Master in Management
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MyGuardian: A Pervasive Guardian Service For Elderly with Cognitive Impairment

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Abstract

The importance of assistance for elderly people suffering from dementia has been more and more recognized, and much research has been carried out to find a solution for the risk of confusion – people who suffer from this disease tend to get confused while outdoors and, as a consequence, they may get a lost.

How does geotaging service offer a reliable and sophisticated solution for these sufferers of dementia disease? It aims to facilitate safe and secure mobility of seniors with mild cognitive impairments, by enabling on-demands communication between the senior and the caregivers, remote monitoring of the senior state and, if required, remote assistance services. The provided services also enable coordination between voluntary caregivers (*e.g.*, family) and professional caregivers via a help desk assistance.

In this thesis, I research the various existing geolocation devices which help to enable geolocation of the elderly with dementia, their characteristics, their advantages and their disadvantages. Then, I propose the system design of our new service called "MyGuardian" informed by the opinions gathered via questionnaire conducted with professional caregivers and families. Finally, I summarize our findings and give some design implications for MyGuardian.

Acknowledgements

I would like to gratefully acknowledge the enthusiastic supervision of Dr. Katarzyna Wac who was a great inspiration while working on this project. I also would like to thank her for showing me some examples related to the topic of the project. Thanks to Prof. Giovanna Di Marzo for the technical discussions on the system design and Dr. Wanda Opprecht for the help with explanation for modeling and relevant discussions. I would like to thank the professional caregivers working in the care homes cited in the annex for providing me with their time and the conditions necessary to best complete the survey. Special thanks also to families who look after the Alzheimer sufferer for their help answering the survey.

I wish to express my love and gratitude to my beloved family; for their understanding and endless love, through the duration of my studies.

A big thank you to everyone who helped me near or far to make this work.

INTRODUCTION

1. Introduction

In recent years, the development of new Information and Communication Technologies (ICT) has contributed to the increase in speed of human evolution. ICT includes the techniques used in the processing and transmission of information, mainly computers, the Internet and telecommunications. In our daily life, technology is indispensable. ICT includes a set of resources to handle information and especially computer systems, programs and networks needed to convert, store, manage, transmit and retrieve data.

As part of my second year of a Master program in the department of Hautes Etudes Commerciales (HEC) at the University of Geneva, I have completed my dissertation research at the Institute of Services Science, Quality of Life Group (QoL) which is presented in this document.

This work was an opportunity for me to understand the need for the development of new location-based devices for elderly people with dementia called MyGuardian. The main objective is to make a state of the art with the system design, followed by the development of a questionnaire to allow gather opinions of its potential end-users.

Further the technical knowledge I have acquired, and the skills I have developed, this experience has really helped me understand the reality and sufferance of people with dementia and their entourages, by revealing aspects I had not encountered during my previous courses.

This thesis is structured as follows. In Section 1, I clarify the full description of both diseases: dementia and Alzheimer and the geolocation technologies. Then in Section 2, I give a presentation of the comparison between different existing devices followed by the proposed MyGuardian system design in Section 3. Section 4 provides details of user based survey and the analysis of the results acquired from interviews with professional caregivers and family followed by discussion of the tasks entrusted to me during this period. In the conclusion, I address the difficulties encountered, and the contributions to this work.

1.1.   Context

In recent years, the importance of assistance for elderly people suffering from dementia has been more and more recognised and research has been carried out to help find a solution for the risk of confusion, which brings a risk of getting lost to dementia suffers. For this reason, the QoL group, together with an international project consortium, decided to implement MyGuardian project which aims develop services to help seniors move around safely and securely, and thereby enable them to take part in the self-serve society.

The main goals to be achieved in this service are, enabling easy-to-use and rich communication between the mobile senior and the caregivers, then, enabling remote monitoring and assistance and, finally, enabling coordination between voluntary and professional caregivers. The Figure 1 shows an overview of how MyGuardian is intended to operate [1].
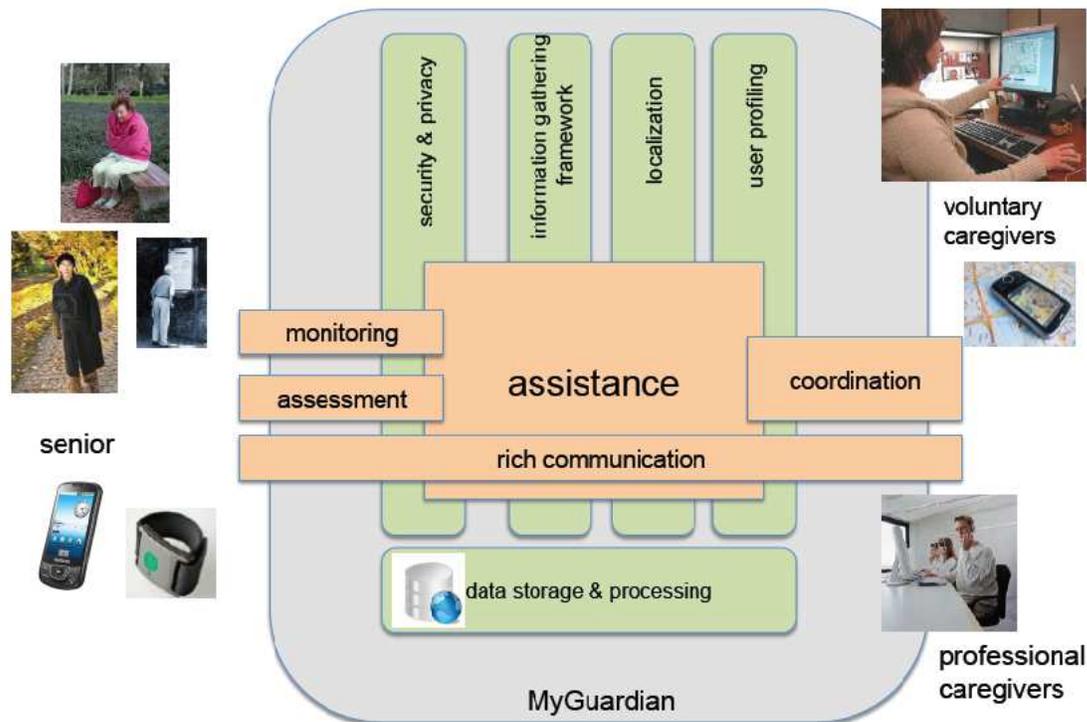
Figure 1: MyGuardian high level architecture

In the following sub-sections, I will give a full description of both dementia and Alzheimer's disease, I will start with a definition of each disease, followed by the causes, diagnoses, symptoms and I will end with the treatment of each disease.

1.2. Dementia

1.2.1. Definition

Dementia is a global impairment of memory and personality, but without an impairment of consciousness. It affects the intellectual and social behaviour making daily life difficult. Dementia is characterized by the reduction of mental abilities such as memory, confusion, memory loss, disorientation, language, and attention. Dementia can cause a state of disorientation and personality change. There is *presenil dementia* which is the term used for seniors below 65 years and *senile dementia* that is used for older persons. The main clinical feature is a general deterioration of intellect, but there are also changes in the mood and behavior of people.

According to "Psychomedia", Dementia is characterized by impairment of memory and other cognitive disturbances that are behind a significant impairment in functioning and represents a significant decline from the previous level of functioning [2].

There are different types of dementia: Alzheimer's disease, vascular dementia, dementia with *Lewy* bodies, *Creutzfeldt-Jacob* disease or *Parkinson*'s disease. These types of dementia are classifiable, but in most cases, it is that an assumption because it is clearly not possible to do a brain biopsy from a living person and be sure of the diagnosis [3].

1.2.2. The Causes

Among the causes of dementia, I have an advanced age and family history of dementia which are risk factors additionally to a) high blood pressure, b) a rise in blood cholesterol, c) diabetes, d) smoking, e) alcoholism, f) a brain injury, g) abuse of drugs, h) side effects of certain drugs, i) abnormalities of thyroid function, j) a lack of vitamin B12, k) complications of chronic hypertension or blood vessel disease, l) *Parkinson*'s disease, which usually begins with tremors and challenges with involuntary and voluntary movements. Dementia can occur when the disease is severe or very advanced.

1.2.3. The Symptoms

The symptoms of dementia are: a) progressive loss of memory and other mental capabilities, b) sudden crises, and without cause, laughter or tears, c) change in approach, d) an early loss of control of bowel or bladder, e) sudden loss of memory or other mental functions, f) symptoms of *stroke* (*eg*. paralysis), g) the same symptoms as Alzheimer's disease, h) problems with language, i) disorientation, j) changes in personality, k) slow thinking, l) difficulty with planning and organizing, m) weakness, n) falling down.

1.2.4. The Diagnosis

For the diagnosis, the practitioner uses several "neuropsychological tests". First, he deals with the history taking into account the senior's symptoms. It is essential also to interview other family members. Then, he asks for a physical and neurological examination, and possibly a psychiatric examination. In some cases he may ask for a brain scan to rule out a stroke or a brain tumor and psychometric tests to assess intellectual performance.

Among the tests used, is the Mini-Mental State Examination (MMS) or Folstein test. This test is performed when there is a suspected a dementia or to help monitor the disease progression. The 2nd test that can be done is the test of Lawton, this test evaluates the degree of partial autonomy. It was suggested by some professionals to help in the detection of dementia. This test consists of four phases: a) ability to use the phone (*e.g.*, normal use, for use of numbers known, totally impossible), b) means of transport (*e.g.*, travel alone, taxi, bus, unable to move), c) medication (*e.g.*, taken only at set times, unable to take them alone, the opportunity to take if they are prepared), d) money management (complete autonomy, can not manage alone) . The last test that can be done is the CODEX (Cognitive Disorders Examination). This test is quick,

lasting about three minutes and simple to perform. It is intended for general practitioners to detect dementia earlier [4].

1.2.5. The Treatment

Depending on the cause of dementia, there are various available treatments. To treat and help people with dementia, it is important to focus on all the activities that the person can still carry out. We must encourage them to continue daily activities and maintain as many social relations as possible. It should also help maintain a healthy life style through physical exercise, proper diet and an adequate fluid intake. Special diets and supplements are generally unnecessary. The goal of treatment is to control symptoms of dementia. In some cases hospitalization may be necessary for a short time [5].

1.3.   Alzheimer

1.3.1. Definition

Alzheimer's disease is a neurodegenerative disease that causes progressive and irreversible loss of mental functions including memory. It was first described by German physician *Alois Alzheimer* [6]. Alzheimer's disease is a progressive mental deterioration for which no cause or cure has been found. Alzheimer's disease is the most common form of dementia and affects about 5% of people aged over 65.
According to the "passport-santé", Alzheimer's disease is a degenerative disease which causes a progressive decline in cognition and memory. Gradually, a destruction of nerve cells occurs in brain regions associated with memory and language. Over time, the person has more and more difficulty in remembering the events, in recognizing objects and faces and in remembering the meaning of words and exercising its decision [6].

1.3.2. The Causes

According to several studies carried out by researchers, it has been revealed that up to now they still hardly know the causes behind Alzheimer's disease or how to stop its progression. But the researchers found out that Alzheimer is a disease that is not a part of the normal aging process; it affects both men and women and it is not due to stress. So, to determine the causes of the disease, researchers examine three areas: a) family history: in some families, there is a link between family history and Alzheimer's disease., while in other families, family history of Alzheimer's disease is at greater risk for family members to be suffering from Alzheimer's disease compared to someone without such family history; b) the environment: the explanation of Alzheimer's disease can be found in our environment: something that would be in the water, soil or air; c) our own bodies: Alzheimer's disease could be explained by an internal phenomenon. It could be a slow-acting virus, a chemical imbalance, or a weakened immune system.

Today, researchers believe that there is not a single factor that causes Alzheimer's disease but rather a combination of factors. There is still much to learn about the disease and researchers continue to try to discover the causes [7].

1.3.3. The Symptoms

The symptoms of Alzheimer's disease include a gradual disintegration of the personality, of judgment and of social skills, a gradual loss of memory of recent events, and inability to learn new things, an increased tendency to repeat, to lose objects and to show confusion.

1.3.4. The Diagnosis

For diagnosis, the doctor uses the results of several examinations. First, he asks the senior to learn more how his memory loss and other difficulties in the daily lives occur. Tests to assess cognitive abilities are made, as appropriate: vision tests, writing, memory, and problem solving.
In some cases, the doctor may also advise the senior to take an examination of brain imaging to observe the structure and activity of different areas of his brain. Imaging can demonstrate the loss of volume of certain brain areas, characteristic of the degeneration of neurons.

1.3.5. The Treatment

No treatment can effectively cure Alzheimer's disease today, or even stop its evolution. To reduce memory loss and symptoms which gradually worsen, the treatment of Alzheimer's disease is usually to use a range of drugs. Even though, the non-drug approach is an important dimension of care. Very different approaches are proposed as rehabilitation/cognitive stimulation that has a modest effect, the occupational therapy to stimulate the attention of seniors has some efficacy. Caregivers, by the way they behave, can control disoriented seniors. The education of caregivers, the notion of "basic security", is all elements that make the care giver a "treatment" in itself.

1.3.6. Evolution of the Disease

The development of Alzheimer's disease evolves over many years and its progression varies greatly from one person to another. There are different stages. The first one is the mild stage, where memory loss occurs occasionally. The short-term memory that is the ability to remember recent information is the most affected. The second stage is the moderate stage, where the memory problems are amplified. The sufferer experiences difficulty retaining new information, difficulty performing familiar tasks (using a key to close the doors, taking drugs, finding objects, *etc*), speech problems (difficulty finding words, speech less comprehensible, use of invented words or inappropriate), difficulty following a conversation. It is increasingly difficult for people to make choices. The last stage is the advanced stage. At this stage, the

senior loses his autonomy. He experiences difficulty recognizing people and the long-term memory is affected (loss of memories of childhood and adulthood). Monitoring or permanent accommodation in a care center is needed. Psychiatric problems may occur, sleep problems are common and seniors also neglect their personal hygiene [8] (see in Annex C the opinion of caregivers on how to define a stage of the disease).

1.3.7. Alzheimer's Disease Statistics

From [8], I learn that this disease occurs most frequently among the segments of the population getting older.

Table 1: Some Statistics of Alzheimer Disease

Statistics
880,000 people involved in France in 2011 where 30000 are aged under 35.
1.3 million French people, or a person over 65 years in four could be reached in 2020
More than 4 million people affected in the U.S.
3 million people affected in France
160 000 new seniors per year in France
25 million people affected worldwide
4th cause of death in France
The number of people aged over 60 was 12 million in France in 2006 and will be more than 22 million in 2050,more than a third of the population
Today, there are approx.107'000 people with Alzheimer's or other dementia type in Switzerland. In 2030 it will double and in 2050 it is expected 300,000. The Alzheimer's Association called on the Swiss political environment so that it focuses on the theme to develop a policy Alzheimer Swiss [9].

1.4.   Dementia vs. Alzheimer

The term "dementia" include a lot of general health problems characterized by an irreversible decline of mental faculties. Alzheimer is the most common form of dementia in older people and represents about 65% of dementia cases. However, the diagnosis of Alzheimer is not always obvious and can be difficult for doctors to differentiate between Alzheimer's disease and "Lewy body", for example.
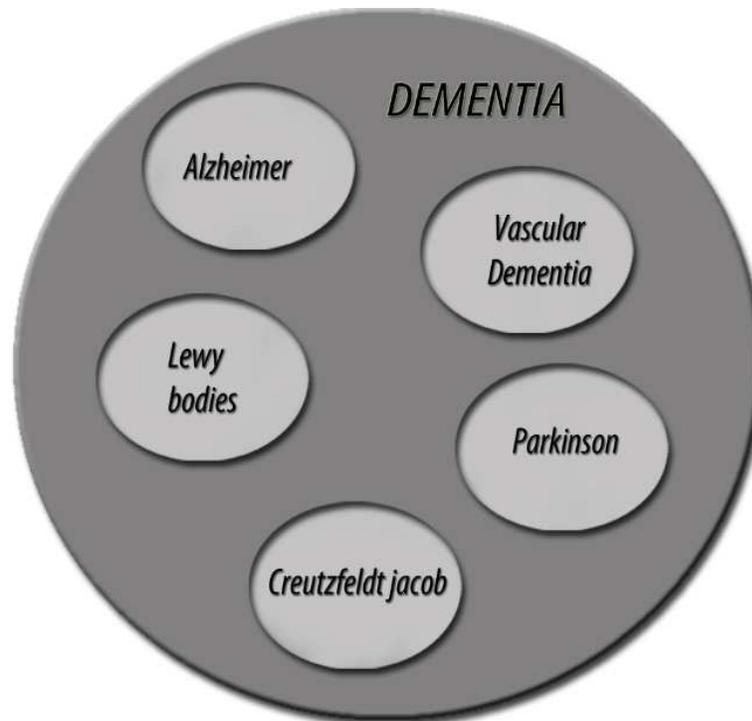
Figure 2: Classification of Dementia and Alzheimer diseases

1.5.   Geolocation Technologies

Geolocation is the process of positioning an object or person on a map using geographic coordinates. This operation is done using a terminal that can be located and can publish its geographical coordinates. There are different types of geolocation, *e.g.*, geolocation via satellite, GSM geolocation, geolocation with Wi-Fi, or geolocation RFID.

1.5.1. GPS: Global Positioning System

The Global Positioning System is a geolocation system which operates globally and provides location and time information in all types of weather, but the accuracy can be influenced by the weather. Since 2011, it works with GLONASS, a satellite positioning system fully operational and accessible to the general public. GPS satellites transmit multiple signals encoded in civil or military destination.

Geolocation via satellite aims to calculate, with the help of signals from a constellation of satellites, the current position of terminal equipped with a compatible chip. This position is then translated in terms of latitude, longitude and altitude which can then be physically represented on a map. The best known positioning satellite network is GPS.

The essential components of a geolocation platform are: a) communicating terminal: the terminal receives its geographical coordinates (via GPS or otherwise) and sends them via a telecommunications network to the platform, b) computer system capable of receiving, storing

and processing the information: they are servers that host the infrastructure and who receive and process the data sent by the terminals, c) module mapping: the integrated module to the computer system that will allow displaying the position of terminals on a suitable base map. This module supports the calculations of distances, directions, detects the interaction with the areas and provides access to information field (*e.g.,* turn restrictions, restrictions for heavy vehicles, speed limits) [10].

To measure the distance of the receiver from a satellite, the satellite sends out electromagnetic waves (microwaves) that travel at the speed of light. Knowing this, we can calculate the distance between the satellite and the receiver, knowing the time the wave has to travel the route.

Smartphones

Calculate the current position of the terminal and translate it in terms of latitude, longitude and altitude

GPS satellites
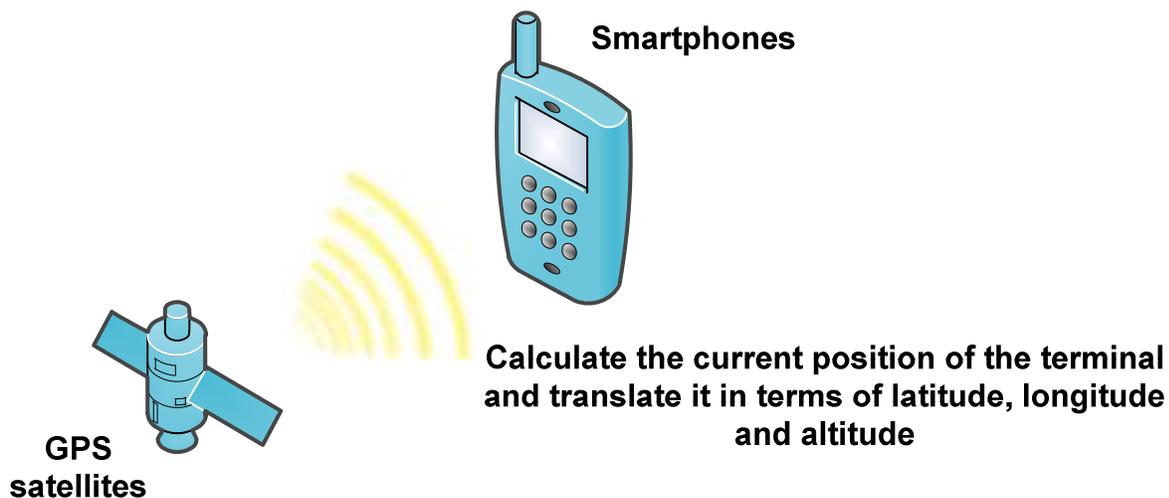
Figure 3: GPS-based geolocation principle

1.5.2. RFID: Radio Frequency Identification

RFID is a method which stores and retrieves data remotely using markers called "RFID tags".

RFID technology can be used for indoor geolocation. To know the position of an individual, a multiple RFID readers equipped with different antennas are positioned to cover the entire desired areas. When this person, equipped with an RFID tag, is active in these areas, the system calculate its position based on the number of readers that detect the tag and deduct the approximate position of the individual.
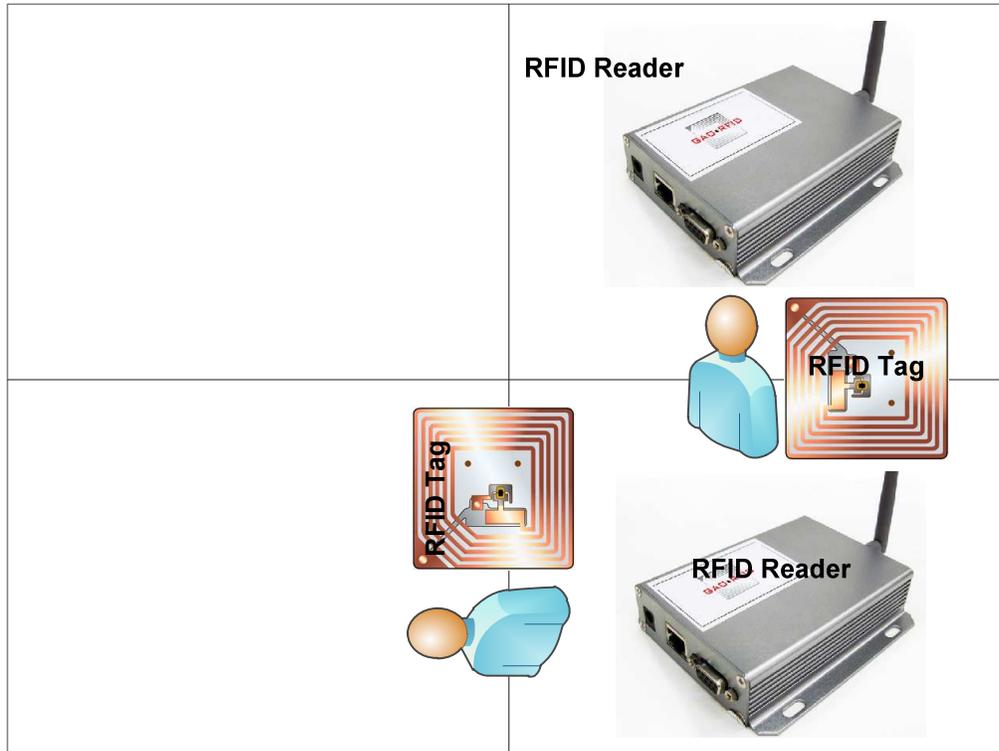
Figure 4: Architecture of system for RFID-based geolocation

1.5.3. GSM: Global System for Mobile Communications

GSM is a standard developed by the European Telecommunications Standards Institute to describe technologies for second generation digital cellular networks. Today, the method most used in GSM geolocation is the Cell ID. The system identification by cell is the geolocation technique, the easiest and the least expensive. This method retrieves the identifiers of the GSM antennas to which the device is connected. Subsequently, through a database linking the identifiers of the cells and the geographic positions of the antennas, the terminal can determine its position and make an estimate. These databases can be made available by operators to their subscribers, or by private companies that evaluate the GSM antennas or have partnerships with operators. Since the Cell ID database is not stored locally in the terminal, an internet connection of GPRS / EDGE or 3G may be necessary to issue a request for correspondence Cell ID / longitude latitude. When the user is located in an area covered by the network, he is located thanks to the identification of the cell which belongs to the antenna through which the communication is transmitted.

