

Digitalized interaction of a patient hygiene solution within a care environment

Filippa Bolin and Cassandra Hennström

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Digitalized interaction of a patient hygiene solution within a care environment

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Subject: Interaction Design (MAMM01)
Division: Department of Design Sciences
Supervisor at Lund University, Faculty of Engineering: Johanna Persson
Supervisor at Arjo: Jörgen Jönsson
Co-supervisor: Magnus Karlberg
Examiner at Lund University, Faculty of Engineering: Håkan Efring

Abstract

Today, the population is getting older and the demand on long-term care facilities is increasing. Faster, less relaxing and undignified washing methods are more prone to be used, such as showering or in bed washing. Arjo strives to increase bathing and to include a feeling of wellness, making bathing a dignified and relaxing experience. This, in order to increase the quality of life for people facing mobility and age-related problems in line with their tagline “with people in mind”. This thesis, written by two biomedical engineering students, investigates the opportunities regarding how a digital tool can create an added value, contributing to facilitate the bathing procedure for caregivers and enhancing the bathing experience for the residents. With an approach of person-centred care, especially important for people with dementia and easy integration of the digital tool in the daily workflow, this solution aims to increase bathing at long-term care facilities.

Needs for Arjo, caregivers and residents were established through evaluation of the company, information received at study visits and through interviews, in combination with literature studies. By using theoretical design and design principles, solutions in terms of concepts were generated and visualized in iteratively created low- and high-fidelity prototypes of a digital app. These were used to evaluate both the concepts and the design of the user interface in the prototypes.

Both the conducted in-person tests, online tests and the online survey, indicated a positive attitude to digital prototype, with some parts having potential for further development. This user interface of the final prototype is a first version to visualize the generated concepts and should be further developed. Also, several concepts should be further investigated in order to improve the usage in the practical workflow and to improve the user experience of the app.

Keywords: Bathing, Elderly care, Dementia, UI, UX, Interaction design, Prototyping.

Sammanfattning

I dagens samhälle blir befolkningen äldre och kraven på äldreomsorgen ökar. Snabbare, mindre avslappnade och ovärdiga tvättmetoder används i större utsträckning såsom exempelvis duschning eller tvätt i sängen. Arjo strävar efter att öka badandet inom äldreomsorgen och att inkludera en känsla av välbefinnande och avslappning, samt att badproceduren ska upplevas med värdighet hos vårdtagarna. Detta för att öka livskvaliteten för människor med mobilitets- och åldersrelaterade problem, vilket är i linje med Arjos slogan "with people in mind". Detta examensarbete, skrivet av två civilingenjörsstudenter i medicin och teknik, undersöker möjligheterna gällande om och hur ett digitalt hjälpmedel/verktyg kan skapa ett mervärde, genom att bidra till en förenklad badprocedur för vårdgivarna och förbättrad badupplevelse för vårdtagarna. Med ett personcentrerat tillvägagångssätt, särskilt viktigt för personer med demens, samt fokus på en enkel integrering av det digitala verktyget i det dagliga arbetet, strävar denna lösning till att öka badandet på särskilda boenden för äldre.

Behov för Arjo, vårdgivare och vårdtagare etablerades genom en utvärdering av företaget, informationsinsamling genom studiebesök och intervjuer i kombination med litteraturstudier. Genom att använda teoretisk design och design principer kunde lösningar i form av koncept genereras och visualiseras i iterativt skapade low- och high-fidelity prototyper av en digital app, vilka användes för att utvärdera både koncepten och designen av användargränssnittet i prototyperna.

Både de genomförda testerna på plats och digitalt, samt den digitala enkäten indikerade en positiv inställning till konceptet och designen, med delar som är i behov av fortsatt utveckling. Detta första användargränssnitt, vilket användes som den slutgiltiga prototypen, är en första version för att visualisera de genererade koncepten och bör vidareutvecklas. Dessutom bör flera av koncepten undersökas vidare för att förbättra användandet i det praktiska arbetsflödet och för att förbättra användarupplevelsen av appen.

Nyckelord: Bad, Äldreomsorg, Demens, UI, UX, Interaktionsdesign, Prototypande.

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Lund, June 2020

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List of acronyms and abbreviations

App = Application

BLE = Bluetooth Low Energy

BT = Bluetooth

High-fi = High-fidelity

Low-fi = Low-fidelity

UI = User Interface

UX = User Experience

1 Introduction

Today, the population gets older and the strain on healthcare increases. Thus, there is an increasing load at long-term care facilities, where many elderly spend their last time of their lives. Making the quality of life as high as possible for these elderly and by providing aids in order to either improve or maintain the mobility for as long as possible, will result in less strain and better working conditions for health care professionals and thus driving financial outcomes. For a better quality of life for the elderly, wellness and relaxation in combination with bathing has become a driving force within the bath segment for Arjo. With focus on residents with dementia and their need for individualized care, this prototype of an application (app) strives to facilitate and shorten the bathing procedure for caregivers as well as to increase the total cost of ownership by minimizing the downtime. This, by providing a booking system with integrated, tailored recommendations for each resident. The bathtub consists of features such as sound and vision system, hydromassage and the possibility to extract data which makes it manageable to create tailored recommendations for each resident. The final product is intended to be used by caregivers at long-term facilities. A future concept includes relatives, home care service and service technicians as users as well.

A design centred process is used throughout the project, containing an iterative approach in all steps. The concept generation is the central part since this thesis focuses on the complete flow with the bathing experience, both for caregivers and residents. The digital prototype of the app is intended to work as a visualization of the generated concepts for the workflow, and thus, is not the focus. The User Experience (UX) of the app is however included in the design process and mirrors the perceived experience when using the app mediated through the design of buttons, icons, symbols etcetera. It is a part of the complete flow of the bath experience investigated.

1.1 Purpose and Goal

In the past, no digital tool connected to any of Arjo's hygiene products has existed. The aim of this thesis is to investigate how a digital tool can create added value and work as a complement to the practical workflow of bathing. This, in order to facilitate for the caregivers and contribute to a relaxing bath experience for the

residents at long term care facilities. Generation of concepts and solutions will be the central part in this thesis, and the digital tool constructed as prototypes will be an aid to visualize these. These prototypes will be made with an ambition of creating a desirable User Interface (UI) to make the UX of the tool most optimal.

1.2 Arjo as a Company

Arjo is a global medical device company that was founded in 1957 in Eslöv by Arne Johansson [1]. The company provides a wide range of medical devices, solutions and services with the aim of improving the quality of life for people with reduced mobility and age-related health problems. The aim is also focused at providing a good work environment for healthcare professionals. The number of employees is nearly 6000 and the market is in over 100 countries, divided into three geographical areas of North America, Western Europe and rest of the world. Arjo provides products for both acute care and long-term care. Some of the products that are offered are hygiene products, medical beds and lifting aids [2]. Within the hygiene market, wellness and relaxation in dementia care or similar cognitive impairments are areas that Arjo focuses on. Giving the residents a pleasant experience is of importance, where dignified care and facilitating the everyday hygiene routines are significant factors.

1.3 Methods

The thesis is based on Arjo's approach and visions, theory, study visits at long-term care facilities and tests conducted in-person and distributed digitally. Also, videos of bath procedures conducted at long-term care facilities provided by an internal source were studied. During the project, continuous meetings have been performed together with the supervisors contributing to valuable inputs and feedback. Throughout the process, design methods have iteratively been applied in order to generate new ideas and to improve them along the process. Study visits were conducted in order to establish the needs from caregivers' perspective, as they are the primary users of the app since they are the ones conducting baths with residents. From these established needs together with theory, two low-fidelity prototypes were created and tested. These worked as a foundation for the digital high-fidelity prototype that was iterated continuously. In order to conduct iterative improvements and receive further input of the concept, a test was constructed in-person and distributed online together with a survey to answer after the test. The aim of the test and survey was to reach out to caregivers at long-term care facilities. However, due to Covid-19, it was not possible to reach out to any caregivers. Thus, employees at Arjo were reached out to since they have knowledge within the care

environment at long-term care facilities and Arjo's product categories and are not external. The collected feedback was used to conclude the final concepts and to make the last improvements of the high-fidelity prototype.

The iterative approach that was used during the whole workflow of this project is visualized in the Figure 1.1 below. This method was applied to the process in order to constantly update and improve the work.



Figure 1.1. Visualization of the workflow during the process adapted to this thesis. An iterative approach was made in order to continuously improve the work.

1.4 Limitations

Due to the time limit for the scope of this thesis, the focus was decided to be on creating an UI for a smartphone directed to caregivers at long-term care facilities. With more time, a web-based interface would preferably also be developed since the concepts support interaction with a computer as well as a tablet. Moreover, Arjo has a broad scope of products and areas for implementation. Thus, this project had to be narrowed and defined to focus on caregivers and residents, primary. Relatives to elderly at long-term care facilities, home care service and service technicians are all user groups mentioned in the final prototype. However, the visualization of the concepts including these user groups were not complete and have to be further developed.

The number of iterations and tests of the concepts and prototypes have also been limited. With more time, the concept would have included more perspectives and the interface to the app would have been better adapted to the user group. As a delimitation, the prevailing circumstances with Covid-19 led to unplanned changes and thus also to limitations in the execution of the method, e.g. it was not possible to conduct tests of the high-fidelity prototype at resident homes, which limits the feedback opportunities both of the interface and of the concepts from the primary user group.

1.5 Work Distribution

The work has been equally distributed between the two authors throughout the process. The authors have studied almost the same courses, which entailed both having the same ability to contribute to all tasks in the thesis.

2 Theoretical Background

2.1 Facts and approach in dementia care

The average age of the population continues to rise all over the world. According to the United Nations, the population aged 80 years or over will increase globally more than threefold between 2017 and 2050 [3]. An ageing population results in an increased number of people in need of long-term care, resulting in an increased demand on health care including long-term care facilities [4]. Since age is the largest known risk factor for dementia, the number of people living with dementia will increase as well. Today, around 50 million people worldwide live with dementia and every year there will be around 10 million new cases. Currently, there is no available cure for dementia, thereby it is of main importance providing support and finding ways to improve quality of life for the people living with it. The Arjo approach when it comes to dementia is to facilitate activities of daily living, enable one-to-one interactions and to support a calm and dignified care environment [2]. It is important to keep in mind that every person is unique, and that dementia affects individuals in different ways [5]. For individuals with impaired mobility and cognitive functions, the bathing procedure is becoming more important to maintain dignity and a level of independence [6].

Predictions of the digital future in health care can be explained by the flow of identifying new methods for patients' engagement, resulting in benefits and measurable behavioural changes [7]. This, in order to provide necessary tools for making clinical integration and data analytics as efficient as possible. Also, the regulatory factors must be considered, such that they promote the most efficient technology.

2.2 Bathing

2.2.1 Arjo Baths

Arjo provides different bathing solutions with lifting aids to provide a good daily hygiene, in combination with a relaxed and calming experience for residents with

differing mobility [8]. To mention some of them, the Rhapsody bath, see Figure 2.1 (a), has a keyhole shape to enable easier access to the resident's upper body and gives more space for the resident. Harmonie, see Figure 2.1 (b), is designed with a straight shape with wider dimensions in order to fit larger residents. The water temperature is adjusted on a display in order to obtain the desired temperature. Different compatible lifts, such as the Alenti shown in Figure 2.1 (c), provide a movement from bed to the bath area and then into the bathtub in one complete movement in order to make it more ergonomic and more comfortable for both the caregiver and the resident. Both baths and lifts can be adjusted in height. The baths also include wellness functions such as hydromassage spa therapy and incorporated sound and vision system for a relaxing and calming experience. The sound and vision system provides underwater light in varying colours and relaxing music to be integrated with the bathing experience.

In the past, there is no digitalized interaction incorporated into the Arjo baths. Thus, there is an interest for a development within the digital area for the company, which in this project will be investigated for baths.



(a) Rhapsody bath



(b) Harmonie bath



(c) Alenti hygiene lifter

Figure 2.1. Image showing two of Arjo bathing solutions and one hygiene lifter.

2.2.2 Workflow of bathing at long-term care facilities

In Figure 2.2, workflow of a bathing procedure at long-term care facilities is stated. The workflow includes procedures for pre-, during and post-bath, conducted by caregivers for residents. However, it is important to state that the workflow of bathing might differ between long-term care facilities, for instance the workflow differ depending on what type of lifts that is used for transportation.

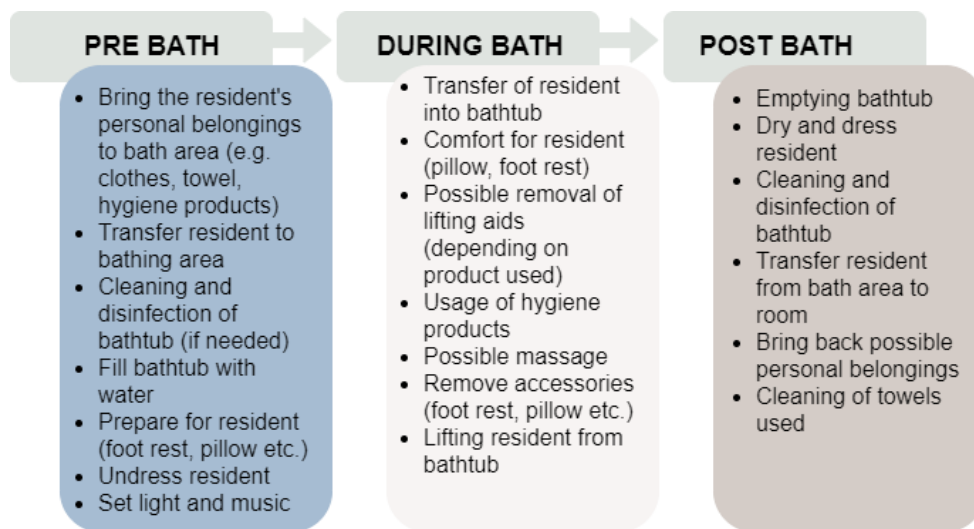


Figure 2.2. Workflow of bathing, pre- during and post-bath.

2.3 Dementia

Dementia is an overall term that covers a wide range of specific medical conditions, like Alzheimer's disease [5]. Dementia is caused by abnormal brain changes due to damage of brain cells. This brain change will cause a communication problem within the brain cells, which usually affect the thinking, behaviour and the feelings for the person. Since the brain consists of different regions responsible for different functionalities, the effect depends on which brain region that is damaged. Functions like memory, judgement and movement can be impaired. The earliest symptom of Alzheimer's disease is memory loss since the brain region responsible for learning and memory, hippocampus, is the first one to be damaged. Dementia is a progressive disease, which means that the symptoms will slowly and gradually increase, making it hard to discover in an early stage.

Since the people living with dementia encounter problems in their daily life, they generally receive more care from relatives and caregivers. The Dementia Care Practice Recommendations have been developed in order to provide better care through the disease course [9]. The main recommendation is to provide person-centred care. In order to provide person-centred care, it is important to know the person that is living with dementia, what are her/his values and interests, both past and present. The interactions with the individual living with dementia should be an opportunity for engagement, support interests and let the person make their own choices. Being present and to treat the individuals with dignity and respect shall always be a part of the relationship. Every individual is different which makes it even more important having an open communication between the individual, relatives and caregivers. This communication between the people involved will be used in order to facilitate and improve the individual's life.

2.3.1 Therapies in dementia

A person-centred care for people with dementia increases the dignity and the quality of life and asserts the human value for each person living with dementia [10]. The most common behavioural changes in dementia include depression, apathy, anxiety and irritability. These responsive behaviours could make the day complicated for a caregiver, but with a person-centred care they might be minimized. There are medications used in order to temporarily reduce the symptoms in dementia [8,11], however, there are also non-medical treatments that can help to reduce symptoms. Aromatherapy, massage, light and music are treatments that have calming effects and benefit persons with dementia by reducing stress and anxiety.

Bath

Bathing is a hygiene procedure that is done in order to receive a calming and relaxing experience [12]. Evidence shows that bathing, also in combination with music and calming sounds, has positive effects on aggression, agitation, anxiety and irritation. The possible reduction of fear and pain are the key advantages with bathing. Further, bathing is the hygiene care task that has shown the highest frequency of behavioural distress among people with dementia. Since no residents are the same, the hygiene procedure might differ widely between residents [13]. Therefore, it is important with hygiene products that offer flexibility and can meet the needs for every individual. For instance, when taking bath and encountering uncomfortable water, a person with dementia may strike out instead of expressing it by words [12]. If the eyesight is decreased, a noise can be stressful since it is more difficult to identify it, which might result in anxiety. Environments that are experienced as being stressful might trigger the psychological and behavioural symptoms of dementia. It is therefore important to identify the needs of each individual and what treatments and situations that tend to be calming.

A practical approach to consider when bathing a resident is to conceptualize the bathing as a relaxing experience [14]. The caregivers should conduct baths as they would want a bath to be for themselves. Time of the day, water temperature, length of the bath, music playing or not and scents are things one should consider important for residents that are bathed. Troublesome behaviours experienced in bathing should be thought of as symptoms of unpleasant bathing. Hence, this problem can be reduced by making the bathing as suited as possible for everyone.

Music therapy

Music therapy is a non-pharmacological solution that has been used in the field of dementia for several years [15]. Combining different cognitive stimulations, which is called multisensory stimulation, is an addition for pharmacotherapy for dementia. These cognitive stimulations can be adapted to the individual's behaviour and psychological symptoms. Music therapy may prevent distressing symptoms of dementia, promote well-being and acts as a sociability part since the verbal ability might be impaired. In general, music has many positive effects on our minds and bodies [16]. Slow music has a relaxing effect since it can decrease the heart rate, lowering the blood pressure and decreasing the levels of stress hormones.

2.3.2 BPSD

BPSD is an abbreviation for “Behavioral and Psychological Symptoms of Dementia”, which is a notion used in the field of dementia [17]. BPSD includes symptoms like agitation, anxiety, apathy and sleep and appetite changes, which cause suffering, mainly for the person with dementia but also for health care staff and relatives. It can be described as a general term for the difficulties people with dementia are experiencing, such as difficulties when it comes to interpreting and understanding communication and impressions. In Sweden, a register is used with focus on BPSD, which is called the BPSD register. It has the purpose of increasing quality of life for the person with dementia. This will be made by providing person-centred care, teamwork with all people involved, and continuous follow ups and to keep updated of the development within the field [18]. The observation of BPSD is done by using an estimation scale in order to assess how often BPSD occurs and how much it affects the person with dementia. After that, an analysis of the actions is made and used for a setup with an individualized approach. An evaluation is made afterwards and used for further improvements of the quality of life for the individual living with dementia. The BPSD register in Sweden will be used in this thesis as an inspiration for the person-centred approach.

2.4 Arjo Principles

In order to make sure that the work during the process is constantly aligned with Arjo's principles and approach, their digital guidelines and the concept of the Positive Eight are a central part. They will be described in section 2.4.1 and 2.4.2, respectively.

2.4.1 Arjo digital guidelines

In order to create a design that is aligned with the general design of Arjo's current digital interfaces, i.e. websites, their fundamental design core elements need to be considered throughout the development of the interface of the digital tool. The impression of the UI shall reflect confidence, intelligence and sympathy. The primary colours blue and white should be used and can be complemented with other defined colours to add energy and warmth to the interface. Further, the appearance and functionality should be consistent throughout the design. These are obtained from an internal source [19].

2.4.2 The Positive Eight

The Positive Eight is a concept Arjo is using to drive long-term benefits for patients/residents, caregivers and care facilities, see Figure 2.3 [20]. Starting with promoting mobility can reduce the need for support by caregivers, leading to improved vital functions and reduced consequences of immobility. This will improve the quality of life for the patient/resident. For the caregiver, a reduced need for support from the patient/resident will reduce work-related injuries and improve efficiency of the daily work. This can lead to reduced sick leave, turnover and compensation claims. These effects will in turn improve care and financial

outcomes and the circle is united.

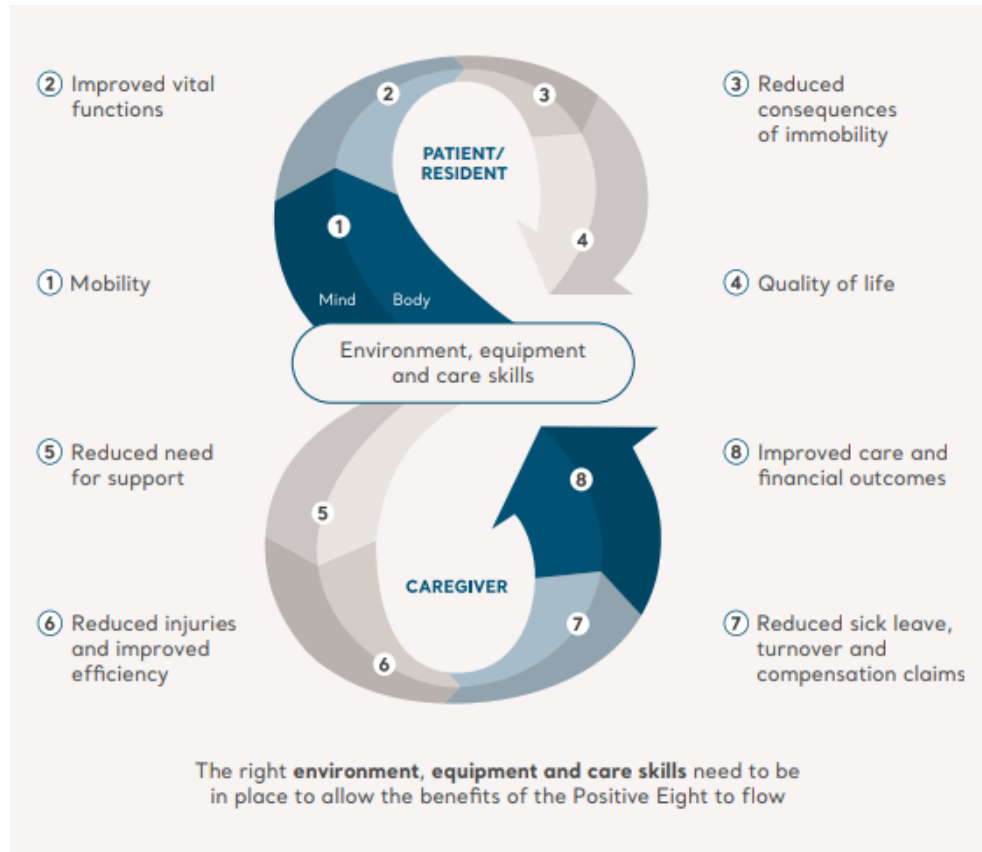


Figure 2.3. The Positive Eight by Arjo illustrates a workflow for driving better outcomes for the patient/resident and the caregiver together with financial outcomes.

2.5 Importance of Relatives' Involvement

When the demands of the caregiving no longer can be fulfilled, institutional placement of the elder usually is done [21]. However, this does not tend to relieve the burden of the relatives. A caregiver's ability of creating a good relationship to the family is important for the adjustment of the family to the situation. This will also affect the involvement of the relatives in the care of their elder. In the article *"Burden Among Family Caregivers of Persons With Alzheimer's Disease in Nursing Homes."* by Tornatore and Grant, it is suggested that more solutions in order to relieve the burden for relatives after placement of their elder at a care facility is desired [22].

