SMILE!

Veerle van Engen | Industrial Design

Facilitating quality in conversations between seniors with dementia, their visitors and caregivers.

SMILE!
Facilitating quality in conversations by capturing the visitors of seniors with dementia.

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Final Bachelor Project
Industrial Design
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Studio Silver - Design for Dementia
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Client: carehome Pleyade (Arnhem, The Netherlands)
Stakeholders: Nixplay (Hong Kong) , carehome Zorgboog (Helmond, The Netherlands)

Abstract

SMILE is a tool for seniors with dementia, who are living in a closed living environment, to capture and review who recently visited them. The senior can take a picture or a video with a visitor or caregiver. The photo or video is automatically send to the photo frame inside the personal room of the senior. SMILE has been shaped through iterative design. The evaluation of SMILE showed that it may offer value to the senior, the visitor and the caregiver. SMILE creates moments of joy. Furthermore, the displayed pictures trigger new personal conversations. Visitors were happily surprised to see who visited the senior. Another advantage is that the act of taking a picture and reviewing a picture creates a shared and accessible activity. The caregiver also valued the product as SMILE provides pleasure during work and informs about the social environment of the senior. Therefore SMILE may contribute to making care more person-focused.

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1. INTRODUCTION

What is dementia?

Dementia is an overarching term for a selection of diseases which affect mental health. Alzheimer's disease is the most common cause of dementia. Other causes include vascular dementia, which is due to reduced oxygen supply to the brain, Lewy bodies syndrome, frontotemporal dementia and a mixture of these (Alzheimer's Society, 2017).

Dementia is a progressive disease that negatively affects cognition. Dementia describes a set of symptoms which vary from person to person (see Figure 1). The most common manifestations are a decreased short-term memory, changes in thinking, difficulties following and participating in conversations and decreased visuospatial skills and orientation (Alzheimer's Society, 2017). Moreover, people with dementia often show changes in mood and behaviour. Factors increasing the chance of developing dementia are low mental activity and challenges, smoking, low physical movement, depression, high blood pressure, diabetes and obesity.

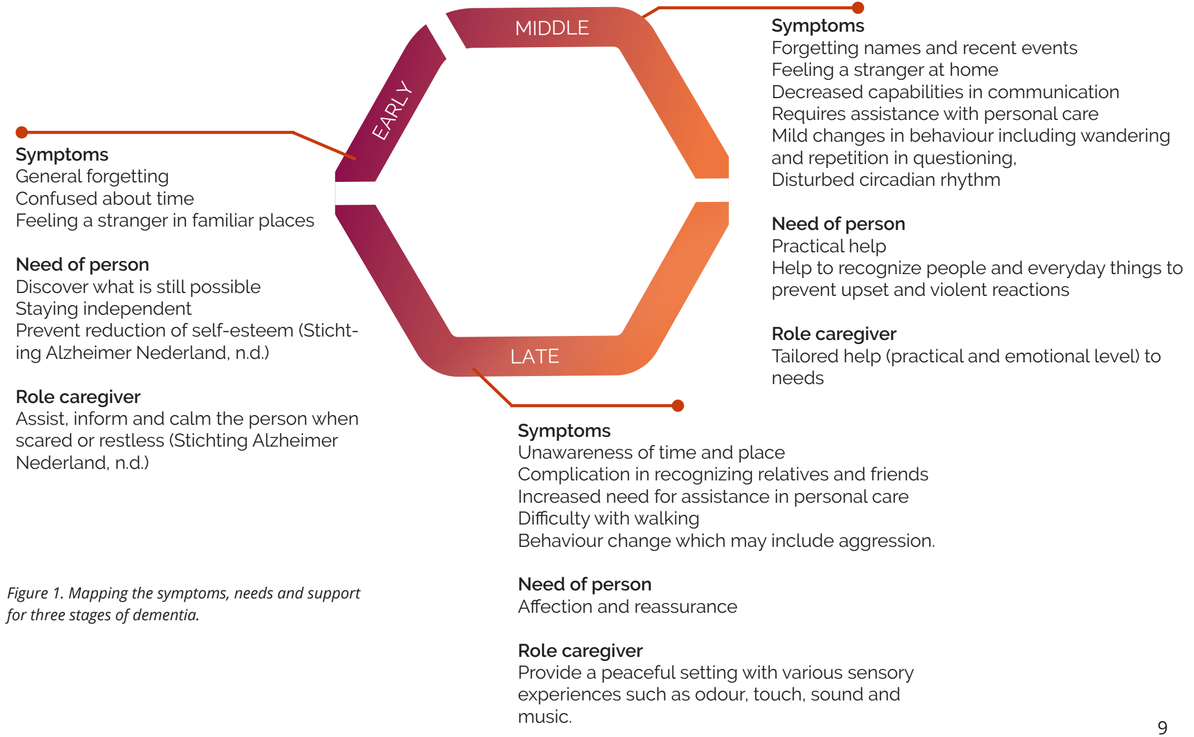


Figure 1. Mapping the symptoms, needs and support for three stages of dementia.

Dementia in numbers

A quick glance at some numbers and facts of dementia (Alzheimer Nederland, 2017).

One on three people gets dementia, of which oneseventh is male

50000 people had dementia in 1950, 2016 counted 270000 people with dementia and this number is expected to reach 538000 in 2040

Ten percent of the people diagnosed with dementia is younger than 65

On average people live eight years with dementia

Recognition and diagnosis of dementia takes 14 months on average

Dementia accounted for 4,8 milliard care costs in 2016 (five percent of the total Dutch care costs). The costs for dementia are expected to rise 2,9 percent each year

Dementia in the Dutch society

In the Netherlands - and other western countries - seniors have the wish to live in their own home as long as possible. This person-centered trend is in line with the strategy to reduce costs by providing care at home and reducing the number of seniors moving into care homes (VUmc, 2016). However, the professional care at home is limited resulting in an increasingly demand of care provided by informal caregivers such as children and neighbours.

To deal with these type of challenges Alzheimer Nederland started an eight-year plan, called the delta Plan Dementia, to investigate and act upon dementia (Bos, 2013). In this plan, which requires an investment of 200 million Euro, science, national government and private parties work together to achieve solutions to challenges in the dementia care. The quality of life of seniors with dementia and their family plays an important role, as well as the role of the society and foreseen consequences.

The Netherlands is known as a pioneer in early diagnostics, diagnosis and studying quality of life. This is in line with the seven components of focus that Alzheimer Nederland set up. These components include case management of dementia, personalized care in care homes and a dementia friendly society. According to Bos (2013) important domains for new interventions are robotics, home automation, e-health and social media. A study compared the Dutch dementia care with the care in seven other European countries, namely Germany, Island, the United Kingdom, Sweden, Estland, France and Spain. The outcome is that the Netherlands scores best all-round, specifically on the low amount of freedom restrictions and the low amount of bedsores (Beurden, 2016). An example of a Dutch innovation is the creation of a neighbourhood for people with dementia, called Hogeweyk, where the residents are able to do shopping and spend time outside. This new care facility enables the residents to live their own life. It ptovides a sense of independence and freedom, whilst they receive the care and security they need.

This project

This project is the work of a Final Bachelor Student Industrial Design, from Eindhoven Technical University (TU/e, The Netherlands). The work presented in this report are the outcomes and process of four months of user engagement, design and evaluation. The project is coached and supervised by the squad Studio Silver, which focusses on designing for seniors.

Design in a multi-stakeholder environment
Several external parties have been involved in this project. These are stated and described below. Appendix D shows mutual communication.

Carehome Pleyade - The client and partner of this project is carehome Pleyade (Arnhem, The Netherlands). Pleyade forms a consortium together with researchers and designers from the TU/e to develop innovations for seniors. Their focus is to enhance the quality of the life of the senior. For this project Pleyade facilitated the engagements and evaluations with the user and expertise from the care professionals.

Carehome Zorgboog - carehome 'Kleinschalig wonen Stiphout' facilitated the long-term evaluation of the product, taking four weeks. The care organization bridged between the family members and me, the designer, to arrange permission for the evaluation.

Company Nixplay Signage (Hong Kong) - The company Nixplay sells digital photo frames. Both the CEO, Mark Palfreeman, and Principal Designer, Lawrence Chu, were positive about the design concept and supported the project by supplying seven digital photo frames. In return, observations and possible improvements were shared on the use of the Nixplay photo screen by the seniors who took part in the evaluation.

Company Compaan – Compaan has been informed about the general concept and has been requested about the possibility to integrate the design with their product and platform.

This report
The report starts with an introduction to dementia. It guides the reader through the design focus and domain and provides an overview and insights about the design process and iterations.
The report ends with a chapter about the envisioned design, based on the design iterations and evaluations presented in the previous chapter. Enjoy reading!

Mission statement Pleyade

The mission statement of carehome Pleyade builds around the theme of treasuring every contact, from a small talk to in-depth conversations (Pleyade, n.d.). According to Pleyade family members and relatives play an important role in the wellbeing of the senior. Therefore they aim to stimulate these contacts and invite them to visit the residence. Additionally, Pleyade invites local residents to be involved with the seniors by participating in activities or to have a chat. Last, Pleyade tries to facilitate senior to live their own life by providing care tailored to the senior.

2. DESIGN BRIEF

Designing for dementia

Designing for people with dementia is a topic that intrigues me due to the societal relevance, the complexity of body and mind and the diversity in people's needs and motives. The effectiveness and appreciation of a design intervention can vary from day to day, as it depends on the wellbeing of the person and context. The latter includes the physical context as well as the interaction with others, such as seniors, caregivers, family members and relatives. This multi-stakeholder environment influences the behaviour, capabilities and wellbeing of the person with dementia and the overall atmosphere. Therefore designing for dementia is about complex-interlinked challenges in a multi-stakeholder setting.

A design challenge encountered in the field of dementia is the inability to (fully) emphasize with the person with dementia. We do not know what the person perceives and experiences, being the first-perspective. Moreover, people with dementia can only share accounts of the 'here and now' as they cannot -or experience difficulties to- reflect upon and remember previous experiences and interactions. For designing this implies that interventions should be experiential. Second, designs should be introduced to the user and context as soon as possible to prevent gaps in envisioning and actual use. Through iterative design processes, the interventions become more tailored to the user group and their capabilities and needs. Moreover, by visually communicating what you want to achieve in context, stakeholders may become enthusiastic and introduce you to contacts or other support. During the evaluations insights can be retrieved from data collection in probes or observations. Last, as people with dementia are a vulnerable target group, designers should take care to provide safe interventions and ask permission to the family beforehand.

What Defines Quality of life?
The World Health Organization (WHO, n.d.) defines quality of life as "the 'individuals' perceptions of their position in life in the context of the culture and value systems in which they live, and in relation to their goals, expectations, standards and concerns". However, a study suggests that for people with dementia the mood of a person is key to the perceived quality of life (Beerens, 2016). It is therefore important that caregivers are informed about personal preferences and background, especially when person with dementia is less capable to communicate. In another study, seniors with dementia participated and discussed together what aspects define their quality of life (Alzheimer's Society , 2010). The outcome shows that the most valued aspect is to have a relationship; someone to talk to, being listened and understood. Other values include living in a safe and ambient environment, living in good physical health and therefore be independent in personal care, having a sense of humour and a sense of personal identity.

Design focus

The domain of this project are seniors with dementia. To narrow the project, the decision was made to focus on seniors with dementia living in a closed living environment. In 2014 it was estimated that 70000 senior with dementia lived in a care home (volksgezondheidenzorg, n.d.). To make the project even more specific, the choice was made to focus on capturing who visited the seniors and present these captured moments back to the seniors. The overarching aim was to add value to the perceived quality of life of the seniors and support their relation and conversations with their close surrounding.

Seniors with dementia living in a closed living environment
This choice was made in consultation with a care professional from Pleyade and the Project Coach from university. An assumption for this choice is that seniors living in the closed living environment receive more visitors and see more people than the seniors who still live independently at their home. Other arguments include that the seniors living in the care home are better reachable and may be less hesitant in using product. Moreover, care professionals will be present to provide information about the product or support the use. As a note, the choice to focus on seniors living in the closed living environment does not mean that the product does not suit the use by other seniors.

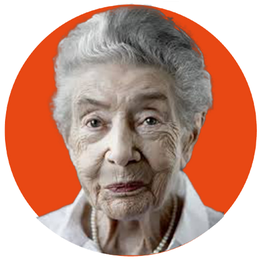
Capturing and display of visitors to support the involvement with the close surroundings of the senior
A personal experience with my grandmother with dementia was that she felt ashamed that she forgot who brought the bunch of flowers that was standing in her room. She forgot that is was her old neighbour who visited her the day before and felt uncomfortable of not remembering.... The care home of my grandmother used a platform to facilitate contact about the senior with caregivers, family and relatives. Via this platform I could find out that it was my grandmother's neighbour who visited her. This event made me question why the platform was not visible and accessible for the seniors themselves. Therefore my personal experience is a source of inspiration for this design work.

Personas

Who are the people that are being designed for? What are their values, needs, qualities and lifestyles? Four personas were drafted to assist the design process in finding valuable opportunities and to evaluate decisions on the appropriateness for the user and context. The personas are fictional characters based on user engagements during various visits to the closed living environments and insights from caregivers.

Two **design considerations** were retrieved from the personas.
- First, All seniors have their own story and identity. There is a big diversity in background, perception, mindset, values, fears and lifestyle. Therefore it may be difficult to make one design fit all seniors. To deal with this it might be interesting to consider a design that is left relatively open. An open design can be used by the seniors in the way it adds value to them.
- Second, an assistive product can be accepted with open arms or be perceived as insult. Due to differences in the awareness and acceptance of the disease, some seniors may not yet feel in need of an assistive product. Therefore it is important to avoid stigma and market the product in a respectful way. Moreover, an opportunity is to focus on providing a positive user experience (besides possible practical assistance) to make seniors more interested in using.

Maria
Feels lonely and uncertain. She thinks that her husband is not visiting her, while he actually visits her daily.



'I am always waiting for people to visit me as I can not visit others myself'

Maria is an energetic woman who used to have many social contacts. Since two weeks she is living in a closed living environment. She does not accept this en is constantly asking for her home.

Pieter
Feels uncomfortable that he does not know what to talk about, because he forgot about what he did and what happened...

'I feel empty and not meaningful'

Pieter is an precise and intellectual man. He used to read a book each day and actively participate in discussions. Pieter is aware of his memory loss and the loss of his identity and passions.

Annie
Feels sad that she does not remember who brought the flowers which are in her room.

'Everything just seems unfamiliar'

Annie lives a calm life. Annie has no children and lives in the closed living environment for already two years. She is happy that people take care of her.

Johan
Is afraid of the day that he cannot remember the names of his children.

'I am fine, I don't need help"

Johan is recently diagnosed with Early Alzheimer's. He feels frustrated that his children interfere more with his life since the diagnosis. Johan wants to stay independent. Yet, he feels increasingly insecure and is fearful for what the future will bring him.

Pictures seniors from Thormaehlen (2016)

Market analysis

There are various products for remenisence on the market for people with dementia. These products focus on recalling past events, products or experiences. The products are used to provide the person with dementia with a moment of familiarity and a positive thought. Moreover, the products help outiders, such as family or care, to connect with the person. Although most remeniscence products focus on products from (tens of) years ago, remeniscence also applies to historical events of a few days ago. However, more recent memories may be harder to recall for the user.