Connected to

Device

Method used: CellID and database
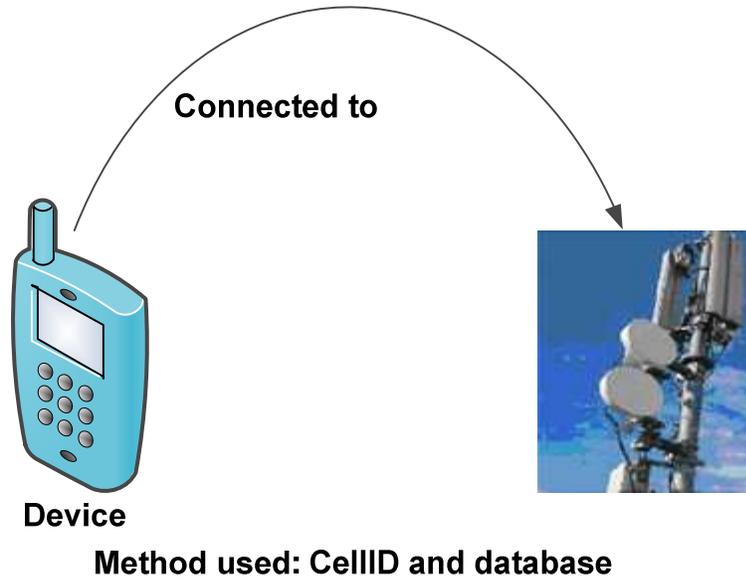
Figure 5: Architecture of system for GSM-based geolocation

1.5.4. WI-FI: Wireless Fidelity

Wi-Fi is a set of wireless communication protocols governed by the IEEE 802. 11standards group (ISO/ IEC8802-11). Wi-Fi is used for connecting several wireless computing devices (*e.g.* computer, router, Internet set-top box) within a computer network to enable data transmission between them.

A wireless terminal can use the same method as the GSM (explained above) based on the identifiers of Wi-Fi hotspots it detects. There are databases of multiple Wi-Fi access points and their location which may belong to private companies or communities that publish them for free. These databases are constructed using the method called War Driving, which is to walk the city streets in a car with a laptop with Wi-Fi and connected to a GPS receiver in order to identify a maximum of Wi-Fi access points. There is another method called "Radio Frequency fingerprinting", which is the location of any Wi-Fi device without the use of special software on the device. Fingerprinting can be divided into two phases: an offline phase and an online phase. The offline phase involves building the signal strength database and creating the signal strength map. After creating an accurate database of Access Point (AP) locations, reference points are chosen. The received signal strength from every visible AP is included in the database for each reference point. After measuring the received signal strength from each visible AP, the mean value of the signal strength and the distribution of signal strength of each reference point will be calculated and stored in the database. During the online phase, both deterministic and probabilistic methods can be employed as a positioning algorithm. The former chooses the reference point in the database whose signal strength has the minimum difference from the received signal strength of the device as the most probable location; the

latter chooses the most likely location of the device in database as the most probable location [11].

1.5.5. Comparison

There are several disadvantages to using a single technique of geolocation: a) dependence on GPS network because it is unable to be used indoors and because of the response time for ignition, b) dependence on the GSM networks mainly due to its geographical coverage, c) dependence on the presence of Wi-Fi access points which are unavailable for example in rural areas. There are devices that combine these three techniques and are able to geotag the terminal in any situation. The Apple iPhone is an example of a terminal capable of using a method of geolocation due to its interface GSM, Wi-Fi and GPS receiver. The accuracy of the position will vary depending on the technologies available which allow us for example to geotag a person outdoor using GPS, and keep track of him inside buildings or tunnels using GSM technology coupled with Wi-Fi (see Table2).

After several searches, it seems that among different types mentioned above, Wi-Fi consumes much energy when it is active. This is a problem for which researchers have proposed a solution based on the organization of the queue, in order to know exactly when activating devices in standby mode.

Table 2: Type of Geolocation and Accuracy

Type of geolocation	Accuracy
Geolocation via satellite	The GPS provides an accuracy ranging from 15 to 100 meters
GSM geolocation	The accuracy of positioning by GSM ranges from 200 meters to several kilometres, depending on whether the terminal is located in urban areas (where the density of antennas is greater), or in rural areas.
Geolocation with Wi-Fi	The average accuracy of wireless terminals is 100 meters without major obstacles between the relay. If we take the case of terminals amplified, this distance can go till about 800 meters or even more.
Geolocation RFID	Few meters

STATE OF THE ART

2. Current Solutions

About the state of the art, I focused on articles I read containing a better illustration and a better description of the various devices that enable communication between caregivers and elderly people, their assistance and their geolocation. This research was done by searching on various websites such as: Scirus, WMO, Pubmed, "passeport-santé".

Eight devices (Témo, Vega, Locate Box Solo, Saver Life, Geophone Pack Senior, Geo 300, Helpi A320 GPS, MobiTel GPS) were found in the report "Pour ne plus sentir perdu-huit dispositifs de géolocalisation des personnes désorientées" [12] and completed through discussions with the distributors, then, a few devices have been found in newspaper articles and by entering the word «elderly geolocation», «geolocation of people with Alzheimer». Other devices were found via finding the websites of distributors of the devices from the above report.

2.1.   Comparison criteria

In the Table 3, I will describe the criteria that will be used for the description of the geolocation devices.

Table 3: Comparison Criteria

Feature	Description
Geolocation technology	Technologies used for geolocation (Vision Cell ID, Sbas-GPS, Vision-indoor, GPS, GSM, GPRS, AGPS)
Type of the device	Bracelet, Watch, Medallion, Phone, Shoe
Followed the route in real time	Monitoring of the elderly people in real time (yes, no)
Information when the person leaves the safe zone	Information when the person leave the zone programmed by the family (yes, no)
Right of caregivers to manage the secure zone	If the secure zone is managed by the caregiver (yes, no)
Launch a voice call from the device	If the elderly people can launch a voice call from the device (yes, no)
Number of programmable numbers	Number of programmable numbers that can be called by the elderly person (integer)
Direct call of the caregiver	If the elderly people can call directly the caregiver (yes, no)
Sensitivity and access keys	If the access keys on the device is easy (very good, good, acceptable, insufficient, very insufficient)
Information on the battery	Information if the battery is low (very good, good, acceptable, insufficient, very insufficient)
Autonomy of the device	The life of the battery (very good, good, acceptable, insufficient, very insufficient)
Availability of support	The availability of the help desk assistance (very good, good, acceptable, insufficient, very insufficient, not offered)
Weight	The weight of the device (grams)
Price	The price of the device (euros, dollars)
Locking mechanism	If the device has a locking mechanism (yes, no)
Dimensions	The dimensions of the device (mm)
Watertight	If the device is watertight (yes, no)
Quality of the instruction manual	if the instructions in the manual are detailed (very good, good, acceptable, insufficient, very insufficient)
Setting the device	Configuration of the parameters of the device (very good, good, acceptable, insufficient, very insufficient)
Quality of the micro	The quality of the micro (very good, good, acceptable, insufficient, very insufficient)
Listening quality	The quality of the listening (very good, good, acceptable, insufficient, very

	insufficient)
Right of caregivers to manage phone numbers	If the phones numbers which can be called by the elderly people are managed by the caregivers (Yes, no)
Opportunity for the distributor to manage the phone numbers	If the phones numbers which can be called by the elderly people are managed by the distributor (yes, no)
Opportunity for the distributor to manage the secure areas	If the secure zone is managed by the distributor (yes, no)
The secure zone up to how many kilometres	The secure zone up to how many kilometres (km)
Reliability at the network level	The reliability at the network level
The device is used for geolocation inside or outside	The device is used inside or outside (inside, outside)
How many people suffering from Alzheimer use this device	How many people suffering from Alzheimer is using the device
SIM Card	If the device has a SIM card (yes, no)

Note: All the criteria outlined in the table above are evaluated by distributors and users. If no information is available, the feature is indicated "N/A".

2.2. Bracelets

2.2.1. Vega by EnLigneAssitance (France)

Vega is a bracelet designed for people with cognitive impairment. It enables coordination between the wearer and the family and between the wearer and the help desk assistance when the wearer pushes the alert button. The family can also call the help desk assistance to ask for the location of the elderly.

Figure 6: Overview of Vega service

The advantages of Vega are: 1) the contract is terminable at any time, 2) two secure areas: day and another for the night, 2) it has a terminal to increase the autonomy of the device by putting

the GPS on standby while maintaining the function of emergency call, 3) SMS alert in case of low battery of the device.

The drawbacks of Vega are: 1) many alert calls fail, without knowing whether the problem is due to poor coverage of the GSM operator or device itself, 2) the help desk assistance that provides geolocation information to the caregiver is not very precise, 3) poor quality of the micro part, 4) the installation and charging of the device requires the assistance of a third party, 5) The refusal of the persons who had previously accepted the test.

2.2.2. Bracelet B2 by Geocalise (France)

The BraceletB2 is a new GPS bracelet for Alzheimer's sufferers. It enables seniors to increase their mobility and it allows them to send an alert to the family or the help desk assistance when they leave the secure area. In the case of an emergency and if the wearer can push the emergency button, 5 numbers can be called in turn.

Help desk assistance

Bracelet B2

Alert when the wearer leaves the secure area to the help desk assistance or to the family

Pushes warning button: 5 numbers can be called in turn

Caregivers

Figure 7: Overview of Bracelet B2 service

The advantages of Bracelet B2 are: 1) the device initiates a sequence of voice calls one after the other according to the three phone numbers defined in the configuration. If none of these phone numbers is responding, the device repeats the process until the numbers answer back.
2) very easy to use, 3) not heavy.

The main drawback of Bracelet B2 is that there is no information on the level of battery charge sent to caregivers.

2.2.3. Saver Life by Geocalise (France)

Saver Life is a bracelet composed of four call buttons. When the wearer pushes the alert button for the help desk assistance an alert is sent to them and if the elderly person pushes the button for the family, the later receives an alert.
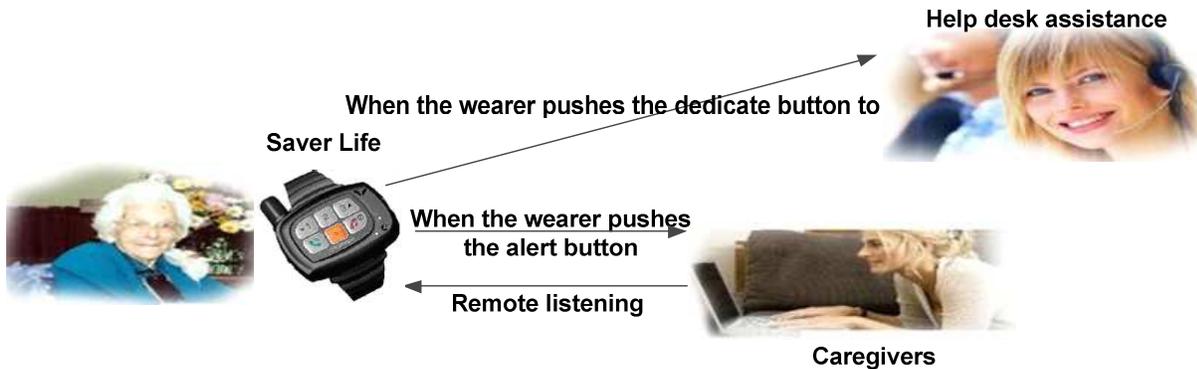
Figure 8: Overview of Saver Life service

The advantages of Saver life are: 1) simplicity of the device with automatic answer,
2) emergency call clearly visible and identifiable by a visually impaired person, 3) good battery life as evaluated by users, 4) high availability of support service after waiting for 30 seconds.
The drawbacks of Saver life are: 1) the bracelet can be uncomfortable, 2) the quality of the voice part is very poor in the call origination, 3) no secure area, no monitoring of the course, no possibility to visualize the position of the wearer, 4) the level of the charge of the battery is unknown before it is low, 5) the remaining telephone credit is unknown, 6) the device automatically answers and the wearer can be spied without knowing it.

2.2.4. Columba device by Medical Intelligence Technologies (Canada)

For seniors with mild cognitive impairments Columba works as follows. When the wearer leaves the secure area, an alert is sent to the help desk assistance, and when the battery is low, an alert is sent to the family who can have voice contact with the wearer. If the help desk assistance receive an alert which is about dementia (when the senior leaves the predefined area), they provide the coordinates of the wearer to the family.

They can geotag the senior when he leaves the predefined area and communicate directly with him

Help desk assistance

If this is a crisis of dementia, the help desk assistance provides the coordinates of the holder

An alert is sent when Columba leaves its secure area

Columba bracelet

Alert in the case of low battery

They may have a voice contact with the wearer

Caregivers

Figure 9: Overview of Columba service

The Columba device was replaced by another Bracelet "Vega" (*cf* Section 2.2.1).

The advantages of Columba are: 1) alert button which can operate both inside and outside the residence, 2) alert button which can be disabled remotely, 3) watertight, 4) it cannot be cut as it incorporates a wire; and it has an attachment system that requires a special key in order to remove it, 5) battery charges in one to two hours and then wearer has autonomy for about one week, 6) electronic alert (SMS, email, voicemail, *etc*) automated for caregivers in low battery level 7) the help desk assistance can geotag the elderly people when they leave the predefined area and communicate directly with them.

The drawbacks of Columba are: 1) the wearer cannot launch a voice call from the device, 2) the size of Columba is slightly bigger than a regular watch.

Regarding the battery life, when Columba remains in the regular zone, the battery has a range of 3 to 7 days. Then, the device must be immediately recharged using the battery pack, and when the Columba leaves its secure area, it gets more frequent communication and transmits information to the help desk assistannce. Autonomy is thus affected, and may be reduced to 12 hours.

Table 4: Characteristics of Bracelets

	Vega	Bracelet B2	Saver Life	Columba
Type	Bracelet	Bracelet or Medallion	Bracelet	Bracelet
Geolocation technology	GPS / AGPS	GSM / GPS	GPS	GPS, GSM, GPRS
Followed the route in real time	No but it is possible to perform every 4 minutes outside monitoring of displacements	Yes	No	No
Information when the person leaves the safe zone	Yes	Yes	N/A	Yes
Right of caregivers to manage the secure zone	No	Yes	N/A	Yes
Launch a voice call from the device	No	Yes	Yes	No
Number of programmable numbers	1	5	4	N/A
Direct call of the caregiver	No	No	Yes	No (an alert is sent electronically by the device for medical

				help desk who sent it to the caregivers and family).
Sensitivity and access keys	Very insufficient	Good	Acceptable	Acceptable
Information on the battery	Very good	N/A	Insufficient	Very good (SMS, Email, Voicemail)
Autonomy of the device	Acceptable	Acceptable (2 to 3 days)	Good	Good (Regular mode: from 3 to 7 days, out of secure area: 12h)
Availability of support	N/A	Good	Very good	Very good
Weight	68	According to « technipro » 55g According to « geolocalisation tracking » 110g	71g	60g
Price	455 euros	47 euros	753 euros	200 euros, customers must also purchase a subscription of 59 euros per month in Mobile Medical, European subsidiary of Medical Intelligence.
Locking mechanism	Yes (but there is a simple strap option exists, but it pays off).	Yes	N/A	Yes
Dimensions	N/A	60 x 42 x 16.5	N/A	N/A
Watertight	N/A	N/A	N/A	Yes
Quality of the instruction manual	Very insufficient	N/A	Acceptable	N/A
Setting the device	Good	Acceptable	Good	Acceptable
Quality of the micro	Insufficient	N/A	Very insufficient	N/A
Listening quality	Insufficient	N/A	Acceptable	N/A
Right of caregivers to manage phone numbers	No	Yes	No	N/A
Opportunity for the distributor to manage the phone numbers	Yes	No	Yes	N/A
Opportunity for the distributor to manage the secure areas.	Yes	N/A	N/A	No
The secure zone up to how many kilometers	The safety zone is unlimited on the French territory to the maximum and minimum of 60 meters.	N/A	N/A	N/A
Reliability at the network level	Network reliability is the same as a cell phone.	N/A	N/A	N/A
The device is used for geolocation inside or outside	The geolocation system operates mainly outside	N/A	Inside and outside	Inside and outside
How many people suffering from Alzheimer use this device	90% of users of VEGA are suffering from a cognitive impairment, or Alzeihmer	N/A	N/A	N/A
SIM card	Yes	Yes	Yes	Yes

2.3.   Shoes

2.3.1. GPS shoes by GTX Corp (USA)

The aim of GPS shoe is to allow seniors with mild cognitive impairments to move around safely and securely. With a downloadable app, caregivers or family can monitor elderly people using the GPS or get an alert if they leave a pre-set safe zone. When the family loses a child or Alzheimer's senior, they can call the help desk assistance, who can activate the GPS remotely and alert authorities if the family can provide the correct password.
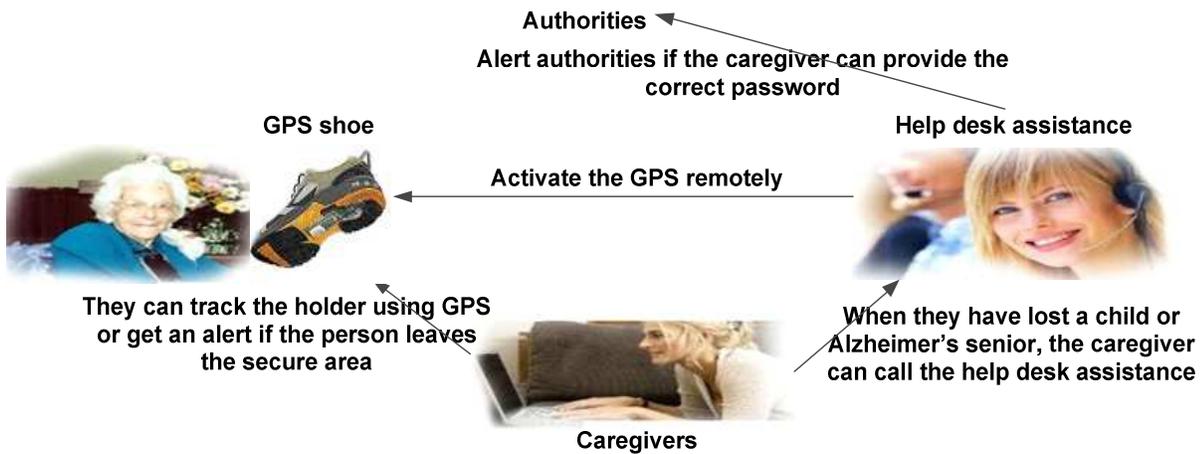
Figure 10: Overview of GPS shoe service

Table 5: Characteristics of GPS Shoes

	Shoe
Type	GPS Shoe
Geolocation technology	GPS
Followed the route in real time	Yes (once the button is on, caregivers can monitor the wearer and the shoe will transmit information until the battery runs out)
Information when the person leaves the safe zone	Yes
Right of caregivers to manage the secure zone	N/A
Launch a voice call from the device	No
Number of programmable numbers	N/A
Direct call of the caregiver	No
Sensitivity and access keys	N/A
Information on the battery	N/A
Autonomy of the device	Good
Availability of support	Very good
Weight	N/A
Price	300 dollars
Locking mechanism	N/A
Dimensions	N/A
Watertight	N/A
Quality of the instruction manual	N/A
Setting the device	Acceptable
Quality of the micro	N/A
Listening quality	N/A
Right of caregivers to manage phone numbers	N/A

Opportunity for the distributor to manage the phone numbers	N/A
Opportunity for the distributor to manage the secure areas.	N/A
The secure zone up to how many kilometers	N/A
Reliability at the network level	N/A
The device is used for geolocation inside or outside	N/A
How many people suffering from Alzheimer use this device	N/A
SIM card	Yes

Figure 11: The GPS built into the heel of the shoes

The advantages of GPS shoe are: 1) there is a sensor which puts the device to sleep after one minute of no movement, which allows enhanced battery life and power optimization, 2) the GPS shoe also comes with an alert button providing subscribers with a precise alert notification location on Google or Microsoft maps that can be monitored on laptops, cell phones, and PDA's, 3) the maker of GPS shoes note that seniors have rejected other GPS devices such as bracelets or medallions and actually they have a new model called Blue GPS shoes, 4) easy to use.

The drawbacks of GPS shoe are: 1) the wearer cannot launch a voice call from the device, 2) it is difficult to see the level of battery charge when the wearer is outside.

2.4. Phones

2.4.1. GSM ALADIA 3000 by Teltonika (France)

GSM ALADIA 3000 is a device that allows geolocation of a person following his call for help. It allows caregivers to act quickly if the elderly people feel unwell while being reassured to know where they are at any time. When the elderly people press the red button, the emergency number is called and the location is sent by SMS.
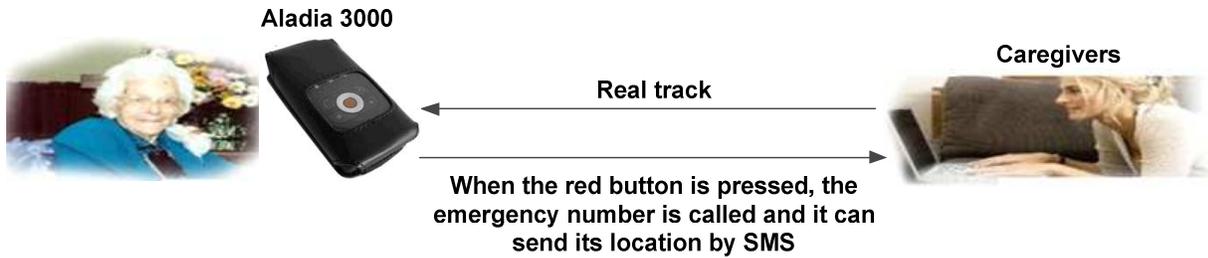
Figure 12: Overview of GSM ALADIA 3000 service

The advantages of Aladia 3000 are: 1) visualization of all displacements that were made through the historic journey, 2) illuminated buttons and status indicator, 3) warning if the elderly people fall through a sensor loss of verticality (when charging period, the loss function of verticality is disconnected).
The drawbacks of Aladia 3000 are: 1) the caregiver does not know the level of the charge of the battery, 2) there is no locking mechanism.

