IPS AS A TOOL FOR DESIGNING TO IMPROVE THE CARE FOR PEOPLE WITH DEMENTIA

TUDelft Graduation Thesis

IPS AS A TOOL FOR DESIGNING
TO IMPROVE THE CARE FOR PEOPLE WITH
DEMENTIA

Designing a new system for the nursing home

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PREACE

This graduation thesis is the final deliverable of the master degree program Strategic Product Design at Delft University of Technology. It is the result of an almost 6 months long research and design project.

This project is a combination of my interest in healthcare and service design. I've heard that the graduation project should combine all your skills developed as a student into a final 'masterpiece'. While I think I am quite lucky that besides being able to make use of my skills, I have learned much more throughout this graduation project too. Therefore, I feel greFat pleasure to work for this project and contribute to the field of caring for people with dementia.

I want to thank for the support from my supervisor team. I started my project with limited knowledge about dementia, because of their help, I conducted my project successfully and fluently.

I've spent quite a long time in nursing home, observing and learning about people with dementia. During the process, I've also gain a lot of insights about their disease and life. At the same time, I've seen many touching moments among themselves, between their family members and caregivers. This makes me feel that if my project can help them, even a little bit, it's very meaningful for me.

Finally, I want to switch the focus from PwD to the staffs, especially caregivers. They provide PwD with meticulous care, but they are often overlooked. In this project, I hope to emphasize their importance to PwD and hope to give them more attentions.

Enjoy reading the report!

EXCLUSIVE SUMMARY

This project aims to improving the care service for people with dementia who exhibits BPSD (Behavioral and Psychological Symptoms of Dementia) by providing the relevant stakeholders data insights, and meanwhile improving these people's working efficiency.

The target group of this project is people in their moderated to advanced stages of dementia who also exhibits BPSD living in nursing home. These people are less autonomous which lead to frequent care service demand, and the symptoms cause a lot of problems for the patient and the caregivers (Teresa et al., 2016). Therefore, we chose them to be our research group.

In order to know the context, the literature reviews were performed from people with dementia, quantitative measurements in nursing home and design method for this group. And two field studies were also conducted. First one is to gain insights about the living environment of people with dementia and the management structure of the ward, the second one analyzed the daily life of this target group and interviewed the relevant stakeholders by presenting the data we collected from PwD.

The analysis of the two studies reveals that in order to providing better care service for the target group, we should let the staffs work more closely by providing them a platform to sharing and interpreting the quantitative data of the patients. Then, the requirements of the system are listed:

Personalized care plan
Involving relevant stakeholders
Integrating with current system
Combination of quantitative and qualitative data

To start the design process, a brainstorming session together with the stakeholders was performed, which resulted in four design ideas. Considering about the feasibility of the technology, one idea was removed and other three ideas were combined into a new idea. Then after three iteration process, the new idea was explored into the final idea that a new system that use IPS data to quantify the behavior of each client, helping staffs evaluate their work and optimize their efficiency.

INTRODUCTION

According to the World Alzheimer Report, nearly 50 million people are living with dementia worldwide in 2016, and this number is expected to increase to 131 million by 2050 (World Alzheimer Report, 2016). While the number of people living with dementia keeps increasing rapidly, currently there is no cure for the disease (Alzheimer's Society, 2018; World Health Organization, 2017b). Dementia not only shortens the lives of those affected, but also has great impact on the quality of life of people living with dementia as well as the lives of family members and most importantly of the caregivers, considering that most of the people with dementia will live in the nursing home eventually (Prince et al., 2015).

Due to the fact that dementia is such an impactful disease, more focus should be put on how to improve the quality of life for those living with dementia, instead of just trying to find a cure (T. P. Ettema et al., 2005). And for those who live in the nursing home, improving the care service they get is one way to optimize their life quality.
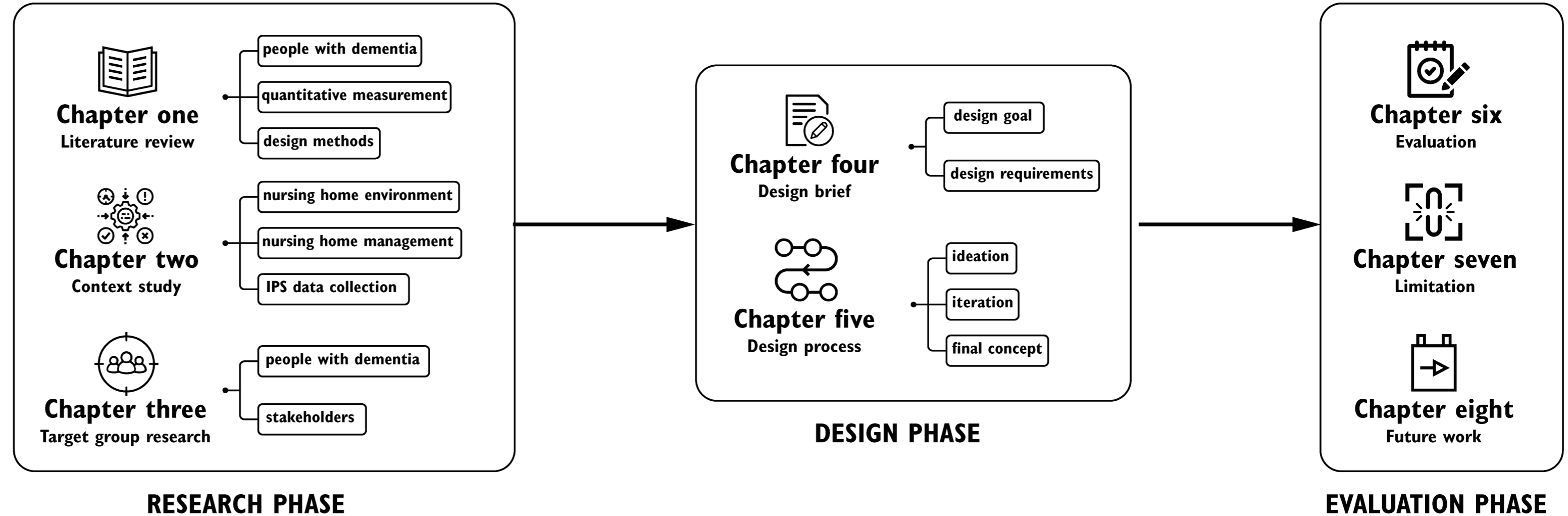
Besides, this disease is progressive, people in the early stages are affected in a different way than people in the later stages as well as their behavior and emotions (Alzheimer's Society, 2019). Therefore, more specific focus is needed for this project. This project is inspired by the research elective course, whose target group is people who lives in later stages of the disease with Behavioral and Psychological Symptoms of Dementia (BPSD) in nursing home setting. Hence, this target group was also chosen as the focus for this project.

Additionally, with the expected decline in workforce in the Netherlands, the ration of potential working people to people with dementia will decrease from 69:1 in 2000 to 27:1 in 2050 (Health council of the Netherlands, 2002; Wancata et al., 2003). There is an urgent need to improve the working efficiency of the caregivers and provide adequate care for growing number of persons with dementia. Therefore, new technologies with assistance for caregiver's work should be involved in current dementia care industry and the importance of those technologies will increase.

This project will cooperate with a technology company pinXact to introduce IPS (Indoor Positioning System) technology to the nursing home. IPS can keep track of the location data of each People with Dementia (PwD) and their caregivers over time. By combining the traditional qualitative methods such as observations and interviews with a quantitative method facilitated by IPS, this project aims to identify the factors influencing BPSD, then using those findings to help people with dementia get better care service.

STRUCTURE OF THE REPORT

A visual overview of the graduation project is given. The structure of this report is based on the project approach. The literature review part is presented in chapter 2, which divided into three subchapters: people with dementia, quantitative measurements in nursing home and design methods. Chapter 3 describes the context study, and chapter 4 describes the target group study. The design brief and design requirements are presented in chapter 5. The design process is in chapter 9, and in chapter 10, the final concept is evaluated. The limitation of my work and the suggestions for future work are presented in chapter 11 and 12.

RESEARCH PHASE

Chapter one
Literature review
- people with dementia
- quantitative measurement
- design methods

Chapter two
Context study
- nursing home environment
- nursing home management
- IPS data collection

Chapter three
Target group research
- people with dementia
- stakeholders

DESIGN PHASE

Chapter four
Design brief
- design goal
- design requirements

Chapter five
Design process
- ideation
- iteration
- final concept

EVALUATION PHASE

Chapter six
Evaluation

Chapter seven
Limitation

Chapter eight
Future work

CONTENT

CHAPTER 1

LITERATURE REVIEW

1.0 INTRODUCTION

In order to understand the research problem being studied, the first step of this project is to analysis the relevant literatures. This chapter presents the analysis of three key fields which guided by the design brief of this project – people with dementia, quantitative measurements in nursing home and design methods for people with dementia.

Basic pathology knowledge about this disease is presented, then information is given about this project's target group – people with dementia who exhibits BPSD (Behavioral and Psychological Symptoms of Dementia).

The second part of this chapter talks about current quantitative measurements been applied for designing for people with dementia, from the function, benefits and limitation's aspects. Two examples of the technologies are given: Electronic Tracking System and Indoor Air Temperature. Then compared with these measurements, the advantages and potentials of Indoor Positioning System are discussed.

The last part of this chapter investigates which design methods are suitable for this target group, and user-centered approach and participatory design method that I performed in this project are listed. Then, for this project, qualitative and quantitative research methods are selected. Lastly, lean product design

Each part is ended with the implication for design, presenting what are the main inspirations for me to do the following process.

1.1 PEOPLE WITH DEMENTIA

1.1.1. General information about dementia

Dementia is a collective term for a syndrome covering different types of diseases with similar symptoms caused by damage of the brain (Perrin, May, & Anderson, 2008b). The very typical phenomena when a person develops dementia are the deterioration in memory, thinking, ability to stay focus and pay attention and the ability to manage daily-life activities. Most dementia is progressive, and currently there is no cure for this disease (World Health Organization, 2017b).

Number of people living with dementia is growing
World population is growing older, it is estimated that in 2040 there will be three times people more people aged over 85 than there are today (Lopes et al., 2016). Owing to the rapidly aging population, the number of people with dementia is predicted to increase. Nearly 50 million people are living with dementia worldwide in 2016 according to the World Alzheimer Report, and this number is expected to increase to 131 million by 2050 (World Alzheimer Report, 2016).

Therefore, the demand for nursing home care is also predicted to rise markedly (Cooper et al., 2017). While, with the expected decline in workforce in the Netherlands, the ration of potential working people to people with dementia will decrease from 69:1 in 2000 to 27:1 in 2050 (Health council of the Netherlands, 2002; Wancata et al., 2003). Hence, there is an urgent need to look for new ways to support the caregivers to provide adequate care service for people with dementia.

Different types of dementia
The most common type of dementia is Alzheimer's disease, accounting for the majority of dementia (approximately 60 to 80%), but there are many kinds (Hendriks et al., 2013), and each one is characterized by different patterns of symptoms, especially in early stage.

Alzheimer's disease
Alzheimer's disease acknowledged as progressive multifarious neurodegenerative disorder, is the leading cause of dementia in late adult life (Kumar et al., 2015). Alzheimer's disease leads to nerve cell death and tissue loss throughout the brain. Over time, the brain shrinks dramatically, affecting nearly all its functions

Vascular dementia
Vascular dementia is a decline in thinking skills caused by cerebrovascular disease, and it is the second most common type of dementia. Vascular dementia can happen as people age and can be related to atherosclerotic disease or stroke.

Dementia with Lewy bodies
Dementia with Lewy bodies, also regarded as the third most common cause of dementia, is caused by protein deposits in nerve cells. This interrupts chemical messages in the brain and leads to a decline in thinking, reasoning and independent function.

Frontotemporal dementia
Frontotemporal dementia refers to a group of disorders caused by progressive nerve cell loss in the brain's frontal lobes (the areas behind your forehead) or its temporal lobes (the regions behind your ears), which variably cause deterioration in behavior, personality and language abilities.

Huntington's disease
Huntington's disease is caused by a defective gene. This disease causes changes in the central area of the brain, which affect movement, mood and thinking skills.

Three stages of this disease
Due to the progressive nature of this disease, it can be divided into three stages, which are mild stage, moderate stage and advanced stage. And in the mild stage of dementia, symptoms depend on the type of disease and which parts of the brain are typically affected by this disease (World Health Organization, 2017b). as the stage goes further, the brain is most damaged, therefore, in the later stages, symptoms can be quite similar across different types of dementia (Alzheimer's Society, 2014). And Alzheimer's disease is taken as an example to show what happens to the brain in different stages and what are the typical symptoms.

Mild stage
In this stage of dementia, people will experience memory loss, getting lost and some behavior changes.

Learning and Memory   Thinking and Planning

Figure 1: The brain parts been affected in the mild stage

Moderate stage
In this stage, damage occurs in areas of the brain that control language, reasoning, sensory processing, and conscious thought. People may be unable to learn new things, carry out multistep tasks such as getting dressed, or cope with new situations, and normally, additional care is needed in this stage.

Speaking and Understanding Speech

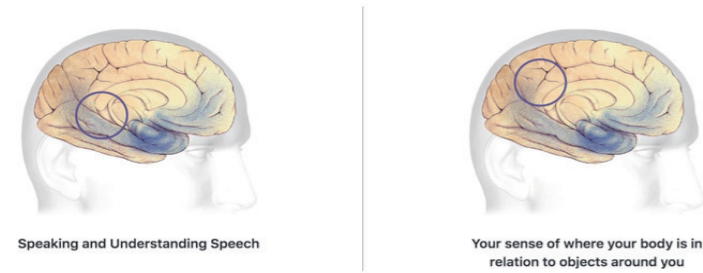Your sense of where your body is in relation to objects around you

Figure 2: The brain parts been affected in the moderate stage

Advanced stage
In advanced Alzheimer's disease, most of the cortex is seriously damaged. The brain shrinks dramatically due to widespread cell death. Individuals lose their ability to communicate, to recognize family and loved ones and to care for themselves. Therefore, in this stage, they are completely dependent on others for their care.
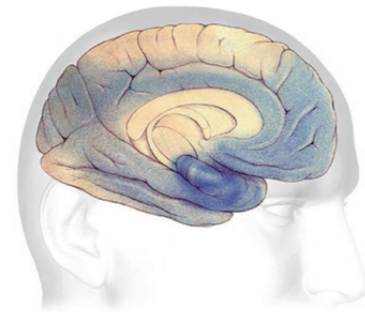

Figure 3: The brain parts been affected in the advanced stage

(Alzheimer's Association, 2019)

Typical behaviors for people with dementia
Most people with dementia have very typical behavior, such as aggression, agitation and wandering (Alzheimer's Association, 2019).

Aggression
Aggressive behaviors may be verbal or physical. They can occur suddenly, with no apparent reason, or result from a frustrating situation.

Agitation
A person with dementia may feel anxious or agitated. He or she may become restless, causing a need to move around or pace, or become upset in certain places or when focused on specific details.

Wandering
It's common for a person with Alzheimer's to wander and become lost, and it can happen at any stage of the disease. In fact, six in 10 individuals with Alzheimer's will wander at some point (Alzheimer Association, 2018).

1.1.2. Behavioral and psychological symptoms of dementia (BPSD)

BPSD, defined as "signs and symptoms of disturbed behavior, mood, thought, or perception" are the most worrisome symptoms (Kales et al., 2015). In fact, this symptomatology has a high degree of frequency and is present in at least 50–90% of patients (Steele et al., 1996). Moreover, around 97% of PwD will develop at least one symptom over a five-year period (Steinberg et al., 2008). Due to the extensive spread among people with dementia, it is chosen to be the target group of this project, and also because BPSD significantly affect the patient and his/her family or main caregivers (Teresa et al., 2016).

The evaluation and diagnosis of the BPSD
The evaluation and diagnosis of the BPSD can be carried out through observation and interviews with the patient and his/her caregivers (Teresa et al., 2016). In addition, instruments such as the neuropsychiatric inventory (NPI) can be quite useful (Cummings et al., 1994). The Neuropsychiatric Inventory–Questionnaire (NPI-Q) has categorized the reported signs and symptoms into: delusions, hallucinations, agitation/aggression, depression/dysphoria, anxiety, elation/euphoria, apathy/indifference, disinhibition, irritability/lability, motor disturbance,

nighttime behaviors, and disturbance in appetite/eating (Kaufer et al., 2000). Below, Table 1 which combines the NPI-Q and the publication from the International Psychogeriatric Association shows the definition for each symptom.

Symptom	Definition
Delusions	Irrational or false idea or thought that distances them from a true comprehension and perception of the surroundings
Hallucinations	False perceptions that can affect any perceptual sphere
Agitation / Aggression	Behaviors of physical or verbal violence toward people or objects, manifested as great activity involving movements, shouting, and aggression
Depression / Dysphoria	Sadness, anhedonia, feeling of being a burden, lack of hope …
Anxiety	Feelings of anticipator fear of a danger that they consider imminent
Elation / Euphoria	Abnormally good or inappropriate humor
Apathy / Indifference	Lack of interest, motivation, feeling, emotion or concern
Disinhibition	Lack of social tact in language, body language, and other behaviors
Irritability / Lability	Bad mood, quick, unjustified changes in mood, impatience, intolerance
Motor disturbance	Imperious need to move without any defined objective, often accompanied by anxiety
Nighttime behaviors	Insomnia, hypersomnia or parasomnias
Disturbance in appetite/eating	Capricious eating, compulsive eating, or lack of appetite

Table 1: Main behavioral and psychological symptoms of dementia

Why chose this target group?
BPSD have great repercussions, they hinder the patient's autonomy and lead to frequent care service demand, therefore cause a lot of problems for the patient and the caregivers (Teresa et al., 2016). Besides, BPSD reduce the patient's quality of life which leads to a decided reduction in the quality of life of the caregivers, increasing their stress (Burgio, 1996). Thus, these types of symptoms are the most suffering consequence for caregivers, causing depression and desperation in them (Cummings, 1996).

Meanwhile, BPSD is identified as a predictor of nursing home placement (Gaugler et al., 2003). Due to increased medical and psychological care, security concerns, and staff turnover caused by PwD with BPSD (Kales et al., 2015), more researches should be done with them.