Various products and services use photos to enhance reminiscence or use it for (internal) communication. Five products are discussed and analysed in this paragraph. The products are mapped on two axes (see Figure 2) to illustrate the differences, similarities and find design opportunities. The horizontal axis displays whether the product is primarily designed for the senior or for this person's direct contacts. The vertical axis makes a distinction whether the action with this product is primarily passive or active of nature.

Three insights can be retrieved from the analysis.

- Most of the products are either focused on the senior or on the direct environment. None of the products focus on enhancing the mutual experiences. Therefore I see opportunity to enhance the interaction between the family and senior by offering a shared activity or goal.
- As the analysis depicts, most of the products provide value for the senior with dementia. The only exception is a communication service between the family members/spouse/relatives and caregivers. This made me feel curious whether this service could be tweaked to also target and benefit the senior.
- The products and services for seniors are primarily passive in interaction and control. The seniors can watch the pictures or read the newspaper that was created for them. Therefore I see the opportunity to make the seniors more active and in-control. For example, can seniors take pictures themselves?

Products for people with dementia using photos

1. Static remeniscence boxes or ordinary photo's (Alzproducts., n.d.)

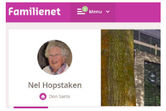
2. Digital photoframes or viewing photos on Compaan (Compaan, n.d.)

3. Lifelogging Automatical capturing of pictures throughout the day (Sellen et al., 2007).

4. Personalised newspaper for Japanese elderly living in remote areas created by family members (Softbank group coorporation., n.d.)

5. Familienet or writing pad

Platform for sharing pictures and personal details amongst family and caregivers



The five products are displayed as the grey shapes and are mapped on the axises.

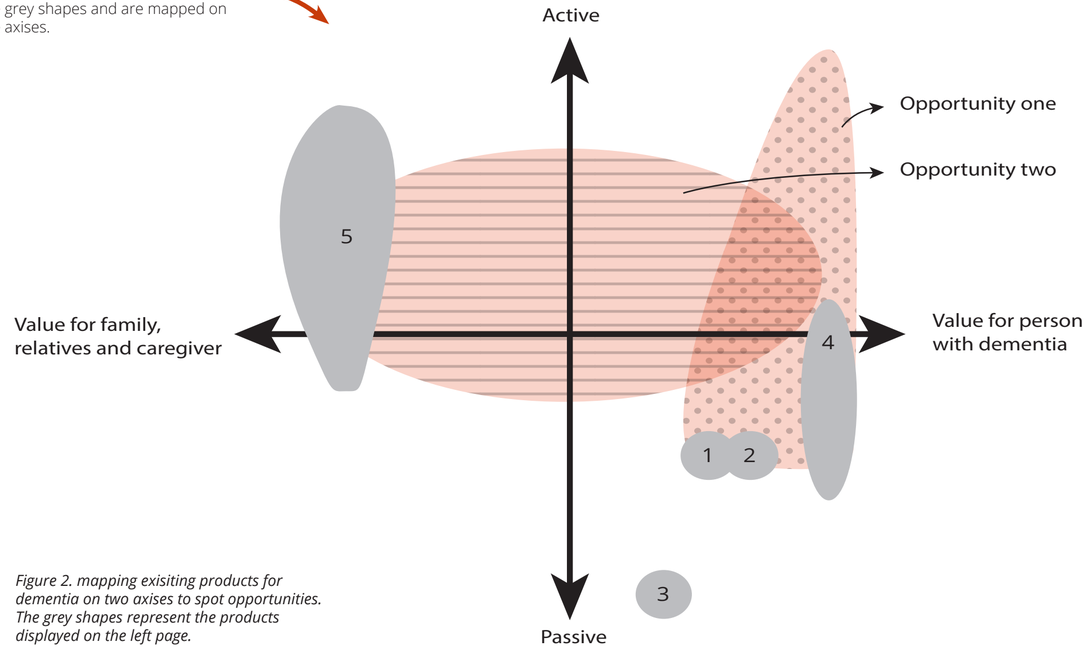


Figure 2. mapping exisiting products for dementia on two axises to spot opportunities. The grey shapes represent the products displayed on the left page.

Personal vision

My vision on the domain consists out of a statement, a time-frame and a set of design considerations. The statement creates awareness about the position that is taken and how this affects the design focus and decisions. To create a set of design considerations, the tool '30 elements of value'has been used. The elements in the tool are categorized into four layers which build upon each other similar to Maslow's pyramid of human needs (Mcleod, 2017). The layers - from bottom to top - are functionality, emotional, life changing and social impact (Bain & Company inc, 2015).

Statement
I want to 'Support seniors with dementia in their daily conversations and thoughts to enhance social cohesion'
How? By actively capturing who visited them and displaying this to facilitate conversations.

Time-frame
My aim is to bridge the here and now with a future perspective; to design for the current age group with eye for the future. To be able to evaluate the concept it should match the users and context of the world today. However, to take into account that it takes time to develop and market a product, I want to be future oriented and be aware of technological advancements that will take place in the coming years.

Design considerations
Using the 30 elements of value (Bain & Company inc, 2015) various qualities were listed as aims for designing a product for seniors with dementia. These considerations are used to inspire design decisions.
For design the product, the aim is to make a simple, inviting and respectful product that enhances wellbeing and the sense of belonging by informing and entertaining the senior.

- Simple: familiarity, no complex action, guided in use
- Inviting: the product should be visible, be recognizable and have a friendly look.
- Respectful: avoid stigma
- Enhances wellbeing and sense of belonging: the product should involve the senior and provide an opportunity to stay socially connected and provide a sense of affiliation.
- Informing: The product can provide information to trigger the mind of the senior and provide a new focus.
- Entertaining: the product may be fun and surprising to use and provide a positive user experience

Design strategy

Based on the target group characteristics (see paragraph designing for dementia) and my personal development goals for this project I listed five core approaches and mindsets.

- **Decide <> evaluate: move forward**

Why? My pitfall can be to stay in the exploratory phase for too long. As a result I have limited time for the actual designing and evaluation. Especially for this target group it is impossible to predict their interaction and perception of the design. Therefore it is important to make decisions and evaluate these to inspire new decisions.
How? Inspired by Experiential Design Landscapes (Peeters et al., 2014), my strategy is to use probes during the start of the project to inspire decision choices. Second, my aim is to build an experiential demonstrator and place it in the context of use. I will leave the design open so people have freedom in the use of it.

- **Visualize concepts and make them experience-able**

Why? During my study I learned the power of communicating using visuals instead of text. Visuals provide an impression, forces you as a designer to make design choices and limits miss communication due to different interpretations.
How? My aim is to use various types of media such as visuals and video to convey messages. Moreover, I want to present experience-able demonstrators by starting early with prototyping.

- **Pro-actively involve stakeholders**

Why? Input from various stakeholders will help me to see the design from different perspectives and hopefully gain valuable input. Second, as I want to develop myself to become a strategic designer I want to gain experience with working in multi-stakeholder environments.
How? I will actively contact stakeholders and interesting parties. This requires taking a vulnerable position. However, my mindset will be to just give it a try.

- **Long user evaluation in context**

Why? My previous user evaluations were not extensive and professional. They mostly focused on a first impression. However, I think it is interesting to have people use the demonstrator for a longer period of time to learn about the value and interaction. How (often) will people use it? What role does the novelty effect play? And why do they use it?
How? My aim is to start early with prototyping and build a robust demonstrator. I will also start early contacting carehomes to arrange a user evaluation of at least two weeks.

- **Bridging future with today**

Why? Due to the time that it takes to develop a product and make it to the market, I aim to have a prolonged view into the new generation seniors. For example, the next generation of seniors is more acquainted with digital technology and screens.
How? I will actively look for opportunities to embed new technologies.

3. DESIGN PROCESS AND ITERATIONS

General concept

SMILE enhances quality in conversations between seniors with dementia, who are living in a closed living environment, their visitors and caregivers and functions as an energizer. How? By providing a visual impression of who has recently visited the senior. This visual impression is a photograph or a video that is taken by the visitor or caregiver – together with the senior - using the SMILE camera. The captured photo or video is send to a digital photo frame which is placed inside the personal room of the senior (see Figure 3). To facilitate storytelling, the photos can be enriched with a message in text or audio. Can you spot your picture? And what are the stories of other pictures?

Figure 3. SMILE consists out of a photo camera and a photo frame (or in case of multiple residents, multiple photo frames).

Flow of using SMILE

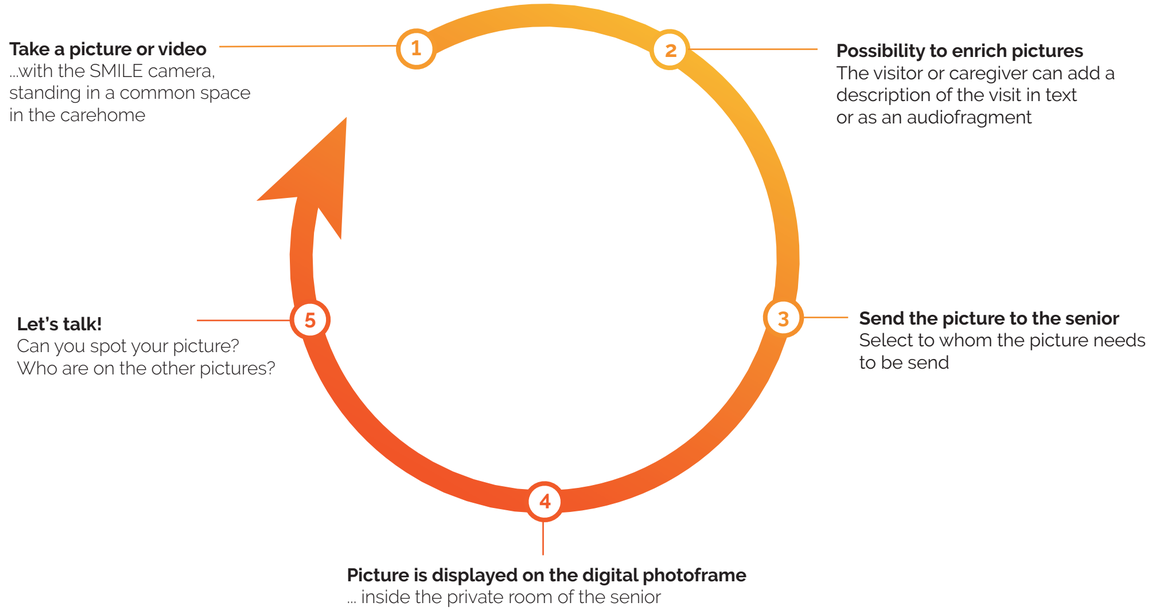


Figure 4. The steps taken in using the product SMILE

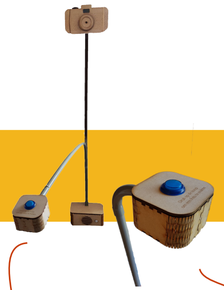
Overview iterations

Figure 5 displays an overview of the process and iterations that were carried out during the project. The various iterations are described in more detail in the following paragraphs.

First concept video: https://drive.google.com/open?id=1nMpVFeaMtxdvFKUsoJV8J_LY19I1Tfqd

Probe & User engagement
during mini internship at Pleyade

Insight: Perception photo cameras, understanding family relationships, value and effects of viewing photos



Iteration One A
Photo capturing tool for a single senior. Place of button is right distance to camera

Insight: Instability, space occupancy high

Iteration One B
Pole with pushbutton.

Decision to focus on shared living spaces with multiple seniors.

Iteration Two
Photo capturing using voice control for multiple seniors (name recognition), guided by led in pole.

Insights evaluation One at Pleyade: seniors feel unfamiliar and uncomfortable to speak to product. Invisibility of function possibilities. Difficulties voice recognition due to volume and pace speech senior.

Iteration Three
Panel with buttons with pictures of senior. Press to make picture and voice in camera provides instructions.

Insights evaluation One at Pleyade: Senior capable of using. Uncertainty about location of pressing button. Stories about pictures of seniors. No response to voice instruction camera. See: https://drive.google.com/open?id=1wN-7sZBquoTV6NAkUswqK2DaeBMXhUD7

Midterm explanatory movie: https://drive.google.com/open?id=1nD9nRaSPN1kTl0-f3lZwrJB_nrccIKQp

Iteration Four
Camera placed on tripod and dot added on pictures panel button.

Insights evaluation Two at Zorgboog: product valuable as facilitator of quality in conversations and energizer. Seniors look at button panel where action has taken place. Room for improvement to involve senior more.

Iteration Five
Tablet as control panel. Opportunity to add text or audio fragment to photo or to take a picture. Also possible to have flexible amount of seniors.

Iteration Six- envisioned design
Control panel and camera integrated. Tablet with application placed on a tripod. See: https://drive.google.com/open?id=1Pqi5aC1ezwA5GwQDkXqCiiOzVjlceNG_

Figure 5. An overview of the iterations and key insights

Probe

To inspire first design decisions, six seniors living in a closed living environment in Pleyade were confronted with a paper probe. The probe consisted out of two parts. First, the probe depicted various types of photo cameras (see Figure 6). The seniors were asked to describe what they saw on the probe and what camera is most familiar to them. Second, the probe depicted a picture taken of a senior with a middle-aged person holding a paper with a name written on it. Similarly, the seniors were asked for descriptions and perceptions to learn what links they make between the social relationship and the name. The conversation, taking approximately 10 to 15 minutes, was carried out in an informal way and therefore without the use of consent forms.

Insights - The perception of the cameras differed substantially between the seniors. All seniors were familiar to the modern looking camera and some seniors explained that they used that camera in the past. Some of the seniors also recognized the box camera whilst they expressed that they had never user it. The other cameras were not recognized and were described as a car on its side, a cash desk, a lamp or a music instrument.

By talking about the cameras the seniors started sharing stories about the value of pictures. The conversations about pictures primarily resulted in a positive vibe as seniors were reminded about joyful holiday experiences, life events and pride of their children. Several seniors invited me to their room to take a look at the pictures. However, the positive atmosphere risked changing towards a negative experience at they created awareness about memory loss. A senior felt uncomfortable that she forgot the name of the country where the picture was taken. Another senior felt inconvenient when the pictures confronted him with pictures of his wife who passed away.

For the picture displaying the senior and adult holding a paper with a name, the seniors were able to understand that the paper contained a name and that the name would probably belong to the person holding it. As a note, although some research states that seniors with dementia only recognize themselves on pictures from the past, I did not notice this during the user contact. On the contrary, two of the seniors recognized themselves in the senior on the picture as they both had grey hair, glasses and similar clothes.

Figure 6. The probe as topic of conversation in carehome Pleyade

Iteration one - single button

The first iteration is a laser cut 3D-camera that can be activated by a single button (See Figure 7). The button bridged a distance of approximately one meter to make sure that people were standing at the right distance from the camera to take a picture. The camera itself was placed on a foot with fading lights to attract the attention and steer the user to look in the camera.

Insights - This construction was unstable and therefore easily tumbled over. Second, from contact with a caregiver from Pleyade I learned that this concept might better fit the seniors living in a closed living environment a they received more visitors, were better reachable and accepted the design more easily. Especially the latter is interesting as people with beginning dementia may benefit most from the aid although they do not want to use it as they are denying and not accepting the disease.

Figure 7. The lasercut camera and pushbutton for usage by a single person.

