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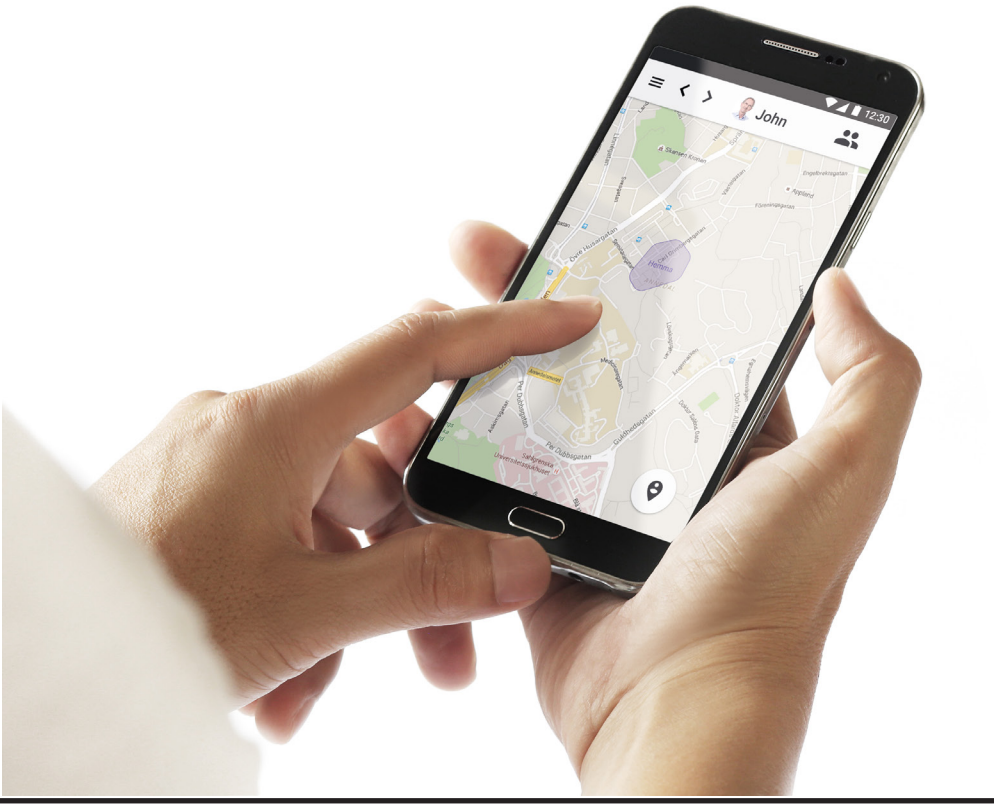

Design of a user friendly localisation application

-Facilitating dementia care through technology

M.Sc. Thesis in Industrial Design Engineering

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Jacob Magnell

CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenborg, Sweden 2016

Department of Product- and Production Development
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Master of Science Thesis

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Gothenburg, 2016

Erika Bung and Jacob Magnell

ABSTRACT

Ailments such as dementia limits the mobility and freedom of the afflicted persons and their loved ones. Advancements in technical solutions for care purposes has the potential to enable these persons to live free and safe lives. One solution that has the potential to make a difference is localization devices that can be given to a person afflicted with dementia. This type of devices utilizes GPS satellites to track persons in need of this service. Localization devices are often monitored and administrated by a caregiver or relative through a graphical interface. Posifon AB has decided to create a new application to gather all their devices into one interface. The interface is to be called Posifon Care and will completely replace Posifon's old application Posifon Omsorg.

This project aimed at simplifying interaction between the localization devices and the persons operating such devices. The project also aimed at creating a less cognitively stressful environment for the persons interacting with the interface, benefitting both users of and carriers of localization devices. The goal of the project was to create an application with conditions for good usability for its users.

Through interviews and usability tests with experts and first time users of existing interfaces, requirements for a new application were identified. It was found that a customizable solution for mobile use was preferred. One of the most central findings from the tests and interviews was that the existing applications lack user and device carrier focus and instead focus on the devices themselves. From these requirements, an extensive list of functions was created. This function list was central to the project and was used as the foundation for all further development of the application. The list was also divided into clusters of functionality that were customized for the different users of the application. A set of keywords, or traits were also defined to ensure that the development would follow the intended design path.

The development continued with ideation, concept development and evaluation of the applications architecture and interactions. This process was iterated until a detailed design could be defined. The design was then tested and evaluated until a final design could be used in an interactive prototype. In testing the design, it was found to be robust in a usability perspective.

CONTENTS

1. INTRODUCTION

This thesis describes the development of an application for use with localization devices used in dementia care. The focus being on the interface and its conditions for usability. This chapter describes the background, goals and limitations of the project as well as describing the context in which the application is meant to operate in and the general conditions for the project itself.

1.1 BACKGROUND

As the world population ages (Department of Economic and Social Affairs, 2015), ailments such as dementia increases the need for technical solutions to enable affected persons to live free and safe lives. One such solution is localization services that can be used to locate people in need. This has led to the release of a multitude of different personal localization services on the market which all have their own interfaces for monitoring and configuration. The conditions for usability of existing services fail to meet the needs of a care giving situation in Sweden, making handling this type of service cumbersome for people responsible for the care of persons with localization difficulties. The separate interfaces cause trouble when a user wants to monitor several different devices. Posifon AB has therefore decided to create an application to gather the devices under the same interface. The interface is to be called Posifon Care and will completely replace Posifon's old application Posifon Omsorg.

1.1.1 POSIFON AB

Posifon AB is an IT/telecom company based in Gothenburg. They specialize in localization devices used in health and social care to make it possible to track people in need. Posifon provides GPS devices with related applications on the Nordic market. To further establish themselves on the Nordic market, Posifon AB now wants to gather all their products under one localization interface with improved conditions for usability. Their vision is to make everyone feel safe outside their homes and improve quality of life for people in need of their products. Posifon aims at pushing technology forwards and are currently involved in several large development projects addressing the need for technology in elderly care in Sweden (DESA, 2015).

1.1.2 THE SYSTEM

The localization system was identified as follows:

- **Carrier** - Person affected by some form of localization difficulty. The carrier carries a localization device. This project focus on carriers with dementia.
- **Localization device** - The device carried by a carrier. Often a GPS tracker, for example a wristband with GPS.
- **Localization application** - Program that communicates with localization device and the user.

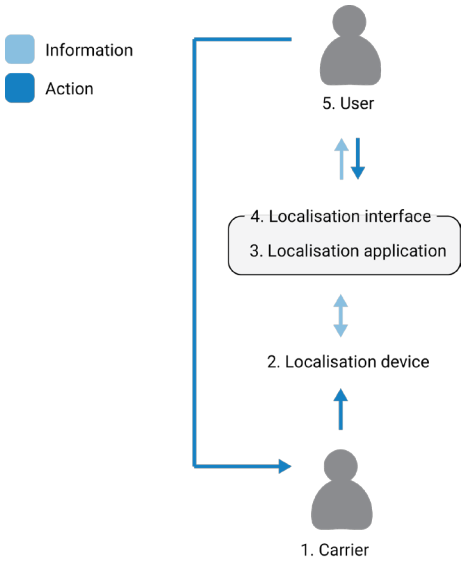


Fig. 1.1 System

- **Localization interface** - The interface through which the user communicates with the localization application.
- **User** - For example a care giving relative, can find positioning data through

the application and its graphical interface and thereby ensure the wellbeing of the carrier. Another type of user can be a technician who makes settings to the system, for example how often positions should be communicated through the interface, in the rest of this thesis these denominations are used to describe the different parts of the system (fig 1.1). The focus of this project will be on the interaction between the user and the graphical interface, as well as the functionality of the application.

1.1.3 USERS

The users of these applications are concerned with the wellbeing of one or more carriers wearing localization devices.

Users include:

- Personnel in health and social care
- Relatives to carrier of localization device
- Staff at elderly care homes
- Alarm technicians
- Supervisors

The term "user" will through this report refer to the persons using the application through the graphical interface. The person carrying a localization device will always be referred to as "carrier"

1.1.4 LOCALIZATION DEVICES

There exists a range of localization devices with separate localization applications on the Swedish market. The administrative interfaces of each respective localization application also vary widely in their functionality. In this project, mainly the three devices in Posifon 's product range will be considered in the interface development process, The GPS Smartsole, Keruve and the GeoSKeeper. These devices all have their own administrative interfaces today. They all have geofence capability, meaning that a user can define a specific area, called a geofence. When the carrier of the localization device goes outside the geofence, an automatic alarm is triggered for the care giver to see in the interface.

GPS Smartsole

GPS Smartsole (fig 1.2) is a localization device that can be placed in the shoes of the carrier. It is activated when it's in motion and sends information about the carrier's positions. The information about the carrier's positions is saved and a user can find this information through the localization interface long time after the event. This is an unobtrusive solution that can be helpful for carriers who does not want to carry a different type of device or might forget it (Posifon AB, 2016).

Fig. 1.2 GPS Smartsole

Keruve

Posifon Keruve (fig 1.3) is a watch band that can be attached to the user's own watch. With this localization device, the carrier's position is only shown when the user of the localization application asks for it (Posifon AB, 2016).

Fig. 1.3 Keruve

GeoSKeeper
Posifon GeoSKeeper (fig 1.4) is a combined GPS locating device and emergency GSM phone. It can function as a one button cell-phone to call relatives or emergency contacts. The interaction possibilities for the carrier makes this suitable for people in an early stage of dementia (Posifon AB, 2016).

Fig. 1.4 GeoSKeeper

1.1.5 USABILITY

In this project, the ISO definition of usability will be used. This definition has been found to coincide with the design team's view on how to develop products with usability as a main design driver. The ISO definition also enables user centered design in a clear manner.

ISO's definition of usability is as follows:
The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use. (ISO 9241-11:1998)

Jordan (1998) describe the components of the ISO definition:

- Effectiveness, to what extent the goal or task is achieved with accuracy and completeness.
- Efficiency, how much resources and effort are spent on completing the task.
- Satisfaction, the level of wellbeing the user feels towards the product.

1.2 AIM/PURPOSE, GOAL AND LIMITATIONS

This section contains the aim, purpose, goal and limitations of this project.

1.2.1 AIM/PURPOSE

This project aims at simplifying interaction between the localization devices and the persons concerned with the carrier's well-being. The project also aims to create a less cognitively stressful environment for the persons interacting with the interface, benefitting both users and carriers.

1.2.2 GOAL

The goal of the project is to create an application with an interface with conditions for good usability for the users in contact with the localization application.

To achieve the goal of this project, the following questions needs to be answered:

- What are the key features in a personal positioning interface that makes the service usable in an effective and efficient manner and gives a satisfactory result for the involved parties?
- What information should the application share with different users with regards to the integrity versus safety of the carrier?
- How can the interface be adapted for different types of users to provide conditions for efficient and effective use in a satisfactory manner?

1.2.3 LIMITATIONS

The scope of the project will be limited in the following aspects:

- Only the interface for tracking the localization products will be subject to development in this project, not the localization products themselves.
- This project will not include programming as this is not deemed to be inside the project groups domain of expertise.

- This project will focus on the Swedish market as the project recourses are limited to this market.
- This project will focus on incorporating the products provided by Posifon in the interface design.
- Many different types of users will be in contact with the application interface. This project aims to include all identified users in terms of functionality but focus on users close to the carrier when it comes to design and usability of the graphical interface.

1.3 PROCESS

The project process (fig. 1.5) was based on the ACD3 method (Bligård, 2015) and included the following phases

Start up:
The first phase of the project includes project planning, definition and limitations. This phase included literature studies and other methods for obtaining information about the parts of the system. This creates a knowledge base for executing the project as well as creating early demands of the localization interface.

User study:
In the user study, user types were identified and connected to product development and usability theory.

Identification of needs:
This phase included interviews with users and usability tests of Posifon AB's existing interfaces. The tests explored how the existing interfaces are handled and how a future interface should be designed. The input from this and the previous phase were then analyzed to identify what functionality needed to be included in the interface and what demands need to be fulfilled with a solution.

Development, Architecture:
The basic structure were developed first using mock ups and graphical representations. A more detailed architecture were developed in the next phase of interaction development.

Development, Interaction:
Interactions to navigate the architecture and access functions in the interface were defined. An evaluation ready concept were created and evaluated.

Development, Detailed design:
Graphical prototypes were created and tested by users from the target groups.

Evaluation:
The interface is evaluated throughout the whole development process. Iteration of design development methods were used to refine the design. A final evaluation took place to evaluate and further refine the detailed design with potential users.

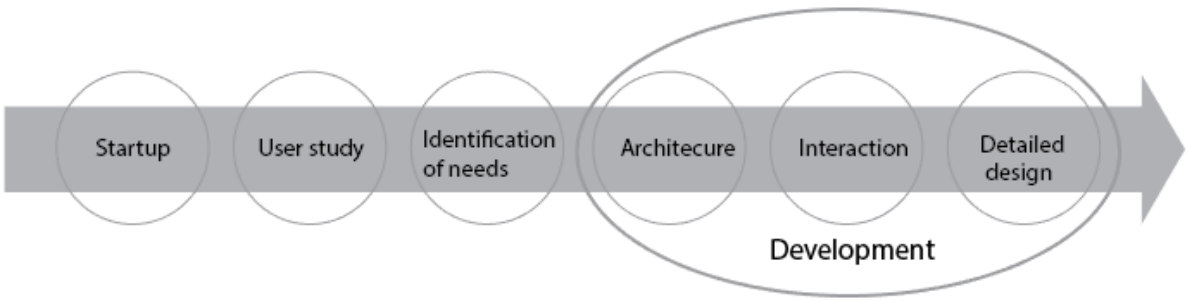


Fig. 1.5 Process picture

2. THEORY

The use of localization products within health and social care and its effects on the health care system was investigated through a literature study and through interviews with experts.

2.1 POSITIONING TECHNOLOGIES

The use of technology in the welfare sector has the potential to increase freedom for the caretakers while simultaneously freeing resources for caregivers. Positioning technologies are at the time of this project in the forefront of this type of technology (Göteborgs stad, n.d.), (Myndigheten för delaktighet, 2016). The following section is devoted to describing technology associated with positioning technology relating to the project.

2.1.1 GLOBAL POSITIONING SYSTEM (GPS)

GPS or Global positioning system is a navigation system that relies on groups of satellites sending precise information about time and their position. A GPS device collects this information from four satellites and can then calculate its position and velocity (U.S. Coast Guard Navigation Center, 2016).

2.1.2 GEOFENCING

A Geofence is a digital boundary in the physical space that when broken triggers a signal to be sent. One way of measuring if the geofence has been broken is via GPS. In the elderly care context, this signal can be used to alert responsible parties that the carrier of a localization device has left his or her home (Chamberlain, 2016). Geofences can be located either on the device itself or in the system backend on a server. Having the geofence on the device allows the device to not send data when inside of the geofence, thereby potentially increasing the carrier's integrity. One downside to this method is that the computing capability of the devices limit how many active geofences there can be and what shapes they can have. Having the geofence located in the system backend allows for more customizable geofences (Business area manager, IT. Interview 2016).

2.2 DEMENTIA CARE

This chapter is devoted to describing dementia care, involved persons and how technology can facilitate the situation for those affected with it.

2.2.1 THE PERSON WITH DEMENTIA

The total number of persons with dementia in Sweden is estimated to be 160 000. This is a number that will rise as the elderly population increase if a cure is not invented. Dementia is a collective name for a range of symptoms caused by brain damage. The most common is Alzheimer's disease which represents 50-60 percent of the cases.

Common symptoms for dementia includes:

- Cognitive symptoms: Impaired memory, language, time perception and orientation.
- Psychiatric symptoms: Confusion, anxiety and aggression.
- Behavioral symptoms: A tendency to wander.

The difficulties with orientation can cause problems with finding home from work or other previously known sites (Svenskt demenscentrum, 2016a). Someone with a tendency to wander seems unable to come to rest and will therefore walk around a lot. These persons run a higher risk of getting lost and/or fall (BPSD, n.d.)

2.2.2 CARING FOR SOMEONE WITH DEMENTIA

The type of persons who care for someone with dementia can vary widely. It can be a relative or a professional, it can be in a home environment or an elderly care unit (Svenskt demenscentrum, 2016b). In a home environment, the care giving person can be a relative

or home care staff. It is also common to live at care homes where the personnel at the care home are care givers (Svenskt demenscentrum, 2016c).

2.2.3 LOCALIZATION TECHNOLOGY WITHIN DEMENTIA CARE

Difficulties orienting themselves can cause people with early stage dementia to become less physically active. It is important to encourage and support physical activity as it has positive effects on health and can reduce symptoms of dementia (Helbostad, Taraldsen and Saltvedt, 2008, 272-278). Physical activity outdoors has extra advantages due to positive effects from the outdoor environment (Bengtsson, 2003)

The usage of localization technology within dementia care, at home and in care giving facilities, serves to increase physical activity outdoors for the person with dementia (Linköping, 2016). It is not uncommon to decrease the mobility of people with dementia, using code locks at doors or similar methods both at care giving facilities and at home. These kinds of safety measures can be replaced with localization technology to increase the wellbeing and mobility of both staff, persons with dementia and their relatives (Administration manager, interview 2016). The ethical aspects should of course be considered.

2.3 ETHICS CONCERNING GPS POSITIONING

The ethical implications of GPS localization in dementia care is investigated and discussed by Magnusson, Sandman & Rosén (2013) they discuss the balance between freedom, self-reliance and integrity. They discuss how ethical aspects need to balance each other out, that a loss of integrity might be motivated if it leads to increased mobility, safety or autonomy. At the same time the authors point out that there are predefined ethical values that needs to be followed, one example of this is that care institutions should respect the patient's informed wishes.

According to Magnusson, Sandman & Rosén (2013) it is also important to consider how a carrier's autonomy can affect the autonomy of their kin. In their study one third of the respondents stated that their freedom had increased since their spouse or relative with dementia had received a localization device. One important conclusion that is drawn in the study is that sometimes it can be justified to limit the autonomy of the carrier to greatly improve their safety or the autonomy of their next of kin.

This type of restrictions on a carrier can sometimes increase their long-term autonomy in the form of less dependence on accompanying caregivers and give them possibilities for a more active life. It is also discussed whether the carrier's integrity is affected negatively using localization products. If the alternative is to be accompanied by a caregiver the use of a positioning device could be less intrusive, as it can only record the carrier's position and not his or her activities.

2.4 USABILITY GUIDELINES

Jordan (1998) has formulated 10 usability guidelines that formed the basis for usability decisions throughout the later design phases of this project.

1. Consistency: The design should facilitate that similar tasks can be solved in similar ways.

2. Compatibility: In the design the method of operation should be compatible with user's expectations based on their knowledge of other types of products in the 'outside world'.

3. Consideration of user resources: The designs method of operation should take into consideration what demands are put on the user's resources during interaction.

4. Feedback: The design should acknowledge the user's actions and give meaningful indications on the results of these actions.

5. Error prevention and recovery: The design should be developed in a way so that the likelihood of user error is minimized and so that errors are easily and quickly recovered, should they occur.