2.6 Technologies for Exchanging Data

Along with the developing technology, data transfer obtains a crucial part, especially when considering data collected from mobile health devices to be integrated into clinical workflow [7]. A closed data loop is usually necessary and is initiated by a patient or a care provider, followed by cloud-based data transfer and an initiation of an algorithm-based interpretation of the data. The information is then returned to the patient or care provider in order to be clinically evaluated and used. The concept for the prototype of the app is building on a communication channel between the bath and a smartphone. Thus, most common techniques for exchanging data will be described in the following in order to enable comparisons to suggest the best method for data transfer.

Bluetooth

Bluetooth is a technique that is used for wireless communication between external devices [23]. It is used for short range exchange of data. The transmission takes place on a license-free frequency band in all countries, which means that anyone can send on this frequency. Bluetooth is today widely used for example within health care to transfer health information and to help people to keep track of their health, in order to relieve the health care system [24]. It provides a low-power wireless connectivity, which makes the technology function as a transport layer for data. Further, the phenomena of Internet of Things (IoT) has grown strongly and has enabled constant internet connection of electronic products, so they can be controlled no matter where you are [25]. IoT can use Bluetooth for file transfers between devices wirelessly [26].

A new “version” of Bluetooth, Bluetooth Low Energy (BLE) hit the market 2011, with the difference of having smaller energy consumption. This is essential for applications that only need to exchange small amounts of data periodically. Unlike the classic Bluetooth, the BLE enters a sleep mode and remains there until a connection is initiated.

To make a summarized comparison, Bluetooth and BLE are used for different purposes. Bluetooth can handle more data but consumes more battery and is more expensive. BLE is used when there is no need to extract large amounts of data and it can last for a couple of years due to its low energy consumption.

Gateway

A gateway is used to connect networks. Earlier, the notion of gateway was also used for a router [27]. An IoT gateway enables IoT communication, for example device-to-device communication or device-to-cloud communication [28]. It facilitates communication with non-internet connected devices among many things.

Wi-Fi

Wi-Fi is another type of wireless communication [29]. It provides a high-speed communication and works by a router that sends out information from the internet service provider to a computer or another connected device. It offers a longer-range connection compared to e.g. Bluetooth [30]. It demands more power, which makes it most suitable for e.g. PCs or mobile devices with a good battery. Compared to Bluetooth, it is generally more expensive. Wi-Fi has a high data throughput [31], which is advantageous depending on the situation.

2.7 Cloud Storing

Cloud storing is a model of storing data on the Internet through a cloud computing provider [32]. It is based on the concept of a provider that operates and stores data as a service. This makes data accessible in an easy way from all over the world. One pays for the shared hardware by the storage cost, which erases the need for managing storage systems. When it comes to storing data of individuals, it is of main importance to take into consideration what kind of data can be used and stored in the cloud as discussed in section 2.9.

2.8 Usage of Mobile Devices

The market of smartphones and applications is continually rising. In 2019, there were approximately 3.2 billion smartphone users in the world [33] and the growth in downloads of applications are increasing each year [34]. There are no signs of this market slowing down or decreasing, which indicates great possibilities of creating an app. The importance of UX is significant in the development process. The more flaws generating an unpleasant UX, the more does the users tend to stop using the app after a couple of months, which implies the importance and need of a good UX when developing an app.

The usage of mobile devices within healthcare is also evident [7]. The convergence of science and technology has resulted in several digital health devices. This has enabled opportunities for patient engagement, reduced healthcare costs and improved outcomes. Usage of mobile devices at long-term care facilities has increased along with this digital wave as well [35]. Using technology at long-term care facilities can offer an efficient and useful way to collect care notes. Handheld mobile devices provide a possibility to make real-time updates about the care or other information relevant about a person, rather than writing it down on a paper at the end of the worked shift. A software might know each resident's normal daily routines by asking the staff applicable questions and offering quick answers, in order

to collect fast data entry. Softwares like this can also provide a possibility for relatives to have an insight into their elder's everyday life.

2.9 Secrecy and Privacy

An important area to consider when it comes to developing an app within the healthcare sector is secrecy and privacy. One function can seem and might be useful, however from a security and integrity perspective, it might not be preferred.

It is of main importance considering what kind of data will be managed and stored in the apps, mainly focusing on what kind of personal data regarding residents that will be stored and who will get access to this. This is where awareness of regulations regarding processing data, regulated by the European Union in the General Data Protection Regulation (GDPR), must be stated [36]. This legal framework regulates the collection and processing of personal information.

Usually for healthcare apps used at hospitals or other care facilities, a multi-factor authentication is required due to the high-risk information. This information was obtained through a discussion with an employee at “Malmö Stad” working with digitalisation of health care. In Sweden, these kinds of regulations are governed by “Socialtjänstlagen” [37]. Important aspects to consider are the traceability, anonymously and consent.

2.9.1 EU MDR

The European Union Medical Device Regulations (EU MDR) is a new set of regulations for medical devices that will enter into force 26 of May 2021, replacing the current Medical Device Directive (MDD) [38]. Due to some issues have being arisen regarding certain groups of medical devices, stricter safety measures will with these new regulations be applied in the medical device area.

This thesis investigates an integration of a digital solution within a medical device. Thus, the “Guidance on Qualification and Classification of Software in Regulation (EU) 2017/745 – MDR and Regulation (EU) 2017/746 – IVDR” should be considered. This guidance defines the criteria whether a software is falling under the regulation of the new medical device regulations [39]. If so, it provides guidance of which classification that should be applied.

Is not intended to construct a digital tool that will be classified as a medical device. However, it is of great importance to be aware of these regulations to make sure that the resulting product will not contain any parts that might violate this.

2.10 Interaction Design and its Importance

Interaction design can be described as designing interactive products with the end users in mind, so the products support the communication between users and the everyday life [40]. It is of importance to design according to the founding concepts in mind. Thus, the concept generation is a crucial part of the design process as well as the designing of an interface. Interaction design has a central role when designing interactive human-computer systems. Further, in order to design for a successful UX, the designer shall consider different properties of the users, the technology and the interaction between them.

Further, when developing a product, one must also be aware of the technical, financial and the marketing perspective since these factors also will have a crucial part in the use. Today, digital interaction is widespread among product development due to its importance. If the concept and the UX are not good, a company might be facing a devastating future. By being able to market the design as engaging, easy and effective to use, one has a lot to gain.

2.10.1 User Experience (UX)

UX describes how a product is used by people and how the product behaves when using it [40]. UX is about what the user feels about a product while using it and how the overall impression from it is. One cannot design a user experience, only design for a user experience. For instance, one cannot design a sensual experience, only design features that evoke that feeling. If a design evokes an unpleasant feeling, it is most likely to imply a poor UX. Also, another important perspective is to design not only to make something functional, it should also be fun to use and enhance a feeling of joy while using it.

Further, some other central aspects to take into consideration in the UX are usability, aesthetics, the context, the appearance and the feeling it sends. It is crucial to point out that there is no template or instruction of how to combine all these factors in order to produce a good UX. Rather, there are conceptual frameworks, tested methods and guidelines that can be used. For instance, the *10 Usability Heuristics for User Interface Design* by Jakob Nielsen and Rolf Molich can be used during the development, where they serve as broad rules of thumb [41]. To also include the end users' experience during development, user surveys in form of either questionnaires or interviews, in combination with iterative testing of low-fidelity prototypes and high-fidelity prototypes can be performed [42]. The surveys are preferably used in combination with complementary observations or other methods in order to obtain different types of input.

2.11 User Interface Design

Another central part in interaction design is the UI [43]. Unlike in UX design, where the aim is to make the interaction as easy and effective as possible in order to achieve the goal with the usage of the product, UI shows how the product will look like and be perceived. The UX design focuses on how users use a system, while the UI design focuses on the appearance of the system. In UI design, properties like colour, contrast, and font etcetera are adapted in order to attract the attention of users. This will be considered in the creation of the low-fidelity and high-fidelity prototypes in order to create a tempting UI and to invite to usage of the app.

2.11.1 Conceptual and mental models

A conceptual model describes how a product works and can be used [44]. It is a, often simplified, model that aims to evoke associations to things that we normally recognize and know the function of, in order to understand the functions of the product. There are often multiple conceptual models that vary depending on e.g. the knowledge of people involved. Mental models are conceptual models in people's minds. Thus, different people may have different mental models of how a product works. One person might even have several mental models of a product, where some models can be at conflict. It is important that a product suggests a good conceptual model since it provides an understanding and a way for the user to predict effects of different actions. If it is not a good model, the user operates blindly; one can follow instructions of how the product is used, but do not obtain information of why you do in that particular way or what to do if something goes wrong. A basal part of the project will be to produce concepts that will be visualized by creating a visual prototype with an easy UI and UX.

2.11.2 Design Aspects

Gestalt principles

The gestalt principles describe how humans match objects and group them, how they recognize patterns and how to understand complex images [45]. These laws are central in UX design since the users must be able to understand what they see and what to do immediately when looking at the interface. It is essential for designers to understand how the brain and the mind strive to organize images and shapes into order, and that non-structure tends to annoy users. There are several gestalt laws and four of them are the following: the law of *closure*, *continuity*, *proximity* and *similarity*. The law of closure implies that the mind automatically strives to fill in gaps in order to create complete shapes and images [46]. The law of continuity describes how we tend to follow lines or curves in order to determine relationships

within an image. The law of proximity tells how the mind perceives elements close to each other to be related, compared to elements that are distant from each other. Lastly, the law of similarity describes how the mind tries to find similarities and differences in shapes or in an image, and link similar elements together [45]. These four laws are important to consider during the design process since they affect how we as users perceive parts of a user interface. The Gestalt principles will be considered for instance regarding the placement of buttons when creating the low-fidelity and high-fidelity prototypes.

The seven fundamental Principles of Design

The seven fundamental Principles of Design include the following: discoverability, feedback, conceptual model, affordances, signifiers, mappings and constraints [44]. These principles will contribute to the interface being easy to use, but also easy to understand and what to do if something is done wrong. For instance, by providing good feedback in the design, the users get continuous information and responses of actions, so they know what to do in the next step. Further, affordance and the relationship between controls depends on spatial layout and temporal contiguity, respectively.

There are some factors to remember in order to create a good UX for the users [47]. Properties like if the UI should be hand-held friendly or if many components should be allowed in the interface must be thought through, since the principles of design affect these. If designing an interface for a tablet, mapping, for instance, can be an important feature to consider since the screen is bigger than for a phone. If connected components are placed far from each other, then it might be perceived as they in fact are not connected. These principles will be used both during the concept generation and the development of the prototypes in order to be aligned throughout the whole process. Also, it will reduce the risk for possible mistakes and confusion of the concepts and design from the beginning.

7 Principles of Universal Design

The 7 Principles of Universal Design are also good to keep in mind [48]. Then, a design with all users in consideration can be created to include users with different abilities. The principles are: *equitable use*, *flexibility in use*, *simple and intuitive*, *perceptible information*, *tolerance for error*, *low physical effort* and *size and space for approach and use*. The principles of being equitable to use, simple and intuitive to use, as well as perceptible information are important to consider during the development of a UI. Since the users can be of varying age and possess different levels of knowledge, it is important to consider these principles during the concept generation and development of the prototypes.

Colours

Another aspect to consider when designing is the choice of colours [49]. It is certainly important when it comes to colour-blindness, where the ability to distinguish and see colours are affected. To avoid any mistakes or confusion regarding this, one shall not rely on colours solving problems. However, colours can be used in order to make the UI more inviting and improve the UX. If it is desired to use a colour that might be hard to see for people that are colour-blind, adding a text or an icon might be a solution. This approach will be considered in the development of the UI in order to not exclude any group from easy usage.

2.12 Brainstorming

Brainstorming is a traditionally used method to encourage creativity, with an intention of concept generation and idea generation of a certain challenge [42]. The brainstorming process shall be a judgement-free zone in order to create new concepts. This method will be used interactively when establishing the needs, in the concept generation and when prototyping if needed.

3 Establishing the Needs

In order to obtain as much information for a research question as possible, it is good to use several methods, which individually contribute with evidence from different angles [42]. Different methods have different advantages and disadvantages, and by using triangulation, which is a convergence of at least two methods, one can use the benefits of all the methods and use them complementary. One can ensure accuracy and suppress the weaknesses of the methods efficiently. For instance, it is common to combine methods of large survey methods with depth-interviews, in order to reach a large target group and at the same time get more detailed knowledge and opinions from a smaller group. Thus, both qualitative and qualitative data is obtained.

Two long-term care facilities were visited in order to obtain a wider perception of the workflow with bathing and how Arjo's baths are used today practically. Interviews were either conducted during or prior demonstration. Open questions were prepared to invite the interviewee to speak openly about the workflow. For instance, some questions regarded their bathing schedule, if and what moments induce anxiety and how the transportation to the bathing area is done. Several videos of bath sessions from long-term care facilities were studied, provided by an internal source. Additionally, data collection in the form of literature studies was implemented in order to further identify needs. The choice to use several different methods to establish the needs was based on the method of triangulation described in the segment above.

3.1 Data Collection

From section 2.3 in the Theoretical background, it can be identified that people with dementia, anxiety and other behavioural responses could make the day complicated for caregivers. However, with a person-centred care, complications might be minimized. Further, bathing is a procedure that can be a calming and relaxing experience. No person is the other like, and everyone might differ in preferences around the bathing procedure, which indicates a need for an individualized solution in the care process. Also, sound in special settings can have a soothing and calming effect, which indicates a need for an easy implementation of playing music.

The importance of relatives' involvement in the care has shown to be significant. This implies a need for an easier solution for relatives to be involved in their elder's health and caring. Further, smartphones and applications have shown to be used as daily tools in the care of residents at long-term care facilities. This usage is also widespread more generally, which strengthens the purpose of using a phone or similar device as an aid.

The concept of the Positive Eight has a central part when establishing the needs. By focusing on making a better experience for the resident and the caregiver, the advantages identified in the Figure 2.3 might be fulfilled. Thus, the identified needs chosen to proceed with are going to be chosen with the Positive Eight in mind.

The BPSD register used in Sweden, described in section 2.3.2 entailed valuable insights and inspiration regarding how a person-centred care might be applied. By collecting feedback from the bath sessions for each resident, a more person-centred care can be conducted, which is of main importance, especially for people with dementia.

From studying the videos of real situations regarding the workflow of bathing and washing at long term facilities, a better understanding of the practical flow was obtained. This yielded crucial insights of where a digital tool might be integrated in the workflow and where it would rather hinder the daily work. The videos showed situations where the bath procedure was running smoothly and where it was complicated, and the residents expressed anxiety and discomfort. This material was a complement to the study visits, see section 3.3 below.

3.2 Study Visits at Long-term Care Facilities

3.2.1 Long-term care facility A

Long-term care facility A consists of seven departments. The caregivers work with a rehabilitating approach and bathing is conducted by two persons once a week. Thus, a resident usually gets to bathe every eight week and the bathing process takes around one and a half hour. For this long-term care facility, the bathing procedure is used as a luxurious and wellness experience, which is highly appreciated by the residents. The bathing area is used once a week by the long-term care facility and the rest of the week the bathing area is available for the local home care service.

During the bathing procedure, a footrest will be placed in the bathtub in order to ensure a stable and comfortable position for the resident. Calming, instrumental music will be played on a CD-player during the complete bath procedure. The

caregivers will never leave the bathing area, they will always be present in case something happens. The social part of the procedure is also of big importance for the residents. The caregiver will be a part of the hygiene process for the resident by using small towels specialized for the hands to provide dignity and avoid direct contact. The caregiver will also provide a relaxing massage if desired.

After the bathing procedure, the bathtub will be cleaned with disinfectant in order to ensure that no bacteria remain in the bathtub. The responsible caregiver for the bathing procedure writes notes by hand in a notebook. The notes include the name of the resident, bathing date and time, caregiver involved and relevant notes from the bathing procedure, which might be any experience of pain and anxiety for the resident. The caregivers involved during the procedure will sign the paper.

When it comes to the booking system of the bathing area, everything is done manually on a paper sheet. The responsible caregiver for bathing constructs the schedule on her own according to an additional schedule at the long-term care facility and she provides a schedule for all departments. The booked time slots are written in each department's schedule manually. Post-it tags are placed in the residents' apartment at their refrigerator to communicate when a bath is booked for them.

The responsible caregiver for the bath procedure has been working at the long-term care facility for a longer period and knows the residents well. The responsible caregiver knows their preferences during bath. Normally, residents with mobility difficulties will be given bathing time in the morning due to a possible extension of the bathing session. Also, the procedure of getting fully dressed does not have to be done twice, which requires more resources and costs more time. Some residents have their own preferences regarding when a bath should take place, however, it is very individual. Each department has a smartphone, which has no use when it comes to scheduling activities, such as baths. However, each caregiver has its own phone which is used for confirmation an alarm or attendance in a resident's apartment. The phones are not included in the booking or to register attendance in a bathing procedure.

A coordinator at the long-term care facilities handles the service and ordering of the disinfectant used for cleaning and disinfection of the bathtub. The caregiver informs the coordinator if any error occurs or if the disinfectant level is low.

Other relevant information obtained from the study visit at long-term care facility A is that normally the residents appreciate the bathing procedure, however, this might differ when it comes to residents with dementia. The usage of music is very popular among the residents, though it is of importance to play the same kind of music for some of them, since they will react negatively to changes in the music. The usage of dimmed light when bathing is desirable for the residents. When it

comes to relatives, their involvement regarding their elder differs a lot, some are more involved than others.

3.2.2 Long-term care facility B

Long-term care facility B consists of six departments with one bathing area. This area is also working as a spa area, where an educated caregiver is responsible for spa treatments and conducting the baths. The baths are always conducted by two caregivers where the other caregiver working in the department that the bathing resident is staying at. The caregiver responsible for the bath meant that there are few caregivers that conduct baths due to insecurity of the procedure.

There are two bath sessions every week of two hours, respectively. It takes around 15 minutes to prepare the room with candles and music. The bathing takes around one hour to conduct. Creams and cleansing products are provided in the bathing area, however some residents prefer to use their own products. There are plenty of towels in the bathing area and the used towels and other laundry will be handled by the person responsible of the bathing or by the cleaning staff. If they are out of any product, e.g. disinfectant, the person responsible for the economics makes an order after the responsible caregiver has communicated this.

The booking system consists of a paper schedule outside the bathing area where the responsible caregiver writes names and time on the schedule in order to make a booking. If a booking should for some reason get cancelled, another resident can bathe instead. The same caregiver always makes the bookings.

Each caregiver has their own smartphone where they have their own work schedule and other services provided in the app named Mobil Omsorg. In this, each working task is strictly stated with times and planned time the task is supposed to take. One can only see one self's schedule and not the other caregivers' schedule. When a person shall e.g. give medication to a resident, the person holds the phone up in front of an NFC tag in each resident's apartment in order to register attendance. When leaving the apartment, the same procedure is repeated.

The caregivers have a documentation system where they document events that the residents have been a part of, for instance when a resident has gotten a bath. The documentation is possible for relatives to take part of. However, the relatives do not often ask to see this documentation.

There are usually the same caregivers working, thus there are few substitutes at the resident home. If something is wrong with the bath, the responsible caregiver of the bathing contacts the coordinator or the manager who has contact information such

as address and telephone number to the service support. Lastly, the caregiver did not perceive relatives being involved so much in their elder's care and life.

3.3 Results from Study Visits

The study visits resulted in several insights valuable when establishing the needs. Firstly, at both places, handwritten schedules were used for booking of a bathing area, which were placed outside the area. In case of errors, they draw a line over the error and write the new, updated booking at the side. Further, at long-term care facility A, if the resident is active in its own everyday process, the caregiver often puts a post-it note at their refrigerator to communicate when a bath is booked for them. When asking the caregiver at long-term care facility A about a digitalized system for making the bookings, she did respond negatively. However, she is the only one making bookings and conducting the baths on all departments, which probably explains why she did not seem eager about it since she knows her own papers well. It was the same circumstances at long-term care facility B, where only one caregiver handled the bookings here as well.

Anyhow, a need for a digitalized booking system in order to structure the bookings could be identified. Since this was a behavioural study, what they did was the central part to observe. If a substitute would be needed for some reason or if those caregivers quit their work, a digital tool could facilitate through a quick and collected access to helpful information. Further, at other long-term care facilities, there may not be only one person handling the bookings and bathing. Also, at long-term care facility A, the local home care service used the bathing area the days the residents did not bathe. Thus, there is an external communication that could be facilitated with a digital solution in terms of getting information about free time slots and if bookings are cancelled.

Secondly, a coordinator or a caregiver responsible for the economics, at long-term care facility A and B respectively, handled the orders of disinfectant. Hence, a need could be identified for an automatic ordering of disinfectants, which also relieves the caregivers and the other staff involved. There is no communication between the caregivers if the coordinator has been informed regarding a current error issue or low disinfectant level, which might lead to several caregivers communicating to the coordinator regarding the same issue or being worried in vain.

Thirdly, another need that could be identified was to provide a simple way to present helpful information about how the residents experienced the bath. Today at long-term care facility A, information like bathing temperature and if the experience was good or bad was noted on paper, which only the caregiver responsible for the baths used and looked at.

3.4 Summary

By using the information extracted from the study visits, interviews and data collection, challenges could be defined, see section 3.4.1 and 3.4.2. Further, the different users are described in section 3.4.3 and a mind map of them with identified needs can be seen in Figure 3.1.

3.4.1 Challenges with bathing

Below, in Table 3.1, the main challenges with bathing are stated, identified by Arjo [6].

Table 3.1. Challenges with bathing, identified by Arjo.

<i>For the residents</i>
<ul style="list-style-type: none">• The resident may feel cold if left wet and exposed during transfers• The resident may be fearful of slipping• Getting in and out of the bath may trigger undesirable behavior• Dignity aspects related to undressing and dressing; this should happen in the bathroom to ensure dignity
<i>For the caregivers</i>
<ul style="list-style-type: none">• There may be a risk of static overload for a caregiver• There may be a perception that bathing takes a long time• Assisted bathing involves a high number of assisted transfers• Often no space to dry and dress• The facility does not have the right equipment to support or transfer the resident/patient to/from the bath or provide sufficient support whilst immersed in the water

3.4.2 Additional challenges identified

During the study visits and during the data collection, additional challenges for the caregivers were identified. These additional challenges for the caregivers and challenges of implementing a digital tool are stated below, in Table 3.2.

Table 3.2. Additional challenges identified for the caregivers and challenges for an implementation of a digital tool.

<i>For the digital tool</i>
<ul style="list-style-type: none">• Caregivers at long-term care facilities may be resistant to a new digital tool• Implement usage of the digital tool in the daily workflow• How to structure the manual paperwork into digital representation

-
- Coordinate a digital tool where all caregivers and other users of the bathing area, such as home care service, will be included.
-

For the caregivers

- Residents have varying needs and preferences with bathing and there is no general approach for caregivers
 - Caregivers might feel insecure and uncomfortable to conduct bath sessions.
-

3.4.3 Target group

In order to state the target group more protruding, a brainstorm session was conducted on a whiteboard. The target group is the caregivers at the long-term care facilities, since they are the primary users of the app. The secondary users are the residents, but will not physically use the app. The tertiary users of the app are the relatives to the residents. Potential users might be home care service and service technicians. Since the residents are the primary users of the bath, there is a risk of misunderstanding that the residents are also the primary users for the app. This is however not the case, which is why it is important to point out that the caregivers are the primary users of the app. When this was decided, the needs together with possible ideas for each user group were identified by a brainstorm session as well. These identified needs function as a foundation in the process of creating functions integrated in the app. The result of the brainstorm session resulted in a digital mind map, see Figure 3.1, where the main three users are divided in separate parts and potential users are only stated. During the study visits at the long-term care facilities, information that the bathing area is used by home care service certain days was obtained, there by seen as potential users. Further, service technicians are also considered as potential users for some possible functions when it comes to error handling. The two potential users will be mentioned in some concepts later.