General construction of the camera (which is also used in iteration two, three and four)
The camera consist out of a laser cut box with engravings to create texture and add text. The camera box contains a mini camera that can be controlled via Raspberry PI. The camerabox is attached to an aluminium pole with a U-profile (see Figure 8). Inside the U there is a ledstrip which is covered by a strip of wood that has been designed to partly make the light shine through. The drawings for the lasercut can be found in Appendix A.

The box at the floor contains the electronics, which include a Raspberry Pi, a microphone, a speaker (from the Google Voice kit) and a motion sensor. The box is weighted down with concrete.

Figure 8. Construction of the camera and covering the ledstrip with lasercut wood

Iteration two - voice control

The second iteration is the laser cut 3D-camera that is controlled by voice (see Figure 9). The camera is placed on a foot with fading lights to attract the attention and steer the user to look in the camera.

Scenario of use - The senior (or visitor or caregiver) can trigger the camera by saying out loud the sentence 'Maak foto' (In English: take a picture). The camera would respond by counting down from five to zero, before taking the pictures. In the meanwhile the light inside the beam moves up to steer the person to look to the camera. When the light reaches the camera the picture is taken. The camera voices a congratulation and asks to whom the picture should be send to. The senior responds by stating his or her name. Respectively, as the visitor or caregiver uses the product, the response should be the name of the senior who should receive the picture. The camera would respond with the sentence that the picture is send to the photo screen of the person who was mentioned.

Argumentation - The reason for using voice control is that most seniors with dementia are able to speak, even while they may physically be limited. Moreover, the use of voice control may expand the lifespan of the product as it does not include mechanical components that risk breaking. Last, in line with the design strategy I aimed to include future-oriented technologies and evaluate these in the specific context.

Technological - An interactive demonstrator was developed. To implement voice control, the program Jarvis was used in combination with the Google Voice Kit. Adaptations to the Jarvis code include new trigger words. To make the program recognize the names as pronounced by different people, the names were written phonetically. A Raspberry Pi and corresponding camera has been used to take pictures. The pictures are send to the photo screens by mail; each photo screens has an identical mail address. In combination with an Arduino the led strip and motion detector were controlled (see Appendix B for an overview of the electronics).

Evaluation - The demonstrator has been evaluated on usability and experience with five seniors with beginning to middle stage dementia (see Appendix F and Figure 10). The seniors still lived at home individually and visited Pleyade for activity and support on weekly base. Insights are that users felt uncomfortable and unfamiliar to talk to the product. As a consequence they voiced with a questioning intonation which the product could not distinguish. Moreover, the seniors talked very soft. Furthermore, the seniors expressed that the action possibilities were not visible. The seniors did not or hardly respond to the instructions that were provided by the camera by voice. What may have been of influence is that iteration two and three were evaluated together and placed in front of a bookshelf that provided many visual stimuli. Therefore, it might not have been clear where the voice came from.

Figure 9. Camera operated by voice commands

Figure 10. Evaluation of iteration two and three at carehome Pleyade

Iteration three - button panel

The third iteration uses a button panel with pictures of the seniors to whom the picture could be send (See Figure 11). The product was evaluated together with iteration two as is described in the previous paragraph. For a video, see: https://drive.google.com/open?id=1wN-7sZBquoTV6NAkUswqK2DaeBMXhUD7

Scenario of use - The user can trigger the camera by pressing the picture of the senior to which the picture should be send to. The panel with buttons contains a textual description for this. The camera responds and asks to push the same button once more as confirmation. The camera says out loud that a picture will be taken and counts down from five to zero (at the same time a led on the camera blinks). The user hears that the picture is taken. The camera congratulates with the picture and explains that the picture is send to the selected person.

Argumentation - The reason for using buttons is the familiarity for seniors. The buttons were big in size to facilitate easy use. In the hope that the seniors would be able to recognize themselves, a picture was printed on the button accompanied with their name. The confirmation was added to prevent the seniors from taking undesired pictures. This choice was inspired by an interview with a caregiver who stated that the seniors will touch everything that is around. Initially, the demonstrator made a 'beep' sound instead of counting down. However, a first pilot test already showed that the beep sound does not communicate when the picture will be taken and was therefore not appreciated.

Technological -Iteration two formed the base for this demonstrator. New are the buttons which communicated with the raspberry pi via a four-channel 433mHz receiver-transmitter (for electronics see Appendix B and code see Appendix G).

Evaluation - A first insight from the evaluation is that the seniors were all capable of using the buttons to take and send a picture and reading the instruction on the panel. The seniors felt convenient with the ease. However, in first instance it was not clear that the pictures of the seniors represented buttons. Additionally, some seniors tried pushing the button at the top instead of the bottom. Some seniors joked about the pictures of the seniors which were glued on the buttons. They talked about their facial expression, their haircut and clothing. One senior did not like the pictures as the photographed people were old and she did not want to be compared with them. Similar to iteration two, the seniors did not or hardly respond to the voice instructions by the camera.

Figure 11. The camera and control panel with pushbuttons containing pictures of the seniors to whom the picture could be send.

Iteration four - button panel improved

Iteration four is a continuation of the third iteration. Adaptations include that a red dot was added to the pictures on the pushbutton to steer the user in pushing at that place (see Figure 12). The choice to use a small, clearly visible dot came forward from a small explorative study with various visuals to trigger action. The second change is that the camera is placed on a tripod. The reason for the tripod is that it creates more space than an object fixed to the wall. Moreover, it offers the opportunity to direct it depending on the context, user and light conditions.

This iteration has been used in a carehome during four weeks (see Figure 13). The details and outcomes of this evaluation are stated in the next pages.

Figure 12. The SMILE camera placed on a tripod and the control panel with minor adaptations.

Figure 13. The SMILE camera in use at the carehome (Left). An impression of the photos taken during the evaluation (Right).

Methodology

Study design and context

The study design consisted out of two components, namely a photo camera to capture a photo and a digital photo screen to review the photos. Image 12 shows the camera that was placed on a tripod. The camera was controlled using a panel that contained an image of the seniors who participated in the study. The photo camera was placed in the living room of a closed living environment for seniors with dementia. The camera and an informing poster (see Figure 15) were visible when somebody entered the living unit. The digital photo screens were placed at a cupboard or windowsill in the personal rooms of the participants (see Figure 14). The screen displayed the pictures when there was movement in the room. Moreover, the screen showed the text: 'We visited you'.

Objective

The study had three objectives. The first goal was to gain insights about the product experience of the user, visitor and caregiver. The second goal was to evaluate the impact of the design on the interaction and perceived involvement between the aforementioned parties. The last objective was to learn how the product could add value to the care and how it could be used. Of course, a sub objective has been to receive design suggestions for improvement.

Participants

The participants of the study were four seniors living in a closed living environment in care home 'Kleinschalig wonen Stiphout (organization Zorgboog)'. Three of the participants were female. No requirements were set to participate in the study. As the study involves mentally impaired persons family members of the seniors were addressed to give permission to the study (See appendix E for provided information) and sign a consent form (see Appendix C).

Procedure

The study took place during a period of 26 days. During the study observations were made about the use of the photo application tool during four dayparts. In the last week of the study a semi-structured interview (see Appendix F) was conducted with two users, three caregivers and six visitors. The interview with the senior took place in presence of a family member or caregiver. The interview took on average seven minutes. During the interview keywords were noted and after the interview the keywords have immediately been written to full sentences. Both the fieldnotes and interview quotes have been manually analyzed using Thematical Analysis. Codes were constructed by stating the number of the interviewed senior (S), visitor (V) and caregiver (C) and the number of the quote.

Figure 14. Two screens (of the four screens in total) placed in the personal room of the senior with dementia.

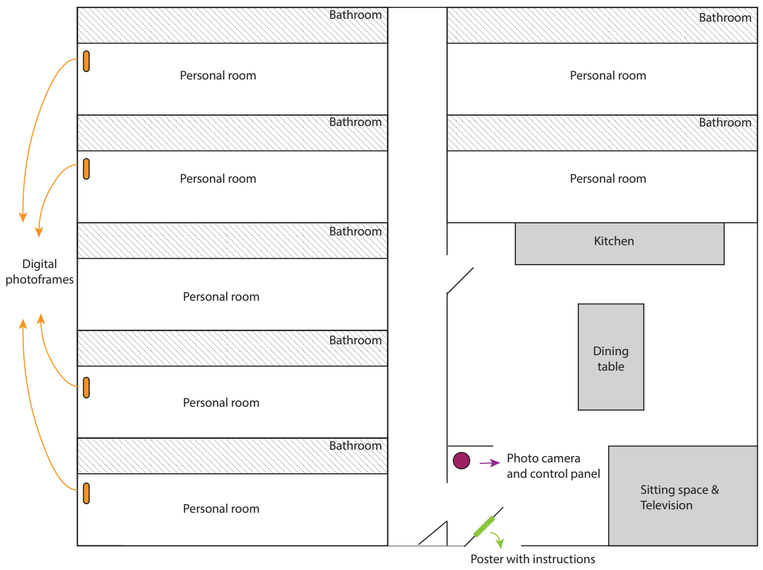


Figure 15. A floorplan depicting the position of the camera, poster and photoscreens inside the carehome during the evaluation (left). The poster with instructions to trigger and inform about usage of the product (right).

Findings
In total 111 distinct quotes have been gathered from the interviews. To incorporate the first-person perspectives the interview results are combined with fieldnote observations by the designer. The observations created 35 notes, primarily on the act of taking a picture. The findings are structured according to three insights about the value of the product, respectively 'Informing', 'Energizer' and 'Facilitating quality in conversations'. A fourth theme includes suggestions to take into account for design. As a note, the use and experience of the product are highly dependent on the stage of dementia of the user and personal conditions, which may vary from day to day. According to a professional caregiver the product is assistive for seniors with beginning dementia, whereas it may be perceived as confusing by seniors with later stages of dementia.

• Informing
For the senior with dementia there were no remarkable insights about the perception of the photos. It is unclear whether the pictures make a senior remember or recognize visits or whether seeing the picture makes the person understand and imagine that a visit took place. However, the seniors seem to be able to recognize familiar people on the pictures and are able to identify themselves. *'If I know the people on the photos than I can tell you who they are. That is 1-0 for me'* (S1Q1).

The pictures of visitors presented in the digital photo frames were used as a source of information. For family members and relatives the pictures provided an impression of the life and appearance of the senior with dementia. *'It provides an impression of my mum's life here. Who visits, how she presents herself.'* (V1Q16). Second, family members and caregivers felt curious who visited. Last, the pictures were seen as a valuable memento of the last stage of life. The pictures provided the caregivers with the opportunity to learn more about the senior they care for. The display of relationships and the corresponding stories can enhance seeing the human behind the client and thus personalize care. Moreover, the pictures informed caregiver about possible triggers for certain behaviour or stories by the client.
'If the person talks about something I can maybe use the pictures to trace back what made impact.' (C1Q17)

• Energizer
Both the act of taking a picture and the act of reviewing the pictures were experienced as a positive stimulus. The act of taking a picture creates an opportunity for the senior to shift their attention. Moreover, the camera stimulates the senior to have some physical movement. *'My mother is increasingly neutral in her perception. Yet, this is a way to shift her attention and to have an action component. It's good to stretch your legs, they are sitting a lot throughout the day'* (V1Q11). The family members or relatives who visited the senior perceived the camera as an accessible activity that could be performed together with the senior. *'It is playful and creates a moment of personal attention'* (V6Q36). Another response to the act of taking a picture is that the visitor provides some personal care by doing the hair of the senior or improving how the senior is dressed. *'The visitor positions the senior in front of the camera and tells her to wait. The visitor walks at a fast-pace to the room of the senior and returns with a hair brush. She brushes the hair of the senior and pulls her shirt down. As a response the senior asks when the hairdresser will come'.* (Obs6). Moreover, the visitors and care professionals used the camera to express some humour by taking pictures with funny faces. *'So when I walked by the photo camera I said: "you like to be photographed, don't you". Then she asked whether the photo camera was still functioning, so we tried it together. So I found myself smiling to a camera together with the caregiver. Afterwards we ran to the room of my mother to see whether the picture appeared. So in that sense the product creates new interaction with the care'* (V6Q33).

In reviewing the pictures the senior was energized by having a tangible display and the automatic circulation of the pictures, which grabs attention. *'The visibility of who visited is good. You can grab the frame to talk about it. Without the pictures I would not manage to have her recall the person I am talking about'* (C1Q14). Family members felt positively surprised by learning that the senior has been visited, for example by far relatives, as this information may otherwise not have reached them. *'Personally I also like to see who visited. Some time ago I heard from my brother that an aunt her visited. That is special. The number of people that are faithful and visit my mother. [...] But if my brother did not see her coincidentally, then we would have known that she visited. Or just some time after.'* (V6Q10). Moreover, they feel happy to see pictures of the senior together with the caretaker as it shows that activities were undertaken and gives an impression of a good relationship. The caregiver experienced an energetic and joyful moment by seeing pictures of colleagues who were joking and drew strange faces. *'It is relaxing, a moment other than the daily care activities. It caused me to smile'* (C3Q3).

• Facilitating quality in conversations
Instead of having small talk, the photo camera and photo screen facilitated more personally oriented conversations. The act of taking a picture and reviewing the pictures were used to give compliments in the visitor-senior and caregiver-senior conversations, enhancing the self-esteem of the senior. *'You see that Miss... feels honoured when you ask her to take a picture and you say that she looks good'* (C3Q9). A caregiver proposes that taking a picture can function as a last activity before saying goodbye between the visitor and senior. *'We just discussed the case that a husband of a senior living here does not want to leave, so he lingers at the door. In that case we can say "let's take a picture to say goodbye"'* (C2Q9). No remarkable comments were made on the influence of the camera for conversations between the visitor and caretaker.

The display of pictures provided the senior with a trigger to share a story. *'This morning I was at the room of Miss.... and had a glimpse at the photo frame. She noticed and immediately shared that her old neighbour had visited her that day [...] And that is good as it helps to get to know more about the person'* (C1Q2). Furthermore, the picture supported the senior to understand the conversation by providing visual context for interpretation. For visitors the pictures triggered mutual conversations about who the person on the picture is. Moreover, the pictures were a topic of conversation between the visitor and senior. Visitors used the picture as a motive for sharing information about the photographed person. *'For the picture of Marieke I for example tell how she is doing. Just the everyday information that I know. For example that she is doing her final exams'* (V6Q3). Caregivers used the pictures in conversations with the senior to reduce stress or tension by showing visual proof. *'One of the seniors always asks when her husband will come to visit her, even if he has already come by. So at that moment I took the picture frame, but unfortunately they did not take a picture together. Otherwise I could have easily shown her that he already visited her that day as she is wearing the same clothes as on the picture. If I just tell her, she would not believe me' (*C3Q13).

• Suggestions
The senior can experience that the act of taking a picture overcomes them. To involve the senior and make the senior feel in control and participating, more tailored assistance is desired from the caretaker or visitor. To enable more assistance, the act of taking a picture should be provided in smaller steps which are controlled by the visitor. *'When I am explaining that we are taking a picture the device is counting down, so halfway my explanation I have to SMILE to the camera. My mother has no sense of what is happening at that moment'* (V6Q23).
Moreover, observations show that the senior looks at the place of physical action, in this case the panel with buttons. Their attention is not grabbed by the voice that comes from the camera. Neither do they respond to the audio instruction to look in the camera. The majority of the pictures with a senior show that the senior is not looking straight into the camera and that their eyes are downwards oriented. As a response, visitors tried to make the senior look in the camera by pointing towards it and giving instructions by voice.