Implication for design

Dementia is a collective term for a syndrome covering different types of diseases with similar symptoms caused by damage of the brain (Perrin, May, & Anderson, 2008b). It is progressive that the patient's symptoms will eventually get worse, therefore people who lives in the moderate or advanced stages of dementia tends to live in nursing home. And their daily living is highly dependent on caregivers and other staffs.

Among them, the symptoms displayed by people with dementia who exhibits BPSD are the most suffering consequence for caregivers, causing depression and desperation in them. Therefore, if we want to design for this target group, the stakeholders around them are very important. As this group of people may have trouble in expressing their needs, the staffs can be a starting point for further design.

1.2 QUANTITATIVE MEASUREMENT IN NURSING HOME NOWADAYS

1.2.1. Applying IPS in nursing home

This project aims to apply quantitative measurements in the nursing home to identify factors influencing Behavioral and Psychological Symptoms of Dementia (BPSD) in nursing home setting, then using the results to design for PwD. Therefore, Indoor Positioning System (IPS) is introduced to the nursing home in this project through cooperating with a company named pinXact. IPS can keep track of the location data of each People with Dementia (PwD) and their caregivers over time. Therefore, it can generate quantitative and objective data for the identified factors influencing BPSD which are location-related and other location-related factors which might influence BPSD for each PwD.

Currently, there are some other technologies tested in the nursing home using quantitative measurements to help PwD and the caregivers. In order to better apply IPS, it is beneficial to analysis those similar technologies, knowing their strengths and limitations.

1.2.2. Electronic tracking system

Electronic tracking system is developed to minimize the risk of people with dementia's wandering behavior and manage the unsafe wandering. It can locate the person who wanders outdoors quickly, thus to reduce anxiety and psychological burden of family members and caregivers.

Electronic tracking device functionality
The device for PwD is mobile phone shaped which can attach to the person with a belt clip (Figure 4). At regular intervals, the phone sends a text message containing the precise location data to the receivers. Below, Table 2 shows the device's functions.

Figure 4: The device for PwD

Function of the device
1. Geolocation alarms
2. Voluntary alarm
3. Automatic alarm when the person goes beyond a pre-set safety zone
4. Automatic alarm detecting long inactivity
5. Automatic alarm detecting falls

Table 2: Functions of the device

Evaluation

The tracking function of this device is proved to be useful. Ogawa et al. performed a rescue test, and the results showed that the mean rescue time (rescue time is the time required for the caregiver to find PwD) was 13 minutes. Meanwhile, the tracking devices are widely accepted by caregivers and PwD (Faucounau et al., 2009).

On the other hand, the appearance of this device is not aesthetic and too voluminous. According to caregivers and the patients, the device must not be stigmatizing in order not to associate it to a restriction of movement freedom, however, the device must be unnoticeable for PwD.

Related to IPS

IPS can also track people with dementia's wandering behavior, which has been approved to be very important by this case study. While, the appearance of the IPS device should be more aesthetic and less obvious, otherwise PwD won't accept it.

1.2.3. Indoor air temperature system

It is commonly believed that people with dementia are very sensitive to indoor environmental conditions (Kort et al., 2009). Since they may have difficulties in actively adjust or interpret the environment around them, agitation is a form of communication that they employ to express themselves or be an outcome of unaddressed needs (Kort et al., 2009). Therefore, there is a connection between agitation behavior and the indoor environment around people with dementia. The specific correlation between indoor air temperature and agitation has been studied by gathering quantitative evidence.

Data collection and analysis

Three types of data are collected through an eight-month period: agitation behaviors, indoor air temperature and time spent by each resident in various locations throughout the nursing home. The Cohen-Mansfield Agitation Inventory (CMAI) is used to assess agitated behaviors. The devices been used for the indoor temperature can measure and store dry-bulb air temperature at 15-minute intervals with an accuracy of 0.5 °C.

The data analysis is carried out suing Mixed Model procedure in IBM SPSS Statistics. And the results show that the CMAI total frequency scores increased when residents are exposed to either relatively cold or warm indoor temperature (Cooper et al., 2017).

This indicates that both cold and hot indoor temperatures should be avoided in the nursing home because they may impact the residents' health and well-being.

Evaluation

The results of the study prove that good "thermal care" can be an effective non-pharmacological approach to reduce the behavioral disturbances of people with dementia. While, there are some limitations. Other factors influencing the perception of thermal comfort are not considered in this study, such as air speed, relative humidity etc., Besides, the location data for each resident is collected be asking the caregivers, which means the data is not very precise.

Related to IPS

Similar to the Indoor Air Temperature System, IPS also produces quantitative data of people with dementia. Therefore, the data collection and analysis methods in this case can be useful for IPS.

1.2.4. Indoor positioning system

In my project, IPS is introduced to the nursing home by cooperating with a company named pinXact. And the elementary feature of this technology is to track the location data of caregivers and people with dementia.

It is an easy setup system which requires three main elements, traceable tags, fixed anchors and gateways. Tags are industrial grade active radio electronics that is attached to the objects or carried by people to be traced. Anchors are the reference points that are installed in the area and require only a power connection to operate. Gateways transfer data to the server. Below, Figure 5 shows how the system works.
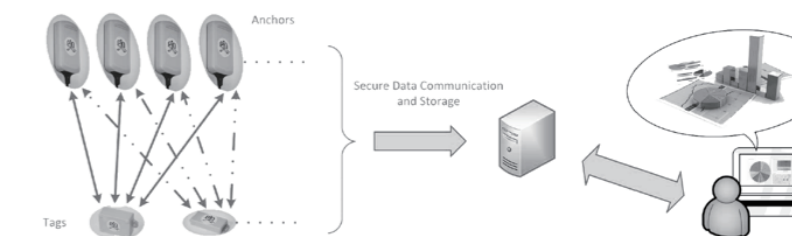

Figure 5: The working flow of IPS system

Furthermore, there are other features of IPS, and the details are presented in the following Table 3.

Features
Precise location down to 10 cm.
Additional sensors such as heart-rate, shock, loudness, temperature, etc. can be integrated in tags.
Customizable dashboard and reports.
Smartphone application
Integrate with outdoor (GPS tracking) solutions
Send notifications in emergency situations

Table 3: The features of IPS

Implication for design

Quantitative measurements will be very beneficial to the nursing home if these technologies can track people with dementia's behavior. Therefore, in the following design process, more focus should be put on exploring more types of behavioral data of people with dementia.

The aim of this project is to use IPS to improve the care service of people with dementia, therefore, how to apply IPS in the nursing home is also very important. Several requirements are identified as follows:
--- the devices used by people with dementia should be less obvious
--- data collection needs a longer period
--- quantitative data analysis is needed.

1.3 DESIGN METHODS

Dementia affects a person's cognitive, behavioral and emotional functioning, which indicates that working with persons with dementia asks for a specific approach (Anderiesen Le Riche, 2017). Therefore, by investigating what type of design methods are suitable for this target group, the available methods for this project are listed in this part, which are user-centered approach and participatory design method.

Subsequently, qualitative and quantitative research methods are also applied in this project. Because in this project, we aim to mix these two approaches to identify factors influencing Behavioral and Psychological Symptoms of Dementia (BPSD) in nursing home setting. Then the results can inspire the following design process.

1.3.1. User-centered approach

The importance of assistive technologies in current dementia care industry is increasing (Meiland et al., 2014). In dementia caring design, previous researches has suggested that the development of such technologies requires holistic, user-centered approach with the target group involved from the outset (Faife, 2006). Therefore, for this project, user-centered approach is applied due to the involvement of new technology (IPS) in the nursing home.

How to involve users in design?
It is necessary to think carefully about who is a user when perform the user-centered design method. Users are the people who will use the final product or artifact to accomplish a task or goal. But there are other users as well. The people who manage the users have needs and expectations too (Chadia, 2004). Below, Table 4 suggests ways to involve users in the design process (Preece, et. al, 2002).

Techniques	Purpose	Design stage
Background Interviews and questionnaires	Collecting data related to the needs and expectations of users; evaluation of design alternatives, prototypes and the final artifact	At the beginning of the design project
Sequence of work interviews and questionnaires	Collecting data related to the sequence of work to be performed with the artifact	Early in the design cycle
Focus groups	Include a wide range of stakeholders to discuss issues and requirements	Early in the design cycle
On-site observation	Collecting information concerning the environment in which the artifact will be used	Early in the design cycle
Role Playing, walkthroughs, and simulations	Evaluation of alternative designs and gaining additional information about user needs and expectations; prototype	Early and mid-point in the design cycle
Usability testing	Collecting quantities data related to measurable usability criteria	Final stage of the design cycle
Interviews and questionnaires	Collecting qualitative data related to user satisfaction with the artifact	Final stage of the design cycle

Table 4: How to involve users

Advantages and limitations

The major advantage of user-centered approach is that designers can have deeper understanding of the target users from different aspects, such as physically, psychologically and socially, and define the factors affecting the usage of the potential product (Chadia, 2004). The involvement of users in every stage of design assures that the product will be suitable for its intended purpose in the environment in which it will be used.

The limitation of this method is that it can be quite costly and time-consuming. The process requires resources, both financial and human.

1.3.2. Participatory design

Participatory design method is widely used in projects designing for people with dementia, such as the keeping in touch everyday project performed by Louise et al., and the lived neighborhood project performed by Richard et al. In participatory design the users are involved in development of the products, in essence they are co-designers. By co-designing with the users, the chance to end up with a successful design outcome reflecting the preference and expectations of them will be much higher (Frederik et al., 2013).

How to perform participatory design?

Participatory design is still developing and consequently its research design tends to be quite flexible. But three basic stages are presented in almost every participatory design research (Spinuzzi, C. 2005).

Stage one: Initial exploration of work

In this stage, designers meet the users and familiarize themselves with the ways in which the users work together. This exploration includes the technologies used, but also includes workflow and work procedures, routines, teamwork, and other aspects of the work. Observations, interviews, walkthroughs and organizational visits are often used in this stage (Lander et al., 1997).

Stage two: Discovery process

Stage 2 is where researchers and users interact most heavily, and it also typically involves group interactions (Spinuzzi, C. 2005). In this stage, designers and users employ various techniques to understand and prioritize work organization and envision the future workplace. This stage allows designers and users to clarify the users' goals and values and to agree on the desired outcome of the project. This stage is often conducted on site or in a conference room, and usually involves several users.

Stage three: Prototyping

In this stage, designers and users iteratively shape technological artifacts to fit into the workplace envisioned in Stage 2. Prototyping can be conducted on site or in a lab; involves one or more users. These techniques include mockups (Kyng et al., 1991), paper prototyping (Novick, 2000) and cooperative prototyping (Mogensen et al., 1994).

Limitations

Similar to the user-centered approach, participatory design research takes an enormous amount of time, resources, and institutional commitment to pull off. Besides, participatory design studies typically require continuous participation by the users (Spinuzzi, C. 2005).

1.3.3. Qualitative and quantitative research method

Previous studies for people with dementia mostly use qualitative research methods to gather data, with which interview and observation are frequently used techniques. While, with more and more technologies involved in this field, quantitative data also provides beneficial insights.

At a general level, qualitative research is often described as a naturalistic, interpretative approach which focuses on obtaining data through open-ended and conversational communication (Bilgin, 2017). While quantitative research focuses on gathering numerical data and generalizing it across groups of people or to explain a particular phenomenon, and it also emphasizes objective measurements and the numerical analysis of data.

Differences between qualitative and quantitative research method

These two research methods differ in five aspects, their analytical objectives, the type of questions asked, the type of data collection instruments, forms of data they produce and the degree of flexibility. More details are showing in the following Table 5.

Attributes	Qualitative	Quantitative
Analytical objectives	This research method focuses on to describe individual experiences and beliefs.	Quantitative research method focuses on describing the characteristics of a population.
Types of questions asked	Open-ended question	Closed-ended question
Data collection instruments	Use semi-structured methods such as in-depth interviews, focus groups, and participant observation	Use highly structured methods such as questionnaires and surveys
Forms of data produced	Descriptive data	Numerical data
Degree of flexibility	Participant responses affect how and which questions researchers ask next	Participant responses do not influence or determine how and which questions researchers ask next

Table 5: Differences between qualitative and quantitative research method

Frequently used methods in qualitative and quantitative research

The following are the research methods that are frequently used in these two fields.

In qualitative research

In-depth interview: Conducting in-depth interviews is one of the most common qualitative research methods. It is a personal interview that is carried out with one respondent at a time. This is purely a conversational method and invites opportunities to get details in depth from the respondent.

Focus group: A focus group also one of the commonly used qualitative research methods, used in data collection. A focus group usually includes a limited number of participants (6-10) from the target group.

Observation: Observation is a process of research that uses subjective methodologies to gather systematic information or data.

In quantitative research

Survey: Surveys used to ask questions to a sample of respondents, using various types such as online polls, online survey, paper questionnaires, web-intercept surveys etc.

Correlation: correlation research is conducted to establish a relationship between two variables and how one impacts the other by using mathematic analysis methods.

Experimental research: experimental research is based on one or more theories. In an experimental research, an analysis is done around proving or disproving the statement.

Implication for design

Participatory design method will be applied with the relevant stakeholders for people with dementia since they are more familiar with the context and the target group.

Meanwhile, in order to apply a new technology in the nursing home, the whole design process should be user-centered. All the information and functions should be developed according to the target group's requirements.

The combination of quantitative data and qualitative research methods is also necessary, as it can provide more holistic and complete information.
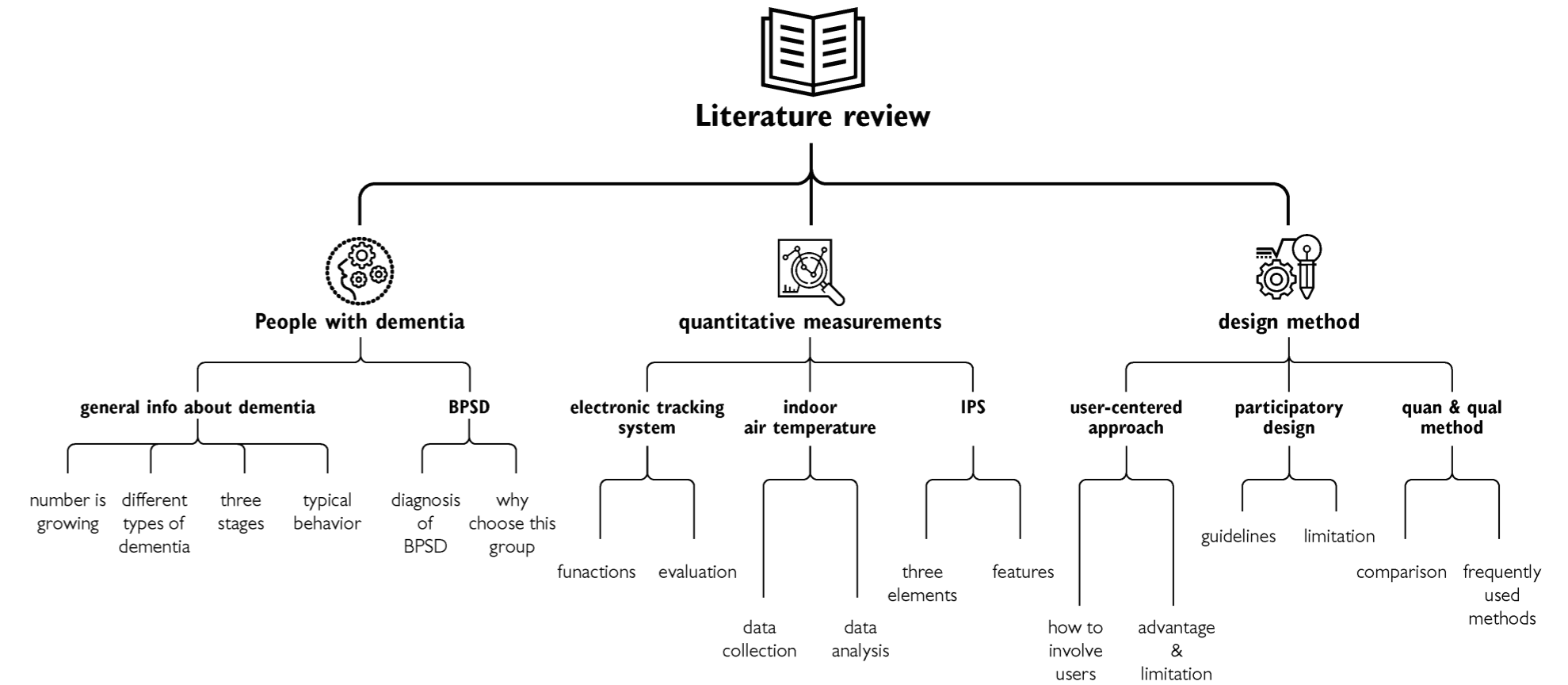
I.4 MIND MAP

Figure 6: mindmap for literature review

CHAPTER 2

CONTEXT STUDY

The first field study was conducted in order to gain insights about the context. Therefore, this chapter mainly describes the general information about the nursing home such as the living environment and the management. And we also installed the IPS.

2.1 ETHICAL CONSIDERATION

The participants are PwD exhibiting BPSD and their caregivers in the nursing home Zorggroep Elde. Ethics approval has been received from the TU Delft ethics committee and the supervisory board in the nursing home. In total, there are eight residents participated in this study. Since the PwD participants are unable to give informed consent, the proxy consent is given by a close family member and the responsible caregiver of each PwD. If the person who has the right to make this decision decides something which does not seem to be in accord with the good of the PwD, other responsible people may challenge the decision of the proxy. The participants can withdraw from the study at any time.

2.2 NURSING HOME ENVIRONMENT

To achieve a broad perspective about the living environment of people with dementia, we visited one nursing home Zorggroep Elde which locates near the city center of Boxtel, Netherlands.

Zorggroep Elde is a large-scale nursing home with dedicated wards for people living with dementia. One of the ward participated in our research and all residents are person with dementia who exhibits BPSD.

In this ward, there are ten bedrooms available, and each resident has his or her own bedroom, which they can decorate with their personal belongings, like pictures of relatives and furniture from their previous home (see Figure 7-9 showing the decoration of one resident).