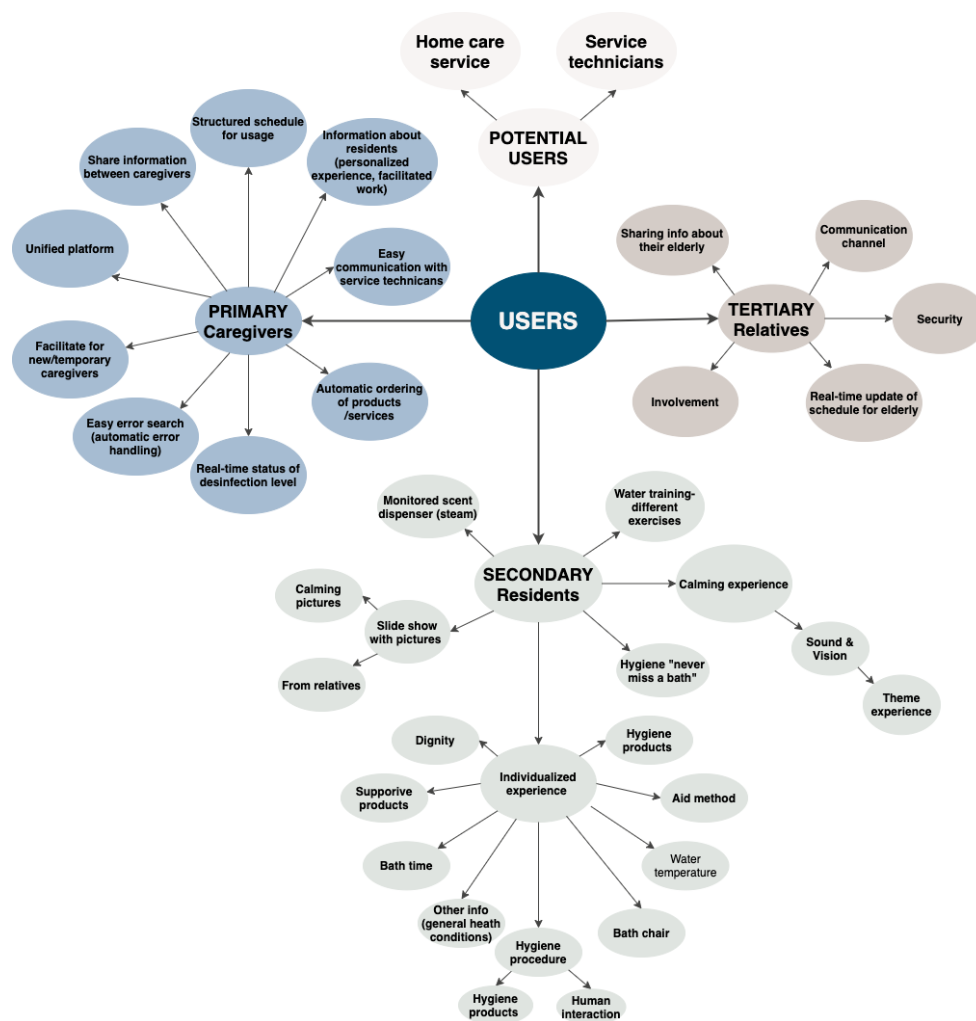


Figure 3.1. Mind map of the primary, secondary, tertiary users and potential users along with identified needs.

4 Concept Generation

In order to develop concepts for the app, different methods were used. During the whole concept generation part, the Arjo principles, the design aspects and the secrecy and privacy have been taken into consideration. Inspiration from existing apps was used for different concepts and inspiration regarding how to Call To Action was also obtained, see section 4.1. Brainstorming sessions were performed in order to generate ideas further of plausible functions in the app. These brainstorming sessions, including rapid ideation and mind mapping were iterated in order to continually improve and to find the most desirable ways of each concept, see section 4.2. Storyboarding enabled a visualized representation of the flow and different scenarios in which the app is going to be used. In order to prioritize which functions to include and further develop, the MoSCoW method was used, see section 4.4.3. Also, by using the design aspects and conventions stated in section 2.11 above, in combination with studying concepts of other apps that exist on the market, a concept selection could be made. An overview of the concept generation can be seen in the Figure 4.1.

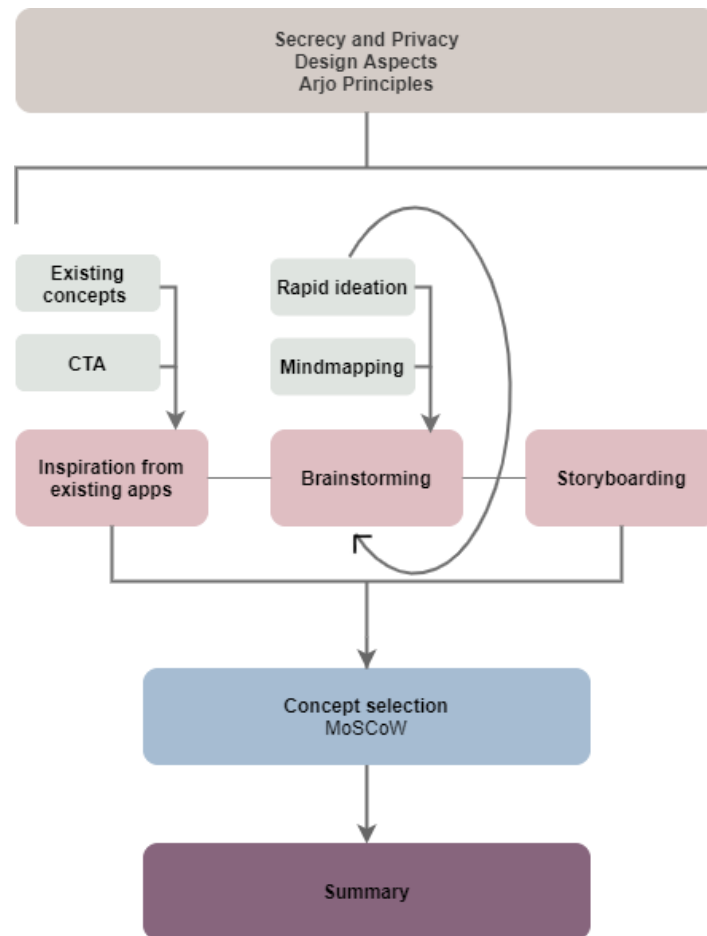


Figure 4.1. An overview of the workflow for concept generation.

4.1 Inspiration from Existing Apps

As mentioned above in section 2.8, mobile applications have become a popular item to use for relatives to follow the everyday life of their elder. For example, PainScale is an app where relatives can track an elder's pain [50]. Further, there are apps that monitor elderly that live alone, which can especially be at use if elderly suffer from Alzheimer's disease [51]. Thus, to use an app in order to integrate relatives in getting updated information about their elder, seems to lie in the range of modern attempts to solve this problem.

Mobil Omsorg was mentioned in section 3.2.2 and is an app that provides a digital service for home care, home health care and residential care [52]. It provides services within the scope of planning, scheduling, mobile working approach and presence registration. The user can choose which functions to activate according to the needs. Caregivers can communicate with each other and with coordinators through chat voice messages. Further, the presence at a resident's apartment can be registered using NFC technique as mentioned in section 3.2.2. This information is further used to supervise working times and register when work tasks are done. Documentation possibilities are also provided in the app, which meet the requirements of the Patient data law and GDPR. The system in Mobil Omsorg is integrated with several others, e.g. schedule systems in order to decrease duplication work. Further, an amount of data is stored in order to do customer follow ups and to develop and improve the business. In order to educate new users, the app provides web-based courses. The app is intended to maximize the working time.

The concepts in these apps were studied in order to find inspiration for this project. For instance, the app Mobil Omsorg was studied and inspiration regarding planning and scheduling work were used. Different apps not related to health care or home care/residential care were also investigated in order to obtain inspiration how the design principles in section 2.11.2 above are used practically in an app. Facebook and Instagram are two popular apps that for instance were investigated. Placement of buttons, proportions of text and symbols, colours and type of feedback were studied. This, in order to obtain input and inspiration in the prototyping process. These apps worked as an important inspiration in order to promote the usage of the app, for instance, by using notifications.

4.1.1 Call to Action (CTA)

Call to action (CTA) is used in marketing as a statement designed with the purpose of getting immediate attention and response from whomever reading it [53]. CTAs are often used in sales in order to increase the market and the profits. One frequently used technique in CTA is to enhance the feeling of urgency and limitations [54]. For instance, by stating a message telling that you are soon out of product X, and that a new one easily can be ordered, the process of making a sale is accelerated. By enlightening the feeling of missing out or obtaining freedom and self-empowerment, the CTA might be an effective approach.

Further, clarity is another factor important in order to create successful CTAs [54]. Stating what to do and what is received if following the call will prompt an action. Lastly, when creating CTAs, it is advantageous to design them to be bigger, have a distinct colour and outlining them. This avoids the CTAs to blend into the other content.

With call to action in mind during the concept generation, functions that can be useful and at the same time invite constant usage of the app represent a central part in the concepts. This is an important part of the concept generation since this kind of digitalization of healthcare and integration of an app in the workflow might be resistant by the intended users to a beginning. The app will infer changes in their routine, and it might seem more like a burden than help at first. CTAs might enhance the usage in this stage and with time, the users will get more and more used to the app in their workflow.

4.2 Brainstorming

A lot of brainstorming sessions were conducted in order to find suitable ideas in different areas. First, possible areas of how a digitalized interaction within the hygiene area at long-term care facilities can be used were considered through rapid ideation, with inspiration from the established needs. At a later stage, those areas were narrowed in order to find an orientation of the project and where it will be most useful. This app will be used mainly by caregivers at long-term care facilities, even so by relatives, home care staff and service technicians. By considering all these users, there is a lot to think about and many possible ideas of how to construct the app and its usage. In all brainstorming parts, post-it tags were used in order to create an inspiring atmosphere and to increase creativity. In Figure 4.2, the result from one of the brainstorming sessions can be seen. This mind map was one of the later sessions, summarizing the different functions in groups, in order to facilitate which functions to move on with.

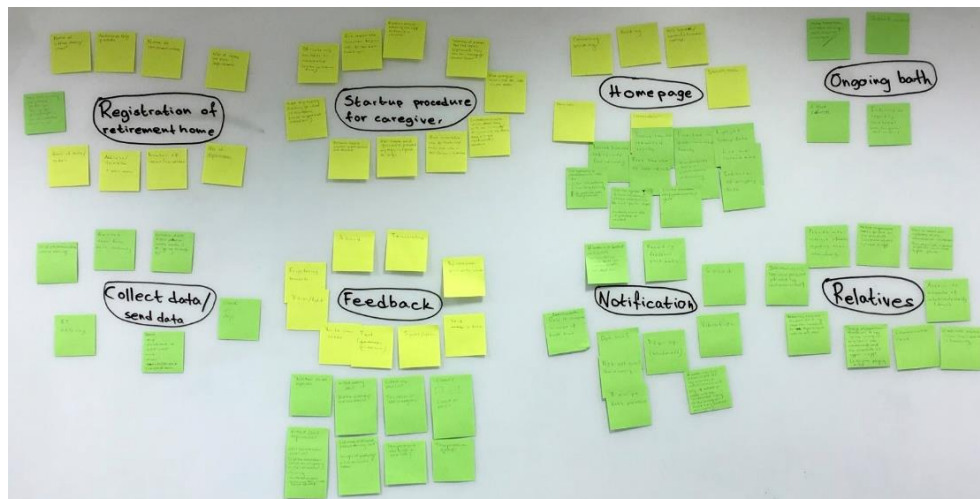


Figure 4.2. A mind map showing the results from a brainstorming session at a later stage. Ideas were generated and functions were categorized in groups.

4.3 Storyboarding

Storyboarding is a low-fidelity prototyping tool for visualising different scenarios [40]. Sketches will show how a user might progress through a task by usage of the product. By drawing sketches of different scenes, starting from the start-up scenario of the app until end-usage by the caregivers for different functionalities, a better understanding and perspective of how the app will be used was obtained.

The series of sketches were created in order to visualize the different concepts, which can be seen in the figures below, Figure 4.3 and Figure 4.4. Each storyboard (number 1 to 18) is showing different scenarios, from the setup of the app to the usage of different functionalities.

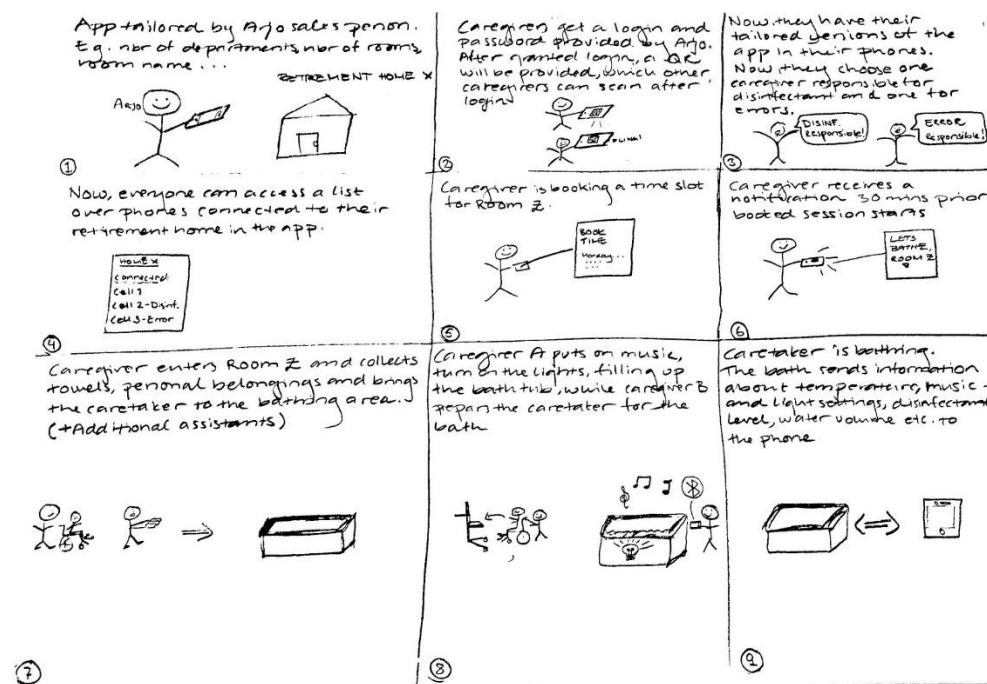


Figure 4.3. Storyboards of different scenarios, showing how the user will interact with the app.

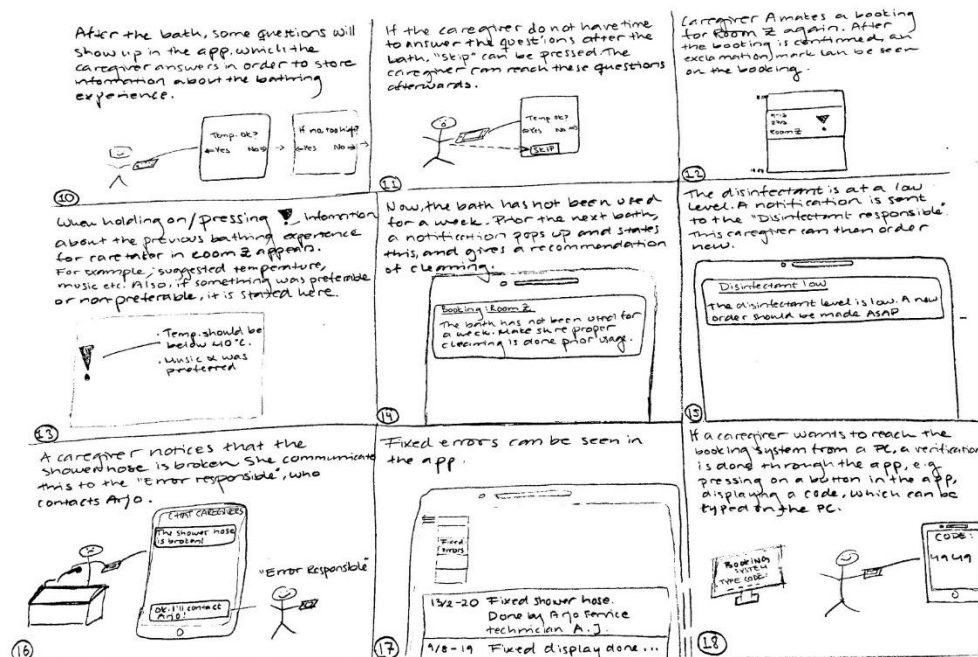


Figure 4.4. Storyboards of different scenarios, showing how the user will interact with the app.

4.4 Concept Selection

4.4.1 Pros and cons with generated concepts

During the concept generation many concepts and functions to the app were generated and discussed. Some of those concepts had to be further investigated in order to decide if they should be used or not, which can be seen in Table 4.1 below, together with pros and cons for each concept. All concepts generated are visualized in a mind map together with more extensive description of their pros and cons in Appendix A.

Table 4.1 Pros and cons with concepts.

<i>Description of concept</i>
Fixed tablet in bath area
<ul style="list-style-type: none"> + All long-term care facilities do not provide smartphones to each caregiver + No need for personal smartphone to bring all the time - No notifications can be sent directly to responsible caregivers, regarding e.g. upcoming bath session, cleaning and errors → Decreased CTA - No flexibility - Caregivers need to go to the bathing area to make bookings - Security (personal data)
Smartphone for each caregiver
<ul style="list-style-type: none"> + CTA + Receive useful notifications/reminders + Flexibility - Each caregiver needs to have its own smartphone - Smartphone must be brought to every bath session
Sensor for towel registration
<ul style="list-style-type: none"> + Information directly to cleaning staff if need for restock + Decreased preparation time + Assure that there always will be towels in the bathing area - Administrative process of towel restock are different between long-term care facilities
Communication channel between caregivers/long-term care facilities
<ul style="list-style-type: none"> + Share information regarding experiences and recommendations - Information might go outside scope - Communication might be done via other channels
Individualized profiles for residents
<ul style="list-style-type: none"> + Person-centred care + Facilitate for new/inexperienced caregivers + History tracking - Sensitive information to be stored - Evaluation must be made after each bath session (time factor)
Automatic start of water filling before bath session
<ul style="list-style-type: none"> + Facilitates the process + Shortens the preparation time – start the bath when on the way - Bath session might be delayed. Water will then get cold
General log in for all caregivers
<ul style="list-style-type: none"> + Easy access - No adapted notifications sent to caregivers - No possibility to track the user
Checklist before bath session
<ul style="list-style-type: none"> + Important products will not be forgotten to transfer from residents to bathing area + Facilitated process for new/inexperienced caregivers - Disturbing and time-consuming moment for experienced caregivers

Automatic booking to provide regular bath sessions for residents	
+	Decrease administrative time regarding booking
-	Might cause overlapping of other scheduled activities
-	The time slot that does not fit the schedule might not be cancelled → prevent others to use the bath
-	Caregivers will use the app less
Additional purchases of products within app	
+	Facilitate administrative services regarding purchases
-	Out of scope/ future concept
Educational videos	
+	Every caregiver will feel more secure and confident regarding how to conduct a bath
+	The bathing procedure time might decrease since caregivers are more prepared
+	Provide residents with a better bath experience
-	Uncertain if caregivers will make time and watch these videos
Registration of activity in bath area with sensor	
+	Someone enters the bath area and bathtub filling → bath session started → automatic “check-in”
+	Track bath time
-	Do not receive any information of time pre- and post-bath i.e. the only time registered is the time in the bath area, and not for the whole bath procedure
Fixed time slots in booking view	
+	Facilitate booking
+	Faster booking
-	Caregivers less flexible in their workflow
-	Risk for a lot of empty “in-between” timeslots
-	Varying bath time between residents
Synchronize height of bathtub with bath chair	
+	Facilitate for caregivers to set the optimal position for the resident
-	Caregivers have varying height and might want to change the height setting anyways
-	Not feasible
-	Not a need from caregiver perspective
Collect data from bathtub regarding for instance energy consumption, usage of bathtub and the sage of different features	
+	Use data for improvements of product
+	Marketing material
+	Adapt additional products/sales depending on the customers’ needs and habits
-	Out of scope
Add users by QR-code	
+	Easy to add users
+	QR code can be adapted depending on what access the certain user shall have
+	No need for username and password
-	Might be spread easily among people that should not have an access

4.4.2 Why, What and How

A UX designer should consider the *Why*, *What* and *How* of the product [55]. The *Why* includes the users’ motivation, which values and views the users associate with owning the product. The *What* involves the functionality of the product and

what they can do with it. Lastly, the *How* is used in order to develop a product that can be meaningful and useful for the users.

To summarize the needs in larger groups in order to facilitate the choice of concepts to proceed with, the method of Why, What and How was applied, see Figure 4.5.

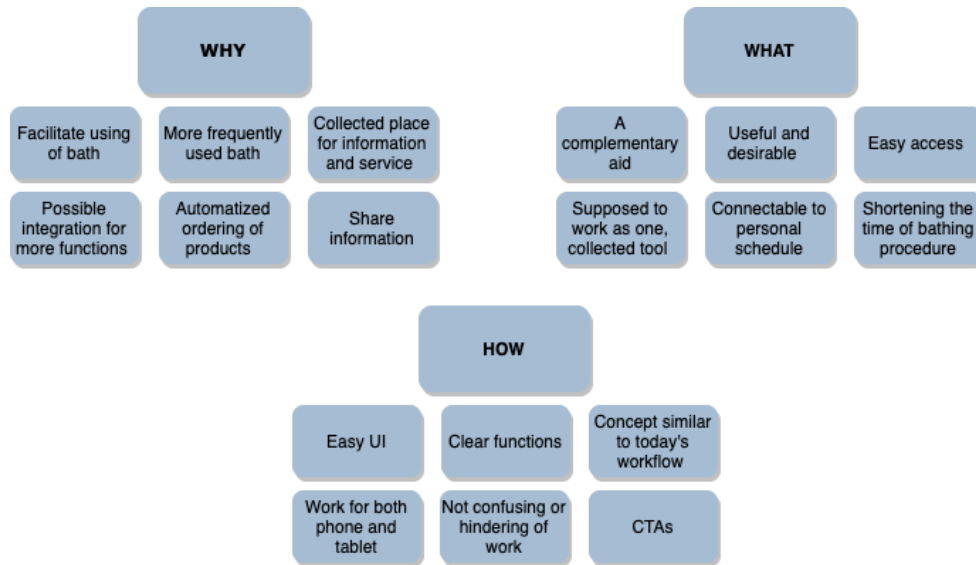


Figure 4.5. Why, What and How of the digital tool stated.

Concepts connected to each area stated in Figure 4.5 can be seen in the following section 4.4.3.

4.4.3 MoSCoW

In order to state the different functions of concepts wanted in the app and how to prioritize them, the MoSCoW method was used [56]. The MoSCoW method is a prioritization technique, which includes four categories; *Must have*, *Should have*, *Could have* and *Will not have (this time)*. The functions within this prioritization list are based on the functions that were generated in the mind map in Figure 4.2 during a brainstorming session. This prioritization can be seen in Figure 4.6. The first category, *Must Have*, is considered mandatory. The second category, *Should Have*, are important but not 100 % necessary for delivering the product, the product will still function. The third category, *Could Have*, are not necessary for the core function, they will be delivered if there is enough time. The last category, *Will not Have (this time)*, is not a priority and agreed for not going to happen for this specific time frame. This is a method used to understand the main important functionalities of the app and which ones to focus on. However, some functions might switch

categories as the project continues and more information will be collected when test sessions of the prototype will be conducted. The priority was set in collaboration with the supervisors at the company based on what was considered most feasible to cover and that would contribute to most added value for the caregivers and residents.