2.4.2. ALADIA-GO by Teltonika (France)

For seniors with mild cognitive impairments, the Aladia Go aims to help them move around safely and securely. For this device, families must set the number of emergency for SOS button and set the numbers for the B and C buttons. When the person leaves the secure area or when the battery is low, an SMS is sent to the emergency number programmed for the SOS button.
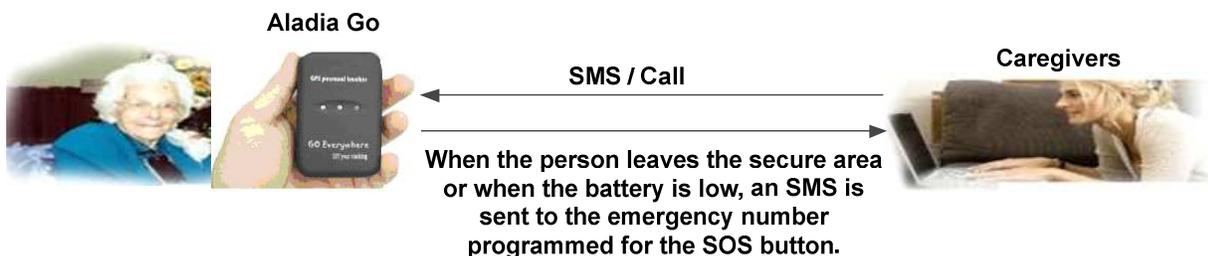
Figure 13: Overview of ALADIA GO service

The advantages of Aladia-go are: 1) easy to use, 2) warning if the elderly person falls through a sensor loss of verticality (in charge period, the loss function of verticality is disconnected)

The drawbacks of Aladia-go are: 1) the caregiver does not know the level of the charge of the battery, 2) there is no locking mechanism; 3) it does not monitor in real time.

2.4.3. MobiTel GPS by Geocalise (France)

MobiTel GPS is a device used for tracking people with visual impairments. The help desk assistance can locate the holder 24/24. The family receives an alert when the person pushes the green button and when the elderly person pushes the red button, the help desk assistance are alerted.
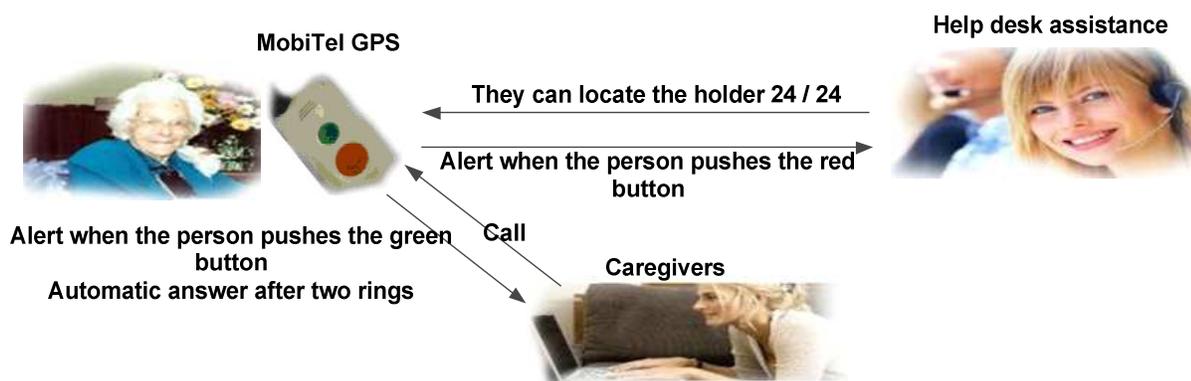
Figure 14: Overview of MobiTel GPS service

The advantages of MobiTel are: 1) very good battery life, good quality of the telephony part, 2) a fall sensor, 3) the sound quality is correct and allows good communication, even without speaking directly into the microphone, 4) automatic answer after two rings.
The drawbacks of MobiTel are: 1) general appearance is stigmatizing, 2) during the tests, the helpline has never been able to geotag the person following an SOS, 3) it is too complex, 4) no secure area, no monitoring of the course, no possibility to visualize the position of the person, 5) instructions tinkered within consistencies and gaps, 6) the helpline does not respond to every call alert, 7) the caregiver is disturbed when requesting a location without any alert; the platform suggests calling back (which is not always done), 8) the device automatically answers and the person can be spied on without knowing it, 9) the level of battery charge is unknown before ignition of the battery indicator, 10) when the device is stopped or unloaded, an incoming call leads to an answering machine offering to leave a message that can never be heard.

2.4.4. Témo by e-medicis (France)

Témo is a support service via a mobile terminal which can be purchased in e-medecis by the beneficiary. Témo has been designed to meet the needs of seniors, is a mobile phone easy to use to keep in touch with family and friends. When the senior pushes the middle button, an

alert is sent to e-medecis. The reference number which has been defined receives an alert when the wearer pressed the button on the left, and this number also receives an SMS when the senior leaves the secure area and when the battery is low.
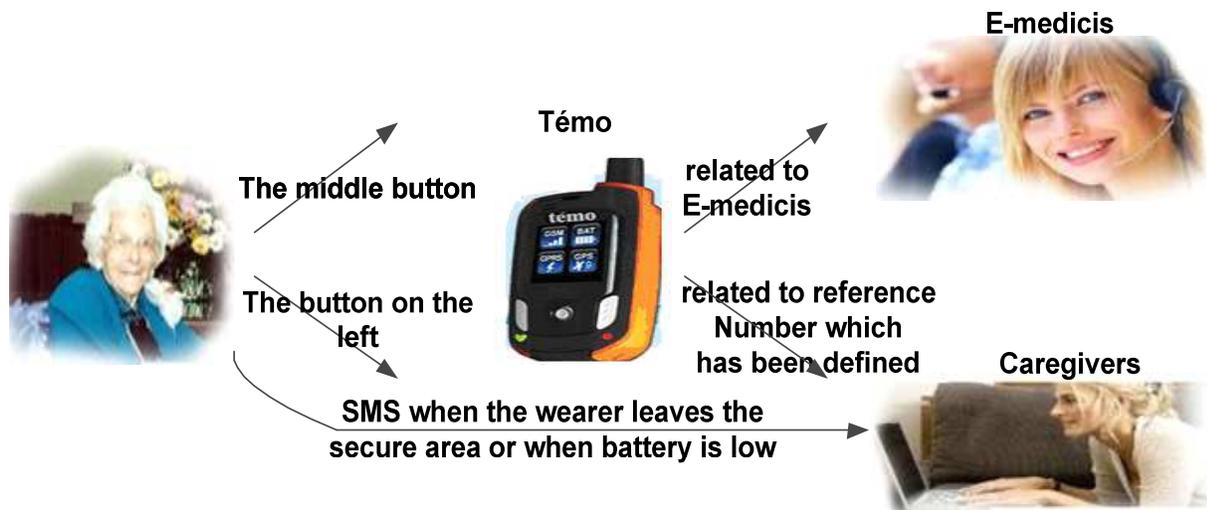
Figure 15: Overview of Témo service

The advantages of Témo are: 1) good sensitivity and accuracy of the GPS device, 2) communication with good quality audio in both directions, 3) visualization of the state of various features with logos dedicated, 4) SMS to help in the case of the low battery charge, 5) a site can easily locate the wearer; see the history of events, have information on the physical condition of the wearer and manage the list of contact persons, 6) an application for smartphone that takes the great features of the website.

The drawbacks of Témo are: 1) heavy and bulky device with a screen sensitive to glare, 2) battery life very poor, 3) the location requires an Internet connection on a computer or smartphone, 4) the remaining telephone credit is unknown; the consumption monitoring impossible on the site.

Table 6: Characteristics of Phones

	GSM Aladia 3000	Aladia Go	MobiTel GPS	Témo
Type	Phone	Phone	Phone	Phone
Geolocation technology	GPS	GPS	GPS	GPS
Followed the route in real time	Yes	No	No	No
Information when the person leaves the safe zone	Yes	Yes	N/A	Yes (SMS)
Right of caregivers to manage the secure zone	N/A	Yes	N/A	No
Launch a voice call from the device	Yes	Yes	Yes	Yes
Number of programmable numbers	N/A	2	2	2 which can be changed on the site www.my-temo.com.
Direct call of the caregiver	Yes	N/A	Yes	Yes

Sensitivity and access keys	Good	Good	Acceptable	Acceptable
Information on the battery	N/A	N/A	Insufficient	Very good
Autonomy of the device	Insufficient (2 to 3 hours and 7 days on standby)	Insufficient (18 to 20 hours)	Very good	Insufficient (12 to 14 hours)
Availability of support	Not offered	Not offered	Very good	Very good
Weight	80g	90g	79g	115g
Price	249 euros	299 euros	746 euros	Price: 300€TTC Activation:€ 25 A charge of€ 39.90per month.
Locking mechanism	N/A	N/A	No	No
Dimensions	92 x 44 x 18	76 x 46 x 25 mm	82 x 45 x 20 mm	N/A
Quality of the instruction manual	N/A	Acceptable	Acceptable	Acceptable
Setting the device	Acceptable	Acceptable	Good	Very good
Quality of the micro	N/A	N/A	Very good	Very good
Listening quality	N/A	N/A	Very good	Good
Right of caregivers to manage phone numbers	N/A	Yes	No	Yes
Opportunity for the distributor to manage the phone numbers	N/A	No	N/A	Yes
Opportunity for the distributor to manage the secure areas.	N/A	N/A	N/A	Yes
The secure zone up to how many kilometers	N/A	N/A	N/A	Few kilometres
Reliability at the network level	N/A	N/A	N/A	The mobile is suffering the perturbations of networks as all mobile phones.
The device is used for geolocation inside or outside	N/A	N/A	N/A	Outside
How many people suffering from Alzheimer use this device	N/A	N/A	N/A	Témo is not aimed specifically at Alzheimer's, it may be useful for seniors with early disease, but as soon as it is too advanced, Témo is no longer useful
SIM card	Yes	Yes	Yes	Yes

2.5.   Watches

2.5.1. FREEDOM GPS by Geocalise (France)

The FREEDOM GPS is a new model for persons with Alzheimer's. The family receive an alert of the location of the senior when he pushes the emergency button, and they also receive an alert when the battery is low or when the elderly people leaves the secure area.

When the holder pushes the alert button: the caregiver will be informed of the location of the holder

Alert if:
The battery is low
The holder leaves the secure area

Caregivers
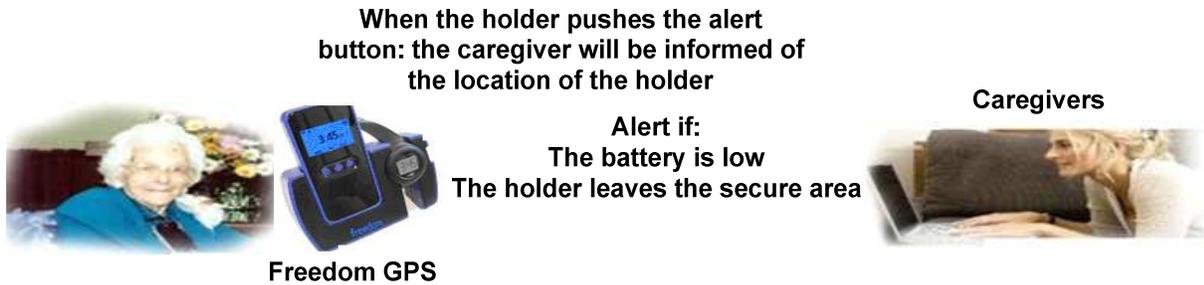
Freedom GPS

Figure 16: Overview of Freedom GPS service

The advantages of Freedom GPS are: 1) it sends an email in case of low battery of the device, 2) it sends text messages to any mobile phone, 3) the life of the battery: 30 days when used in RF mode, 24 - 48 hours when used in GSM/ GPS.

The main drawback of Freedom GPS is that the location requires an Internet connection on a computer or smartphone. According to "geolocation-tracking" Freedom GPS will be available at the end of January 2012.

2.5.2. Kéruvé Pro by Kéruvé (France)

Kéruvé Pro is a locator which is composed of a GPS Watch with safety lock carried by the person with Alzheimer's disease and a portable receiver for caregivers. By simply pressing a button on the screen of the receiver, caregivers can see the exact position of the person on a map. Family or caregivers can turn on the receiver for use in emergencies or for a security alarm. The caregivers can be notified when the person wearing the watch is out of its normal range and Kéruvé Pro can locate up to 10 watches with a single receiver.

Person with Alzheimer wears the GPS watch

Alert when the wearer leaves the secure area

From the receiver, the caregiver can know the position of the holder on a map, the battery level and configuration
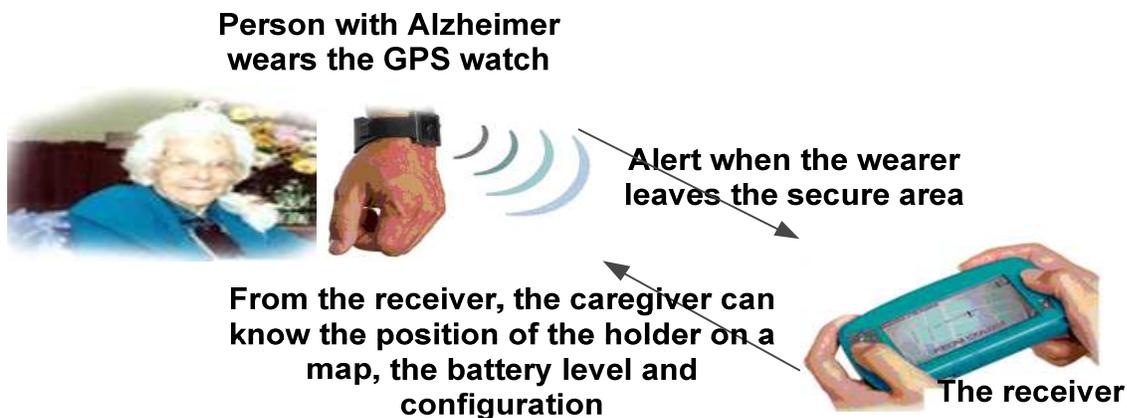
The receiver

Figure 17: Overview of Kéruvé Pro service

During the holidays, the family can entrust the receiver to a caregiver, neighbour, or keep it and then they will be allowed to locate the person using the phone or PC.

The advantages of Kéruvé Pro are: 1) very easy to use, 2) quiet and elegant, 3) there are different models and designs available for women and men, 4) the use of four positioning

systems (SBAS-GPS, Vision CellID-y, T-GSM), which allows the caregivers to find the wearer of the watch, even if it is within a building or underground, 5) this GPS for Alzheimer helps to ensure that seniors like to wear it, see it as a familiar object and therefore do not try to remove it in case of disorientation, 6) family or caregivers need only press a button on the touch screen to see a map with the exact position of the person wearing the watch GPS. If the user has to go in search of the senior, he will take with him the portable receiver which will indicate the location of the senior as and when it progresses.

The drawbacks of Kéruvé Pro are: 1) the wearer cannot launch a voice call from the device, 2) the receiver has a touch screen; it can be a disadvantage for those who are not comfortable with.

2.5.3. Limmex Watch by Limmex (Switzerland)

Limmex's vision is to provide the best possible help to people in emergency situations. For this, Limmex combines traditional Swiss watch making craftsmanship techniques and innovative communications security. In the case of an emergency, the holder can contact the registered person (family or help desk assistance). Depending on the configuration carried out by the family, an alert is sent to inform them when the battery is low. There are two types of subscription, the first one is security plus which allows three successive calls of the wearer's choice, if no one answers, the call is transferred to the central emergency call. The second type is security basic, in this case, successive calls to the phone numbers from1 to 10 of the wearer's choice, the person who answers first will organize a support.

In the case of an emergency, the holder may contact the registred person (family or help desk assistance)

Help desk assistance

Limmex

If Security plus:
Three successive call of the wearer's choice. If no one answers, the call is transferred to the help desk assistance

If Security basic:
Successive call to the phone numbers from 1 to 10 of the wearer's choice. A person who is answering first will organize a support

An automatic message is received (if they want) when the battery is low

Caregivers

Figure 18: Overview of Limmex service

The watch has two batteries Limmex: battery for the clock display with a life span of up to six years. This battery can be replaced by Limmex.

The watch also has a rechargeable battery for the emergency phone component. The battery lasts for several months in normal operation. However, it should be recharged after each emergency call, with the charger included. If the watch needs to be recharged, a red light appears on the dial. If the battery is not recharged within 24 hours, the caregiver receives an automatic SMS or e-mail.

The advantages of Limmex are: 1) emergency calls can be made both inside and outside, 2) a simple press of a button to trigger an emergency call, 3) no installation technique is required, 4) very low power consumption, 5) wrist watch, high quality, which is not perceived as a security system.

The drawbacks of Limmex are: 1) there is no locking mechanism, 2) there is no secure predefined zone.

2.5.4. Nu·m8+ by lok8u (United Kingdom)

The Nu·m8 aims to facilitate safe and secure mobility of children. The parent can see the locate icon go from green to orange on the web portal account in the case of low battery. They can also receive an alert if an unauthorized person remove the lok8 GPS child locator, if the battery is low, and if the child leaves the secure area defined by their parents.
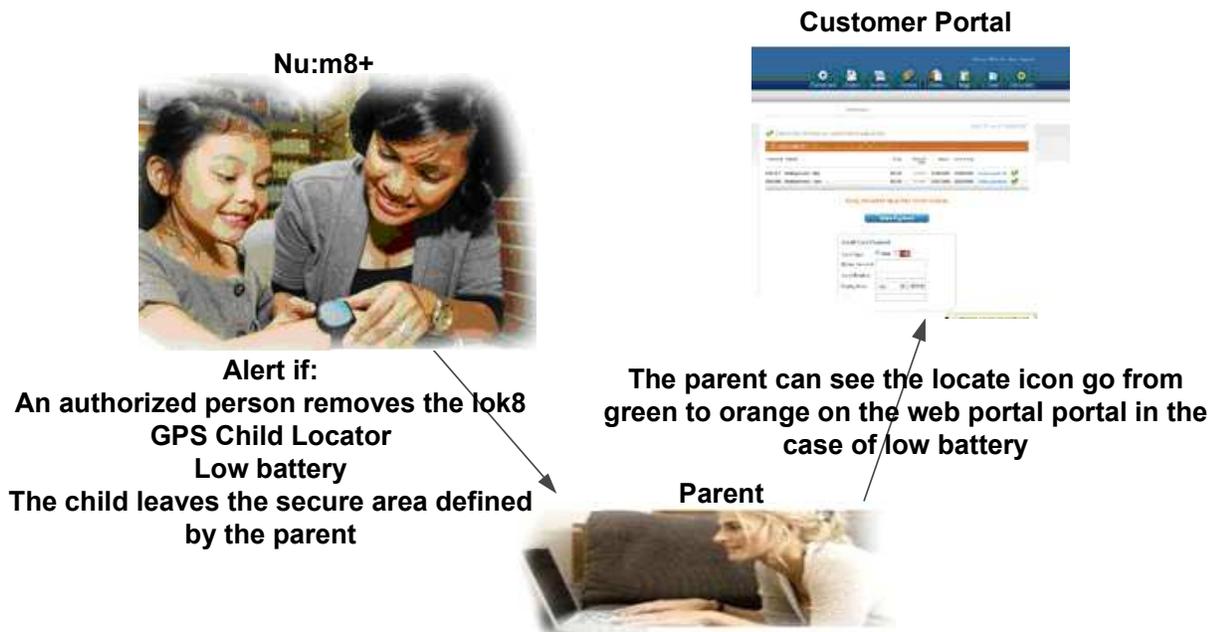
Figure 19: Overview of Nu·m8+ service

The advantages of Nu·m8 are: 1) dermatologically tested to ensure safe wearing, 2) all interaction with the device is from mobile phone (SMS) or computer, 3) encrypted data sharing to ensure no unauthorised access of location, 4) when the parent logs into the web-portal account, they will be able to customize certain features to best fit their and their child's needs (they can play safely). They also can set device on standby or live track mode, and can even choose the devices GPS update rate (2, 5, 10, 15 or 30 min intervals), 5) in the customer portal, the parent can also edit and add a Home Zone or Safe Zone which are an area on a map where the parents are happy and feel save for the child to play. If the child moves outside of this area

the parents will receive an alert, 6) the parent can also click on the "where r u" button to request the location of their child through the customer portal then it shows the location of the child in a map.

Regarding the drawbacks of Nu·m8, we have: 1) the Lok8u GPS Child Locator is not a Real-Time GPS tracker. This means that the parent will not be able to look at "tracking history" data once they leave the web portal. Once the parent ends their session by logging out, they will no longer be able to pull up the specific history, 2) poor GSM coverage and when the device is configured for "Live Track" or "Safe Zone" with intervals of 10 minutes, the battery life will be 4-5 hours which is not enough, 3) the Live track mode must be used carefully as it is a very battery intensive operation.

