

HCI Project Report

Reminder for People with Dementia

Group 7

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Reminder for People of Dementia

According to the introduction in the *Alzheimers' Disease international*, dementia is a collective name for progressive brain syndromes which affect memory, thinking, behaviour and emotion. Dementia affects 50 million people worldwide, with a new case of dementia occurring somewhere in the world every 3 seconds. The classical feature of dementia is memory loss, while behavioural and psychological symptoms are also salient (Cerejeira, Lagarto and Mukaetova-Ladinska, 2012). There are three stages of dementia, early stage, middle stage and the late stage. As the deterioration of the disease, it negatively impacts the ability of people with dementia (PwD) to negotiate their environment and independently complete activities of daily living (ADLs) (Hersch, Falzgraf, 2012). When dementia patients gradually cannot live independently, it also burdens family caregivers (Black, Almeida, 2004) who are responsible for cognition prompting, remind and support PwD in the performance of ADLs (O'Neill, Gillespie, 2008).

The aim of the project is designing a product which will help people with dementia live independently as long as possible. The aim of the report is to introduce the product and the process of creating the product, including reviewing literature, user research, analyzing demands and design.

Literature Review

Assistive technologies (ATs), referring to devices designed to enable people with disability to function more independently (O'Keefe, Maier, Freiman, 2010). These technologies help people in three ways: "(1) by providing assurance that the elder is safe and is performing necessary daily activities, and, if not, alerting a caregiver; (2) by helping the elder compensate for their impairment, assisting in the performance of daily activities; and (3) by assessing the elder's cognitive status" (Pollack, 2005). Considering our knowledge and interest, we are going to focus on developing a reminder for helping the elder compensate for their memory loss. Then we think about what should be remind in daily live.

In the research -- Behaviors Associated with Dementia (Smith, Buckwalter, 2005), one of the principles of care is that adjusting daily routines to focus on the person, not the tasks, which not only help the person with dementia know what to expect, but help her to continue to do things on her own. Therefore, we will remind PwD according to their existing habits. Through reminding, we hope that PwD will keep their habits as long as possible.

PwD easily forget things and their caregivers are always concerned about their daily life, the caregivers will be the best person who are responsible for reminding PwD through ATs. Thus, our product aims to remind PwD of their daily activities through watches as well as help caregivers to set up the reminder on cell phones (figure 1).

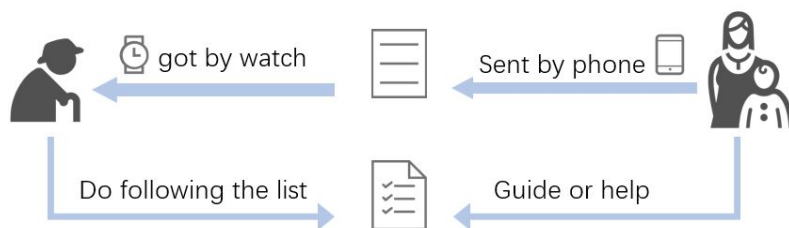


Figure 1 the main function of our product

User Research – semi-structured interview online

In order to understand the real users (people with dementia and their caregivers) and their demands, we need to do user research. There are three reasons for using semi-structured interview online. The first one is that interview is the most effective way to understand users' needs and mental models. The second reason is that in the literature review, we collected data and design some questions, but we still expected to explore new problems, so the semi-structured interview not only enables us to follow the designed questions but also allows us to discovery new topics. The limitation of meeting target users face to face is the third reason that made us decide to interview online.

Before interview, we designed the guideline of the interview, main questions of the interview and the explanation of questions. In guideline of interview, there are five parts, including introduction to the project, introducing the interview consent form, asking warm up questions, asking substantive questions and thanks part. For understanding daily activities of PwD, we create a activities list according to twenty models created in the paper *Predicting the role of assistive technologies in the lives of people with dementia using objective care recipient factors* (Czarnuch, Ricciardelli, Mihailidis, 2016). It will predict the level of difficulty care recipients with different ADL. In More details of each part will be shown in the appendix 1 in the end of the report.