Figure 7 – 9: The interior decoration of the resident

The bedrooms open onto a main hallway, to which the living room is also connected. The living room is shared by these ten residents, and the decoration presents a home-like nostalgic atmosphere (see Figure 10-15). Overall, most residents spend their daily time in the living room. This is where daily activities take place, such as watching television, singing, playing games or reading the newspaper. Besides, the caregivers also spend a lot of time in the living room to interact with the residents.

Figure 10: The relaxing area

Figure 11: The sitting area

Figure 12: The meeting area 1

Figure 13: The kitchen

Figure 14: The TV area

Figure 15: The meeting area 2

2.3 NURSING HOME MANAGEMENT

There are 15 caregivers currently working for 10 clients in this ward, and there are three shifts for them during one day: morning shift is from 7:00 am to 2:00 pm; afternoon shift is from 2:00 pm to 10:00 pm; and the night shift is from 10:00 pm to next day's morning. Normally, there will be 2 to 3 caregivers working in the morning and afternoon shift, while only 1 caregiver will work in the night shift.

Meanwhile, there are one manager, one doctor, one psychologist, one dietitian working for this ward's clients. And once a week, there is a meeting within all the staffs (see Figure 16). The administer structure of this ward can be seen in the following Figure 17.

Figure 16: The weekly meeting

Ward for BPSD

in total 10 clients

| doctor
| psychologist
| dietitian
| manager
15 caregivers

once a week regular meeting

night shift — 10:00 pm to next day
afternoon shift — 2:00 pm to 10:00 pm
morning shift — 7:00 am to 2:00 pm
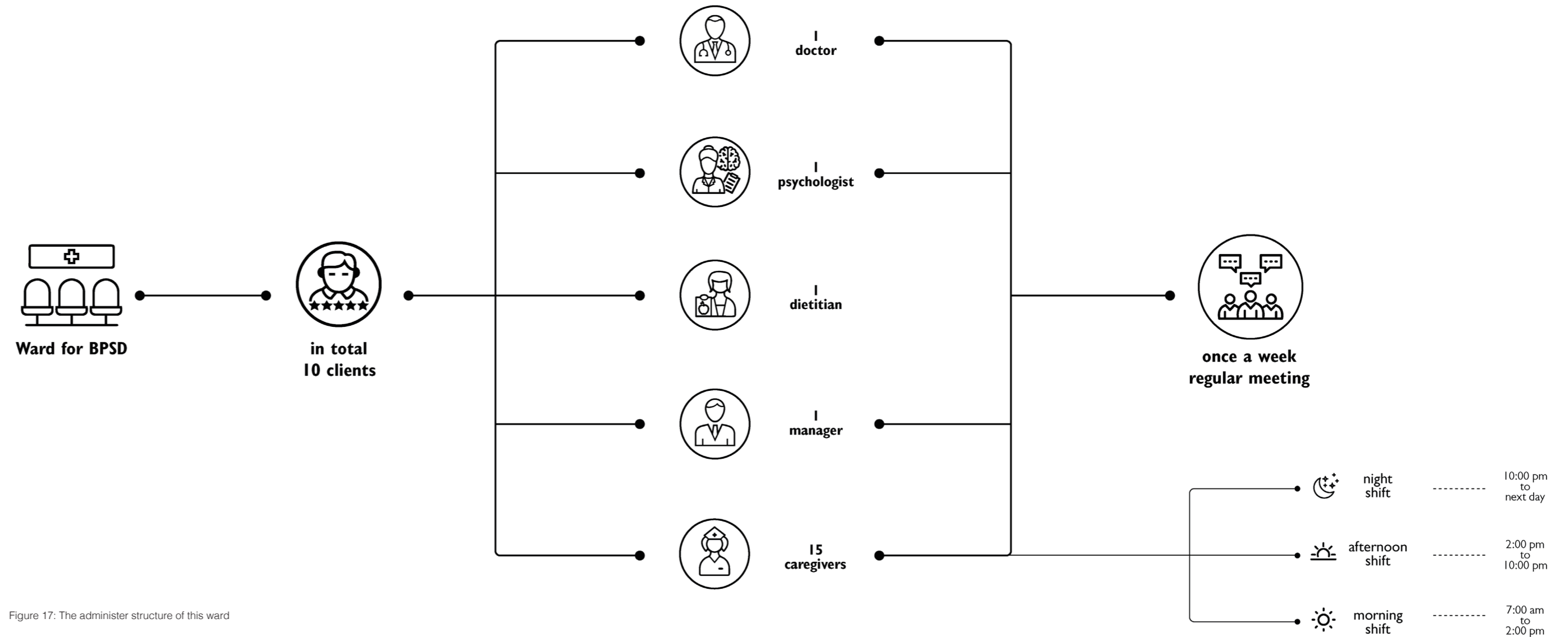
Figure 17: The administer structure of this ward

2.4 IPS DATA GENERATION

2.4.1. IPS installation

Anchors are attached to the ceiling of each room, including living room, bedroom and toilet, making sure the signal covers the whole ward. Tags are assigned to caregivers and participating residents every morning, and collected after the residents go to sleep in the night.

2.4.2. Data colletion

The IPS data is collected from 7:00 to 20:00, every day. Observational data will be collected during the same period to complement with the IPS data. Each participant wears a tag during the collecting period. The tag worn by each participant has a specific number. In addition to the5 PwD participants, there are 5 caregivers working in the ward each day. Therefore, 10 tags are used in total.

2.4.3. Initial data

Three types of data are collected through IPS, which are time-related, distance-related and location-related. Below, Table 6 shows more details about each type.

Time	
1.	The duration of PwD staying each room
2.	The duration of PwD being physically closed to caregivers (Physically close" is defined to be that the distance between two tags is within 0.5m)
Distance	
1.	Distance traveled over they day by caregivers
2.	Distance traveled over they day by PwD
Location	
3.	The total PwD's staying time for each rooms (The rooms are separated into kitchen, dining room, corridor, bathroom, bedroom)
4.	The frequency PwD switching from each room

Table 6: Three types of data collected through IPS

2.4.4. Currently interfaces

IPS has two original data-presenting interfaces, which are animation and graph as showing in the following two figures.
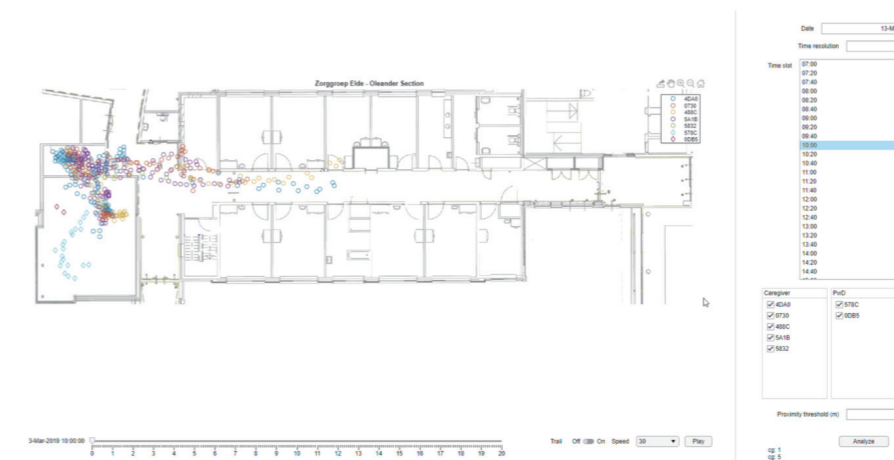

Figure18: The animation interface

Figure 19: The graph interface

Each spot in the animation represents a real-time movement for each person, users can choose what time period data they want to see, and also speed up the animation.
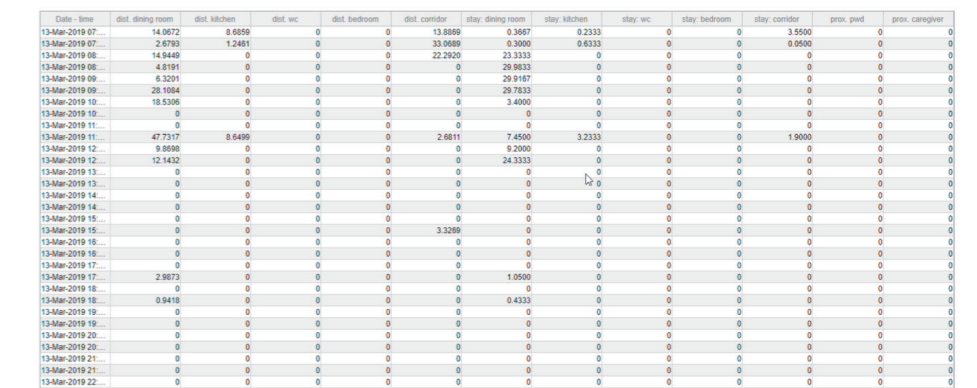
In this interface, users can see the overall data of the day if they want to have a quick overview. The data are presented in the excel with travel distance and staying time in each room for each person.

CHAPTER 3

TARGET GROUP RESEARCH

3.0 INTRODUCTION

This chapter describes the results of the researches about people with dementia, and the relevant stakeholders around them.

First, we created four user profiles based on our study to show the different characteristics among the residents. Then the routine of their daily life is also presented, which shows that their life schedule is quite regular and they are highly dependent on the staffs. Combined our observations and interviews, we concluded the PwD's behavior model and the factors influencing their complex behavior, which are very insightful for further design.

By making the stakeholder map for PwD, we selected five important types of staff (caregiver, dietitian, manager, doctor, and psychologist) to conduct the interview. Insights were gained about their current working status and their feedbacks about the IPS data.

3.1 PEOPLE WITH DEMENTIA

3.1.1. User profile

Based on the observation in the field study, several user profiles are created to describe the different characteristics of these residents.

Gender	Male
Stage of dementia	Moderate stage
Types of dementia	Huntington's disease
Staying time	1 year
Characteristics	**Apathy** Edison is not very sensitive to the surroundings; he spends most of the time sitting in the living room quietly. **Loss of Mobility** Edison is unable to move freely without assistance; he can't eat or drink by himself.

Edward (55)

Table 7: Edward's profile

Edward (see Table 7) is a 55-year-old man, who has been living here for one year. He is quite apathy, not sensitive to his surroundings. Most of the time, he just sits in the living room quietly. Due the lack of reactions, he cannot draw much attentions from the caregivers. While, he can't do daily activities without assistance and he is unable to move by himself.

Gender	Male
Stage of dementia	Moderate stage
Types of dementia	Alzheimer's disease
Staying time	2 years
Characteristics	**Vocalization** Frank is quite easy to get agitated, because he lacks the patience. Every time he gets agitated, he will shout loudly. **Certain level of mobility** Frank can move by himself sitting on the wheelchair, and he can eat chopped food autonomously.

Frank (66)

Table 8: Frank's profile

Frank (see Table 8) lives in the ward for around 2 years, and he is in the moderate stage of dementia. He always sitting on his wheelchair, but he can move his wheel chair by himself. Frank is quite easy to get agitated due to his lack of patience. Because he has some hearing problems, every time he gets agitated, he will shout aloud, which will draw a lot of attentions from the caregivers. Frank is a social person who enjoys sitting in the living room with caregivers and his fellow residents. And he is still capable of having and understanding conversations.

Gender	Female
Stage of dementia	Moderate stage
Types of dementia	Dementia with Lewy bodies
Staying time	6 months
Characteristics	**Halluciatio** Because of the dementia type Amy has, a certain part of her brain was damaged leading her having illusions. She will get agitated when she meets some unfamiliar people. **Normal communication** Amy is capable of having conversations with caregivers and other staffs, and these people don't have trouble understanding her.

Amy (60)

Table 9: Amy's profile

Amy (see Table 9) is a 60-year-old lady, who has Lewy bodies dementia. This type of dementia causes her having illusions, therefore, she is easy to get agitated about unfamiliar people since she will image them to be some horrible persons in the religious stories. While, she doesn't have any problems on communicating with others, and she can eat and drink totally by herself.
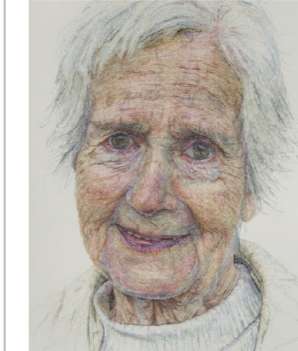

Gender	Female
Stage of dementia	Advanced stage
Types of dementia	Alzheimer's disease
Staying time	3 months
Characteristics	**Aggression** Ella barely leaves her bedroom, and she always refuses caregiver's help, and she is very aggressive. **Loss of mobility** Sometimes, she doesn't need the wheelchair, but she needs assistance to move, so do eating and drinking.

Ella (60)

Table 10: Ella's profile

Ella (see Table 10) comes to this ward for three months, and she barely leaves her room. Since she is in the last stage of her dementia, her brain was so damaged that she can't recognize anyone. It's quite difficult for caregivers to provide caring service for her because she is very aggressive, and she refuses the assistance. However, she can't eat or drink by herself.

3.1.2. Resident's daily life in nursing home

A journey is created which gives insight of the resident's daily life in the nursing home (see Figure 20). This journey is an example of what a regular day could look like. Some activities, like breakfast, dinner and dessert happen every day at approximately the same time. Others differ per day. Activities such as family visit, health check or party are not included in this journey since they are not on the fixed regular schedule and they can differ per person.
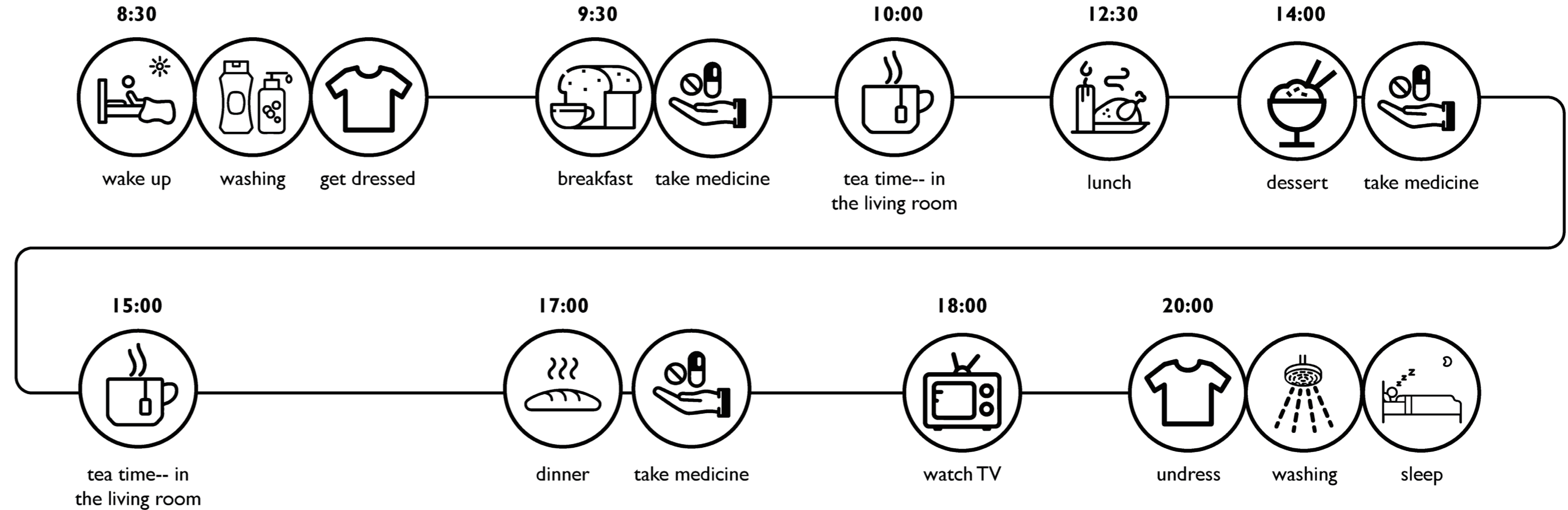
Figure 20: The resident's daily life

8:30 — wake up — washing — get dressed
9:30 — breakfast — take medicine
10:00 — tea time-- in the living room
12:30 — lunch
14:00 — dessert — take medicine
15:00 — tea time-- in the living room
17:00 — dinner — take medicine
18:00 — watch TV
20:00 — undress — washing — sleep

3.1.3. Dementia's behavior

As a result of the interview and observation of the field study, different behavior are defined which can be classified into two types, positive behavior and negative behavior. People with dementia also have neutral behaviors, but for my project, I did not record this type of behavior.

Smiling to the caregivers, responding to caregivers and actively interacting with caregivers can be seen as positive behavior; while getting agitated, missing meals and having trouble in understanding caregivers can be seen as negative behavior.