Figure 20 shows the customer portal for account management.
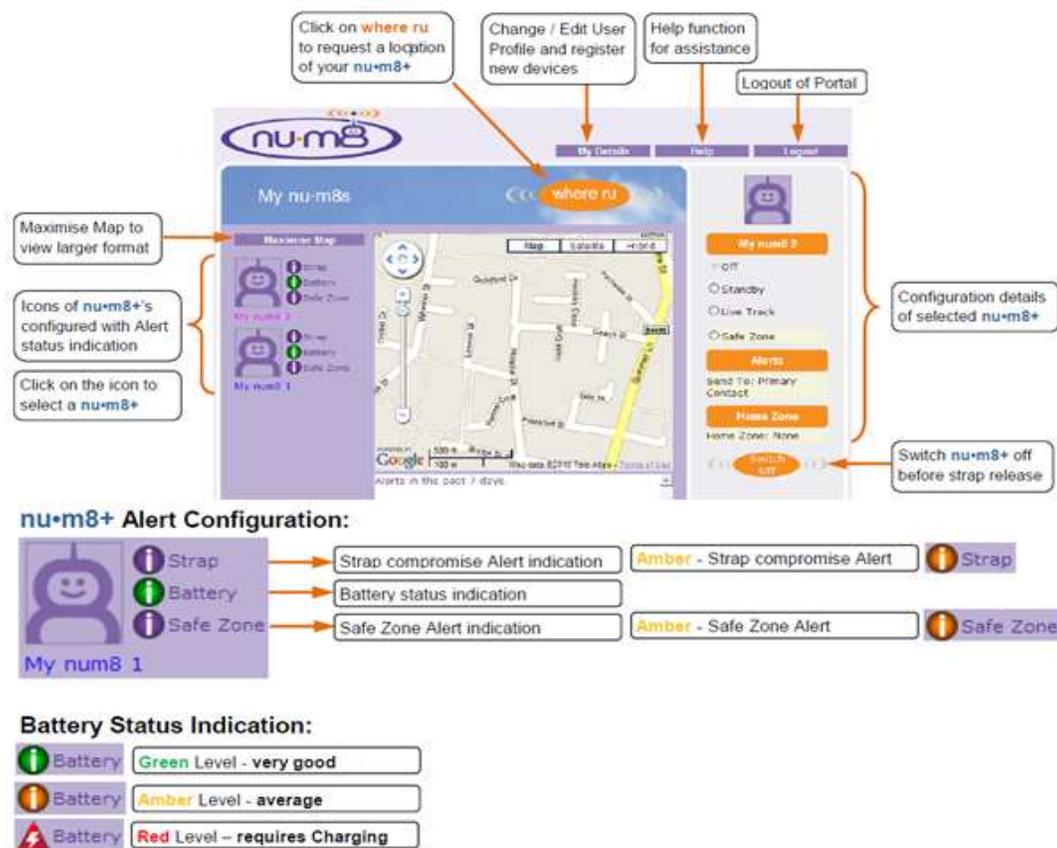
Figure 20: Customer portalNu·m8+

Table 7: Characteristics of Watches

	Freedom GPS	Kéruvé Pro	Limmex	Nu-.m8+
Type	Watch	GPS watch and portable receiver	Watch	Watch
Geolocation technology	GSM / GPS	SBAS-GPS, Vision-indoor, Vision CellID-y, T-GSM	N/A	GPS, GPRS

Followed the route in real time	Yes	No, the watch turn on his GPS at the location request or alarm triggered. to save the battery, Kéruvé turn off his GPS.	No	No
Information when the person leaves the safe zone	Yes	Yes	N/A	Yes
Right of caregivers to manage the secure zone	N/A	Yes	N/A	Yes
Launch a voice call from the device	No	No	Yes	No
Number of programmable numbers	It allows to send text messages to any mobile phone	N/A	Up to 10	N/A
Direct call of the caregiver	No	No	Yes (In normal operation, it is not possible to calla watch Limmex. Exception: after the wearer activated an emergency call, the watch can be called for 30 minutes to ensure that the help was organized well. During this time, the watch Limmex automatically accepts incoming calls.)	No
Sensitivity and access keys	Good	Acceptable	Acceptable	Acceptable
Information on the battery	Very good	From the receiver	Good	Very good (SMS, Email)
Autonomy of the device	Acceptable (LF : 30 days, mode GSM/GPS: 24 to 48 hours)	Good (between 3,5 to 4,5 days)	Insufficient (It should be recharged after each emergency call)	Good (24-48 hours of battery life)
Availability of support	Not offered but for ideal protection, family or caregivers can register for monitoring at the emergency response call center.	Not offered	Very good	Not offered
Weight	N/A	Watch: 36g Receiver: 141g	N/A	N/A
Price	N/A	The price of Kéruvé Pro is 950 € and 550 € for each additional watch, and the operating cost is 0.17 € per location or alarms and 0.60 € per location if the alarm is in a building. This rate is owed to the fact that communication between the watch and the receiver is done through the mobile telephone network.	From 495euros to 735euors	154 euros plus a subscription of 5 to about 20 euros per month
Locking mechanism	Yes	Yes	No	Yes
Dimensions	N/A	Watch: 38 x 45 x 16 Receiver: 144 x 82,5 x 19	N/A	35 x 35 x 13
Watertight	N/A	Yes	Yes	Yes
Quality of the instruction manual	N/A	N/A	N/A	N/A
Setting the device	Acceptable	Acceptable	Good	Acceptable

Quality of the micro	N/A	N/A	Good	N/A
Listening quality	N/A	N/A	Good	N/A
Right of caregivers to manage phone numbers	N/A	N/A	Yes (They must be configured on the site www.limmex.com)	N/A
Opportunity for the distributor to manage the phone numbers	N/A	N/A	No	N/A
Opportunity for the distributor to manage the secure areas.	N/A	No	N/A	No
The secure zone up to how many kilometers	N/A	For individuals, there are three predefined areas (1km, 3km, 7km), the family selects the perimeter it wants depending on the stage of disease, concerning the retirement homes, nursing homes or hospitals, they can be reduced to 200 meters.	N/A	N/A
Reliability at the network level	N/A	The device functions as a cell phone, it will not work if there is no telephone network (in the mountains in the countryside with little antennas GSM)	The network depends on the number of Swisscom GSM relay tower in the environment of the watch.	Like the mobile phone there are certain times and places where the network coverage is poor or non-existent.
The device is used for geolocation inside or outside	N/A	The Kéruvé can work outside using the SBAS-GPAS and V-INDOOR, AND V-CELLID T-Mobile for positions inside (approximate position and inaccurate)	Inside and outside	N/A
How many people suffering from Alzheimer use this device	N/A	Between 1000 and 2000 (7 countries, association, individuals, hospitals .)	N/A	N/A
SIM card	Yes	There is a SIM card into the watch and also in the receiver, two SIM cards prepaid	Yes	Yes

2.6. Medallions

2.6.1. Helpi A320 GPS by Geocalise (France)

Helpi A320 GPS is a medallion providing an SOS button and another button to adjust the volume during phone calls. It allows sending an SMS to the family to know the location of the senior and sending an SMS for 4 reference and calls the first one to request for assistance when the elderly person pushes the button.
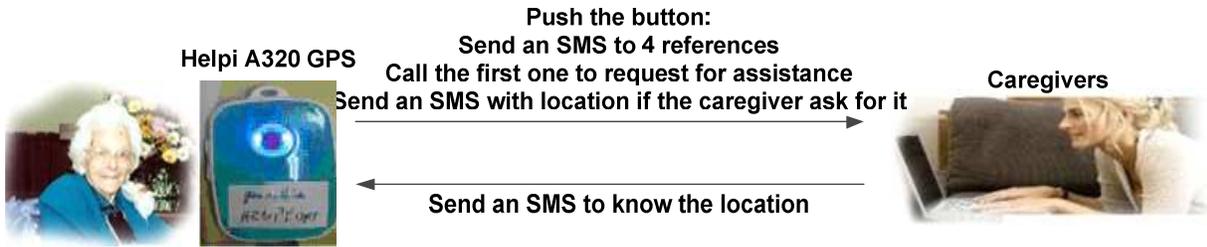
Figure 21: Overview of Helpi A320 GPS service

The advantages of Helpi A320 GPS are: 1) its ease of use, 2) the advantage of simplicity: a single button, 3) the quality of the telephone is generally good, 4) light, 5) quick charge and long battery life.

The drawbacks of Helpi A320 GPS are: 1) its high imprecision in calculating the position of the person and location map is very difficult to read on a smart phone, 2) incoming calls do not pass, 3) the device does not have a secure area, no monitoring of the courses, 4) programming phone numbers through the distributor (it is necessary to return the device to change the number of the caregiver), 5) strange sound of barking dogs are heard when charging and switching on the device, 6) impossible to know the charge level at a distance, 7) no warning when the battery is discharged, 8) the plastic cover is not strong.

2.6.2. GEO-300 by Geotraceur (France)

GEO-300 is a geolocation device comprising a panic button for sending an SMS to a phone number. When the senior pushes the alert button, an SMS is sent to the family with the positions. Geo-300 also consists of four other buttons that can be configured to direct calls or send SMS alerts.
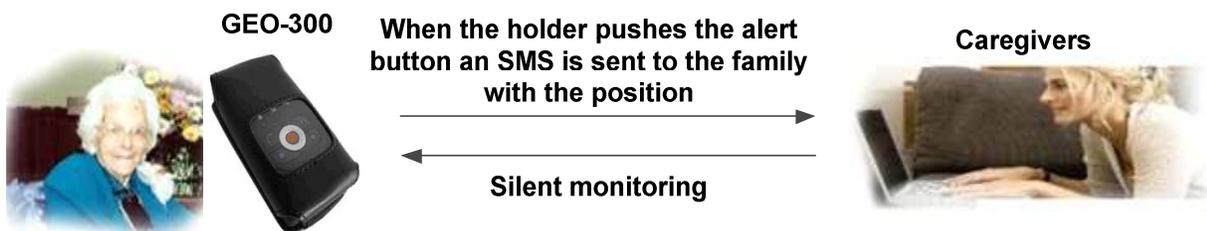
Figure 22: Overview of Geo-300 service

The advantages of GEO-300 are: 1) the location seems correct, 2) the five buttons on the device can be configured for voice calls or sending SMS alert, 3) unlimited number of security zones, 4) good information on the status of GSM and GPS functions, 5) high quality of voice communications, 6) good battery life, 7) the caregiver can configure the tracking by SMS, alert number, trigger the remote listening, and know the level of the battery. It will be informed of the position of the wearer on demand and warned by SMS when the wearer falls, 8) the wearer must press each key for a long time in order to avoid unintentional calls.

The drawbacks of geo-300 are: 1) the ability to assign each key a phone number which leads to some complexity beyond two numbers (so each key has several functions). For example, pressing "hang up" can afford to call a number which lends to confusion, 2) the history of travel and setting security zones require MapPoint, software expensive (about€ 380) published by Microsoft, 3) the device requires to be used by an expert in SMS, 4) there is no automatic communication when there is an alert: the caregiver must call, forcing the wearer to unhook, 5) the remaining telephone credit is unknown; the recharge is difficult, impossible to do by the wearer. In addition, the location is impossible when there is no credit.

2.6.3. Geophone Pack Senior by Geophone (France)

Geophone Pack Senior is a friendly device reserved for a user with a very good design, good sensitivity of the fingers accompanied by a caregiver who has always easy access to the Internet. In the costumer portal, the family with login and password can set the various features of Geophone. The device is composed of 2 buttons to call 2 persons and SOS button to send an SMS with the coordinates of position to 4 persons. This device also allows sending an SMS to the family if the senior leaves the secure area and it can also link with the help desk assistance.
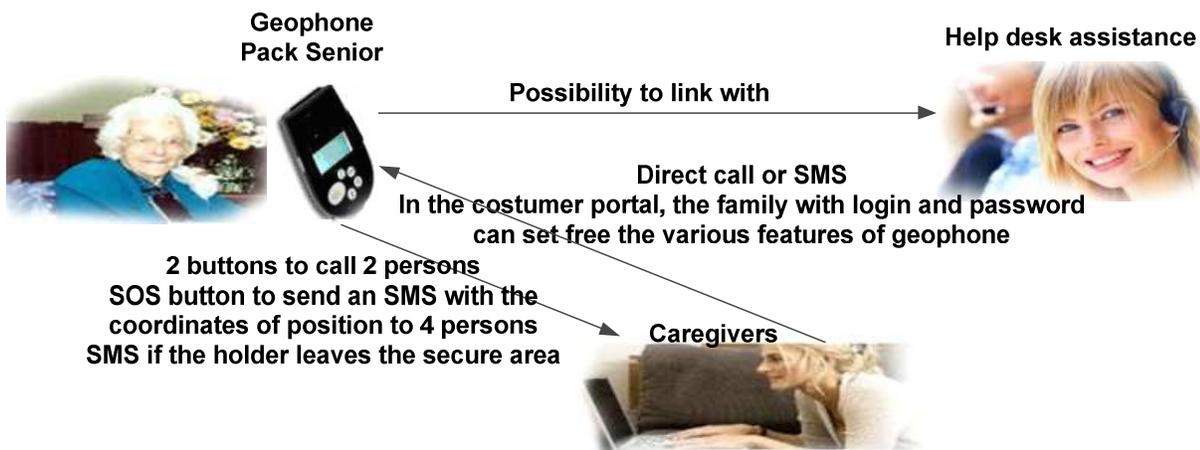
Figure 23: Overview of Geophone Pack Senior service

The advantages of Geophone Pack Senior are: 1) automatic answer after a few rings, 2) everything can be configured with the online site, 3) changing the caregiver's number is relatively simple, 4) one can locate the wearer and have a history of his travels, 5) one can call the device and send messages, 6) no limitation in creating secure areas, 7) overall, the voice is good.

The drawbacks of Geophone Pack Senior are: 1) screen unreadable (except indoor, well lit and with a magnifying glass). Of the five symbols present, only two are known (battery charging and receiving phone), others are not talking, 2) the power button is not accessible and too small, 3) the button "alert call" is identifiable only by its size, 4) the location requires an

Internet connection, 5) the remaining telephone credit is unknown, 6) the website is not very intuitive, 7) changes to the settings are not always taken into account.

2.6.4. Locate Box Solo by Espace mobilité (France)

Locate Box Solo is a medallion that seems complicated, even for the simplest two functions: making a call (three short presses on a button) or receiving a call (unhook by pressing any key except the key 2). The difficulties of setting, charging the credit, and communication between caregiver and the wearer limit its use for wearers and caregivers who master the SMS and the Internet. It allows for the family to have a direct call or send an SMS and it allows sending SMS with the coordinates of position and the address when the senior pushes the SOS button. An automatic alert is sent to the family when the elderly person leaves the secure area or if the battery is low.

Locate Box Solo

Caregivers

Direct call or SMS

When the holder pushes SOS button Calls to 3 people SMS with the coordinates of position and the address

Alert if The holder leaves the secure area The battery is low
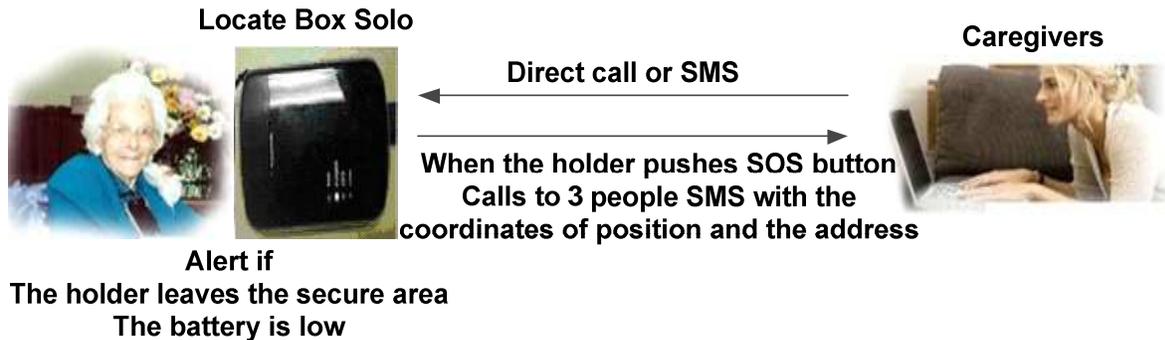
Figure 24: Overview of Locate Box Solo service

The advantages of Locate Box Solo are: 1) the device is small and relatively unobtrusive, 2) when desired, the caregiver receives SMS with not only the location coordinates, but also the address, 3) the setting of the device can be remotely directed by SMS, 4) with the diodes and the screen, it is easily seen when the GPS and GSM are active, and the battery status.

The drawbacks of Locate Box Solo are: 1) its use is not at all intuitive, 2) not enough autonomy, 3) the keys are very small and indications, 4) the caregiver must stop the alarm by sending an SMS, or he receives a series of text messages every five minutes until exhaustion of credit, 5) there is no automatic communication when the alarm is sent: the caregiver must call, obliging the wearer to press a button to unhook, 6) there is no information on the level of battery charge before the appearance of low battery indicator, 7) the remaining telephone credit is unknown; the recharge is difficult, impossible to do by the wearer, 8) stop the device is via a long press (3 seconds). It is believed that the device is off and it is not.

2.6.5. Ekotek by Multitone (England)

Ekotek is a solution to protect lone workers and seniors, it may provide elderly people with a means of enabling them to easily call for help and allows them to move safely and securely within a building.

This systems consists of :a) a medallion which allows seniors to send an alert for assistance with the current position, b) a pagers which allows caregivers viewing and responding to calls for assistance, displaying messages received from the station pivot and generating alarms, c) a repeaters which make connections between them to allow messages to pass and determine the place of issue of the alarm, d) a station pivot which allows configurations and receiving all the communications which pass through the system.

The advantages of Ekotek are: 1) ease of installation, 2) no cable connected, 3) a low cost product, 4) it works in all countries, 5) an acknowledgment of acceptance of the alarm received on the pivot station or a pager by caregivers is addressed to the senior, 4) The battery levels of all devices are monitored continuously, 5) it can also work outside (such as parking or pedestrian areas) by fixing the repeaters in streetlights

The drawbacks of Ekotek are: 1) there is no locking mechanism (seniors can remove the medallions at any time), 2) there is no SIM card, the senior cannot have a voice contact with the caregivers in order to avoid their displacements.
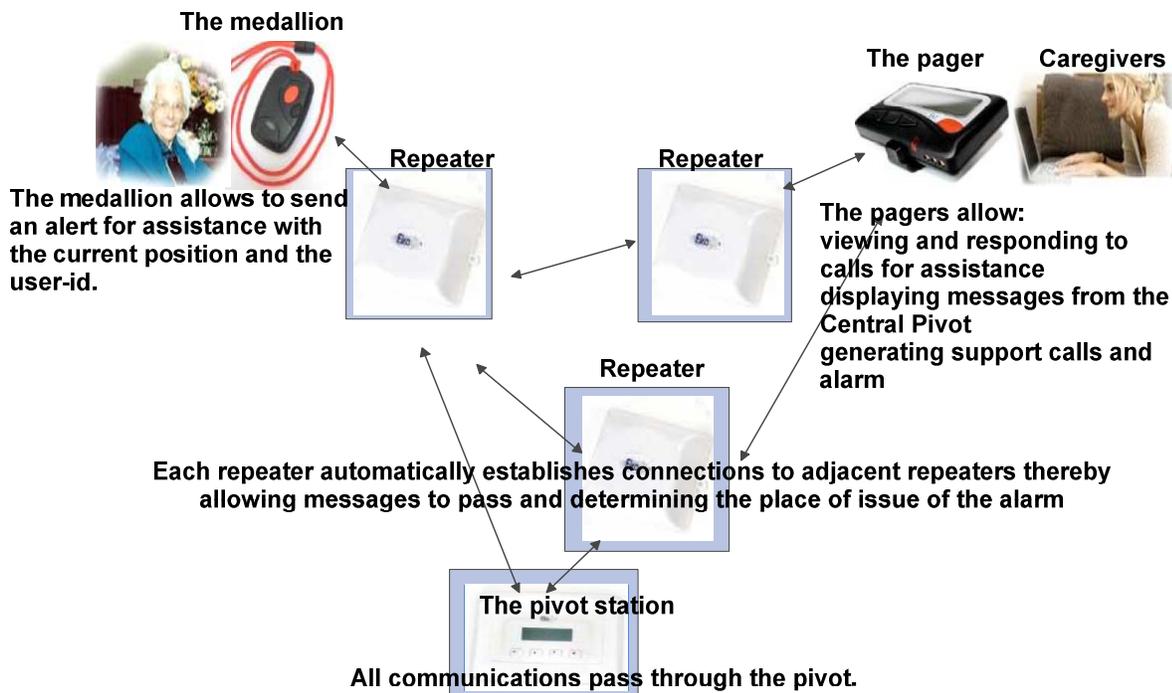
Figure 25: Overview of Ekotek

Table 8: Characteristics of Medallions

	Helpi A320 GPS	Geo 300	Geophone Pack Senior	Locate Box Solo	Ekotek
Type	Medallion	Medallion	Medallion	Medallion	Medallion
Geolocation technology	GSM	GPS / AGPS	GPS	GPS	Zigbee
Followed the route in real time	No	Yes with a subscription	Yes	Yes	N/A
Information when the person leaves the safe zone	N/A	SMS	Yes (SMS)	Yes	N/A
Right of caregivers to manage the secure zone	N/A	Yes	Yes	Yes	Yes (the current position for each repeater can be configured through PC)
Launch a voice call from the device	Yes	Yes	Yes	Yes	No (just a signal)
Number of programmable numbers	4	5	3	3	N/A
Direct call of the caregiver	Yes	Yes	Yes	Yes	No
Sensitivity and access keys	Acceptable	Acceptable	Insufficient	Insufficient	Good
Information on the battery	Very insufficient	Very good	Very good	Very good	Good
Autonomy of the device	Very good	Insufficient	Acceptable	Very insufficient (a battery life of 70 hours depending on use)	Acceptable (rechargeable or disposable batteries for pager, repeater, medallion)
Availability of support	Not offered	Not offered	Not offered	Not offered	Not offered
Weight	29g	74g	85g	54g	N/A
Price	681 euros	404 euros	416 euros	346 euros + subscription	N/A
Locking mechanism	N/A	N/A	No	No	No
Dimensions	59 x 39 x 19 mm	92 x 44 x 18	N/A	N/A	N/A
Watertight	N/A	N/A	N/A	N/A	N/A
Quality of the instruction manual	Acceptable	Acceptable	Very insufficient	Good	N/A
Setting the device	Very insufficient	Acceptable	Acceptable	Acceptable	Good
Quality of the micro	Good	Very good	Very good	Insufficient	N/A
Listening quality	Good	Very good	Good	Very good	N/A
Right of caregivers to manage phone numbers	No	Yes	Yes	Yes	N/A
Opportunity for the distributor to manage the phone numbers	N/A	No	No	No	N/A
Opportunity for the distributor to manage the secure areas.	N/A	No	No	N/A	No
The secure zone up to how many kilometers	N/A	Unlimited zone from 100 meters to several hundred kilometers in France	Between 100m and 50 km	N/A	Room level, pedestrian areas, parkings
Reliability at the network level	N/A	The device is suffering the perturbations of networks, it works in France, Europe and in most African networks	N/A	N/A	N/A
The device is used for geolocation inside or outside	N/A	Outside	Outside, it is used inside if the wearer presses the emergency button.	N/A	Inside and outside
How many people suffering from Alzheimer use this device	N/A	N/A	over 5000 users, there are 100 people with Alzheimer's	N/A	N/A

SIM card	Yes	Yes	Yes	Yes	No

2.7.   Devices used in Care Homes

2.7.1. Vivago by Vivago Oy (Finnish)

Vivago is a personal alarm system and monitor of activity developed by the Finnish company IST (International Security Technology). This watch allows to indicate to caregivers the quality of sleep disorders in people with cognitive impairments and it also allows ongoing monitoring. This device has a manual alarm button, it allows to avoid unnecessary and long research, to detect whether the bracelet is worn or not beyond the time set, to generate an automatic alarm with the caller's name, the request and the place where the senior is (within the care homes) in case of abnormal immobility or when the senior leaves the building. If the senior does not go through a controlled gate, the system sends an alarm of connection loss.
The system Vivago studies the daily rhythm (daily activities) of each user. The reference period is 4 days and the stored profile becomes the normal profile of the user. Thereafter, if the system detects significant variations from the normal profile, these changes will be automatically analyzed and possibly trigger an automatic alarm. By pressing the emergency button, the senior can have a voice contact with caregivers even if the watch is not worn.