Result of interview

We made five interviews, four patients are more than 80 years old and more than half of the caregivers are middle aged. During the interview, we collected qualitative data through asking questions and recording answers. We also asked interviewees to fill in a form in which there are many daily activities, the degree of difficulty, the degree of being easy to forget something as well as the frequency of activities. Thus, from the quantitative data, we found that eating medicine is the most forgettable thing, which means that when caregivers using our product, most of them may set up a reminder for reminding of eating medicine. In this case, we will design a shortcut for setting eating medicine reminder. We also found that PwD will do the same activity many time in one day. For example, they prepare food and eat 2 to 4 times, and they watch TV 3 times. Therefore, in our product, it should be enable users to save their reminder, so that they are able to use it again quickly. More quantitative data will be

shown in the appendix 3.

The descriptive data below shows the methods of reminding

- Caregivers need to remind PwD regularly every day for shaping a new habit, so that PwD is able to remember to do the activity.
- Caregivers need to tell PwD what thing should be done. Sometimes, it needs several times.
- Caregivers need to encourage PwD when they are unwilling to do something through giving some rewards.
- Caregivers need to do the first few steps for reminding PwD what the next steps.
- Caregivers need to assistance PwD during doing activities.
- Caregivers need to use photos to remind PwD of recent events and new friends.
- Caregivers need to write notes and stick them to remind PwD somethings.

Demand analysis

According to the data we collected, we found that in the patient group, when they still in the early stage, they are able to live alone and do many things independently following their daily routine, though they are easy to forget new things. For middle stage patients, their caregivers need to give assistance when they do many activities in daily life, but they are still trying to live independently. For late stage patients, however, they totally depend on their caregivers. Therefore, our product is suitable for patients who are in the early and middle stages. Therefore, our target users are people with dementia who are in the early stage or middle stage, and their caregivers.

Furthermore, we also found that caregivers want to help their loved one to live independently through reminding them of daily activities and guiding them to complete these activities. And we also found that PwD need a simple device without many interactive operations, which will remind them. In terms of methods of reminding, from the interview, we knew PwD and caregivers always communicate by verbal expression rather than sending message. We also knew that caregivers will show photos and picture to PwD for reminding their recent events and new friends. Therefore, in our product, we decided to use caregivers' record as the alarm for reminding PwD with relevant picture. Besides, we also created the personas for supporting us when we need to image the practical situation and the personas are also used in expert evaluation part when we introduce our target users. After creating personas, we brainstormed according to the demands and the features of our personas. Finally we create the wireframe of application and the watch. More details about the demands analysis will be shown in appendix 4.

Design

Our product is consist of two parts. The first part is a watch for people with dementia who are in the early stage and in the middle stage. The second part is a mobile phone

application for caregivers. In the watch, users only need to touch the screen for stopping or activating the alarm and to press the only one physical button for sending the helping message. In the application, caregivers are able to set up daily activities and the steps of activity for PwD, which will be synced with the watch, so that PwD will be reminded. At the same time, caregivers also receive the messages from the watch, so that they will know whether their loved one need help and know the stage of activities or steps, such as being completed.