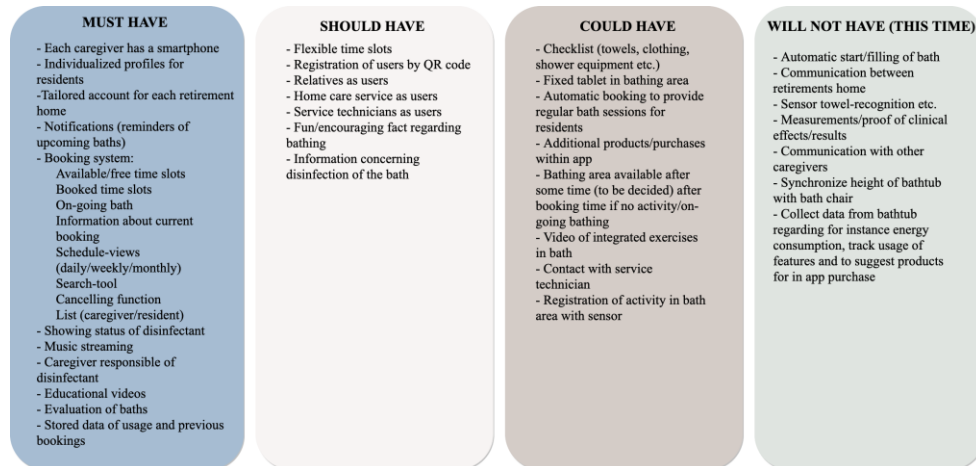


Figure 4.6. Usage of the MoSCoW method in order to state the priorities of functions in the concepts.

4.4.4 Data transfer

One central area in order to get all the concepts to work is the process of data transfer, since data must be transferred in both ways between the bathtub and the smartphone. The techniques of Bluetooth and Wi-Fi has been described in section 2.6. When comparing the two possible techniques, Bluetooth is most used at short range communication. BLE is here preferable due to its low energy consumption. Hence, for data extraction, BLE will be suggested as a choice, since this process automatically proceeds while a device is recognized in the nearby. The BLE will enable transfer of data to a cloud storing service through a gateway, placed in the bathing area. For streaming music from smartphone to bathtub, classic Bluetooth will preferably be used, since a pairing of two devices is done and streaming is by convention more often using Bluetooth. Wi-Fi is not preferable in this concept since it is usually used for larger data exchange and it consumes more energy. Since the app is intended to be used on a smartphone or possibly a tablet in the bathing area, Bluetooth is estimated to be sufficient. From an economic perspective, Bluetooth is cheaper than Wi-Fi. Also, a Wi-Fi facility infrastructure with the use of username and password may change over time.

To clarify, not all functions in the app will demand a connection with the bathtub through Bluetooth or BLE in order to work. For instance, the booking function will

only demand the smartphone being connected to the cloud in order to store the added information. The function of BT will be to stream music and BLE will be used to extract data, in order to store the used settings in the cloud used during a bath session. This information will then be used to correlate with a resident's preferences stated in the evaluation, which is done by caregivers after a conducted bath session.

4.5 Summary

The concept generation and concept selection together with the MoSCoW method as a prioritization technique resulted in concepts that will be further developed and improved in the next coming steps in the process of the project. The chosen concepts are stated in the Figure 4.7 below. Those concepts will be further analysed and tested in the creation of the low-fi- and high-fi-prototypes, together with user tests.

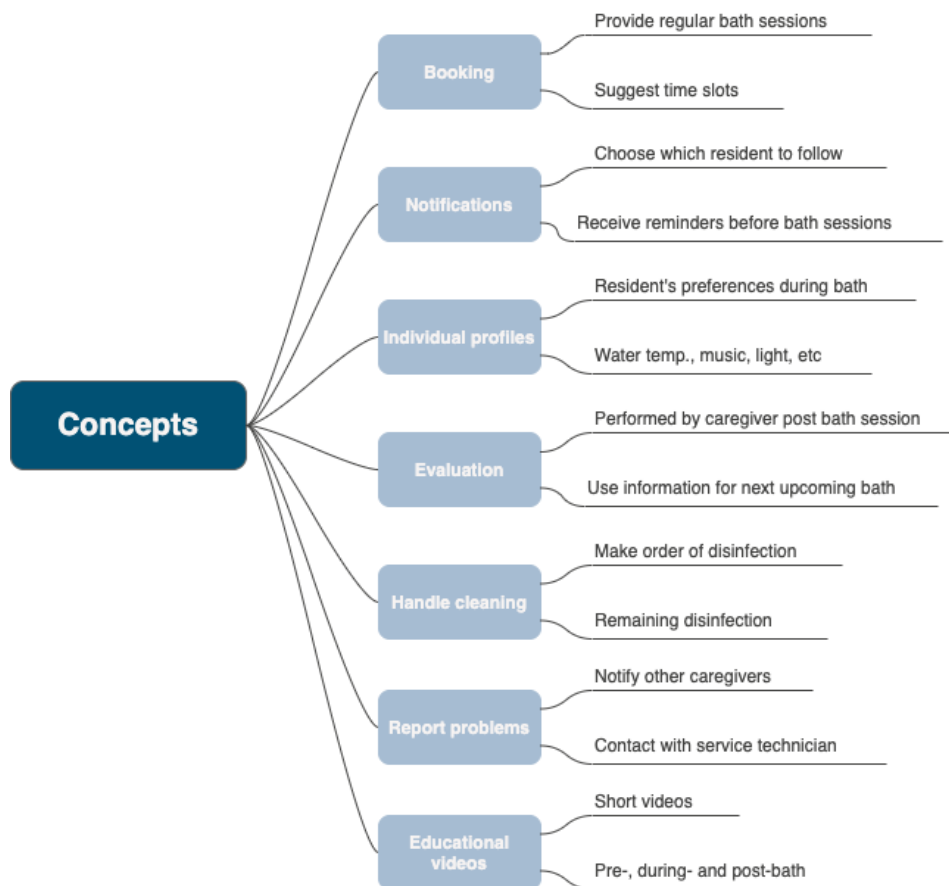


Figure 4.7. The chosen concepts of the application.

5 Low-fidelity Prototypes

Prototyping is a method of testing ideas of a design interactively on users [57]. It enables a representation of concepts and ideas in a tangible form, which opens for several insights in how a user will interact with the design and functions as a type of checkpoint for designers. Design prototypes can vary in complexity and are defined by their fidelity. Low-fidelity prototypes can be in the form of concept sketches and storyboards, as used and mentioned above in section 4.3, or as sketch models. They can be used to show a concept purpose to obtain a constructive review, in order to get feedback so that an iterative process can be applied. A common type of prototyping is prototyping on paper, where users get to interact with paper representations of interface screens. It enables a visual following of what the user intends to do at each page, simulating an interaction by swiping or adding drawings or images as results of each step the user follows. Areas and concepts of difficulty can easily be noted and improved.

When prototyping, it is desired to test different aspects of the concept and often, compromises are necessary [58]. Thus, the prototypes must be developed with the key issues in mind. The two main compromises that are often put against each other are the breadth of functionality and depth. These are called horizontal prototyping, including a wide range of functions but little details, and vertical prototyping, providing a high level of details but showing few functions.

5.1 Initial Low-fidelity Prototypes

The initial low-fidelity prototypes were mainly done as horizontal prototypes in order to cover as many functions as possible as a beginning. Details were not prioritized in this stage of prototyping. The following figures show some of the first prototypes that were used to present the concept in a more realistic way.

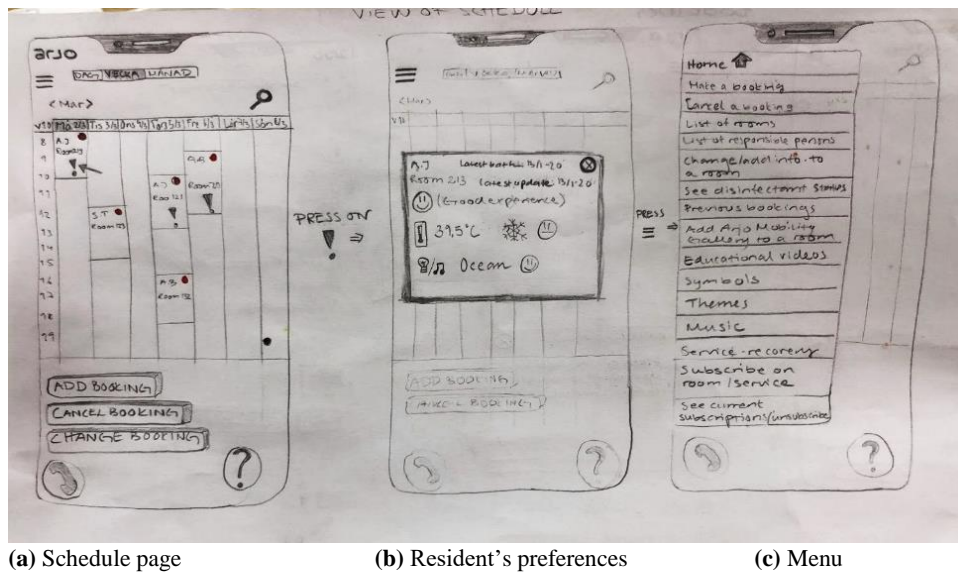


Figure 5.1. One of the first low-fidelity prototypes.

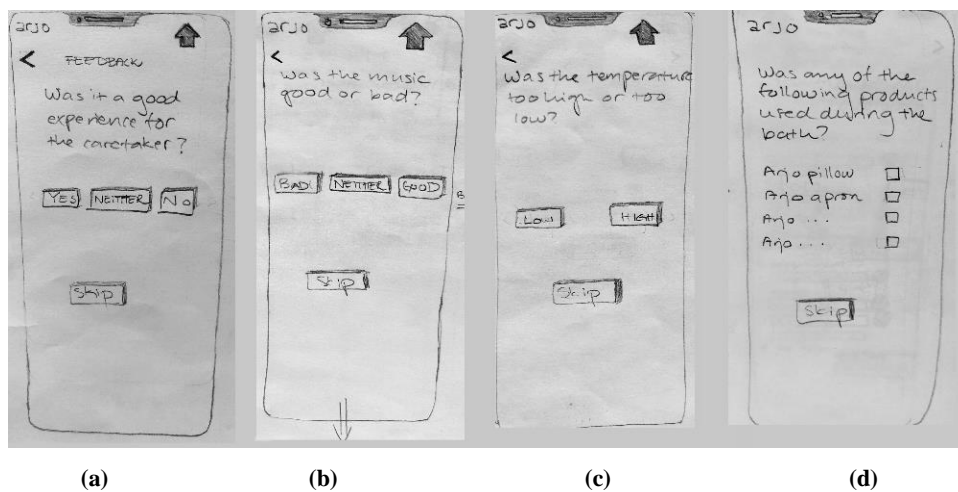


Figure 5.2. One of the first low-fidelity prototypes. Figure (a)-(d) are showing the feedback (evaluation) pages with different kinds of questions concerning the bath experience for the resident.

5.1.1 Concept flow investigation

In order to practically test the concept of the initial low-fidelity prototype, the prototype shown in Figure 5.1 and 5.2, along with the rest that is not shown, were used in a simulated workflow of a real situation where the app would be used. The simulation of the workflow was conducted by the authors, in an environment consisting of a bathtub and a hygiene lifter in order to get involved and understand

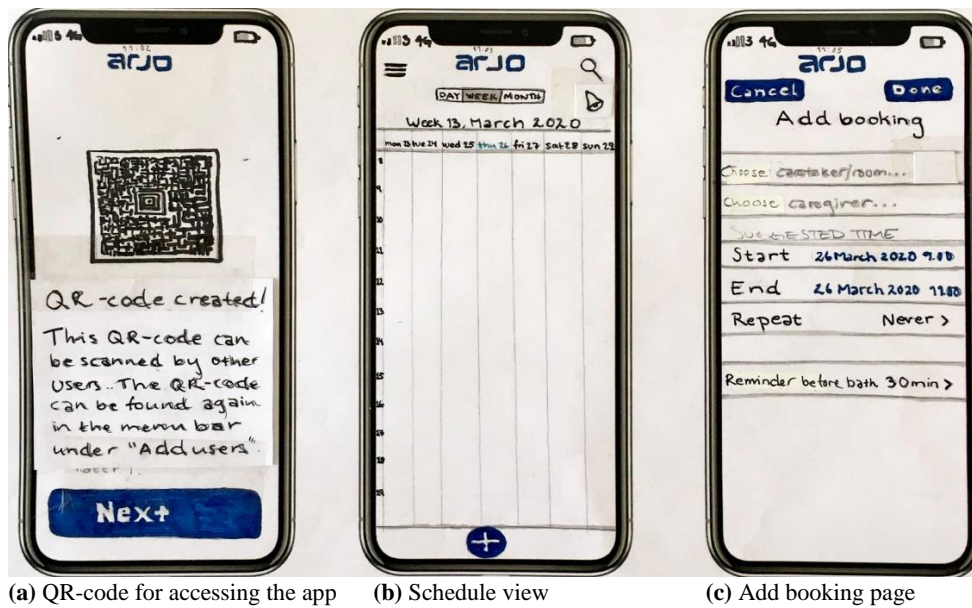
the caregiver's way of conducting baths. During this test, a "caregiver" was using the hygiene chair in order to transfer the "resident" into the bathtub. The workflow was recorded in order to later go through it again to discover where flaws could be detected. At points where hesitations were observed and the flow was disturbed during the test, these pages and concepts were noted simultaneously as the recording was reviewed. Several different flaws and unclear parts of the concept appeared.

For instance, when the "caregiver" was going to find the preferences for a resident in order to choose the settings on the bathtub, the first impression was, while having a "resident" in the bath, it was not clear that they were reached through pressing on the exclamation point on the booked time in the schedule. This exclamation point was rather perceived to indicate that something was wrong with the booked time, see Figure 5.1 (a). Also, it was realised that the preferences should have been looked at before the resident was placed in the bathtub, since some of the preferences are regarding for example initial temperature on the water.

From these insights, the more advanced low-fidelity prototype could be designed. This was created with an approach of vertical prototyping, in order to present and test a design that is more like a real design of an app.

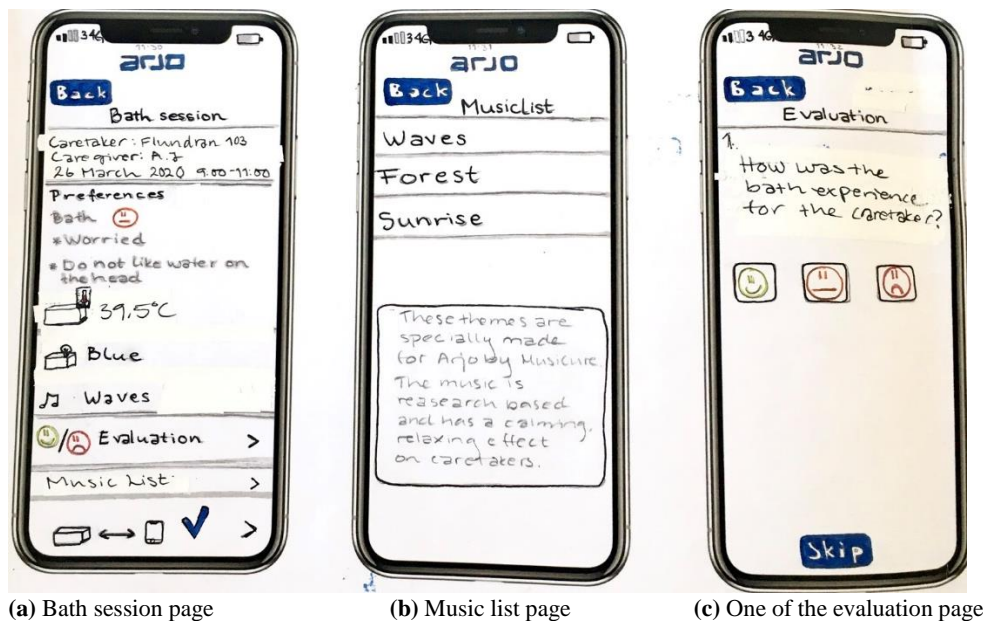
5.2 Interactive Low-fidelity Prototype

The interactive low-fidelity prototypes were created based on the initial low-fidelity prototypes and created to be more functioning. All pages of the interactive low-fidelity prototypes which were used to conduct the usability tests can be seen in Appendix B.1. However, the manually added notifications or other text boxes are not shown. Figure 5.3 and 5.4 below show in total six pages as examples of the interactive low-fidelity prototype created.



(a) QR-code for accessing the app (b) Schedule view (c) Add booking page

Figure 5.3. One of the latest interactive low-fidelity prototypes.



(a) Bath session page (b) Music list page (c) One of the evaluation page

Figure 5.4. One of the latest, interactive low-fidelity prototypes.

5.2.1 Design perspectives considered

The initial low-fidelity prototypes, seen in Figure 5.1 and 5.2, were created without a lot of consideration to design principles or such. This since these had the purpose to solely visualise the concepts in order to investigate whether they were applicable in a practical workflow. When creating the interactive low-fidelity prototype that was used in the usability testing, design principles was applied and considered throughout the complete process. The placement of the buttons e.g. “Yes”, “No”, “Good” etcetera in Figure 5.1 and 5.2, where neither good in that sense that they were placed in the middle of the page, taking up a lot of space, or that they were not consistent throughout the prototype. Further, the type of feedback was mixed with both buttons and check-in boxes in order to answer the questions in the evaluation, see Figure 5.2 (a)-(d). This might be confusing, increase the cognitive load and thus the time to conduct the evaluation.

These flaws regarding the design in the prototype were considered in the construction of the interactive low-fidelity prototype, see Figure 5.3 and 5.4. The seven fundamental Principles of Design and the 7 Principles of Universal Design described in section 2.11.2, were used. For example, in order to decrease the potential increased cognitive load and the time it takes to fill the evaluation and thus increasing the ease of use, simple symbols were instead chosen to be used when giving feedback. Also, the placement of buttons was made according to conventions with inspiration from a user interface in a smartphone today, e.g. at the top left and right corner to go back and forth, or to cancel or be done. At pages where one read from top to below, the button was placed at the bottom of the page. This, in order to follow the flow and not oblige the user to search for the button at the top of the page, consuming more time and an increased cognitive load, see Figure 5.3 (a) for an example.

5.3 Usability Testing and Test Scenarios

Usability testing is an evaluative method to observe an individual’s experience of an interface as he/she goes through several steps in a presented task [59]. The purpose is to identify parts in the interface that are confusing so that they can be improved and fixed. The test is usually designed in order to represent the end-user goals. The tasks should be specific and concrete. Scenarios is used to contextualize the task and written to provide necessary information to complete the task. Neither the task nor the scenarios should affect the test person to finish the task in a certain way or to justify product requirements. The evaluator should try to detect for instance if the test person understands the task but cannot complete it within the given time, gives up or resigns from the process or if the test person seems surprised or delighted. The usability test will reveal problems and developers will get an

insight in how the perception of the interface differs between themselves and the typical end users.

5.3.1 Usability test

The interactive low-fidelity prototype was planned to be tested by caregivers at long-term care facilities, optimally at the same long-term care facilities as the study visits were conducted. However, due to the Covid-19 situation, no visits at long-term care facilities or meetings with caregivers were possible. Thus, the usability tests were conducted by three persons, two with knowledge within the care and bathing environment and one with knowledge within design and usability.

The procedure of the usability testing began with a short explanation of the administrative procedure prior to the start page in the low-fidelity prototype, in order for the test person to have some background knowledge of the app and its purpose. Further, the test scenarios in section 5.3.2 were presented along the testing procedure, and the interactive movement and the thoughts of the concept the test person had were followed and recorded.

5.3.2 Test scenarios for interactive low-fidelity prototype

Seven test scenarios were created with the information about how to create and conduct a usability test in mind. Based on which concepts that were desired to evaluate, the scenarios could be stated. These test scenarios were conducted by using the created low-fidelity prototypes, see Figure 5.3 and 5.4. The test scenarios were stated as following:

1. Pre-settings have been installed by Arjo's sales representative, tailored for the current long-term care facilities. As a caregiver, start the app and proceed the initial steps until the home page is reached.
2. Make a booking for room Flundran 103, caregiver A.J the 26th of March. Change the booking and cancel the booking.
3. Make a subscription for room Flundran 103 and for Disinfectant.
4. The booked time has started. Open the bath session. Make sure that the app is connected by Bluetooth to the bath. Read the personal preferences. Start the music and choose the song "Waves". Now, the bath is done, go to "Evaluation" and answer the questions about the bathing session.
5. Check how much disinfectant level that is left in the bath.
6. Watch the educational video of the procedure during a bath.
7. Check the history of bookings for Flundran 103.

5.4 Results

The initial low-fidelity prototype provided a possibility to test the concept in a simulated user case. Flaws or unclear parts of the concept were identified and modified. The interactive low-fidelity prototype enabled usability testing, where further input of the concepts and UI and UX could be obtained.

5.4.1 Usability test

The usability tests resulted in many comments and thoughts that were noted. They have been summarised and the most important takeaways can be seen in Table 5.1.

Table 5.1. The most important takeaways from the usability tests with the low-fidelity prototype.

<i>Design related aspects</i>
<ul style="list-style-type: none">• Make the buttons clearer• List with alternatives of departments and rooms instead of free text• Use confirmation pop-ups• Uniformity of buttons• Do not mix feedback answers buttons on the same page• When one has marked a button, clearly visualize this to distinguish• Make the symbol of bathtub and smartphone connection clearer
<i>Concept related aspects</i>
<ul style="list-style-type: none">• Clarify concept with QR-code• Information symbol instead of exclamation symbol• Change the text “Start bath” since not understandable of what will happen• Change the name of concept regarding “subscriptions”• Make it easy to understand to whom the evaluation question considers• Make it easy understandable when a bath is starting• Make the disinfection page more understandable• Shorten evaluation questions• Should remove the obligation of choosing caregiver when making booking

5.4.2 Summary

The usability tests gave several important insights, both regarding the design related aspects and the concept related aspects. Several design aspects need to be improved such as better mapping, feedback and choices of symbols and instructional text. Thus, the Gestalt Principles are further considered during the high-fidelity prototyping. The 7 Principles of design are also further considered, which will be

easier during the high-fidelity prototyping. It is of importance to state out that the central part has been to develop and investigate the concepts and evaluate these, and not to describe graphical decisions. However, the design perspectives are mentioned and investigated to some extent in order to improve the UI such the concepts will be understandable and clear.

Comments regarding the concepts will be regarded. For instance, by changing the formulation of the text regarding “subscriptions” to e.g. notifications, it can be clarified what the intended purpose of the page is, since the word “subscriptions” tended to be misleading. By adding the department name and room number on the evaluation page for the current resident that has bathed, it is clarified whom the evaluation questions actually regard.