2.7.2. HealthCarion by healthCarion (Berlin)

The healthCarion Guard provides typical maintenance and safety functions for care homes. Its aim is to allow seniors with mild cognitive impairments to move around safely and securely. HealtchCarion is used to support the processes of care and protection of elderly people in hospitals and care homes. The seniors wear the Ekahau bracelet tags that enable them to call the caregivers from any location in the building in the case of an emergency or if they fall. Caregivers have a Ekahau Wi-Fi Pagers which inform them about the current position of the elderly people.
This system allows also to analyze the calls and the alarms generated in order to optimize the care process and if required, provides process verification. But after having interviewed a professional caregivers who are using this device, they confirmed that they had received this device but it is not always used because they are still waiting for the translation of the documentation.
Note: Ekahau is the market leader in systems for real-time location (RTLS) that provides Wi-Fi tags to locate the staff and seniors within care homes.

2.7.3. Anti-wandering devices and carpets-alarm

In all EMS surveyed, most of them use devices that allow continuous monitoring and which have the autonomy and some form of freedom to the person helped. Alarm systems used

allows to let the seniors more independent and autonomous in their mobility around care homes.

In general, the anti-wandering system is a secure way that allows caregivers to know when the senior leaves the controlled doors of the building or the predefined zone.

Among the devices used include: "call caregivers device" which allows to call the caregivers by pressing the emergency button in the device, "surveillance cameras", "carpets alarm system" which generates an alarm when the senior gets out of bed. In one care home, residents use a the watch alarm "Vivago" (*cf.* Section 2.7.1), in another care home, they plan to use "HealthCarion" (*cf.* Section 2.7.2). Among the care homes visited, there are also care homes fenced and closed with the existence of a gate closing the enclosure of the EMS by code (for severe dementia).

2.8.   Conclusions

After studying how all these devices work, I focused on advantages and disadvantages of each, then, I have compared all of them in order to design our own system.

Table 9: Common Advantages of Current Solutions

Battery
a.   Simplicity and quick charge b.   Long autonomy (life time battery is 7 days) c.   Sensor inside which puts the device to sleep after one minute of no movement (to save battery)

Design
a.   Status indicators and illuminated buttons. b.   Good design which is small and not heavy c.   The device cannot be cut as it incorporates a wire; and it has an attachment system that requires a special key in order to remove it

Monitor of location
a.   Real time monitoring

Help desk assistance
a.   High availability of support service in the case of emergency call after waiting of 30 second

Secure area
a.   Unlimited numbers of security zones b.   Caregivers defining zones

Others
a.   The wearer must press each key for a long time in order to avoid unintentional calls b.   Dermatologically tested to ensure safe wearing c.   Change of caregiver's number is simple d.   Contract is terminable at any time e.   Warning if the elderly people fall f.   Watertight g.   No installation technique required h.   Very low power consumption i.   The caregivers have a touch screen to take with them when they go in search of the elderly people, the screen will include the location as and when it progresses. j.   Historic journey available to show all displacements k.   Encrypted data sharing to ensure no unauthorized access of location l.   Alert button which can operate both inside and outside providing caregivers a precise alert notification that can be monitored on laptops or PDA. m.   Device automatically answers after two rings n.   Customer portal for family and professional caregivers to manage secure zones, programmable numbers, real time tracking, history of events

Table 10: Common Drawbacks of Current Solutions

Battery

- a. It is difficult to see the level of battery charge when the wearer is outside
- b. Autonomy is poor (battery lifetime is 2 hours)
- c. Installation and charging requires the assistance of third party
- d. Unexpected sounds are heard when charging and switching on the device

Design

- a. The size of the device
- b. Complex
- c. The plastic cover is not strong
- d. Bracelet uncomfortable
- e. Screen unreadable
- f. Heavy
- g. No locking mechanism
- h. Instructions tinkered with gaps, complex manual and not clear
- i. The touch screen can be disadvantage for caregivers who are not comfortable with
- j. The board buttons are very small

Monitor of location

- a. Not real time GPS tracker

Coverage

- a. Poor GSM coverage

Help desk assistance

- a. Helpline does not respond to every alert call

Secure area

- a. No secure area

Precision

- a. High imprecision in calculating the position of the person

Others

- a. The wearer cannot launch a voice call from the device
- b. Location requires internet connection
- c. The remaining credit is unknown, so the monitoring of consumption is impossible
- d. When the device answers automatically, the person can be spied on without knowing it.
- e. When the device is stopped, an incoming call leads to an answering machine offering to leave a message that can never be heard
- f. Programming numbers through service providers (the device should be returned for change)
- g. History and setting requires expensive software
- h. The location is impossible when there is no credit
- i. Changing the setting are not always taken into account
- j. Many alert calls fail
- k. The device is stopped via a long press (device appeared to be off but it is not)
- l. The caregiver must stop the alarm by sending an SMS, else he receives series of SMS every 5 min until the completion of credit

SYSTEM DESIGN

3. System Implications

3.1.   Overview of MyGuardian Service

Based on the knowledge on current solutions and common advantages and drawbacks, I propose the following design for MyGuardian service (Figure 26).
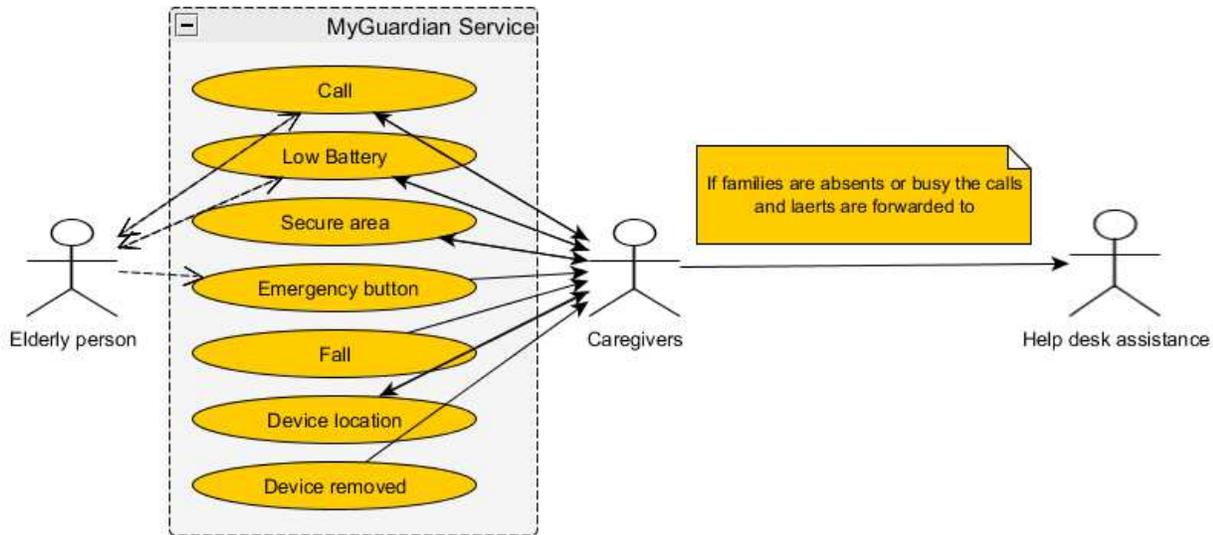
Figure 26: Overview of MyGuardian service

MyGuardian service consists of three main actors: the senior, the caregivers, and the help desk assistance. This service has seven features: call, low battery, out of the predefined area, press the emergency button, fall, device removed and device location. 1) The call feature: it allows to have a voice contact between the elderly person and caregivers. 2) The low battery feature: it allows to send an alert to caregivers when the battery is low and it allows to alert the senior by generating a vibration and a bip. 3) The predefined area feature: it allows to send an alert to caregivers when the senior leaves the predefined area. 4) The emergency button feature: by pressing this button, an alert is sent to caregivers 5) The fall feature: an alert is sent to caregivers if the elderly person falls down. 6) The device removed feature: in this case, an alert is sent to caregivers to prevent them that the device is removed. 7) The device location feature: it allows caregivers to send an SMS to MyGuardian client to know the current location of the senior.

The Figure 26 shows the relationship between the senior, the caregivers and the help desk assistance. The link between the elderly person and the call, low battery and the emergency button is optional. Depending on the stage of Alzheimer's disease, the person can or cannot press the emergency button, call the caregivers, and charge the battery. In addition, the elderly people cannot take the appropriate action when they fall down or when they are out of the predefined area. In all cases (call, low battery, emergency button is pressed, fall, device

removed and when the senior is out of the predefined area), an alert is sent to families to warn them of the problem that occurred. If the family are not there or they are occupied alerts and calls are transferred to the help desk assistance.

Through MyGuardian service, the caregivers can: a) program the secure zone, b) program the numbers to be called in case of problems, c) know the location of the senior, d) last but not least, check the level of charge of the battery and make a call.

3.2.   Use Case Diagram

The following paragraphs contain user case Diagrams of MyGuardian.
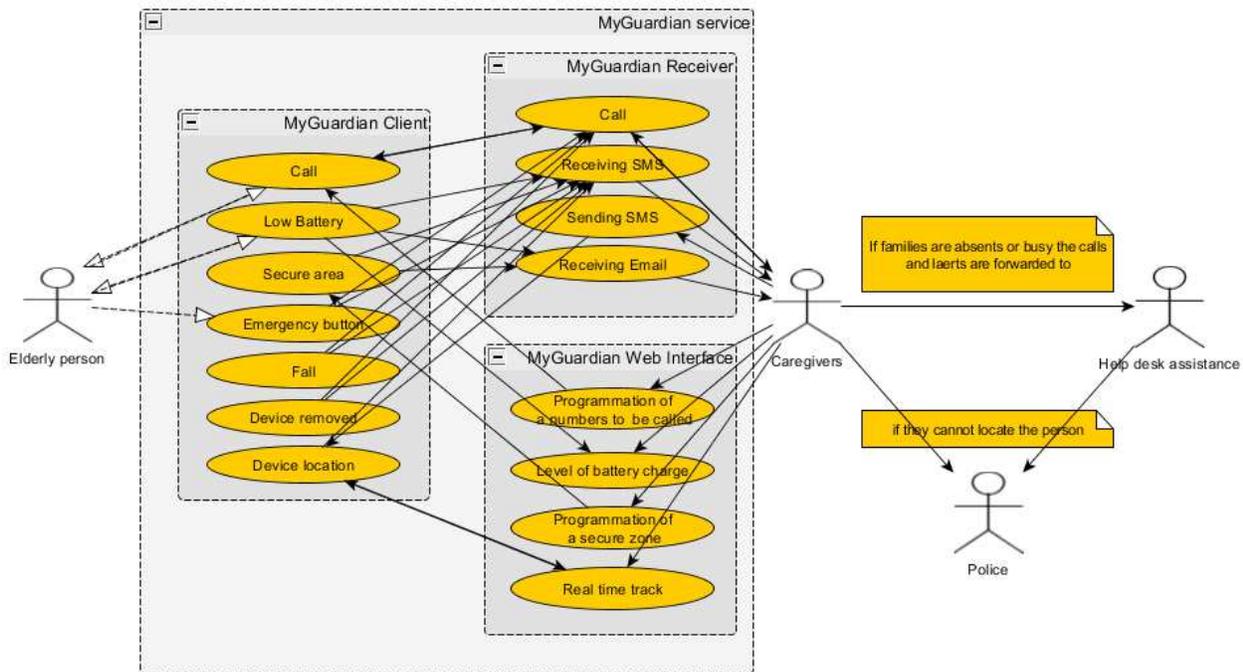
Figure 27: Detailed overview of MyGuardian service

Figure 27 shows the service MyGuardian more detailed, the reaction between MyGuardian client (at the senior side), MyGuardian receiver (at the caregiver side). If an elderly person is in a stage or he/she can press the emergency button, a call or SMS is sent to the family or professional caregivers depending on the configuration. In this case, I chose that the help desk assistance acts as a back up to the caregivers (if MyGuardian receiver does not receive an acknowledgement from caregivers). But, according to configuration made by families or professional caregivers, other cases can be considered as well: both the family and the help desk assistance should be alerted at the same time; or the family is contacted first and the help desk assistance as a backup; or the help desk assistance is contacted immediately (*e.g.* in case of holidays of the family).

If the elderly person falls or if the device is removed, in this case, a warning in the form of call or SMS is sent to the family. In the case of low battery, if the person is in a mild stage of the

disease, they can charge the battery themselves, and in parallel, an SMS or an email is sent to the family. If the person leaves the areas predefined by family, an SMS or email is sent to the caregivers. In case the family are not present or they are busy (if MyGuardian receiver does not receive an acknowledgement from caregivers), all calls and alerts are forwarded to the help desk assistance. The family, the professional caregivers or the help desk assistance can call the elderly person to ensure awareness of problems and the senior's health. They can also send a predefined SMS to know the location of the senior is who is unable to give this information by himself. And in this case, they receive an automatic reply with a coordinates where is the elderly person. All that is related with the location of the device, checking of the current location of the senior to see if he is out of the secure area, is managed by the GPS which integrated to MyGuardian client.

Through a web interface, the family or the help desk assistance can set the numbers to be called in emergency, they can also predefine areas in which the senior can move safely and securely. All this information is stocked in the memory of MyGuardian client. Through this interface, caregivers can also view the battery charge level and do a real time monitoring. If the family, caregivers, and help desk assistance cannot locate the elderly person, an alert is sent to the police or the fire brigade.

3.3.   State Diagrams

State diagrams aim to explain the inner workings of the main blocks of MyGuardian service. Figure 28 explains the functioning of the internal block in charge of checking the level of charge of the battery of MyGuardian client. First, the sensor checks if the level is <25%, whichever is the case, it takes care of sending an alert to caregivers or to the help desk assistance via SMS or email to warn of low load level, otherwise it continues its monitoring of battery change level.
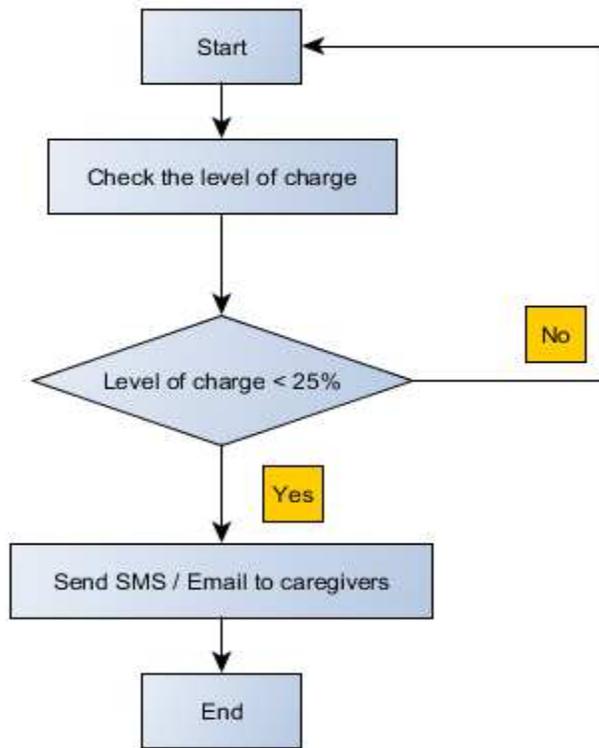
Figure 28: Diagram of the control of the charge level

Figure 29 shows the operation of the block that handles the verification if the current location is out of the secure area. Initially, the sensor checks the area as predefined by the family. If the senior is outside of this area, an alert is sent to caregivers or help desk assistance (SMS or email).
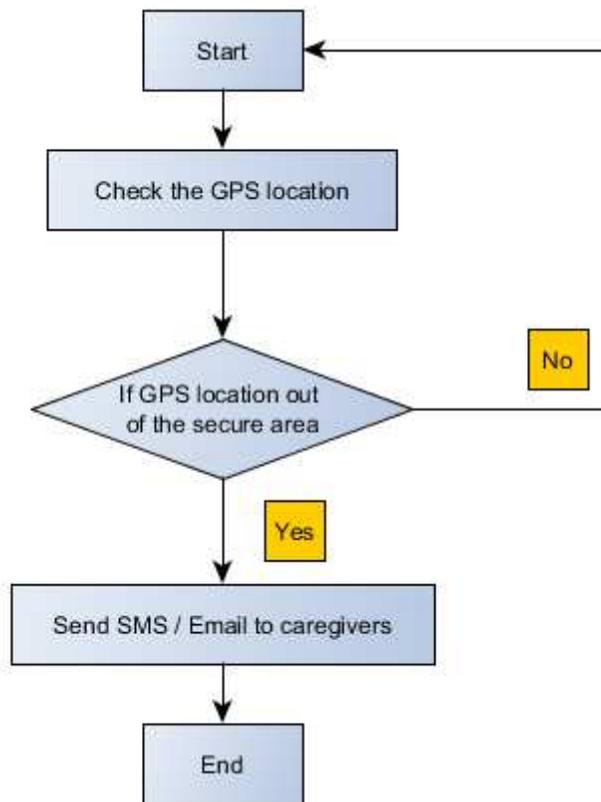
Figure 29: Diagram of the control of the GPS location

In the case of an event, the Figure 30 explains the functioning of MyGuardian. If the senior presses the emergency button, a call or SMS is sent to caregivers or to help desk assistance.
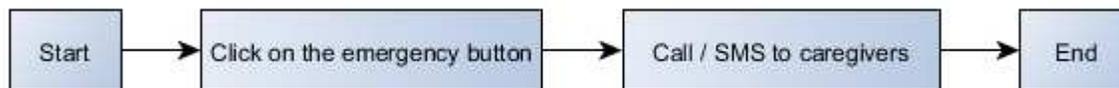
Figure 30: Diagram of the emergency button

Figure 31 shows the operation of the block that handles the verification of the position of the device. Initially, the device checks the value of the temperature sensor. If the temperature does not belong to the interval [35°…38°] this means that the device is removed or the senior is ill, an alert is sent to caregivers or help desk assistance (SMS, Call).

This solution is not completely reliable, since in case of hot weather a removed device can still report a temperature between 35 and 38 degrees. For more reliable results this information should be combined with the location or the inclination to take a better decision or another sensor should be considered. This will depend on the actual device that will be developed in the MyGuardian project.
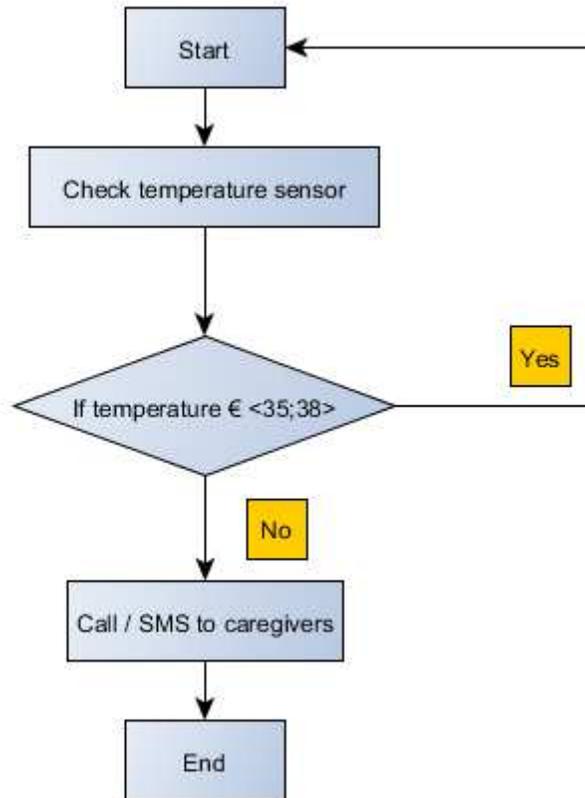
Figure 31: Diagram of the control if the device is removed

Figure 32 shows the operation of the block that handles the verification if the elderly person falls. Initially, the sensor checks the value of the altimeter. If the height's value where the altimeter is placed relative to a reference level (the ground) is equal to zero, this means that the person fell, and in this case, an alert is sent to caregivers or help desk assistance (SMS, Call).
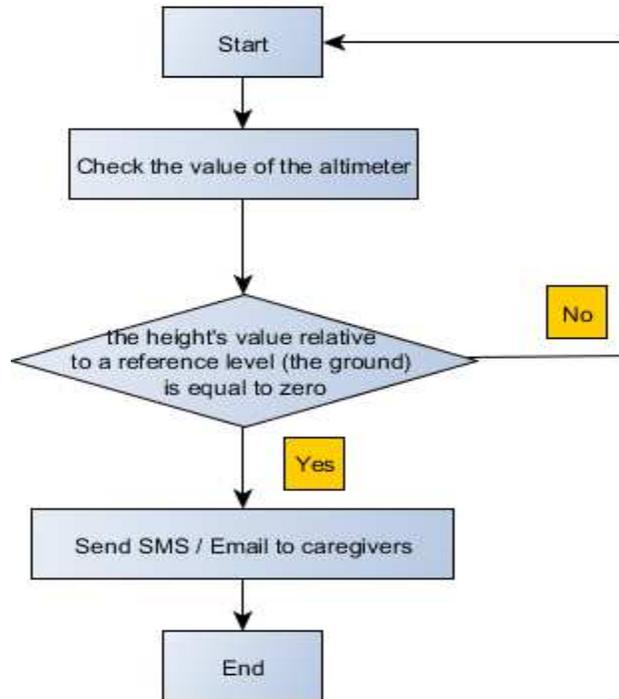
Figure 32: Diagram of the control of the fall