Besides, there are some characteristics of PwD's behavior also being defined in the study. We think that people with dementia's behavior is changeable, predictable and they get certain preferences. For instance, they can sometimes act oppositely with their words, while when they are provided the food, they always tend to eat. Some PwD require specific ways of interaction, and certain PwD and caregivers are getting along well with each other. More explanations are presented in the following Figure 21.
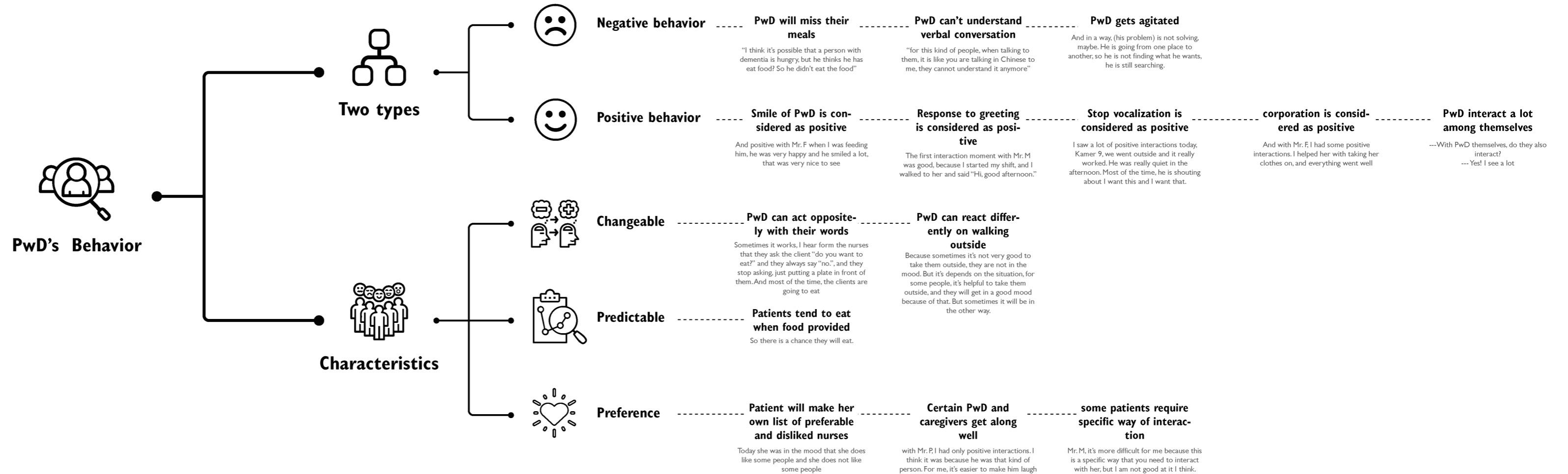
PwD's Behavior

Two types

Negative behavior

PwD will miss their meals
"I think it's possible that a person with dementia is hungry, but he thinks he has eat food? So he didn't eat the food"

PwD can't understand verbal conversation
"for this kind of people, when talking to them, it is like you are talking in Chinese to me, they cannot understand it anymore"

PwD gets agitated
And in a way, (his problem) is not solving, maybe. He is going from one place to another, so he is not finding what he wants, he is still searching.

Positive behavior

Smile of PwD is considered as positive
And positive with Mr. F when I was feeding him, he was very happy and he smiled a lot, that was very nice to see

Response to greeting is considered as positive
The first interaction moment with Mr. M was good, because I started my shift, and I walked to her and said "Hi, good afternoon."

Stop vocalization is considered as positive
I saw a lot of positive interactions today, Kamer 9, we went outside and it really worked. He was really quiet in the afternoon. Most of the time, he is shouting about I want this and I want that.

corporation is considered as positive
And with Mr. F, I had some positive interactions, I helped her with taking her clothes on, and everything went well

PwD interact a lot among themselves
---With PwD themselves, do they also interact?
--- Yes! I see a lot

Characteristics

Changeable

PwD can act oppositely with their words
Sometimes it works, I hear form the nurses that they ask the client "do you want to eat?" and they always say "no.", and they stop asking, just putting a plate in front of them. And most of the time, the clients are going to eat

PwD can react differently on walking outside
Because sometimes it's not very good to take them outside, they are not in the mood. But it's depends on the situation, for some people, it's helpful to take them outside, and they will get in a good mood because of that. But sometimes it will be in the other way.

Predictable

Patients tend to eat when food provided
So there is a chance they will eat.

Preference

Patient will make her own list of preferable and disliked nurses
Today she was in the mood that she does like some people and she does not like some people

Certain PwD and caregivers get along well
with Mr. P, I had only positive interactions. I think it was because he was that kind of person. For me, it's easier to make him laugh

some patients require specific way of interaction
Mr. M, it's more difficult for me because this is a specific way that you need to interact with her, but I am not good at it I think.

Figure 21: The thematic analysis of PwD's behavior

3.1.4. Factors influencing complex behavior

Through the data we collected in the observation and interviews with caregivers and other staffs, we also identified the possible factors which can influence PwD's complex behavior (BPSD). Our findings are in line with the Need-driven Dementia-compromised Behavior (NDB) model developed by Algase in 1996, while we have discovered more insights to supplement his model. The data analysis is processed by the thematic analyzing method.

NDB model

According to Algase, Need-driven Dementia-compromised Behaviors (NDBs) such as wandering, vocalization and aggression are an expression of people with dementia's undressed needs, and the factors contributing those behaviors can be divided into two types, the background factors and proximal factors (Algase et al., 1996). The background factors are the root causes of BPSD, which include neurological, cognitive, general health and psychosocial factors. And the proximal factors are the triggers of BPSD, which contains the personal factors of the PwD, and the physical and social environments around the PwD.
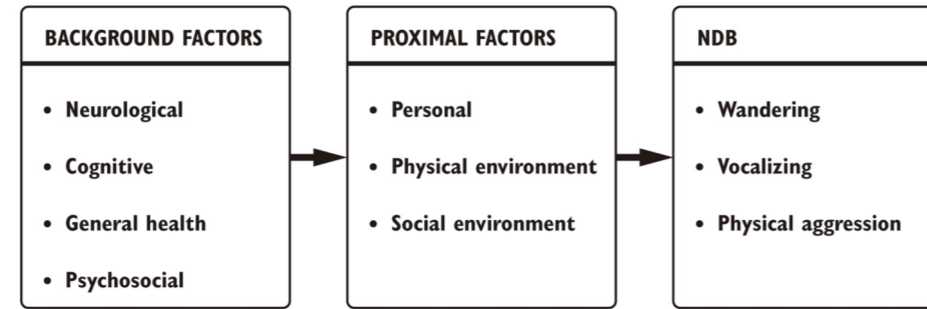
Figure 22: NDB model

Brainstorming

First, we initiated a brainstorming session with several caregivers and other staffs, such as doctor, dietitian and manager. We asked them to think about some factors they think might be relevant to the patients' complex behavior, and a writing sheet was provided to them along with some sticky notes. The brainstorming papers are presented in the following Figure 22.
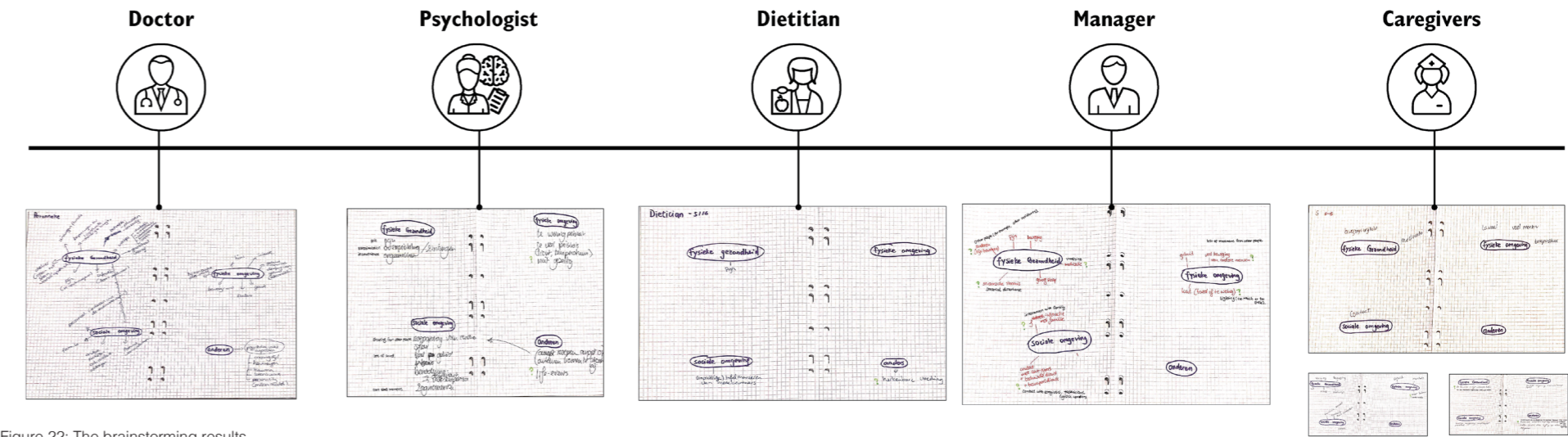
Figure 22: The brainstorming results

With doctor

Physical health: pain

Physical environment: odor, movement, the outside

Social environment: family members, family of others, staff

With psychologist

Physical health: pain, senses, over stimulation

Physical environment: movement, the outside

Social environment: family members

With dietitian

Physical health: pain

Social environment: unpleasant table manners of fellow residents

With manager

Physical health: pain, sleep, sensorial disturbance

Physical environment: sound, movement, light

Social environment: family members, caregivers

With caregivers

Physical health: sleep, medication, food

Physical environment: sound, furniture, weather, temperature

Social environment: family members

Thematic analysis

Before the brainstorming session, we primed the participants with showing them the data collected by IPS. Then, after the brainstorming sessions, we conducted the interview with caregivers and staffs, asking them to explain their brainstorming results to us, and then based on their answers to asked them further questions related to the BPSD. Then a thematic analysis was done combining the brainstorming results and the interviews. And we defined the factors which can influence PwD's complex behavior. The results are presented in the following Figure 23.

Factors

Personal

Emotion state --------- Unfamiliarity --------- Stress --------- Confusion

Unmet physiological needs --------- Wrong diet --------- Hunger and overeat --------- Lack of movement --------- Lack of sleep --------- Toilet needs

Mismatch between functional ability and performance --------- Movement freedom --------- Break of routine

Environment

Light ------------- Not enough to see clearly

Noise ------------- Unsuitably low --------- Unsuitably high --------- Echo

Temperature ------------- Unsuitably low or high

Crowdedness ------------- People walking in the surroundings --------- Staying by oneself in a room

Smell ------------- Unpleasant smell

Weather ------------- A sunny day is preferred --------- Bad weather has a negative influence

Interior decoration ------------- Match personal identity

Social environment

Caregiver demeanor --------- Proactively interact with PwD --------- Inform PwD about what will happen

Family visit --------- The contrast during and after the family visit --------- Tiredness after family visit --------- Family member could give more rules to PwD

Other staff visit --------- Normally do not interact with PwD

Fellow residents ------ Realizing oneself is different from others ------ Dislike the behaviors of other residents ------ Physical closeness are normally negative

Figure 23: The thematic analysis of factors influencing BPSD

3.1.5. Stakeholder map for people with dementia

Based on the first field study, we found that it was difficult to communicate directly with people with dementia from the ward we visited, because most of them are in the moderate or advanced stages of their dementia, besides they also exhibit BPSD. Therefore, we decided to turn to the relevant stakeholders for our further research. And according to Claudia et al.'s study, they found that people with dementia reported fewer needs compared with the reports of their caregivers and the professionals when the researchers trying to find out the umen needs of PwD. Therefore, they believe that it is important to consider all perspectives and involve all the relevant stakeholders when making care plans (Claudia et al., 2013).

Before we do further research with the stakeholders, a map (see Figure 24) was created to give us an overview about who are the relevant stakeholders. Then, manager, doctor, dietitian, psychologist and caregivers are selected to be our following interviewees and more researches were done with them.
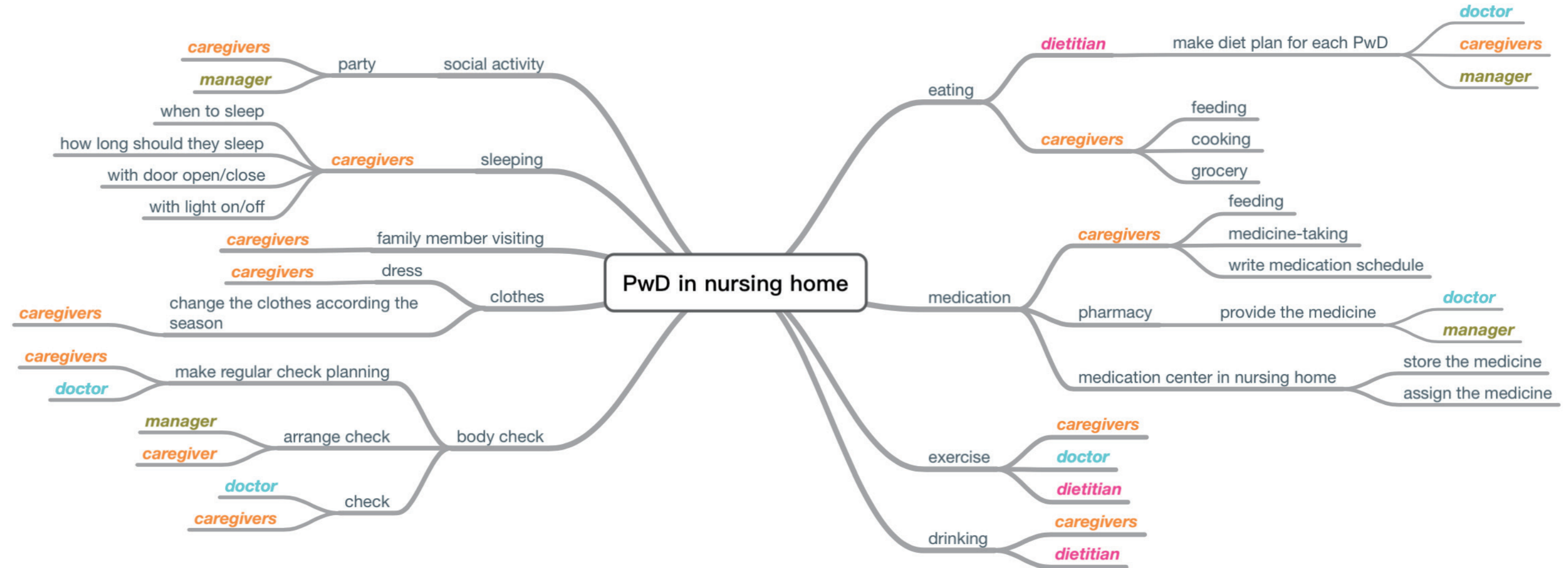
Figure 24: The stakeholders map for PwD

3.2 DIFFERENT STAKEHOLDERS

After defining the five most relevant stakeholders for this project, we conducted several interviews with them in order to gain more insights. For caregivers, observations were applied to get an overview of their daily working routine.

The interviews were semi-structured, making use of an interview guide. Notes were taken by the researchers during the interview, and each interview was audio recorded under each interviewee's permission for further transcript.

We first presented the data we collected through IPS for each stakeholders, and asked them to reflect on those data. Then guided by the interview guide, we asked them further questions.

3.2.1. Interview with caregivers

Several caregivers were interviewed, and two caregivers were observed during their working shifts.

Figure 25 - 28: Interview with caregivers

Three roles

There are different roles for caregivers, including kitchen, nursing and activity. Caregivers who are responsible for kitchen shift will stay in the kitchen most of the time cooking breakfast and dinner for the clients, while nursing caregivers will washing for the clients and prepare medicine for them. Caregivers who in charge of activity will take clients outside and organize some social activities with clients.

Daily work

Two observation sheets were created by following two caregivers' daily shift. Based on the observation sheet, I better understood the work routine of caregivers, and the relationship between nurses and people with dementia. Figure is the observation for morning shift, and Figure is for afternoon shift.

In general, caregivers need to deal with multiple tasks during their shift, which causes them to face high-intensity work every day. And during their working hours, medication and meal time are the busiest time for caregivers.

When caregivers taking the morning shift, they will gather together to talk about each client's situation during the night. While for afternoon shift, there is no such discussion. Caregivers tend to communicate with their colleagues when the client gets agitated, and this is also the time caregivers feel most stressed. More details can be seen in the following two figures.

Maartje / morning shift

Time

| 07:40 | 07:41 | 07:43 | 07:46 | 08:05 | 09:15 | 09:19 | 09:27 | 09:30 | 09:34 | 09:40 | 10:35 | 10:40 | 11:00 | 11:15 | 11:30 | 12:10 | 12:20 | 12:23 | 12:30 | 12:35 | 12:37 | 12:40 | 12:42 | 12:49 | 12:53 | 13:00 |

Location

| living room | room 1 | pantry | room 1 | living room | room 9 | room 1 | living room | office | room 3 | living room | special toilet | living room | office | living room | living room | living room | room 6 | corridor | living room | room 1 | living room | room 10 | living room | room 3 | living room | living room |

Activity

| 1. start working 2. preparing drink | 1. bring medicine | 1. prepare to wash the elderly 2. get the glove and tower 3. shave | 1.choose clothes 2.prepare shampoo & shoes 3. shave 4. wipe the body 5. get dressed 6. change diaper 7. get agitated | prepare the breakfast | help elderly eat breakfast | Maartje goes back to continue her work: 1. change the clothes 2. wipe body for elderly 3. cleam the bed 4. tide the bed | take the dirty dishes to the living room | check the medicine schedule & prepare medicine for room 3 | feed medicine with drink | 1. chat with her colleagues 2. order supplies | help the elderly to go to the toilet | come back to continue ordering the supplies | 1.check the agenda 2. check the email | accompany with elderly together with other caregivers | lunch with other caregivers | prepare 'dinner' for elderly | bring dessert to the elderly | prepare 'dinner' for elderly | cleam everything with other caregivers | 1. bring the dessert to the elderly 2. tide the toy | prepare yogurt | 1. bring the yogurt 2. the elderly get agitated 3. try several times, and when some signal show up, she quits and leaves | talk with colleagues about room 10's agitation | take elderly to his room to rest with one colleague | chat with her colleagues | write the agenda |

With whom

| other caregivers | people with dementia | people with dementia | people with dementia | other caregivers | people with dementia | people with dementia | other caregivers | alone | people with dementia | other caregivers | people with dementia | other caregivers | alone | people with dementia | other caregivers | alone | people with dementia | alone | other caregivers | people with dementia | other caregivers | people with dementia | other caregivers | people with dementia | other caregivers | alone |

Mood

| ☺ | | ☺ | ☹ | | | | | | | 😐 | | 😐 | | 😐 | | ☺ | ☺ | | | | | ☹ | | | | |

Memo

| morning shift meeting — they are discussing what happened during last night | | | because Maartje is a bit early, the elderly gets agitated. Maartje goes outside to take the breakfast, trying to comfort him. But it's not working, so Maartje has to stop and come to room 1 later. | communication — Maartje tells her colleague about room 1's agitation behavior | while the elderly is eating breakfast, Maartje will cleam the room and tide the bed, change the bed sheets | when Maartje comes back to room 1, the elderly already dressed himself and eat the breakfast. | | | | everyday, they will order the breed, and every three weeks, they order other supplies, such as butter, cheese. | because the elderly is in the toilet alone, when he finished, he just screams very loudly. | | | | | | the elderly needs to eat at her room, because she will eat everything she sees. | | | | | when room 10 gets agitated and she starts beating the caregivers, they usually will quit and wait for a while. | communication — Maartje tells her colleague about room 10's agitation behavior | | communication — Maartje tells her colleague about room 10's agitation behavior | |