In reviewing the pictures, some visitors experienced unclarity due to the quality of the picture, the subject of the picture and the way of presentation. Some pictures were perceived as too dark to clearly see the content. Moreover, some pictures displayed visitors of another senior as they were addressed to the wrong person. Last, visitors and caregivers were confused about whether the date on the frame was the date that the picture was taken or whether it was the date of today. The automatic circulation of the pictures creates unclarity about the subject of the conversation and the time-line of when a picture has been taken. *'It is confusing that the pictures are moving on. Image and story need to fit together'* (V6Q6) and *'It confused me that the pictures were displayed in a random order, or at least after the last picture the first picture appears again. As a result I have no clue about when somebody has visited. Maybe it is already weeks ago'* (B1Q9). A suggestion of the caregiver is to add the opportunity to send pictures to a digital screen in the common living room. The pictures could for example be discussed during coffee and at that moment the screen could go hand to hand. However, a family member noted that pictures from other seniors may not be familiar to the senior as lead to unfamiliarity.

Captured data

In total 52 photos have been taken (for participants one till four respectively 19, 9, 9 and 15 photos). Besides the participating seniors themselves, the pictures contained 43 distinct visitors of which five were a caregiver. Six visitors used the photo camera during multiple visits. Approximately two-third of the photos have been taken together with the senior. Six pictures were send to the wrong senior. Of the 26 days that the product was placed in the care home, the product did not function during 8 days – or day-parts - as is visualized with the red markers in Figure 16. Moreover, during the first week one participant respectively pulled the plug of her digital photo screen as she packed all her belongings with the idea to leave the care home.

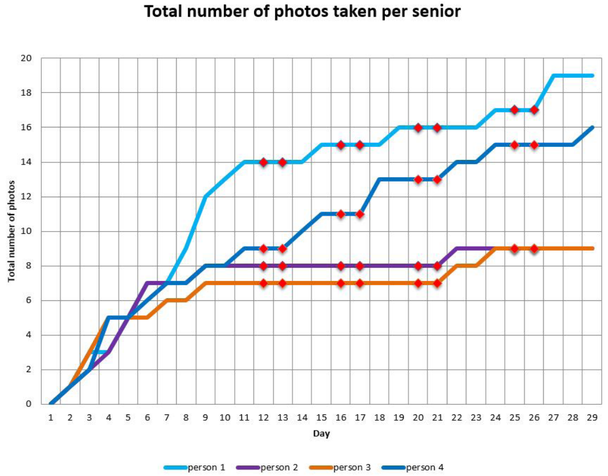


Figure 16. The number of photos send to the participating seniors throughout the study.

Discussion

The findings entail that the main value of the design intervention is the enhanced social connectivity between the senior, the visitor and the caregiver. Therefore it seems that the product indirectly influences the wellbeing of seniors by facilitating a shared activity, conversations and entertainment. Moreover, the tool triggers more quality in the conversations by providing triggers for personal stories, which eventually may lead to increasingly person-centered care. Observations in the use of the camera showed that the senior does not respond to the voice and looks at the place where the action of pushing the button has taken place. This observation was supported by the captured pictures which show that the seniors often look down.

This insight may imply that it is better to integrate the button with the location of the camera. Furthermore, one of the participants receptively unplugged the photo frame and packed it with her belonging to take it home during the first week. This act can be interpreted as that the senior accepted the use of the photo screen and thought it belonged to her as it contained pictures of her and the people she knows. Last, the data about the use of the product show the presence and impact of the novelty effect. After one week the use dropped. However, the data on usage may be influenced by the tool malfunctioning during eight days, as is discussed in the limitations.

Limitations

Product - Due to WiFi connectivity problems the photo screens have not been connected with the photo capturing tool during eight days. As a result, the images appeared on the screen with a delay and no new pictures could be captured. From this we can conclude that the evaluation period of 29 days consist out of three-week with functioning design. During the malfunctioning, people may have gained a negative user-experience which may have prevented them to capture a picture during next visits.

Approach - During the interview it was noticeable that the participating seniors were not - or hardly - able to express themselves about the pictures displayed on the screen or about the act of taking a picture during the informal interview. A better approach to integrate their perspective might have been to take a picture and in the meantime ask about their thoughts and understanding. This method of 'the here and now' could be repeated during several days to learn how their perception changes during 'good' and 'bad' days. Second, the number of captured photos highly depends on the number of total visitors. Therefore, a next study would become more meaningful if it would also measure the relation between total number of visitors and number of visitors who used the tool to capture a photo.

Visibility and information - A poster was used to inform the visitors about the possibility to take a picture. However, novel visitors may not have been aware about the possibility to interact. For example, a visitor thought it was a new art piece. Therefore, the number of pictures that have been captured are influenced by the initiating and explanation of the caregiver. This may imply that the frequency of use could be higher if the visitors are informed and aware of the product, the aim and their role. Moreover, for two participants the photo screens in their personal room was not well visible as the plugs were situated at the corners of the room. The lowered visibility of the screen may have reduced the use by visitors.

Conclusion

In conclusion, the product SMILE showed to be of indirect value for the senior with dementia and also meaningful for the visitors and caregivers. SMILE seems to facilitate more quality in conversations and provides an energizing, shared activity. Moreover, SMILE created some moment of joy and contributed to peronalize the provided care. The product is dependent on the use of visitors and caregivers to reach the aforementioned values. Therefore it is key to inform the visitors and enhance the visibility of the product to invite and stimulate usage. In addition, the flexibility and accessibility of the product allows usage tailored to the user. The act of taking a picture can improve by providing opportunity for the visitor or caregiver to explain what is happening and therefore involve the senior more. Last, the evaluation showed that the senior with dementia is likely to look at the control panel with pictures instead of looking in the camera for the evaluated demonstrator.

Iteration five - enriched photos

The fifth iteration was developed during the evaluation of iteration four. Therefore this iteration does not include changes according to all outcomes of the evaluation. The focus of this iteration was to develop a functioning application to control the camera, rather than communicating the envisioned looks. Changes are that the iteration replaces the fixed panel with buttons with a tablet to control the camera. Moreover, it is possible to add audio fragments to photos or take a video to enrich storytelling (see Figure 17).

Scenario of use - The senior (or visitor or caregiver) touches the screen to trigger the camera. The camera responds by voice to welcome and asks to select whether the user want to take a picture or a video. The user selects his choice on the screen that popped up. The camera counts down to take the picture or video of maximal 10 seconds. For the pictures the user is asked to provide a textual description or add an audio fragment. Both are optional. As the user chooses to add a message, the message is added underneath the picture. The text is written underneath the picture and the audio is attached as a separate file. Last, the user reviews the picture or video and is asked to select to whom the media should be send. A page pops up with a visual that the picture is send to the personal photo frame of the senior.

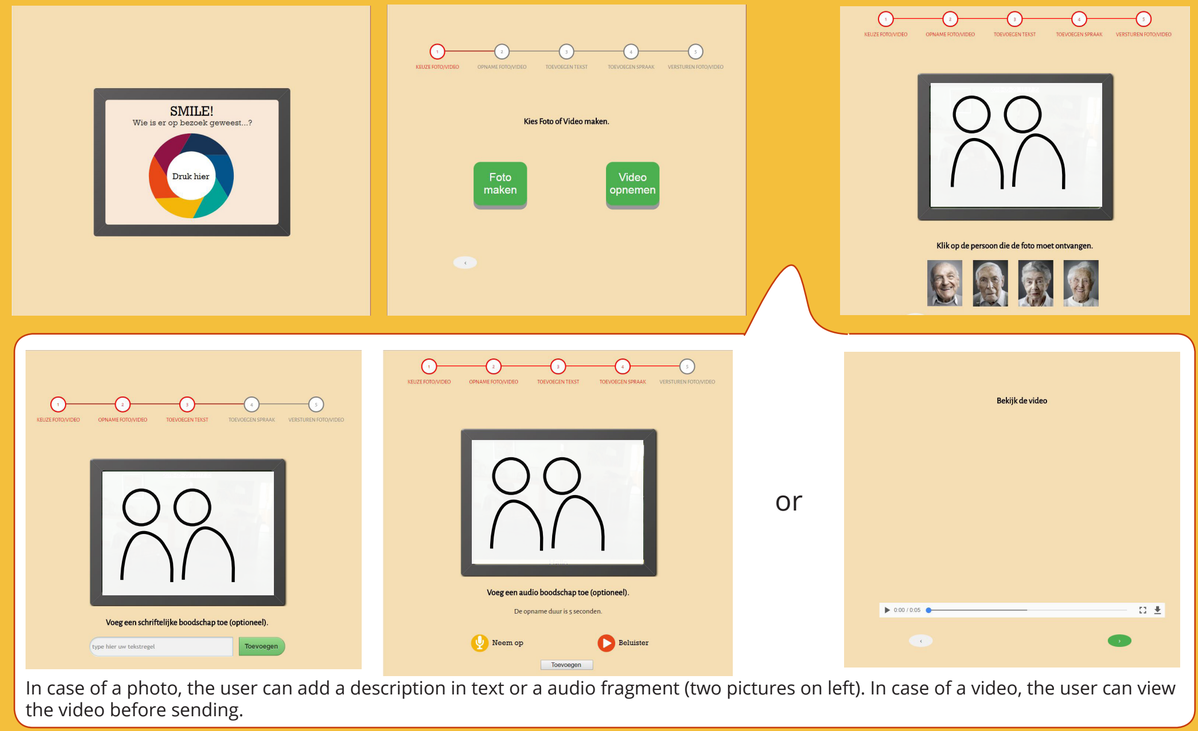
Argumentation - Based on insights from caregivers that is was a pity that only four seniors could participate due to the panel with four buttons, the aim was to make a more universal panel where the number of seniors could be set separately. The choice to add additional information via text or audio came forward from first observations at the evaluation of iteration three. Users and caregivers preferred to have more background information, such as the date or the activity that was undertaken. As some seniors had bad sight and the manufactures of the digital photo frames released an update with the possibility to display short video's, the idea came forward to add audio and video as well. Depending on the preference and capabilities of the user and senior, the user can decide what medium fits best.

Technological - The application contains a html page (the first screen) and php pages, which run on the raspberry pi. The program Apachy has been installed on the Raspberry Pi to achieve open-source HTTP server projects (for code see Appendix H).

To note - the aim of this application was to make it functional. Therefore, little attention has been paid to the looks, including the texts, font-size and use of visuals.

Figure 17. The prototyped application running on a tablet to take a picture or video, add a description in text or voice and send it to a senior. The individual application pages are shown on the right.

The screens underneath give an impression of the envisioned specifications of the application. Users can choose to make a photo or a video and send it to one of the senior residents. As a final screen the application shows an arrow from the taken photo towards a photoscreen to communicate that the picture has been send. This screen is not added in this overview.



In case of a photo, the user can add a description in text or a audio fragment (two pictures on left). In case of a video, the user can view the video before sending.

Design proposal

An insight of the evaluation of iteration four was that the attention of the seniors is grabbed by action. As a result most seniors looked at the control panel which was pushed instead of looking at the camera. Therefore the final design combines the control panel with the camera. The integrated product consists out of a tablet which runs a photo booth application with the product qualities as described in iteration five.

To ensure that the product provides the impression of taking a picture, the tablet case depicts a photo camera. Moreover, the tablet is placed on a tripod to prevent the product from becoming a flat, digital screen that is connected to the wall. Additionally, the tripod enables more freedom in taking pictures and creating the right light circumstances for quality pictures.

The specific design is elaborated upon in the next chapter.

4. Final Design and Business

SMILE: the product

To recap, SMILE provides a visual impression of who has recently visited the senior. This visual impression is a photograph or a video that is taken by the visitor or caregiver – together with the senior - using the SMILE camera. The captured photo or video is send to a digital photo frame which is placed inside the personal room of the senior. To facilitate storytelling, the photos can be enriched with a message in text or audio. Moreover, a time stamp is automatically added to the pictures.

The proposed product SMILE
The product SMILE consists out of the SMILE camera to take the picture or video and a photo frame for each of the seniors (see Figure 18). The captured media is send to the photo frame via mail, as each screen has a unique mail address.

The SMILE camera is a tablet which runs the SMILE application. This application is specified in the next paragraph. The tablet case is shaped like a camera and contains a wireless charging plate. The tablet case can be attached on top of the tripod.

For an explanatory video, see: https://drive.google.com/open?id=1Pqi5aC1ezwA5GwQDkXqCiiOzVjIceNG_

Current specifications and envisioned specifications of the photoframe

The design uses Nixplay photo screens. Limitations of this product are that:
- It is not possible to set a lower minimum than 100 photos for the number of displayed photo's
- The videos can have a maximum duration of 15 sec
- The videos can only be manually uploaded via the Nixplay application on a IOS device and not by mail. Moreover, only mp4 files are accepted. Therefore the audio file should be merged with a picture still to create a movie.
- Videos automatically play on the screens (volume can be set manually)
- The controller is used to pause the photos on the frame and to set the volume.

Ideally, SMILE has the following characteristics and interaction:
- Frame only displays the ten most recent photos and videos
- Videos are send by mail as well. And the picture and audio file as combined to a mp4 file which is send.
- Videos do not automatically play and are send as a photo with a video symbol. The user can manually start the video, for example by tapping the screen
- The photo sequence stops when the screen is taken in the hand, for example during a conversation about a photo. Therefore, the product needs a sensor for rotation or an accelerometer. An envisioned interaction with the product is that the user can angle the screen to the right to move to the next photo and to the left to go to the previous photo. To define what interaction is most intuitive, a user study needs to be performed

SMILE camera
Placed in a shared living space

Tablet
with SMILE application

Case shaped like a camera
with wireless charging plate

Tripod

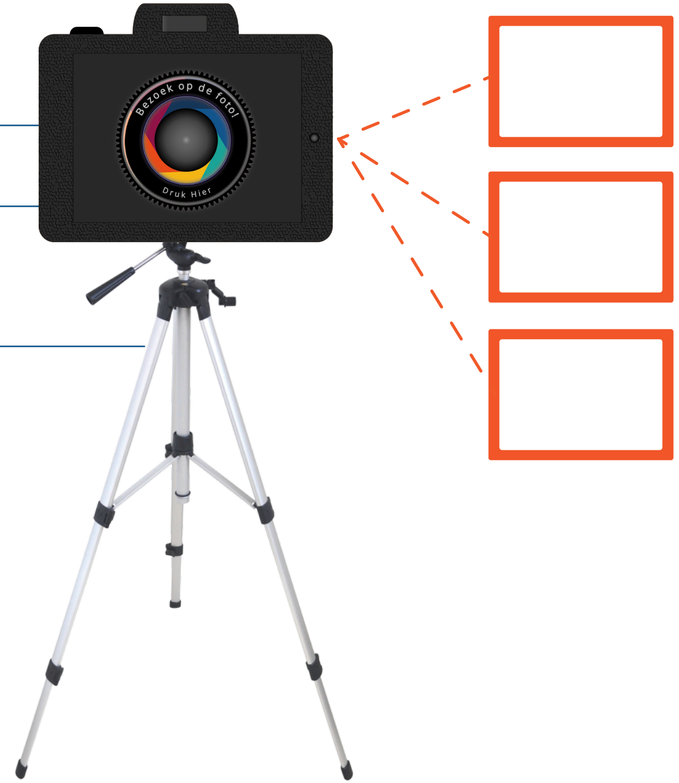


Photo frames
Placed in the private room of the senior

Each frame has a unique mail address and can only receive content from accepted senders