In the case of a call (Figure 33), a senior can press the button dedicated to the numbers pre-programmed by the caregivers through the web interface and stocked in the memory of MyGuardian client. The caregivers can also have a voice call with the elderly person for reassurance.
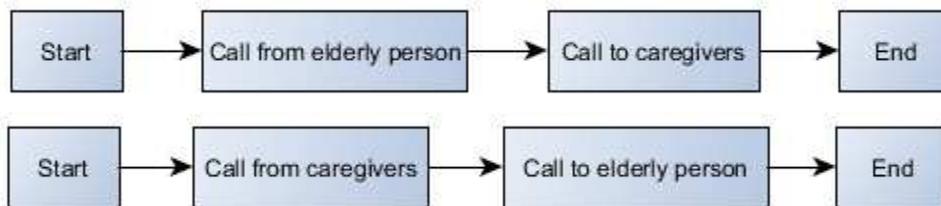
Figure 33: Diagram of call between senior and caregivers

3.4. Event Notification Service

In Figure 34 sensors based on a timer conduct tests at the level of the predefined area, the emergency button and the level of charge of the battery and then send a signal to the system for sending email or SMS. This Figure explains the functioning of the system for sending and receiving SMS / email from MyGuardian client to caregivers. Once the receiving system receives the notification (SMS / email), it sends an acknowledgment to the sending system. If it does not receive an acknowledgment after $\Delta t > 50$ms, it resends the notification again. If the

receiving system receives an erroneous message, it sends an error to the system error which itself takes care of forwarding the message.
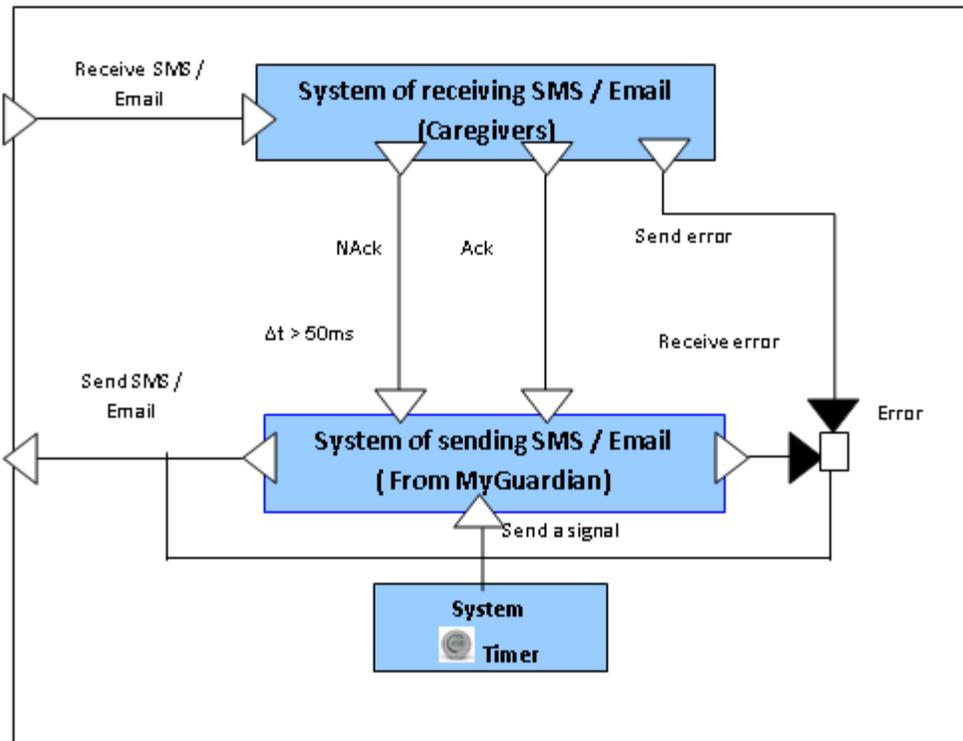
Figure 34: System of sending SMS / Email from MyGuardian to caregivers

Regarding the calls, when the GSM system receives a signal in the case of an event, fall, or the device is removed, at first, it sends a call to caregivers. If they do not answer, a signal is sent to the system error that deals with the recall. After three unanswered call, the GSM system tries to call the help desk assistance to intervene. (Figure 35)
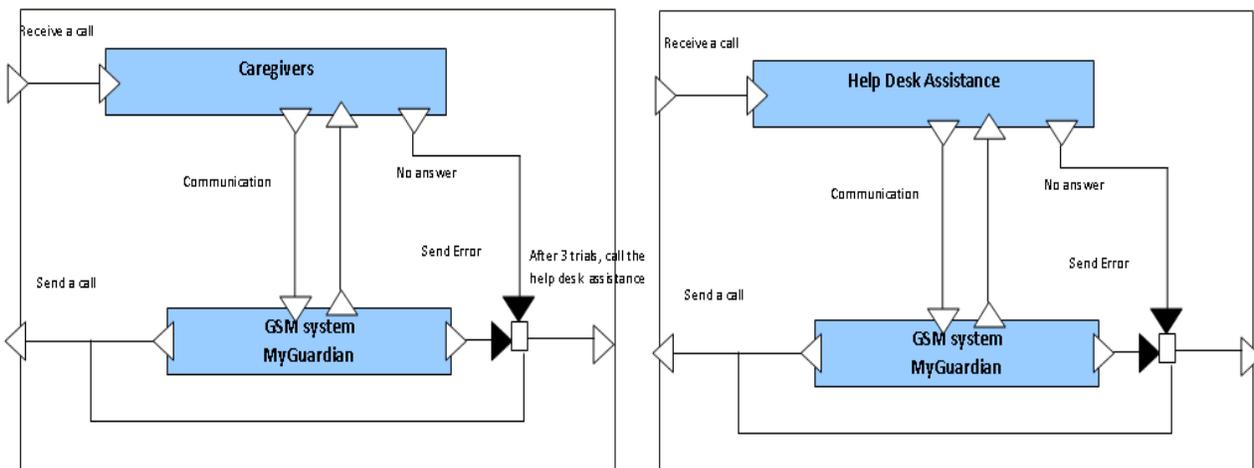
Figure 35: System of call from MyGuardian to caregivers and help desk assistance

3.5.   Time Sequence Diagrams

3.5.1. Interaction from elderly person to caregivers through MyGuardian

Below, in Figure 36 I have a sequence diagram that show the links between the elderly person, MyGuardian client, MyGuardian receiver, the caregivers and the help desk assistance. If the battery is low, an SMS or email is sent from MyGuardian client to MyGuardian receiver and read by the caregivers, then MyGuardian receiver should receive an acknowledgment and then the caregivers through MyGuardian receiver call the elderly people or take a note. If the receiver do not receive the acknowledgement, this means that the caregivers are busy, absent or there is a problem connection, so, the alert is resent to the help desk assistance.

If there is an event or the senior fell, a call or SMS is sent to MyGuardian receiver which is then received by caregivers. If the alert is well received an acknowledgement is sent as reply and the caregivers call the senior or locate him and go. If MyGuardian receiver did not receive an acknowledgement, it resends the alert to the help desk assistance.

If the elderly people are out of the secure area or the device is removed, an email or SMS is sent to MyGuardian receiver and read by the caregivers. If the receiver receive an acknowledgement, the caregivers call the senior or locate him and go but if MyGuardian receiver did not receive the acknowledgment, it resends the alert to the help desk assistance.

In this case, I chose that the help desk assistance acts as a back up to the caregivers. But, according to configuration made by families or professional caregivers, other cases can be considered as well: both the family and the help desk assistance should be alerted at the same time; or the family is contacted first and the help desk assistance as a backup; or the help desk assistance is contacted immediately (*e.g.* in case of holidays of the family).

For simplification purposes, the diagrams show only the case of the caregivers or help desk assistance contacted as a result of MyGuardian Service computations.
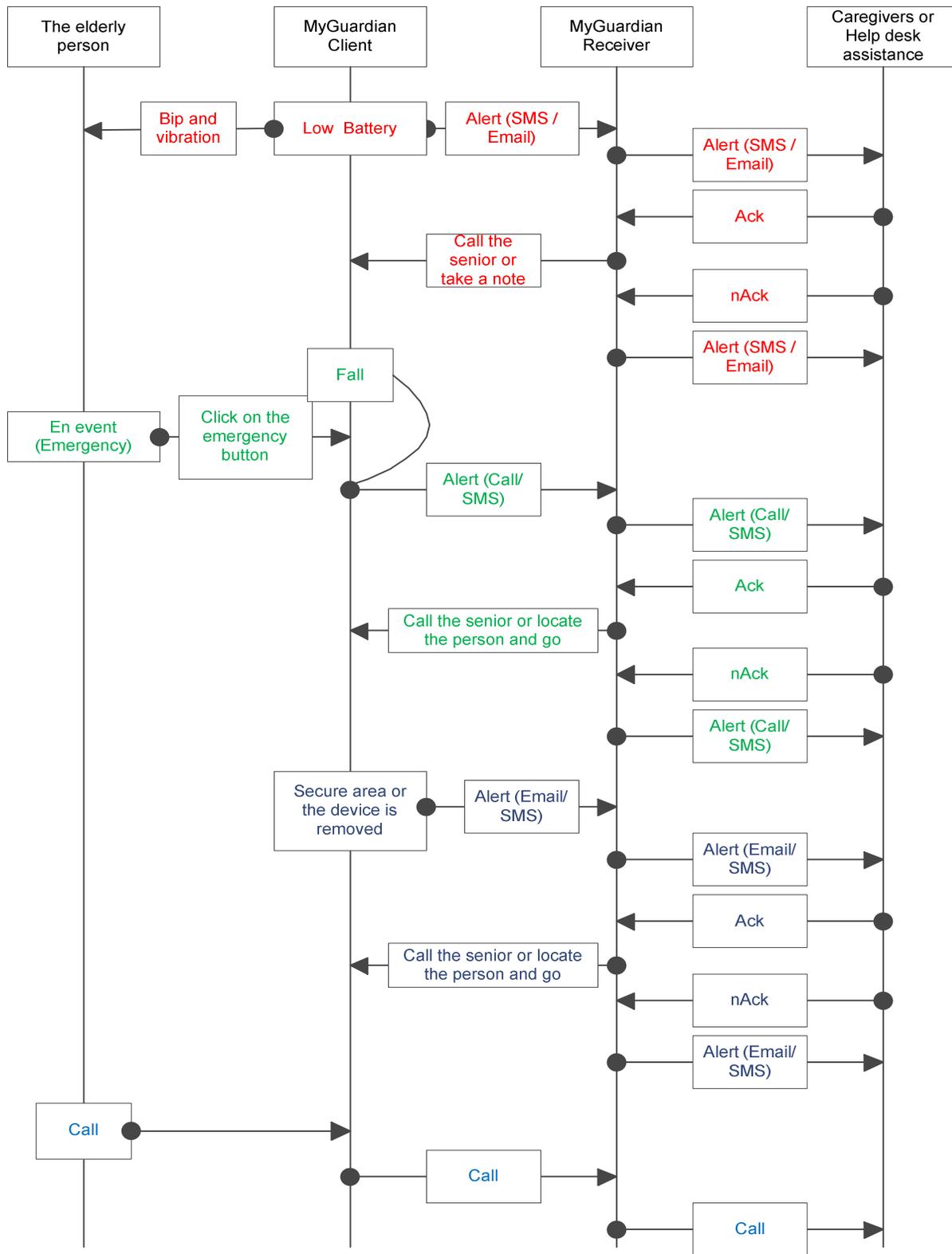
Figure 36: Sequence diagram from MyGuardian to caregiver or help desk assistance

3.5.2. Interaction from caregivers to elderly person through MyGuardian

Figure 37 shows the links between MyGuardian receiver, the elderly person and MyGuardian client. If a senior cannot be accounted for, the caregiver sends a predefined SMS from MyGuardian receiver to locate him. If the SMS is well received by MyGuardian client, it sends the coordinates to the caregivers or the help desk assistance. If MyGuardian receiver does not receive an acknowledgment, it resends an SMS to MyGuardian client and if the receiver does not receive an acknowledgment for the 3rd time, this means that its' not possible to locate the senior. In this case, an alert is sent to the police or to the fire brigade.

If the caregivers or the help desk assistance call the elderly person, he answer the call if he is in the mild stage, else MyGuardian client answer automatically after three rings.
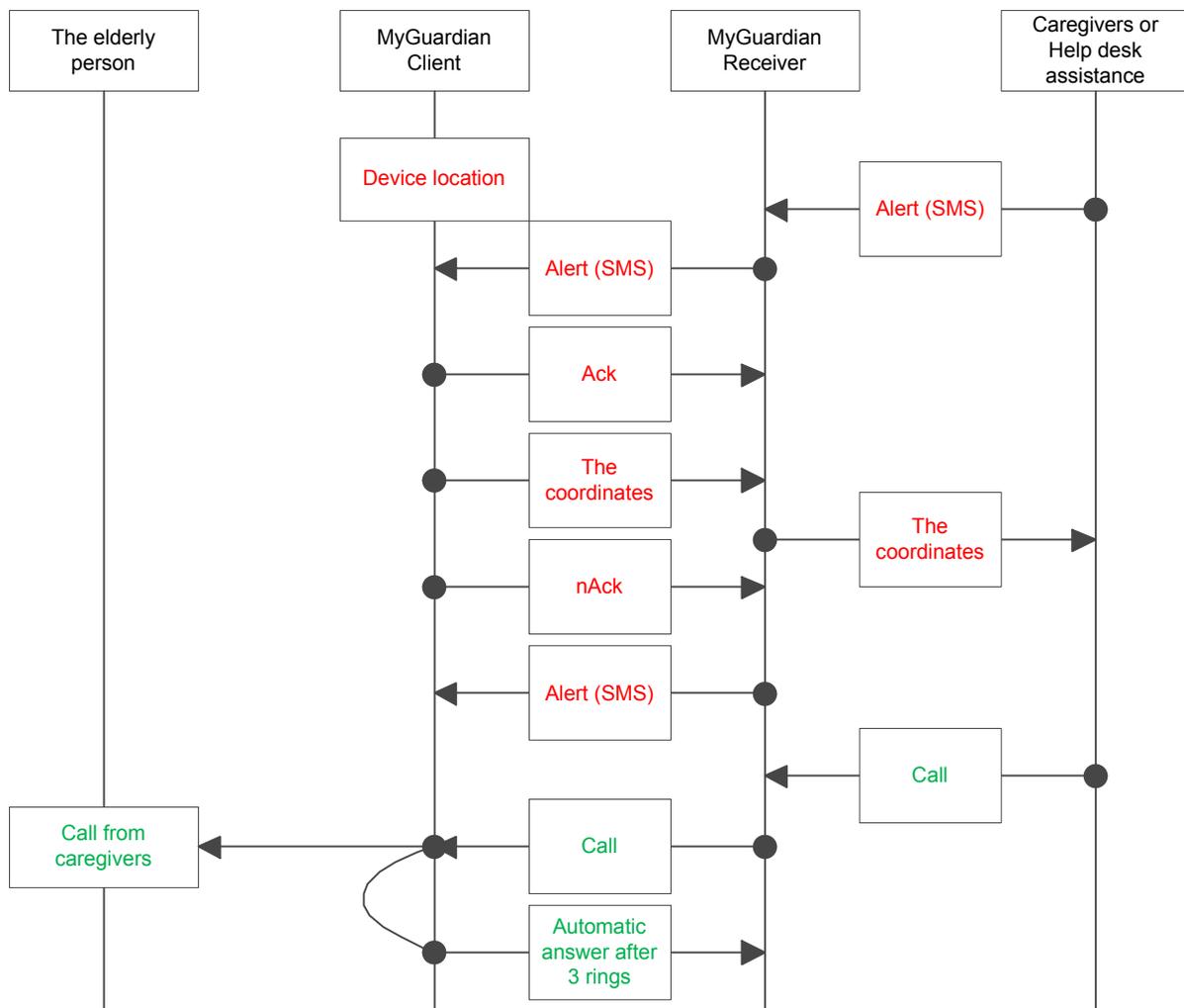
Figure 37: Sequence diagram from the caregiver to MyGuardian

USER SURVEY

4. User Survey

Based on the state of the art, the design proposed, this third part of the thesis consist of a survey completed by families of elderly person and professional caregivers in different care homes . In this section, I will present statistics and data analysis. I will also present and expose the words expressed by people who are in direct contact with people affected by dementia (*c.f.,* Annex B).

4.1.   Population

The target population of the survey is that of caregivers in different care homes and families of seniors with Alzheimer's disease living in the canton of Geneva and neighbouring France. This study consist of a set of families and caregivers of the department of Ain in France and various municipalities in the canton of Geneva (Versoix, Chêne Bougeries, Chêne Bourg, Cologny, Satigny, Bernex, Charmilles, Lancy, Veyrier, Eaux Vives, Drize, Vessy, *c.f.,* Annex D).

Families were contacted through my social network, and for the coordinates of care homes EMS (établissement médico-social) cited above, I did a search on the website http://www.ge.ch/ems/ where I took all telephone numbers, addresses, and emails. At first, I made a list sorted by municipality, and then I tried to call them. Of 48 EMS called, 26 refused, among them, there are some who preferred to participate by writing or email. The remaining 22 made an appointment or they proposed to recall me. Those to whom I sent emails, there are some who have responded and there are some who have not responded.

4.2.   Overview

The survey Annexed is seeking the views of the professional and voluntary caregivers through 30 main questions. It was developed in spring 2012 and presented in care homes and families in order to have their views on improving the design of MyGuardian

The questionnaire is divided into two main sections: general information and technology.

The contents of these sections are as follows: Issues relating to demographic and general information which are intended to understand and characterize the population of seniors and that of caregivers, in order to better review the design of MyGuardian. Then I have technical issues which constitute the core of this research.

In the survey there are some multiple-choice questions offered the option "other specify" to allow an opening on possible opportunities not provided. There are three issues which are entirely open to allow free expression of caregivers.

Finally, the main part covers the MyGuardian technical issues, which are: falls, localisation, cognitive impairment, miscellaneous services (miscellaneous information, press emergency button, leave the predefined area).

4.3. Results

4.3.1. Overview

26 questionnaires were completed including 4 by the families and 22 by caregivers working in different EMS. Results for both are presented separately in the following sections.

The study gave a number of calculations and partial results. To preserve the clarity of the presentation of results, several syntheses of analyzes were performed corresponding to various parts of the questionnaire: population, current uses of technology, relationship to new technologies, etc. These summaries are accompanied by tables, charts and a few paragraphs detailing the synthesis.

4.3.2. Care homes

Caregivers were on average 45,5 years (Figure 39) (stdev 8.26) but those suffering from Alzheimer are much older, the majority are between 80 and 89 years, with older women who are 90 years old. In general, women are the most numerous (59%) and in some care homes there are 41 % of both men and women (Figure 38).
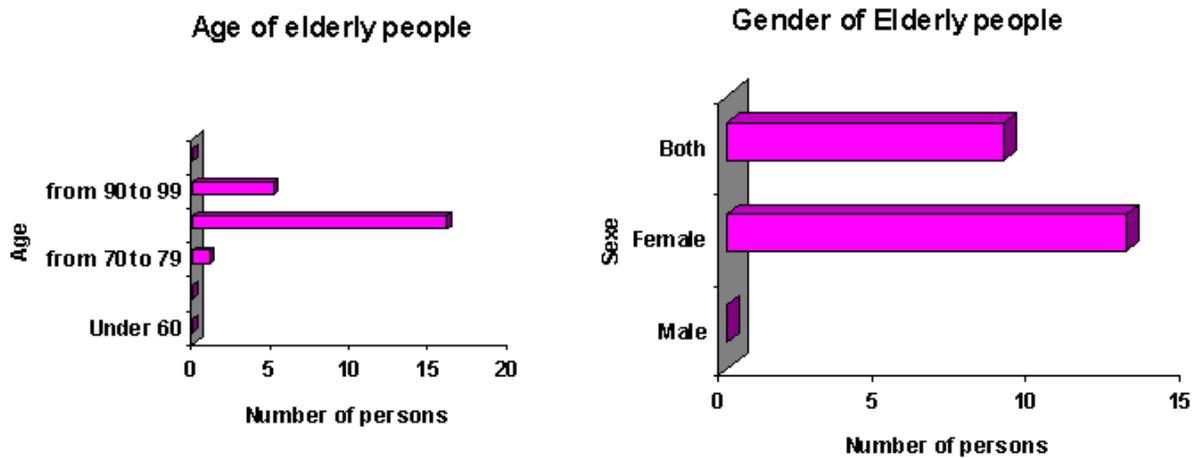
Figure 38: Age and gender of elderly people
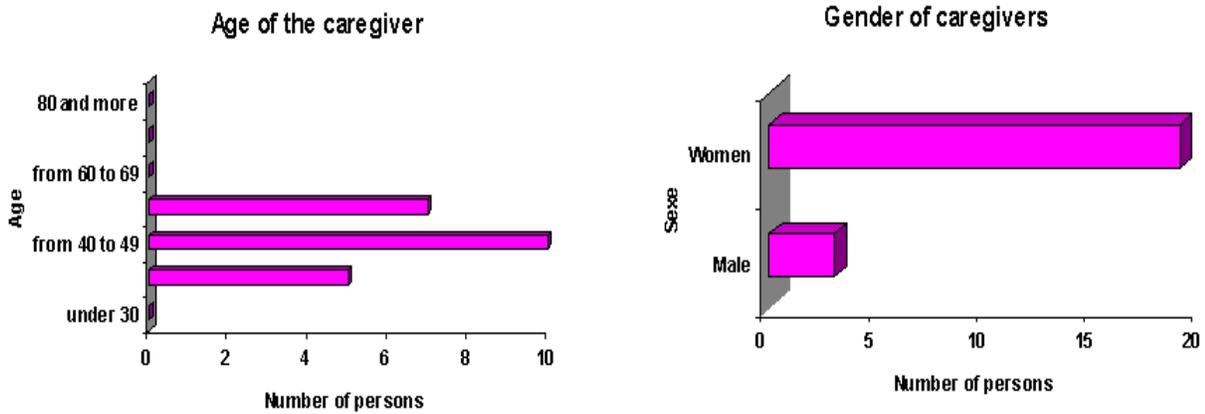
Figure 39: Age and gender of caregivers

Regarding the questionnaires, the majority of caregivers felt that the elderly people are not at all aware of their disorder (50%), and for those who answered "it depends" (13.6%) means that it depends on the time and it depends on the stage of the disease.
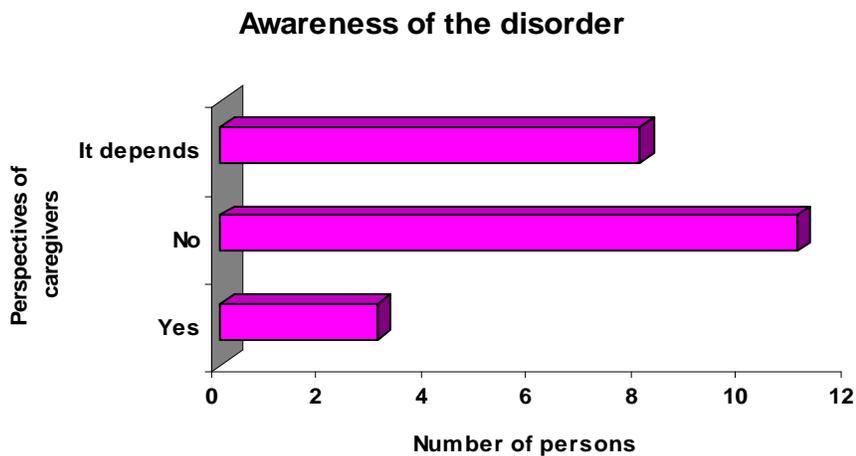
Figure 40: Awareness of the disorder of elderly people

The real time tracking does not depend on the stage of the disease, but according to caregivers, devices must follow the law and the privacy of residents. The geolocation of people with Alzheimer's disease should be done with the consent of families and the attending physician.