6. User control: The user should be in control over which state the design is in.

7. Visual clarity: Visual information should be displayed in a way that is easily read and understood.

8. Prioritization of functionality and information: The most important parts of the interface should be the most accessible parts for the user.

9. Appropriate transfer of technology: The design should make appropriate use of technology developed in other contexts to enhance the usability of the product.

10. Explicitness: The interface should be designed in a way so that cues are given as to its functionality and method of operation.

2.5 USER TYPES AND USABILITY

Jordan (1998) expands on the concept of usability by describing five levels of task performance ranging from a first-time user's ability to guess how a product functions to an expert performing specialized tasks in a consistent way. In this project the identified user types were compared to these task levels to identify at what level the interface should be focused to optimally satisfy the needs of the users.

Jordan's five components of usability:

1. Guessability, how well the user can perform tasks with a product for the first time.

2. Learnability, at what level a user can perform tasks with a product, having already completed those tasks once previously.

3. Experienced User Performance, how well experts can perform tasks with a product.

4. System Potential is the optimum level of effectiveness, efficiency and satisfaction with which it is possible to perform specified tasks with a product.

5. Re-usability, how well a user can perform tasks with a product a long time after the previous use.

3

3. METHODOLOGY AND EXECUTION

This chapter describes the methodology and execution behind the project. The following sections correspond to the chapters of the report in the following manner:

Section 3.1 User study - **Chapter 4, Users**
Section 3.2 Identification of needs - **Chapter 5, Needs**
Section 3.3 Development of functionality - **Chapter 6, Functionality**
Section 3.4 Interface development methods - **Chapter 7, Interface development**
Section 3.5 Detailed design methods - **Chapter 8, Detailed design**
Section 3.6 Evaluation methods - **Chapter 9, Evaluation**

The method used in this projects can be divided into methods concerning usability, graphical interfaces and evaluation of products.

.1 USER STUDY

In the user study, user types were identified and connected to product development and usability theory. Different types of users were identified in terms of their usage of the system rather than their job title. The intended effect on the surrounding system from the solution was identified, what effect the surroundings will have on the solution and what characteristics and functionality users value in a solution.

The main questions posed for this work was:

- What different user types are in contact with the interface?
- What are the main tasks in the interface for different user types?
- What user types should the solution focus on?
- How should the interface be designed to fit the users in focus, in terms of usability?

3.1.1 DEFINITION OF USER TYPES

To better understand the users and their needs, the tasks one would want to perform with the interface was identified. The main tasks one would want to perform with the interface was defined using information from Posifon and existing interfaces.

It was found that there are many different users of these kind of systems, with different job positions within health and social care or persons in a care situation at home. The interface should be adaptable depending on the different tasks these users may want to perform using the interface. This multitude of users made it important to distinguish between a person's position in the workplace and a person's role in the interface. The type of user a person can be defined as depends on what tasks they want to perform in the interface. Two people with different job titles can be the same user type of the interface depending on their main objective during usage. A study was conducted to define which user types the interface must consider and how these relate to each other in different contexts.

An initial user/task chart was constructed with expertise from Posifon and the four main tasks (Appendix 1 User/tasks chart draft). It included three contexts; private care at home (their own), care homes and municipal care of the elderly in their own homes (assisted living). To complete the chart, an interview study was conducted. The interview subjects had insight in all or some of the predefined contexts for the interface to operate within and had some experience with the usage of localization systems within their workplaces. An overview of the interviewees can be seen in appendix 2 (Interviews, user/tasks).

The interviews were semi structured and formed to fit the interviewee. It started with conversations about the contexts and aimed to gain insight and information regarding different user types. The initial user/task chart was introduced midway through the interview as a mediating object to stimulate further conversation and gain more precise information without steering the conversation from the beginning. The initial draft was updated with information from the interviews.

The data was divided in the three contexts in the user/tasks chart. People with various positions were placed into their contexts on the chart and four main tasks were sorted amongst them. This made the interviewees give a lot of input and they could also provide suggestions for additional functionality, something that was considered in later phases of the project.

3.2 IDENTIFICATION OF NEEDS

This section describes interviews and tests that were conducted to understand the situation for existing and potential users of localization systems within dementia care. The interviews and tests focused on creating a more detailed image of the environments and situations for the solution to function within. It also focused on identifying areas for improvement regarding both user situations and the existing systems.

The main questions posed for this work was:

- What characteristics would benefit users most in a new interface?
- What platform/platforms should the interface be designed for?

3.2.1 EXISTING INTERFACES

Existing interfaces for this type of technology were studied to identify areas for improvement and demands on a new interface. The interfaces in Posifon's selection were studied and discussed to find initial problem areas and gain understanding of the general usage. These discussions were also conducted to orient the design team with respect to the existing interfaces. Focus were on the interface developed by Posifon themselves, "Posifon Omsorg" which is connected to their device GeoSKeeper.

To get a more nuanced view of the existing interfaces, that were found to be confusing and messy, an expert from Posifon on these types of interfaces was consulted to orient the design team in the use of these applications.

Based on the knowledge from the study of the interfaces and the consultation, an initial user study was conducted. Posifon's existing interface for their product GeoSKeeper "Posifon Omsorg" was evaluated. The test and the participants are described in appendix 3 (Initial usability test). The participants had never used the technology before and could provide insight into the guessability of the interface. In an explorative user test, the participants were given different tasks to complete using the interface. The test was centered around a scenario where the test participants were asked to find a device carrier that was lost.

After the test, the interface was discussed with the participants and the design team. The participants were asked to explore the interface and describe their first impressions. The participants and the design team then covered the usage of the interfaces and their respective strengths and weaknesses.

3.2.2 INTERVIEW STUDY

A series of interviews was held with people with knowledge within health and social care and insight into the use of welfare technology. The interviews provided insight in the different organizations and facilities the localization interface should operate within and the people involved. The interviews were semi structured and formed to fit each interviewee.

Interviews with relatives of persons with dementia was focused around the general care situation and how the existing application and GPS devices supported them in their daily lives. Interviews with technicians and nurses were a bit more technical and focused more on how the technology functioned in their system. The interviewees that had a more administrative role in their organization was asked questions that related to the organizational aspects of the future interface. These persons also possessed knowledge about how the existing devices worked and were therefore asked the same questions about the existing interface as the previous groups as well (Appendix 4 Intervjustudie).

The seven participants (Appendix 5 Interviewees, Interview study) all had different backgrounds and knowledge in the subject of the project. They were chosen to provide information of the different users considered in the application. Five of the participants were chosen to secure that users that are likely to be subjected to the interface are included, it was also important to make sure that these participants had a varying degree of computer knowledge. The remaining two participants were chosen to catch any thoughts of the groups likely to be the purchasers of the new application.

3.2.3 ANALYSIS

A phase of analysis took place after the user study. The analysis was done per the KJ method, a method for finding structure in big quantities of verbal data. The interviews were transcribed and relevant quotes and comments were summarized and sorted to form a range of problem areas important to consider. These were further analyzed to define desired functionality for the localization application that the interface should support. The study also provided information regarding common users of the interface and situations when usage occurs.

3.3 DEVELOPMENT OF FUNCTIONALITY

Desired functionality identified in the KJ analysis was organized into a list of functions. This was used to define function clusters and define which type of users would access what functionality and how. This list of function was then used in further analysis to answer the following questions:

- What users should access what functions and information?
- How should functions and information be provided to different users?

The list of functions, combined with findings from earlier project phases was used to further define the different users and how they would use the application. To clarify this a function matrix, including the list of function and the answers to the above questions was constructed.

As validation, the systems functionality clusters were discussed and compared to the analysis of the systems backend architecture that was performed by the company Elicit, an IT consultant company that works with Posifon. The function matrix was discussed with Posifon and Elicit several times to evaluate and review the functions and sorting. It was also compared to a list of demands for a localization system in Norway to detect possible gaps. The function matrix was also evaluated with personas to ensure that it corresponded to the needs of representative users. The personas were created based on the user study (section 3.1) and was taken into consideration in all following development phases (Appendix 6, Personas).

3.4 INTERFACE DEVELOPMENT METHODS

The development phase of a new interface started with its architecture, the structure of the interface. It moved on to designing the interaction between user and application

through the interface. The design was evaluated and developed in iterations until a satisfactory result was reached.

3.4.1 ARCHITECTURE

The overall structure for the interface was investigated, including what hierarchy gave the best interaction between users and applications. A basic architecture was first developed to define a frame for further work and evaluation. A more detailed architecture map was thereafter defined in the application space while focusing on the interaction between user and application.

The main questions posed in this phase were:

- What hierarchy will enable the best interaction possibilities?
- What information should normally be presented on the start screen?
- What functionality should be available directly from the start screen?
- Where should alarms and notifications be presented?

3.4.2 INTERACTION

The interaction between user and application through the graphical interface was developed. Interaction surfaces and iconography was also specified to be able to test interaction in a satisfying way.

Fig 3.1 Physical wireframe

The interaction development began with a study of Google map's mobile application. It was studied using a physical wireframe (fig. 3.1). The screens and elements were represented with paper and their connections with strings between. This provided a thought-out example for early stage evaluation of the new interface design.

The interaction development began with writing down all the interaction elements that had been identified on notes and placing them in different configurations. The configurations based on the basic architecture. The goal was to make the interactions as straightforward as possible. The completed screens were then connected with string to illustrate interaction paths, as in the previous study of Google maps. To facilitate evaluation, the wireframe was further developed and visualized graphically and a detailed interaction wireframe was made.

3.4.3 EVALUATION

To evaluate the interaction wireframe a sample of 3 persons (Appendix 7 wireframe evaluation) was asked to follow the interaction arrows and explain how they thought when following these interactions. They all had experience of localization technology and could therefore provide feedback from an expert point of view. This gave a rough idea of what interactions where clear and which interactions needed more thought. The evaluated detailed interaction wireframe was primarily used to communicate with Elicit about how the general structure of the application should be constructed.

For evaluation purposes key interaction paths were defined to benchmark the number of interactions needed to perform a task with the interface concepts. The key interaction paths was defined as a likely interaction path that the projects personas would make to perform a specific task with the interface. This then lead to a benchmark test that compared the efficiency of the old Posifon Omsorg to the new interface.

To evaluate the interaction with potential users, an early concept of the graphical inter-

face was developed. This work overlapped with the next phase, detailed design. It was necessary to have graphical representations that potential users could relate to and give feedback. These were printed on paper as separate screens and presented to a total of 8 test participants. The participants for this test came from different municipalities in Sweden.

These expert users (Appendix 8 Expert user test) were asked to think out loud during two sample interactions, add a geofence and respond to a breached geofence. The test was conducted in four separate sessions with different number of participants at a time depending on their expertise and wishes. The last session was an open group conversation with three participants regarding the design. The personas (Appendix 6, Personas) were used in both discussions and test sessions to provide likely scenarios.

3.5 DETAILED DESIGN

Suggested changes in interaction was implemented in the detailed design phase of the project. In this phase, graphical content of the application interface was developed.

Some limitations for the detailed design work were defined:

- Screens will be produced as examples of how the interface will look for an alarm receiver and an administrator at a care home. For other contexts and user types the screens can be modified per the function matrix (section 6.3).
- The design for someone with access to administrative functions will be illustrated in the main screens but not on a detailed administrative level.
- Graphical content will be developed with respect to common situations in the care giving context. For more extreme/unusual situations (for example several carriers disappearing at the exact same time) more studies are needed.
- The login screen is not included in the design work due to safety demands that are not within the scope of this project.
- Error messages and warning are not included in the detailed design as graphical content. The kind of situations that should trigger an error message/warning will be noted.
- The design will be made for one operating system.

The care home context was put in focus for the detailed design since this is more complex than a private home context. In the case of a care situation at home, the application often only must accommodate one carrier and one or a few users of the application interface. A care home is more likely to have demands on a solution that can handle more carriers and users. Hence, a solution that suits a care home should also suit a private user in a simplified form.

During the design phase, personas (Appendix 6 Personas) were considered to ensure the detailed design to fit different types of users. It was central to the entire development process that the design follows the design guidelines defined by Jordan (section 2.4) and official application development guidelines from companies that develop operating systems for digital products. This is done to ensure that the design follows the mental model that users have of digital interfaces. These guidelines together with the results from the user tests and focus groups was the foundation to all design work in the following section. It was decided to design for Android devices. The rationale behind choosing Android was that it has robust design guidelines and their products are widely used. It was decided together with Posifon that an Android application was the most likely to be produced first.

Jordan's 10 usability guidelines (section

2.4) formed the basis for usability decisions throughout the detailed design phase. Therefore, the project functions and demands was cross referenced with Jordan's theories and the ISO definition of usability (section 1.1.5).

It was decided that the project should follow Google's guidelines for creating Android applications. Relevant parts of the design guidelines can be found in appendix 9 (Google guidelines for Android.)

3.6 EVALUATION METHODS

The design was first evaluated with the function matrix to ensure that the design supported relevant functions. The functions for alarm receiver and administrator was regarded in accordance with the focus of this project. After this test, several tests with user participation took place (Appendix 10 Evaluation test, participants).

The test was designed to test primarily the guessability and learnability of the application (Appendix 11 Utvärdering, användbarhetstest). The first part of the test was focused around testing the interface guessability This was done in the form of a scenario where the test participants were asked to respond to an alarm caused by a persona carrier. When that task was complete the test, participants were asked to explain what they thought about different icons and interaction surfaces in the interface. In the second part of the test the participants were asked to, from the start screen, find the custom carrier information field in the carrier profile and change that information. The rationale behind this was that for administrative tasks, such as changing information about a some need for training can be accepted. For more critical tasks, such as responding to an alarm it is important that even completely new users can perform the tasks with a satisfactory result.

The validation test was split up in two test rounds due to feedback from the first three tests leading to some immediate changes in the design. The changes were then evaluated in the second round of the evaluation tests with five participants, conducted in the same way as the first round of testing. These five participants had no previous experience of localization devices and their interfaces which ensured the that their reactions where their first.

4. USERS

This chapter describes results and findings from the user study (section 3.1). The primary users of a new interface were defined as a person using localization technology to locate other persons whom are not able to effectively orient themselves in the environment in which they are located. The persons identified as primary users are not always the same persons as the ones making settings and setup of the system. It is therefore important that the system can accommodate secondary users with these types of tasks. In this project, users are found in the dementia care context. Defined contexts for this projects are municipal care homes and private homes with private care or municipal home care. Other potential users are people concerned with the well-being of persons with difficulties orienting themselves due to other causes. For example, parents to children with autism are not studied but will likely benefit from the solution.

4.1 DEFINITION OF USER TYPES

The definition of different user types depended on the tasks one wanted to perform with the interface. Information from Posifon and existing interfaces led to one main task and four supporting tasks being identified (fig. 4.1).

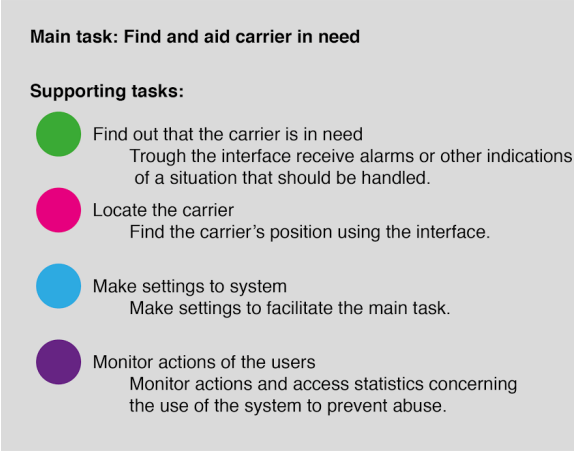


Fig. 4.1 Tasks

In the user study (chapter 3.1), the tasks that are likely to be performed by a certain person was sorted in a user/task chart (fig. 4.2). Depending on the user situation or organization the tasks could be divided differently between the involved persons.

The user/task chart therefore displays multiple cases in each context. Multiple tasks can be assigned to one person, as is often the case when care is give at home by the carrier's relatives. Tasks can also be shared by multiple users. The user/task chart made it clear that someone who performs the task "find out that a carrier is in need" most often also wants to perform the task "locate the carrier" which formed the user type alarm receiver. Someone in charge of making settings to the system will be an administrator. The task of monitoring actions of the users is performed by someone with a monitoring function within the operation. It's not likely combined with many other tasks since the execution of these tasks often is what needs to be monitored.

It was concluded that there are three main roles that users generally have when interacting with the application (fig. 4.3). The alarm receiver that receives alarms and notifications concerning the carrier and then acts on the information provided by the application. The administrator that sets up the system and connects alarm receivers and carriers. And finally, the monitoring function that supervises the users of the system and collects information about its usage.