6 High-Fidelity Prototyping

The high-fidelity prototype was iteratively created based on the established needs, the concept generation and insights from the low-fidelity prototype tests. The prototype was created as a digital prototype in the program Adobe XD [60], see section 6.1. The digital prototype can be used as a mobile app in a smartphone, which enables a physical, interactive experience mimicking the experience of a real app. Users can test the prototype and evaluate the aesthetics, interaction, usability and as close as possible, the functionality [59]. Due to the limitations in the program, not all functions will be completely implemented such as “List of rooms/caretakers” and “History of bookings”, see Figure 6.1 (a). Also, some functions of the UI are not possible to represent as they would have been in a real app, for instance a scrolling bar. Thus, there are limitations of possible choices in the app which results in the usability testing being somewhat controlled, like the process with testing the low-fidelity prototype described in section 5.3.

6.1 Design Tool

Adobe XD is streamlined software that is used to design UI and prototypes [60]. One can choose which type of layout, such as an iPhone or an iPad that is desired to design and create screen transitions in order to make interactions between created screens. Also, transitions between objects on the screens can be created. The prototype can be shared, and Adobe XD can be downloaded as an app, which enables user interactions that most realistic simulates interaction with a real app on a smartphone. Hence, the UI and UX can be perceived closely as it would in a coded app.

6.2 High-fidelity Prototype

Figure 6.1 to 6.3 show some of the pages from the high-fidelity prototype. This prototype was used for the assessment testing, see section 6.3, and it was continuously improved according to the obtained feedback from the tests.

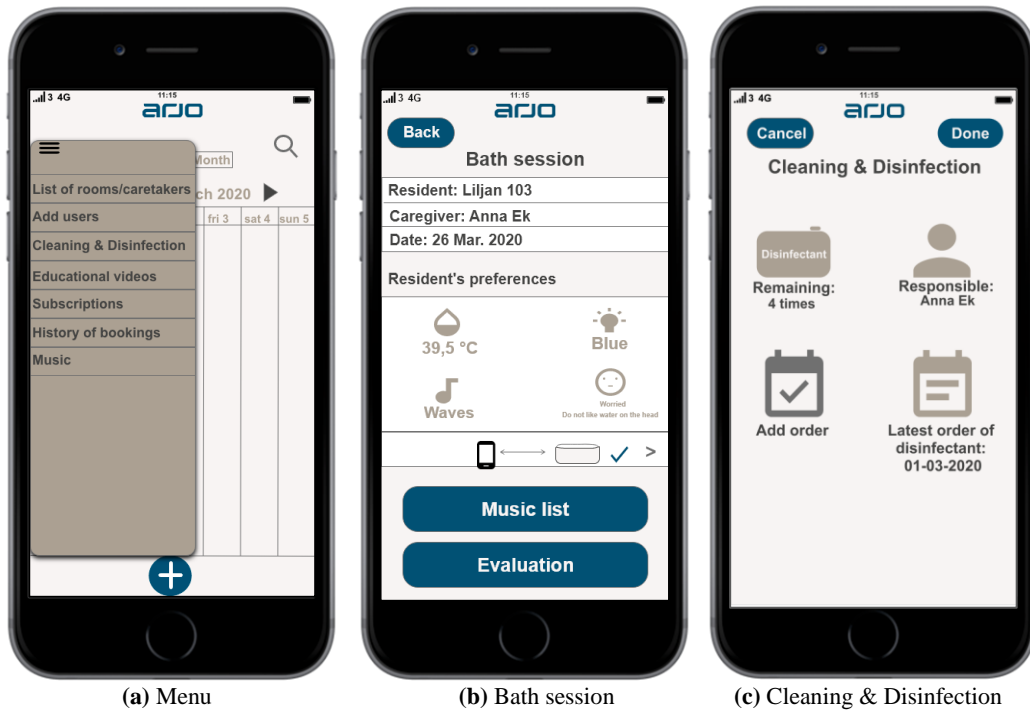


Figure 6.1. Three pages from the high-fidelity prototype created in Adobe XD.

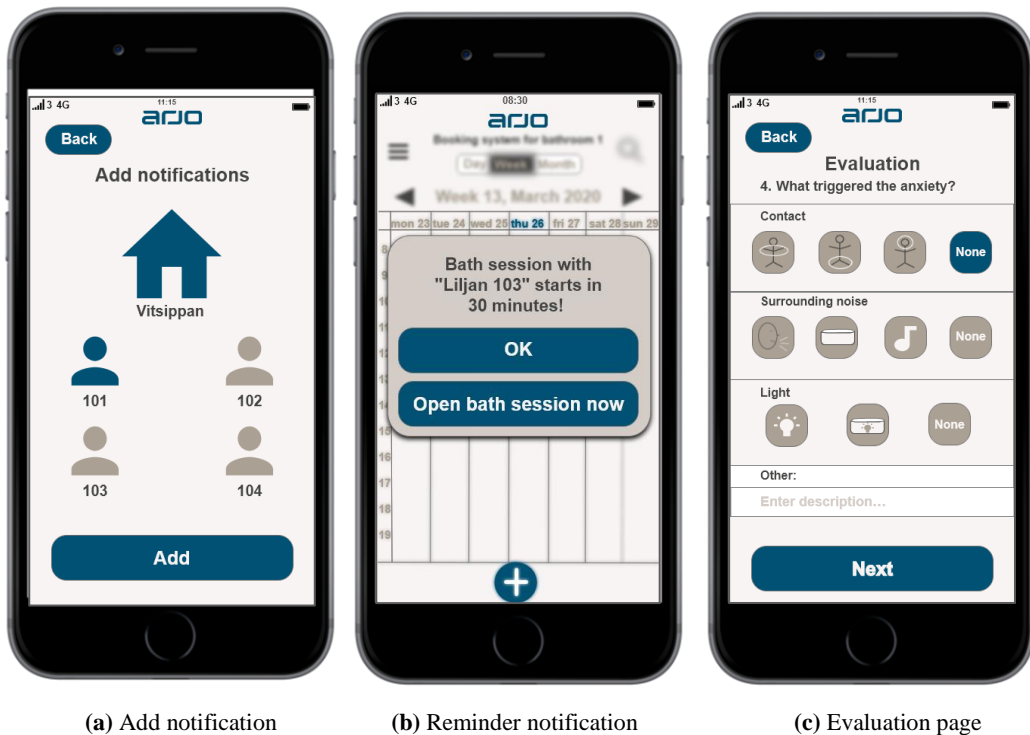


Figure 6.2. Three pages from the high-fidelity prototype created in Adobe XD.

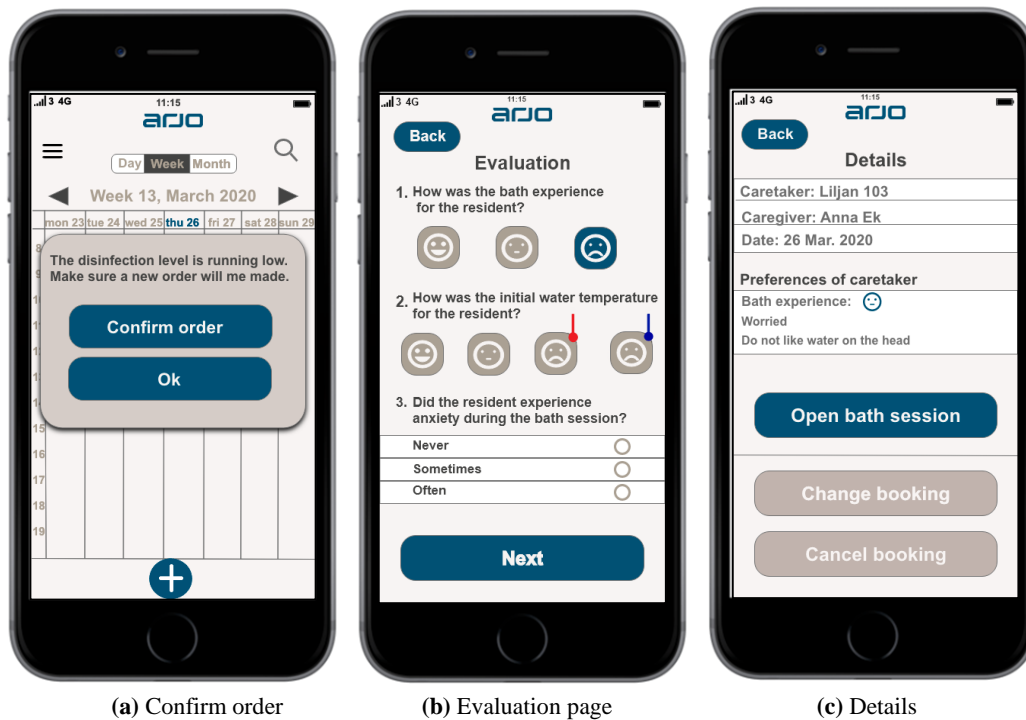


Figure 6.3. Three pages from the high-fidelity prototype created in Adobe XD.

6.2.1 Design perspectives considered

When creating the high-fidelity prototype seen in Figure 6.1 to 6.3, the interactive low-fidelity prototype showed in Figure 5.3 and 5.4 was used as a base. The consistency of the design and the appearance can be identified, for example when studying Figure 5.4 (a) and 6.1 (b). The main difference between the low-fidelity and the high-fidelity prototype, except for being on paper and being digital, is that the UI has been made cleaner with less small details. This increases the visibility, which is important to consider according to the 10 Usability Heuristics for User Interface Design, see section 2.11. Also, symbols have been made bigger and all space on the page has been used.

Further, as stated in section 4.1.1, in order to call to action, objects or text boxes should be made bigger, have a distinct colour and be outlined. Thus, when creating notifications and information boxes, the background has been blurred in order to increase the contrast and make the important information enhanced. Notifications that has not been opened or read have another colour than the ones that have been read, in order to call to action and give the user a clear reminder.

The colours in the UI was chosen according to the ones used by Arjo, see section 2.4.1 regarding Arjo's digital guidelines. The blue and the beige colour were chosen to be the main ones. Blue indicates that the buttons are pressable and leads to the next page, while the beige colour works for symbols showing information or to

communicate that they have not been pressed. However, in the evaluation pages, a lot of symbols with the colour beige were used, even if they were pressable. The choice of this is based on that it was easier for the user to get a confirmation of which symbols that have been pressed on, if they changed from colour beige to blue and not the other way. This choice was made according to the Gestalt law of consistency, see section 2.11.2, in order to make the UI easy to understand and follow.

6.3 Usability Testing

As mentioned, the situation with Covid-19 has affected the possibility to conduct the usability testing and assessment testing as planned. However, by developing an online test, assessment tests could be conducted anyhow.

Assessment testing is one of the most typical usability tests and it is conducted early or midway through the product development cycle, usually when the fundamental or the high-level design has been established [61]. The purpose of the test is to evaluate the usability of the lower-level operations and the different aspects of the UI. It is simple and straightforward to conduct and aims to examine how efficiently the concept has been implemented. The intuitiveness is examined and identifying usability deficiencies are interesting factors studied in the test.

The testing of the high-fidelity prototype was more thorough and extensive compared to the usability testing of the low-fidelity prototype, due to the more advanced possibilities to visualise concepts. Hence, more theory regarding how to plan and conduct an assessment test was used in order to obtain as good results from the tests as possible.

6.4 Method of Conducting a Test

It is crucial to state the importance of creating a test plan, especially when it is a more extensive test. The plan describes exactly how to conduct the testing of a product and it helps to make sure that all involved receive the necessary information and that the test will yield desired results [61]. Further, a test plan describes and implies necessary resources, which might need planning. Table 6.1 below states the method of creating a test with sections and their descriptions important to include.

Table 6.1. Sections together with descriptions that should be considered when creating a test [61].

<i>Parts of the test plan</i>	<i>Description</i>
Purpose, goals and objectives of the test	State the reasons for performing the test at this time.
Research questions	<p>Describes the issues and questions that need to be resolved. Example of questions are:</p> <ul style="list-style-type: none">• How well do users understand symbols and icons?• How easily do users switch between modes on multi-purpose buttons? Which ones are problematic? Why?
Participants characteristics	Describes the characteristics of the end/target users. For experimental design, a minimum of participants is 10 to 12. A less formal usability test can be conducted with four to five.
Method (test design)	<p>Describes how the test session will proceed. It enables understanding and visualizing what will happen, so that suggestions and input can be given accordingly. It also enables multiple test moderators to conduct the test in a similar way.</p> <p>Within-subjects Design is a test type where each test person conducts the same tasks. By randomizing the tasks (a method called counterbalancing) the effect of possible learning transfer can be limited.</p>
Task list	Includes the tasks the participants will perform during the test. The scenarios will contain real details and the context should be provided such that the test can be performed with as little help as possible from the test moderator.
Test environment, equipment, and logistics	Describes the environment the test will be conducted in and possible equipment needed e.g. phones or a computer. If possible, try to simulate actual conditions.
Test moderator role	State what the test moderator will do and if there might be occasions out of ordinary, to prevent confusion.
Data to be collected and evaluation measures	Provides an overview of the type of measures that will be collected during the test, both performance and preference data. The data collected should be based on the research questions.
Report contents and presentation	Summary of the main sectors and the intended way of communicating the results.

6.5 Test and Survey

An assessment test was created with the test scenarios for the low-fidelity prototype in section 5.3.2 as a foundation, see section 6.5.1 below. This test was conducted by twelve people in total. Seven of the test sessions were conducted in-person while the other five test sessions were conducted digitally without any supervision due to Covid-19 and due to some of these persons not being in Sweden. The persons not being located in Sweden work for Arjo globally and have knowledge within the care environment at long-term care facilities. An online survey was distributed to all participants in order to receive the same kind of feedback from everyone. Feedback was also obtained from the in-person tests as a result of the “Think aloud” principle.

The online survey contained questions formulated accordingly to obtain feedback regarding the concepts and whether the functions were perceived reasonable and understandable. Additional feedback regarding the design was also desired through some of the questions, in order to investigate the perception of the symbols, colours etcetera. The questions can be seen in Appendix C.3.

6.5.1 Test scenarios for high-fidelity prototype

The test scenarios were based on the most important functions for understanding the concept in the prototype. They were written to be as objective as possible. Since only some of the functions have been implemented in the digital prototype in Adobe XD, the test scenarios will only cover these. These test scenarios are based on the test scenarios created to the low-fidelity prototype, see section 5.3.2. However, these have been updated and adapted to the concepts that have been developed or changed since the low-fidelity prototype was created. See them below:

1. Sign in procedure

- Log in as a caregiver.
- Type in “Lunden” as username and ***** as password.
- Sign in.
- Follow the instructions in the app until the schedule view is reached.

2. Booking of bath sessions

- Add a booking for the resident:
 - Choose the resident's department and room “Liljan 103”.
 - The suggested bath time does not suit you as a responsible caregiver. Change the date and time of the booking to “26 mar, 9.00 - 11.00”.

- “Liljan 103” wants to have a bath session every two weeks. Set Repeat to “Every two weeks”.
 - You as a caregiver want to receive a reminder before the bath session with “Liljan 103”. Set Reminder before bath session to “30 min”.
 - Add the booking.
- 3. Add relative as a user to the app**
- A relative wants to get access to the bath schedule for its elder. Add a relative for “Liljan 103” as a new user.
 - You have received the QR-code for access to the app to the relative, but you shall not go further with it.
- 4. Notifications**
- You want to receive notifications regarding the upcoming bath sessions for your residents.
 - Add notifications from “Liljan 103”.
 - Add notifications from “Vitsippan 101 and 102”.
 - Now you are done.
- 5. Handling of the cleaning and disinfection of the bathtub**
- You are going to be the caregiver that is responsible for the cleaning & disinfection. Add yourself as the responsible caregiver.
 - Return to the homepage.
- 6. Disinfection level low**
- You have received a notification regarding the disinfection level. Read the notification and go to the Cleaning & Disinfection page.
 - Add an order to notify all other caregivers that you have contacted Arjo and ordered new disinfectant.
- 7. Start bath session**
- Press on the booked time slot in the schedule on the homepage.
 - Read the notification of the upcoming bath session for “Liljan 103”, 9.00-11.00 sent to you and open the bath session.
 - Your Bluetooth is off. Press OK in order to “simulate” a connection between your smartphone and the bathtub.
 - Make sure to study the preferences for the resident.
 - “Liljan 103” prefers the music “Waves”. Start and stop the music “Waves”.

8. Evaluation of the bath session

- The bath session is now done, and you want to perform an evaluation of the bath session in order to make the bath session as good as possible for your resident the next time.
 - The bath experience was “bad”.
 - Initial bath temperature was too hot.
 - The resident experienced anxiety sometimes.
 - Head contact did trigger the anxiety.
 - Music triggered the anxiety.
 - Light did not trigger the anxiety.
 - No other things triggered the anxiety.
 - A pillow under the left arm was not useful.
 - A pillow was used behind the neck.
 - Skin moisturizer was used as skin care products.

9. Error handling

- During the bath procedure you noticed an error. The cover on the bathtub is broken. Report the error in order to let your colleagues be aware of the error situation.

10. Educational videos

- As a caregiver you are not feeling comfortable when it comes to the procedure after a bath. Go to Educational videos and have a look at the video “Part I” under “Post bath”.

As mentioned, there was no possibility to proceed the tests at any long-term care facilities and thus, an online survey was made with Google Forms in order to receive feedback. To enhance the will to take the time and conduct the test, the online survey was constructed such that it would be quick and easy to fill, but had possibilities to be more detailed if wanted. Thus, mainly semantic differentials scales and checkbox questions were used, but at places where some more explanations might be useful for the results, non-mandatory fill-in questions were provided. The online survey can be found in Appendix C.3.

To ensure that a study will be perceived as aimed and to obtain a reliable result, a pilot study can be implemented [40]. This is a smaller study that is done before the main study in order to discover e.g. errors or questions that can be perceived wrongly or unclear. By doing a pilot study, time can be saved both for the involved developers and the respondents. For instance, if sending out a questionnaire, the respondents will not be able to ask about questions that are unclear, which might affect the answers to that question.

Further, it should be noted that people that participate in a pilot study shall not participate in the main study. This is due to the fact that they have seen it before and

thus, the results can be distorted. Also, a pilot study enables detection of questions that are skewed in a way so that they lead the respondents to answer in a way one would like them to answer [61]. It might also give the developers insight to explore areas that they did not think of earlier. When the online test and the survey were constructed, they were tested by supervisors to this project as a pilot test in order to discover uncertainties and possible confusing parts. For instance, it was recommended to include instructions on how to proceed if one would get stuck on a page in the prototype during the test. A small instruction of which button to press in order to get back was stated in the updated version of the test instructions. Further, it was recommended to include more questions regarding the how the concepts were perceived. Also, to add a more thorough descriptions to the grading questions was also recommended and applied.

6.6 Results

The results from the online survey were not as extensive as desired. Opinions from caregivers as the primary user group were not obtained despite several attempts. The reason for this was the complication with getting in contact with caregivers at long-term care facilities as explained earlier. However, answers from sales representatives and developers at the company gave some insights. Furthermore, one participant had previous experience of working within a care environment as a nurse, which broadened the scope of knowledge and insights obtained in the results. The feedback during the in-person tests can be seen in section 6.6.1, and the results from the survey can be seen in section 6.6.2.

6.6.1 Feedback from in-person tests

The results from the in-person tests can be seen in Table 6.2, where the most important feedback is stated. All the comments were noted by hand during the tests. The feedback during the tests has been summed up to include the most relevant parts in order to make the feedback as effective and easy to interpret as possible.

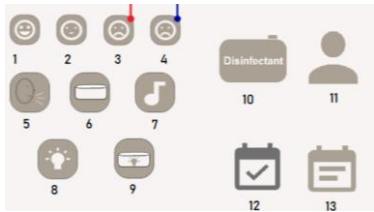
Table 6.2. The most important takeaways from the in-person tests of the high-fidelity prototype.

<i>Design related aspects</i>
<ul style="list-style-type: none"> • Should be able to press directly on the schedule to make a booking • Scroll function melts into background, make it clearer • Be consistent regarding placement of “Done” buttons • Increase contrast regarding choice of colors • Change name of buttons to make it clearer when adding notifications • Use more lines to separate groups of objects • Better explanation of the symbol in cleaning and disinfection page • Change the color gray for symbols since they might be perceived as not pressable • Add color confirmation when an error or order is registered • Add a BT symbol when bath is connected to smartphone • Take into consideration people with color blindness regarding temperature symbols in evaluation • Change symbol in evaluation regarding body contact, show a passive person instead • Clarify bathtub symbol • Change evaluation symbol name, “None” should be “Neither”
<i>Concept related aspects</i>
<ul style="list-style-type: none"> • The QR-code function might be good for the usage of scanning the product which one are next to in order to retrieve a serial-number of the product and to use as an identification, for instance the bathtub • Clarify bath system specifications, too technical for everyone to understand • Better explanation of how to add users • Consider the secrecy and privacy aspects • Better description of cleaning and disinfection • Clarify concept of ordering disinfection

6.6.2 Feedback from online survey

In the following the results from the online survey are stated. The results are divided according to the segments in the survey in order to group the feedback for an easy interpretation. Table 6.3 states the key takeaways from the questions regarding the following aspects: design, functions, symbols and concepts that required a written answers or checkbox answers. The questions that required grading as answers are seen in the bar chart below each segment, respectively.

Table 6.3. The key takeaways regarding the four aspects of design, functions, concepts and symbols from the online survey.

<i>Design</i>
<p>Buttons</p> <ul style="list-style-type: none"> • All the buttons were easy to reach on the screen • Two participants hesitated at some point/points which button to press to proceed forward in the app <ul style="list-style-type: none"> ○ Design, placement and colour would enhance which button to press on ○ Keep a consistence regarding placement of the buttons, for instance “Back” and “Done”
<i>Functions</i>
<p>QR-code</p> <ul style="list-style-type: none"> • One participant did not perceive the QR-code as a good way to share the app between users
<i>Symbols</i>
<ul style="list-style-type: none"> • Following symbols were confusing: 5, 6, 7, 12 and 13 • Symbol 3 and 4 might be difficult for people with colour-blindness, due to the colors red and blue • None of the participants would prefer a describing text to the symbols

<i>General about concepts</i>
<ul style="list-style-type: none"> • One participant state that using room numbers for indicating residents might cause confusion for caregivers • One participant did not think it is a good concept of adding notifications yourself in order to determine which resident/residents you want to receive reminders about regarding booked bath times • It has potential to Arjo’s business and is a good way to follow the usage of bathing and to replace the paperwork/bookings, according to one of the participants • If music was a more central part of app, customers would probably tend to use the app more • Educational videos are a good concept

-
- Currently there is no other smart way to keep track on bathing for residents
-

Design

The Figures 6.4 to 6.8 below show the grading of how the design was perceived.

Choose a number between 1 and 5 how you perceive the design in terms of the following
description: Attractiveness → ugly or nice
5 responses

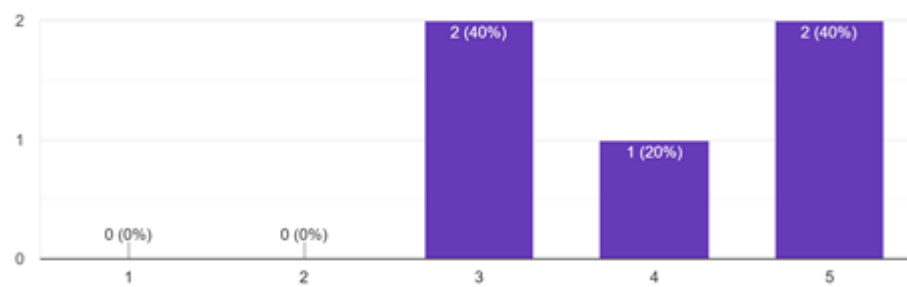


Figure 6.4. Grading of the attractiveness of the app.