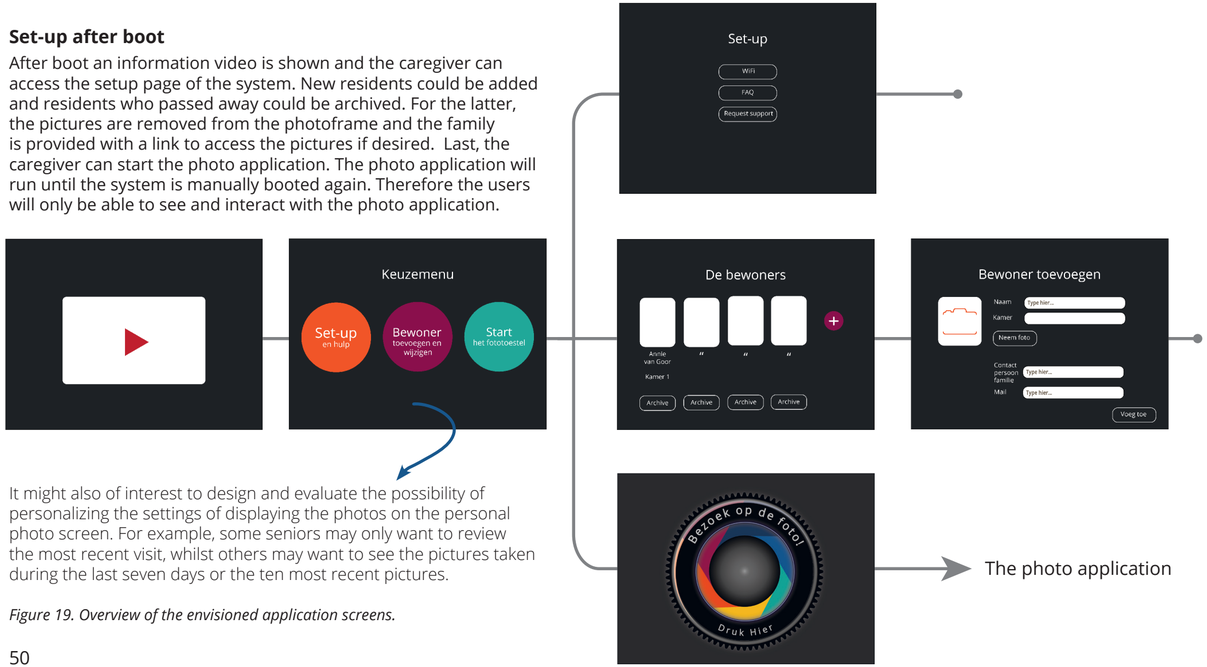
Figure 18. The SMILE camera and components

The application

Figure 19 provides an impression of the envisioned set-up and functions of the application. It is important to note that further attention should be paid to the looks. For example, the amount of text, text size and use of visuals have not been addressed in the design.

Set-up after boot

After boot an information video is shown and the caregiver can access the setup page of the system. New residents could be added and residents who passed away could be archived. For the latter, the pictures are removed from the photoframe and the family is provided with a link to access the pictures if desired. Last, the caregiver can start the photo application. The photo application will run until the system is manually booted again. Therefore the users will only be able to see and interact with the photo application.

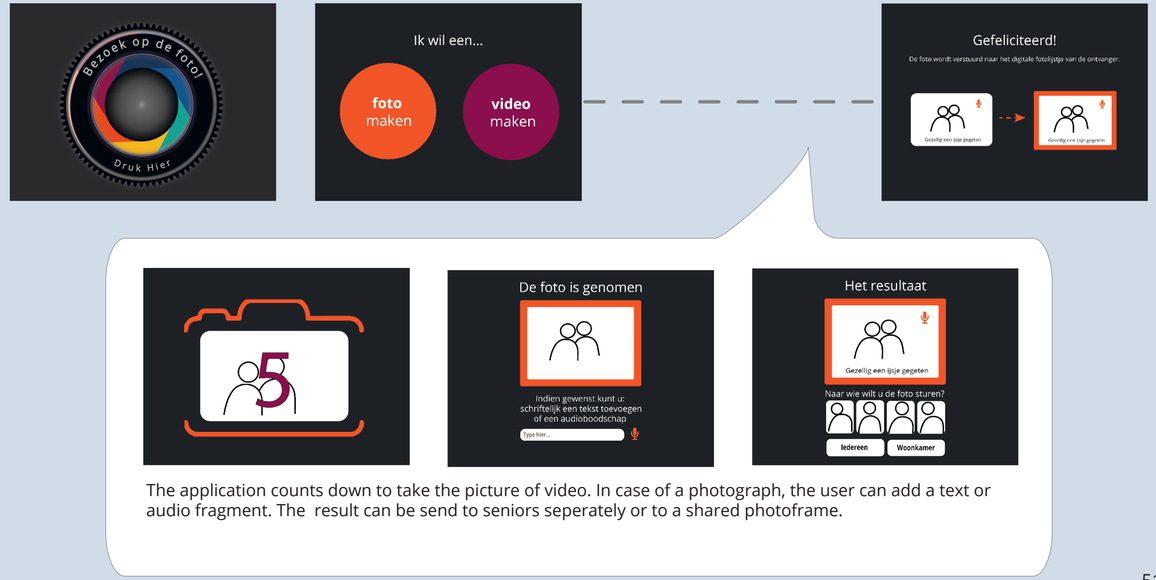


It might also of interest to design and evaluate the possibility of personalizing the settings of displaying the photos on the personal photo screen. For example, some seniors may only want to review the most recent visit, whilst others may want to see the pictures taken during the last seven days or the ten most recent pictures.

Figure 19. Overview of the envisioned application screens.

The photo application

The first screen depicts a camera lens and is used as eye-catcher. When the user tabs the screen the camera asks whether the user wants to take a picture or make a video. The user responds by tabbing on his choice on the screen. The camera will count down in voice and the count-down is displayed on the screen. In the background, the user can see himself and take the right position for the photo or video. The user can view the captured media and in case of a photo the user can add a description in text or an audio fragment. In all these steps the user is supported by the voice-explanation of the camera. Last, the user can select to whom the media should be send. This could be one of the seniors, all of the seniors or optionally the photoframe screen that is placed in the shared living space. When there is more than one minute of inactivity, the application returns to the home screen.



The application counts down to take the picture of video. In case of a photograph, the user can add a text or audio fragment. The result can be send to seniors seperately or to a shared photoframe.

Business

Value Proposition
The product SMILE consists out of the SMILE camera, the corresponding tripod and a set of seven photo frames (the number of photo screens can be extended to ten residents). Moreover, service is provided to install and maintain the product and a service contract can be purchased for subsequent years. Based on the evaluation described above several values for the senior, visitor and caregiver have been identified (see box on the right).

To summarize, SMILE offers the care home a unique service as selling point. For the senior and surrounding SMILE enhances:
- person-focused care
- the relation between senior and visitor
- the wellbeing of employees.

Values
SMILE offers the senior
- wellbeing by more personlised quality contact
- an energizing (mental and physical activity)
- a trigger to express themselves

SMILE facilitates the visitor
- to enhance quality in conversations
- reassurance about life and doing senior
- a shared activity
- a capture of the last phase in life of the senior

SMILE facilitates the caregiver
- to create quality in conversations
- learn more about the senior to personalize care
- with a tool to calm seniors or raise self-esteem
- to relax and have fun with colleagues (humour)

Argumentation for
- placing a separate SMILE camera in each shared living room.
  By placing the SMILE camera inside the shared living room, the product is easily accessible and well visible, enhancing the use. Moreover, as the SMILE camera displays the pictures of the residents it is important that the privacy is ensured. Additionally, the aim is to avoid long lists with seniors the user can choose from to send the picture.

- off-purchase costs and an optional service contract
  Assuming, care institutions will be hesitant to sign a contract for several years. Besides the fact that they have not yet experienced the value of the product, the care institutions are not aware of new - and possibly better-alternatives that will enter the market.

User and competition
The primary user of SMILE Is the senior living in the closed living environment. Secondary users include the care professionals and visitors. As the product provides value for the aforementioned parties, the product facility can be framed as a unique person-focused selling point of the care homes.
Market analysis shows there is limited competition. What makes SMILE distinctive from other products is the facility to easily capture and display photos or videos of recent visitors of the senior. A possibility for cooperation is to integrate the SMILE product with existing communication and photo tools, such as the Compaan tablet which can be used to view pictures send by family members.

Purchaser
Two scenarios are of interest in defining to whom the product is sold. The first and most promising scenario is that the care home purchases the full system, which consists out of the SMILE camera and seven to ten photo frames. In this case the product belongs to the care home. A second scenario is that the care home only purchases the SMILE camera to facilitate use. The family members of the seniors can decide whether want to buy a photo frame to be able to make use of the service. Although the second scenario may result in a higher number of photo frames purchases and a continuous income, since each new resident is a potential purchaser, it also introduces uncertainty as the word potential already implicates. Moreover, when the frames are sold independently the installation costs will increase as the installation service is fragmented.

Expected sales
As a continuation on the scenario that the care home is the purchaser of the complete system, a calculation has been performed to research the market size and expected sales. In 2014 it was estimated that 70000 senior with dementia lived in a care home (volksgezondheidenzorg, n.d.). Based on the assumptions stated below the market for SMILE are 7000 living rooms, of which 1680 living rooms will purchase SMILE.

Assumptions

- Ten residents with dementia share a single living room
- The marketing of SMILE reaches 80 percent of the living rooms (potential purchasers).
- 30 percent of the reached potential purchasers will buy the product.

Figure 20. The Nixplay photoscreen used by a senior.

Cost estimation and number of purchases for break-even

Table 1 depicts the estimated starting costs to develop the product and yearly costs for maintenance and marketing. The biggest cost is the development of the SMILE application. Besides the functionality of taking a photo or a video, the product application should offer control over the settings and content displayed on the photo frames. Other requirements include that the product is controllable from outside, that personal data is well-protected and that the design invites for use. The development of the case includes the production of a mold. Costs that have not been taken into account include transport, packaging and databases. Table 2 shows the costs of the product for the purchaser, consisting out of a single purchase of 3000 euro for the product and an optional service contract for 1500 euro on yearly base. For simplicity, a purchaser is defined as a shared living room with seven residents. The service contract, which is included in for the year of purchase and can be extended for the subsequent years, includes support and replacement of broken parts. Table 3 sums the costs and purchase to calculate the profit. Based on the starting costs, 193 products have to be sold to break even.

	Starting costs*	Yearly costs*
Development application	45000	
Yearly maintenance app		4500
Development case	7500	
Marketing	15000	1500
Unforseen	5000	500
Total	72500	6500

* costs in euro, excluding taxes

Table 1. An overview of costs for the company

	Off purchase costs	Yearly costs (optional service contract)*
Tablet	450	
Replacement tablet		200
Photoframes (7 pieces)	1000	
Replacement photoframe		400
Tablet case (1 piece)	25	
Tripod (1 piece)	50	
Yearly maintanance app		25
Service contract	800	800
Marketing		10
Installation costs	250	
Unforeseen	50	5
Total costs	2625	1440
Selling Price	3000	1500

* costs in euro, excluding taxes

Table 2. An overview of costs for the purchaser

Starting costs*	72500
Yearly costs *	6500
Income off-purchase *	3000
Income yearly service*	1500
Profit off-purchase *	375
Profit service*	60
Break-even point (number of purchases)	193

* costs in euro, excluding taxes

Table 3. Calculation of the costs, profit and break-even point

Discussion

To recap, the predicted number of purchasers is 1680. Therefore it seems realistic that the break-even point of 193 purchases is reached and profit could be made. However it is important to be aware that this business model generates most revenue from the off-purchase costs. This means that the sales will drop when the care homes have purchased the product. The goal is to keep the costs for screen replacements and hours of provided service minimal to increase the profit from the service contract.

Discussion

This paragraph reflects upon some important choices and approaches in the project. These are the definition of the targetgroup, the appropriateness of this project for the client, the use of technology and the evaluation.

Target group - The proposed product has targeted seniors with dementia living in a closed living environment. These seniors are, generally speaking, in a more progressed stage of dementia compared to seniors with dementia still living at home. However, according to the caregivers whom were interviewed in the evaluation of SMILE the product may be most valuable for the seniors with beginning dementia. For this target group the product may support their memory. Moreover, the seniors with beginning dementia may be able to learn using the product, so they are already acquainted with it for later times. The seniors with beginning dementia may therefore seem an interesting target group for further evaluation. However, some difficulties with this target group are that they may not be willing to use the supportive product as they do not yet accept the disease. Moreover, the product may confront the seniors with their disease and how it will progress. At all times, it is therefore important to frame the product in a respective, non-stigmatizing way. Another target group could include the geriatric ward in hospitals.

Client – The product SMILE fits with the ideology and aims of the client, carehome Pleyade, to treasure all social contacts. The product enhances the quality and person-centeredness in conversations between the senior, visitor and caregiver and provides an energizing activity. Therefore this product may be of value for the client. If preferred, the photo tool could also be connected with the Compaan, an interface that Pleyade is currently using, for example to review photos. Additionally this project and value proposition may inspire more innovations in this area. Last, I believe that the product is meaningful for the majority of closed living environment, as it is not specifically tailored to the context and facilities of carehome Pleyade.

Technology – In my opinion technology is a means to achieve a certain value. A product has only meaning when used by a person. Therefore a good and inviting interaction is key. However, during the project I was dependent on technology of other parties, for example the existing photo screen. This has impacted the functioning of the demonstrator. To not be limited by the design specifications I decided to add some words on the envisioned design and usage. A design choice that I made is to only display the ten most recent media files. Therefore seniors do not have the ability to delete content, but only to replace it with newer content. However, this choice has not been evaluated. Possibly a next study could investigate whether seniors like to have a simple delete function, for example a button on a the photo screen.

Evaluation - Iteration four has been evaluated during a study in context for several weeks. The study resulted in interesting insights about the value and possible improvements. However, information was primarily gained from the visitors and caregivers. The interview approach did not successfully integrate the first point perspective of the senior. Therefore, I suggest that another study focusses more on the value and perception of the senior. Second, no evaluation was performed on the final design proposition. The design proposition is a personal translation of the key insights of the evaluation to improve the design. The proposition focusses on functionalities and requires more front-end design effort. Last, the final design proposition should be build and evaluated on the use and experience to reflect upon the design choice of using a digital screen as control panel instead of the tangible buttons.

Conclusion

With SMILE the senior with dementia can take a picture or video with a visitor or caregiver. This media file will automatically be send to the personal photo frame inside the private room of the senior. The evaluation of SMILE showed that SMILE seems valuable for the senior, the visitor and the caregiver. SMILE creates moments of happiness. The displayed pictures trigger new conversations with personal content. Visitors were happily surprised to see who visited the senior. Another advantage is that the act of taking a picture and reviewing a picture seems to facilitate a shared activity. The caregiver also valued the product as an addition to their work. SMILE provides pleasure during work and informs about the social environment of the senior. Therefore the caregivers noticed that they could make the care more person-focused.

The final design proposed in this report is based on the prior iterations and user engagements. Yet, this design still needs to be realised. Evaluation should be performed to define and support the value proposition.