Figure 29: Observation sheet for morning shift

Amanda / afternoon shift

Time	15:30	15:44	15:50	15:53	16:00	16:05	16:20	16:23	16:30	16:32	16:41	16:47	17:00	17:15	17:20	17:25	17:30	18:10	18:16	18:20	18:31	18:35	18:40	18:42	18:45	19:30
Location	living room	pantry	main hall reception	office	room 1	room 10	living room	room 10	living room	office	room 2	office	living room	room 6	living room	room 2	living room	office	room 4	living room	room 8	corridor	room 2	living room	living room	living room
Activity	1. drink tea 2. chat with colleagues 3. cook soup	chat with her colleagues	chat with receptionist	1. check files 2. print files	1. bring water 2. chat with the elderly's son 3. take spoon	bring water	1. cleaning 2. chat with her colleagues	bring soup and coffee	cleaning	1. check the medication schedule 2. prepare medecine	bring water/ medicine/soup	1. check the schedule again 2. prepare medicine	bring medicine	bring medicine	chat with her colleague	1. bring medicine 2. the elderly gets agitated 3. ask her colleague for help	eat dinner with her colleagues	1. organize the medicine 2. prepare the medicine	bring medicine	cleaning	1.move the table out 2. make the elderly sleep	chat with her colleagues	bring cake to the elderly	1. drink water 2. chat with her colleagues	doing the report in front of the computer	1. finish the report 2. take the elderly to his room
With whom	people with dementia	other caregivers	people with dementia	people with dementia	people with dementia and their family member	people with dementia	other caregivers	people with dementia	alone	alone	people with dementia	alone	people with dementia	people with dementia	other caregivers	other caregivers people with dementia	other caregivers	alone	people with dementia	other caregivers	other caregivers people with dementia	other caregivers	people with dementia	other caregivers	alone	people with dementia
Mood	🙂	😐	😐	😐			🙂	😐		😐	☹		😐	😐	🙂	☹	🙂	😐	😐			🙂		🙂		
Memo										from 16:30 until 17:30, Amandastarts give people with dementia medicine. some is in their room, and some is in the living room.	from 16:30 until 17:30, Amandastarts give people with dementia medicine. some is in their room, and some is in the living room.	from 16:30 until 17:30, Amandastarts give people with dementia medicine. some is in their room, and some is in the living room.	from 16:30 until 17:30, Amandastarts give people with dementia medicine. some is in their room, and some is in the living room.	from 16:30 until 17:30, Amandastarts give people with dementia medicine. some is in their room, and some is in the living room.	from 16:30 until 17:30, Amandastarts give people with dementia medicine. some is in their room, and some is in the living room.	from 16:30 until 17:30, Amandastarts give people with dementia medicine. some is in their room, and some is in the living room.	from 16:30 until 17:30, Amandastarts give people with dementia medicine. some is in their room, and some is in the living room.			**communication** Amanda tells her colleague about PwD's agitation behavior		**communication** Amanda tells her colleague about PwD's agitation behavior				

Figure 30: Observation sheet for afternoon shift

Current working system

Currently, the caregivers work with three main systems, one is the medical checking system integrated in the iPad (see Figure), they use it every day to check every client's medication plan; second is the daily report system (see Figure) in their computer, they use it when they finish their shift to write down the daily situation for each client; and the third system is the food ordering system (see Figure) integrated in the tablet, they use it once a week to order the grocery for the ward.
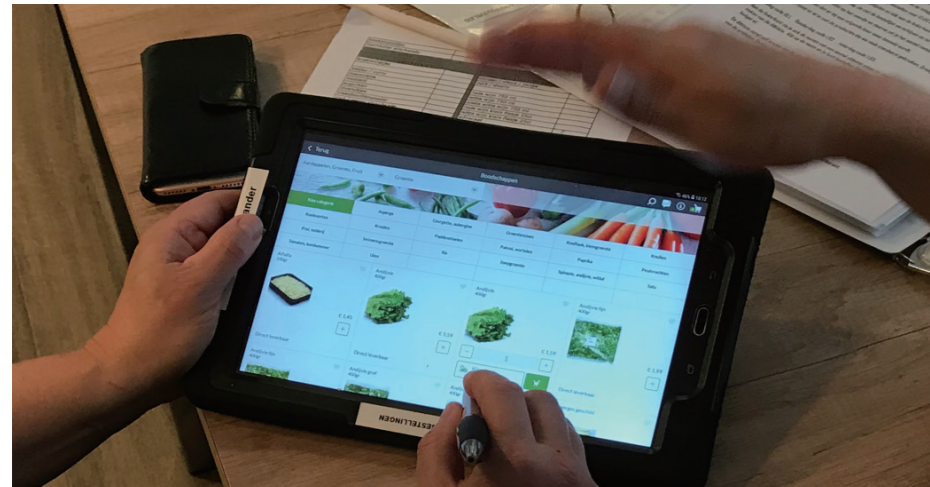
Figure 31: Food recording system

Food ordering system

They think the food ordering system is quite easy to operate, because each food comes with a picture, and they can order everything in the system.
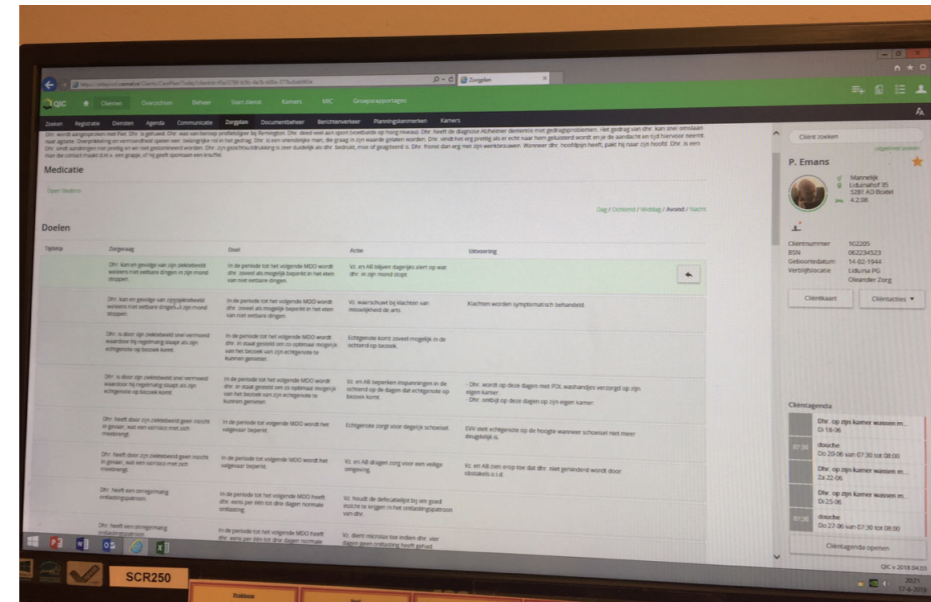
Figure 32: Report system

Report system

Caregivers mainly use qualitative data to describe each client's daily situation, sometimes the report can be very short. And they think the report system is a bit annoying because it doesn't have an overview, if they want to know the general information about each client, they have to click every report and read it.

Figure 33: Medical system

Medical system

Caregivers think the iPad is very handy, because they can carry the iPad with them to check the medicine for each client.

Figure 34: Signalering plan

Signalering plan

The signalering plan is used to describe people with dementia's status, which has four phases, green, yellow, orange and red. From green to red means that PwD is restful and happy to very agitated and restless.

3.2.2. Interview with dietitian

Figure 35: Interview with dietitian

Daily work
Dietitian only works 6 hours per day, but she is responsible for over 40 clients, including the clients from other wards. Therefore, she only updates the diet plan for the clients once a month, and normally, she won't change the whole plan.

Current working system
Sometimes, dietitian will ask caregivers to record certain clients' daily eating for several days, therefore the specific food-recording system will be provided to the caregivers, and dietitian will adjust the diet plan according to the record. Figure 36 is the special food-recording system used by both dietitian and caregivers.

Figure 36: Special food-recording system

Reflect on the IPS data
--- Dietitian thinks that only part of the data is relevant to her work, and she only cares about the long-period data.

--- Dietitian thinks that she can use the data to do some calculations in order to help her make diet plan.

3.2.3. Interview with manager

Figure 37: Interview with manager

Daily work
The manager is responsible for the caregivers' working shift schedules and the ward's funding, she is also in charge of the communication with clients' family members.

Once a week, she will attend the regular meeting with caregivers, doctors and psychologist to discuss each client's situation. And all the data she got is qualitative, she can also read the report made by caregivers.

Reflect on the IPS data
Manager thinks the IPS data can be quite beneficial for her work. Several insights are given:

--- Use IPS to get the quantitative data, therefore she has the prove, and she can use it to apply the funding for the ward.

--- She can use the IPS data to arrange caregivers' shifts, release their burdens and make them work more efficiently.

--- However, she found that the current interface is not very user-friendly, and the data she need is not directly presented on the system.

3.2.4. Interview with doctor and psychologist

Since the doctor and the psychologist are a team, they share the same data and work together for the most of the time, therefore we choose to interview them together.

Figure 38: Interview with doctor and psychologist

Daily work
The doctor and psychologist will have meetings with the caregivers twice a week at a regular time. Every Monday, only the doctor, psychologist and the caregiver will attend the meeting, they will discuss about the clients' situation in health aspects. And on Tuesday, there is another meeting to discuss more general situation about each client, and the manager will also attend.

Current working system
Doctor and psychologist are working with a similar system as caregiver's reporting system (see Figure 39), and those two systems are connected. Doctor can share information with caregivers and also read caregivers' daily report.

Similar to the reporting system, doctor and psychologist do not receive any quantitative data from caregivers, and sometimes the information they got is quite limited.
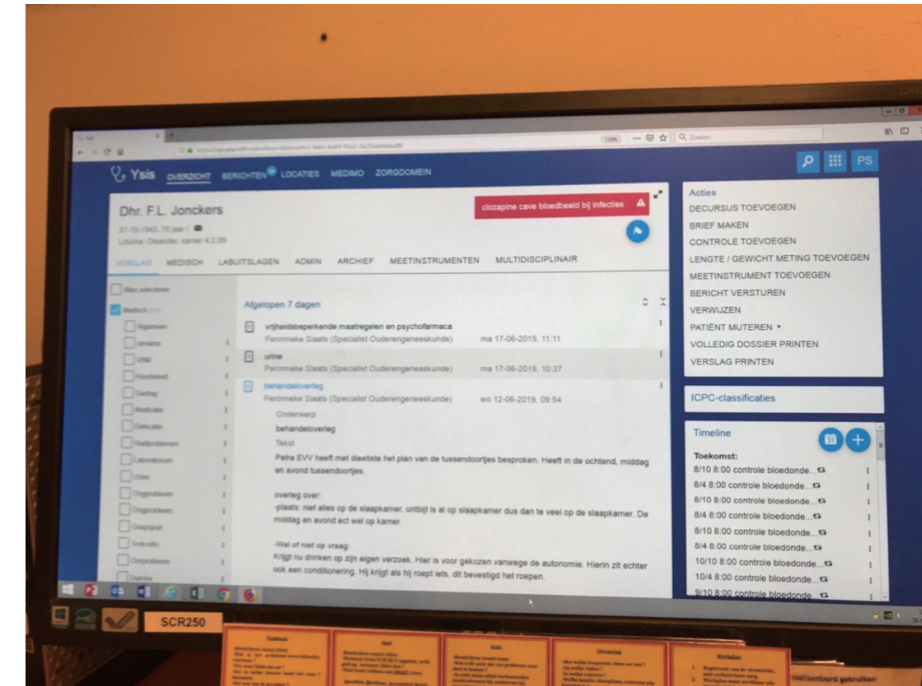
Figure 39: working system for doctor and psychologist

Reflect on the IPS data
--- They think the IPS data can help them indicate client's agitation behavior, therefore, they can take some preventions.

--- They think the IPS can also help them to identify clients' pattern or preference.

--- They also see the potential that IPS can help them notice the changes, both behavioral and physical health, of the clients on time.

--- However, like the manager and caregiver, they still do not know how to implement the data with their daily work.

3.2.5. Conclusion

People with dementia
--- People with dementia who exhibits BPSD have very different characteristics, for instance, some can be very apathy, while others can be quite emotional.

--- It's hard to design directly for this group of people since their brain were so damaged that they can't communicate or express their needs to the designers.

--- People with dementia's behavior in certain way is predictable, but the changes of their behavior are often not noticed in time by the caregivers.

Caregivers
--- Caregivers currently do not have any quantitative measurements to record clients' behavior, and they think the IPS can provide data to assist their daily work.

--- It's hard for caregivers to recall all the things happened during their shift, therefore some important information will miss in their daily report.

--- Caregivers currently are working with several different systems. It's a bit annoying for them to switch the system.

Dietitian
--- Dietitian only cares about the long-period data, since she has limited time working for this ward, and she only cares about the information related to food consumption.

--- Dietitian wants to have more detailed information about the food-record, which requires minimal work of the caregivers.

Manager
--- Manager wants to have a better way to arrange caregivers' shift.

--- She also wants to have data prove to evaluate the ward's work.

Implication for design
--- It's necessary for caregivers to have a personalized care plan for each client.

--- The stakeholders around the PwD can be a starting point for the design.

--- Quantitative data can track PwD's behavior and define the patterns of their behavior.

--- The factors defined as influencing PwD's complex behavior can be used as a predictor to prevent their agitation behavior.

Implication for design
--- IPS can provide quantitative data to record each client more precisely, and also use this data to help caregivers better reflect their work as well as their daily report.

--- It's better to integrate IPS data with their current working system.

Implication for design
--- New system should provide the most relevant information for dietitian to help her make diet plan for clients, and also improve her work efficiency.

--- Digitalize the food-record file, and make the operation easy and simple.

Implication for design
--- New system should let manager know how much care each client received in quantitative data format, and how the data changes.

Doctor and psychologist
--- Doctor and psychologist only get limited information from the caregivers, and most of the data they have is qualitative and subjective.

--- There are limited materials for them to prepare the regular meeting, and the messages they delivered during the meeting sometimes were missing.

Implication for design
--- New system should build a better communication channel among those stakeholders.

--- New system should provide more objective and detailed information for doctor and psychologist.

CHAPTER 4

DESIGN BRIEF

4.1 DESIGN GOAL

Based on the design brief of my project, the goal for the design
phase is presented as follows:

" *Designing a new system to improving the care service*
for people with dementia who exhibits BPSD by using
IPS data insight, Supporting the works of relevant
staffs contributes to the care service. "

4.2 DESIGN REQUIREMENTS

Insights were gained during the research phase which leaded to the design requirements for this goal. All the requirements are listed.

Personalized care plan

People with dementia who exhibits BPSD share very different characteristics, as presented in user profile, chapter 5. Therefore, one patient's behavior can vary from other's a lot. In order to provide good care service for every client, the plan should be tailored according to their behavioral characteristics.

Involving relevant stakeholders

In order to provide good care service for each client, it's necessary to involve all the people who are currently serving for this target group, as showed in stakeholder's map, chapter 5. By improving supporting their work and improve their working efficiency, the clients can get better care. Therefore, it's also important to enhance the connection between all the stakeholders, making the communication easier.

Integrated with current system

Currently, caregivers and other staffs already work with several different systems, as presented in interview with different stakeholders, chapter 5. For the new system, it should be integrated with the current working system to reduce the requirements of extra work for stakeholders to encourage them to use.

Combination of quantitative and qualitative data

IPS can generate quantitative data, while explanations are needed for this data. Therefore, it's necessary to combine the quantitative data with qualitative data which can be provided by their current working systems. And the combination of the data can present a more holistic view of the clients' situation.

CHAPTER 5

DESIGN PROCESS

5.0 INTRODUCTION

This chapter describes the design process of the project. The ideation starts with the brainstorming sessions with 5 important stakeholders, doctor, psychologist, manager, dietitian, and caregivers, then several features were generated after the brainstorming. And some of the features were chosen to make the first prototype. To optimize the design, three prototype iterations were performed, and this resulted in the final result in a final layout of the design.

Idea 1
Idea 2
Idea 3
Idea 4

Design brief   Brainstorming   Prototype development   Iteration 1   Iteration 2   Iteration 3   Final concept
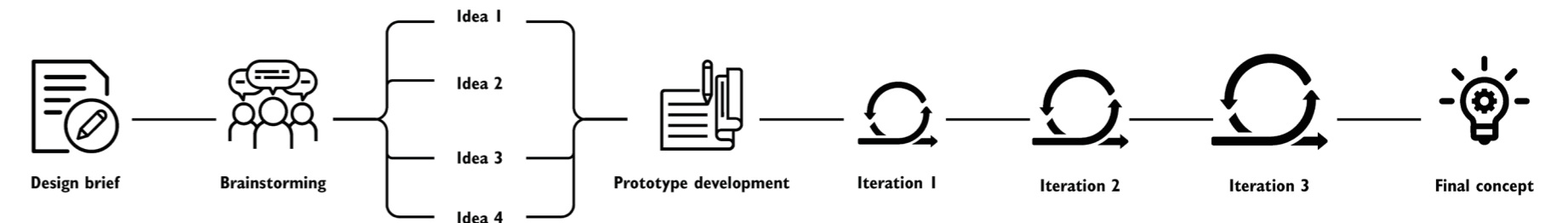
5.1 IDEATION

5.1.1. Brainstorming

A brainstorming session was performed in order to gain insights about what kind of information they (doctor, psychologist, dietitian, manager and caregiver) want to know about people with dementia based on the IPS data. And then, we asked them to draw some ideas of how they want to the information been presented in their daily work. Then details about the brainstorming session can be seen in the appendix. And after analyzing the results generated by the stakeholders, we got several ideas.