Choose a number between 1 and 5 how you perceive the design in terms of the following
description: Pedagogical → complicated or simple
5 responses

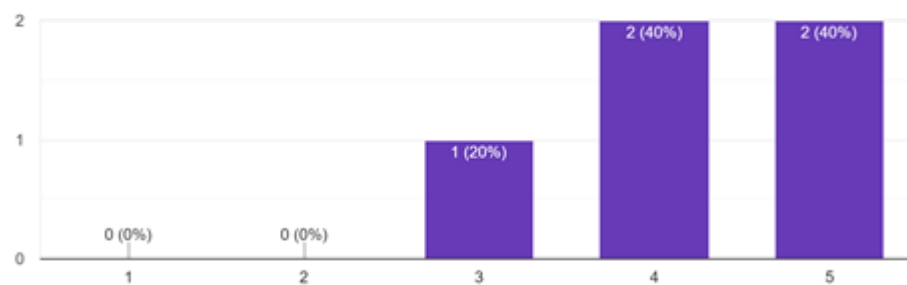


Figure 6.5. Grading of how pedagogical the app was perceived.

Choose a number between 1 and 5 how you perceive the design in terms of the following description: Perception → counter intuitive or intuitive
5 responses

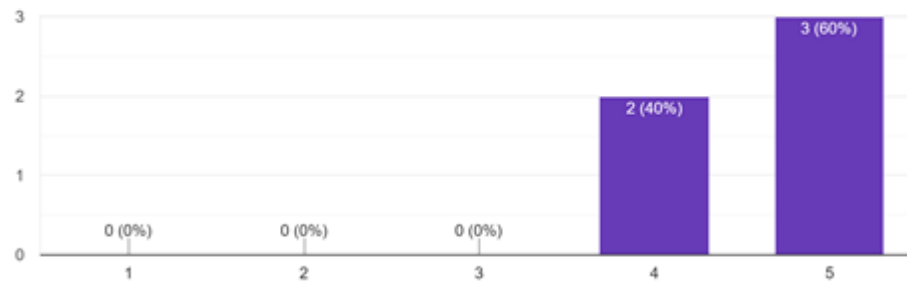


Figure 6.6. Grading of the perception of the app.

Choose a number between 1 and 5 how you perceive the design in terms of the following description: Reliability → unprofessional or professional
5 responses

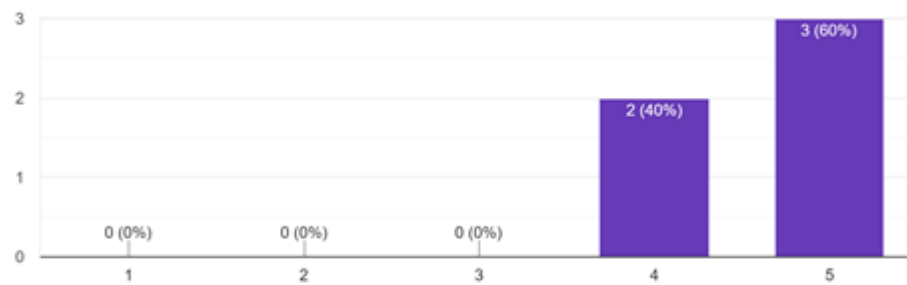


Figure 6.7. Grading of the reliability of the app.

Choose a number between 1 and 5 how you perceive the design in terms of the following description Structure → messy or clean
5 responses

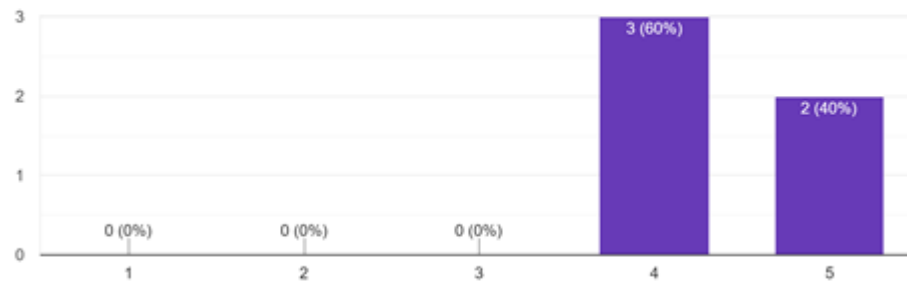


Figure 6.8. Grading of the structure of the app.

Functions

The Figure 6.9 shows the participants' gradings of their impression of the booking schedule view.

What was your impression of the booking schedule view? (Bad or good)
5 responses

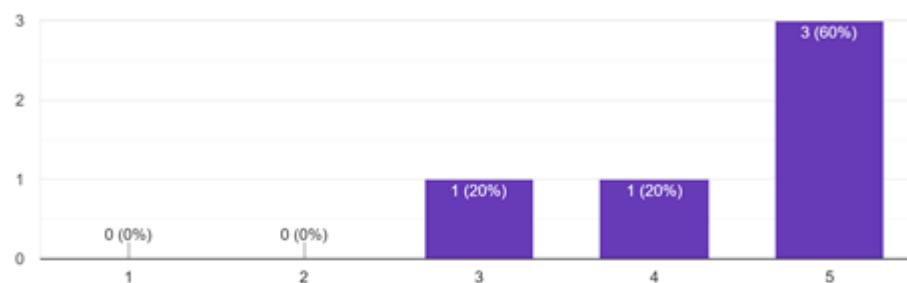


Figure 6.9. Grading of the booking view.

Symbols

The Figure 6.10 shows the participants' grading regarding the symbols.

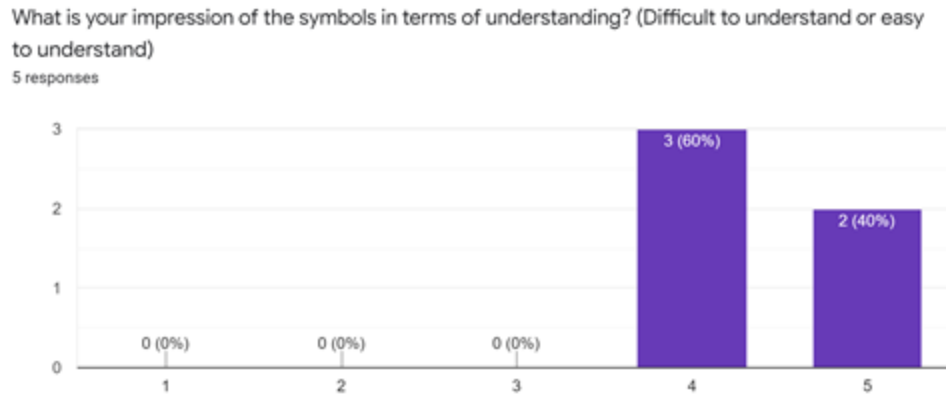


Figure 6.10. Grading of the symbols in terms of understanding.

6.6.3 Summary of the results

To sum up the results of the tests of the high-fidelity prototype, it can be stated that the overall impression of the concepts was perceived having potential and to fulfil a need at the long-term care facilities. However, some uncertainties were identified, e.g. using room numbers which might be confusing and to add notifications yourself. Regarding the design, the overall impression was perceived as good, with some flaws and potential improvements. No grading of the design was below a number 3 and most of them were graded a number 4 or a 5. Comments regarding some unclear symbols were obtained. The feedback and some of the buttons in the UI would preferably be made clearer by changing colours or placement. All the results from the in-person tests and the online survey were considered and used when stating the chosen concepts below in section 7.3, along with updating the UI in the prototype.

7 Final Prototype and Concepts

The final prototype and the final concepts are presented in this section. Also, a summary of benefits with the concepts is stated in order to point out the advantages with the concepts, which might be at use when marketing the product. The final prototype can be viewed online by using the link seen in Appendix D.2, along with the final test scenarios in Appendix D.1.

7.1 Final High-Fidelity Prototype

Some pages of the final prototype can be seen in Figure 7.1 to 7.3. Changes and updates in the design such as colours, symbols and placement of buttons along with clarification of unclear concepts, with the results in section 6.6 as a foundation, has been done.

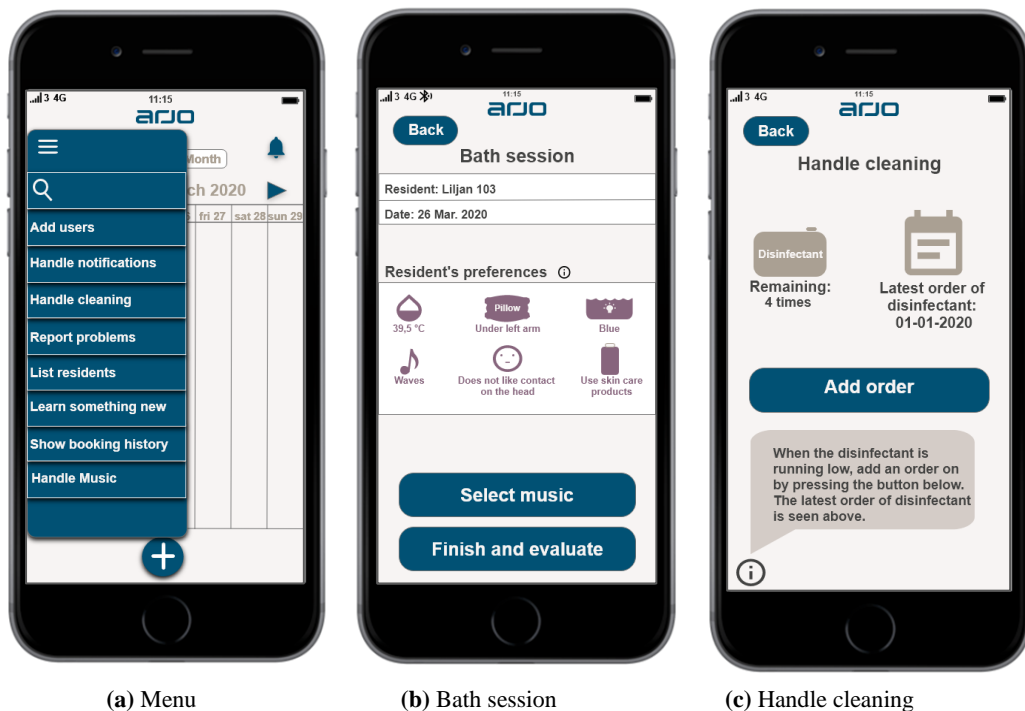


Figure 7.1. Three of the pages from the final high-fidelity prototype created in Adobe XD.

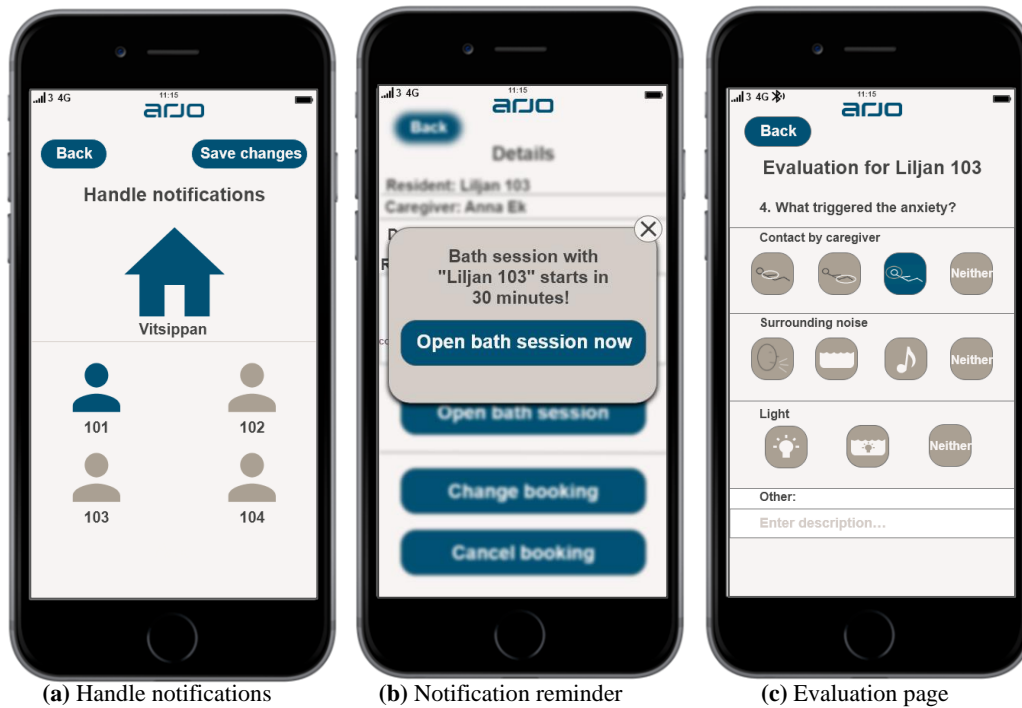


Figure 7.2. Three of the pages from the final high-fidelity prototype created in Adobe XD.

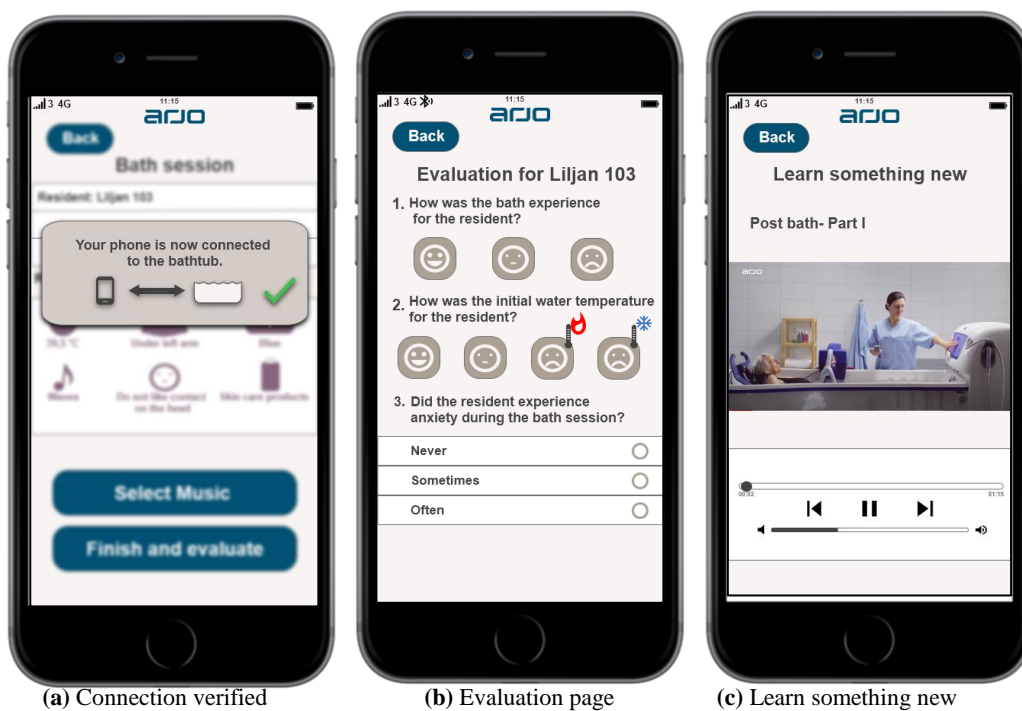


Figure 7.3. Three of the pages from the final high-fidelity prototype created in Adobe XD.

7.2 Users of the App

The main users of the app are the caregivers at the long-term care facilities. Other users of the app are relatives to the elderly, home care service and service technicians. These three last stated users have not been further developed in the final prototype. In section 7.2.1 to 7.2.4, a short description of each user is stated.

7.2.1 Caregivers

The main users of the app are the caregivers, which will have full access to the app, including all information regarding the residents' preferences. The caregivers are the ones that will provide access to colleagues by creating a tailored QR-code with limited access depending what type of access they shall have.

7.2.2 Relatives

The relatives will get access to the app if wanted, however with limited access. They will only have the possibility to view the schedule of their elder. When creating the QR-code to a relative, the caregiver will type in which resident's schedule the relative shall get and thereby a tailored QR-code will be created.

7.2.3 Home care service

The home care staff have the possibility to become users of the app. Their access will be limited since they will not have any information about the residents at the long-term care facilities. The home care staff will only be able to get an overview of the schedule of bath time slots, make bookings for their own caretakers and to store their preferences. Other relevant functions such as an error handling will also be included in their access of the app. However, other administrative procedures and decisions regarding the home care staff's ability to use the bathing area must be discussed with the long-term care facilities and be setup when providing access by the QR-code.

7.2.4 Service technicians

When an error is reported by caregivers or when a system failure occurs, the service technicians will be notified regarding this. Service technicians will use the app to scan the QR-code on the bathtub and thereby get all information needed regarding the bath system. The long-term care facilities will be kept updated regarding the status of the error through the app.

7.3 Chosen Concepts

7.3.1 Administrative procedure

The startup procedure of the app requires a conversation between a sales representative at Arjo and the long-term care facility as the customer. By obtaining information regarding for instance the number and names of departments and the number of rooms, Arjo will set up a tailor-made profile for the long-term care facilities. The first caregiver that installs the app will get username and password credentials provided by Arjo through mail or similar. These credentials will only be needed once by the first caregiver that installs the app. In order to receive the information needed regarding the bath system, the caregiver needs to scan the QR-code on the bathtub. Following, a QR-code will be created specifically for this long-term care facilities for other caregivers to obtain the exact same version of the app. The first caregiver can reach this QR-code in their app and the other caregivers can easily download the app and scan this QR-code through the scan page that will appear when they open the Arjo app. They do also need to scan the QR-code on the bathtub as a safety measure.

When having access to the tailor-made Arjo app, caregivers may add other users such as relatives and home care staff. The administration of this procedure will be conducted in a similar way as adding caregivers. However, different access will be provided depending on what kind of user it is. When a relative want to get access to the schedule of its elder, a caregiver at the long-term care facility will create a tailored QR-code, which has to be scanned by the relative. This scanning procedure may either be performed by the relative scanning the caregiver's phone or by scanning the QR-code sent by email. To give access to home care service the same procedures will be done. However, the difference is that the home care service will be able to see information regarding booked time slots and being able to make bookings.

7.3.2 Booking

One challenge with performing bath sessions is the time factor. The time it takes to prepare the resident and the bath itself in combination with the procedures after the bath is a key explanation to why showering might be done instead of bathing. The purpose of the booking system is to facilitate the usage of the bath and to ensure that time is used most efficiently in order to enhance bathing when possible.

During an ongoing booking, a suggested time will appear when the department and room number has been typed in, which will be based on previous bookings. When a time is set, the caregiver can repeat this bath time slot during upcoming weeks, for

instance every two weeks, in order to provide regular bath sessions for the residents. Further, there will exist a function where previous bookings can be viewed. A time span can be set in order to cover only the previous bookings of interest. Here, information collected for each booking through the evaluation can be reached. This will be found under “List Residents” in the menu, see Figure 7.1 (a).

It should be added that in order to facilitate this step, a desktop would preferably be used to make bookings and other administrative steps due to the current usage of a computer for similar tasks at long-term care facilities. As stated in section 1.4, the project is limited to show an interface for a smartphone, however the concept is also intended to be compatible on a computer.

7.3.3 Ongoing bath

During an ongoing bath session, caregivers will open a bath session page from the schedule view or directly through a reminder notification of an upcoming bath session. This page will provide the caregiver with relevant information regarding bath settings, including past bath experiences and suggested preferences for the current resident. Through the bath session page, the caregivers will also be able to stream music to the bathtub and be able to make an evaluation post bath session. The purpose of this bath session page is to make the caregivers comfortable with performing a bath session by providing information of what settings to use. These settings and preferences are based on the resident’s previous bath sessions through an algorithm that provides the suggestion by correlating stored settings on the bathtub and the answers from the evaluations, stored in the cloud. This creates an individualized experience. The resident’s preferences of light, music and water temperature are based on an average of previous bath experiences.

7.3.4 Evaluation

An evaluation of the bath session will be conducted post bath session. This evaluation will be used in combination with the data extraction from the bathtub regarding the settings. The purpose of performing evaluation is to provide recommendations for upcoming bath sessions. The first question the caregiver will answer concerns the overall experience of the bath session. If the bath session was good, the evaluation will consist of fewer questions to answer. However, it will still consist of questions regarding the initial temperature and which products that were used. The caregiver will also be able to answer an open question regarding what made the bath session good.

The evaluation part works in the following way, for instance, if the resident experienced the initial water temperature as too cold, the caregiver marks this in the

evaluation. The app would know the initial temperature since the data have been extracted from the bathtub. For the next bath session with the same resident, the initial temperature will be recommended to a higher degree Celsius. The caregiver will then feel confident and know what water temperature to set in order to provide a good bath experience. Questions regarding accessories such as pillows or if any skin care products were used are intended to enhance the comfort for the resident. The usage of skin care products might also contribute better skin conditions for residents. Thus, by reminding caregivers to use skin care products if a resident needs it, might yield a benefit for the app through a possible correlation of using the app for enhancing the usage of the products, and possible improved skin condition for the residents. Further, depending on the functionalities of the bath system, for instance if the function of hydromassage is included, the questions in the evaluation will be adapted to these.

The evaluation post bath session does not have to be completed directly after a bath session, since the evaluation shall not interrupt the caregiver during his/her regular working schedule. If an evaluation has not been done directly post bath session, the responsible caregiver will receive notifications regarding this and can go directly to the evaluation page. It is also possible for the caregiver to reach the evaluation page by searching on the room/resident and go to the time slot where the evaluation has not been done. The page will show which bath sessions that have not received an evaluation yet. It can also be done by pressing the booked time slot on the schedule view.

7.3.5 Handling cleaning

The cleaning and disinfection procedure of the bathtub is a central and important process and must be done after every bath session. In order to make sure that there always will be enough disinfectant in the bathtub, the app will send notifications to all caregivers when the disinfectant level is running low. The bathtub system will directly notify when refilling of the disinfectant has been done in the bathtub, and the caregivers will be able to see the current disinfectant status both on the bathtub display and in the “Handle cleaning” page in the app. When a new order of the disinfectant must be made, this will be done directly in the app on the “Handle cleaning” page. When a disinfectant order is confirmed, Arjo will be notified regarding this and send a new batch of disinfectant. The caregivers will also be informed about this order. All caregivers will be able to conduct this procedure in the app.

7.3.6 Report problems

When a non-systematic problem appears, which then will not be detected by the bath itself, a caregiver shall be able to report this directly in the app on the page “Report problems”. When a systematic error appears, which will be detected by the bath itself, an automatic notification regarding this will be sent out to the caregivers and home care staff for them to know that the bathtub cannot be used. A service technician will then be able to see this and when the problem is solved, the service technician will mark this issue as done in the app in order to communicate this to caregivers and home care staff. A non-systematic problem might be, for instance, a broken cover. By implementing a function with the purpose of reporting problems and involving service technicians, makes service technicians as a user of the app as well.

7.3.7 Information about bath procedure in videos

A central part of providing a good bath experience for the resident is that the caregiver feels safe and confident in how the procedure shall be performed. By providing educational videos of the bathing procedure in the app, the caregiver will be able to watch these videos whenever they want and wherever they are. Some caregivers feel insecure and scared of doing wrong and need advice. An easy way to inform and to give recommendations to the caregivers of how the procedures shall be proceeded, is to watch these short instructional videos for different bath related procedures. This might also reduce the time of the bath procedure in terms of improving the efficiency, which might yield a more prone attitude to bathing. Further, these videos can integrate instructions of how to work in ergonomic postures and what to think about in order to not strain the back or retrieve any work-related physical injuries. This benefit is aligned with the concept of the Positive Eight described in section 2.4.2. The daily work can be made more efficient and contribute to reduced sick leave and turnover as described in the Positive Eight.