Personal reflection

Designing for better health and wellbeing is a topic that intrigues me due to the societal relevance, the complexity of body and mind and the diversity in people's needs and motives. As stated in my vision I feel attracted to design for essentials in life, which include health and wellbeing. In line with my identity I like the challenge of working with multiple stakeholders to find shared value, from the user perspective ranging to the societal point of view. Therefore this project has been a good fit. I am happy with my pro-active attitude to contact external parties for support and their perspective. From these contacts I learned to communicate the concept with a top-down perspective and by putting extra emphasis on the values. It was beneficial that I created several visuals and videos to explain the concept and provide an impression of the concept in context and use. Due to my enthusiasm I may not have been aware of the parties underlying interests to support the project. Therefore I may have been naïve in sharing information about my concept or evaluations. From this experience I learned that I should take care of mapping the stakeholders, their interests, influence and the value exchange.

In the future I want to orientate myself to strategic design. This perspective has been integrated in the project by performing a market analysis and creating a design strategy and vision. However, I jumped between futuristic design ideas to design ideas for the current seniors. In future project I could therefore pay more attention to distinguish between today's user and tomorrow's user and pay more attention to societal trends. Moreover, I should look at how I can translate futuristic design ideas to the here and now by discomposing design elements of value.

As I felt insecure about performing project individually, I set myself the goal to quickly move towards prototypes which could be tested. Moreover I hoped that this approach would be valuable to gain input from the seniors with dementia as it not possible to emphasize and understand their perception as an outsider. This approach turned out to be successful as I have been able to do both a small user evaluation as well as a long-term user evaluation of several weeks In context. In hindsight, I could move even more quickly as I would have defined what design characteristic I aim to evaluate. In this way I could work towards a minimal viable product, whilst I currently did unnecessary work in detailing and improving the prototype quality, for example by adding motion sensors. From doing a project on my own I liked to be able to take the pace that I aimed for. However, I also felt that I was missing knowledge from technical and business expertise areas. As a result, I had to invest time to develop myself in these areas. Moreover, during coming projects which include people with reduced mental capabilities or the ability to express themselves, I would like to invest more time to consider the best technique to involve them in the research. Besides observations, I tried to interview the seniors. However, this approach did not lend itself for the target group. Therefore I aim to investigate other techniques, such as co-reflection, probes and think aloud, to learn how I could best retrieve information from the first-user before performing the final evaluation.

Acknowledgements

University
I would like to thank the coaches from Studio Silver for the advices and feedback. Specifically I appreciate the support from Rens Brankaert, Hugo Nagtzaam and Julie Hornix; you triggered me to perform to the fullest :)

Pleyade
I like to thank Maaike Thissen from Pleyade for the arrangement of the user engagements and for her perspective on the concept. Additionally, I would like to express my appreciation to Antoinette Janssen for inviting me to the daycare at Pleyade Eilandstaete and reflecting upon the concept.

Zorgboog
Thank you – and especially Malou Grootenboer - for your enthusiasm and practical support to arrange the user evaluation at the Zorgboog.

Nixplay
I am thankful for the positive response on the concept and the provision of seven photo screens. This had enabled me to lift the project by performing a bigger user evaluation. Moreover, it was of great value to hear your feedback and advices on the concept.

And of course: thank you to all the seniors, visitors and caregivers who participated in the user engagements and product evaluations.

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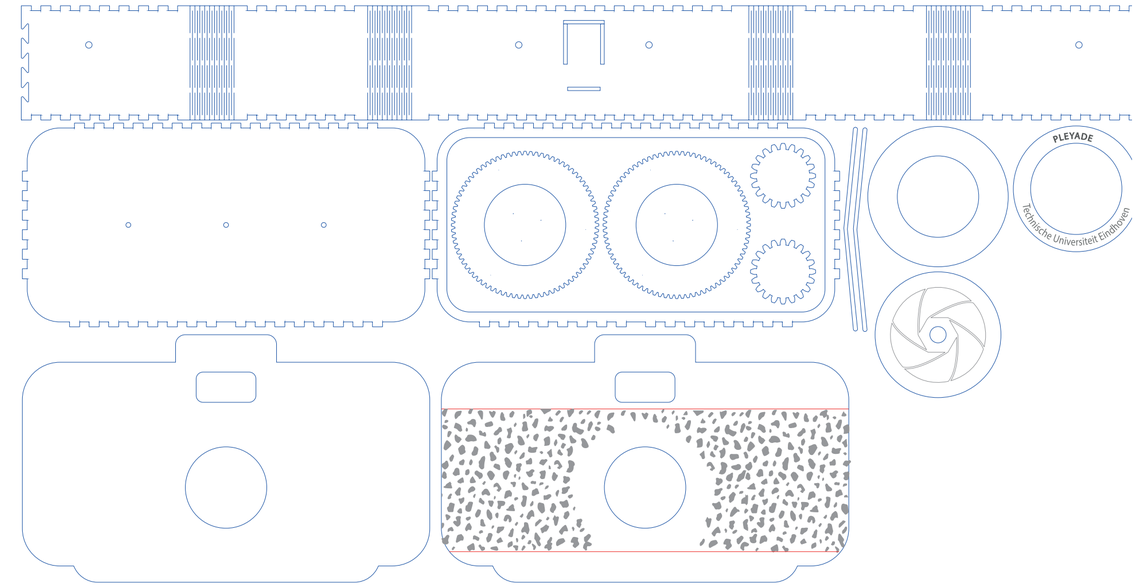
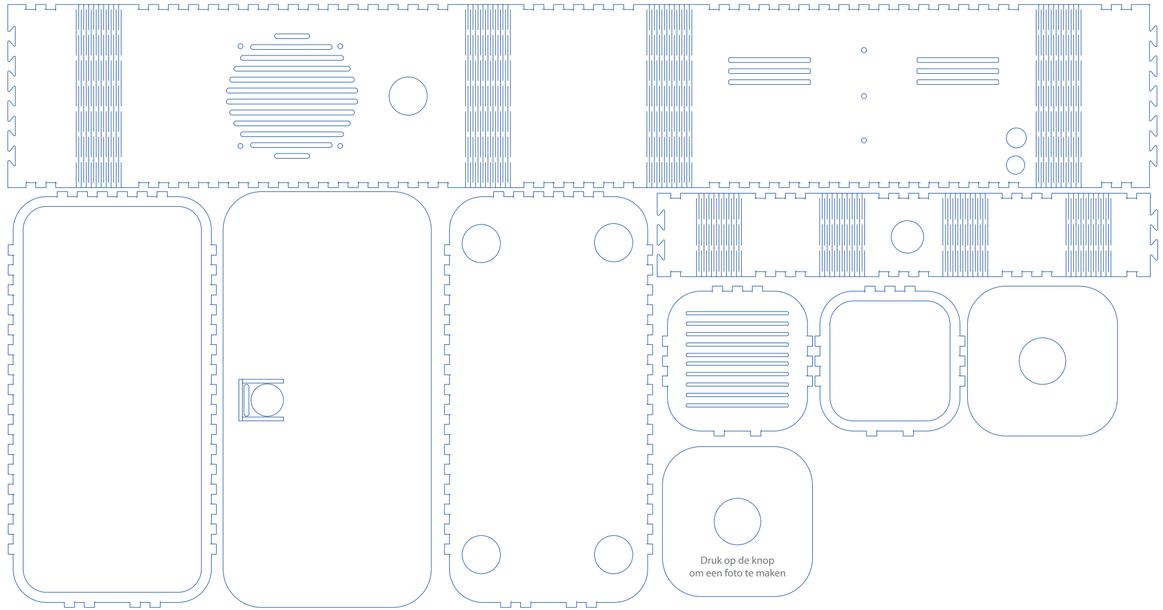
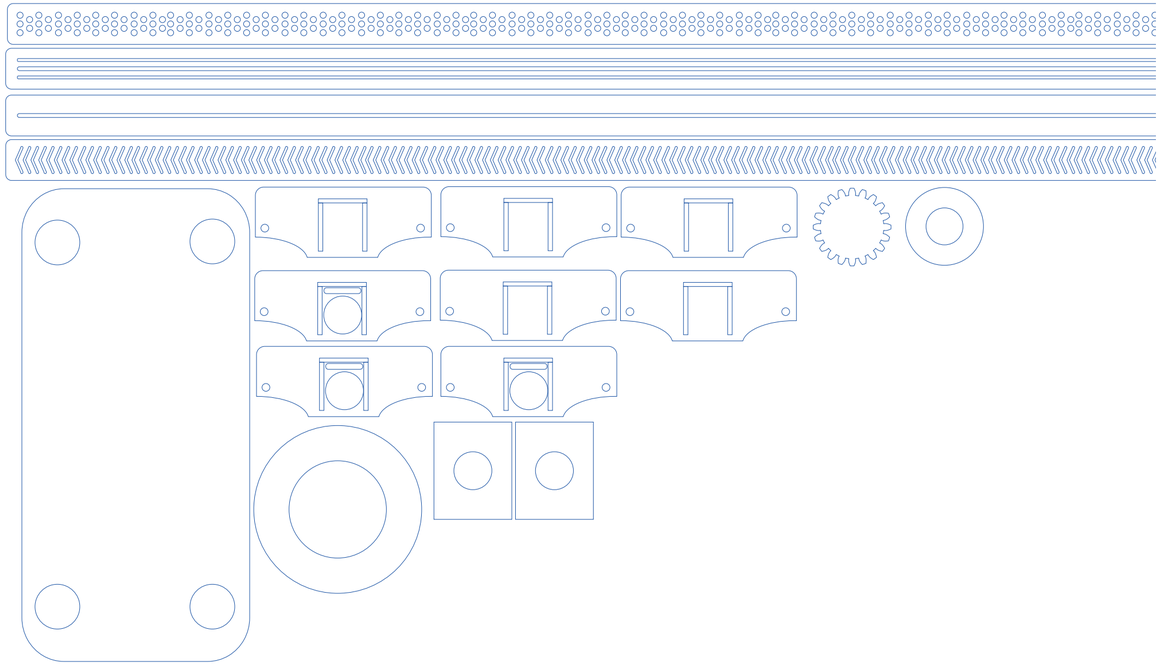
Appendices

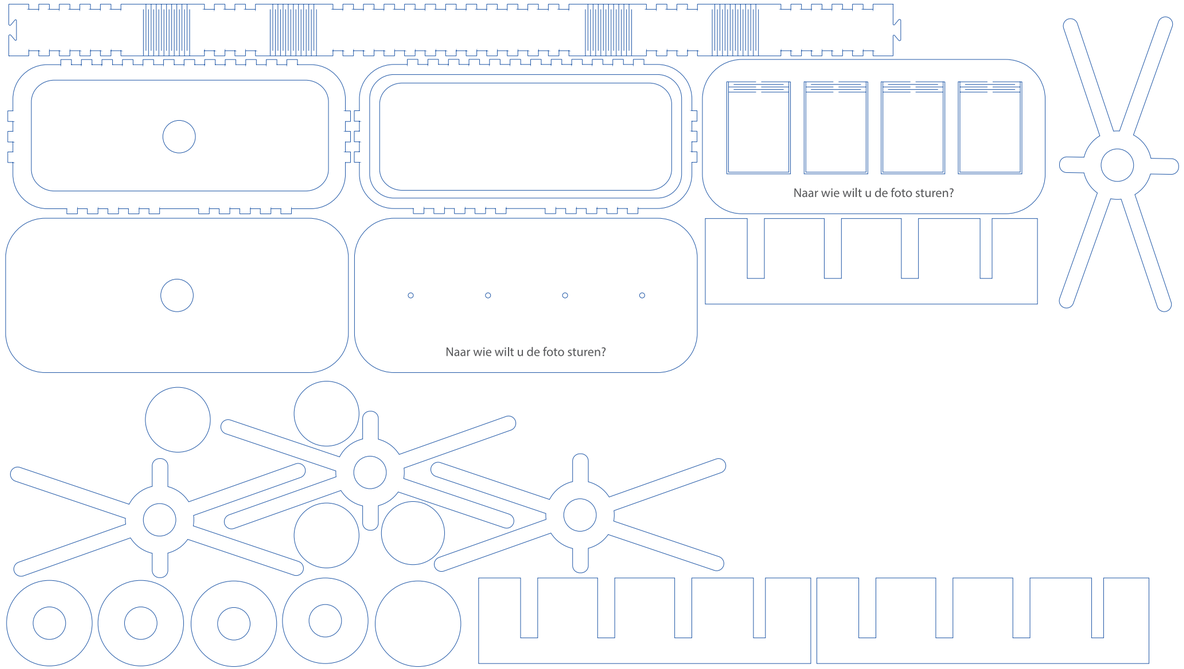
Appendix A

Laserut files for the camera




Druk op de knop
om een foto te maken

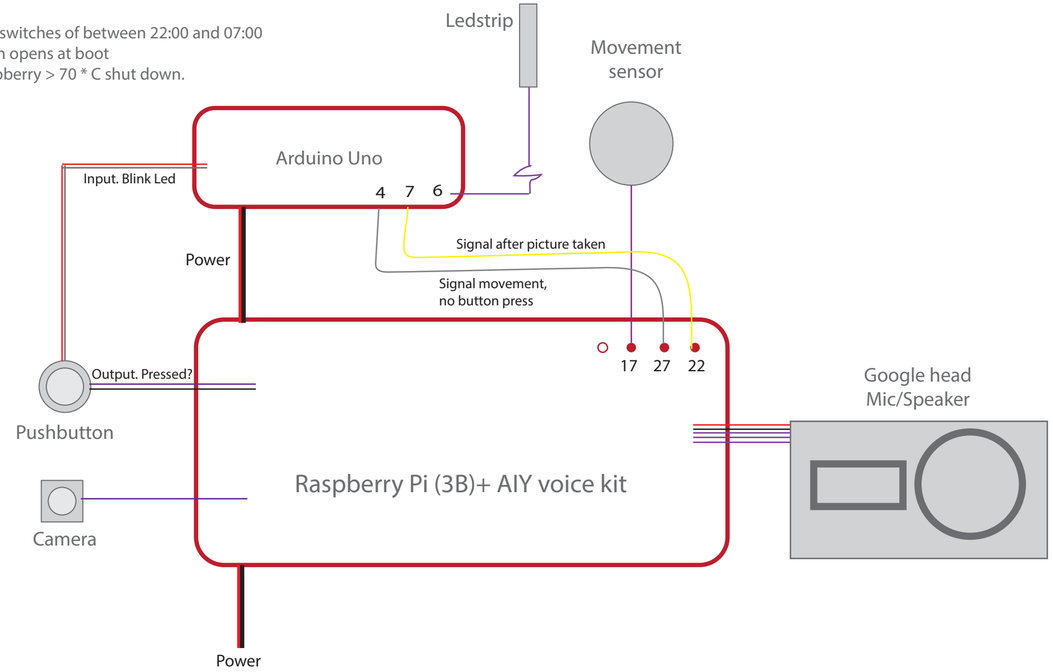




Appendix B
electronics overview

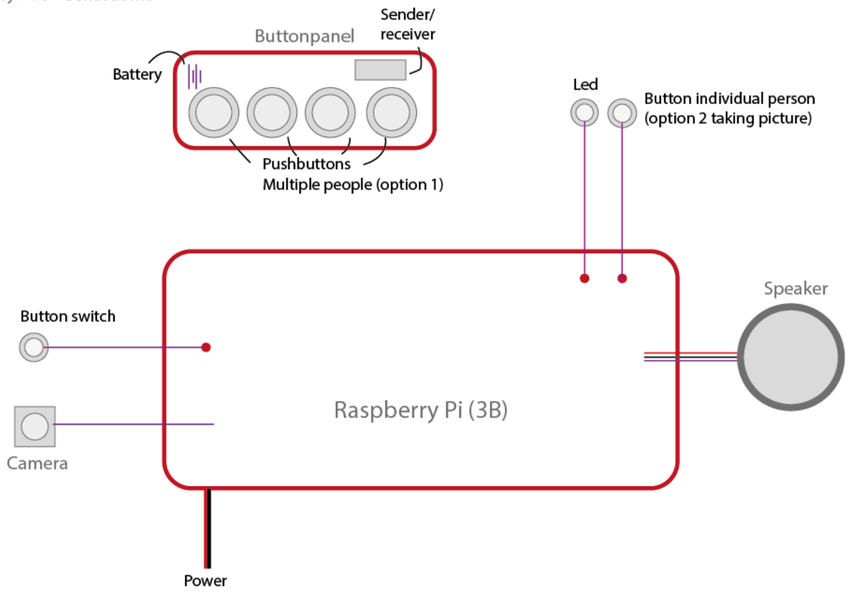
Prototype 1
Voice recognitionsoftware: Jarvis
Google head AIY Kit

Raspberry switches of between 22:00 and 07:00
Application opens at boot
When Raspberry > 70 * C shut down.