All user types can overlap and the interface should be flexible enough to handle that. For example, alarm receiver and administrator are likely to overlap and someone might oversee all tasks included in those types. The user types should therefore not be seen as fixed,

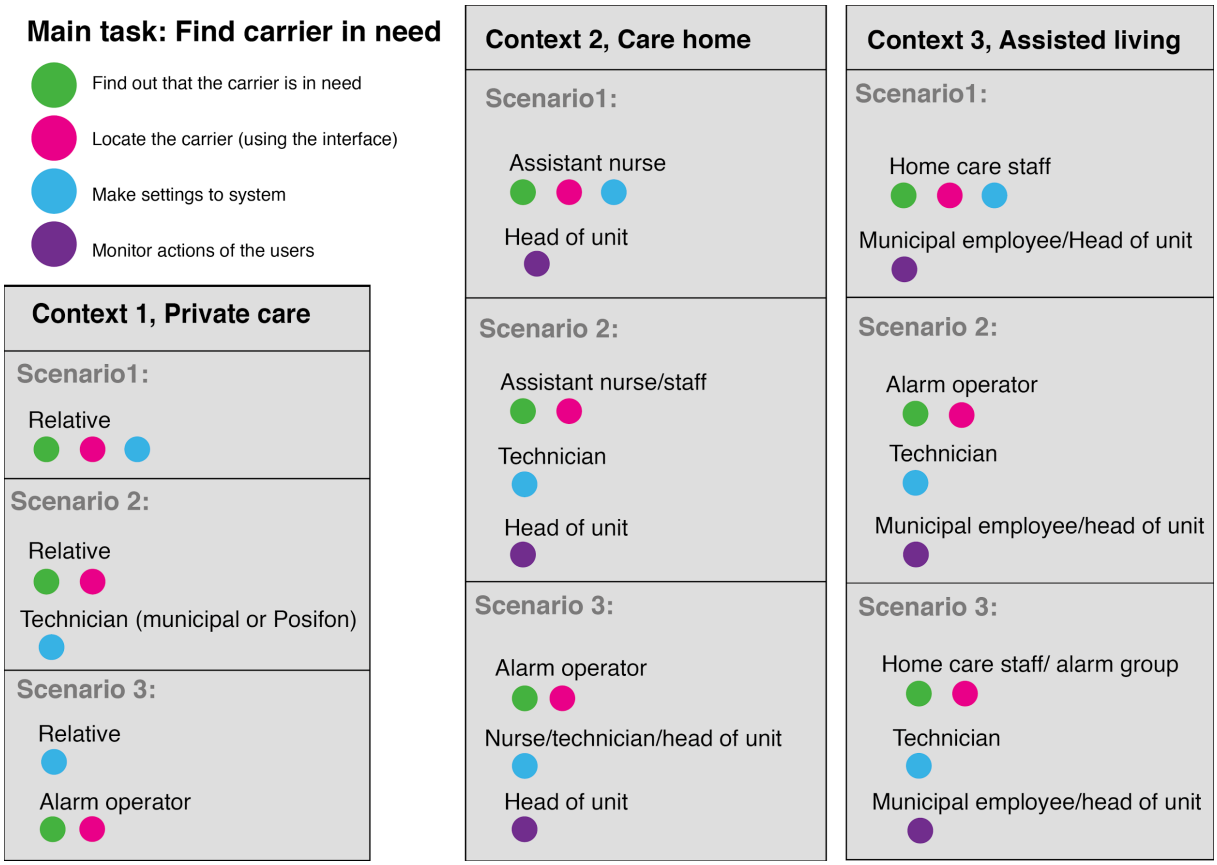


Fig. 4.2 User/task chart

Alarm receiver

- Find out the carrier is in need
- Locate the carrier

Administrator

- Make settings to the system

Monitoring function

- Monitor actions of the users

Fig. 4.3 Different users

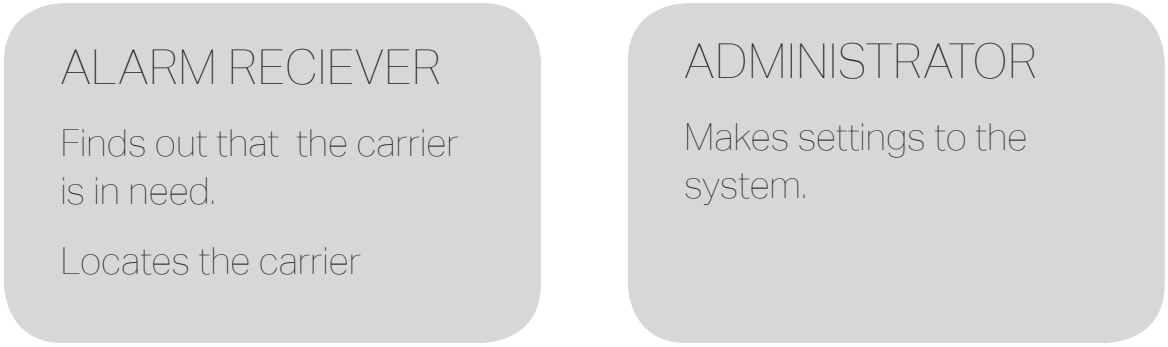


Fig 4.4 Users in focus

but as a guide to provide proper permissions and functionality to different users.

Based on the study it was decided that the project will focus on the user types alarm receiver and administrator (fig 4.4).

After the KJ analysis it was clear that these groups would benefit the most from a new interface with conditions for improved usability. This was due in part that these persons were identified as the most frequent users of the interface. But also, that this group largely consists of technologically inexperienced persons. Their usage also includes situations when they must be able to perform a task in the interface in a short amount of time, for example during a manual alarm from a carrier. In the case if a person is not acting on alarms but simply having the responsibility of receiving alarms and transferring them relevant parties is reserved to persons working at an alarm central. An alarm operator working at an alarm center can be seen as an alarm receiver but was excluded since their context and situation of usage was shown to differ a lot from other users in this project.

4.2 USER TYPES AND USABILITY

After connecting the identified user types to Jordan's defined levels of usability (section 3.1.1) some important aspects regarding how to develop the application was identified. The alarm receiver is often inexperienced with the interface and perform critical tasks, often under time pressure. For this user type the guessability and learnability of the application is very important. The users also need to feel confident that they will be able to locate the carrier of a GPS device even after not having used the application for long time periods, making re-usability a considerable factor. However, if the guessability and learnability is well met, the re-usability of the application can be assumed to be satisfactory as well. The re-usability has therefore not been further investigated.

For the administrator, the systems experienced user performance and system potential is important. This user type has demands on the software's flexibility and customizability since it must function within operations that are different.

4.3 PERSONA

Based on stories and information from the user study, a set of personas (Appendix 6 Personas) was created and used in evaluation and development of a new interface. The persona that was used most in evaluations with users is Jörgen. This was due to Jörgen being a persona for a care home context which the design that was being evaluated was adapted for. This context is more complex than a care giving situation in a private home and the design therefore needed to fit this complex situation as well.

PERSONA, JÖRGEN

Jörgen is 32 years old and works as a nurse in an elderly resident's department for dementia. Jörgen wishes the residents of the department were given greater freedom but have been through many difficult situations with people who wandered away and therefore understand the decision to have code locks on the doors. He owns both a smartphone and tablet, and are used to modern technology. This has meant that he has received an additional responsibility for the technology in the department.

One of the residents, John, has great tendency to disappear, which means heavy workload and concern for Jörgen. John is 67 years old and is in good physical condition. However, he has difficulty to localize himself because of dementia and no understanding thereof. John look young, dress properly and is very social, which means that the families of other residents at the nursing home sometimes mistake him for a visitor. It has happened that people have kept the door open for him so he could easily slip out and walk away.

5. NEEDS

After defining that the project should focus on the alarm receiver and administrator, their needs were investigated (chapter 3.2) It was also investigated how well these needs were taken care of by the existing interfaces.

5.1 EXISTING INTERFACES

The studies of Posifon ABs existing interface showed that they failed to meet the needs of an intuitive interface for inexperienced users. One major contributing factor was that the interface showed the system for how it works and not how a user thought it worked, mainly meaning it was built around the localization device and not the carrier. This led to confusion since the test participants mainly focused on the actual carrier when performing actions. For example, when asked to change a geofence all participants first thought they would access this through the settings for the carrier which wasn't the case (Fig 5.1).

The lack of feedback and helpful hints made test participants uncertain if their actions were correct and information from the interface was often misinterpreted. Two participants were confused by an error message, telling them that the specified address is wrong when it was due to the radius being undefined (fig. 5.2).

Fig. 5.2 If the user forgets to define radius, a message tells him/her the address is wrong

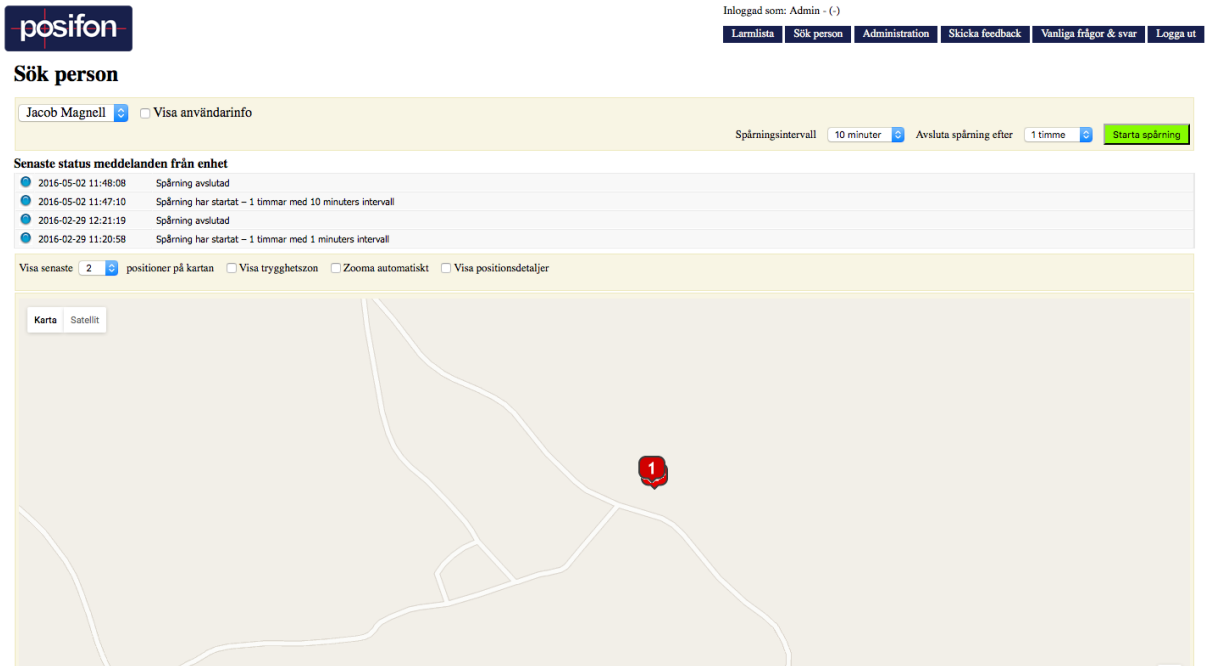
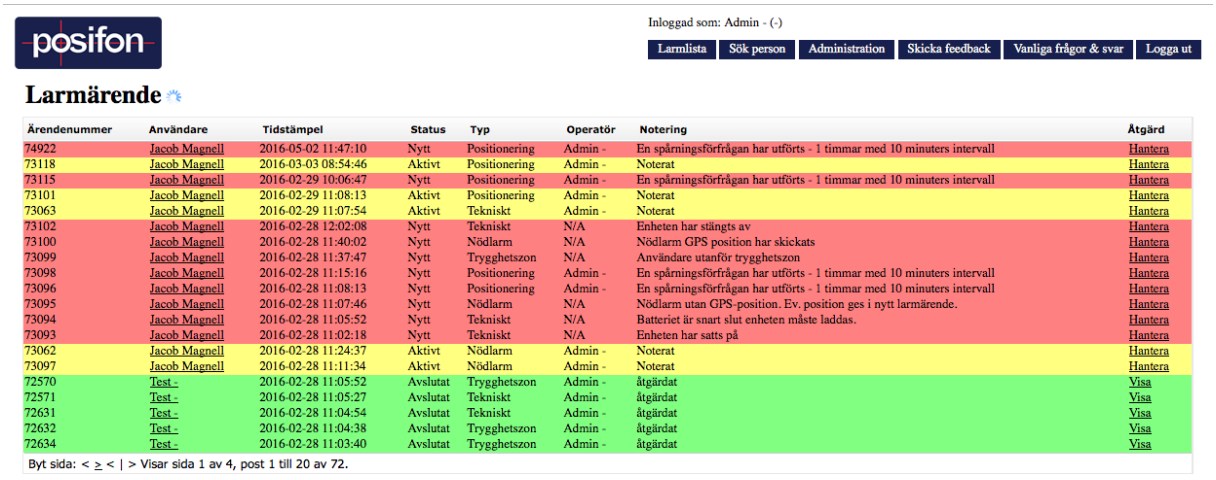


Fig 5.1. Active view when searching for a missing person



Ärendenummer	Användare	Tidstämpel	Status	Typ	Operatör	Notering	Åtgärd
74922	Jacob Magnell	2016-05-02 11:47:10	Nytt	Positionering	Admin -	En spårningsförfrågan har utförts - 1 timmar med 10 minuters intervall	Hantera
73118	Jacob Magnell	2016-03-03 08:54:46	Aktivt	Positionering	Admin -	Noterat	Hantera
73115	Jacob Magnell	2016-02-29 10:06:47	Nytt	Positionering	Admin -	En spårningsförfrågan har utförts - 1 timmar med 10 minuters intervall	Hantera
73101	Jacob Magnell	2016-02-29 11:08:13	Aktivt	Positionering	Admin -	Noterat	Hantera
73063	Jacob Magnell	2016-02-29 11:07:54	Aktivt	Tekniskt	Admin -	Noterat	Hantera
73102	Jacob Magnell	2016-02-28 12:02:08	Nytt	Tekniskt	N/A	Enheten har stängts av	Hantera
73100	Jacob Magnell	2016-02-28 11:40:02	Nytt	Nödlarm	N/A	Nödlarm GPS position har skickats	Hantera
73099	Jacob Magnell	2016-02-28 11:37:47	Nytt	Trygghetszon	N/A	Användare utanför trygghetszon	Hantera
73098	Jacob Magnell	2016-02-28 11:15:16	Nytt	Positionering	Admin -	En spårningsförfrågan har utförts - 1 timmar med 10 minuters intervall	Hantera
73096	Jacob Magnell	2016-02-28 11:08:13	Nytt	Positionering	Admin -	En spårningsförfrågan har utförts - 1 timmar med 10 minuters intervall	Hantera
73095	Jacob Magnell	2016-02-28 11:07:46	Nytt	Nödlarm	N/A	Nödlarm utan GPS-position. Ev. position ges i nytt larmärende.	Hantera
73094	Jacob Magnell	2016-02-28 11:05:52	Nytt	Tekniskt	N/A	Batteriet är snart slut enheten måste laddas.	Hantera
73093	Jacob Magnell	2016-02-28 11:02:18	Nytt	Tekniskt	N/A	Enheten har satts på	Hantera
73062	Jacob Magnell	2016-02-28 11:24:37	Aktivt	Nödlarm	Admin -	Noterat	Hantera
73097	Jacob Magnell	2016-02-28 11:11:34	Aktivt	Nödlarm	Admin -	Noterat	Hantera
72570	Test -	2016-02-28 11:05:52	Avslutat	Trygghetszon	Admin -	åtgärdat	Visa
72571	Test -	2016-02-28 11:05:27	Avslutat	Tekniskt	Admin -	åtgärdat	Visa
72631	Test -	2016-02-28 11:04:54	Avslutat	Tekniskt	Admin -	åtgärdat	Visa
72632	Test -	2016-02-28 11:04:38	Avslutat	Trygghetszon	Admin -	åtgärdat	Visa
72634	Test -	2016-02-28 11:03:40	Avslutat	Trygghetszon	Admin -	åtgärdat	Visa

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Fig. 5.3 The list of alarms on the start screen

The hierarchy of the interface didn't correspond to the objectives of the common users. When starting the application one is immediately presented with a list of alarms, both current and present. Ongoing alarms telling that someone is missing is relevant but this information was drowned in the brightly colored historical alarms (fig 5.3).

5.2 PLATFORMS

Based on the user study, the platforms for a new solution was considered (Appendix 12 Möjliga lösningar teknik). The findings from the interviews (chapter 4) suggests that the main user groups have very different needs that affect the optimal platform for respective user type (fig. 5.4).

It was, as stated in section 4.3, not uncommon for the alarm receiver and administrator to be the same person. This leads to the conclusion that the tasks for these user types should be well integrated and that similar tasks should be performed in a consistent way between platforms. One examples of this was that information about the carrier should look the same when reading on a small screen as on a desktop computer. This does however not mean that the interface should be identical, specific tasks will be performed in different way on a touchscreen or with a mouse and keyboard. It was more important that the alarm receiving and locating functions are intuitive to the users and that the administrative duties had a high degree of custom-

Fig. 5.4, The different user types have different demands on what platform the application should be developed for.

izability. It was the alarm receiver tasks that were the most critical for a well-functioning system since they are responsible of taking care of the carrier. The alarm receivers were also the ones with the most to gain from having a user-friendly interface and the alarm receivers have a high demand on the solution to be mobile. Therefore, it was decided that this project were tofocus on a mobile application with the alarm receiver in focus and have the administrative tasks well represented. The main advantage to this approach was that the administrative interface would be fully developed while the mobile platform enables the alarm receivers to perform their tasks efficiently.

5.3 KEYWORDS

The interview study resulted in a set of four keywords to consider in the application development process. This is done to ensure that the interface is accessible to the target user groups.

Customizable
The analysis made it evident that the application and interface must support customizability to fit the needs of different users. Someone who wants to perform advanced settings might not be entitled to a carrier's personal information and someone close to the carrier might not be suited to have access to all settings.

This is also important when it comes to the carrier's integrity and regulations regarding personal information. To make the system flexible in how information and functions is shared with different users allows for an operation to share personal information to the people they consider suitable.

Helpful
The application should be helpful and facilitate the work for the user. One important example is that the application should tell the users when they should do something and how. Several interviewees mentioned that charging the product causes problems. The person responsible of putting the device back on the carrier sometimes forgets about it. In municipal care, it might be due to different persons being responsible at different times, in private care the responsible person might be under a lot of stress which makes it easier to forget things.

"You know, you put it on charge and then you go out and you start another activity and then it is very easy that you forget it " - IP4

The interface should help the user remember such things.

Intuitive
The interface should be designed in a way that enable new users to perform critical tasks without prior training. Tasks that are critical are find out whether a carrier is in need and locate a carrier in need.

Carrier focus
The interface should be built with the carrier in focus, this is mainly to comply with the user's mental view of the system. In existing solutions, the GPS device have a to central position in the applications. This likely due to a technical approach when developing the applications.

6. FUNCTIONALITY

From the interviews and the following analysis, a list of functionalities was developed. This list was intended to match the user's needs for functionality, connected to what the user types require to operate at maximum capacity.

6.1 LIST OF FUNCTIONS

The analysis of the interviews resulted in a list of functions (appendix 13 möjliga lösningar, interaktion) that the interface should support to fulfill the user's demands on the interface. This list was divided into groups based on what entity is affected by its modification. Functions affecting the carrier, functions affecting the alarm receiver, functions affecting the administrators of the systems and functions connected to support. This list later lay a foundation for all further work with functionality and the sorting of functionality.

6.2 USER DOMAINS

Combined with the analysis of user types and the list of functions, the different users of the interface became more clear. The user type that previously was identified as an administrator has been divided in administrator, system manager and super administrator. How these relate to each other and the alarm receivers can be seen in figure 6.1, user hierarchy.

In a municipal caregiving context this system should be operable within it's important to consider different domains. In figure 6.2, the alarm receiver's domain could be a unit at a retirement home. Here, a group of alarm receivers can be connected to several carriers. An administrator's domain could be the retirement home with responsibility for several domains with alarm receivers. The system manager could be responsible for similar places in a municipality. The super administrator is the staff at Posifon who connects the new devices.

Fig 6.1 illustrates how the different user types can administer the user types below them in the hierarchy. An administrator can for example change settings for an alarm receiver in his/her domain. A system manager can change settings for that administrator or make changes between the subdomains in his/her domain. This could for example mean moving a carrier from one subdomain to another due to a change of the carrier's care situation. All types of users are described in figure 6.2.

