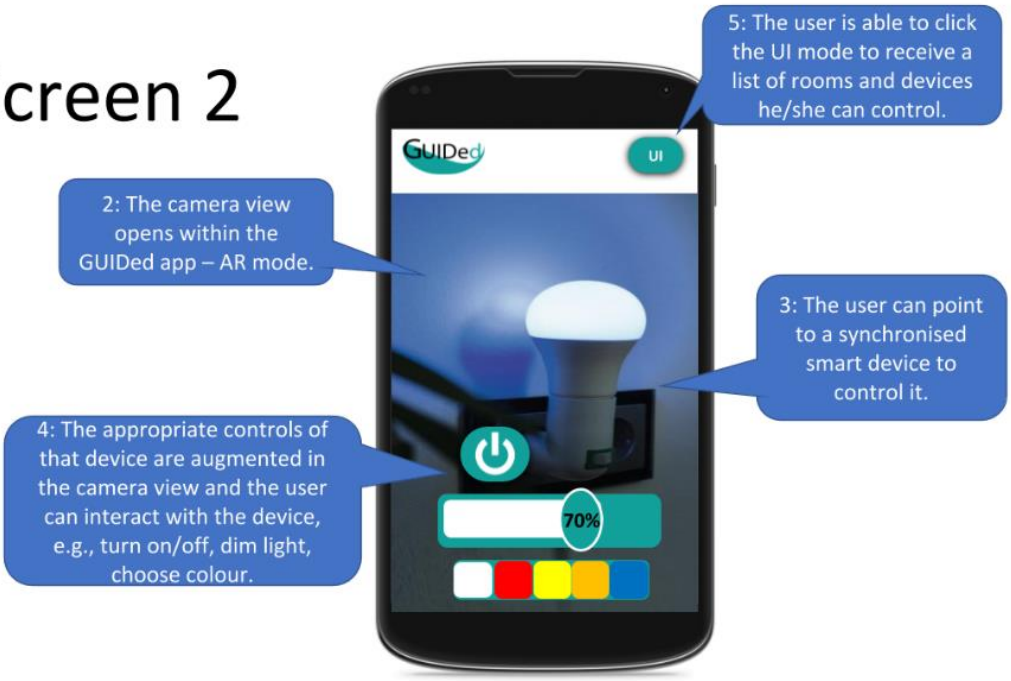
1. Do you understand what the service does?
2. What features are missing? (if any)
3. Does anything seem out of place or unnecessary? Would you add or remove anything?
4. What do you think might be difficult when using this service? (if anything)
5. What do you think will be easy when using this service? (if anything)
6. Any comments?

Researchers' notes:

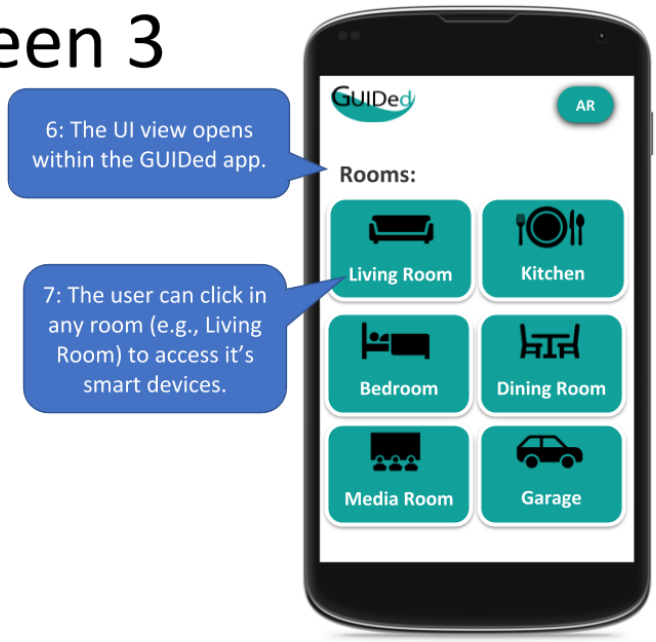
Smart Home Service

Screen 1

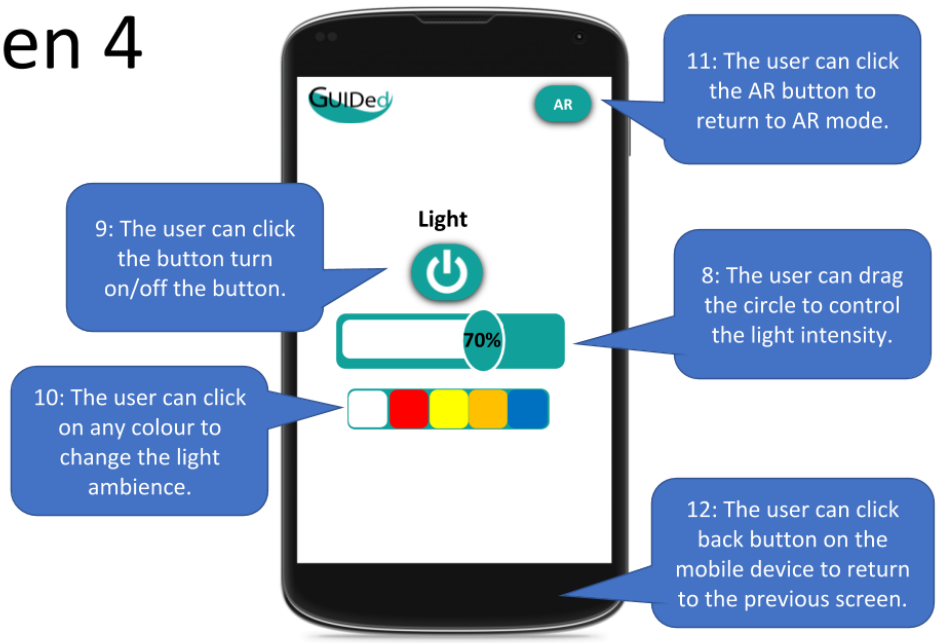
Screen 2



Screen 3



Screen 4



Questions on the Smart Home service

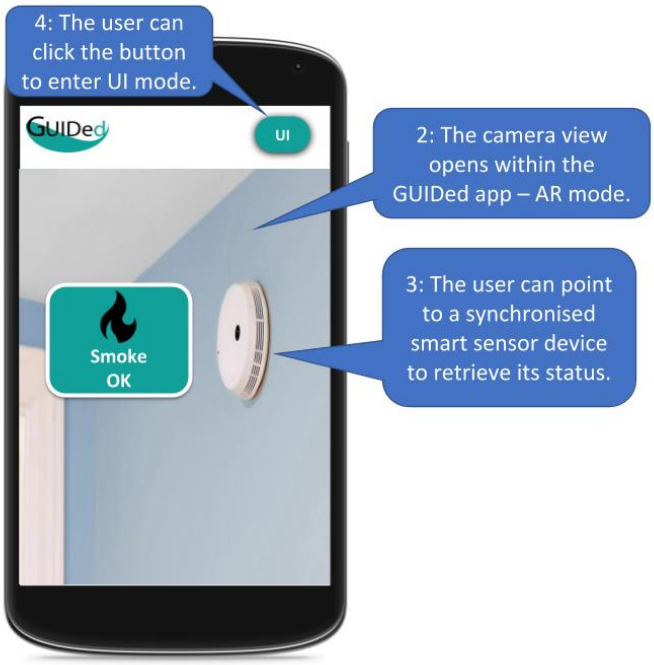
1. Do you understand what the service does?
2. What features are missing? (if any)
3. Does anything seem out of place or unnecessary? Would you add or remove anything?
4. What do you think might be difficult when using this service? (if anything)
5. What do you think will be easy when using this service? (if anything)
6. Any comments?

Researchers' notes:

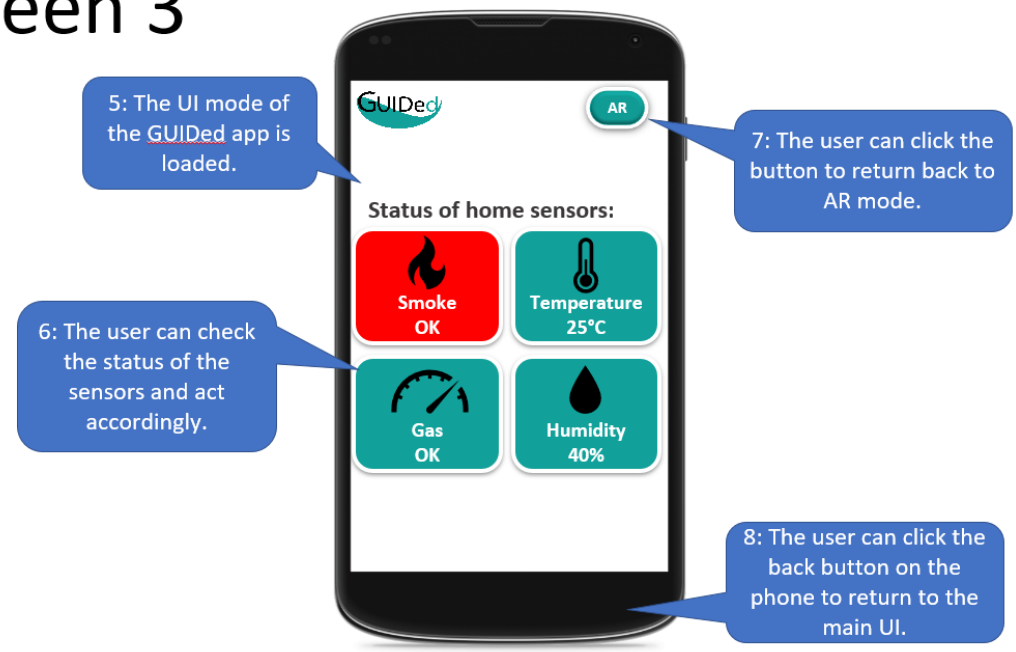
Smart Safety Service

Screen 1

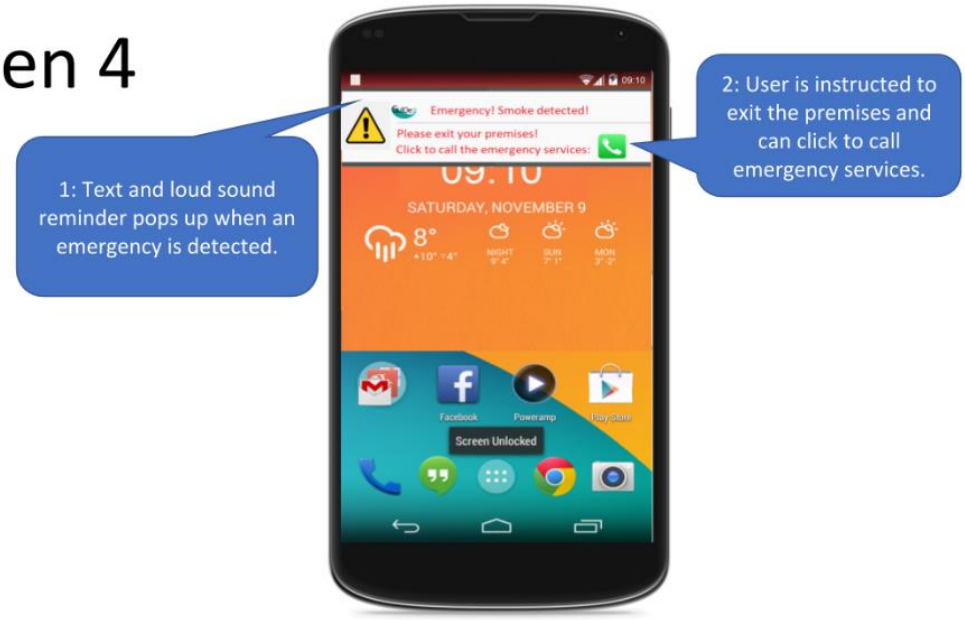
Screen 2



Screen 3



Screen 4



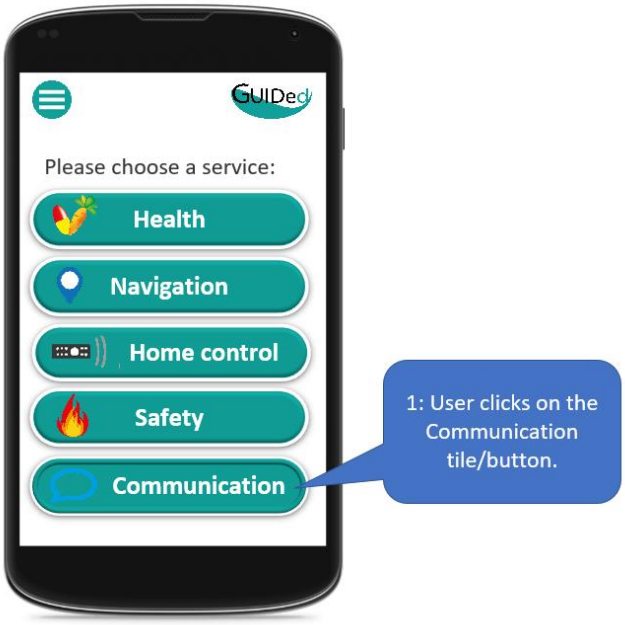
Questions on the Smart safety service

1. Do you understand what the service does?
2. What features are missing? (if any)
3. Does anything seem out of place or unnecessary? Would you add or remove anything?
4. What do you think might be difficult when using this service? (if anything)
5. What do you think will be easy when using this service? (if anything)
6. Any comments?