Prototype 2
Buttons

Raspberry switches of between 22:00 and 07:00
Application opens at boot
When Raspberry > 70 * C shut down.



Appendix C
Consent form

TU/e Technische Universiteit Eindhoven University of Technology

Technische Universiteit Eindhoven, 29 maart 2018

Toestemmings Formulier

Voor het project 'Design for Dementia' van de Technische Universiteit Eindhoven, wordt onderzoek gedaan naar uw mening over een speciale toepassing van een digitaal fotoscherm. Onderdeel daarvan is het praten met u en het nemen van foto's van de interactie met het product. Er zullen vragen worden gesteld en het product zal worden gebruikt, daarvan zullen video opnames en foto's worden gemaakt.

U bent niet verplicht de vragen van de studenten te beantwoorden. Indien u zich wilt terugtrekken van het onderzoek kunt u dit ten aller tijden aangeven aan de onderzoeker. Alle informatie zal als vertrouwelijk worden behandeld tenzij u aan geeft dat het publiekelijk mag worden gemaakt.

☐ Ik geef **wel** toestemming, mijn video's en foto's openbaar te publiceren op internet en andere media daarnaast mag mijn data worden gebruikt ten behoeve van het onderzoek. Mijn data zal anoniem worden verwerkt.

☐ Ik geef **geen** toestemming, mijn video's en foto's openbaar te publiceren op internet of andere media mijn data mag uitsluitend anoniem worden verwerkt ten behoeve van het onderzoek. Ik zal niet in enige video te zien of te horen zijn.

Ik heb het 'toestemming formulier' begrepen, en neem vrijwillig deel aan deze evaluatie. Ik begrijp dat mijn toestemming mijn wettelijke rechten niet beschadigt in geval van nalatigheid of andere wettelijke schuld van iedereen die betrokken is bij deze studie.

Datum: .....

Naam participant: .....

Handtekening participant: .....

Datum: 29 maart 2018.....

Naam student: Veerle van Engen.....

Handtekening student:

Appendix D

Communication with Nixplay, carehome Zorgboog and Compaan.

Beantwoorden Allen beantwoorden Doorsturen

za 17-2-2018 07:38

MP

Mark Palfreeman <mark@nix-digital.com>

Re: appreciate contact!

Aan Engen, V.P.M. van

Cc mark@nixplay.com; Lawrence Chu; John Marsden; Patrick Chan; Tom Ho; Philip Ng

U hebt dit bericht beantwoord op 17-2-2018 13:34.
Klik hier om afbeeldingen te downloaden. Om uw privacy te beschermen, zijn enkele afbeeldingen in dit bericht niet automatisch gedownload.

Dear Veerle,

Thank you very much for your email. What a wonderful project you are working on!

answers to your questions in order:

1. I believe that in the mobile app > My Frames > Frame Settings. You will see in the setting 'When Frame Wakes up'

vr 23-2-2018 14:15

LC

Lawrence Chu <lawrence.chu@nix-digital.com>

Re: appreciate contact!

Aan Engen, V.P.M. van

Cc mark@nixplay.com; Lawrence Chu; John Marsden; Patrick Chan; Tom Ho; Philip Ng; Mark Palfreeman

U hebt dit bericht beantwoord op 24-2-2018 10:26.
Klik hier om afbeeldingen te downloaden. Om uw privacy te beschermen, zijn enkele afbeeldingen in dit bericht niet automatisch gedownload.

Hello Veerle,
I'm Lawrence, nice e-meeting you.

Thank you for reaching out to us. It is always exciting to see a different perspective and application on how our products and services can evolve into. We are constantly seeking to build empathy with our lead users. It's awesome seeing projects such as yours taking shape as we are particularly keen on creating innovations that are human-centered around the elderly audience.

We are interested to help out with your project and maybe doing a little more. Please let me know if you have some availability sometimes next week, maybe we could get on Skype for a chat? Let me know how that sounds, look forward.

Thank you,

Lawrence Chu MDes
Creedon Technologies | Principal Designer

Aan 'Lawrence Chu'

Dear Lawrence,

Thank you very much for the inspiring chat this morning.
Please let me recap the main points to check if I understood you well. Moreover, I like to share the conclusions from the coach meeting I had today.

Recap
Nixplay is orientating themselves towards user-centered design for the elderly market.
Nixplay wants to sponsor my design project by providing seven screens. However, for return you want to gain knowledge about the European elderly market. Your interests are:

1) Elderly lifestyle research, for example focusing on memory or photo imaging
2) The electronic penetration and advancements in IoT and Cloud-based products. How elderly presume technologies to be and how they can be relevant for the elderly market.
3) A user study on the interaction with a Nixplay screen (6-week journal including photos and video's).

Fitting in with my project
Today I discussed the proposal with my coach at university.
We concluded that all of the aforementioned researches will be on top of my ordinary design project. Coming semester I will build and iterate upon my concept and evaluate it in context. For the (first) prototype(s)/demonstrator I will use the Nixplay screen. Although I think that the research topics are very interesting, they fit better in a Master degree program according to my coach. Next year maybe…of course I am still enthusiastic :)

That means that I can offer you my design report at the end of this semester. This report probably touches upon some of the areas. For example, it will include market research on existing elderly products.
Moreover, I am happy to share my progress and insights during the project; also on the experiences and interaction with the Nixplay screen. And of course, I will promote the Nixplay at all times!

I hope that this mail is clear and that you understand my position (also there is a regulation that all my work is intellectual property from the university).
If you have any questions I am of course happy to answer them.
Furthermore, if you would like to get in touch with the my coach from university I can share contact details.

I look forward to hear your response and thank you again for the enthusiastic response!

With kind regards,
Veerle

Feedback Nixplay's photo screens

In general the seniors were very positive about having a single medium to show a set of pictures. In the use it was remarkable to see that family sent two types of pictures to the senior(s). The first being recent pictures of the family members and pets. The second type were old pictures which were digitalized. According to caregivers, which visit seniors at home, they see a big rise in the use of digital photo frames, especially in the living room. They seem to be a perfect and well-appreciated birthday gift!

Feedback senior perspective

Suggestions:

- The notification that a new pictures is added can be emphasized by adding a sound cue.
- The text which can be added underneath a photo can be hard to read due to the size and small contrast with the background of the photo.
- Some complain that photos are cut 'at wrong places' to fit the screen.
- The wish to pause/freeze the screen on a certain photo without using the controller.
- The seniors prefer the option to see the newest pictures only (less than 100 that is the lowest number at this moment). Some state they wish to see the last 20, others state they like to see the photos from the last 7 days.
- It would be appreciated if the user can easily switch between various playlists (without having to log in to the Nixplay website or app). Playlists that they like to choose from are: 1) an automatically generated playlist that shows the most recent pictures or the pictures that were added during the last 7 days. 2) A playlist with all pictures. 3) A playlist per timeframe that the photo is taken, for example 1960-1970. 4). Photos that contain a certain person. 5) Photo's uploaded by a certain person.
- Some seniors express that they like to have an option to request new photos (notifying the uploaders with this wish).

Feedback family/relatives perspective

In general the family/relatives control/manage the photo screen that is placed by the senior. The family members/relatives send photos by mail and only log-in to the Nixplay website/app to control the settings, invite others to upload pictures and to review whether new photos were uploaded.

Positive:

- Ease of use: great to be able to send pictures by email. Low threshold.
- Good that permission to send photos can be set per mail address

Suggestions/feedback:

- Some people prefer to receive a confirmation after emailing the photo to know that their photo is well received by the screen and is displayed.
- The ability to download pictures to one's computer from the Nixplay application. The photo's can for example be a nice memorial when someone passed away.
- Having the possibility to be informed about new uploads by others.
- Knowing whether the screen is positioned in landscape mode or portrait so they can take this into account when selecting and taking pictures.

Personal perspective:

Positive:

- The newer Nixplay screens have a cable that is partly stiff and a connection cable that is flexible. This is a big advancement in the stability of the screen!

Additional suggestions:

- In case that multiple Nixplay screens are used which are registered in one account: giving each screen a unique mail address so a person can select to which screen a photo should be send. This could also be achieved by having the ability to specify to what screen the photo should be send in the mail subject/header or content.
- The ability to use audio (I noticed this is already possible in the introduction animation that is played when installing the screens). Opportunities are to enrich the viewing experience by providing a background music. Additional, similar to what I envision in my concept is to connect an audio file to pictures. This enables users to share their story that comes along with the photo. Photos with an connected audio file could for example display a symbol while they are shown in slideshow. When manually selecting a picture the audio file should play and the photo should be displayed with a similar duration as the audio file.

MG

wo 28-3-2018 00:32

Malou Grootenboer <Malou.Grootenboer@zorgboog.nl>

Digitaal fotolijstje

Aan Engen, V.P.M. van

U hebt dit bericht beantwoord op 28-3-2018 09:10.

Hallo Veerle

Wat een mooi initiatief.
Toevallig hebben we dit onderwerp afgelopen week op woning 1c besproken.
Daar is een nieuwe cliënt, die vaak naar haar man vraagt. Ook wanneer deze net is geweest.
De collega's hadden toen ook bedacht om een foto te maken wanneer haar man er is, zodat de zorg deze foto aan mw. kan laten zien wanneer ze er naar vraagt.

Wanneer zou je in de gelegenheid zijn om een keertje langs te komen?

Met vriendelijke groet,

Malou Grootenboer
Verpleegkundige
Kleinschalig Wonen Stiphout

Dag Veerle,

Leuk idee!

Iedere Compaan, of iedere Compaan profiel als je het over de huiskamer Compaan hebt, heeft een eigen mailadres. Dit adres is alleen niet van buiten benaderbaar. Je moet “uitgenodigd” worden om met de Compaan te kunnen communiceren. Technisch gaan we het wel werkend krijgen.

Met wie spreek je bij Pleyade?

Met vriendelijke groet,

Joost Hermanns

Appendix E

Information and introduction to evaluation in carehome Zorgboog

Beste mensen,

Graag stel ik me aan u voor. Mijn naam is Veerle van Engen.
Als een student Industrial Design (Technische universiteit Eindhoven) ontwikkel ik op dit moment een product voor mensen met dementie. Dit kan een positieve bijdrage brengen aan hun leven en verblijf in een woonomgeving.
Daarom heb ik onder andere contact gezocht met het kleinschalig wonen van de Zorgboog. Samen zijn we erg enthousiast om het product in de praktijk te evalueren.

Natuurlijk kan dit alleen met uw toestemming. Met dit bericht wil ik u dan ook graag informeren en vragen of ik uw familielid of echtenoot/echtgenote hierin mag betrekken. Meer informatie over het product en de evaluatie treft u aan in de bijlage.

Ik stel een positieve reactie erg op prijs. U kunt reageren door op dit mailtje te antwoorden, het liefst op kort termijn.
Na akkoord zal ik u verder informeren over het moment waarop de evaluatie zal plaatsvinden (in de periode april tot midden mei).

Natuurlijk ben ik altijd bereid om vragen te beantwoorden.
U kunt mij bereiken via v.p.m.v.engen@student.tue.nl

Alvast veel dank!

Met hartelijke groeten,
Veerle van Engen

Het idee
Het product bestaat uit een digitaal fotolijstje (zie afbeelding 1) en een zelfgemaakt fototoestel (zie afbeelding 2). Het fotolijstje komt op de kamer van de bewoner te staan. Het fototoestel zal een plekje krijgen in de gemeenschappelijk woonkamer.

Afbeelding 1. Het digitale fotolijstje

Afbeelding 2. Het fototoestel met knoppen naar wie de foto gestuurd moet worden.

Het idee is dat een foto wordt gemaakt van de bewoner met bijvoorbeeld een bezoeker. Deze actie nemen de bezoeker en bewoner samen; zij worden daarin op een eenvoudige manier begeleid. De gemaakte foto wordt automatisch naar het fotolijstje van de bewoner gestuurd.
De foto is een directe herinnering van het bezoek; deze blijft steeds terugkomen, met andere foto’s, op het fotolijstje. Hierdoor hoop ik houvast te bieden aan de oudere, die bijvoorbeeld denkt: ‘Die mooie bloemen in mijn kamer…;Ik geloof dat ik die gisteren heb gehad, maar van wie…?’. Ook denk ik dat het tonen van deze foto’s gesprekstof kan creëren, kan bijdragen aan het behouden van iemands identiteit en eigenwaarde en eventuele leegte kan opvullen door te laten zien dat er bezoek is geweest en dat er activiteiten ondernomen zijn. Voor een eerste concept video zie: https://drive.google.com/open?id=1vn1iXEaIJe4h-kq170HqbRdhOHFgksCk

De evaluatie
Samen met De Zorgboog evalueer ik graag het concept met vier bewoners van de groep, waar uw familielid of echtgenoot/echtgenote ook woont (woning 1c). Tijdens de evaluatie hebben de deelnemers het digitale fotolijstje in hun persoonlijke kamer staan. Het fototoestel krijgt een plekje in de woonkamer. De evaluatie zal twee weken duren. Gedurende die tijd nodig ik al het bezoek van harte uit om samen met de bewoner een fotootje te maken. Deze actie zal voor u, als familie of echtgenoot, slechts enkele seconde in beslag nemen. En wellicht vindt u het ook leuk om samen de foto’s van voorgaande bezoekers te bekijken…? Dat kan een leuk aanknopingspunt zijn voor een gesprekje ☺ Uit deze evaluatie hoop ik te leren of de foto’s een waardevolle geheugensteun kunnen zijn.

Toestemming
Het project slaagt alleen als voldoende bewoners kunnen deelnemen aan deze evaluatie. Tijdens de evaluatie zullen er foto’s worden gemaakt. Deze zullen niet worden gepubliceerd of voor andere doeleinden worden gebruikt. Ook zal alles anoniem zijn. Als u toestemming geeft vraag ik u een consent formulier te ondertekenen. Deze kunt u ondertekenen als u tijdens de evaluatie op bezoek bent. Onderstaand vindt u het formulier ook digitaal. De evaluatie zal plaatsvinden in de periode van april tot midden mei. De exacte data worden nog gecommuniceerd.