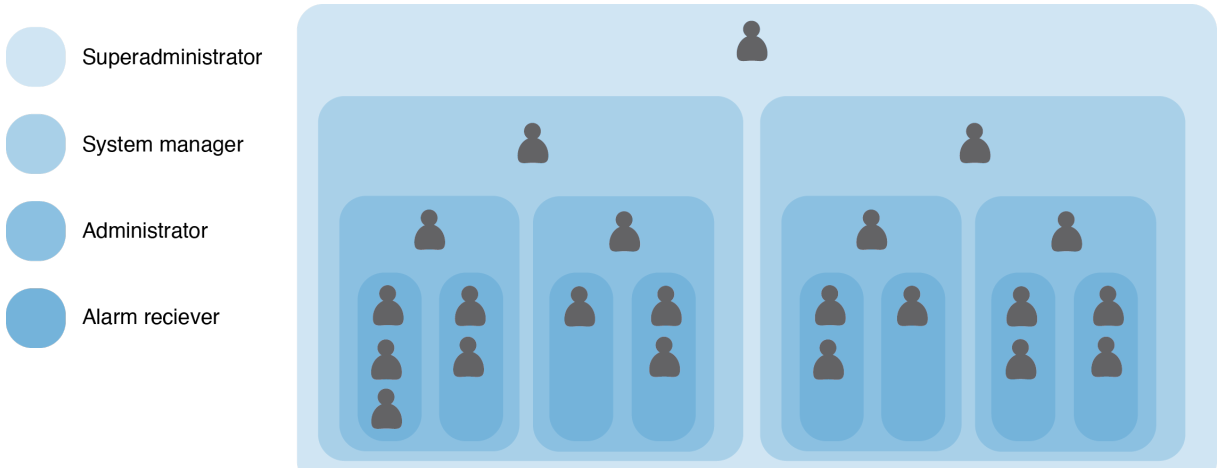


Fig 6.1 User hierarchy, graphics

Super administrator

- Connects new devices in the system and administers the system manager.

System manager

- Manages the administration of domains / departments
- Administers Admin
- Distributes devices / carriers between Admin

Administrator

- Manages the administration in its domain / department
- Setting up units and users
- Administer Carriers
- Administer Users

Alarm receiver

- Get to know the carrier needs to be found and find carrier.

Information owner/monitor

- Own statistics and information in the system. Can provide information to those who need, for example care managers. This includes information and statistics concerning both carriers and users of the system. Statistics regarding carriers can provide helpful information for future care measures. Statistics regarding users can be helpful to prevent system abuse.

Fig. 6.2 User hierarchy, descriptions

These can be seen as different function groups in the system. An employee within elderly care might have access to both the alarm receiver functionality and administrator functionality to fit the workflow at that context. Another might have the administrator function group but with limited access to some functions. As stated in the list of functions, the access to functions and information must be customizable for different users to make it user friendly and allow for municipal units to find the best combination of functionality and confidentiality.

To keep the design close to the users with a close connection to the carrier, the design focused on alarm receiver and administrator.

6.3 FUNCTION MATRIX

The functions in the function list was sorted for the five different types of users of the interface in terms of what functions they are most likely to benefit from (fig 6.3). It was organized into main functions and their support functions. The main functions in the first column is supported by the functions on the same row. The different rows in the list of functions can be treated as clusters when it comes to defining access to functions and information. One of the most important functionalities of the function matrix is to show how the application can be customizable. Access to information and functions should always be defined by the user above in the user hierarchy and the function clusters will group functionality in a way that is meaningful for the administrators when defining access to functions. An administrator can define what information and functions an alarm receiver should access and so on.

The first row in the matrix has the function cluster “indicate carrier position” with eleven functions that support the function indicate carrier position. The function “show information about carrier” is an exception since this information is particularly sensitive. These part functions should therefore be treated separately in the application so one user can have access to some of them but not all.

	Tasks	Functions		
	Locate carrier			
Recieve geofence alarm Recieve manuel alarms request tracking	Indicate the carriers position	Admit manual positioning of carrier	Admit automatic positioning of carrier	Indicate carriers current direction
	Admit customisation of map and positions	Show public transportation on map.	Help the user make choises conserning batery time contra battery time	Provide settings to admit normal andsattleite map
	Show the carriers last positions	Show position on map.	Illustrate battery status	illustrera att det är en gammal position
	Contact carrier	Offer quickdial	Show the carriers phone number	Ilustrate secondary device capabilities such as phone.
	End alarm	Offer maual termination of alarms	Automatically when the unit is inside of geofence again.	Ask alarmreciever if alarm is finished after x amount of time
	Indicate that a carrier is in need of assistance	Show geofence breach	Upon manual alarm from carrier	Describe alarm reason
	Support and contact			
	Admit support functionaliti from within the application	Via FAQ	Through forums	
	Contact support	Show telephone #	Show mail adres	
	Contact support	Show telephone #	Show mail adres	
	Contact support	Show telephone #	Show mail adres	
	Administration			
Administer alarmreciever	Administrate alarm reciever	Define access to functionality/information	Add/change carrier information	Add/Change alarmreciever /admin/admin+
	Administrate admin	Define access to functionality/information	Add/change contact information	Add/remove bort larmmottagare /admin/admin+
	Administrate Admin+	Define access to functionality/information	Add/change contact information	Add/remove bort larmmottagare /admin/admin+
Show alarm reciever information	Show alarm reciever information	Define access to functionality/information	Show contact information	
show admin information	show information about admin	Define access to functionality/information	Show contact information	
	Show information about admin+/admin/larmmottagare	Define access to functionality/information	Show contact information	
Administer Carrier	Administer Carrier	name	link to GPS device	Admit showing photography
	Show information regarding carrier	show name	show link to gps device	Show photography
	Handle carrier position information	Admit differentiatedd save times and amount of positions saved in the system, this scholud be compliant to guidelines and rules.	Posibility to limit access to position history for defined alarm recievers	Show statistics of carrier alarms
	Handle information conserning usage of the system.	logg positioning requests thet are not a responce to an alarm. this includes name of inquirer, time and place.	Logg in and illustrate what settings has been done (who, where, when)	
Administrera geofence	Administer Geofence	Change size and shape of geofence	Move geofence	Define action if geofence is breached
Show geofence	Show geofence	Show geofence		
	Change devises availability in the system	ad to customer	add to department	Mark as not available
	Show devices availability in the system	Sshow acces to customer	Show what department device belongs to	Show non available units
	Show ling between diffrernt user types and carriers.		Show admin level in the system and admistration levels below.	Show admin+s level in he system and those below
	Administer alarm recieving method	add alarmreciever	Define when alarmrecievers recieve alarms	notify if no alarmreciever can be identified in a certain timespan,
	Show alarmrecieving method.	show alarm reciever	Show when specific alarmreciever will recieve alarms	Show when alarms are sent in case of geofence breach
	User type:	**Alarm receiver**	**Administrator**	**system manager**
	colour in function matrix:			

Fig 6.3 Function matrix

Show carrier on map	Notify if speed goes abowe fast walkin pace	Illustrate position accuracy	Indicate the status of the application when searching for position and provide actions	Admit tracking in time intervals	Show carriers GPS-coordinates	Indicate adress close to position	Indicate position time
Clearify road taken by carrier	Indicate old position times						
Describe alarm reason	Show time of alarm initiation						
Name Alarmreciever/admin/admin+	Localise alarmreciever/admin/admin+ in the system	Add way of receiving alarm					
name larmmottagare /admin/admin+	localise larmmottagare /admin/admin+ in system						
Namne larmmottagare /admin/admin+	Localise larmmottagare /admin/admin+ in system						
Admit freetext field that bescribes if the carrier has anny speciel needs at pickup.	Add contact information for carrier	Add relatives contact information	Add/remove carrier	Add remove action plan for user			
show freetext field that bescribes if the carrier has anny speciel needs at pickup.	Show contact information for carrier	Add relatives contact information	Show carriers in the system	Show action plan during alarms			
Show carriers position statistics	Make summaries of statistics in the system						
Remove geofence	add geofence	add timerules for geofence	Create preset geofences	Create goefence from unit position	Create geofence from adress	Create geofence by drawing on map	
Enblesettupofheartbeat							
show that a unit is not responding	show uncharged units	show battery status	show missing unit heartbeat	Show discharged units	Show charge status	show missing heratbeat	
show alarmrecievers connected to a carrier	show alarmrecievers connected to a carrier	show alarmrecievers connected to a carrier	show alarmrecievers connected to a carrier	Show superadmins level in system			
Notify when alarms are sent in case of a geofence breach	Add alarm message	Add exeptions to alarms					
show alarm messages	Show expetions from alarms						
Superadmin	**Information owner**						

7. INTERFACE DEVELOPMENT

This chapter describes the development of the application and its interface. The first part of the chapter details the architecture of the application and the second part moves on to interactions and interaction surface placement.

7.1 ARCHITECTURE

The architecture (fig. 7.1) of the interface is mainly structured as a localization screen with a map and functions necessary to localize a carrier, an overview over users and carriers in the context of the current user and personal profiles with information about the users and carriers.

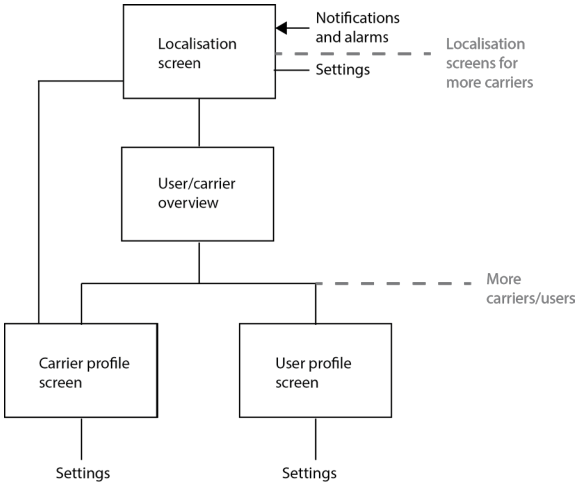


Fig. 7.1 Simplified Architecture

Localization screen
The localization screen contains all the functionality needed to monitor the status of the carrier and receive information that is needed to locate the carrier if needed. This screen also functions as the applications start screen. The rationale behind this is that most users need to access the information on this more often than any other screen and should therefore be directed there upon starting the application. This is also the most important screen during stressful situations, for example when a carrier is missing. Alarms should be visible on the localization screen for the same reason. Direct links to both the carrier profile page and the user/carrier overview should be located so that they are easily accessed from the localization screen.

User/carrier overview
This is the system overview as seen by the users, it shows other users and the carriers connected to the system. A user can see his/her own domain and the users and carriers connected.

Carrier profile screen
The carrier profile screen contains all the necessary information needed to give the users the best possible basis to help the carriers. This includes contact information to relatives, picture of the carrier and descriptions of how to treat the carrier. For administrators, this screen also provides possibilities of setting up carriers and their devices.

User profile screen
Contains all the information necessary to provide the users with notifications and alerts about the carries. This screen provides information of when the user is responsible for which carrier.

Settings menus
Settings menus for the carriers and users. These menus will be accessible from their respective profile screens.

The architecture was further developed in the next phase, focusing on the user/interface interaction.

7.2 INTERACTION

The functions from the function matrix was taken and transformed into interaction elements. For example, the “find user” function lead to the interaction element “Carrier positioning button” the “enable system overview” function lead to the “overview” button and screen. More of these can be seen in appendix 14 (functions leading to inter-

actions). With these interaction elements and the physical wireframe (section 3.5.1) a detailed interaction wireframe (fig 7.2) was created. In this wireframe interaction paths, can be seen as orange arrows leading through interaction surfaces and buttons to different screens in the interface. This was the first iteration of the application with detailed functionality placed in the interface. This wireframe would then serve as the foundation for all design work following this phase.

Elements on the localization screen (fig 7.2, in the middle) serves to give the user helpful tools when locating and aiding a carrier. A hamburger menu (fig 7.2, top left) holds map settings and other tools for the map view.

The overview (fig 7.2, top and bottom right) is sorted in carriers, alarm receivers and administrators. For a larger organization, system managers can easily be added to this view in the same manner.

The different profile screens (fig 7.2, top and bottom right) are connected to the overview and holds relevant information regarding the type of user or carrier it refers to. The profile screens connected to different carriers allows for adding custom information about the carrier to ensure the best possible treatment.

When creating a new geofence, one is presented with a geofence screen (fig 7.2 bottom left). This is not considered one of the main screens of the interface. The geofence screen is where geofences can be administered in a map view.

7.3 EVALUATION WITH KEY

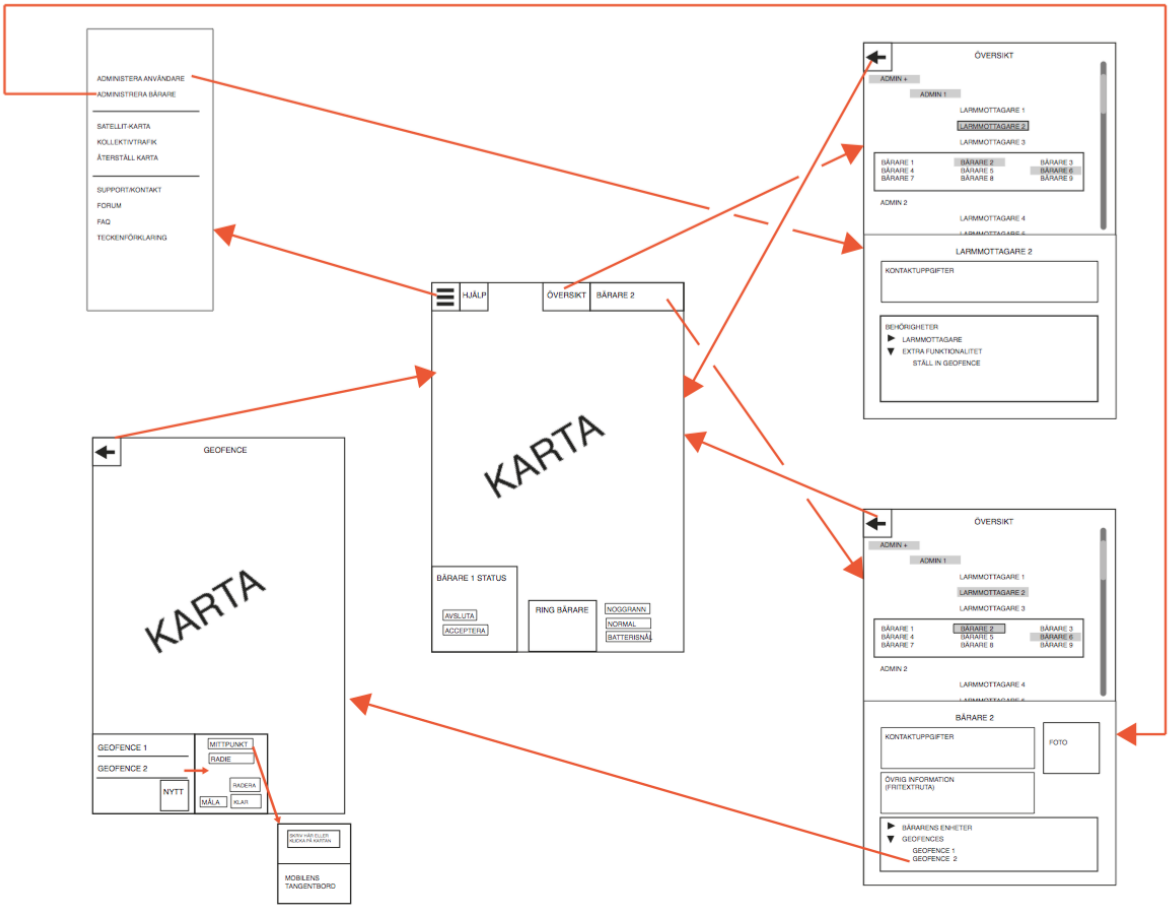


Fig. 7.2 Detailed interaction wireframe.

Locate carrier A critical task that every GPS locating interface needs to be able to handle well.	Add a geofence A standard settings task.	Change user contact information A specialized settings task.
Posifon omsorg Open application ▸ locate the right person ▸ start tracking 3 interactions	Posifon Omsorg Start application ▸ administration ▸ Safety Zones ▸ new zone ▸ name zone ▸ new zone ▸ set radius, adress, post code ▸ save ▸ close menu 10 interactions	Posifon Omsorg Start application ▸ administration▸ Användare ▸ redigera användare ▸ insert information ▸ save ▸ close menu 8 interactions
Posifon Care Open application ▸ start tracking 2 interactions	Posifon Care Start application ▸ open overview ▸ open person of interest ▸ press geofence ▸ Input centre address, radius, postcode ▸ close menu 6 interactions	Posifon Care Start application ▸ overview ▸ user ▸ enter information ▸ close menu 5 interactions

Fig 7.3 Interface tasks

INTERACTION PATHS

The following section shows three of the most representative tasks that are performed with the application. Locate carrier is performed by alarm receivers and the other two tasks are performed by administrators of the application (fig 7.3).

All the interactions the design team have tested has resulted in fewer interaction steps for the new application compared to the old Posifon Omsorg. This indicates that both the interaction paths and architecture of the new concept is more effective and efficient than the old Posifon Omsorg.

7.4 EVALUATION WITH USERS

The evaluation with users was conducted using an early graphical representation of the interface with the developed architecture and interactions represented (fig 7.4 - 7.6). The screens were placed in an overlapping manner to make the structure of the application visible for the users.

The evaluation showed that the participants (Appendix 8, Expert user test) were positive to the new interaction but that some details demanded further work. All participants were positive to the carrier focus in the application. Especially the opportunity in the carrier profile (fig 7.6) to write custom information about how to give the carrier the best treatment. One of the test participants stated: "This is so much better than what is available today, so it's easy to forget whether it would need something more."

All test persons understood how to create geofences and that they could change the shape and size of a geofence (fig. 7.7) by dragging the corners.

Fig 7.4 Localization screen

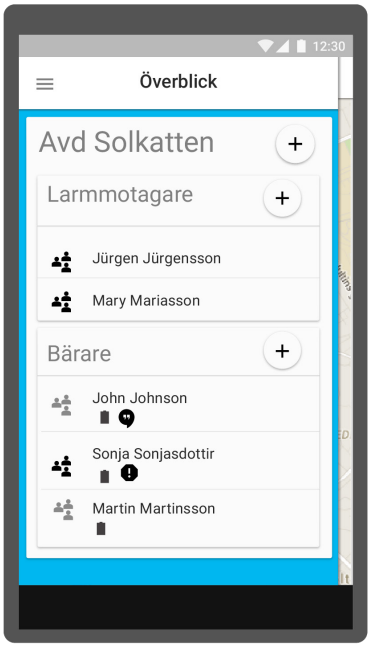


Fig 7.5 Overview

Fig 7.6 Carrier profile screen (all content visible when scrolling)

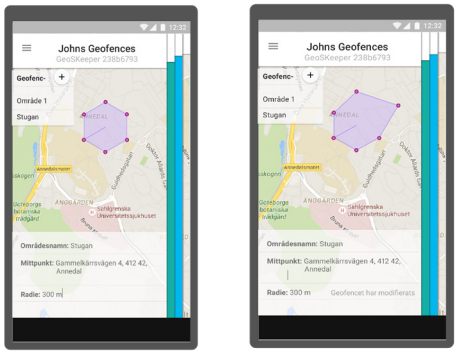


Fig 7.7 Modify the shape of a geofence

The test version of the program had several features that were removed after the test due to poor conditions of usability or ambiguous meaning. Other features were added to make the interface more functional.