Researchers' notes:

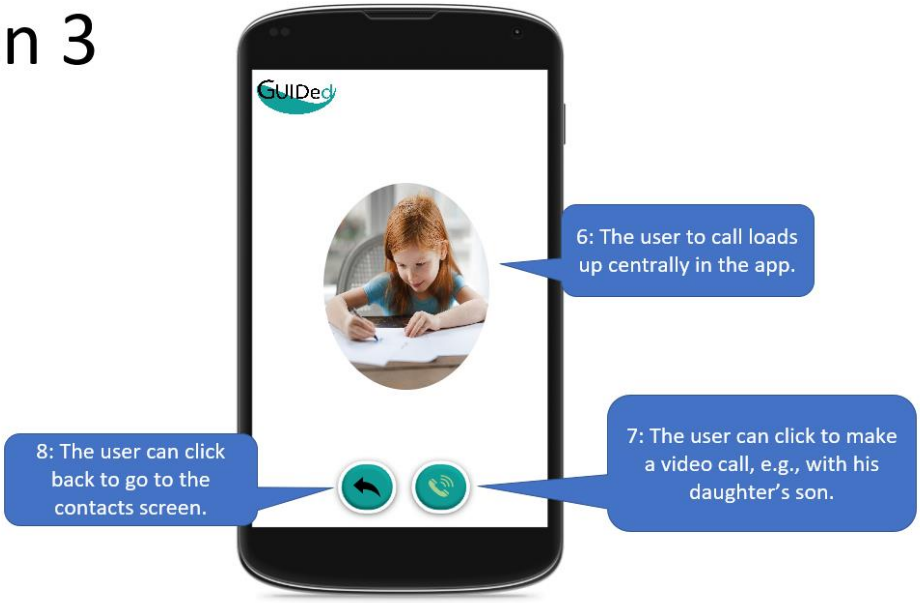
Smart Communication Service

Screen 1

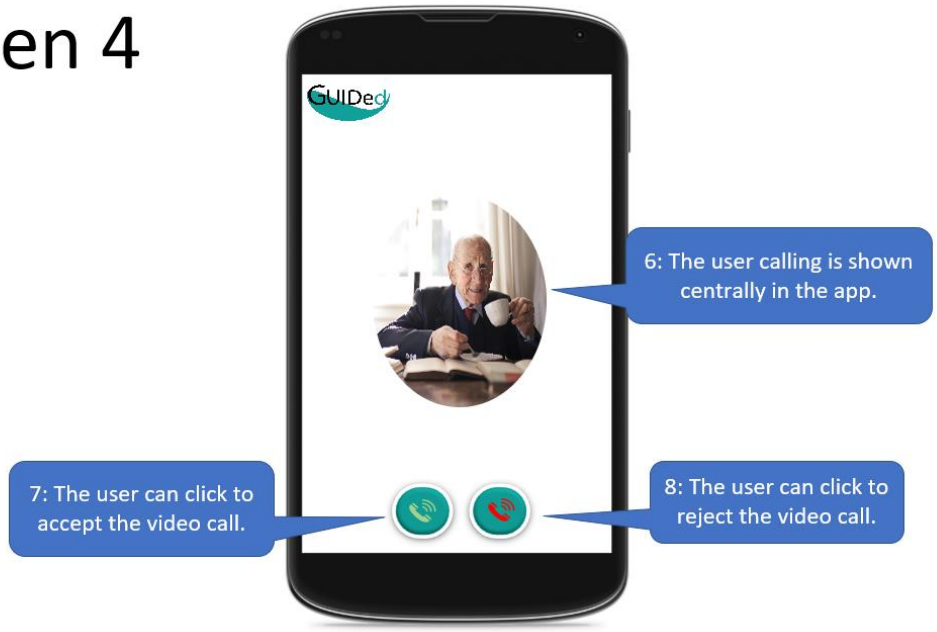


Screen 2

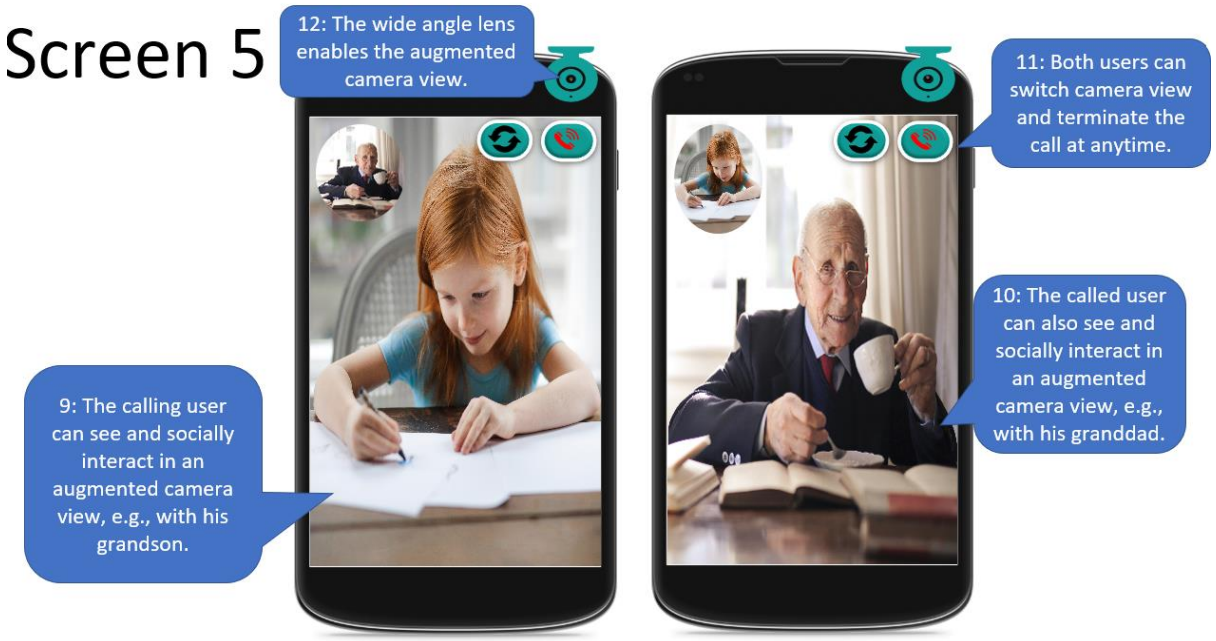
Screen 3



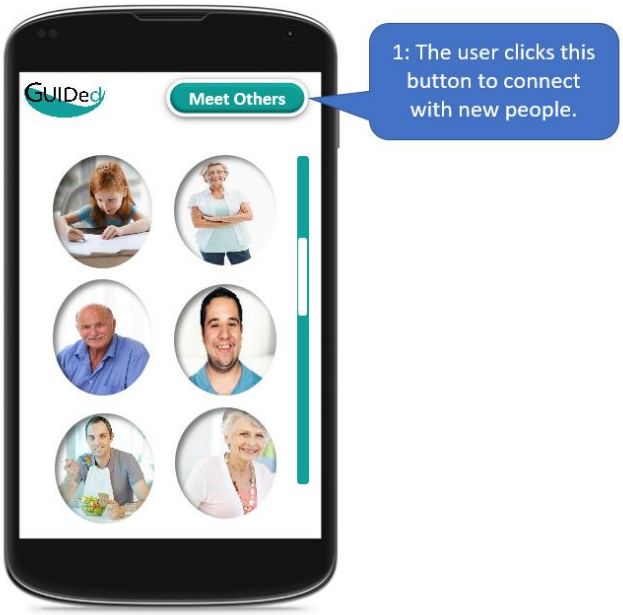
Screen 4



Screen 5

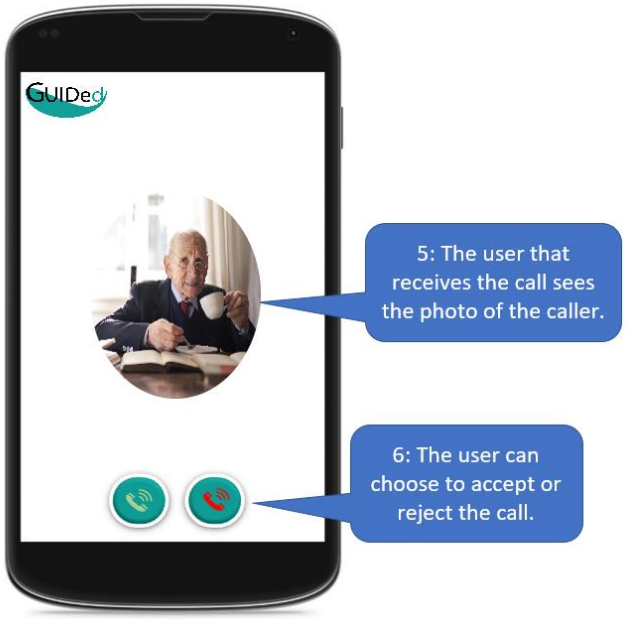


Screen 1

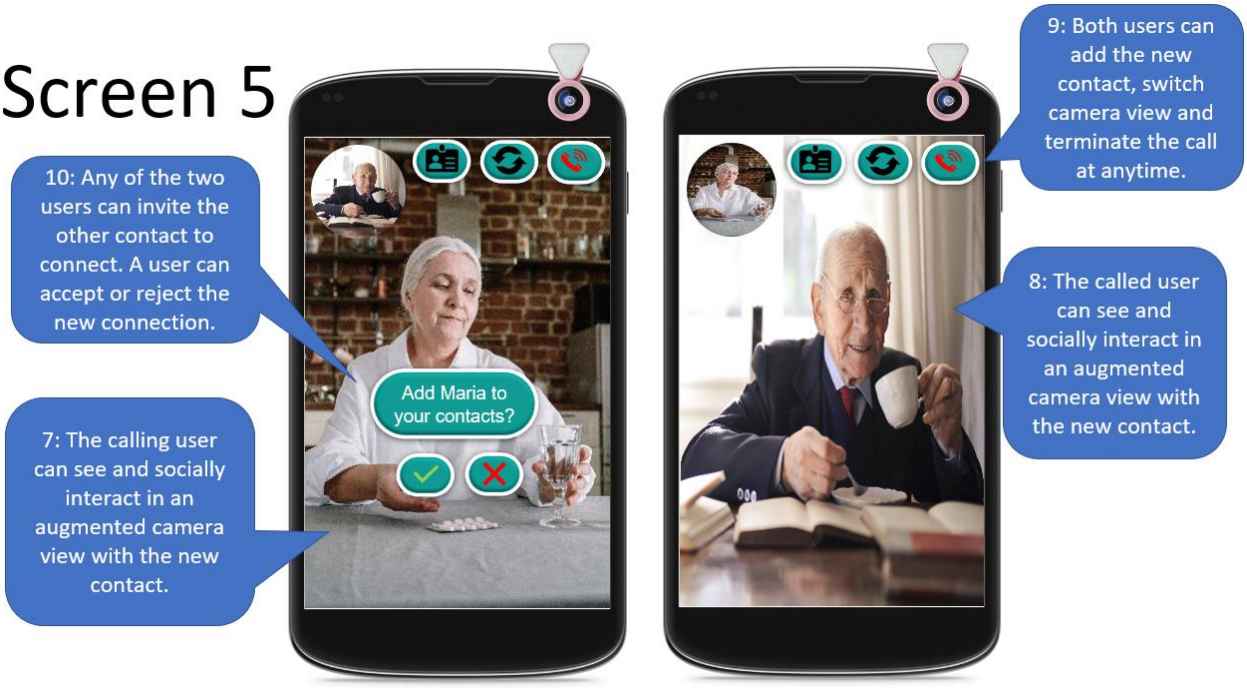


Screen 2

Screen 3



Screen 5



Questions on the Smart Communication service

1. Do you understand what the service does?
2. Do you think this service should be configurable on the mobile application or on the web interface?
3. What features are missing? (if any)
4. Does anything seem out of place or unnecessary? Would you add or remove anything?
5. What do you think might be difficult when using this service? (if anything)
6. What do you think will be easy when using this service? (if anything)

7. Any comments?

Researchers' notes:

General questions:

Visualisation:

1. Overall, what do you think about the navigation? (easy or difficult to navigate?)