Appendix F

Evaluation setup andpreparation for evaluation one and two

Evaluatie #1
Datum: 29 maart
Plaats: Eilandstaete Pleyade, Arnhem

Introductie (keywords)
Student Product ontwerpen, Technische Universiteit Eindhoven
Project dementie
Doel: helpen herinneren wie er op bezoek is geweest. Minder eenzaam, spreekstof leuke herinnering, eigenwaarde, herkennen van objecten in kamer.
Hoe? Fototoestel waarmee bezoek foto kan maken met de persoon met dementie. Foto zal verstuurd worden naar het fotolijstje dat op de kamer staat van de persoon met dementie.
Evaluatie twee prototypes. Mijn vraag aan u is om beide prototypes uit te proberen en een aantal vragen te beantwoorden. In totaal zal dit een kwartiertje duren.
Concent form laten tekenen.

Interactie met prototype 1 (los fototoestel met toetsenbord)
Introductie: bij dit product zijn er een aantal knoppen. Op deze knoppen zal een foto komen te staan van de ouderen met dementie. Bezoek kan dat op de foto klikken van de persoon waar ze bij op bezoek zijn. En de foto zal naar deze persoon worden gestuurd. U mag zelf een persoon kiezen.

Interactie observaties:
(duidelijkheid, verstaanbaarheid, opvolgen van opdracht, lichaamstaal/gezichtsuitdrukking)

Vragen:
Kunt u een omschrijving geven wat u zojuist heeft gedaan?
Wat ging er goed?
Wat ging minder goed of was moeilijker?
Wat vond u van het drukken op de knop?
Wat vond u van de stem (verstaanbaar? Opdrachten duidelijk?)?
Wat vond u van de manier dat er een foto is gemaakt?

Interactie met prototype 2 (fototoestel met knop en spraak)
Introductie: Dit product doet hetzelfde als het andere fototoestel. In plaats van de knoppen wordt dit toestel alleen bestuurd met spraak. Het fototoestel zal u op een gegeven moment vragen naar wie u de foto wilt sturen. In plaats van namen van personen heb ik in dit geval de schermpjes een kleur gegeven. Dus dan kan u bijvoorbeeld zeggen: blauw of zwart/rood/geel.

Interactie observaties:
(duidelijkheid, verstaanbaarheid, opvolgen van opdracht, lichaamstaal/gezichtsuitdrukking)

Vragen:
Kunt u een omschrijving geven wat u zojuist heeft gedaan?
Wat ging er goed?
Wat ging minder goed of was moeilijker?
Wat vond u van het drukken op de knop?
Wat vond u van de stem (verstaanbaar? Opdrachten duidelijk?)?
Wat vond u van het antwoorden met spraak?
Wat vond u van de lampjes?

Vergelijking
Welk van de producten sprak u het meeste aan? Waarom?
Wat vind u van het idee om foto's te maken met bezoekers zodat mensen met dementie houvast krijgen?
Denk u dat dit product behulpzaam zal zijn voor deze mensen?
Wat vind u van de vormgeving?
Zou u het product zelf willen gebruiken als u dementie heeft? Waarom?
Zou u zelf een fototoestel in uw kamer willen hebben? Waarom?
Zou u als u op bezoek gaat bij iemand een foto willen maken met dit product?
Zou u zelf zo'n fotolijstje willen hebben? Waarom?
Waar zou u het fotolijstje neerzetten?
Wanneer zou u naar de foto's kijken?
Ik ga de komende weken verder met het maken van dit product.
Wat zijn zaken die ik zo moet laten en wat zou ik kunnen verbeteren?
Heeft u nog andere ideeën?
Hartelijke dank!

Evaluatie #2
Plaats: Kleinschalig Wonen Zorgboog Stiphout, Helmond
Wanneer: 14 tot 20 mei
Contact persoon: Malou grootenboer (Malou.Grootenboer@zorgboog.nl)
Woning: 1c

Doelen
1) Inzicht in hoe de foto's ervaren worden door de bewoner. [lens: gebruiker]
2) Inzicht in hoe de foto's en het nemen van de foto's invloed heeft op de ervaren sociale betrokkenheid van de bewoner en de interactie tussen de bewoner en bezoeker. [lens: sociaal]
3) Inzicht in welke waarde het product kan toevoegen in de zorg en hoe het gebruikt kan worden. [lens: organisatie]

Opzet
Semigestructureerd interview van circa 10 minuten.
Het interview met de verzorging en bezoekers is 1-op-1.
Het gesprekje met de bewoner zal bij voorkeur in bijzijn van een familielid of verzorger plaats vinden.
Voorkeur heeft dat er een audio opname van het interview wordt gemaakt. Als daar geen toestemming voor wordt gegeven, wordt er schriftelijk aantekingen gemaakt.
Het streven is om minstens vier verzorgers te spreken (die op de woning 1C staan en dus ervaring hebben met het product), vier familieleden van bewoners die meedoen en minstens twee bewoners zelf. Indien mogelijk wordt ook een vrijwilliger benaderd voor een interview.
De interviews zullen geanalyseerd worden aan de hand van quotes uit het interview. Deze zullen gesorteerd worden op thema's die naar voren komen.

Interview vragen familielid / verzorger / vrijwilliger
Hoe heeft u het product ervaren?
Kunt u aangeven wat u aanspreekt in de fototoepassing (a. nemen van foto, b. terugzien van foto op lijstje)?
Kunt u aangeven of en zo ja wat er verbeterd kan worden aan het de fototoepassing (a. nemen van foto, b. terugzien van foto op lijstje)?.
Hoe reageert de bewoner (uw 'familielid') op de foto's die in het lijstje getoond worden?
Hebben de foto's de betrokkenheid in relatie tot de omgeving van de bewoner (uw 'familielid') gewijzigd? Zo ja, hoe. Zo nee, hoe kunt u dat verklaren?
Kunt u beschrijven welke situaties zich het best lenen om een foto te maken omdat het waarde toevoegt?
Hoe beïnvloedt het nemen van een foto de interactie tussen:
- voor verzorging: 1) u en de bewoner, 2) u en het familielid van de bewoner
- voor familielid: 1) u en uw familielid die heer woont, 2) u en de verzorging?
Hoe beïnvloedt het fotolijstje met foto's van vorige bezoekers de interactie tussen:
- voor verzorging: 1) u en de bewoner, 2) u en het familielid van de bewoner
- voor familielid: 1) u en uw familielid die heer woont, 2) u en de verzorging?
Heeft u nog andere ideeën of opmerkingen?

Interview vragen bewoner
Hoe vindt u het dat u een foto kan nemen met dit fototoestel?
Kunt u mij vertellen wat u op het fotolijstje ziet?
Wat vindt u van het bekijken van deze foto's?
Heeft u andere ideeën die het wonen hier leuker maken?

Appendix G
Schematics and code Iteration 3

```
import threading
import picamera
import sys
import RPi.GPIO as GPIO
import time
import smtplib
from email.mime.text import MIMEText
from email.mime.image import MIMEImage
from email.mime.multipart import MIMEMultipart
import os
import subprocess
from time import sleep
import string
from subprocess import call
time_stamp = time.time()
```

Python code
Hardware
Raspberry pi3, with picamera module

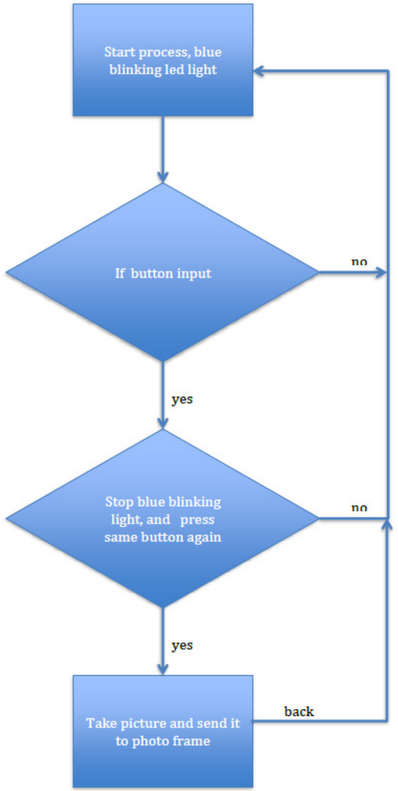
High bright RGB led

Wireless 433Mhz RF Module Reciever and Transmitter, 4 channel

4 microswitches

USB sound card

USB speaker




```
# definition and setup of the in- and output pins
GPIO.setmode(GPIO.BCM)
GPIO.setwarnings(False)
GPIO.setup(23, GPIO.IN, pull_up_down=GPIO.
PUD_UP)#Button to GPIO23
GPIO.setup(21, GPIO.IN, pull_up_down=GPIO.
PUD_DOWN)#Button to GPIO40
GPIO.setup(20, GPIO.IN, pull_up_down=GPIO.
PUD_DOWN)#Button to GPIO38
GPIO.setup(16, GPIO.IN, pull_up_down=GPIO.
PUD_DOWN)#Button to GPIO36
GPIO.setup(12, GPIO.IN, pull_up_down=GPIO.
PUD_DOWN)#Button to GPIO32
GPIO.setup(22, GPIO.OUT)  #LED to GPIO22
GREEN
GPIO.setup(27, GPIO.OUT)  #LED to GPIO27 BLUE
GPIO.setup(17, GPIO.OUT)  #LED to GPIO17 RED
GPIO.output(22, False)
GPIO.output(27, False)
GPIO.output(17, False)
# pin and name relation 20 Annie 21 Pieter 16
Maria 12 Johan

# making of the picture
def my_photo():
   call(["aplay", "/home/pi/Music/napiepjes.wav"])
   with picamera.PiCamera() as camera:
         camera.resolution = (1024, 768)
         camera.start_preview()
         call(["aplay", "/home/pi/Music/countdown.
wav"]) # countdown sound
         call(["aplay", "/home/pi/Music/shutter.
wav"]) # sound of a shutter
         camera.capture('//var/temp/photo.jpg') #
location , name and format of the picture
         GPIO.output(22, False)
```

```
# sending the picture as attachement by
google email to the photoframe
def send_email(host, subject, to_addr, from_
addr, body_text):
   """    Send an email
   """
   msg = MIMEMultipart()
   body = 'Hi there, sending this email camera
application!'
   msg.attach(MIMEText(body,'plain'))
   filepath = '//var/temp/photo.jpg'
   with open(filepath, 'rb') as f:
         img = MIMEImage(f.read())
   img.add_header('Content-Disposition','attac
hment',filename=os.path.basename(filepath))
   msg.attach(img)
  server = smtplib.SMTP('smtp.gmail.
com',587)
   server.starttls()
   server.login("bezoekersapp@gmail.
com","bezoeker")
   server.sendmail(from_addr, [to_addr],msg.
as_string())
   server.quit()
   call(["aplay", "/home/pi/Music/dank.wav"])
#thank you wav

#timeout when second button press is not in
time
def my_timeout():
   GPIO.output(22, False)
   GPIO.output(17, True)
   time.sleep(3)
   GPIO.output(17, False)
```

```
#background process blinking leds (blue)
when movement sensor is activated
def my_blink(arg):
   t = threading.currentThread()
   while getattr(t, "do_run", 2):
      GPIO.setmode(GPIO.BCM)
      GPIO.setup(27, GPIO.OUT)  #LED to
GPIO27 BLUE
         GPIO.output(27, True)  # led on
         time.sleep(1)
         GPIO.output(27, False) # led off
      x=t.do_run # interrupt of the function for
x secods
      time.sleep(x)

# action when input from keybord is recieved
# second press of same button is needed to
controll the right input
def my_function(pin):
   t.do_run = 30
   stop = time.time() + 60
   GPIO.output(22, True)
   #First time the Button Pressed...
   call(["aplay", "/home/pi/Music/bevestiging.
wav"]) # sound the button is pressed
   time.sleep(0.5)
   while time.time() < stop:
```

```
    #press button again to print and send photo"
    #GPIO.cleanup()
    GPIO.setmode(GPIO.BCM)
    GPIO.setwarnings(False)
    GPIO.setup(23, GPIO.IN, pull_up_down=GPIO.
PUD_UP)
    GPIO.setup(21, GPIO.IN, pull_up_down=GPIO.
PUD_DOWN)
    GPIO.setup(20, GPIO.IN, pull_up_down=GPIO.
PUD_DOWN)
    GPIO.setup(16, GPIO.IN, pull_up_down=GPIO.
PUD_DOWN)
    GPIO.setup(12, GPIO.IN, pull_up_down=GPIO.
PUD_DOWN)
      if pin == 23: #method  to shutdown the
raspberry pi in a controlled way
            channel = GPIO.wait_for_edge(pin,
GPIO.FALLING,bouncetime = 50, timeout=15000)
            sleep(2)
            if GPIO.input(23) == 0:
                  subprocess.call(['poweroff'],
shell=True, \
            stdout=subprocess.PIPE,
stderr=subprocess.PIPE)

      else:
            channel = GPIO.wait_for_edge(pin,
GPIO.RISING,bouncetime = 50, timeout=15000)
      if channel is None:
      #   timeout occured or difference between
first and second button
      my_timeout()
      call(["aplay", "/home/pi/Music/oeps.wav"])
 t.do_run = 1
      else:
```

```
# Photo is taken with pin number
      my_photo()
    host = "mySMTP.server.com"
    subject = "Test email from Python"
    if pin == 23: #pin numer and
photoframe adress
      to_addr = 'bezoeker12051@
mynixplay.com'
    if pin == 21:
      to_addr = 'bezoeker13062@
mynixplay.com'
    if pin == 20:
      to_addr = 'bezoeker12051@
mynixplay.com'
    if pin == 16:
      to_addr = 'bezoeker12051@
mynixplay.com'
    if pin == 12:
      to_addr = 'bezoeker13062@
mynixplay.com'

    from_addr = "bezoekersapp@gmail.
com"
    body_text = "foto"
    send_email(host, subject, to_addr,
from_addr, body_text)
    t.do_run = 1 #start backgroud process
again
    GPIO.output(22, False)
    stop = time.time() - 60
t = threading.Thread(target=my_blink,
args=("task",))
t.start()
t.do_run=1
```

```
#main programm; chech which button is
pressed
try:
  while True:
    button_state23 = GPIO.input(23)
    button_state21 = GPIO.input(21)
    button_state20 = GPIO.input(20)
    button_state16 = GPIO.input(16)
    button_state12 = GPIO.input(12)

    start_time = time.time()
    if button_state23 == False:
      pin=23
      my_function(pin)
    if button_state21 == True:
      pin=21
      my_function(pin)
    if button_state20 == True:
      pin=20
      my_function(pin)
    if button_state16 == True:
      pin=16
      my_function(pin)
    if button_state12 == True:
      pin=12
      my_function(pin)

except KeyboardInterrupt:  #exit
  GPIO.cleanup()      # clean up GPIO on
CTRL+C exit
  GPIO.cleanup()      # clean up GPIO on
normal exit
```


Appendix H

Schematics and code Iteration five

Needed software.

NOOBS Jessie
Apache 2 PHP
Python 3

Needed hardware

Raspberry pi3 with camera module
Google HAT AIY (sound and microphone)
Arduino uno R3 and RGB ledstrip
Motion sensor HC-SR501 PIR
Laptop (HTML)

For code see: https://drive.google.com/open?id=1RnyHrXti1j4tpsBNhifPFFlHYHLoFzdj