7.3.8 Notifications

By adding notifications regarding certain residents, the caregivers will be able to tailor their own app by receiving notifications of their interest and need, which will facilitate their workflow. In order to receive notifications of upcoming bath sessions, the caregivers have to add notifications for certain rooms/residents manually, which creates a flexibility and eligibility for the caregivers regarding what notifications they would like to receive. Receiving notifications from every upcoming bath session might cause a disturbing factor which will be avoided with this function. For instance, when a caregiver has an upcoming bath session with a resident, a notification reminder will be received in order to not forget and to have the time to

prepare for the session. The choice of what time prior the upcoming bath the caregiver wants to receive a reminder of will be selected during the booking.

Other kinds of notifications will be used in the app, which have different purposes. These notifications might concern an error with the bath or regarding the disinfection level. The most important notifications can be seen in the Table 7.1. The notifications will be viewed as pop up boxes and stored in the notification centre, which is under the bell in the UI, see Figure 7.1 (a) for example.

If the bathtub has not been used for X days, the caregivers need to be notified regarding this prior to their upcoming bath session in order to clean and disinfect the bathtub. The cleaning and disinfection part is of main importance since the bath is used by many residents and thus, bacteria growth may occur if not disinfected properly.

If a resident has not been bathing for a while, notifications will be sent to the caregivers that have added notifications for that resident. These types of notifications are important in order to provide the residents with continuous and regular bath sessions. This connects to the concept of the Positive Eight in section 2.4.2 through that these reminders might contribute to increasing the frequency of bathing. Increasing baths might initiate the first steps in the Positive Eight of increased mobility, setting off for the loop to continue. Other types of notifications include information regarding the importance of a relaxing bath experience for the residents, in order to increase the usage and to remind the caregivers of the important aspect of providing baths.

The evaluation after a bath session does not have to be done directly post bath session. However, a notification will be sent to the responsible caregiver in order to remind that the evaluation has to be done. In order to call to action regarding the usage of the app, the caregivers that have low activity of use will receive notifications with information of why a bath is of main importance for the residents.

Table 7.1. Different notification messages in order to call to action or remind regarding an activity.

<i>Notification received by</i>	<i>Description of notification</i>	<i>Notification text</i>
The caregivers & home care staff	If a resident has not been bathing for x days	<i>Resident A has not been bathing since x days. Do you want to make a booking now? (Make booking now)</i>
	If the days since last cleaning of the bathtub has passed the limit	<i>Do not forget to clean the bathtub before starting a bath session!</i>
	Bathtub cannot be used	<i>The bathtub cannot be used due to a system failure.</i>
	Bathtub has some kind of problem	<i>A problem with the bathtub has been reported. *Description of the problem*</i>
The caregiver that was connected by his/her smartphone to the bathtub during bath session	When evaluation after a bath session has not been done	<i>Evaluation has not been done for resident A, date, time. (Go to evaluation / remind me later)</i>
All caregivers	Disinfectant level is running low	<i>The disinfectant level is running low. Make sure a new order will be made. (Go to handle cleaning page)</i>
Caregivers that have not been using the app in X days.	Encouraging information regarding bath experience	<i>“Did you know that bathing in combination with calming music has positive effects on aggression, agitation, anxiety and irritation? Do not forget to give your residents a relaxing bath experience!”</i>

7.4 System Flow Concept

In order to understand the whole system concept of this digital service tool, a schematic figure of the system flow concept was made. The complete flow from startup procedures of the application for a certain long-term care facilities to the process of extracting data, is shown in the Figure 7.4.

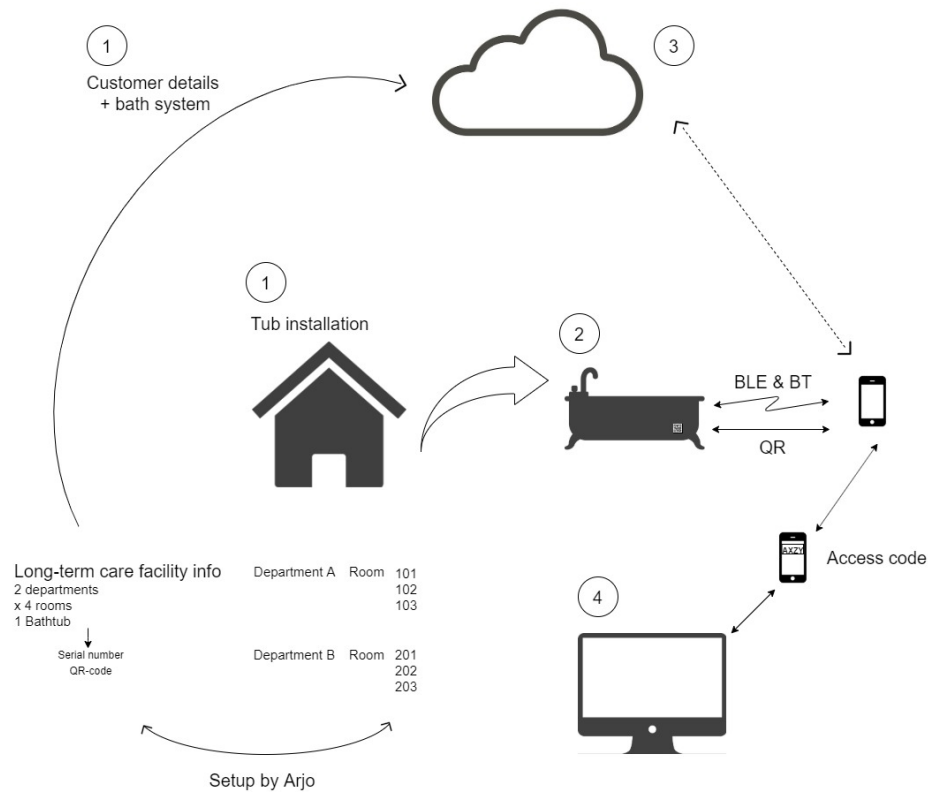


Figure 7.4. A schematic overview of the system flow concept.

1. The startup procedure of the app requires a conversation between Arjo sales representatives and the long-term care facilities as the customer. This startup will include customer details including details of the long-term care facilities. Installation of the bathtub is conducted.
2. The first caregiver will download the Arjo app, typing in username and password, provided by Arjo. Next step for the first caregiver is to scan the QR-code on the bathtub to connect and get details of the bathtub. Service technicians will also scan this QR-code in order to get all required information of the bath system. When a bath session is ongoing, the smartphone and the bathtub will exchange data in both directions, from the bathtub to the smartphone and vice versa, by BLE. BT will be used to stream music from the smartphone to the bathtub. Important to state is that the app will not control any of the functions on the bath than the sound, due to the risk associated with such remote controls.

3. The extracted data from the bathtub during the ongoing bath session will be stored in the cloud.
4. A smartphone that has been connected to the system by verifying presence, by scanning the QR-code on the bathtub, can request a 60 seconds access code. This code will be used to login by using a computer screen, which will facilitate the administrative procedures.

7.5 Summary of Benefits with the Concept

For the prototype to be used, convincing benefits and recommendations, which can contribute to positive outcomes with bathing, are important to state. These benefits can be useful for Arjo's sales representatives when presenting the product to customers. These are connected to the challenges stated by Arjo and the additional challenges identified, described in chapter 3.4.1 and 3.4.2. However, solutions to all challenges stated by Arjo could not be achieved by the digital tool.

7.5.1 For the caregivers

Reduce static overload for caregivers

To reduce the potential static overload for a caregiver, one recommendation is to rotate the caregivers that conduct baths. This can reduce the time the same caregiver is exposed to potential static overload, and at the same time more caregivers in the staff will learn the procedure and hopefully get more comfortable with the process. This can be easier controlled with a digital booking system. Further, by providing educational videos in the app, caregivers can use this material in order to get tips on how to conduct a bath more efficiently and ergonomically.

Bathing takes long time

Using the educational videos and streamline the procedure might yield a time reduction for the bath procedure, without the relaxing part for the resident being compensated. Furthermore, by using the app with its booking system, planning of the workflow can be done which might contribute to the time pre- and post-bath being reduced and used on other care activities instead. Also, by providing helpful notes about what settings on the bath a resident prefers and if any accessories should be brought, time can be saved here as well.

Residents have varying needs and preferences with bathing and there is no general approach for caregivers

The concept of performing an evaluation after the bath session will create individualized profiles for the residents. Since these evaluations will be used in

order to provide preferences and recommendations regarding baths for residents, based on their needs and preferences, the caregivers will know how to conduct baths for different residents.

Caregivers might feel insecure and uncomfortable to conduct bath sessions

The combination of providing educational videos of the bath workflow, pre-, during and post-bath, together with preferences for the residents might contribute to a secure and comfortable way for the caregivers to conduct baths.

7.5.2 For the residents

Getting in and out of the bath may trigger undesirable behaviour

By providing individualized preferences in the app, a calm experience can be created from the beginning of the bath procedure for the resident, which might yield the undesirable behaviour being reduced. The usage of the preferences might create such a calming experience that the resident will associate the bathing with something good even during the pre-bath procedure.

Improved skin condition

By providing individualized preferences regarding skin care conditions, it might be of help for caregivers to remember this area in the care. Maintaining a good skin care for the residents may result in wound prevention, which in turn will contribute to a better quality of life for the resident and more time for caregivers to put on other work tasks [6]. However, if the app is desired to be intended for proving clinical outcomes, such as improved skin condition, the MDR must be considered for compliance, see section 2.9.1.

8 Discussion

8.1 Main Goal

The main goal of creating a digital tool to complement the practical workflow of bathing, contributing to a relaxing experience for the residents has been accomplished. During the initial phase of this project, several ideas and concepts were discussed and evaluated since there are many possible ways of how a complement to the practical workflow regarding bath procedures for residents could be done. However, the main reason of why some parts had to be limited was due to the secrecy and privacy aspects, stated in section 2.9. The project had to be narrowed down into a few concepts to focus on, since the time factor was a constraint. The concepts that were out of scope for this project have been kept in mind for a future extension and are explained later in this chapter.

The main issue that had to be considered when deciding which of the concepts to proceed with concerns the actual usage of the app, regarding if these concepts will be used by caregivers and not just cause a disturbing moment and an unnecessary additional tool. Creating an additional digital tool to complement the practical workflow for caregivers that shall be used has been difficult and a lot of time has been spent focusing on this area. Many caregivers working at long-term care facilities have their own habits and are used to perform tasks in a certain way. The purpose is not to create a digital tool that will be lying on the desk; the app shall be a complement and facilitate the practical workflow. It is of importance that the caregivers understand this by using the app with its evaluation post bath. In order to put this into reality, the app must be used and thereby CTA was of main importance during the creation, as well as the flexibility to tailor made the app depending on the caregivers' preferences of which notifications to receive.

8.2 Method

8.2.1 Design Process

Using an iterative approach during the design process enables many ideas and generated concepts to continuously be improved. However, the challenge with an

iterative approach is that a lot of the material is generated throughout the process, but not all details will be included along the way. Several ideas and thoughts that were generated in the early phase of this project were diminished and rediscovered in a later phase of the project. These are important to include since they had a crucial part in leading the project in a direction ending up in the obtained results.

Further, several flow charts and mappings were constructed during the process, which have been changed in their content along the process. For example, the mapping of the users in Figure 3.1 has been used during the process. However, the target users have been updated and adapted along with the progress of the project in order to be aligned with the needs and concepts generated.

8.2.2 Establishing the Needs

When establishing the needs, literature combined with study visits, which included interviews and observations, were used. This resulted in input regarding the needs in general as well as specific needs observed at the visited long-term care facilities. It was an advantage to use different kinds of methods in order to obtain information about the needs, however, it would also have been good to conduct a larger survey or a study involving more people and areas. The input that the stated needs was based on was from a few numbers of people. More people would have yielded a larger perspective of opinions of the core idea and the need for it. It would also yield a better, more reliable result of the establishing of the needs. However, it should be enhanced that the persons in the interviews and study visits all were caregivers and thus, represented the primary users. They were well chosen for the purpose of the investigation.

8.2.3 User tests

Test of low-fidelity prototype

Two main user tests were conducted, one on the initial low-fidelity prototype and one on the interactive low-fidelity prototype. Due to the time limit, only three persons conducted the test on the interactive low-fidelity prototype. It would have been preferable to have more participants in this step, in order to receive more feedback on both the design and the concept. However, since one of the test persons works with design and usability, the input received in this step was weighted heavily for the next step of developing the high-fidelity prototype.

Further, a low-fidelity prototype has limited complexity, which made the usability tests somewhat difficult to conduct regarding some concepts. For instance, when simulating a change of a page when a button has been pressed, one of the test

moderators had to physically change the picture and put separate pictures simulating popups or colour changes or similar. This is not optimal, which is why some concepts had to be further investigated in the high-fidelity prototype where they were simpler to visualise.

Test of high-fidelity prototype

The design of the assessment test for the high-fidelity prototype was discussed as to which method that should be used. First, randomizing the tasks was debated because of possible learning transfer can be limited, see table 6.1 above. However, uncertainties might appear during the test, which becomes an issue since some of the tests were conducted digitally unsupervised without a possibility to ask questions. Also, with the limitations in the app there was a risk for getting stuck in the flow. Thus, it was decided that all participants were going to conduct the exact same test and in the same order to facilitate the making of the test scenarios and to avoid the risk for any uncertainties as much as possible.

Further, the user tests conducted of the high-fidelity prototype deviates from how they were planned to be constructed and conducted from the beginning. The aim was to make several visits to long-term care facilities and try out different concepts and from this develop the high-fidelity prototype, which then would be tested by caregivers. Due to this change in the planning, the process got somewhat delayed and the construction and quality of the tests had several areas of improvements. It was difficult to describe the background and meaning of the app in a short and summed way in a digital document, without leaving any important part out or giving rise to confusion. Furthermore, since it was not possible to follow the test persons' steps and thoughts that conducted the test digitally, information about where one might get stuck and how to proceed might have gone missing.

Another challenge was to formulate an online survey for the purpose to obtain feedback about the design and about the concepts themselves. A balance of including many questions in order to obtain information about as many parts as possible and of making a survey that is fast and not difficult to fill, in order to increase the number of answers, had to be done as well. The questions were formulated with the aim of evaluating the concepts where some uncertainties had been identified in previous tests, e.g. the cleaning and disinfection page. The design related questions were formulated with Arjo's digital principles in consideration. For instance, participants were asked to grade their perception regarding e.g. the reliability and structure. These yielded an insight in how well the design was perceived aligned to the core elements of design used by Arjo.

Since no caregivers at long-term care facilities were possible to get in contact with, the obtained feedback from the tests were from people with knowledge within care environment and bathing, and within design and usability. Thus, despite no input from the primary user group, the feedback was obtained from people with relevant

knowledge for this project. The feedback contributed to the development of the concepts and the design of the prototypes, with caregivers and residents in mind.

To sum up, there are several areas of improvement with the methods of constructing and conducting the tests of the low- and high-fidelity prototypes. However, it is significant to point out that despite the insufficient parts in the tests, it was still positive that participants could be found and that some feedback was obtained, with the situation of Covid-19 in mind.

8.3 Final Prototype

8.3.1 Design tool

The digital tool Adobe XD entailed some limitations in the creation of the high-fidelity prototype. Firstly, it was not possible to freely explore the app, thereby strict test scenarios had to be followed during the tests. Secondly, functions like scroll bars, playing music and insert videos were not possible to implement either. Thus, the prototype was not able to match the expectations on the thought solution. Some of these limitations were explained to the participants during the tests, however it is evident that these limitations affected the overall impression of the design and the concepts.

8.3.2 Feedback regarding design

Despite the limitations, valuable feedback was obtained as stated in the results in section 5.4 and section 6.6. The feedback was from both a design and usability perspective and from a conceptual perspective. Some feedback from the in-person tests regarded quick fixes such as placement of buttons, contrast between object and background and insert informational bubbles for elevated knowledge. When choosing the placement of buttons, inspiration from other apps was obtained along with consideration to the Gestalt laws of similarity and proximity. However, learned from the feedback is that the context is also an important factor to consider. Even though the placement of buttons matched conventions, the buttons were not perceived as clear during the tests in some places in the UI of the prototype and therefore, they were moved in order to enhance the UX.

Symbols were also a central part of the feedback, both in the in-person tests and in the online survey. When studying the results, several symbols yielded confusion and cognitive load, which was an issue partly known of and thereby was an aim to pinpoint which of them that were the most difficult to understand. The reason for

this issue being already known was that some of the desired symbols for the prototype, e.g. disinfection tank, speaking person and illustrating body contact were not available or yet created at Arjo. Thus, they had to be created only for the purpose of being used in the prototype. In the future, streamlined symbols and icons for Arjo will be used instead of these but until that, these works as a representation of the thought ones.

On the contrary, no participant answered in the online survey that a describing text was desired as a complement to the symbols and icons used. This seems like a conflicting result, either explained by the questions being unclear, or by the fact that solely symbols are the preferred mean of communication due to its simplicity and no need for also reading a text. Further, adding a text to the symbols would have been difficult in this project since no short standard word could have been implemented. However, in general, it was a positive result that the symbols seemed to work as intended despite them not originating from a standard gallery.

The design was perceived to be accepted with grading of three to five, see results in section 6.6.2, which was a positive result. Some comments were received regarding colours and contrasts in the design, which was considered during the iterative updates of the high-fidelity prototype. For example, in some of the feedback it was questioned to have clearer indications of which symbols and buttons that were clickable by changing the design, colour and/or the placement. Also, one comment regarded the colour on thermometers in the evaluation, where the red colour might be difficult to perceive for colour-blind users. In order to eliminate this risk, the thermometers were complemented with symbols of a fire and a snowflake, so that even though the red colour cannot be perceived there is a symbol indicating the hot or cold temperature, see Figure 7.3 (b).

8.3.3 Feedback regarding concepts

Another area for discussion is the “Handle Cleaning” page, which induced some confusion. The button of “Confirm order”, see Figure 6.3 (a), was perceived as an order was made for real and not as to solely communicate to colleagues that an order had been made externally. This concept has been changed during the project due to potential issues with implementing this function from a supply chain and logistics perspective. However, as a conclusion, it was decided to have ordering of disinfectant as a function in the app, which then eliminated the confusion with this page of being solely a communication channel regarding disinfectant.

Some feedback also covered the perspective of secrecy and privacy, which will be discussed later in section 8.4. However, one part that will be discussed here is the choice of using room numbers in order to make the residents more anonymous. Some feedback regarding this can be seen in table 6.3 in section 6.6.2, where it is

stated that using room numbers might represent a risk for errors. If there are many rooms in a department, it might be difficult to remember which resident that corresponds to which room. This is a fair point of view that has been kept in mind already from the beginning of the concept generation. It was suggested in the feedback that personalization could be added in forms of e.g. using a personalized emoji or to include pictures of residents' belongings. However, using e.g. pictures on personal belongings might also be a violation of integrity. Using an emoji might be an alternative but it needs to be further evaluated before proceeding with this idea. Using initials has also been a subject for discussion, but questions like if it is too easy to connect to the resident or if several residents have the same initials did that the choice of using room numbers was proceeded with. However, this might also be further discussed in order to eliminate the potential risk of confusion.

The feedback regarding the general concept of having a digital tool/service such as this app as a complement to the practical workflow of bathing was miscellaneous. To sum it up, the concept has potential with some parts yet to be further developed and investigated. Due to the time limit of this project, concepts for the future are presented in section 8.5. The UI of the prototype is a first version in order to visualise the concept and to give a suggestion on how to design it. Further development and programming will enhance the design and the app itself.

8.4 Secrecy and Privacy

As been mentioned in section 2.9, it is of importance to consider secrecy and guarantee integrity. In order to anonymize the concept as much as possible, department and room numbers were chosen to represent residents instead of their name, as mentioned throughout the report. There are pros and cons with this approach. The pros are the limitations of personal information being leaked and connected to the information of the preferences stated in the app. However, this leads to possible confusion if one does not remember the department and room number for each resident.

Further, the concept with the QR-code in order to share basal information about the long-term care facilities and residents eliminates possible struggle with credentials and facilitates the process through an easy scan which is less time consuming. However, this will represent a risk for inaccurate sharing of information. This concept was generated with the presumption that the app will be used on a smartphone at the workplace, and not on a private smartphone. In this way, the risk for spreading will decrease. However, with the concept of integrating relatives by providing a QR-code with limited information might compose a larger risk. Firstly, the elder at the long-term care facilities will lose a part of its integrity when someone, even if it is a relative, will have access to a part of their daily schedule.

Further, it is difficult to assure that an alleged relative is a relative. With a possible large turnover of staff and residents, it might be difficult to keep track of this information. Secondly, a relative will have the app and the information on its private smartphone, which yields this information leaving the long-term care facilities and can end up everywhere without knowledge. This will violate the integrity of the resident.

Discussions regarding the secrecy and privacy of this concept were held with people at “Malmö Stad” within the digitalization area of healthcare, stated in section 2.9. These discussions were valuable in order to understand the importance of the integrity within this kind of an app, security aspects and further steps that must be investigated in future procedures were discussed. The importance of traceability in terms of who has conducted which action in the app, was realised during the discussions and relevant for the concept of the QR-code.

To sum up the part with secrecy and integrity, it is important to state that there are parts in the concept that must be further considered in the future procedure regarding this. This area might be investigated by legal roles in order to secure that no violations will be made.

8.5 Concepts for the Future

Due to the limited amount of time, some limitations had to be done during the concept selection. All generated concepts could not be included in the final prototype, however, they will be stated for future usage and development of the app.

8.5.1 Adapted to different kinds of platforms

The user interface for this thesis has been created for a smartphone in mind. However, it is desired that this concept will be compatible on a desktop as well in order to facilitate the booking process. Some of the functions will be easier to integrate with the workflow on a computer where a larger screen is available, such as the booking process, and some will be easier and more useful on a smartphone or a tablet such as reminders and details for upcoming baths. Providing choices of several types of platforms would enhance the usage of the concept as well.

8.5.2 Startup session by Arjo

The startup session conducted by an Arjo sales representative will be done e.g. either at the long-term care facility or from an office by phone contact. The concept for

this will however be secondary due to the many ways of proceeding with this UI depending on what is most suitable for Arjo regarding administrative flows. This setup can either be done by using the app in a smartphone or by using a computer and the administration of the app is not stated. Thus, a suggestion to the UI has been presented in the high-fidelity prototype, however this might change later due to different approach opportunities for the setup.

8.5.3 Relatives' involvement

The inclusion of relatives in their elder's care was stated important in the theory. According to the interviewed caregivers at the two long-term care facilities, relatives' involvement in their elder's care and life was not evident at long-term care facility B and varying at long-term care facility A. Thus, a concept of making relatives more involved was generated. This involves a certain access level for relatives in the app, so they can sign in and only being able to see their elder's bathing schedule. An extension of this function is to synchronize the bath schedule with the common schedule existing on long-term care facilities, in order to not only see when a resident might be bathing, but also doing other activities. This, in order to facilitate for relatives when it is best suited to come for a visit and minimize the risk for arriving when their elder has activities and to be more involved. However, it is important to state importance of including the secrecy in this concept aligned with the discussion throughout the report regarding the secrecy and privacy.