2. Overall, how easily do you think users will be able to use the services?
3. Is the layout clear to understand (user-friendly)?
4. As we were explaining the services and their functionalities, did you become confused at any point?
5. Does the information architecture and navigation make sense? (Can users find what they're looking for?
6. How would you describe this product using your own words?
7. What would you change?
8. Is there anything else you would like to talk about?

Researchers' notes:

The End

Credits to: https://www.pexels.com/ for the people's photos.

Annex 4 Stage 2 User Recommendations

Country Sample	Area of Recommendation	Recommendation	Comments	Importance
CY	Functionality	Include voice control for all services		Low
CY	Functionality	Enable the storing of user credential		Very High
CY	Functionality	Enable the storing of more than one user credential	This could be a primary and a secondary user with different access rights	Very High
PL	Functionality	Include audio notifications	The request here is that all services should provide audio notifications accompanied visual notifications	Very High
CY, NO	Interface	Ability to lock OR choose certain Services and not others		High
CY	Interface	Ability to lock sub-module to Meet People in current prototype (and generally have the option to deactivate modules e.g., nutrition module in the future)		High
CY	Interface	Simplified user deletion process (e.g., via a button?)		Utmost
CY	Interface	The position of the buttons interferes with the camera view	Consider changing the Camera view	Medium
PL, AT	Interface	Invert colours at users choice to accommodate visual impairment		Medium
PL	Interface	Enlarge fonts		Medium
PL, NO	Interface	Change to more contrasting colours		Medium
PL	Interface	Some Icons are darker than others		Medium
PL	Interface	Enable a custom interface where users can select fonts and colours		Medium
AT, NO	Interface	Include option for display in local language		High