In the system overview (fig 7.5) the symbols to the right of the persons were meant to illustrate how different persons are connected in the application, for example if the symbol next to alarm receiver (larmmottagare) Jörgen Jörgensson was pressed, carrier (bärare) John Johnsson and Sonja Sonjasdottir would be highlighted as well. To indicate that Jörgen Jörgensson receives alarms from John Johnsson and Sonja Sonjasdottir. This was very confusing for the test participants and one was adamant in his critique of this feature. “I don’t see the reason for this”. Three of the test participants also expressed that they thought that it was unintuitive that it was not possible to get to individual carrier map views directly from the system overview.

It was decided after analysis of the evaluation to scrap the icons representing relations within the system as this information is easily found in the carrier profile and user profile respectively. For a user with an administrative position in the system the overview of inter system relations needs to be further evaluated. In addition, a map symbol was added to the right side of the carrier names

Fig. 7.8 Map symbol

to provide a quick way of accessing their map views (fig. 7.8).

The overlapping but visible screens (fig. 7.9) did not seem to help any of the test participants in their navigation of the application. This was also confirmed when participants were asked to comment on elements of that screen.

It was therefore decided that the next iteration of the interface should be without this. The main finding from the evaluation was that information regarding how to handle alarm situations for different carriers was desirable. How to handle situations might differ depending on the involved carrier since all carriers have different needs. This resulted in carrier specific action plans being added to the application.

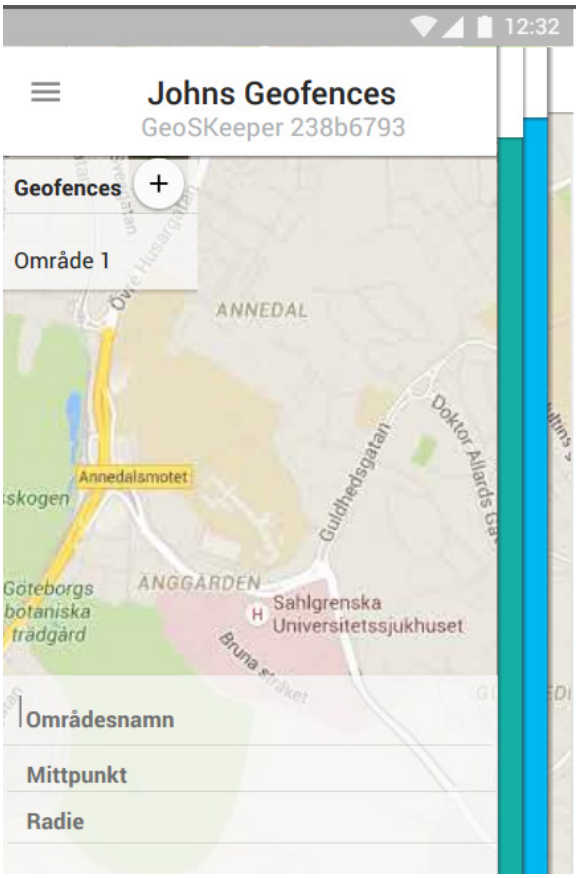


Fig. 7.9 Overlapping screens

8. DETAILED DESIGN

The following design is made for an Android interface. Google's symbols, color swatches and mobile whiteframe for Android was used to ensure a design that follows conventions for app design and is implementable for mobile use.

8.1 GRAPHICAL ELEMENTS

In this section, graphic elements such as icons are described and shown.

As stated in section 3.4, it was decided that design guidelines from a major operating system developer should be used to make the interface conform to the user's mental model of how an application should look and feel. In this case Google's Android was chosen. Most of the graphical elements in the interface has also been provided by Google's icon library for design for Android.

Some needed icons were not to be found in the library and was therefore designed by the project group or modified to suit the purposes of the interface (fig. 8.1)

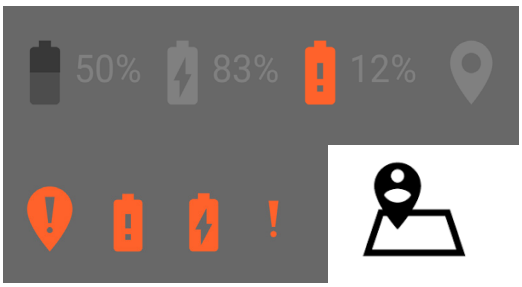


Fig. 8.1 Symbol 1: Missing carrier with alarm unhandled. Symbol 2: Critical battery level. Symbol 3: Fully charged device still charging. Symbol 4: Malfunctioning device. Symbol 5-7: Battery level. Symbol 8: Carrier under tracking. Symbol 9: Map view.

8.2 SCREENS

This section describes the screens and their graphical content.

The interface has been designed with the personas in mind. The following design displays how the interface would look for Jörgen (section 4.3) at the care home where he is an alarm receiver and cares for the carrier John. It is also described how the interface will look for someone with access to more functions, for example an administrator. An alarm receiver can also have access to functions more associated with an administrator and vice versa. To keep it simple the following descriptions will however focus on default settings for alarm receivers and administrators.

8.2.1 LOCALIZATION SCREEN

The localization screen (fig. 8.2) contains all the tools used to localize a carrier. The localization screen is also used as start screen for the application that opens when the application is started.

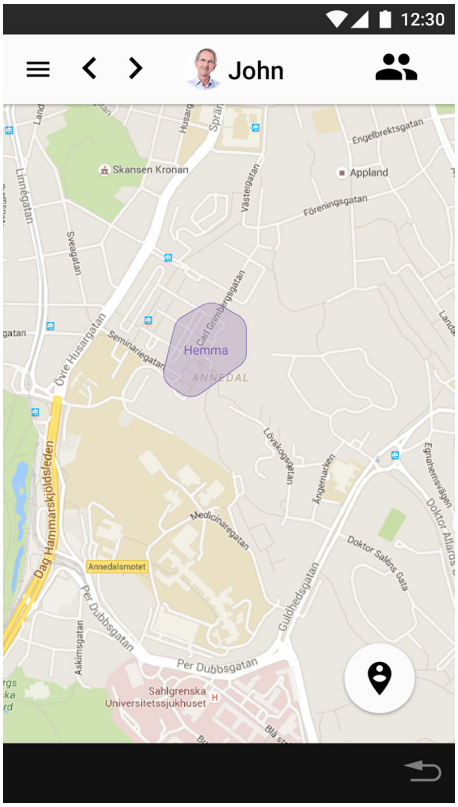


Fig 8.2 Localization screen with John as carrier in focus

The main part of the screen is filled by the map and information such as carrier positions and active geofences. Geofences are shown as semitransparent purple areas with their names in the middle. To the bottom right on the screen the locate active carrier button is located. This is used to find out the current location of the carrier. A carrier's position is only visible when a user asks for it by pressing this button, making it possible to log this action. An exception is when an alarm is triggered by a carrier leaving his/her geofence or sending a manual alarm (possible with GeoSKeeper). Since this is a critical situation, the carrier's position will be visible automatically. When pressing the hamburger menu in the top left of the screen a menu with the Posifon logo is presented (fig. 8.3). This menu contains the option to show the user's own position with respect to the active carrier, map settings such as show satellite map and support functions.

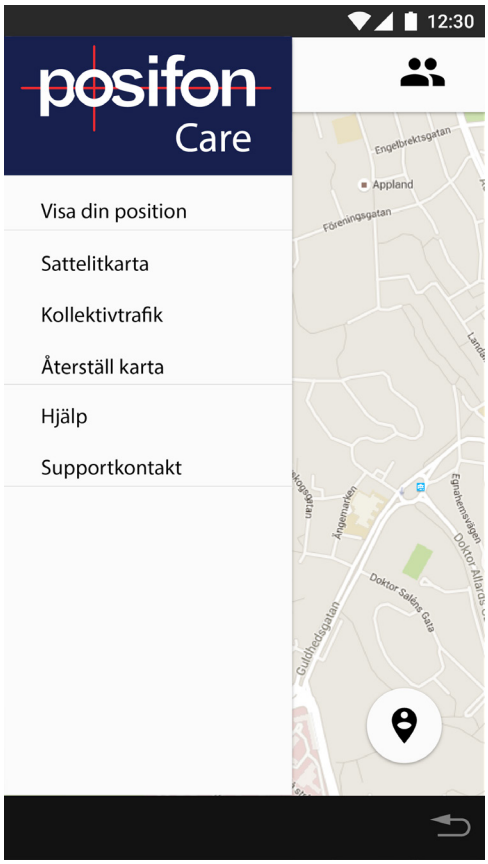


Fig. 8.3 Expanded hamburger menu

Navigation arrows that is used to browse between carriers (fig 8.4) and a button that leads to the carrier/user overview screen is also in the top bar. A picture and the name of the currently selected carrier in the top bar makes it clear what carrier is currently in focus.

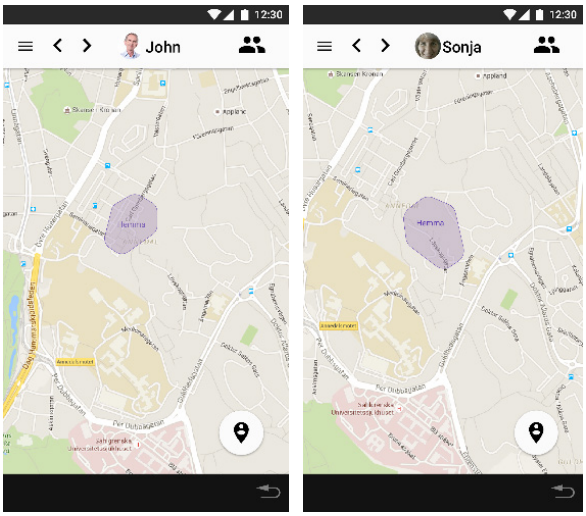


Fig. 8.4 Localization screen with different carriers in focus

8.2.2 OVERVIEW

The overview screen shows the users their organization. In figure 8.5 the alarm receiver (Larmmottagare) Jörgen sees a list of carriers (Bärare) in his department and a list with himself and his colleague Mary. To the right of each carrier name and portrait there is an icon that lead to the localization screen of that carrier. Status indications concerning the device carriers are seen as symbols in the overview screen.

Status indications are seen for:

- Ongoing localization alarm (fig. 8.6, symbol 1).
- Battery status (fig. 8.6, symbol 2 and 5-7).
- Fully charged device still charging (fig. 8.6, symbol 3).
- Malfunctioning device (fig. 8.6, symbol 4).
- Ongoing tracking (fig. 8.6, symbol 8).

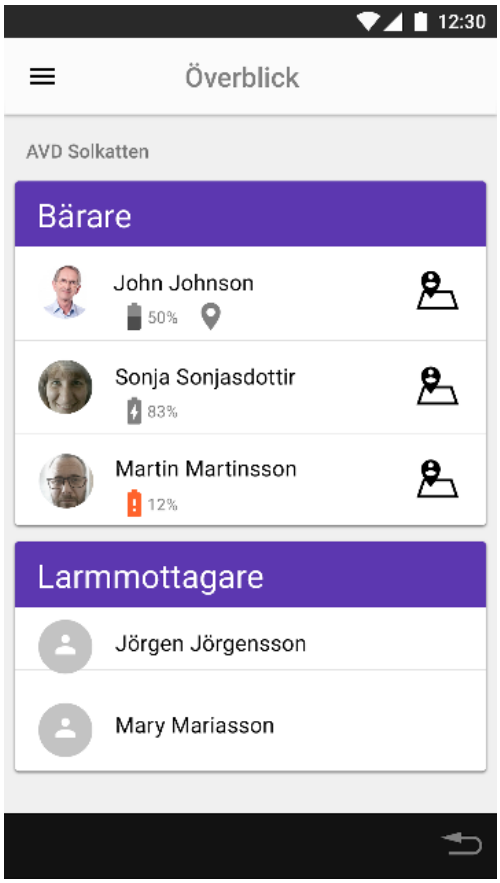


Fig. 8.5 Overview

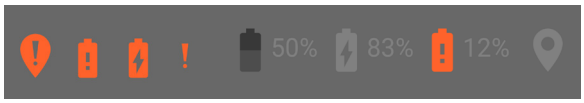


Fig. 8.6 Symbol 1: Missing carrier with alarm unhandled. Symbol 2: Critical battery level. Symbol 3: Fully charged device still charging. Symbol 4: Malfunctioning device. Symbol 5-7: Battery level. Symbol 8: Carrier being tracked

In the example in figure 8.5, John is being tracked which is indicated by the position symbol under his name. The example also shows that Sonja's device is being charged, as indicated by the symbol under her name. Martin's device battery level is below 20 % which is shown with an orange battery symbol. This means that it has triggered an alarm which is sent to the responsible alarm receiver. All orange symbols in the overview illustrates a critical situation which has triggered an alarm. Alarms are further described in section 8.3.

Figure 8.5 illustrate how the overview looks for an alarm receiver. For an administrator, it looks a little different. The administrator view is similar to the alarm receiver view but contains some added functionality. The administrator interface contains the add user and ad carrier buttons in the top bar of each list which can be seen in figure 8.7. This view also contains the possibility for the administrator to add and see more than one department (AVD solkatten). In the administrator

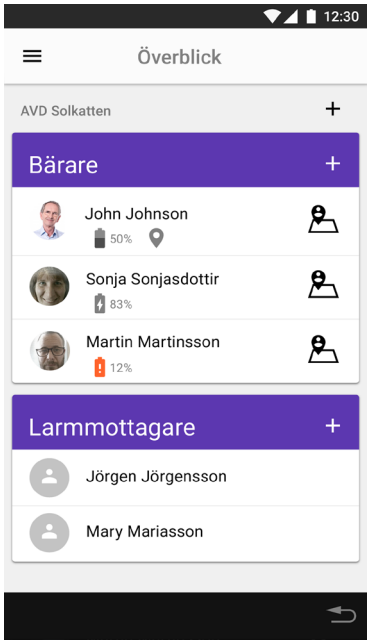


Fig. 8.7 Administrator, overview

view below there is only one department with the possibility to add another.

By clicking the purple banner in one of the boxes, the boxes can be expanded or compressed in the same manner as the carrier profile screen described in the following section.

8.2.3 CARRIER PROFILE SCREEN

The carrier profile screen contains sections with information and settings relevant to the carrier. To expand or compress a section, the user can click the purple banner, as seen in figure 8.8.

8.2.3 CARRIER PROFILE SCREEN

The carrier profile screen contains sections with information and settings relevant to the carrier. To expand or compress a section, the user can click the purple banner, as seen in figure 8.8. The first section, named after the carrier, contains information about the carrier such as name, address and a free text field where notes on how to interact with the carrier can be seen in fig. 8.9. This section also holds the action plan, a free text field with information on how the users should respond to an emergency involving this carrier.

The second section, Alarm Settings (Larminställningar) (fig. 8.10) shows an alarm settings section with two active alarms for John. Alarm 1 has the primary receiver set as the alarm receiver Jörgen and the secondary alarm receiver Mary. This alarm is active on the days highlighted in green during the times mentioned below the days. If an alarm receiver is missing for a certain time interval a red warning text will appear. The importance of primary and secondary alarm receivers is further described in section 8.3.

The third section is the geofence section (fig. 8.11). By pressing the name of a geofence it can be viewed in a map view.

The last section contains information about the localization devices connected to the user in question. To add a new device to the carrier the add button is pressed. The application then asks for the device's serial number after this number is entered the relevant fields appear and can be filled in to setup the device. In figure 8.12 settings for a GeoSKeeper can be seen.

For an administrator, or someone with both alarm receiver and administrator access, the carrier profile screen contains the ability to add fields and update information (fig. 8.13). An administrator can also add geofences, localization devices and alarms.

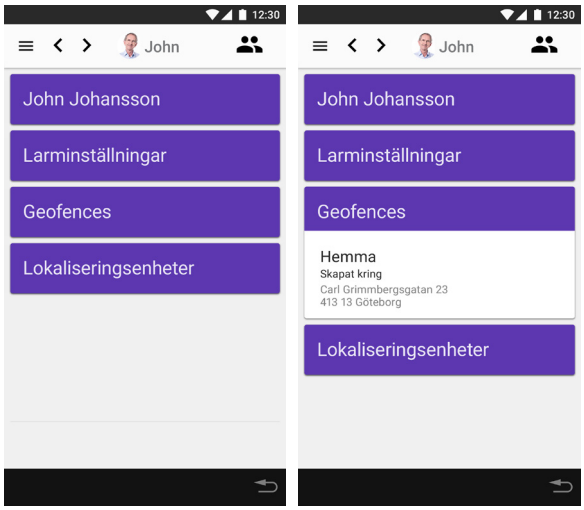


Fig 8.8 Alarm receiver: carrier profile. Expandable sections

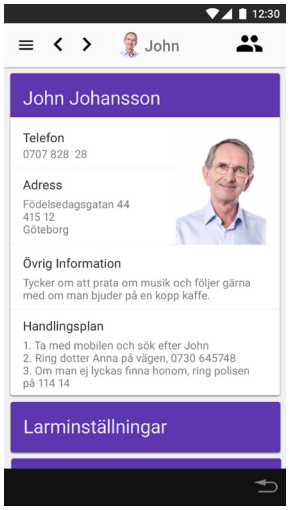


Fig 8.9 Alarm receiver: carrier profile. "John Johnsson" section expanded

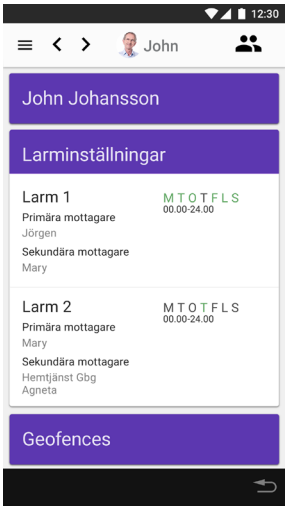


Fig 8.10 Alarm receiver: carrier profile. "Larminställningar" section expanded

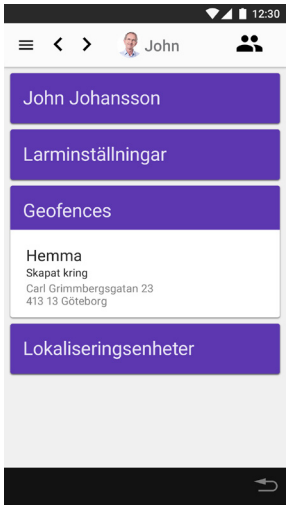


Fig 8.11 Alarm receiver: carrier profile. "Geofence" section expanded

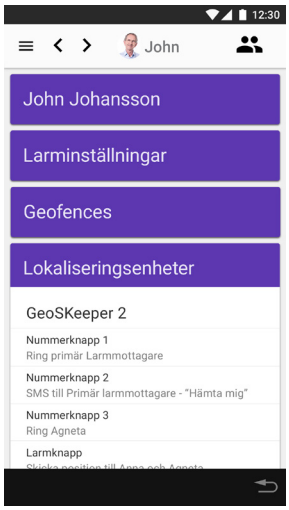


Fig. 8.12 Alarm receiver: carrier profile. "Lokaliseringsenheter" section expanded

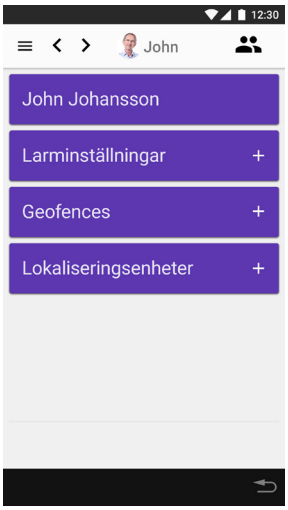


Fig. 8.13. Administrator: Carrier profile. All sections compressed

8.2.4 GEOFENCES

If an administrator chooses to add a geofence, the selected carrier's geofence screen is opened (fig. 8.14). From this screen, it is then possible to enter the relevant information necessary to create a new geofence (fig. 8.15):

- Name of the geofence
- Address or coordinate that define the center point of the geofence
- Longest distance to center point, this defines the initial radius of the geofence

Lastly the administrator can customize the geofence by moving the handles in the corners of the geofence (fig 8.16)

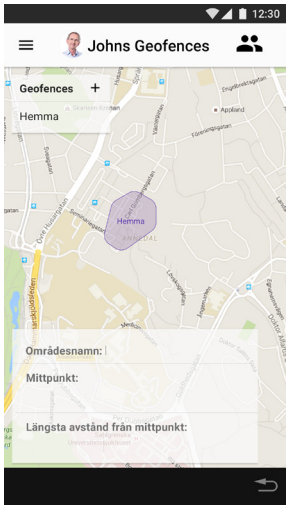


Fig 8.14 Geofences step 1

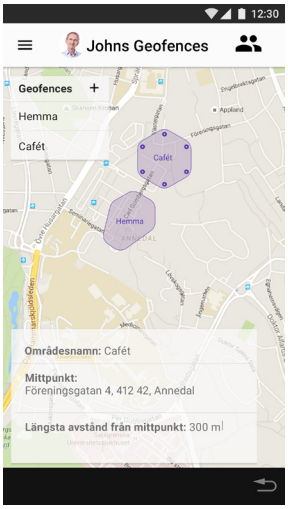


Fig 8.15 Geofences step 2

The corners of the geofences are rounded due to technical limitations. The GPS devices are not accurate to measure the short distances in a pointy corner. This view can also be accessed to view, edit or remove geofences.