For those who answered "it depends" for the desired device, this means that everything depends on the character of people suffering from Alzheimer, and for those who answered "it depends" for the ability of pressing the emergency button, this means that some people in the medium stage can press the button and others cannot.

In the majority of the care homes, the people need assistance the entire day, so 90.9% (Figure. 43) depend on the presence of caregivers the whole day.
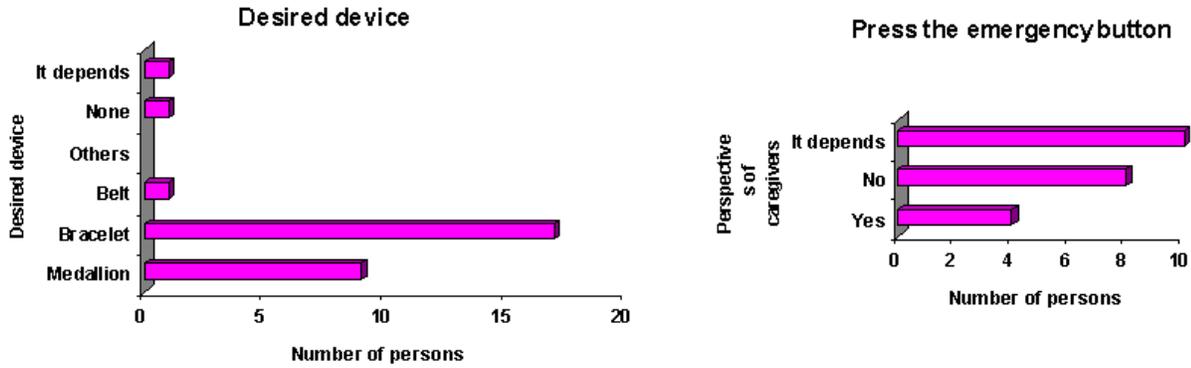
Figure 41: Desired device and ability of pressing the emergency button

For caregivers who do not want geolocation, it is because they see it as a restriction on freedom or it is because the residents are always accompanied by someone outside the residence.

As explained above, most of those who agree to geotaging residents, insist that it must respect the law.

Sending an SMS and receiving a reply with the details of a person whereabouts is very helpful as long as the text message sent is simple and predefined so it does not take much time for caregivers.

Among the care homes visited, one already use the geolocation of residents but it consumes battery power, so, they suggested a more reliable solution with an effective battery.
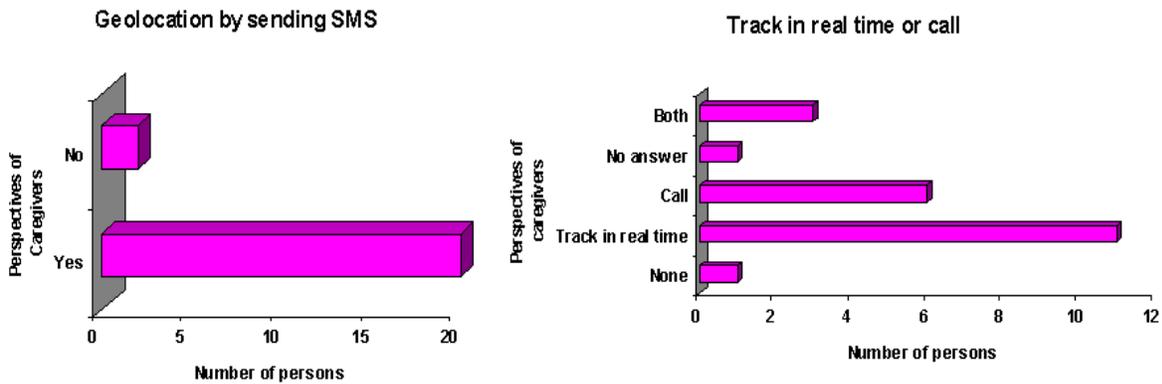
Figure 42: Real time tracking and geolocation by sending SMS

The degree of dependence of helped
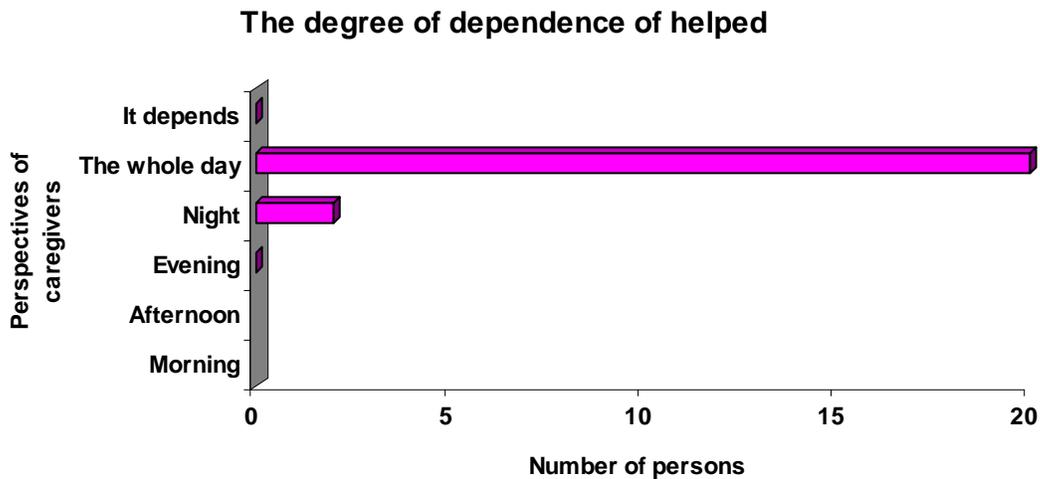
Figure 43: Degree of dependence of helped

Among those surveyed, 81.8 % are against the existence of help desk assistance and 18.2% are for the idea of employing a help desk for an assistance (besides EMS) to handle the contact with the person suffering from Alzheimer (see Figure 44).

Usefulleness of the help desk assistance
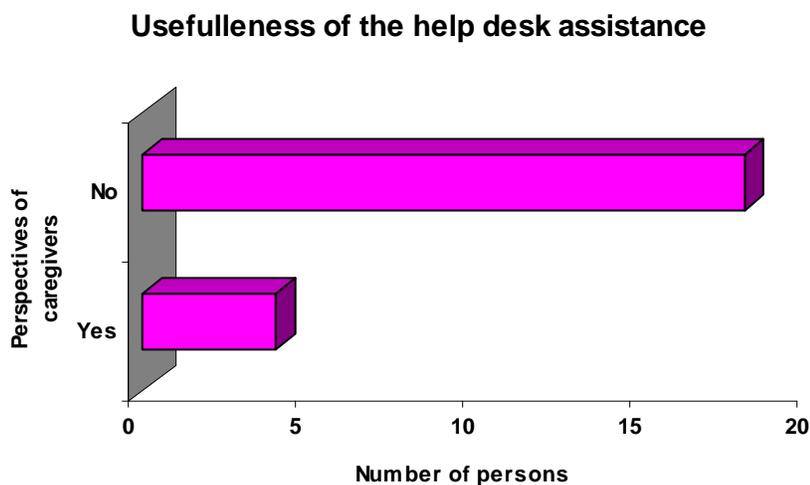
Figure 44: Usefulness of the help desk assistance

Based on the questionnaires completed, I can deduce that the time of onset of behavioral problems is 13.6 % from 14h, 9% from 15h, 18.2% from 16h, 36.4% from 17h, 4.5% from 18h and 18.2% depends on the character of the person.

I can also deduce also that 72.7% of seniors need the assistance of a relative 24 hours a day, 9% from 10 hours to 12 hours, 9% from 7 hours to 9 hours, 4.5% from 4 hours to 6 hours and for the remaining 4.5% it depends on the character of the persons.
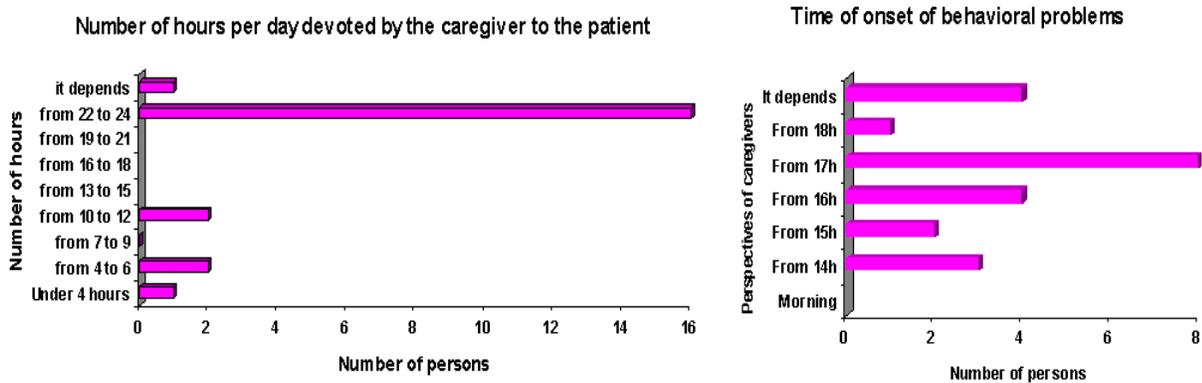
Figure 45: Time of onset of behavioral problems and number of hours per day spent by the caregiver

Among the caregivers surveyed, 45.45% prefer to be alerted by SMS, 13.63% prefer to be alerted via email and 40.9% prefer to be alerted by SMS and email at the same time. For 9% of these people, this device represents a threat, for 68.18% of caregivers, it represents a useful aid, for 13.63% of people it is a lack of freedom, 4.54% told that it depends on the stage and the remaining 4.54% did not answer this question.
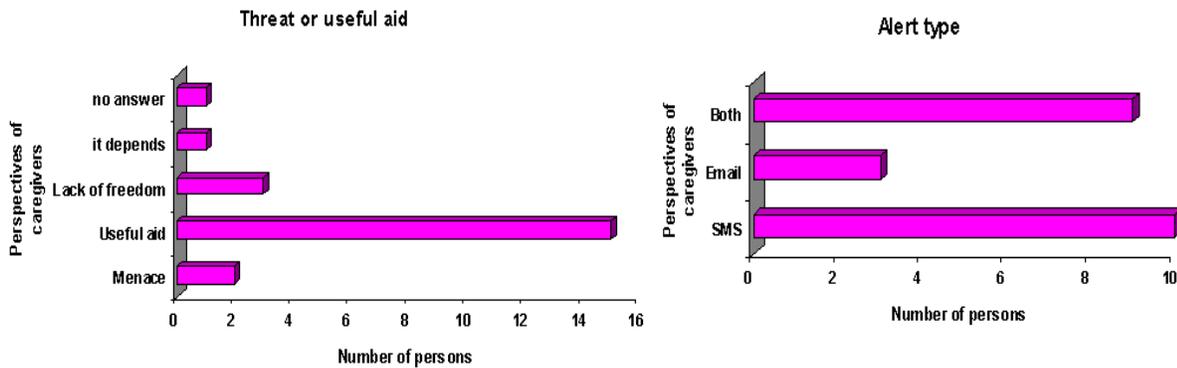
Figure 46: Threat or useful aid and alert type

4.3.3. Family

Four families were interviewed through my social network in different Geneva regions (Saint-Genis Pouilly, Jonction, Poterie, Petit Saconnex).

Scenario 1

The caregiver is 46 year old woman who assists her 74 year old mother. On the desired device, the caregiver wants a medallion or a bracelet on which the senior can press the emergency button if she is aware. On the other hand, she prefers not to involve help desk assistance because she prefers that the disease remain within family.

The caregiver insists that the act of sending an SMS and receiving a reply with the location details of the persons would be very helpful. The senior is not aware of her troubles, she is more agitated from 3 p.m. and she needs assistance for around 8 hours per day and 7 days a week. The interviewee prefers to be alerted by email and SMS in case of problems or alerts. The caregiver adds that she is helped by her sister to take care of her mother.

Scenario 2

The second caregiver is 29 year old, and she helped is an 84 year old family member who is suffering from Alzheimer. The senior cannot press an emergency button fixed on a device because she will not remember its usefulness. The caregiver prefers not to involve the help desk assistance for the privacy of the person. Contrariwise, she prefers to close the door of the house for her safety. For her, the act of sending an SMS and receiving a reply with the details of where the person is would be very helpful. The Alzheimer's sufferer is aware of her troubles; they are more sever when she wakes up from a nap or in the morning. The senior needs assistance for around 5 hours per day and 7 days a week. The interviewee prefers to be alerted by SMS if anything goes wrong.

Scenario 3

The third caregiver interviewed is a 59 year old housewife. She cares for 72 year old man. On the desired device, the senior wishes to wear any device and he admits, the existence of the help desk assistance to contact the person suffering from Alzheimer would help.
By sending an SMS and receiving a reply with the details where is the person would be very helpful. The caregiver does not know if the senior is aware of his disorder because he thwarts her and he does not want to be told that he has Alzheimer's. The interviewee prefers to be alerted by SMS if anything goes wrong.

Scenario 4

The last caregiver surveyed is 29 year old, and the senior is 96 year old. On the desired device, the caregiver wants a bracelet on which she can press the emergency button. The interviewee prefers to involve help desk assistance. She confirms that the act of sending an SMS and receiving a reply with the details where is the person would be very helpful. Her helped is unaware of her disorder, she is more agitated from 4 p.m. and she needs the presence of her helper1-2 hours per day plus several hours per day of professional caregivers. The interviewee prefers to be alerted by email and SMS in case of problems. The caregiver adds that she is helped by care homes to take care of the senior. For all the people surveyed, this device represents a useful aid.

4.3.4. Free comments on the entire survey

Question 1 asks the caregiver to describe how they spend 24 hours with a person suffering from Alzheimer. 22 responses, of the 22 questionnaires, were written by caregivers in response to this question and 4 answers from the 4 questionnaires were written by the families (*c.f.,* Annex B).

Question 8 provides an opportunity for the caregivers to explain what they think about MyGuardian and say if they want to have more or less features than the design. 26 responses, of the 26 questionnaires, 22 of which were written by caregivers and 4 answers were written by the families (*c.f.,* Annex B).

The last question offers the caregivers an opportunity to expose their opinions and ideas that come to mind about the whole questionnaire. 13 comments, among the 22 questionnaires, were written by caregivers in response to this question and 3 comments of the 4 questionnaires were written by the families (*c.f.,* Annex B). All these comments show a range of points of view.

For all the families surveyed, the GPS tracking is very useful but none of them use any device of geolocation, and 2 out of 4 respondents would prefer their elderly people's illness remains in family without involving a help desk assistance.

For all, the act of sending an SMS and receiving an automatic reply with the location details is very helpful and in general this device represents a useful aid. 3 respondents prefer to be alerted via SMS and a one person prefers to be alerted via SMS and email both to be sure of receiving the alert.

Among the relatives, there is one person who think the design of MyGuardian is very interesting as an idea in the sense that this device is as unobtrusive as possible in terms of size.

Regarding the professional caregivers, opinions are different from one person to another. Losing the elderly person is a very common problem. For most, the idea of GPS tracking is very useful and practical, but, we must be attentive to the installation of a pet fencing system for care homes which is a decision to make with a multidisciplinary team and families because it is considered a restraint like the bed rails. Long search procedure can be avoided by using this device, but Wi-Fi can be a disadvantage because of health.

The persons interviewed suggested having a sensor to monitor the phase of sleep to check objectively if the person slept well or not, because even if the elderly people say they slept well this may not be the case. It was also suggested to design a device which looks like a watch, as this will be less cumbersome and less likely to be removed.

In all EMS surveyed, most of them use devices that allow continuous monitoring and which have the autonomy and some form of freedom to the person helped. Alarm systems used allows to let the seniors more independent and autonomous in their mobility around care homes.

Among the devices used include: an anti-wandering, alarm, call caregivers, surveillance cameras, carpets alarm system. In one care home, residents use a watch alarm named Vivago, which allows seniors to alert the caregivers by pressing the manual alarm button if necessary,

and generates automatic alarms according to customized programming (when the senior leaves the controlled doors of the building). In another care home, they plan to use HealthCarion which they sent to the distributor for the translation of the documentation and which they have not yet received. Among the care homes visited, there are also care homes fenced and closed with the existence of a gate closing the enclosure of the EMS by code (for severe dementia).

Of those interviewed: 1) There are some persons who think that MyGuardian should be very useful, especially that the call is forwarded to the help desk assistance if they are not available while still respecting the law, and deprivation of freedom. 2) Other people suggested to have a more powerful battery with low weight and a cheap price. 3) There are some persons who do not like the police surveillance that interferes with the freedom of residents and others who say that it is somewhat complicated device and the distributor should think of several types that are reliable and tailored for each person. 4) Last but not least, another category of respondents find that this device could be interesting for mild cognitive impairments, and for more serious impairments its use would be reassuring.

Analysis and Synthesis

5. Analysis and Synthesis

The pace of innovation in the field of new technology is that we do not know where the "new" stops and when starts the already "old". This reflection on the geolocation of people with cognitive impairment can have a tentative conclusion because each of the device's characteristics cited in this thesis continues to evolve continuously.

As many families and caregivers are seeking to well secure the elderly people and to avoid long research following the fugue, MyGuardian is therefore required more and more as an essential service for seniors with cognitive impairment.

By developing a complete and innovative device as "MyGuardian", the project consortium group has adapted to changing market and think now about offering a new solution. MyGuardian device gathers the essential elements of geolocation and monitoring people with cognitive impairment. The ultimate goal is to satisfy the needs of seniors, families and professional caregivers.

Geolocation of people suffering from cognitive impairment plays an increasingly important role in our daily life. For this reason, companies are therefore investing more and more in Information Systems to give them the means to progress and to meet the needs of customers.

The development of the geolocation device is undeniable, and certainly desirable because of many advantages (time saving, better targeting, reduced fugues, more security .), both for professional caregivers and for families. But these advantages can become disadvantages: (police surveillance, deprivation of liberty .).

This new device enables caregivers to make less effort and to have more details for example (the exact position of the senior, the phase of sleep, the battery level .).

Based on the state of the art, the design proposed and the user survey, I propose to develop a service with the following options:

a) A device which is easily reconfigurable depending on the stage of the disease defined by the caregiver
b) A phase of sleep to see if the person has slept well
c) A device that has an automatic answer after 3 rings in case the person is not able to press the button to answer
d) A device which is as unobtrusive as possible in terms of size
e) A powerful battery with low weight and a cheap price
f) A device with the possibility to send an SMS by caregivers and receive an automatic reply SMS with the location of the person
g) A device that sends an alert if the battery is low, if the person falls, if the senior leaves the predefined area, or if the device is removed
h) A device with automatic recording of all data from the alarm and the various activities which is very useful for subsequent analysis
i) A device that combine three techniques of geolocation which allows to geotag the senior outside using GPS, and keep track of him inside buildings using GSM technology coupled with Wi-Fi for more accuracy

j) A device with an emergency button which can be easily pressed by the senior in the case of an emergency

k) An enabled GPS device to know if the person leaves the predefined area, to know the current location and for a real time monitoring

l) A device with a powerful memory for storing the predefined areas and numbers to be called, in case of problems, which are programmed by caregivers

m) A device with convenient buttons for calling the programmed numbers

n) A device with a LED to warn the senior of the level of charge of the battery

o) A device without locking mechanism for wearer, because after interviewing various caregivers, I realize that this is a deprivation of liberty

p) A device with an included altimeter to know the height relative to a reference level (the ground) in order to be alerted when the elderly person falls down.

q) I suggest developing a web interface to allow caregivers to: a) program the secure zone, b) program the numbers to be called in case of problems, c) know the location of the senior, d) last but not least, check the level of charge of the battery.

r) Last but not least, I suggest having a help desk assistance for care homes who are interested or for families who are often busy or who are frequently away from the elderly people.

Despite of different opinions from one person to another, the idea of GPS tracking remains very useful and practical. The results of studies and analyzes to be made during the interrogation of families in the next steps can also lead to a review or to modify the characteristics of MyGuardian.

Last but not least, to complete this work, I have faced two main challenges:

a) The first challenge occurred while reproducing the questionnaires. By interviewing caregivers, I realized that the overview of MyGuardian should be represented at the beginning of the questionnaire and not the middle, because every time I started the explanation from the middle of the survey.

b) The second challenge occurred while contacting families for the distribution of questionnaires. Generally, families prefer that their health problems remain with the family.

CONCLUSIONS

6. Conclusions

I am very satisfied to have had the possibility to complete my thesis at the University of Geneva (within the Quality of Life Group). The work has been very interesting and diverse and I had the opportunity to learn a lot in the field of geolocation, and also in the field of medicine.

This work aims to study different geolocation devices, collect the opinions of different professional caregivers and propose a design for the new device. Because developing device is a broad area, I could explain here only one type of design that seems reliable and could be accepted by people suffering from Alzheimer's disease and their caregivers.

This thesis has enabled us to reflect and ask ourselves a number of questions. After evaluating the results of our researches, I have produced a number of observations. I noticed a real interest on the part of most caregivers and families which had the habit to control the seniors by using anti-wandering devices or visual surveillance.

In terms of geolocation and tracking in real time, I support our conclusions on the results obtained from interviews (see Annex B). It appears that caregivers who previously used the real-time monitoring have fewer problems with runaways. However, it is interesting to note that sending an SMS and receiving a reply with the details of persons whereabouts is the best answer to this problem. In addition, caregivers get a response in an optimized time. This strategy helps fill gaps, however, one wonders if it provides a real need without inconvenience.

In the choice of contact between caregivers and seniors, I can also consider what is more accessible by caregivers, in fact, an SMS indicating the coordinates where the senior is located is sufficient, or rather just receiving an email.

During my thesis I did not face any severe problems. Sometimes there were small challenges, which I managed to overcome quickly, due to the environment in the department. I always had the possibility to ask assistants if I did not know how to proceed. While working on my thesis, I had a strong influence on the project and tasks I wanted to work on. In general I had the possibility to choose which tasks and parts I wanted to start with.