NO	Interface	Icon of home Smart Home uses different design style than other icons		High
NO	Interface	Consider enabling user to select the types of notifications they receive		High
CY, NO	Moral and Legal	Disclaimers to be placed within the app		High
CY, NO	Moral and Legal	FAQ to be created		High
CY	Moral and Legal	Privacy policy to be included in the Application		Utmost
CY	Moral and Legal	Terms and Conditions to be included in the application		Utmost
CY	Moral and Legal	Consent box in the application to Privacy notice		Utmost
PL	Moral and Legal	Enable users to choose what they share with other users	The request is general though it does seem to relate more to the Smart Communication service of the application (e.g., pic, name, etc)	High
All	Moral and Legal	Make all legal documents available in local language		Very High
AT	Smart Communication	Question: Communication service. Do relatives need to download special software to communicate with the Guided user? Will they need to pay for it?	This would involve additional costs	High
CY	Smart Communication	Separate the talk to trusted contacts form the meet others function		Medium
PL	Smart Communication	Include relevant warning about using the meet others function		High
PL	Smart Communication	Ability to blur background		Medium

NO	Smart Communication	Include a log detailing calls and duration		Medium
NO	Smart Communication	Enable user to arrange contacts and choose which one will appear on their favourites list		Medium
CY	Smart Home	Consider including other similar functions within the service such as tv control		High
CY	Smart Home	Incorporating general recommendations e.g., drinking more water, exercising, etc		High
PL	Smart Home	Ability to deactivate the camera		Low
PL	Smart Home	Enable a preprogramme function of the lights whereby light will turn on and off at specific hours		Medium
PL	Smart Home	Include safety notification pop-ups, e.g. danger of falling down when stretching to activate the lamp		High
CY, AT	Smart Health	Enable the identification of various pillboxes	Perhaps the application will be compatible with five or six of the most popular pillboxes types	Low
CY, NO	Smart Health	Enable the identification of pills side-effects		Outside of scope not a medical device
CY	Smart Health	Allow service to remain updated with respect to the banning of pills		Outside of scope not a medical device
PL	Health	Make necessary adjustments to enable caregivers to check on the pill consumption		High
PL	Smart Health	Include audio alert when it is time to take a specific pill		Very High
PL	Smart Health	Include audio alert when a pillbox has been detected		Medium
AT, NO	Smart Health	Include notification when pills are about to run out		High
AT	Smart Health	Reminder when pillbox empty for restocking		Low
NO	Smart Health	Application should check that pill was actually taken	Perhaps by adding a scale on the pillbox though this may be out of budget	Low
NO	Smart Health	Consider replacing pillbox with electronic dispenser	The application could work supplementary to this	Low

NO	Smart Health	Include notification for more than pills as for example blood tests	In essence if beyond the pillbox we can have a planner for tests and appointments	Medium
CY, PL, NO	Smart Navigation	Include voice commands to user		High
CY	Smart Navigation	Enable for driving		Low
CY, PL	Smart Navigation	Allow users to add and remove more than one destinations along the route chosen		High
PL,NO	Smart Navigation	When device is used in areas with a lot of sunlight the screen becomes unreadable		High
PL	Smart Navigation	Enable type in search of location additional to drop down		Medium
AT	Smart Navigation	Include tracking feature	This is so that caregivers may know of the whereabouts of the person	High
AT, NO	Smart Navigation	Include a point of interest function (thumbtack)	Participant would like to note their location on the map so that they can return to that point again	High
AT	Smart Navigation	Include a help me I am lost function	Notification could be sent to caregiver	Very High
CY	Smart Safety	Consider including an option to deactivate the camera so as to avoid confusion		High
CY	Smart Safety	Consider locking this service to avoid unintentional deactivation		Very High
CY, NO	Smart Safety	Include a loud sound notification when the sensors detect something		Very High
CY	Smart Safety	Include a loud sound notification when the system and sensors is not functioning or needs attendance		Very High
CY	Smart Safety	Include SMS notifications and not only in application notices		Very High
PL, NO	Smart Safety	Make service available even when not home	Users wish to be able to control their sensors and receive notifications without being home	High