Idea 1
They want to quantify the behavioral or emotional changes of people with dementia. And possible features inspired by them are presented:

--- Record the travel distance changes of the caregiver per client

--- Record the client's wandering distance changes

--- Record the frequency of caregivers go into client's bedroom

--- Record people with dementia's travel speed changes

Idea 2
They want to know how people with dementia interact with the environment, and how the environment influences their behavior. And possible features inspired by them are presented:

--- Measure the temperature, humility and brightness of each room

--- Figure out the preference for each client

Idea 3
They want to evaluate their treatment as well as their care service. And possible features inspired by them are presented:

--- Record the frequency of the client's agitation behavior

--- Record the client contact time
(client contact time can be divided into direct or indirect client time. Direct client time is the time when caregivers stay with people with dementia or do something that is directly related to the clients, such as cooking and taking medicine. Indirect client time is the time when caregivers are doing preparation work, such as cleaning, writing report and having meetings.)

Idea 4
They want to make their daily work more fluently and efficiently. And possible features inspired by them are presented:

--- Improve caregiver's daily report

--- Help caregiver to locate the client

--- Stakeholders can communicate through online platform

All the ideas were assessed together with the possible features under each idea, using the design requirements (see chapter 6) as well as considering the feasibility of the technology.

Due to the limitation of the technology, idea 2 was temporarily excluded. And idea 1, 3 and 4 were combined into a new design idea with selected possible features.

5.1.2. Concept generation

The new idea aims to use IPS data to quantify the behavior of each client in order to improve the care service, help staffs evaluate their work and optimize their efficiency.

And the features selected for this idea are listed as follows:

--- Record the travel distance of the clients

--- Record the travel speed of the clients

--- Record the client contact time

--- Improve the report system

--- Stakeholders can communicate through online platform

5.1.3. Prototype development

The first version of the new system was created, which has four main interfaces.
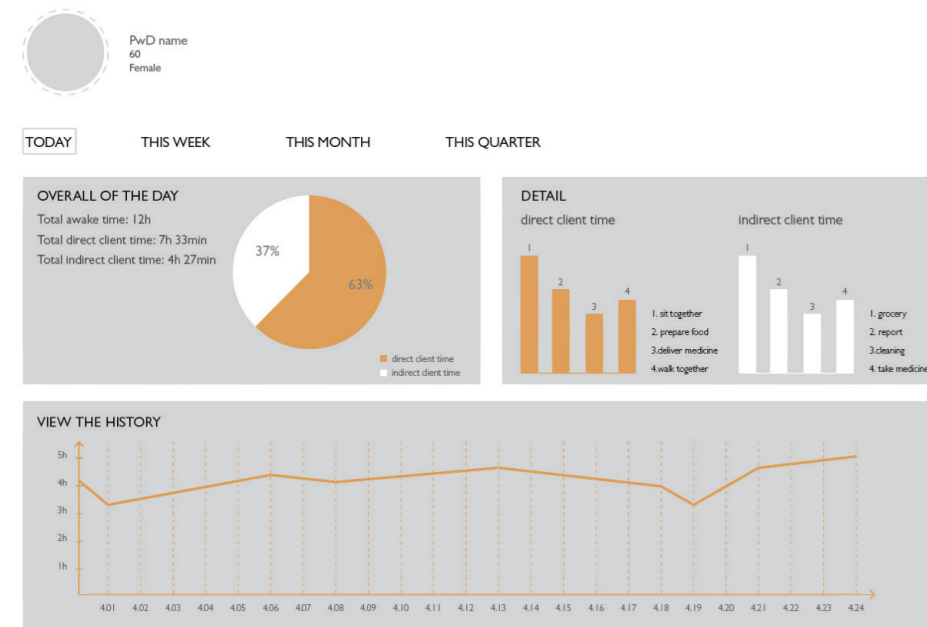
Interface 1 - client contact time

Figure 40: Interface 1

This is the interface that users can check how much contact time one client has received. There are four time periods users can choose, today, this week, this month and this quarter. When user changes different time period, the data will change. Currently the interface shows the daily data.

On daily data interface, users can first get an overview of the day presented in a pie chart form. They can see the percentage of the direct and indirect client time for this patient. And how the direct and indirect client time divided into different tasks are presented in bar chart. At the bottom, users can see the history of how the direct client time changes over the past days, which presented in line chart.

Interface 2 - travel distance
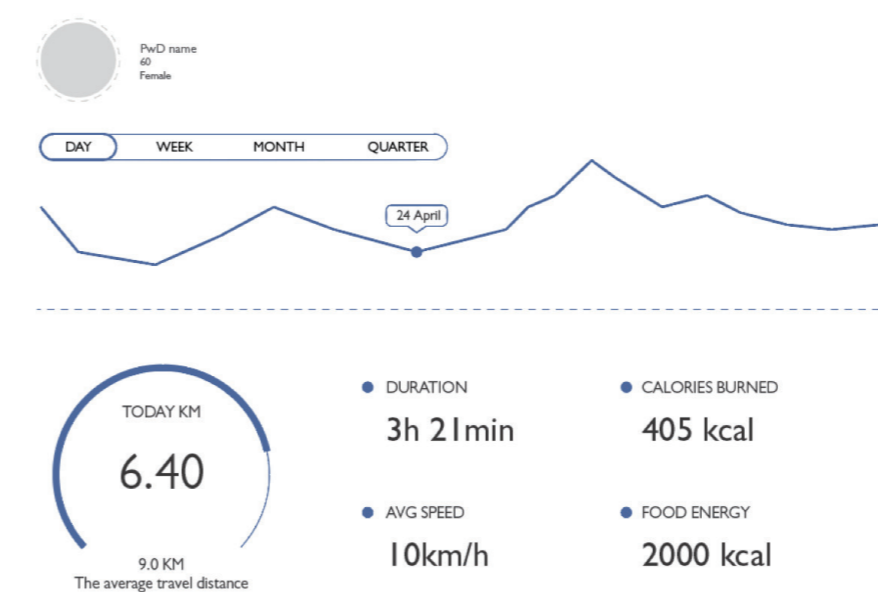
Figure 41: Interface 2

This is the interface which users can check travel distance for the client. Similar to the interface 1, there are also four time periods users can choose, today, this week, this month and this quarter. Currently it's daily interface.

On the top is a line chart shows the trend of client's travel distance. On the bottom, users can see the detail information about today, such as total travel distance, the average travel distance of the week, total travel duration, today's average speed, today's calories burned and today's food energy in-take.

Interface 3 - communication interface

ANIMATION

Amanda/08:30 - 16:00
Notes:

Maartje/13:30 - 22:00
Notes:
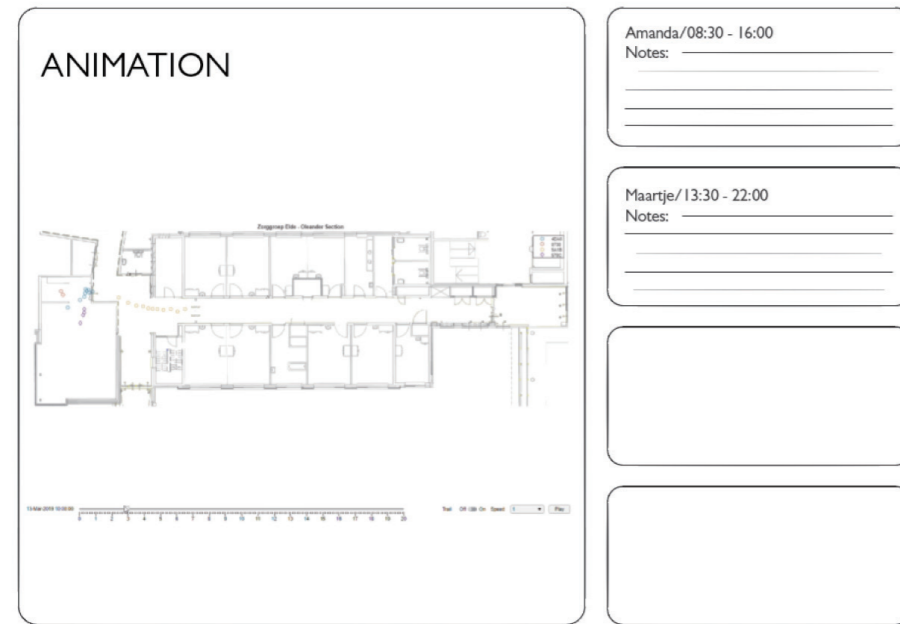
This is an interface for all the staffs communicating about the client and also help them to recall their daily work. This animation can directly be generated by IPS which shows the real-time movement of the clients and the caregivers.

Users can choose to see certain person's movement by clicking different tags, and also speed up the animation if they don't have enough time.

When looking at the animation, uses can write down anything if they find this is very important for others to look at or if they want to ask a question. And other users can reply their questions or make their own notes. All the stakeholders can see those notes.

Interface 4 - daily report

Travel distance:
5.0 km
Direct client time:
4h 50min
Agitation times:
3
PwD name
60
Female
Caregiver note

Travel distance:
6.1 km
Direct client time:
5h 30min
Agitation times:
2
PwD name
56
Male
Caregiver note

Conclusion of the day
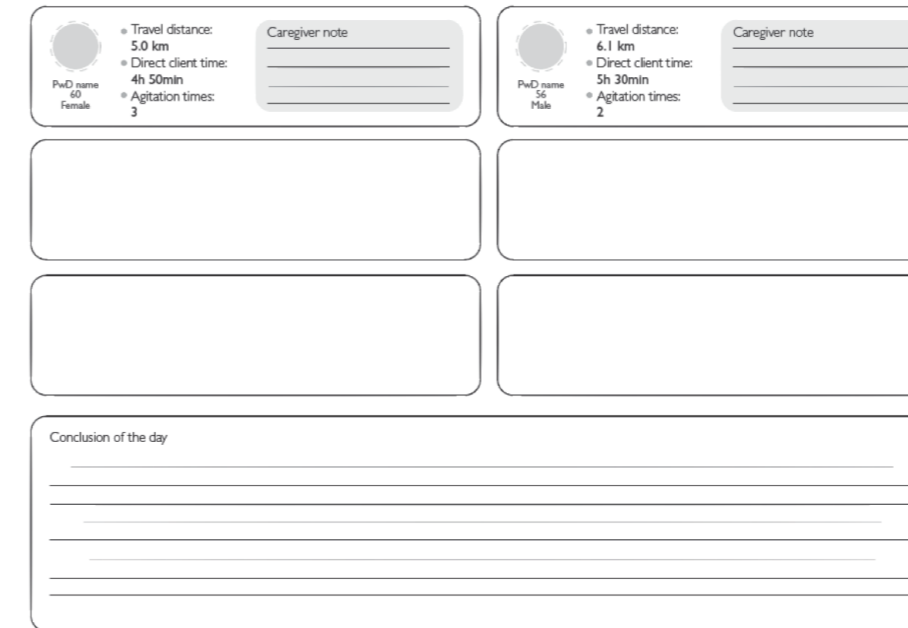
This interface is mainly for caregivers. When they are writing the report, they can first look at the notes made by others, this can help them recall their memories of the day and also give them an overview, which will be helpful for them to write a final report.

5.2 ITERATION

Three iterations were performed with all the relevant stakeholders in the nursing home. The previous two prototypes were made by papers to know more about how to improve the content, and the last prototype was tested on the iPad to give users real feeling and also to see how they will use it in their real working situation.

The same evaluation scale was applied through the whole iteration process. And we asked the users to fill in the scale after they finishing the test. Meanwhile, we also asked them why they made this choice and how we can make it to archive the double plus. The evaluation scale is presented in the following Figure 44.

Please rate the mock-up according to the following aspect.

Figure 44: The evaluation scale

5.2.1. First iteration

The first prototype was printed in A4 papers, and tested with 3 caregivers, dietitian, manager, doctor and psychologist. For the testing session, we offered each participant with pens in different colors and some blank paper together with the paper-version prototype and an evaluation scale.

Figure 45: Evaluation with caregiver

Figure 46: Evaluation with manager

Figure 47: Evaluation with dietitian
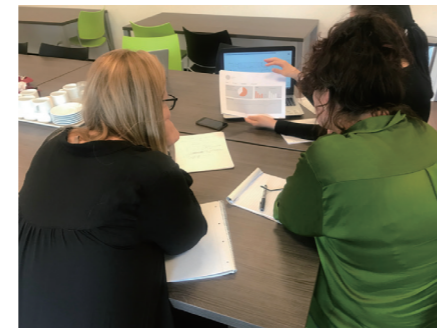
Figure 48: Evaluation with doctor and psychologist

Evaluation

How useful: all the interviewees think the prototype will be useful for their work.

How understandable: most interviewees think the prototype is very easy to understand, while only one elder caregiver thinks the prototype is a bit hard for her to understand.

How clear: most interviewees think the information presented in the prototype is very clear, except the same elder caregiver.

How related to your work: all the interviewees think the prototype is related to their daily work.

Save or waste time: most of the interviewees cannot judge if the prototype will save their time or waste their time.

Positive feedback

--- They find the prototype helps them to reflect their daily work, and they can recall their memories by looking at the animation.

--- They think the data can assist them to notice the behavior changes of the client in time.

--- They believe that they can use the system to identify the patterns of each client's behavior and preference.

--- They think this new system is related to their work.

--- They think the real data gives them the prove about their work.

The improvements for the system

--- The data collection and the operation of the new system should require no extra work for the staffs.

--- The connection between the data and their work is not very strong.

--- The data presenting is not very tailored to different stakeholders' working fields.

The improvements for the interface design

--- The interface should be in Dutch.

--- Different time-period data should be presented in different forms in order to let the users understand easily.

--- The information should be more clear, and the interface design should be more simple and user-friendly.

5.2.2. Second iteration

The second prototype was created based on the insights gained during the first iteration session. And the frame of the second interfaces is shown in Figure 49. The details of the second prototype can be found in the appendix.

Figure 49: The frame of the interfaces

The second prototype specified the different roles of the stakeholders. When users click start using the system, they should choose who are they, then the system will present different types of data tailored to their roles. Details are showing as follows:

Caregivers: client contact time, travel distance, medical schedule and the food record

Dietitian: travel distance and food record

Manager: client time and general condition

Doctor and psychologist: travel distance, medical schedule and health check

Besides, users can decide which time-period data they want to see by choosing daily, weekly or monthly data. Daily data is in text format with more details, weekly data is in bar chart format and monthly data is in line chart format.

Followed the same procedure of the first iteration session, we performed our second iteration. Most of the materials were the same as the first iteration, except a new sheet was created for the researcher to take notes about the participants' opinions of each interface. And the summarized results are shown as follows:

Positive feedback:
--- The layout of the interface is very clear and user-friendly.

--- The data types presented under different roles are very related to their work.

--- The different formats of the daily, weekly and monthly data are very distinguishable for the users.

--- The "notes" function is very useful for all the users.

--- The "black and white" interfaces are widely preferred by the users.

Improvements

For caregiver:
--- Diet check is complex.

--- Average speed is not useful, highest is more useful.

--- The graph (daily travel distance) is not clear, and hard to understand.

--- Specifying the time period of average data.

--- Monthly data can be less insightful for caregivers.

--- Weekly and daily data are more useful.

For dietitian:
--- She doesn't need daily data, preferring monthly or longer period.

--- Adding how much time people sit on the table eating

--- Regular diet check is not needed, while the food recording is only used under special circumstance.

--- The formula of the data for calories burned is needed.

For manager:
--- The general condition of the clients is hard to measure.

For doctor and psychologist:
--- The medical schedule and the health check are not very useful to put on this system.

--- It's better to add location data.

5.2.3. Third iteration

The third iteration was conducted by using the iPad (see Figure 50) in order to gain more insights on how users will use the system in real working environment. The details of the third prototype can be found in the appendix.
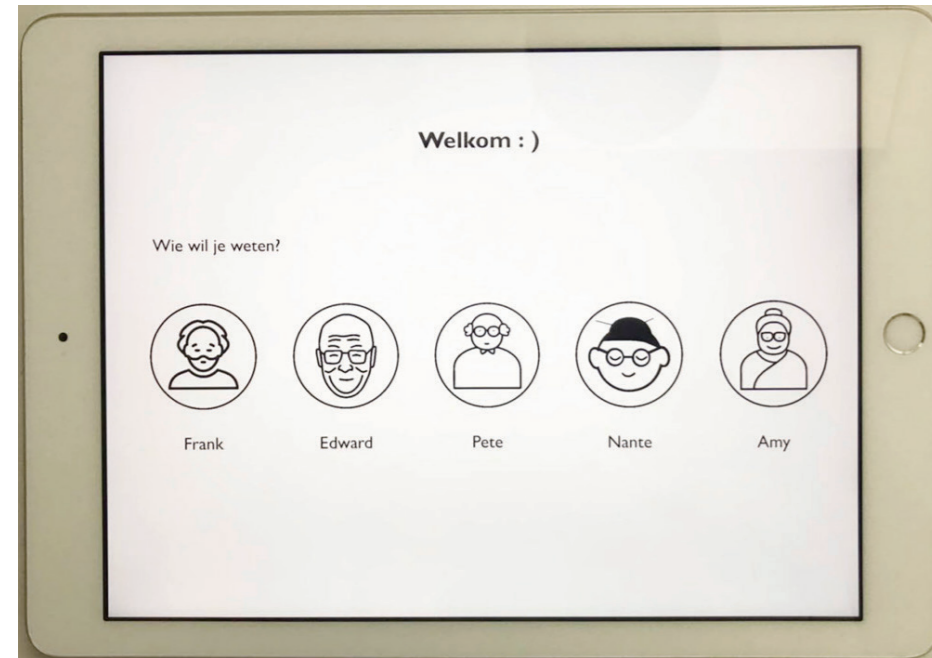

Figure 50: Evaluation using iPad

The feedbacks collected in the second iteration session were directly applied to develop the third version which is interactive. We tested the prototype in the nursing home with all the relevant staffs along with a short video to record their reactions, the details can be found in the appendix.

Combined with the evaluation scale, participants' feedbacks and the videos, I summarized the results for the third iteration as follows:

Video analysis:

The types of interactions
--- with text: Users were looking at the text carefully without physical movements (see Figure 51), the interaction time with text is the longest for all users.

--- with graphs: Users were looking at the graphs, and sometimes lifted the iPad to discuss the graph with colleagues (see Figure 52). The interaction with graphs was not long for caregivers, manager, and dietitian, while for the doctor, she spent quite a long time understanding the meaning behind the graphs.