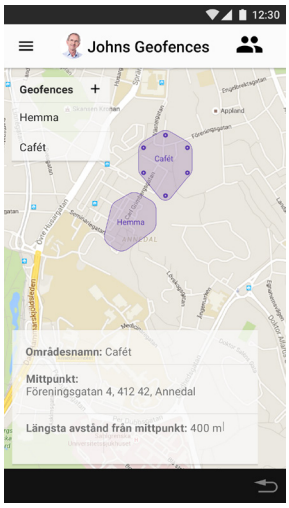


Fig 8.16 Geofences step 3

The user simply presses a geofence in the geofence list in the carrier profile to access the geofence view. The geofence will be displayed in the center of the map view with the options of editing or removing the geofence. Someone without permission to edit geofences (an alarm receiver without access to this administrative function) will only see the geofence.

8.2.5 USER PROFILE SCREEN

The user profile screen (fig. 8.17 and 8.18) is similar to the carrier screen. The first section contains contact information to the user and the second screen lists all the alarms that the user is connected to.

For an administrator, the user profile screen contains a section where the administrator can define access to functions and information for an Alarm receiver (fig. 8.19). In figure 8.19, Jörgen has access to all functions associated with aiding a carrier. He also has permission to the administrative function of modifying geofences. This functionality gives users the ability to customize user profiles and define access for different users in a simple way.

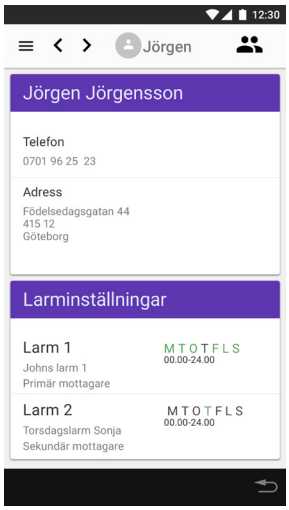


Fig 8.17 alarm receiver: User profile. All sections expanded

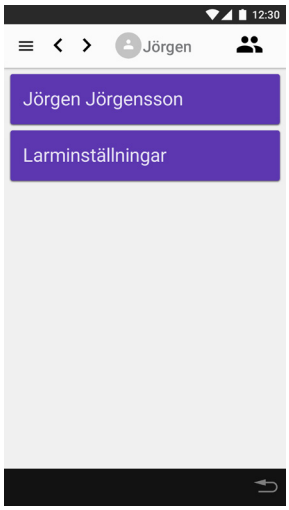


Fig 8.18 alarm receiver: User profile. All sections compressed

Fig. 8.19 Administrator: User profile. "Behörighet" section expanded

8.3 ALARMS

When an alarm is triggered, the alarm receiver receives a push notification and an SMS as default. The alarm receiving method can be edited by an administrator. The thought behind this is that at some locations the internet connection can be down or the phone reception. It can therefore be good to use both channels to ensure that the alarm reaches the alarm receiver.

Alarms are triggered by:

- Breached geofence
- Manual alarm from the carrier (when the localization device supports this)
- Critical battery
- Device loaded and still loading (should be put back on the carrier)
- Malfunctioning device
- Device has been turned off

What triggers an alarm can be changed by an administrator.

When opening the application in the case of an alarm, the localization screen displays what type of alarm is received. In figure 8.20, Jörgen receives an alarm telling him that John has breached his geofence. The action plan (handlingsplan) can be expanded to show Jörgen how to act in the current situation (fig. 8.21). The buttons "handle" (hantera) and "pass on" (sänd vidare) gives Jörgen options to handle the situation himself or pass the alarm on to a secondary alarm receiver, in case he is unable to attend to it. If all colleagues are unable to handle the alarm, it will be passed on to administrator level or, as a final resort, the police. To make the user aware of where the alarm is going, a notification will tell them so after pressing "pass on" so they always know the result of their actions and can undo (fig. 8.22). If he chooses to handle the situation, his colleagues can see this in the overview.

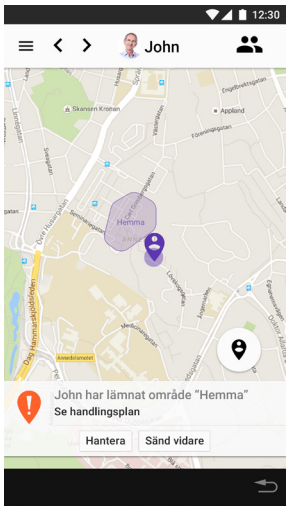


Fig. 8.20. Geofence alarm

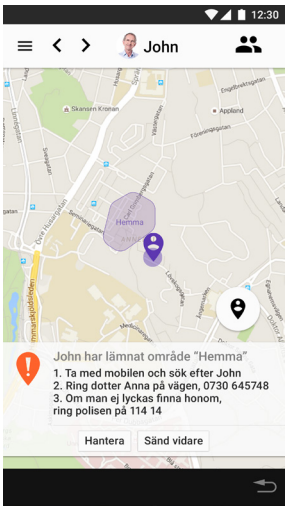


Fig. 8.21 Expanded action plan

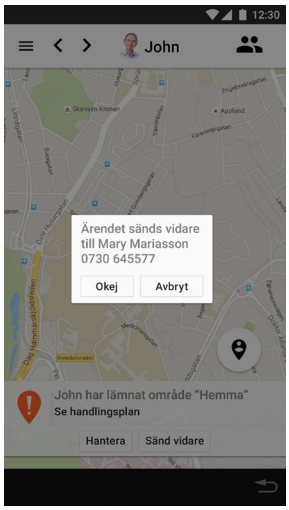


Fig 8.22. Message after choosing to pass on the alarm.

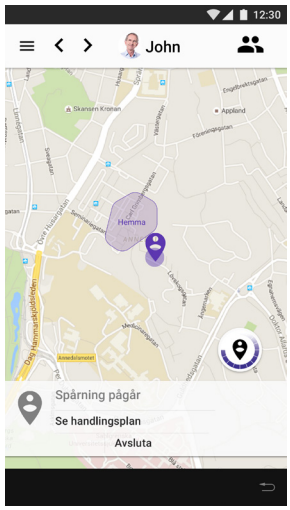


Fig 8.23 Fetching position animation in lower right corner

The most recent location is illustrated with the purple symbol for location with a stylized person figure inside (fig. 8.24). When pressing the symbol for a position one is presented with position data such as time and address (fig. 8.25). Old positions are illustrated as dots with lines connecting them to the most recent to illustrate their order and give a sense of the carrier's direction (fig. 8.26).

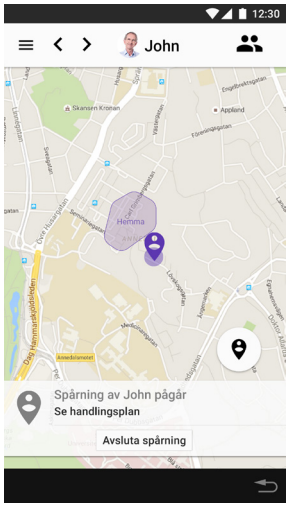


Fig. 8.24 Most recent position

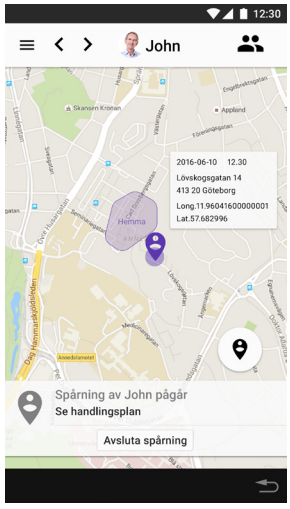


Fig. 8.25 Position data

When John is found, the tracking can be completed by pressing "exit tracking" (avsluta spårning).

8.4 INTEGRITY

As stated in section 2.3, integrity aspects are important to consider in the design of this type of application. This section describes design choices that has been made regarding the integrity and safety of the carriers.

A search for the carrier's position will start automatically in the event of a breached geofence or a manual alarm from the carrier. At all other times, positions will only be shown when asked for. This will ensure that the system can log when someone has retrieved position information from the system. It can also make users more comfortable to look around in the interface as they will not be forced upon sensitive information.

The customizability of the interface allows for operations to decide what information and functions should be given to what users. This allows for the system owners such a municipality to take their own responsibility for handling personal information.

9. EVALUATION

The detailed design was evaluated in several steps. Changes was made to the interface between the evaluation iterations before the final detailed design (chapter 8) was accomplished. Design elements shown in this chapter therefore differs slightly from the final design presented in chapter 8.

9.1 EVALUATION WITH FUNCTION MATRIX

The evaluation with the function matrix (figure 6.3) showed that most functions regarding alarm receiver and administrator had been represented in the interface. The exception was the suggested function "indicate the direction of the carrier". This was at first implemented in the design as an arrow combined with the symbol for the position of the carrier. It however turned out to be problematic due to technical limitations since the application cannot decide the direction of the carrier in a satisfying way. It was therefore decided that this function could be implemented in the design by the possibility of showing at least one position before the most recent (Fig 9.1). This will allow for a user to get an indication of what direction the carrier is heading.

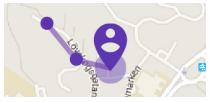


Fig 9.1. Positions, old and current

The functionality that is connected to information gathering in the system has not been included in the design as these tasks fall outside of the scope of this project.

9.2 EVALUATION OF DETAILED DESIGN PART 1

In the first part of the evaluation it became clear that some changes should be made to the design but the overall experience was positive.

9.2.1 FINDINGS

It was clear for all three participants that the first screen presented at the test (Fig 9.2) meant that John had left his predefined geofence and are needed to be found. They all understood the symbol for John's position and how old positions were visualized.

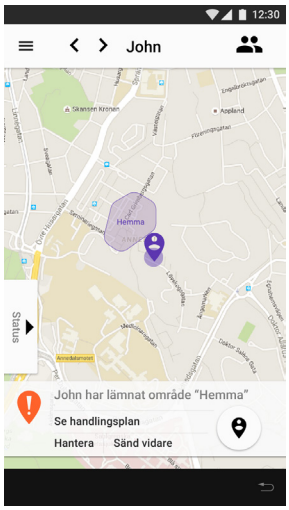


Fig 9.2. Geofence alarm

When executing the task of responding to a geofence alarm, all participants but one completed the task without help from the test moderator. The remaining participant understood what the alarm meant but was unsure about how to respond to it and was afraid to do something wrong. The participants were a bit confused by the options hantera (handle) and sänd vidare (pass on) when receiving a geofence alarm.

Most symbols and icons used in the interface was clear to the participants with a few exceptions. The most problematic one being the symbol for returning to the Localization screen from the Overview screen. The symbol version used in evaluations was almost symmetrical (Fig 9.3 To the left). One

participant thought it looked like the head and shoulders of a person and thought it lead to a carrier profile. Another interpreted it as

Fig 9.3. Localization screen button. To the left: Old version. To the right: New version

Fig 9.4. Overview symbol

a box with the carrier's location inside, thinking it meant that the carrier was inside his/her geofence. The first participant also had difficulties understanding the arrows in the top banner. None of the participants understood that clicking names, both in the Overview and in the top banner of the localization screen, would lead to a different screen. The symbol leading to the overview (Fig 9.4) was unclear for two participants before clicking it, who stated that it reminded them of a symbol for entering a social network. After entering the overview by clicking the symbol, all participants thought the symbol was suitable.

Navigating through the interface was relatively simple for all participants. The major obstacle was the previous mentioned symbol for localization screen (fig 9.3. Left side) which made participants uncertain of how to move on.

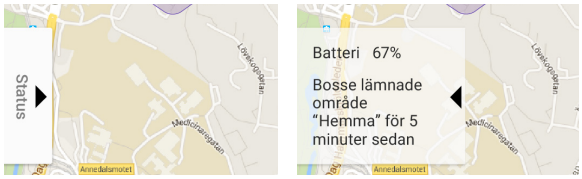


Fig 9.5 To the left: Compressed status banner. To the right: Expanded status banner

	Respond to geofence alarm	Symbols and icons	Terminology	Navigating through the interface	Make settings to user profile
TP 1	Needed guidance	Did not understand: -Symbol for localization screen. -Symbol for overview	Did not understand: -*Hantera* (Handle). -Geofence.	Had problems navigating from the overview	Completed task
TP 2	Completed task	Did not understand: -Status banner	Did not understand: -Avsluta (quit)	Had problems navigating from the overview	Completed task
vTP 3	Completed task	Did not understand: -Symbol for localization screen. -Symbol for overview -Status banner	Did not understand: -*Hantera* (Handle) -Sänd vidare (pass on)	Had problems navigating from the overview	Completed task

Fig. 9.6 Evaluation summary

When helped by the test moderator to reach the profile screens for carriers and users, participants had no difficulties to understand them.

The design under evaluation had a status banner in the localization screen with information regarding the carrier's status (fig 9.5). All participants were confused by the status banner before expanding it (fig 9.5 To the left) since they didn't understand what information would be found there.

All participants could return to the carrier profile to make settings after exploring the interface before. All of them accessed the carrier profile through the overview instead of using the shorter way of clicking "John" in the top banner of the start screen. The previous table (fig. 9.6) summarize the result of the evaluation:

9.2.2 CHANGES TO THE DESIGN

The first evaluation of the design lead to changes being made before evaluating the second time.

- Show the picture of the carrier in the profile screen next to the carrier name to enable fast navigation (fig. 9.7).

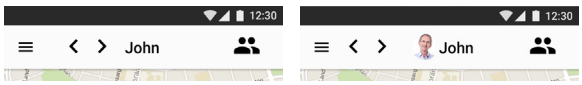


Fig. 9.7. Navigation, To the left: Old version, To the right: New version

- A message was added when pressing the send forward button in the interface to give the users information about what is happening and give the option to terminate action (fig. 9.8).

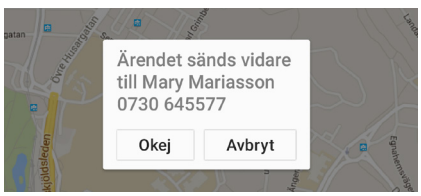


Fig. 9.8. Pass on alarm, Information

- The symbol to enter map view for specific carriers was made less symmetric to clarify its function and reduce the similarity to a human upper body (fig. 9.9).

Fig. 9.9 Left side: Old version. Right side: New version

The second part of the evaluation gave more detailed information about the guessability of the interface and what should be altered. Some changes were made to the design after the evaluation before the final detailed design (chapter 8) was accomplished.

9.3.1 FINDINGS

All five participants completed the task of responding to a geofence alarm. One participant did however request guidance from the test moderator to proceed. It was clear to all five participants in the validation test that the situation described on the first screen in the test (fig. 9.10) is that John has left his geofence area. Two of the test persons stated that they wanted to press the hantera (handle situation) button to progress the situation. Two of

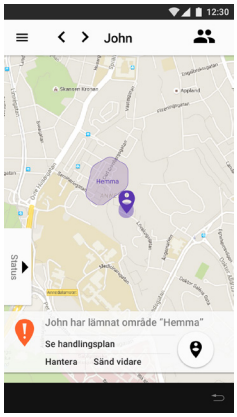


Fig. 9.10 Geofence alarm

the participants were unsure whether hantera and sänd vidare (pass along situation) where interaction surfaces. The design under evaluation did not illustrate these two options with clear buttons but with the same type of text as visa handlingsplan (show action plan).

This was later changed to the final design presented in chapter 8.

All participants except one considered the alarm bar at the bottom of the interface to be cluttered. One participant thought that the status bar (fig. 9.11) was excellent to find

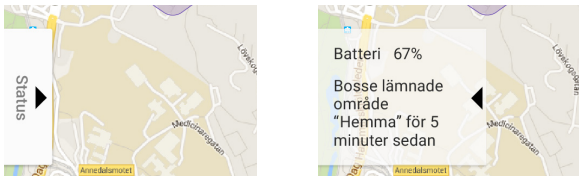


Fig 9.11 To the left: Compressed status banner. To the right: Expanded status banner

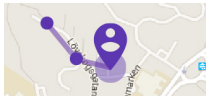


Fig 9.12. Positions, old and current

battery information. The other three participants were confused by both the location of the status bar and the name status. Two of them also did not think that the information given in the status bar felt critical to the task. Four test participants thought that the small markers for old positions (fig 9.12) to be unambiguous. Two participants expressed that it was nice to get an idea about the carrier's direction. All the participants understood the symbol indicating the carrier's position.

When asked to point out all interaction surfaces, two participants clearly understood that the arrows in the top bar are used to browse carriers. The remaining understood

Fig 9.13. Overview symbol

that they are interaction surfaces but did not express their function. None of the participants expressed that they thought that the picture or name of the carrier where interaction surfaces. Four of the participants did however press the carrier name when they wanted to find the carriers information page which showed that it was intuitive. All participants expressed that they were satisfied that the "organization overview" button (fig. 9.13) lead to the organization overview screen.

When asked to edit the carrier information field four of the test participants expressed that they did not know how to enter edit mode for a text field. All participants did however try to press the relevant field, as intended. Several participants stated that it looked like unxeditable text due to the size of the text field and the text looking quite uniform. Two participants were very satisfied when they found the "other information" field. One of them expressed "this is very useful to know when going out to find him."