8.5.4 Expanded use of data extraction

The data extraction from the bath will not exclusively be used to tailor the bath experience for the residents. The data might also be useful for Arjo to enhance the service of the bath, to make improvements of the bath and to store the time the bath has been used. Tracking the amount of time the bath has been used entails service technicians to easier keep track of how long different parts have been used and plan for service and updates. It also provides a possibility for better preparation before a service visit and thus, saving time and money for both Arjo and the customer.

Further, one important part in medical technology companies is the quality assurance and regulatory compliance. One of the foundations in the work at Arjo is the creation of value by contributing to clinical outcomes for patients and to create a better work environment for healthcare professionals [62]. Thus, the data might be used to prove clinical outcomes, optimally in terms of calmer behaviour in worried residents with dementia and a reduced usage of pharmaceuticals. It might also show a reduced time on procedures that might be streamlined and thus, improve the work for healthcare professionals and release more work hours for other

tasks. Educations and/or webinars could be developed by Arjo based on how the customers use and not use the bath, or on the functions of the bath systems in order to increase knowledge.

8.5.5 Algorithm tracking preferences

As mentioned above in several sections, the function of preferences will be based on previous input from completed evaluations. An algorithm using the information from the evaluation, registering which treatment, will generate the preferences and setting that has been given the best grading in the evaluations. This algorithm will not be implemented within the scope of this project, but hereby presented as a concept for future development. The information from the evaluation might tentatively be collected in a database for usage in collaboration with the developed algorithm.

8.5.6 Contact with service technician

One future aim is to further develop the concept with reporting problems mentioned above in section 7.2.4. When proceeding with the app and its ability to report problems with the bathtub, a well-considered communication between Arjo and their customers through the app must be implemented. The complete logistic chain must be further developed regarding how the app will communicate with the service technicians at Arjo and inform them about their tasks. Another important aspect about reporting problems is how to distinguish between system failures of the bathtub and problems where the bathtub still can be used. The app needs to know when a system failure has occurred and communicate that the bathtub is not possible to use anymore. This information flow needs to be further investigated.

8.5.7 Ordering of Arjo products

Another future part of the concept consists of the possibility of in app purchases of disinfectant and accessories from Arjo. An in-app purchase concept might enable an easier channel to enhance purchases. Pop-up boxes might appear with suggested products that are suited for specific long-term care facilities.

8.5.8 Scanning of products

Arjo is offering several products within the hygiene sector and many of them are products suitable for using during bath sessions. A future concept might be to add products in the app by scanning their QR-codes (that will have to be implemented

on all products). This, in order to keep track of the products that a facility has and to synch the evaluation questions according to which products except the bathtub that are used. Further, if a question appears or a service technician needs some extended information about a product such as the serial number, the QR-code can be scanned to retrieve this information.

8.5.9 Extended room relaxation

Currently the resident can have a relaxing bath experience with music and light based on its preferences. This experience can be extended and improved by synchronizing the music and light. This means that a theme can be set for the bath session i.e. a sunset by the ocean. By using themes, the music and light will synchronize and adapt to a chosen location. To further improve this experience, a scent dispenser can be used and be adapted to the chosen theme.

8.5.10 Educational videos

The educational videos that are integrated in the app will have a great impact on the caregivers' ability and confidence regarding how to conduct a bath. A further development of this type of information channel might be to add short video sequences for each function in the app. For instance, instructions regarding how to add users by a QR-code can be viewed and easily understood by playing a short video sequence.

8.6 Ethical Aspects

When working in an area close to people's health, it is of importance to reflect over ethical aspects. This project includes work connected to people with dementia and includes the use of personal data. This raises a demand for a close reflection of what information that is possible to include and what information that should be included, both from a legal perspective and from an ethical perspective. Several ideas have appeared during this project, which later had to be excluded due to the fact of them not being fully compatible with the ethical perspective, for instance using residents' names and to demand a consent from them when they might not be aware of what it actually means. Further, the establishing of the needs are grounded on situations working with people with dementia. It has to be kept in mind that people with dementia might not be able to understand and make choices regarding their own integrity, which is why it is important to think from a perspective covering how they would have perceived e.g. functions if they would have been able to have an opinion about them.

8.7 Next Step

This thesis has resulted in several concepts for a digitalization of a bath in the form of a prototype to an app visualized with a digital prototype tool. The next steps in the development would be to further investigate the concepts more thorough by testing and receiving feedback from caregivers. In order to deeply understand the need and the value of these concepts, caregivers' opinions are a crucial factor. A thorough investigation of the legal parts with secrecy and integrity would also be needed as a next step. When these parts are done, the next step would be to program a real app. Evaluations of this interface would preferably be done through user tests by using the final test scenarios in Appendix D.1 together with the final prototype with link in Appendix D.2. These evaluation should be more focused on the UI in the app.

9 Conclusion

This master thesis resulted in generated concepts consisting of a booking system with individualized profiles of residents, in order to enhance bathing at long-term care facilities and to make the bathing experience better for both the caregiver and the resident. These concepts were visualised in a digital prototype to an app, with a UI designed to create a good UX in order for the concepts to be understood and able to be tried out in the intended daily workflow at long-term care facilities. Thus, the goal with this thesis is considered achieved. From the usability tests and the assessment tests of the generated low-fidelity and high-fidelity prototypes, feedback regarding both the concepts and the design were obtained. This feedback was perceived to state a positive attitude to the concepts and to the design in general. Some uncertainties were identified and considered for the final concepts and the final prototype. Some generated concepts need to be further investigated before a real app is developed and are stated as future concepts to proceed with.

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APPENDICES

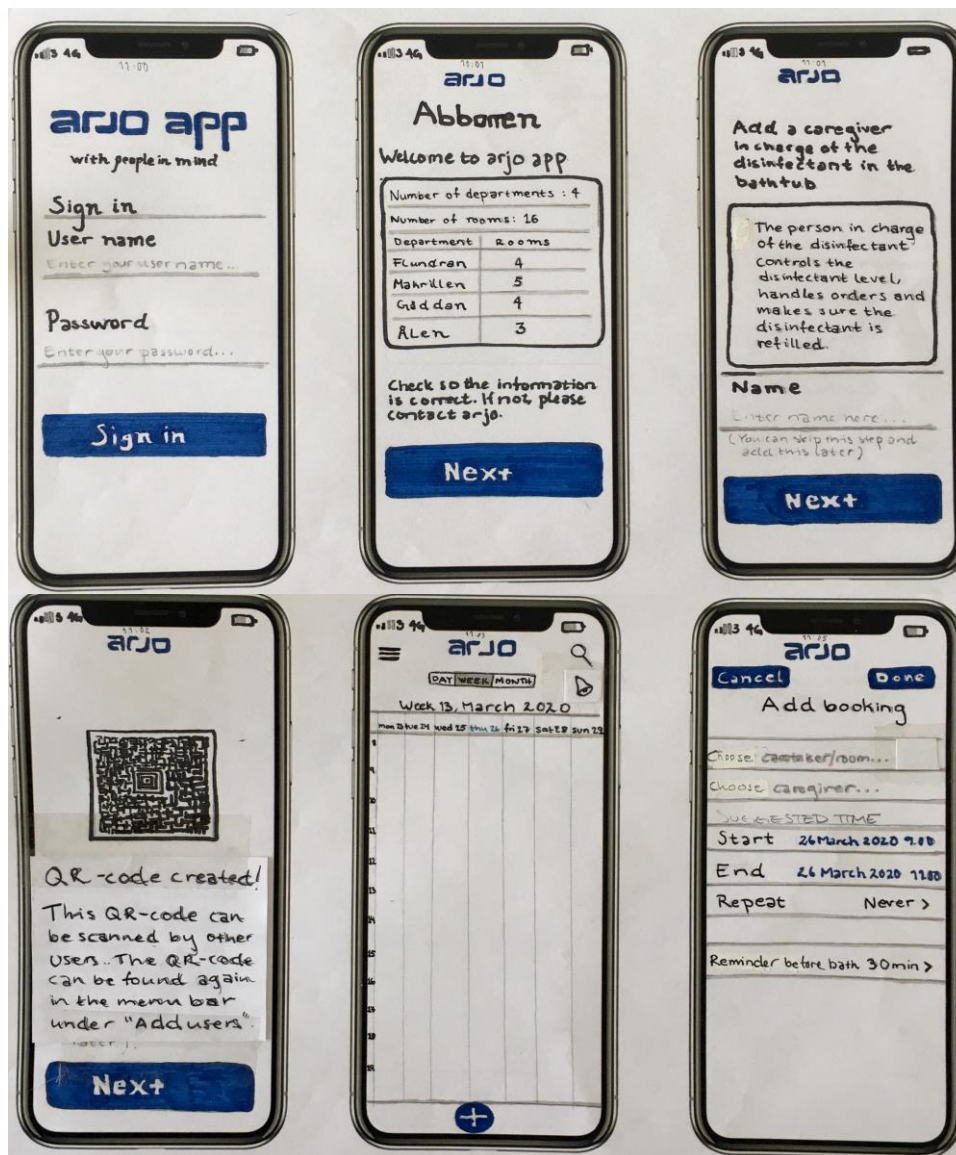
Appendix A Mind map of concepts



Figure A.1. An extensive mind map of generated concepts together with their pros and cons.

Appendix B Low-fidelity prototypes

B.1 Images of Low-fidelity prototypes





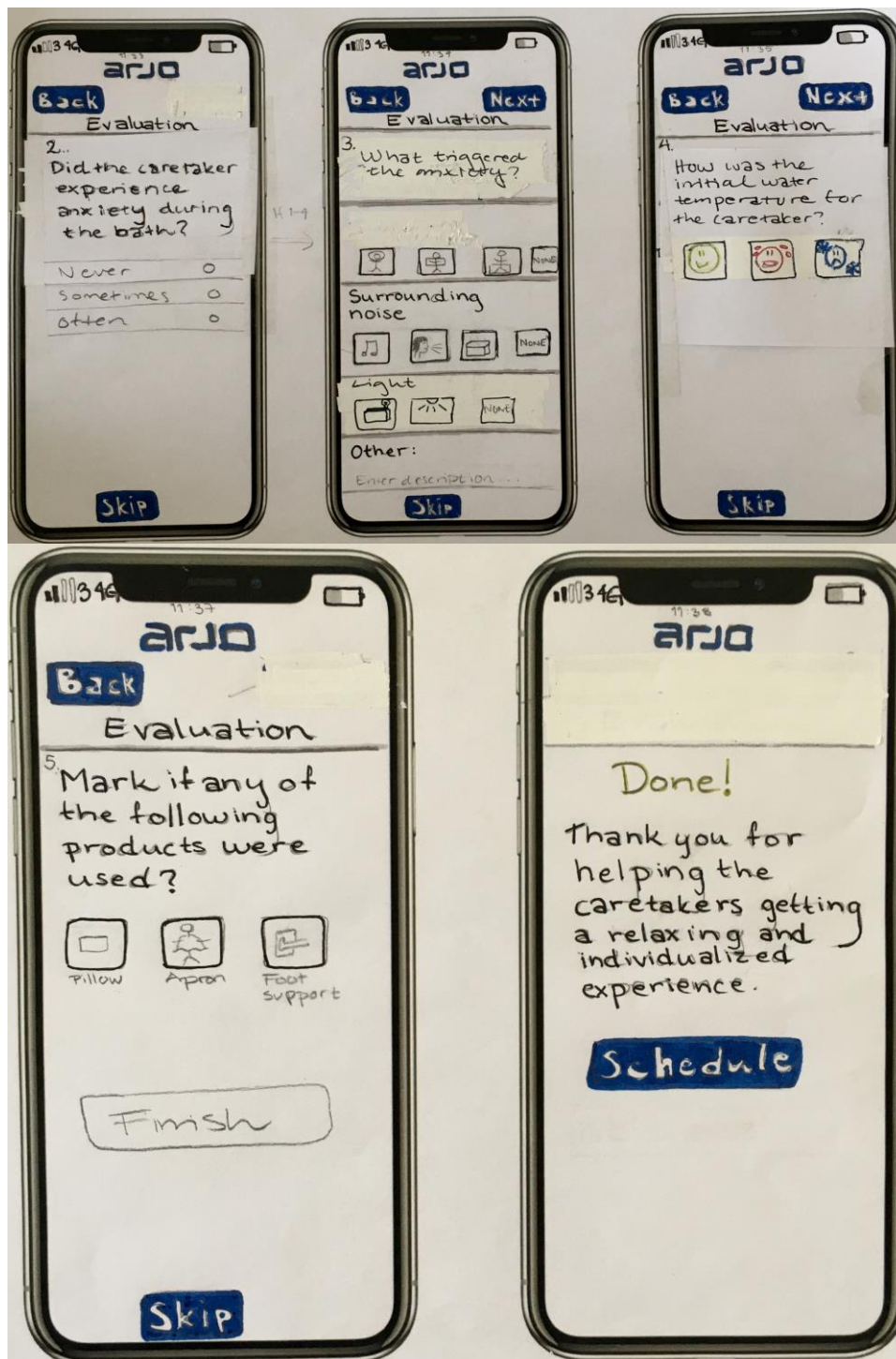




Figure B.1. Figures are showing the created pages in low-fidelity prototype

B.2 Feedback from low-fidelity user tests

Table B.2. Input from low-fidelity user tests.

<i>Design related input</i>
<ul style="list-style-type: none"> • Make buttons clearer. • Rather use a list with alternatives to choose from instead of free text boxes. • Add popups for confirmation of saving. • If you type in the first letters in a word, the whole word should appear instead of having to type in the whole word yourself. • Have confirm buttons at the bottom of the page since one read from top to down. • Place all the buttons in the UI at the same place and with the same colour for uniformity. • Do not use a “Play” icon next if it is not pressable and will start music playing. • Do not mix different types of feedback options in one page, i.e. keep to only having pressable symbols and not symbols and check boxes. • Mark a chosen box with another colour in order to distinguish it from other boxes.
<i>Concept related input</i>
<ul style="list-style-type: none"> • What to do if you have forgotten the password? • Unclear what the QR-code meant or contained. • Change from exclamation point to an information symbol to show hidden information. • Using a button with the text “Start bath” to get to the ongoing bath session is confusing. One might think that the bath itself is started by that button, however the bath will not be controlled by the app. • “Subscriptions” feels extraneous. Would not intuitively choose this button in order to change or add notifications from a specific room. • The one who makes a booking should automatically obtain notifications about that booking, instead of having to subscribe as well. • How to proceed if for instance service of the bath is needed and all bookings for a time period needs to be cancelled? • At the evaluation questions, it was not always clear if the question was directed to the caregiver or if it was about the resident. • It was not clear when the bath session started. Can something be added, e.g a real time animation that shows an ongoing procedure?

Appendix C High-fidelity prototypes

C.1 Orientation script

Background

To begin with, we would like to thank you for taking time and helping out with this test. We, who are asking for your participation, are Filippa Bolin and Cassandra Hennström and we are two Biomedical Engineer students from the Faculty of Engineering (LTH), Lund University. We are currently writing our master thesis in collaboration with the R&D department at Arjo in Malmö, Sweden. The thesis is about developing a digitalized interaction of a patient hygiene solution within a care environment, such as an app that aims to facilitate the usage of the hygiene solution. The project has proceeded since 27th of January and has resulted in this first digital prototype to an app, created with the digital prototyping tool Adobe XD.

Note! This project only is a study of how a digital app would be perceived on the market and thus, it is not a finished product or something that will be launched.

Today, the population gets older and the strain on healthcare increases. Thus, there is an increasing load at long term facilities, where most elderly spend their last time of their lives. Making the quality of life as high as possible for these elderly and by providing aids in order to either improve or maintain the mobility for as long as possible, will result in less strain and better working conditions for health

care professionals and thus driving financial outcomes. In order to provide a better quality of life for the elderly, wellness and relaxation in combination with Arjo baths has become a driving force within the bath segment. With focus on residents with dementia and their need of individualized care, this prototype strives to facilitate and shorten the bathing procedure by providing a booking system with integrated, tailored recommendations for each resident. The prototype of the app is intended to be used by caregivers at long term facilities. A future concept includes relatives and home care as users as well.

C.2 Feedback from in-person tests

Table C.2. Input from in-person high-fidelity user tests.

<i>Number of test scenario</i>	<i>Comments from test persons</i>
<i>1</i>	<ul style="list-style-type: none"> • I understand it from a technical perspective, but does a caregiver understand this? • Unsure if the number of departments are departments with baths or with residents. • Think that name of caregiver is unnecessary to include.
<i>2</i>	<ul style="list-style-type: none"> • Should establish a function where one can press directly in the schedule in order to make • The scroll function melts into the background. One should add a shadow. • Blue and black does not imply a contrast clear enough. • Good with a “Done” button.
<i>3</i>	<ul style="list-style-type: none"> • Thought the plus for adding a booking could be used for adding everything else as well, i.e. in this case a relative. • It is not clear enough, should be written “scan to add” or similar. • There is a risk for leakage of private information and infringement of integrity with the concept of using a QR-code to spread information. The relatives are the biggest problems, more acceptable if on a work smartphone. What do one do if a caregiver quit their job?
<i>4</i>	<ul style="list-style-type: none"> • Add a describing text what cleaning & disinfection means. • Change from solely “Add” to “Add more” or “Add new notification”. • Insert lines in order to separate the room symbol and the department symbol. • The “Add” button should be moved to the upper right corner to make it more visible. • Confusing when one should add notifications for cleaning and disinfection when the page says that one shall add notifications for residents. • Should change the symbol from a person to a disinfection tank.
<i>5</i>	<ul style="list-style-type: none"> • Interpret the “OK” button as to confirm the order. Should have a button with “Confirm” and “Skip, confirm later”. • Shall have the text and symbol for remaining times of disinfection yellow to make this information stand out. • The symbols are grey so it is not intuitive that they are pressable. • Is this to communicate to colleagues or to the person that makes an order? • I think somebody is filling the bath with disinfectant when I read this.

- When a row was yellow and highlighted, I thought I should press on it.
- Add a Bluetooth symbol at the top to symbolize a connection.
- Make it clearer that it is the Bluetooth in the smartphone that is turned off.
- The grey color is dull, should have two theme colors.

Evaluation:

- Should change the color on the thermometer from red to another color if any users are color blind.
 - Might change the symbol of the speaking person to a chat bubble.
 - Should be “Neither” instead of “None”.
 - I do not see why I need to answer a question regarding a pillow twice
-
-

C.3 Online survey

Background

This section covers some questions about your background and will solely be used in order to correlate previous knowledge with the outcome of the test.

How old are you? *

Ditt svar

What is your profession? *

Ditt svar

What work related smartphone apps do you use? *

Ditt svar

Overall impression of the design

This section covers the design of the prototype.

Choose a number between 1 and 5 how you perceive the design in terms of the following description: Attractiveness → ugly or nice *

	1	2	3	4	5	
ugly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	nice

Choose a number between 1 and 5 how you perceive the design in terms of the following description: Pedagogical → complicated or simple *

	1	2	3	4	5	
complicated	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	simple

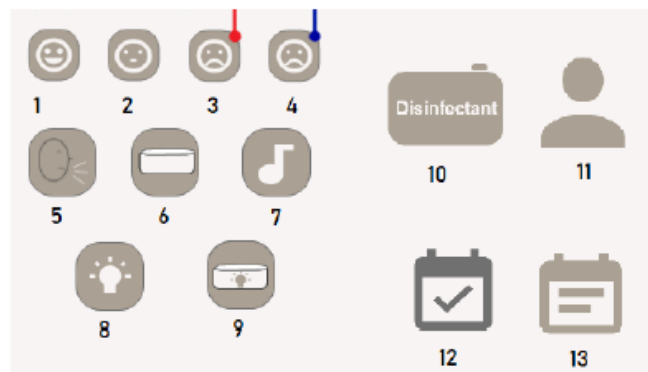
Choose a number between 1 and 5 how you perceive the design in terms of the following description: Perception → counter intuitive or intuitive *

	1	2	3	4	5	
counter intuitive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	intuitive

Symbols

This section consists of questions regarding some of the symbols.

What is your impression of the symbols in terms of understanding? (Difficult to understand or easy to understand) *



1 2 3 4 5
difficult to understand ☐ ☐ ☐ ☐ ☐ easy to understand

If there were any symbols above that were unclear or confusing, please state their number below.

Ditt svar

General about the concept

What are your general thoughts about a digital tool/service such as this app for a smartphone, as a complement to the practical workflow of bathing at retirement homes? *

Ditt svar

Figure C.3 Questions from the online survey, created by Google Forms.

Appendix D Final prototype

D.1 Final test scenarios

Sign in procedure

- Log in as a caregiver.
- Type in “Lunden” as username and ***** as password.
- Sign in.
- Follow the instructions in the app until the schedule view is reached. In order to scan, press on the square.

Booking of bath sessions

- Add a booking for the resident:
- Choose the resident's department and room “Liljan 103”.
- The suggested bath time does not suit you. Change the date and time of the booking to “26 mar, 9.00 - 11.00”.
- “Liljan 103” wants to have a bath session every two weeks. Set Repeat to “Every two weeks”.
- You as a caregiver want to receive a reminder before the bath session with “Liljan 103”. Set Reminder before bath session to “30 min”.
- Add the booking.

Add relative as a user to the app

- A relative wants to get access to the bath schedule for its elder. Add a relative for “Liljan 103” as a new user.

- You have received the QR-code for access to the app to the relative, but you shall not go further with it.

Notifications

- You want to receive notifications regarding the upcoming bath sessions for your residents.
 - Add notifications from Liljan 103.
 - Add notifications from Vitsippan 101 and 102.
 - Now you are done.

Handling of the cleaning and disinfection of the bathtub

- You have received a notification regarding the disinfection level running low. Go to Handle cleaning page.
- Add an order of disinfectant to notify all other caregivers that you have contacted Arjo and ordered new disinfectant.
- Save changes.

Start bath session

- Press on the booked time slot in the schedule on the homepage.
- Read the notification of the upcoming bath session for “Liljan 103, 9.00-11.00 sent to you and open the bath session.
- Your Bluetooth is off. Press OK in order to “simulate” a connection between your smartphone and the bathtub.
- Make sure to study the preferences for the resident.
- “Liljan 103” prefers the music “Waves”. Start and stop the music “Waves”.

Evaluation of the bath session

- The bath session is now done, and you want to perform an evaluation of the bath session in order to make the bath session as good as possible for your resident the next time.
 - The bath experience was “bad”.
 - Initial bath temperature was too hot.
 - The resident experienced anxiety sometimes.
 - Head contact did trigger the anxiety.
 - Music triggered the anxiety.
 - Light did not trigger the anxiety.
 - No other things triggered the anxiety.
 - A pillow under the left arm was still useful.
 - Skin moisturizer was used as skin care products.

Report problem

- During the bath procedure you noticed an error. The cover on the bathtub is broken. Report the error in order to let your colleagues be aware of the error situation.

Learn something new

- As a caregiver you are not feeling comfortable when it comes to the procedure after a bath. Go to the page Learn something new and have a look at the video “Part I” under “Post bath”.

Notification center

- Go to the notification center on the schedule view. Look at the notifications. These you can study if the popup notifications have been forgotten. The blue one has not been viewed.

D.2 Link to final prototype

If possible, download the app “XdViewer” on App Store or “Xd link” on Google Play in order to conduct the test on a smartphone. When downloaded, open this mail your phone and copy the link with the prototype, see below. Insert this link in the app and proceed with the test in this app by usage of the test scenarios mentioned above.

Link to the final prototype via Adobe XD:
<https://xd.adobe.com/view/89a53e87-54d0-42ff-4c49-f798f3d18901-ff94/>