--- with icons: Users were clicking the icons (see Figure 53). The interaction time with icons was quite short.

The frequency of each type of interaction that a user made
--- Clicking is the most used way of interaction for all the users.

--- Sometimes, users would zoom in the text or the graphs.

--- The swiping function was hardly used by the users.

--- When they discussed with their colleagues, they would lift the iPad.

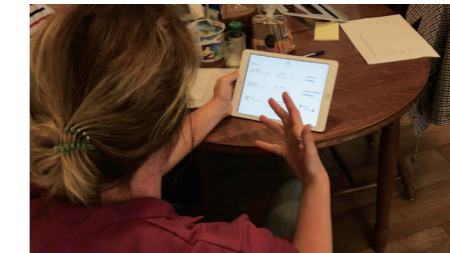Figure 51: Looking at the graphs and texts

Figure 52: Lifting the iPad to discuss

Figure 53: Clicking the icon

.**Positive feedback:**
--- All the participants have no trouble in using the prototype.

--- All the information presented are useful and important for the participants.

--- Participants think the prototype is a real APP and they arelooking forward to use it immediately.

Improvements:
--- The black buttons on each interface's top are very confusing.

--- Sometimes, users don't know how to go back to the previous page.

--- Manager thinks it would great to combine with their current signalering plan

--- Caregivers think it will be great to have a highlight for the import things in report interface.

5.3 FINAL CONCEPT

All the iteration sessions helped to develop the final concept: A new system enables caregiver, dietitian, manager, doctor and psychologist to provide better care service for people with dementia through personalized quantify data insights from each client. In this way, the system also helps them to work more efficiently.
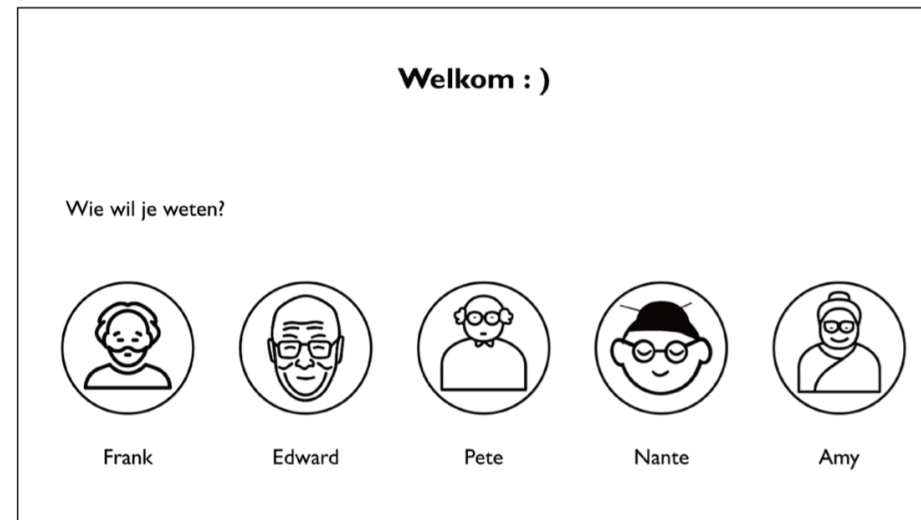
5.3.1. System features

Home page

Figure 54: Home page 1

This page is similar to their current working system's home page: the data is classified by each client. In this way, staffs can get personalized data from every person with dementia. Besides, the similarity between present system and new system will help users to adjust quickly.
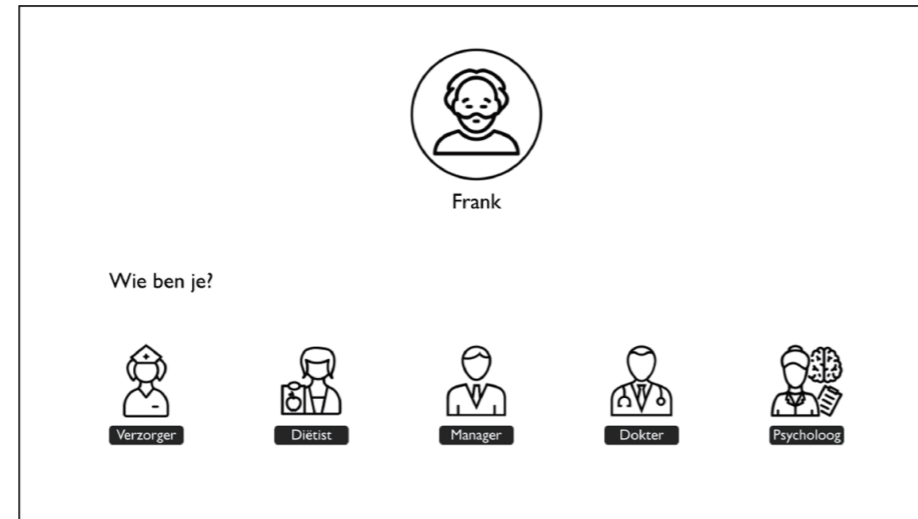
Figure 55: Home page 2

After choosing the client, users need to choose their roles. And the data types are tailored to different roles, which can save their time.

Caregiver

Figure 56 shows the new features for caregivers in the final concept after the third iteration. In this interface, caregivers can see the highlights over the week for each client, which gives them quick access to the overview.

Figure 57 shows the frame of the system features under caregiver's option. Since the caregivers found out that the data from longer period is not very insightful for them, therefore, in the final concept, only the daily and weekly data are available for them.

Caregivers can check the travel distance and the client contact time for each PwD, those two types of data will be collected by the system regularly. Daily interface has more details, while weekly interface aims to show the data's changes.

The special food record interface is an improvement for their current paper-version recording sheet (in chapter 5), which is used only under certain circumstance, for instance, when a new client comes, the dietitian will ask the caregiver to record the food consumption.

The daily report interface is integrated with their current reporting system. They can make highlights when they are writing the report, and the notes made by others will also help them to get a better overview of what happened to the client over the day.
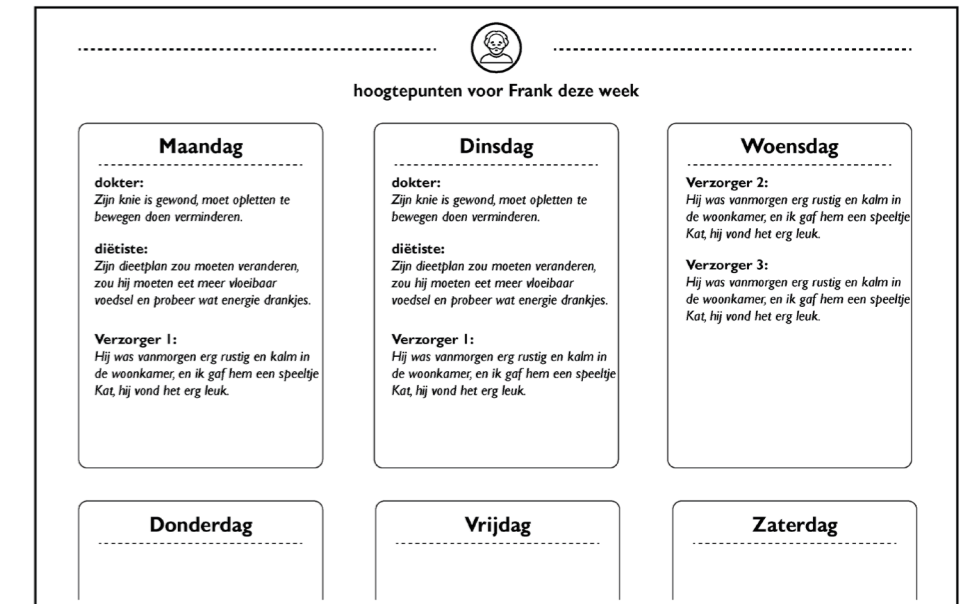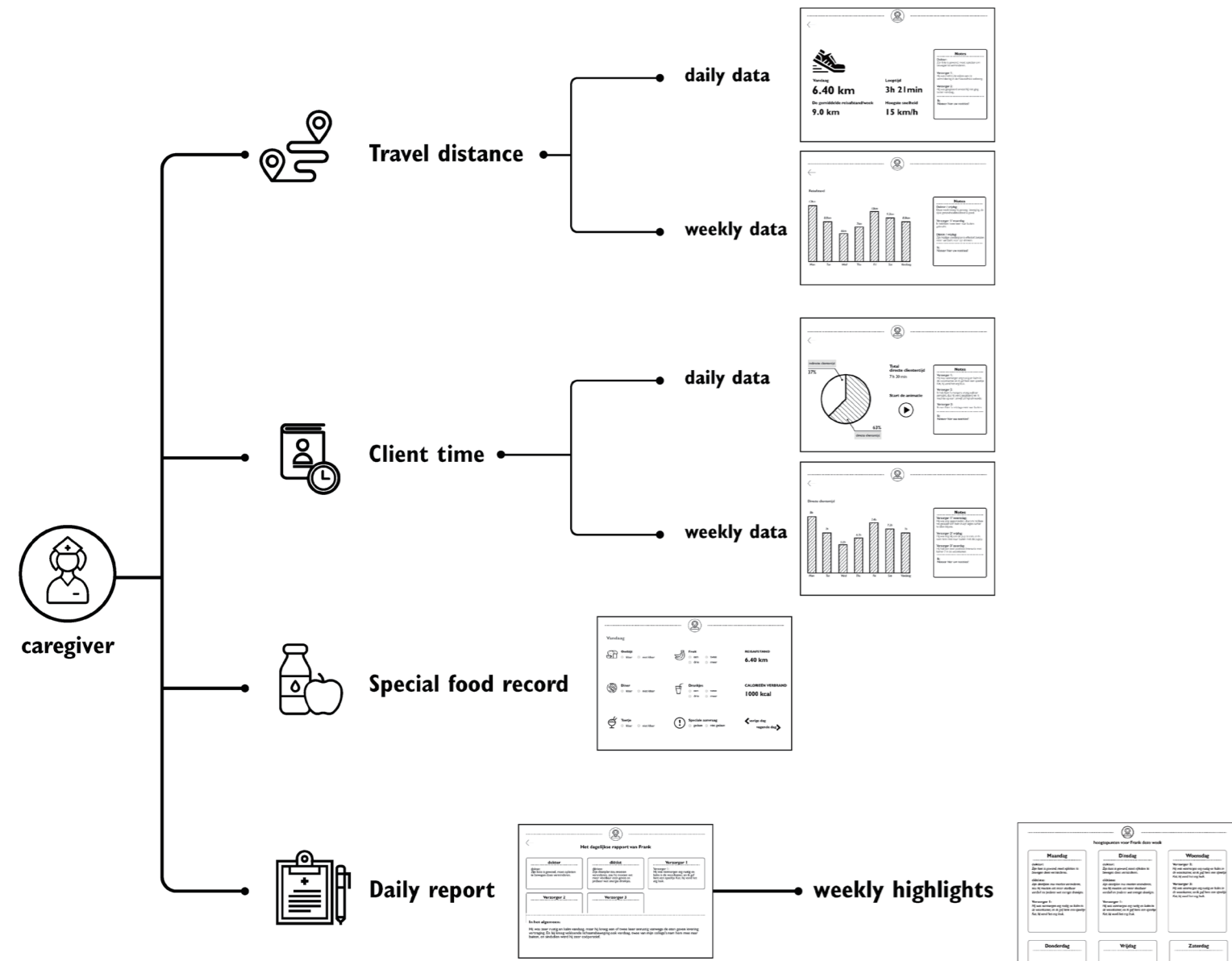

Figure 56: Highlight features

Figure 57: system features for caregiver

Dietitian

Figure 58 shows the frame of the system features under dietitian's option. Followed by the dietitian's opinion, only the travel distance and the special food record which are relevant to her work are presented to her. Unlike caregivers, dietitian cares more about the data of longer period. Thus, daily data is removed, instead, the data for half year is added.

When dietitian asking caregivers to record one client's food consumption for several days, she can see the records made by them from her interface. Besides, the formula of the calories burned of the client is also presented as she mentioned in the previous interviews.
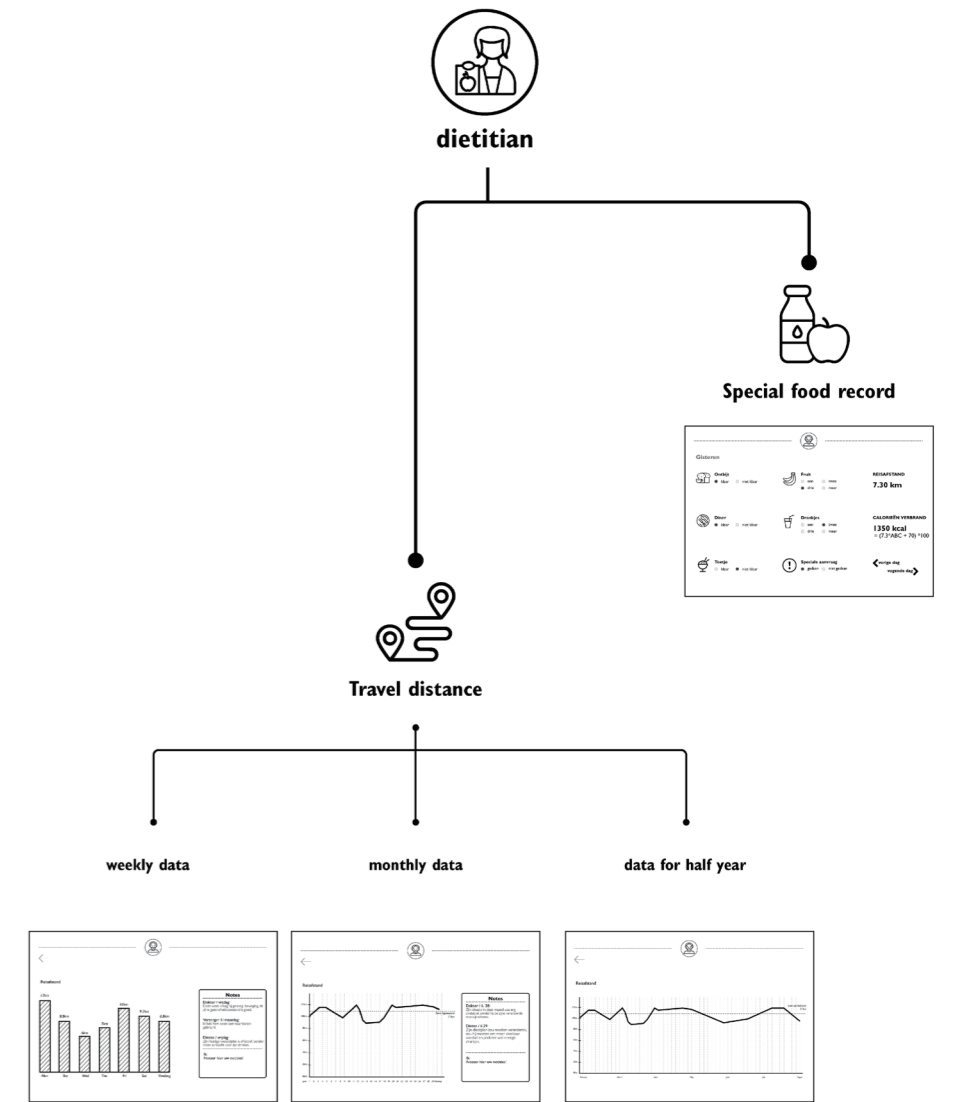
Figure 58: system features for dietitian

Manager

Figure 59 shows the new features for manager in the final concept after the third iteration. In this interface, manager can see the emotional state for each client, which combines with their current signalering plan.

Besides, only the data from client contact time is the most relevant for manager's work based on previous insights, therefore there is only one type of data under on manager's interface. The frame can be seen in the following Figure 60.