PL	Smart Safety	Ensure sensors operate independently of application and that application does not interfere with their functionality		High
PL	Smart Safety	Include instructional links on how users can maintain and customise the sensors		Outside of scope not a technical device
AT, NO	Smart Safety	Include more types of sensors	For example alarm for unauthorised entry	Medium
AT	Smart Safety	The camera mode adds little value		Low
AT	Smart Safety	The service should be compatible with many types of sensors		High
NO	Smart Safety	System should warn when extreme values are set	Moreover system should not allow extreme values such as very high temperatures or humidity detection levels to be set	Very High
NO	Smart Safety	Include water leakage detection feature		Low
CY, AT	Usability	Provide online support		Medium
CY	Usability	Provide Training videos	Reported as Necessary by all Country Samples	High
CY	Usability	Include a highly visible buck button on all services when using the services	Most of the country samples reported this as necessary	High
CY, PL, AT, NO	Usability	Provide genera training on using the services such as YouTube videos and workshops		High
AT	Usability	Include backup function for data and settings		Medium
AT, NO	Usability	Provide troubleshooting function		High
NO	Usability	Consider including instructions how to use the service first time that is activated	Alternatively we can have a tutorial for each service with the option never show tutorial again	High

Annex 5. Testing Phase 1: Stage 2 Demographic Questionnaire

OFFICE USE ONLY	
Participant ID:	

Gender: Please tick the box that applies to you.	
Male	
Female	
Other/would rather not say	

Area of residence: Please tick the box that applies to you.	
Rural	
Urban	
Semi Rural	
Semi Urban	

Country of residence. Please tick the box that applies to you.	
I currently live in Cyprus	
I currently live in Poland	
I currently live in Austria	
I currently live in Norway	

How old are you? Please tick the box that applies to you.	
18 to 25	
26 to 45	
46 to 59	
60 to 65	
65 and up	

What is your IT level? Please tick the box that applies to you.	
Low, I don't use or I use some devices like smart phone, computer, tablet and internet with a lot of difficulty.	
Medium, I use a lot of devices like smart phones, computer, tablet, internet and apps and I can perform a broad array of IT related functions with a low level of difficulty such as using social media	

High, I use devices like smart phones, computer, tablet, internet and apps and I am capable to resolve any technical issues that might arise	

Annex 6. Testing Phase 1: Stage 2 – High Fidelity - Questionnaire

The 'Imagine if…' method is a creative tool designed to elicit a spontaneous and authentic response by the participant. The questions are created to be answered by a primary user but can be adjusted in the case of a secondary user, a tertiary user or an expert. For example, 'Imagine that you are using this service every day to take your medication' can be rephrased to 'Imagine that your protégé (secondary) or customer (tertiary) or the older person (expert) is using this service every day to take their medication'.

Interface

1. Imagine that you had many colorful markers and an eraser on your hands and you could correct the interface of the app. How would you do it?

Smart Health Service

2. Imagine that you are using this service every day to take your medication. How would that be helpful for you? What is the most important benefit you identify?
3. Do you see any dangers?
4. How would you tackle those?

Smart Navigation Service

5. Imagine that you are using this service very frequently to find your route. How would that be helpful for you? What is the most important benefit you identify?
6. Do you see any dangers?
7. How would you tackle those?

Smart Home Control Service

8. Imagine that you are using this service every day to control your lamp or other devices. How would that be helpful for you? What is the most important benefit you identify?
9. Do you see any dangers?
10. How would you tackle those?

Smart Safety Service

11. Imagine that you are using this service every day to check the conditions in your home environment (detection of smoke, CO2 levels, temperature). How would that be helpful for you? What is the most important benefit you identify?

12. Do you see any dangers?
13. How would you tackle those?

Smart Communication Service

14. Imagine that you are using this service every day to talk with your friends and family or meet new people. How would that be helpful for you? What is the most important benefit you identify?
15. Do you see any risks/ dangers?
16. How would you tackle those?

Ethics

17. Imagine that you can keep only 2 services out of the 5. Which would these be and why?
18. Imagine 5 very different older people you know. Could all of them obtain and use the GUIDed app? If no, why?
19. Imagine that you want to give the GUIDed app as a gift to one person you know in order to make them more autonomous and independent in their everyday life. How would the app change their life?
20. Imagine that the application allowed you to fully customize it to your preferences. What customization options would you include?
21. Imagine that GUIDed was one of the apps that you trusted completely:
    1. What would be included in the app (e.g., disclaimers, data protection policy, etc.)?
    2. What would we need to have in place as a company to be trustworthy?
    3. What other actions should we take for you (e.g., training seminars, etc.)?

22. What issues do you feel need to be addressed in terms of a GUIDed user's:

    1. Privacy
    2. Safety
    3. Right to information on how the system works
    4. Control over their options
    5. Anything else related to the use of GUIDed that would affect them on a personal level?

23. How difficult do you find the app from 1-10?