On the following page table (fig 9.14) displays findings from the evaluation:

	Respond to geofence alarm	Symbols and icons	Terminology	Navigating through the interface	Make settings to user profile
TP4	Completed task	Had no problems	Had no problems	Did not consider the possibility to click the carrier name at first but later did that anyway.	Completed task
TP5	Completed task	Had no problems	Did not understand: -*Hantera* (Handle).	Had no problems	Completed task
TP6	Requested guidance	Had no problems	Did not understand: -*Hantera* (Handle). -Avsluta (Quit)	Had no problems	Completed task
TP7	Completed task	Did not understand: -Rotating symbol for fetching new positions -Symbol for Localization screen	Had no problem	Did not consider the possibility to click the carrier name at first but later did that anyway.	Completed task
TP8	Completed task	Had no troubles understanding the symbols and icons	Had some initial trouble understanding the term - *hantera* (Handle)	Did not consider the possibility to click the carrier name at first but later did that anyway.	Completed task

Fig 9.14 Evaluation summary

9.3.2 CHANGES TO THE DESIGN

The evaluation lead to following changes being made to the design:

- Some name changes were made to make information more clear: Avsluta (exit) → Avsluta spårning (exit tracking)
- Dividing lines between the texts in the text boxes for personal profiles and similar screens was added. This was made to make the text boxes look less like non-editable text fields (fig. 9.15).

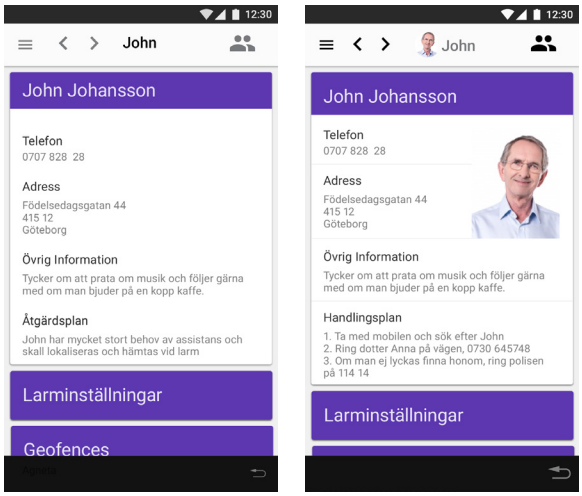


Fig 9.15. Text fields. To the left: Old version, To the right: new version

- The Status box from the start screen was removed since this was found to be confusing and didn't bring much value (fig. 9.16). Battery information can easily be seen in the Overview screen and time since geofence breakage can be seen when clicking the symbol for the first position outside the geofence.
- The icon for localizing a carrier is placed higher when the alarm field is on the screen to make this field less messy (fig. 9.16).
- To make Hantera (handle) and Send vidare (Pass along) more clear, these interaction surfaces was made as buttons. This should make the carrier aware that they are connected and one of them should be chosen (fig. 9.16).

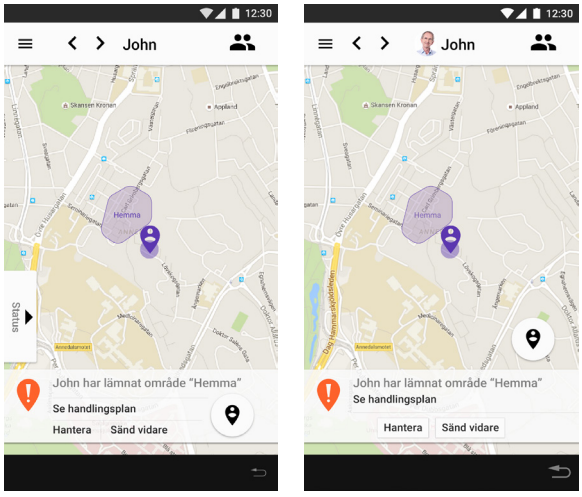


Fig. 9.16 Changes to localization screen. To the left: Old version, To the right: New version

9.3.1 CONCLUSION OF EVALUATION

Overall the participants were very positive in their feedback, especially the two users in the first part of evaluations that had previous experience. They were very convinced that the new application would have been very well suited to handle the challenges they were faced with in the care of a person with dementia. The positive feedback and the three iterations of the design makes the design team confident that the design is robust and would function well for the intended target groups.

10. DISCUSSION

The following chapter contains a discussion about the project process, results and the design that followed. Some minor changes were made after the last session of evaluations.

10.1 ADJUSTING THE DESIGN

The ambition from Posifon is to release the new system and its interface in the early second half of 2016. The design team behind this thesis and Posifon share the view that the interface presented in this report will give the users of the system a clear advantage with respect both to usability and functionality compared to any existing system on the market.

The presented design is specifically aimed at alarm receivers and administrators operating on a small Android device, such as a smartphone. When designing for other platforms and operating systems it is advised to follow general guidelines regarding icons and placement of interaction surfaces, provided by the suppliers of these platforms to conform to platform consistency.

When it comes to screens of a larger size it is recommended to use the extra screen real estate to fit more functionality onto the screen at any given moment. For a Computer screen the following general architecture is advised. The map view should be expanded to cover more of the screen. The Carrier/ alarm receiver view and the organizational overview should always be visible to either side of the map.

When adjusting the design to other groups than the ones that are focused in this project it is recommended that the designers should review this report and then iterate the design process to develop the application in a way that maximizes the applications conditions for usability for these new target groups. The design is developed with consideration to future needs to develop the interface further for system administrators, information owners and other user types. In accordance with the detailed design limitations (section 3.5), the design does not include unusual situations. Some situations that should be considered in further design work includes:

- What happens in the interface is several carriers are missing at the same time?
- How should the overview look for a carrier with several localization devices?
- How should an alarm be handled if there are several primary alarm receivers?

10.2 TECHNICAL LIMITATIONS

It was stated from Posifon that the geofences was defined by the localization device, meaning that the method for defining geofence would have to be handled a bit different in the interface depending on the device. Therefore, if a user has several devices the geofence must be defined for each device. This would decrease the consistency of the interface and make it more device focused instead of carrier focused. In dialogue with Elicit a new method for defining geofences was discussed. This is based on the device sending positions regularly and the geofence being defined in the application instead. This would allow the user to define geofences specifically for the user and not the device and allow for geofence of more complex shapes. This would decrease battery time and increase demands on data security, meaning the positions would have to be encrypted [expert within positioning technology, interview 2016].

During the evaluation phase it was also found that technical limitations focusing in data security regarding suggested way of defining geofences in this project would not be a problem. New demands on data security within these types of applications stated that posi-

tion data would always have to be encrypted, making the new solution feasible. This needs to be further investigated [business area manager, technology in elderly care, interview 2016].

The suggested solution for geofencing demands signals to be sent from the GPS device at regular intervals. This will put considerable demands on the battery than that of solutions where computations are made in the device itself. The decision to go with the more customizable backend geofences was carefully considered and it was found that the batteries in modern GPS devices can handle the strain of sending signals at small enough to give a relevant position of the carrier. Therefor it was decided that this should be used as it was evaluated to possess clear usability advantages over the on device geofencing.

10.3 VALIDITY OF TESTS AND INTERVIEWS

Validation test

When performing the validation tests, the test participants were asked to explore and interact with a printed paper prototype, the test leader then explained what happened when the test participants performed an action with the prototype. This has certainly affected the validity of this test negatively compared to using a digital, interactive prototype. This was deemed to be especially true when it comes to tasks about identifying interaction surfaces where the feedback is intended to be both haptic through vibration and visual, through highlights. In these cases, the test participants expressed a greater discomfort in relation to the test situation and greater insecurity about their own performance, compared to the other parts of the test.

It was decided that this loss of validity was acceptable, considering the amount of effort it would require to produce a functional, digital prototype. Since the validation tests resulted in changes to the interface that were consistent with Jordan's usability guidelines presented in section 2.4 the validation was deemed adequate.

Test participants.

For the early tests the test participants were primarily from the Gothenburg area. Many of them had also met before and discussed welfare technology. It is possible that this might have affected the results of this project as the test participants might have influenced each other prior to the test by discussing the subject of localization devices and their applications.

One potential consequence of this it that several test subjects may have heard the same user stories prior to our interviews. This could then potentially make the project group to have a skewed picture of how common or important that type of situation is in the real use situation.

In the later stages of the project persons from other municipalities where part of the discussions and validation of the interface. This makes the project group suspect that eventual bias in the first test due to limited selection of participants was largely rectified in the second iteration of the design phase.

In this project consideration, has been given to Posifon AB and their wishes on the project and a new interface. This may have affected which persons were interviewed and potentially even what functionality was included in the final prototype. Concerning what persons were interviewed the project handled this by interviewing persons made available to the project by Posifon and then screening the transcription to secure that the answers were relevant to the project. When it comes to functionality included to please Posifon this was apparent in one case where the company asked for a geofence creation system that is suboptimal from a user perspective but better for Posifon's subcontractors. After evaluation

With TP1 and TP2 in the first round of evaluation testing it was decided to go for the more user-friendly option and give Posifon information on how they should implement the other option with as little interference with the rest of the design as possible.

The function matrix was a valuable tool to identify what functions were needed as interactions in the interface. There are however a few aspects of the function matrix that merit a bit more thought. The creation of the function matrix was based largely on the interviews which participants that all had experience with one or more of the three devices. This could lead to the function matrix to be less than ideal when introducing a new unit with different capabilities into the system. With regards to the project this scenario falls outside of the scope but is a concern when it comes to further development of the application. It leads to the question of when the design of a digital product is over. It is the view of this project group that the design of Posifon care would benefit from being further developed in cooperation with a design team prior to any updates to the system.

The information gathering group in the matrix is less well defined than the other function groups. This is due to the limitations of this project; it was decided that these functions needed to be loosely defined to understand the system in with the application operates. If these functionalities are to be incorporated into the application in a meaningful way, a completely new analysis needs to be performed and complementary interviews are probably needed to understand the users that need this functionality.

10.5 DESIGN DECISIONS

Some design choices were discarded but still deserves to be mentioned as they seek to solve some problems with the interface, common for all these solutions are that they make the interface less over viewable or clear.

It was decided to try to differentiate the interface of an alarm receiver from that of an administrator. This was done by graying out text that is not editable. This solution was found to not clarify the interface in the intended way but instead make the interface less over-viewable and made text hard to read. It was instead decided that the interface should follow conventions for uneditable text with a fading highlight when that text is tapped.

To make the architecture of the application visible to the user it was decided in early design phases to show the user where in the application they are by showing underlying screens like in figure 10.1. This proved to be of no greater help to the test participants and consumed screen real estate it was therefore removed.

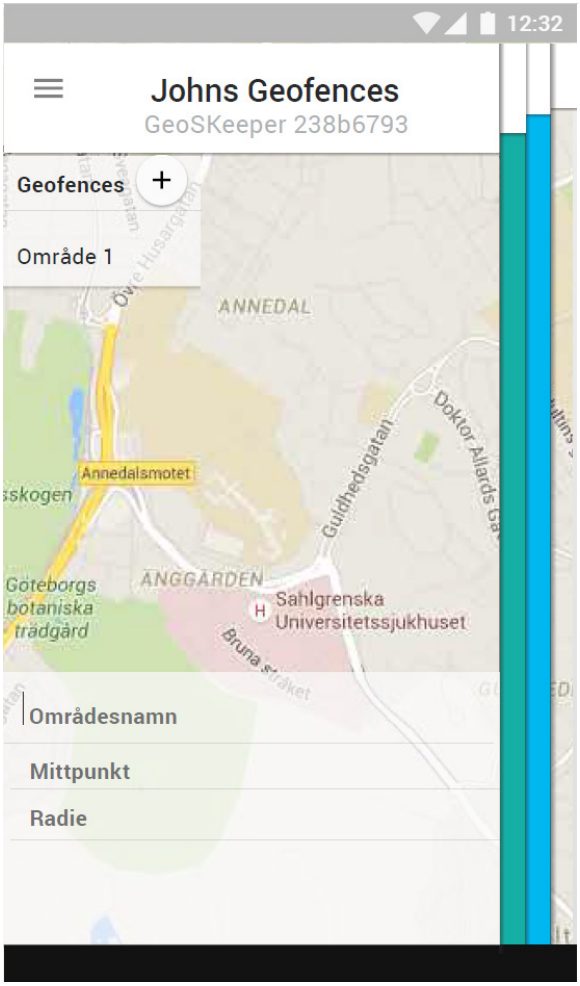


Fig. 10.1 Overlapping screens

10.6 FUTURE CONSIDERATIONS

The elderly care is in a state of change. Not only is the population getting older but more and more technology is introduced for us to be able to cope with the care of this growing community. This state of change makes the legislative part of for example GPS tracking in care of persons afflicted with dementia lag. Developers need to be mindful of not only the needs and wishes of their users and customers but also of how the playing field will change in the upcoming years. This with regards to new rules of how to handle consent when it comes to the dementia care and new rules of how personal data needs to be handled.

The conditions for this type of product will also change as a new generation of elderly are accustomed to and even depend on smart technology such as smart phones. Today this type of technology often induces feelings of insecurity and inaptness both in care staff and for relatives and persons in need of care. While this is likely to change, it is something to consider and avoid when designing this type of system.

10.7 DIFFERENT LOCALIZATION DEVICES

The interface of the application is designed primarily with the three localization devices in Posifon's range, the interface is however designed to be able to handle these different devices in the same way. This is done in three ways, here presented in order from most to least desirable. Firstly, most GPS devices support roughly the same functionality and work in the same way. This enables the interface to present relevant information with a minimal requirement on customization. The second case is when the same function is available on several devices but the information needed to make the function work differs or the information sent from the device is presented in different ways. This is easily handled by designers and programmers by making the interface present information in a consequent way across devices. One example were this approach was applied in this project is with concern to the geofence capabilities of the devices. In this project the differences in geofences was handled by making the devices send positioning signals at regular intervals and doing the geofence calculations in the system back end. The third scenario is when a device has functionality that falls outside what can be expected as is the case in the phone capabilities of GeoSKeeper. In this case it is advisable to initiate a more encompassing design alteration and test the changes that are made to the interface.

11. CONCLUSION

This project resulted in a prototype of a localization application that puts the device carrier that is the center of the user's focus in the focus of the application. This approach has been found to be advantageous for the users of the application as this is more in line with the mental image that the users have of the system in which they operate. The new application also displays improved conditions for usability

It has been shown that technology that is to be introduced into the elderly care situation needs to possess several characteristics to be able to be successful on the market. The technology needs to be customizable, the care sector is far from homogenous in every situation. To fit for as many persons as possible the users need to have the option to be able to adapt the technology to their situation rather than adapting the care situation to the new technology. Customizability is also important to give users ability to define access to different functions and information about the integrity of the carrier. The technology needs to be helpful in the care situation to facilitate the situation for all users. It also needs to be accessible to the intended user groups, this has been achieved in this project by keeping to the standards that have been set up by the leading application developers and by performing a thorough usability study described in chapter 4 of this report. To achieve accessibility, the design needs to fulfill four key characteristics: The technology needs to be intuitive, this has been the focus for much of the evaluation in chapter 9 and was found to be satisfactory. The tests also indicate that the application is a clear improvement, with respect to both usability and functionality, compared to the competing applications that were tested in this project.

SOURCES

BOOKS

Bligård, L. 2015, ACD³ - Utvecklingsprocessen ur ett människa-maskinperspektiv, Chalmers University of Technology, Göteborg.

Jordan, P.W. 1998. An introduction to usability.London: Taylor & Francis

E-SOURCES

Bengtsson, Anna. 2003. Utemiljöns betydelse för äldre och funktionshindrade, Kunskapssammanställning. Statens folkhälsoinstitut.
https://www.folkhalsomyndigheten.se/pagefiles/12210/r2003-60-utemiljons-betydelse.pdf (Retreived 2016-06-21)

BPSD, Svenskt register för Beteendemässiga och Psykiska Symtom vid Demens. Online training. http://www.bpsd.se/media/player/player.html (Retreived 2016-06-21)

Chamberlain, L. 2016, GeoMarketing 101:What is geofencing?
http://www.geomarketing.com/geomarketing-101-what-is-geofencing (Retreived 2016-03-14)

Göteborgs stad, Välfärdsteknik
http://goteborg.se/wps/portal/enhetssida/senior-goteborg/valfardsteknik (Retreived 2016-06-21)

Helbostad, Jorunn L., Taraldsen, Kristin and Saltvedt, Ingvild. 2008. Demens. Ståhle, Agneta (red). FYSS 2008 Fysisk aktivitet i sjukdomsprevention och sjukdomsbehandling, 272-278.
http://fyss.se/wp-content/uploads/2011/02/FYSS-2008-hela-boken.pdf (Retreived 2016-06-21)
Linköping. 2016. Mobila trygghetslarm

http://www.linkoping.se/utforarwebben/vard-stod-och-omsorg/it-och-e-halsa/trygghetslarm/mobila-trygghetslarm/ (Retreived 2016-06-21)

Myndigheten för delaktighet, 2016, Välfärdsteknologi är kunskapen om välfärdsteknik http://www.mfd.se/globalassets/dokument/publikationer/2016/2016-7-valfardsteknologi.pdf (Retreived 2016-06-21)

Posifon AB, 2016, Posifon
www.posifon.se (Retreived 2016-06-21)

Svenskt demenscentrum, 2016a, Vad är demens?
http://www.demenscentrum.se/Fakta-om-demens/Vad-ar-demens/ (Retreived 2016-04-10)

Svenskt demenscentrum, 2016b, Vård och omsorg
http://www.demenscentrum.se/Fakta-om-demens/Vard-och-omsorg/ (Retreived 2016-04-10)

Svenskt demenscentrum, 2016c, Särskilt boende
http://www.demenscentrum.se/Fakta-om-demens/Vard-och-omsorg/Var-bor-man/ (Retreived 2016-04-10)

United Nations, Department of Economic and Social Affairs, Population Division (2015). World Population Ageing 2015.
http://www.un.org/en/development/desa/population/publications/pdf/ageing/WPA2015_Report.pdf

U.S. Coast Guard Navigation Center, 2016, General information on GPS.
http://www.navcen.uscg.gov/?pageName=GPSmain (Retreived 2016-02-12)

APPENDIX

PAPERS

Magnusson, L., Sandman, L., Rosén, K.G., Institutionen Ingenjörshögskolan, Institutionen för vårdvetenskap, University of Borås, School of Health Sciences, School of Engineering & Högskolan i Borås 2013, Nyttoeffekter med mobila trygghetslarm för personer med demenssjukdom och deras anhöriga.

PERSONS

Administration Manager within elderly care. 2016. Interview February 17th.

Business area manager within IT. 2016. Conversation April 21th.

Expert within positioning technology. 2016. Conversation May 5th.

Business area manager within technology in elderly care. 2016. Interview May 25th.