Manager can check how much direct and indirect contact time each client has received per day, and how the direct contact time changes in one week and one month. The direct contact time is more important for manager, because she can use it to evaluate the work of the caregivers and apply for extra funding.
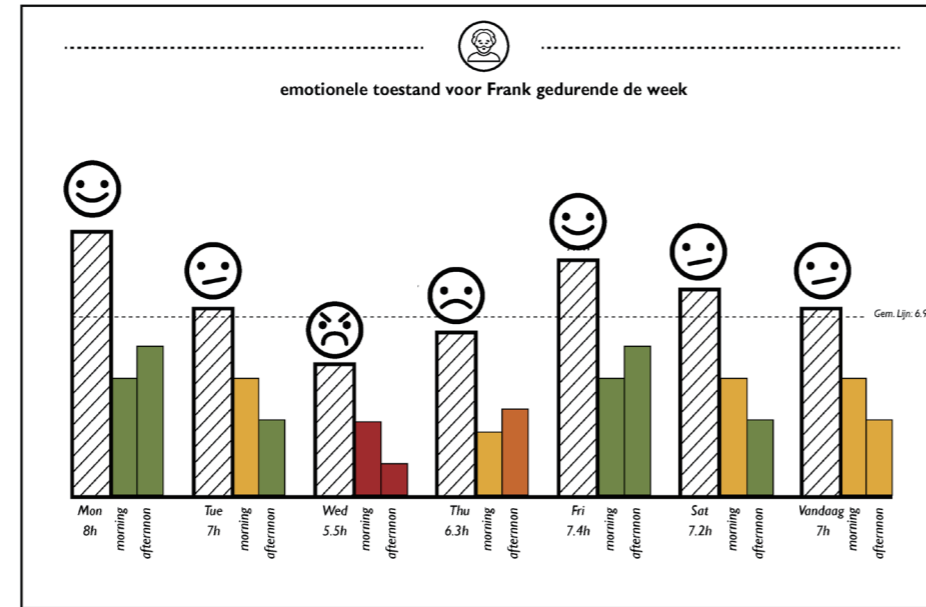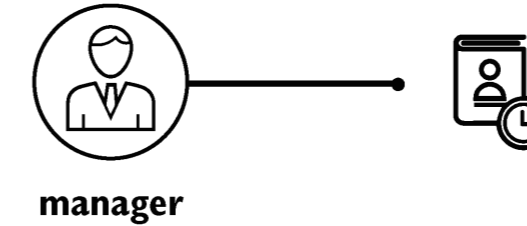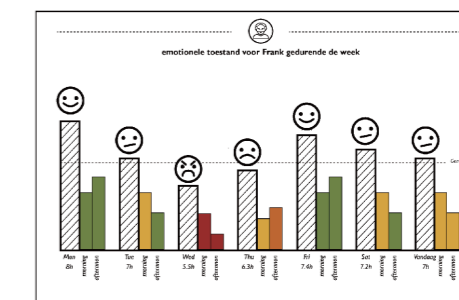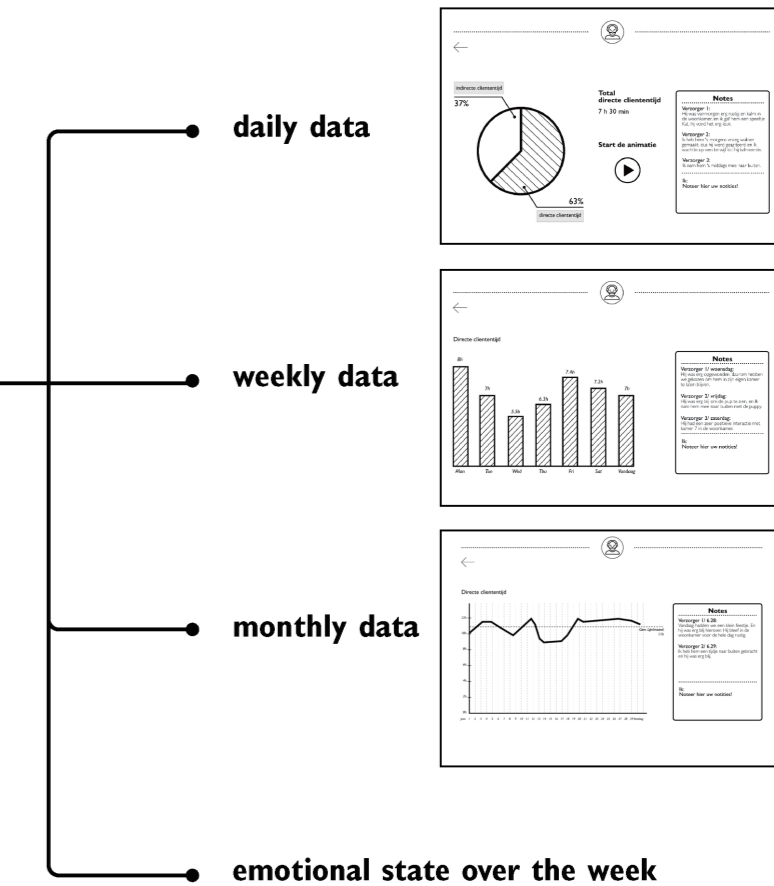

Figure 59: Feature for emotional state of PwD

Figure 60: System features for manager

Doctor and psychologist

Doctor and psychologist work as a team, sharing the same data (see chapter 5). Therefore, I put them together to describe the system features designed for them to avoid repetition. But they have the separate access to the system. The feature frame is presented in Figure 61.

Doctor and psychologist care more about clients' behavior, therefore travel distance and location data are selected for them. Travel distance indicates the client's physical movement, and location data can show the client's preference of different rooms.
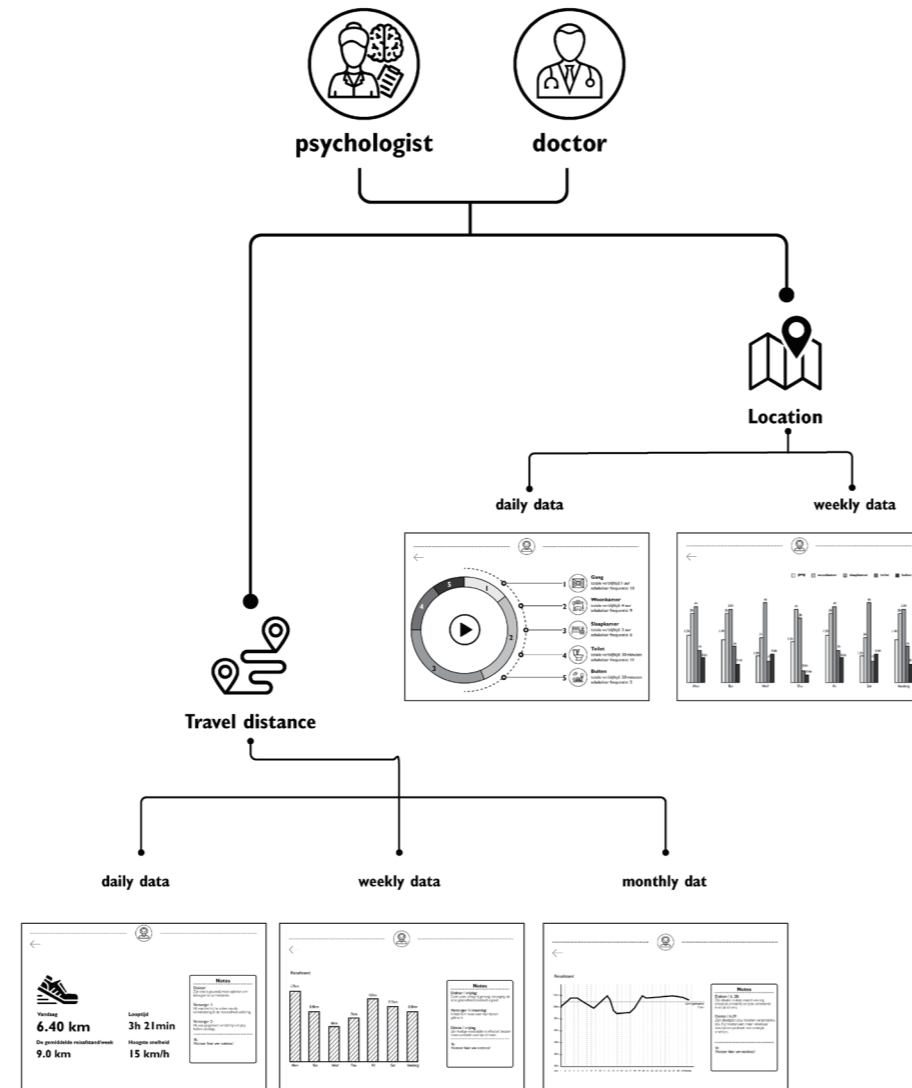

Figure 61: System features for doctor and psychologist

Common features

There are two features (see Figure 62) in the system that all the users can see in their interface.

Notes

This feature aims to enhance the communication among all the stakeholders. When they are looking at the data in their own interface, they can write down their opinions or questions about the data, and other users can see those notes from their own interfaces. They can make comments for the previous notes or they can make their own.

Animation

If the users want to know more about what happened during their working time, they can play the animation. By looking at the real-time movement of all the clients and caregivers, it will help users to recall their memories.

Besides, if the user doesn't have a clue about what's going on, for instance, the client is agitated, she can see the animation and ask someone who might know what happened before. While looking at the animation, user can also write down some notes.
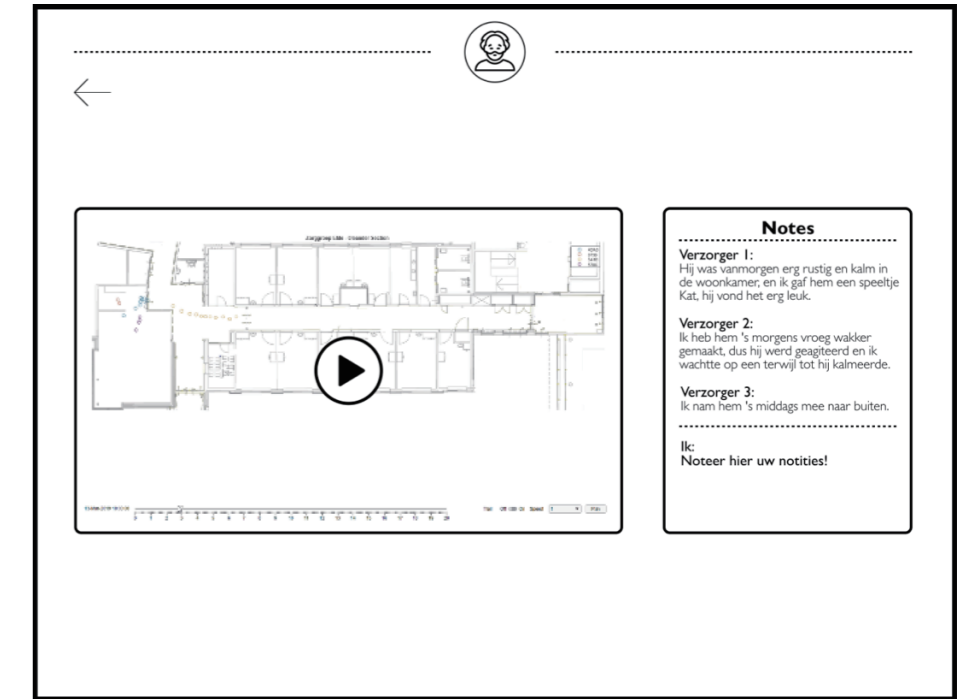

Figure 62: Two common features

5.3.2. User scenarios

The new system allows the users to work with in their daily working routine, and three different scenarios are presented to describe how the system will help them in different situations.

After a short holiday

When a caregiver comes back after a three days' vacation, she wants to know if she has missed something important in those days. Therefore, she turns on the system and goes through the report interfaces. In this interface, her colleagues have highlighted the important things of each client, therefore, she can quickly go through all the information. Suddenly, she finds out there is a note she doesn't quite understand, so she looks at who wrote the note. Then she takes the iPad to find the colleague to ask about the details.

Comparing with their current report system which separates each piece of information for one client into separate pages, the new system can give caregivers quick access to all the important information of one client. In this way, caregivers can save their time.

Figure 63: User scenario 1

Before a meeting

Today is Tuesday, and in the afternoon, there will be a regular meeting among caregivers, manager, doctor and psychologist. This time, they are going to discuss Frank's behavior over the last period to decide if there is anything should be changed for him. Doctor will hold the meeting for this time.

Two hours before the meeting, she opens the system, and goes through the weekly and monthly data of Frank. She finds that Frank traveled a lot more than before in the past week, while the client contact time is less than before. She believes that the two may be related, therefore she writes it down to be discussed in the later meeting.

Currently, there is hardly any meeting materials and no data for them to be prepared in advance. Thus, the information they received during the meeting was from the subjective opinion of caregivers. Sometimes, this information may be incomplete or misleading. The new system provides them quantify data to get prepared for the meeting in a more objective way.

Figure 64: User scenario 2

When client gets agitated

Marry (caregiver) works for nursing shift today, and this morning she spent most of time in clients' bedrooms helping them get washed. When she finished the cleaning task, she comes to the living room. She finds that Frank is very agitated right now, while he is the only one staying in the living room. Marry wants to know what happened before because when she was washing Frank this morning, he was quite happy. So she opens the iPad, and plays the animation. She finds out that 20 minutes ago, Frank, Nancy (another client) and one of her colleague were staying in the living room together. While, 5 minutes later, her colleague took Nancy out of the living room. Marry thinks Frank's agitation might be related to this, so she goes to find her colleague. Her colleague tells Marry that Nancy was shouting at Frank before, which makes Frank agitated.

The animation enables caregivers to review what happened before if they were not there at that time, which can be a good way to find out why the client get agitated.
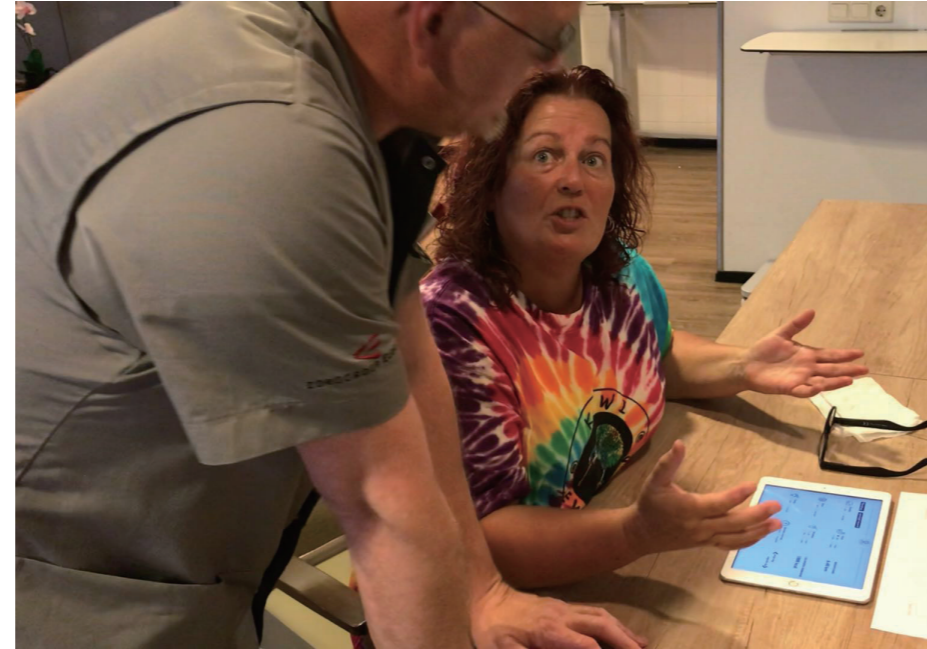

Figure 65: User scenario 3

CHAPTER 6

EVALUATION

6.0 INTRODUCTION

In this chapter, the project will be evaluated. The evaluation is divided into two parts. The first session will discuss the final concept according to the design requirements (see chapter 6). Next, the measurements for the new system' effectiveness will be provided, which can be a guideline for future evaluation.

6.1 EVALUATION FOR FINAL CONCEPT

Based on the design requirements in chapter 6, the final concept will be evaluated in four aspects.

Personalized care plan

People with dementia who exhibits BPSD share very different characteristics, as presented in user profile, chapter 5. Therefore, one patient's behavior can vary from other's a lot. In order to provide good care service for every client, the plan should be tailored according to their behavioral characteristics.

All the data collected are presented under each client, which makes sure that the information is only relevant to this client. And there are different types of data including physical movement, eating habits and social connection in the system for staffs to look at. The system enables them to select the information according to the client's conditions. In previous prototype test, we also found that the participants would choose different data according to different clients.

For instance, Frank is a person who prefers to travel a lot when he is agitated, and he also enjoys having connect with others. Therefore, the data for travel distance and client contact time will provide more insights for the staffs about Frank. While, Edward is more apathetic. He barely moves and has no interaction with others. Therefore, for Edward, the location data is more insightful than travel distance and client contact time.

Involving different stakeholders

In order to provide good care service for each client, it's necessary to involve all the people who are currently serving for this target group, as showed in stakeholder's map, chapter 5. By improving supporting their work and improve their working efficiency, the clients can get better care. Therefore, it's also important to enhance the connection between all the stakeholders, making the communication easier.

In the new system, five types of stakeholders for people with dementia are involved in, which are caregivers, manager, dietitian, doctor and psychologist. Their work covers almost every aspect of the client, such as daily life, health, behavior and mood, and the relationship between the client and the family.

By using the system, they can get more insights about the client, thereby enhancing their working efficiency. Besides, the system can also improve their communication by sharing the same data and making notes. In the end, this will help every client get better care.

Integrated with current system

Currently, caregivers and other staffs already work with several different systems, as presented in interview with different stakeholders, chapter 5. For the new system, it should be integrated with the current working system to reduce the requirements of extra work for stakeholders to encourage them to use.

The new system is embedded in the iPad that they are currently used for medication check. Thus, no new device is required to install the new system. The operation logic of the new system is inspired by their current system. Just like their current system, we separate every client's data, which makes users adjust quickly. And part of the information is transferred from their current working system, for instance the highlights from their current daily reports. The new system makes it convenient for them to get the information and requires no extra work from them.

Combination of quantitative and qualitative data

IPS can generate quantitative data, while explanations are needed for this data. Therefore, it's necessary to combine the quantitative data with qualitative data which can be provided by their current working systems. And the combination of the data can present a more holistic view of the clients' situation.

The new system provides users quantitative and objective data of each client through IPS, those data enables them to get quantify measurements about their work and the treatments for the clients, which is exactly what the nursing home is needed. Besides, next to each item of quantitative data, users can write down their understanding and meanwhile see others' notes. Combining data with their interpretations, the system can help users to draw a more complete picture of each client.

6.2 GUIDELINE FOR FUTURE EVALUATION

Due to the limited time, the system has not been fully used in this project. Since the evaluation for the system requires a certain period for users to use it, therefore, the evaluation cannot be done so far. For further development, a guideline for future evaluation is presented as follows.

Feasibility
Does the system fit their devices?
Does the system fit with their current working routine?
Is the data stable and reliable?

Usefulness
How often do they use the system?
How long they will spend on the system?
How many notes they've made per day?

Effectiveness
Under what circumstances, do they use the system most?
Do the caregivers have more time to spend with their clients?
Does every patient's report become more detailed?

Operability
How long it will take for users to find certain information?
How easy is for elder caregivers to use it?
How convenient for caregivers to make notes when they are working?

CHAPTER 7

LIMITATION

This project has some limitations. Firstly, the IPS technology is not mature enough, some data were missing during our collecting sessions. Therefore, the data presented in the prototype are fake data. Secondly, the number of participants involved in this project was limited, we only cooperated with one ward from the nursing home, which might have biased findings and testing results. Thirdly, due to the limited time, the long term effect of the system has not been tested.

CHAPTER 8

FUTURE WORK

Based on the outcome of this thesis, suggestions for further research can be listed
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--- As mentioned before, combining with the signalering plan can be beneficial. However, in this project, I just presented a rough idea. Therefore, more work should be done on how to let caregivers mark the client's mood without much effort, and how to transfer that information into the system.

--- The final prototype only has very basic interactive functions, which makes it not mature enough to be officially used in the nursing home. Therefore, it will be helpful to put more effort on the prototype's interactivity in the future.

--- The design concept and the prototype should be tested in our wards and other nursing homes to show how applicable the system is for other cases.

--- Use real data

--- Test for longer time

CHAPTER 9

ACKNOWLEDGEMENTS

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Thanks !