As I interviewed a lot of professional caregivers working in different care homes, I propose to follow up and continue working on survey with the families. This project is still in process, and it will be interesting to see its future development. To finish and to open to new information technologies and communication, one might wonder, always in response to our problem, the use of a new tool such as the implant would be effective.

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Annexes

A. Survey

UNIVERSITÉ DE GENÈVE

FACULTÉ DES SCIENCES ÉCONOMIQUES ET SOCIALES
Département des hautes études commerciales

Étude des différents dispositifs de géolocalisation pour les personnes atteintes de la maladie d'Alzheimer

• A remplir par les aidants principaux des personnes atteintes de la maladie d'Alzheimer.
• Répondez aux questions en cochant la réponse de votre choix. Si vous ne souhaitez pas répondre à l'une des questions, passez à la suivante.
• "Votre aidé(e)" désigne la personne souffrant de la maladie d'Alzheimer dont vous vous occupez.

Cette enquête s'inscrit dans le cadre d'une étude menée par Dr Katarzyna Wac à l'Université de Genève.

But de l'étude
Les principaux objectifs à atteindre dans notre recherche sont, en premier lieu, permettre la communication entre la personne âgée qui souffre d'Alzheimer et sa famille ou les soignants, puis, la surveillance à distance et la coordination.

Procédures
Dans le cadre de cette étude, il vous sera demandé de remplir un questionnaire. Le temps estimé pour l'enquête est de 30 minutes.

Exigences des participants
La participation à cette étude est limitée aux personnes de 18 ans et plus, et qui sont en contacts avec des personnes souffrantes d'Alzheimer.

Risques
Les risques et le non confort associés à la participation dans cette étude ne sont pas plus grand que ceux rencontrées dans la vie courante ou autre activité.

Avantages

Il peut n'y avoir aucun avantage personnel à partir de votre participation à l'étude, mais les connaissances reçues peuvent être de valeur pour l'humanité et pour votre entourage.

Confidentialité

En participant à cette enquête, vous comprenez et acceptez que les données et informations recueillies au cours de cette étude peuvent être utilisées par le département Quality of Life de l'université de Genève.

Si vous avez des questions au sujet de cette étude, vous avez la possibilité de communiquer directement avec Dr Katarzyna Wac, par courrier, téléphone ou émail à:

Dr. Katarzyna Wac
Université de Genève
Institut de Science des Services
Quality of Life
Battelle bâtiment A-205
7, route de Drize
CH-1227 Carouge
Switzerland
Tel.: +41 22 379 02 42
katarzyna.wac@unige.ch

Votre participation à cette recherche est volontaire. Vous pouvez cesser de participer à tout moment au cours de cette enquête.

Je suis âgée de 18 ou plus:

☐ j'ai lu et compris les informations ci-dessus

☐ j'accepte participer à cette enquête

1) Comment vous passez les 24 heures avec votre aidé ?

2) Au cours des 4 dernières semaines, votre aidé(e) a-t-il/elle utilisé d'une manière autonome les dispositifs de géolocalisation suivants ?

- [ ] Columba
- [ ] GPS shoe
- [ ] Nu.m8+
- [ ] Kéruvé Pro
- [ ] Témo
- [ ] GSM Aladia 3000
- [ ] Aladia go
- [ ] Bracelet B2
- [ ] Geo 300
- [ ] Saver Life
- [ ] Geophone Pack Senior
- [ ] Locate Box Solo
- [ ] Vega
- [ ] Limmex
- [ ] Aucun
- [ ] Autres – Précisez

3) Apprécieriez-vous les dispositifs suivants ?
- [ ] Columba
- [ ] GPS shoe
- [ ] Nu.m8+
- [ ] Kéruvé Pro
- [ ] Témo
- [ ] GSM Aladia 3000
- [ ] Aladia go
- [ ] Bracelet B2
- [ ] Geo 300
- [ ] Saver Life
- [ ] Geophone Pack Senior
- [ ] Locate Box Solo
- [ ] Vega
- [ ] Limmex
- [ ] je ne connais pas

4) Pensez-vous que votre aidé(e) pourrait appuyer lui-même sur un bouton d'alerte (s'il a fait une chute, s'il s'est égaré hors du logement et ne retrouve plus son chemin, s'il a un malaise, s'il a oublié comment faire quelque chose …) fixé sur :

- ☐ Un médaillon
- ☐ Un bracelet
- ☐ Une ceinture
- ☐ Autres - Précisez

5) Si vous aviez à choisir entre le suivi en temps réel et entendre votre aidé(e) en cas de problème (chute, angoisse…), que préféreriez-vous ?

6) Pour vous permettre de sortir de chez vous en toute tranquillité, un système permettant à un centre de télésurveillance professionnel à distance de voir et d'entendre en permanence (micros, caméras) votre aidé(e) où qu'il/elle soit dans son habitation : est-ce que ce serait une aide ?

7) Suivi dans les rues pour la localisation, un système vous permettant de savoir où se trouve votre aidé(e) lorsqu'il sort de chez lui, c'est-à-dire permettant de le retrouver facilement s'il est perdu, s'il n'est pas rentré au bout d'un certain temps : est-ce que ce serait une aide ?

MyGuardian est un dispositif qui vise à faciliter la mobilité sûre et sécuritaire des personnes âgées ayant une déficience cognitive légère, la surveillance à distance et de l'assistance et aussi de permettre la coordination entre les soignants bénévoles et professionnels
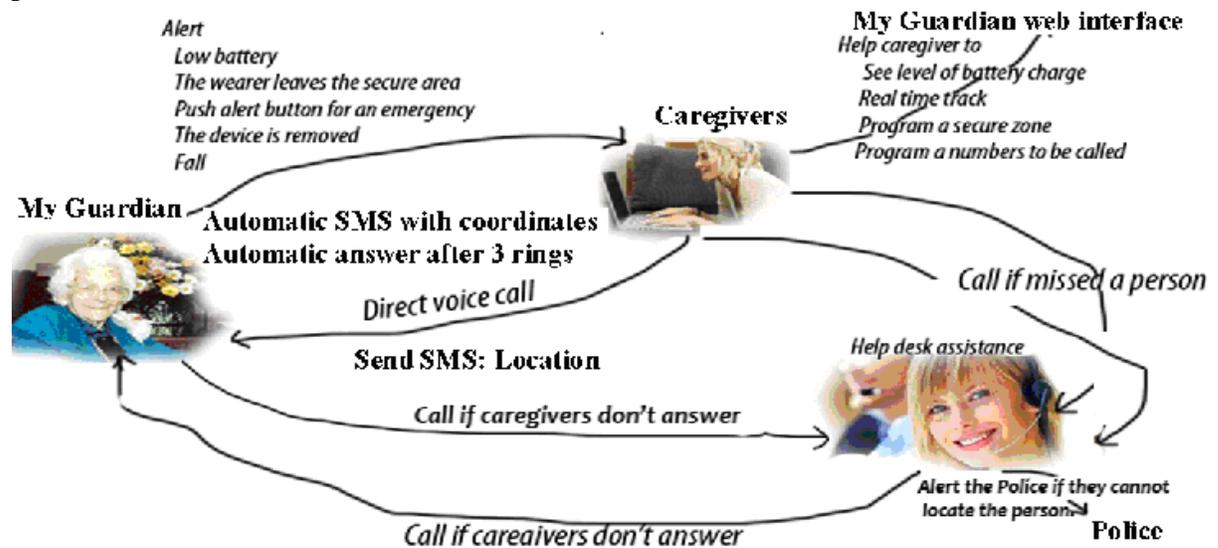
8) Que pensez-vous de ce nouveau dispositif ?

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9) Aimeriez-vous être informé par émail ou SMS en cas de batterie faible ?

10) Aimeriez-vous être informé par émail ou SMS en cas de violation de la zone programmé ?

11) Aimeriez-vous être informé directement par téléphone en cas crises ou par le biais d'un centre d'assistance ?

12) Pour vous et votre aidé(e) toutes les technologies évoquées dans ce questionnaire sont-elles dans l'ensemble une menace pour votre intimité et pour le respect de la dignité de votre aidé(e), ou sont-elles plutôt des aides utiles ?

Questionnaire général :

13)   Votre Age ?

14)   Age de la personne souffrante d'Alzheimer

15)   Sexe
  ☐ Masculin
  ☐   Féminin

16)   Ou vit-elle ?
  ☐ Maison individuelle
  ☐ Appartement
  ☐ Maison de retraite
  ☐ Foyer de logement
  ☐ Autres- Précisez

17)   Vivez-vous avec votre aidé(e) ?
  ☐ Oui
  ☐ Non

18)   Si non, combien de temps vous faut-il pour vous rendre auprès de votre aidé(e) ?

19)   A votre avis, quel est le degré de dépendance de votre aidé(e) ?

☐ Le Matin

☐ L'après-midi

☐ Le soir

☐ La nuit

☐ Toute la journée

20)   Votre aidé(e) a-t-il/elle conscience de ses troubles ?

21)   Combien d'heures par jour, en moyenne, êtes-vous auprès de votre aidé(e) ? Combien de jours/semaine ?

22)   Vous accordez-vous un temps de liberté sans votre aidé(e) ?

23)   Souhaitez-vous être aidé(é) pour vous occuper de votre aidé(e) ?

24)   Dort-il facilement plus d'une heure pour la sieste ? S'endort-il dans la matinée ?

25)   Croit-il qu'on lui veut du mal ? Qu'on va le voler ?

26)   Est-il moins calme ou plus agité en fin d'après-midi ? Ses troubles du comportement sont-ils plus importants à partir de quelle heure ?

27)   Se met-il facilement en colère pour de simples remarques ?

28)   Est-il toujours en mouvement ?

29)   Se fait-il maintenant du souci pour tout ?

30)   A-t-il du mal à rester seul car il a toujours besoin de la présence d'un proche pour le rassurer ?

31)   Merci pour votre aide. Commentaires ?

B. Feedback

B1 : Comment vous passez les 24 heures avec votre aidé ?

Familles :

----

1. One or two time per month we received a call from the retirement home, telling us that our grandmother is missing and we had to go outside and search her in the city (which was quite difficult sometimes as she was physical still very fit)

----

2. Je souffre beaucoup, je ne peux pas beaucoup m'éloigner de ma mère, je m'inquiète beaucoup quand elle sort seule. Je dois l'accompagner pour faire toutes les faits de la vie quotidienne. J'habite pas très loin de chez elle.

----

3. Même moi je suis perturbé, ma belle-mère aussi avait Alzheimer, la crise peut lui arriver à tout moment dans la journée.

----

4. C'est une journée normale, je lui prépare à manger parce qu'elle ne sais plus ce qu'elle doit faire, je dois faire attention pour qu'elle ne sorte pas. Je dois lui chercher la lecture pour qu'elle ne s'ennuie pas même si elle ne se rappelle pas des pages précédemment lues.

EMS :

----

1. Nous utilisons des dispositifs qui permettent une prise en charge sans contraintes lourdes (ex :surveillance par un tiers, contention strictes, ceinture) et de présenter l'autonomie et une certaine forme de liberté à la personne aidé

----

2. Nos systèmes d'alarme nous permettent de les laisser le plus indépendants et autonomes dans leur faits et gestes , aller et venues dans les résidences.

----

3. Avec les dispositifs anti-errance, alarme, appel soignants, cameras de surveillance.

----

4. On surveille, on accompagne pour les sorties, on utilise les tapis d'alarme.

----

5. Dans le cadre de notre EMS, les résidants sont équipés d'une montre alarme Vivago, qui permet d'appeler et qui génère des alarmes automatiques selon la programmation personnalisée faite.

----

6. Surveillance permanente.

----

7. Très difficile avec une nouvelle dame qui a cette maladie et qui veut très souvent retourner à son domicile.

----

8. Surveillance visuelle régulière, résidence clôturée et fermée.

----

9. Dispositif (montre bracelet) de gestion d'alarme avec un paramétrage des zones de déplacements (avec accord de la famille et du médecin), suivi en temps réel si on le veut, bouton d'alerte et l'infirmière acquitte avec un badge pour que l'infirmier chef soit au courant et on peut parler avec eux seulement s'ils sont dans la chambre.

----

10. Système bracelet anti-errance lorsque la personne passe la porte => sonnette sur les téléphones des soignants.

----

11. Existe une surveillance 24/24 avec la présence des soignants de jours et de nuits. Il existe un dispositif à type montre « alarme » pour les résidents à troubles cognitifs légers. Ce sont les résidents qui appuient sur le bouton.

----

12. Boucle et bracelet anti-fugue, vidéo surveillance et protocole de recherche certifié ISO.

----

13. Compte tenu du peu de résidant nous pouvons assurer une présence constante auprès de l'aidé (équipe soins et animations), existence d'un système d'alarme mobile que l'aidé peut actionner, existence d'un portail fermant l'enceinte de l'EMS avec digicode.

----

14. Surveillance visuelle, accompagnement

----

15. Tapis alarme, montre anti-errance

----

16. Portail avec digicode, Montre alarme (zones prédéfinies)

----

17. Structure sécurisée par soignants, système caméra à l'extérieur, jardin clôturée avec code.

----

18. Dispositif anti-fugue (visuelle et audio)

----

19. Bracelet alarme anti-fugue

----

20. Appel soignant, résidence sécurisée.

----

21. Nous avons un dispositif permettant aux résidents d'appeler (système montre). Nous pouvons également les localiser s'ils n'ont pas la possibilité d'appeler. Nous pouvons programmer un périmètre de sécurité.
    Si le résident dépasse ce périmètre une sonnette/téléphone nous informe.

----

22. Résidence avec clôture et portail avec digicode. Surveillance visuelle de proximité (soignants…)

B2 : Que pensez-vous de ce dispositif ?

Familles :

----
1. très intéressante comme idée dans le sens ou ce dispositif soit le plus discret possible en terme de taille.
----
2. rassurant, utile
----
3. une aide merveilleuse, ça va beaucoup nous aider et va nous empêcher de s'inquiéter tout le temps.
----
4. I think it should be very useful, especially that the call is forwarded to help desk assistance if I am not available.

EMS :

----
1. Intéressant pour les personnes à domicile
----
2. Intéressant pour le domicile
----
3. Oui, pas besoin de centre d'assistance médicale. Gestion en institution et en familles
----
4. Ce dispositif peut être rassurant pour les familles car il permet de localiser les personnes
----
5. Bon
----
6. A l'air intéressant.
----
7. très bien., important d'avoir ce dispositif pour plus de sécurité, une batterie plus puissante avec un poids faible, pas besoin de centre d'assistance, prix pas cher.
----
8. je n'aime pas cette surveillance policière qui entrave la liberté des résidants.
----
9. un peu compliqué et peut être penser aux plusieurs types qui soient adaptées aux différents personnes plus ou moins atteint de la maladie.
----
10. très utile pour les familles.
----
11. intéressant pour les déficiences cognitives légères et impossible à un stade plus grave mais peut rassurer.

----

12. très bien, rassurant.

----

13. il n'est pas nouveau de conception ce qui est bien est qui vous cherchez à l'améliorer.

----

14. dispositif déjà connu, serait un plus et important d'être fiable à 100%, la géolocalisation est un plus qui doit pouvoir être programmé suivant chaque personne.

----

15. intéressante quand le dispositif averti que la batterie est faible

----

16. Ce dispositif me paraît adapté, surtout pour les aidés qui ne sont pas placés en institutions.

----

17. J'apprécie ce dispositif, mais pas besoin de centre d'assistance médicale. Gestion en institution

----

18. En milieu d'EMS, ce dispositif ne semble pas adéquat et adapté dans un lieu avec beaucoup de résidants. Déjà notre logo « c'est la liberté chez soi », donc à mon avis, on ne peut pas utiliser ce dispositif.

----

19. Bon système.

----

20. Utile mais il faut que ça respecte la loi, et privation de la liberté.

----

21. Pour les stades non sévères de la maladie

----

22. Il parait pratique, fonctionnel et permettant la sécurité pour les personnes atteintes d'Alzheimer.

B3 : Commentaires

Familles :

----

1. For me the GPS tracking is very useful, as my grandmother often "runs away" and gets lost in the city which can be a danger for her (once she was found after 2 days by hikers on a mountain)

----

2. j'aime bien la structure des questions, ils sont très techniques, je trouve que cette maladie est complexe qui peut rendre la famille malade. Ma mère a souvent peur.

----

3. très utile, pratique, je préfère l'avoir en téléphone comme ça mon mari peut l'accepter. J'en doute fort qu'il l'accepte en bracelet ou autre forme.

EMS :

---

1. Etre attentif à la pose d'un système anti-fugue, décision à prendre avec une équipe pluridisciplinaire et familles, c'est une contention au même titre que les barrières de lits.

---

2. comment faire si les personnes contrarient de porter le dispositif. Idée par d'autre scientifiques : peut être penser à un implant pour la géolocalisation

---

3. Comme le projet est séduisant et efficace, je souhaite qu'il aboutisse

---

4. Une grande aide pour les malade d'Alzheimer

---

5. Je travaille en EMS en qualité d'infirmière responsable. Ces réponses concernent l'ensemble des résidants. Donc 25 résidents.

---

6. Très utile, une aide pour les personnes âgées qui quittent leur maisons, dans les 3-4 mois qui suivent ils veulent retourner chez eux à pied, en bus. La plupart d'entre eux ne sont pas capable de répondre depuis un mobile, la personne dont j'ai parlé n'aime pas la technologie. Je trouve qu'un appareil qui ressemble à une montre sera moins encombrante et moins susceptible d'être enlevé.

---

7. Système très utile pour les personnes avec maladie d'Alzheimer

---

8. J'en doute fort qu'il l'accepte en bracelet ou une autre forme.

---

9. Utile, en tant que responsable de sécurité, la procédure de recherche longue peut être éviter à l'aide de ce dispositif. Ça arrive que les résidents se cachent à l'intérieur du bâtiment, ils prennent le bus tout de suite en sortant, du coup, on ne sait pas où ils sont. Wi-Fi peut être un inconvénient.

---

10. c'est une problématique très actuelle dans notre établissement.

---

11. Je suis ergothérapeute en EMS, c'est là ma relation à mon aidé.

---

12. Je suis ergothérapeute qui suit l'aidé dans son retour ou préservation de son autonomie. On a essayé Healthcarion, mais ça ne marche pas, on attend toujours la traduction.

---

13. Phase du sommeil pour voir si la personne a bien dormi parce qu'ils peuvent dire qu'ils ont bien dormi alors que ce n'est pas le cas. Simple.

B4 : Definitions of Alzheimer

Selon Mme Mikaela Halvarsson « psychologue de l'EMS des Charmettes et L'EMS Val Fleuri »

La maladie d'Alzheimer évolue en trois phases :

1) Première phase: forme légère

Les troubles mnésiques sont constants

2) Deuxième phase: forme modérée

Les troubles mnésiques devient invalidant avec un retentissement sur l'orientation temporo-spatiale, s'y associe des troubles du langage, des praxies (mouvements deviennent difficiles) et des gnosies (non reconnaissance des objets).

3) Troisième phase: forme sévère

La mémoire est massivement altérée, les possibilités de langage très réduites.

C. Relevant Alzheimer Associations

France
Association France Alzheimer
21 Boulevard Montmartre
75002 Paris
Tel: +33 1 42 97 52 41
Fax: +33 1 42 96 04 70
Email: contact@francealzheimer.org
Web: www.francealzheimer.org
Union nationale des associations Alzheimer
Web : www.francealzheimer.org
Association Alzheimer Paris Familles
Web : www.alzheimer-paris.org

Germany
Deutsche Alzheimer Gesellschaft
Friedrichstr. 236
10969 Berlin
Tel: +49 30 315 057 33
Helpline: 01803 171 017
Fax: +49 30 315 057 35
Email: deutsche.alzheimer.ges@t-online.de
Web: www.deutsche-alzheimer.de

Alzheimer Europe
145 route de Thionville
Regional groups
Luxembourg
L-2611
Tel: +352 29 79 70
Fax: +352 29 79 72
Email: info@alzheimer-europe.org
Web: www.alzheimer-europe.org

Italy
Federazione Alzheimer Italia
Via Tommaso Marino 7
20121 Milano
Tel: +39 02 809 767
Fax: +39 02 875 781
Email: alzit@tin.it
Web: www.alzheimer.it

Netherlands
Alzheimer Nederland
Post Bus 183
3980 CD BUNNIK
Tel: +31 30 659 6900
Helpline: 030 656 7511
Fax: +31 30 659 6901
Email: info@alzheimer-nederland.nl
Web: www.alzheimer-nederland.nl

Spain
Confederación Española de Familiares de
Enfermos de Alzheimer
C/ Pedro Miguel Alcatarena nº 3
31014 Pamplona (Navarra)
Tel: +34 902 174 517
Fax: +34 948 265 739
Email: ceafa@ceafa.es
Web: www.ceafa.es

Switzerland
Association Alzheimer Suisse
8 Rue des Pêcheurs
CH-1400 Yverdon-les-Bains
Tel: +41 24 426 2000
Email: alz@bluewin.ch
Web: www.alz.ch

D. Care Homes in Geneva Area

Ems* Nant d'Avril
Chemin de Merdisel 30,
case postale 168,
1242 Satigny GE

Ems Coccinelle
Avenue du Petit-Senn 55,
1225 Chêne-Bourg GE

Ems les Marroniers
Chemin de la Bessonnette 9
1224 Chêne-Bougeries GE

Ems Prieuré
Chemin du Pré-du-Couvent 3,
1224 Chêne-Bougeries GE

Ems Châtaigniers
chemin des Marais 162,
case postale 159,
1255 Veyrier GE

Ems Drize
Route de Drize, 61
1234 Vessy GE

Ems Vessy
Route de Veyrier 85,
1234 Vessy GE

Ems Mimosas
Route de Malagny 39,
1294 Genthod GE

Ems la Méridienne
Route de Rossillon 18,
case postale 81,
1231 Conches GE

Ems les Pins
Chemin de l'Erse 2,
case postale 242,
1218 Le Grand-Saconnex GE

Ems les Mouilles
Chemin des Mouilles 3,
1213 Petit-Lancy GE

Ems la Vendée
Chemin de la Vendée 1,
1213 Petit-Lancy GE

Ems Charmilles
Promenade de l'Europe 67,
1203 Genève GE

Ems du Petit Saconnex
Avenue Trembley 12,
1209 Genève GE

Ems Petite-Boissière
Route de Chêne 46,
1208 Genève GE

Ems la Terrassière
Rue de la Terrassière 7,
1207 Genève GE

Ems les Tilleuls
Rue de Moillebeau 1,
1209 Genève GE

Ems Val Fleuri
Route du Bout-du-Monde 18,
1206 Genève GE

Ems Saint Paul
Chemin Frank-Thomas 104,
1223 Cologny GE

*EMS : Etablissement Médico-Social (Fr)