OTHER

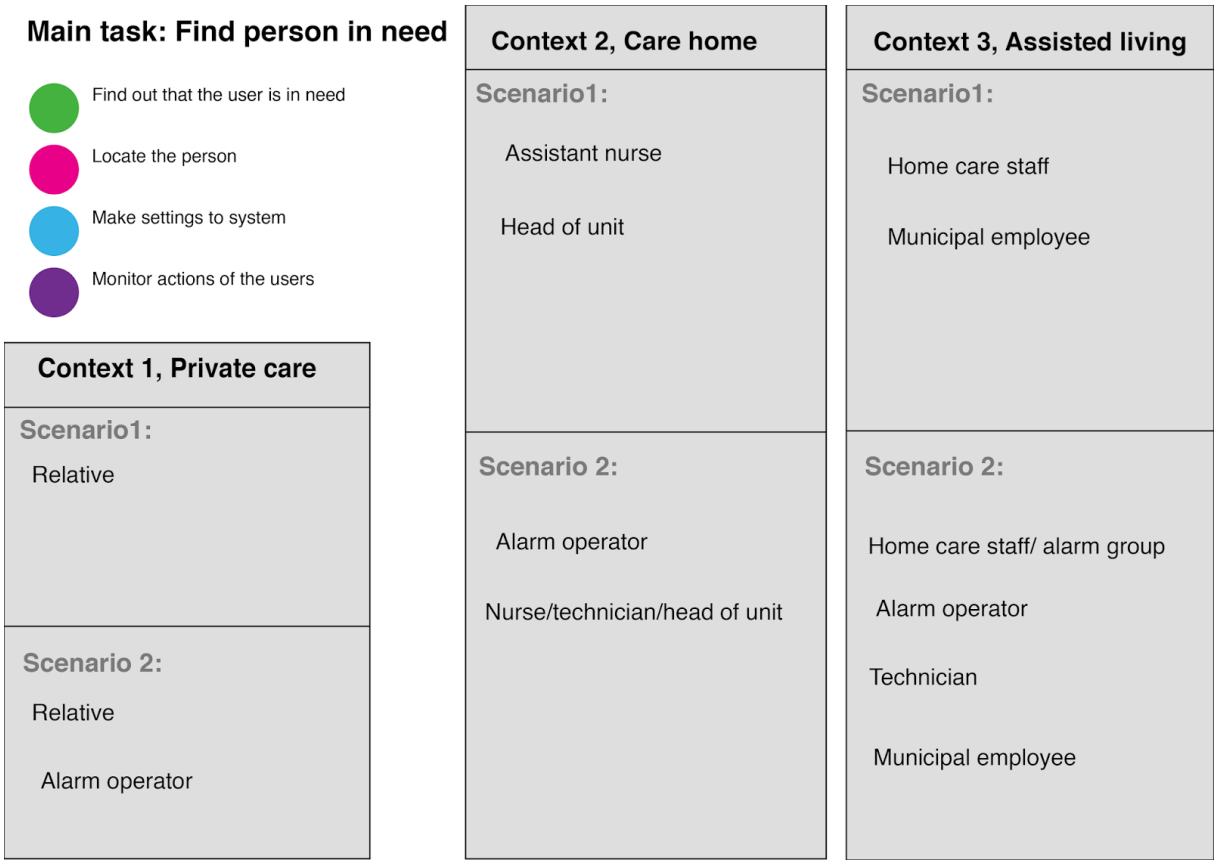
ISO 9241-11:1998(E) Ergonomic requirements for office work with visual display terminals (VDts) - Part 11: Guidance on usability.

APPENDIX

APPENDIX

APPENDIX 1

User/tasks chart draft



APPENDIX 2

Interviews User/tasks
Interviewees
P1: Elderly Coordinator. Good experience of localisation technology
P2: Administration manager for an organisation with focus on elderly care. Some experience of localisation technology
P3: Strategy leader within elderly care. Experience of localisation technology
P4: Dementia nurse. Good experience of localisation technology

APPENDIX 3

Initialt usabilitytest

Participants:

- UP1: No experience of localisation technology. Good computer skills
- UP2: No experience of localisation technology. Good computer skills
- UP3: No experience of localisation technology. Good computer skills
- UP4: No experience of localisation technology. Good computer skills
- UP5: No experience of localisation technology. Good computer skills

TESTPLANERING

Dokumentation av testet:

- Filma

Frågor om testperson inför usabilitytest:

- Ålder
- Teknikvana
- Yrkestitel

Information inför usabilitytest:

- Hur man använder tekniken (armband, sula osv).
- Kort om hur bärarna beter sig, Personas
- Att man kan ställa in särskilda områden där det larmar om bäraren går utanför
- Samtycke för ljudupptagning
- Informera om att det är interfacet som utvärderas, ej testdeltagarens prestation.
- Uppmuntra testdeltagare till att tänka högt under testet

Testet:

- Uppgift 1: (ska kunna utföras utan att ha bekantat sig med systemet)
- Testledaren skickar ett larm från lokaliseringsenheten, testpersonen har mobilen larmet kommer till. Uppgift: Lokalisera personen

Uppgift 2:

- kolla runt i interfacet och bekanta dig med funktioner

Uppgift 3:

- Testledaren skickar ett larm från enhet (gärna utan att användaren märker detta) vänta sedan på att larmmeddelandet kommer upp och lokalisera därefter enhet på kartan.
- (Denna uppgift undersöker om det är tydligt att det inkommer larm)

Uppgift 4:

- Skapa ett nytt geofence

APPENDIX 4

Intervjustudie - stöd för semistrukturerade intervjuer
Intervjuerna undersöker:

- Hur hanteringen av interface ser ut i detalj
- Vilka funktioner som önskas
- Önskad prioritering av funktioner
- Vilka uppgifter görs vid stor resp. liten skärm?
- Olika kontexter applikationer bör fungera inom
- information kring användning/användare

Om intervjupersonen:
Vad är din befattning?
t.ex:

-Undersköterska
- Enhetschef..
- Privatperson
- Annat…

Vad är din roll(er)?

- find out that the carrier is in need
- locate the carrier
- make settings to system
- monitor actions of the users
- Teknikvana?

Om intervjupersonens kontext:

- Berätta om din arbetssituation/situation i hemmet
- Om kommunalt anställd: Hur ser din organisation ut? Ansvarsområden?
- Har ni problem med att personer försvinner/går vilse? Vad gör ni då?

Om gps-positionering:

- Har du använt dig av något gps system i ditt arbete tidigare?
- om ja, vad har du för generell uppfattning av att arbeta med gränssnittet?
- Vad vill du kunna uppnå med hjälp av gps-positionering?
- Hur använder du applikationen? (T.ex. Mobil enhet, sittandes vid dator eller kombination)

Om dagens interface

- Vad ser du för problem med dagens interface?
- Vad ser du för styrkor med dagens interface?
- Känner du dig säker på att du gör rätt? Varför7varför inte?

Hantering, önskad funktionalitet

- Vilken funktionalitet måste du kunna komma åt på språng?
- Vilken information behöver du komma åt när du letar efter en person?
- Vilka inställningar vill du kunna göra med mobil enhet? (t.ex. nytt geofence när du går ut med någon)
- Behövs en påminnelse om någons geofence är av? Ska man bara kunna stänga ner tillfälligt? skräddarsytt efter bärare?
- Vill du kunna göra inställningar gruppvis? (ett gäng på utflykt, samma geofence) Hur dynamisk behöver gruppen kunna vara?

Scenarion
(denna del av intervjun består av scenarion där användaren får beskriva hur hen hade agerat samt använt interfacet i olika situationer)

-Jesper har försvunnit, vad gör du?

Om intervjupersonen har erfarenhet av lokaliseringsprodukter:
Allmänt
Vilka funktioner är viktigast att kunna göra snabbt/lära sig enkelt?
Vilka funktioner vill du nå från stor resp. mobil skärm?
Geofence
Var vill ni att bäraren skall kunna vistas utan att det larmar?
Särskild form på området?
När vill du att det ska larma?
Tidsinställnigar
Vem ska larmet nå och när?
Hur ser struktur ut kring enheter och grupper av enheter där du jobbar?

Lokalisera person
Hur snabbt måste det gå?
Har du intresse/nytta av gamla positioner?
Larm
Vad vill du kunna få reda på angående gamla larm
Vad behöver du veta under pågående larm?
Hur många behöver ha samma larm?

APPENDIX 5

Interviewees, Interview study

- P5: Strategy leader within elderly care. Experience of localisation technology
- P6: Dementia nurse. Good experience of localisation technology
- P7: Occupational Therapist. Some experience of localisation technology
- P8: Head of unit, elderly care. Good experience of localisation technology
- P9: Grandchild of person with dementia with a tendency to disappear. No experience of localisation technology
- P10: Wife of person afflicted with dementia, the now deceased husband had a tendency to disappear. Experience of localisation technology
- P11: Neighbour to a person afflicted with dementia with a tendency to disappear. Some experience of localisation technology

APPENDIX 6

Personas

Persona 1, äldreboende:

Personal, äldreboende: (motsvarar larmmottagare med viss adminbehörighet)

Jörgen är 32 år och arbetar som undersköterska på ett äldreboendes avdelning för dementa. Jörgen önskar att de boende på avdelningen fick större frihet men har varit med om många svåra situationer med personer som irrat iväg och är förstår därför enhetschefens beslut att ha kodlås på dörrarna till avdelningen. Han äger både smartphone och surfplatta och är van vid modern teknik. Detta har gjort att han fått ett extra ansvar för tekniken på avdelningen.

En av de boende, John, har stor tendens att försvinna vilket innebär stor arbetsbörda och oro för Jörgen. John är 67 år och är vid god fysik. Han har dock svårighet att lokalisera sig på grund av demens och saknar insikt i detta. John ser ung ut, klär sig ordentligt och är mycket social vilket gör att anhöriga till andra boende på äldreboendet ibland misstar honom för besökare. Det har därför hänt att personer har hållt upp dörren för honom så han enkelt kunnat slinka ut och promenera iväg.

PERSONA 2, PRIVAT:

Anhörig: make/maka. (motsvarar larmmottagare)

Agneta är 73 år gammal och bor tillsammans med sinman, Bo. Agneta har tidigare arbetat som danslärarinna och vill gärna fortsätta arbeta kreativt. Tidigare gick hon gärna på kurser i hantverk men i och med att Bos demens blivit allt värre vågar hon inte lämna honom ur sikte då hon är rädd att han ska försvinna iväg.

Bo är 74 år gammal. För tre år sedan började Agneta märka av förändringar i hans beteende och man kunde konstatera att det beror på demens. Bo kan bli väldigt förvirrad och hittar oftast inte till platser han ej har inom synhåll. Det har hänt flera gånger att han har gått ut i pyjamasen mitt i natten och inte kunnat hitta tillbaka hem. Agneta hanterar situationen genom att ständigt ha honom under uppsikt samt ha extra lås på dörrarna men detta är påfrestande för henne och hon känner sig ofta väldigt trött. Då hon är ovan vid vardagsteknik känner hon att det kan bli överväldigande att använda moderna system för att underlätta vardagen

APPENDIX 7

wireframe evaluation

Participants

- P12: Programmer. Good experience of localisation technology
- P13: Programmer. Good experience of localisation technology
- P14: Good experience of localisation technology

APPENDIX 8

Expert user test

Participants

- P15: Head of unit, Technology & Service. Experience of localisation technology
- P16: Medical responsibility of Rehabilitation. Some experience of localisation technology
- P17: Head of unit, Security alarm and alarm group. Some experience of localisation technology
- P18: Occupational Therapist, involved in project regarding innovations within elderly care. Some experience of localisation technology
- P19: Head of unit, home care. Some experience of localisation technology
- P20: Technical Specialist, Agency for Inclusion. Experience of localisation technology
- P21: Project leader. Government commission on welfare technology in social services. Experience of localisation technology
- P22: Administration manager for an organisation with focus on elderly care. Some experience of localisation technology

Session 1: P15 and P16
Session 2: P17
Session 3: P18 and P19
Session 4: P20, P21 and P22

Frågor:

- Vad vill man få notifikation/larm om?
- Hur mycket bör systemet uppmana till handling?
- Vad vill man kunna se?

Frågor till de som testat positionering i sin verksamhet:

- Vad är bra? Vad bör ändras?

APPENDIX 9

Google guidelines for Android

Guidlines
Main page/Index:
https://developer.android.com/design/index.html

Patterns:
http://developer.android.com/design/patterns/pure-android.html

Color:
https://www.google.com/design/spec/style/color.html#color-color-palette

User experience:
https://developer.apple.com/library/ios/documentation/UserExperience/Conceptual/Mobile-HIG/

Notifications:
https://www.google.com/design/spec/patterns/notifications.html#notifications-guidelines

Resources
Icons:
https://design.google.com/icons/

Color palettes:
https://www.google.com/design/spec/resources/color-palettes.html

Templates, whiteframes:
https://material.google.com/resources/layout-templates.html

All received 2016-04-22

APPENDIX 10

Evaluation test, participants

Evaluation round 1, participants:
TP1: Wife of person afflicted with dementia with tendency to disappear. Experience of localisation technology
TP2: Neighbour to a person afflicted with dementia with a tendency to disappear. Some experience of localisation technology
TP3: Daughter to a person afflicted with dementia with a tendency to disappear. No experience of localisation technology

Evaluation round 2, participants:
TP4: Used to iOs. No experience of localisation technology
TP5: Used to Android. No experience of localisation technology
TP6: Used to iOs. No experience of localisation technology
TP7: Used to iOs. No experience of localisation technology
TP8: Used to both iOs and android. No experience of localisation technology

The validation test was split up in two test rounds due to feedback from the first three tests leading to some immediate changes in the design.

APPENDIX 11

Utvärdering, användbarhetstest
Frågor om testperson inför test:
Teknikvana
Tidigare vana av lokaliseringsprodukter?
Yrkestitel

Information före test:
- Samtycke för ljudupptagning
- Informera om att det är interfacet som utvärderas, ej testdeltagarens prestation.
- Uppmuntra testdeltagare till att tänka högt under testet
- Persona:

Ditt namn är Jörgen, du arbetar på ett äldreboende. Du har ansvar för John och Mary som båda har positioneringslarm på sig runt handleden. John är ditt största ansvar. Han är dement och har väldigt svårt att lokalisera sig. Han är dock väldigt utåtriktad, pigg och svarar artigt och glatt på tilltal vilket vid ett flertal tillfällen har fått besökare att missta honom för besökare på boendet och hållt upp dörren för honom så han kunnat slinka ut.

Första uppgiften: Din skärm ser ut såhär (geofencelarm inkommet), vad gör du?
De uppgifter som är troliga att man behöver utföra utan att tidigare bekantat sig med gränssnittet är att svara på larm. Denna kommer därför som första uppgift för att testa dess guessability.

Andra uppgiften: Bekanta dig med gränssnittet
Testpersonerna fick först se startskärmen och berätta vad de tänkte om de olika elementen, vilka de trodde sig kunna interagera med samt vad de trodde skulle hända om de trycker på saker. De skärmar deras interaktioner skulle leda till presenterades tills alla skärmar blivit diskuterade. Ibland gavs hjälp för att föra testet framåt.

Avslutande uppgifter:
Hur tror du att man ändrar information i bärarprofilen?
Du vill ändra Johns geofence, hur gör du?
För administrativa uppgifter är det troligt att man redan bekantat sig med gränssnittet. Uppgiften "ändra geofence" kom därför i slutet av sessionen då de redan bekantat sig med gränssnittet.

APPENDIX 12

- Möjliga lösningar teknik
- Larmen kan gå via sms till valfri telefon
- intefacet kan kunna nås till fullo från en surfplatta
- interfacet kan kunna skötas med enbart tangentbord från dator
- interfacet kan ha relevanta funktioner i en mobillösning
- Interfacet kan ge full funktionalitet vid dator samt de vanligaste funktionerna från en smartphone
- Interfacet kan ge full funktionalitet vid både dator och smartphone

Möjliga lösningar, interaktion

- Visa bärarens status
- lokalisera bärare på karta.
- kontakta bärare i de fall detta är tillämpbart
- visa bärarens gps-koordinater
- visa gatuadress
- visa vägbeskrivning (google maps)(kostar pengar)
- se statistik på vart och när brukare försvunnit
- visa vägen bäraren tagit?
- Meddela när bärarens enhet är färdigladdad
- Meddela när bärarens enhet behöver laddas
- Visa att bäraren ej bär enheten (enheten laddas)

- logga in användare
- Logga ut användare

- support och kontakt
- frågor och svar
- forum
- kontakta posifon
- telefonummer
- mailformulär
- mailadress

Administrera Admin och Admin+ och användare

- lägg till användare
- ta bort användare
- namnge användare
- sök användare
- lägg till kontaktuppgifter
- lägg till larmmottagningssätt
- definiera åtkomst till funktionalitet
- definera användarens arbetstider (om tillämpligt)
-

administrera bärare

- lägg till bärare
- ta bort bärare ur system
- namnge bärare
- sök efter bärare i systemet
- lägg till kontaktuppgifter
- lägg till vilka användare som mottagar bärarens larm
- lägg till övriga larmmotagare, (polis, larmcentral etc)
- lägg till larmmedelande
- länka till gps-produkt
- lägg till anhörigas kontaktuppgifter
- Geofence
- lägg till geofence
- Ändra geofence
- lägg till undantag från larm
- ändra larmnummer m.a.p tid på dygnet

Functions leading to interactions

Localise carrier on map	Carrier position marker
Contact carrier	Contact symbol
Show the carriers GPS coordinates	carrier information space
Show carrier adress	carrier information space
Show directions (google maps)(kostar pengar)	NaN
Show statistics on when / where carrier has disapeard	Statistics view
Show carrier path	Carrier old position symbol
Notify user when carrier device is charged.	Unit fully charged symbol
Notify user when carrier device needs to be charged	Unit needs charging symbol
Show that the device is not being used by carrier (device charging)	Unit is charging symbol
Login user	Login screen
Log out user	logout option in menu
Administrer Admin och Admin+ and users	Hireachical task enabling
add user	Add user symbol
remove user	remove user option
name user	press name plate
search for user	Search user field
add contact information	Press contact information field
add alarm recieving method	add alarm recieving method button
define access to functionality	An administrator can check acess boxes in user profile
Define user work times.	Needs more research
Administer carrier	If user has acces to this functionality it is done as with user administration
add carrier	If user has acces to this functionality it is done as with user administration
remove carrier from system	If user has acces to this functionality it is done as with user administration
name carrier	If user has acces to this functionality it is done as with user administration
Search for carrier in system	If user has acces to this functionality it is done as with user administration
add carrier contact information	If user has acces to this functionality it is done as with user administration
Add wich users that recieve alarms from a carrier	Add alarm reciever icon
Add other alarm recievers, (polis, larmcentral etc)	Add alarm reciever icon
add alarm message	press field
Link carrier to GPS product	insert device serial number
Add relatives contact information	If user has acces to this functionality it is done as with user administration
Add geofence	Add geofence button
Change geofence	press geofence field
Add exeptions from alarms	time controll for geofence
Change alarmreciever due to time of day	time controll for geofence

APPENDIX