The design of the watch

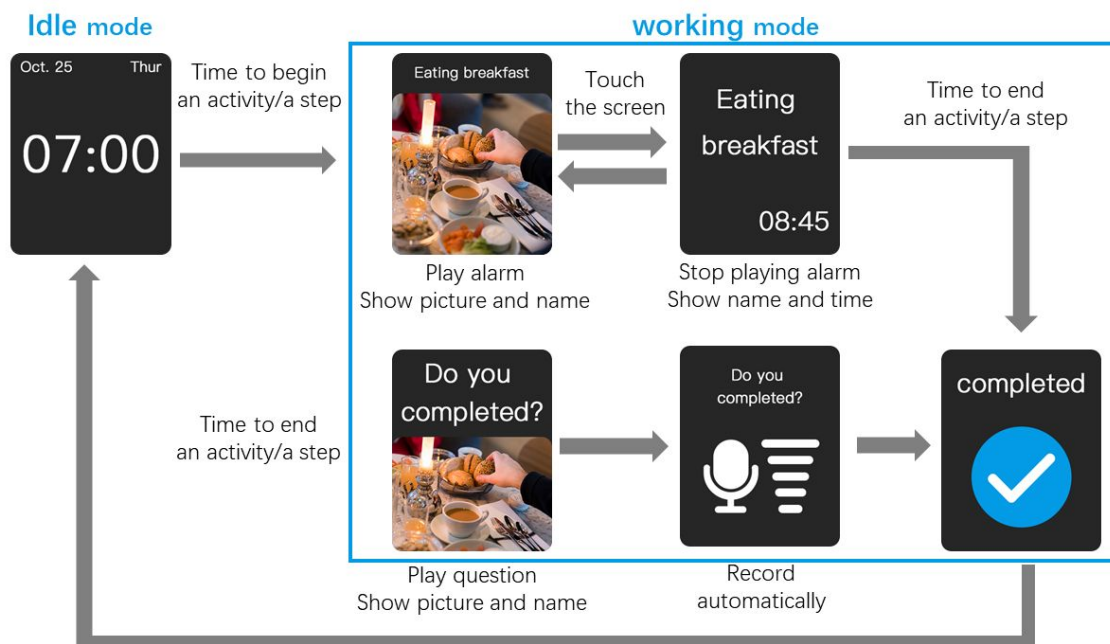


figure 2 the design of the watch

There are two modes of the watch. When there is no activity need to do, the watch is in the idle mode, looking like other digital watch showing the time and date.

When it is time to do an activity, the watch turns to working mode, in which it will play the alarm as well as show the name of the activity and the relevant picture. If there are steps in an activity, after reminding the activity, the first step of the activity will be reminded automatically. We encourage caregivers to record their own sounds as the alarm, because it is more similar to the method of reminding before using our product. But, caregivers are still able to select a ringtone as the alarm. We also require caregivers to use picture as a useful method for reminding. During the time when doing an activity/a step, if user touch the screen, the alarm will play again and will show the picture again. Touching the screen at this moment, the alarm will stop and the time will replace the picture, but the name of the activity/the step will always be shown on the screen.

For the signal of completion, there are two ways to complete. The first one is setting the end time. When the time reach the end time, the name and the relevant picture will not be

shown on the screen, and the watch turn back to idle mode automatically, showing the time and date. Another way is using speech recognition technology. The watch will play a question that recorded by caregiver. After that, the watch will record automatically. If what PwD say matches the keywords which were set by caregivers, the activity/the step will be completed and the watch will turn back idle mode.

The watch is designed for people with dementia. These people are easy to forget new things and they also feel that it is hard to use digital devices like remote control according to the data from our interview. Thus, the methods of interaction of the watch should be as simple as possible. Then, there are just two interactive methods -- pressing the physical button and touching the screen. Besides, because from the interview, we knew caregivers and PwD prefer to communicate verbally, we encourage caregivers to record their sound as the alarm. It will be easier for PwD to use the natural interactive ways. Furthermore, in daily life, caregivers will show pictures for reminding, so we also will show the relevant pictures of activities and steps.

Most dementia people are elderly people who prefer bigger color contrasts, images and icons rather than text menus, so we used contrasting color white and black as the main color and used many icons and pictures.

The design of the application

The two main functions in the application are creating activities and receiving message. Thus, in the *home page* (figure 3.1) the primarily button is the switch button in the top center and the blue button in the bottom center. The switch button was designed for looking today's activities and the message, while the blue button works for creating a new activity. The middle of this page is an activity card which shows the information of the activity. Through swiping left or right, the activities on this day will be shown in chronological order.

Switching to the *message page* (figure 3.2), there are four types of message. The helping message is the most important, so the background color is orange. It supports caregiver to help PwD immediately. The second type of message is the stage message which will be shown when PwD begin, completed and didn't completed an activity or a step. This message helps caregivers to make sure things are going well, and once there is something unusual, caregivers are able to contact PwD in time. If PwD cannot complete an activity, but the next activity is going to begin, the third type message -- move on message will ask for whether moving to the next activity. In this case, the caregivers have to focus on the unusual situation -- unfinished an activity, which will drive them to find the reason. Because the activity cannot be completed, caregivers may need to improve the activity, so the fourth type of message -- modify message is asking for whether they want to modify the activity.

On the both home page and message page, the top left icon and the top right icon are same. They are the pattern button and the personal information button respectively. Because the PwD do a same activity many times in one day, like eating and dressing, the activity can be saved as a pattern, so that caregivers are able to create the activity quickly by using the pattern (figure 3.3). In the personal information page, there are the sync button for syncing the activities with the watch and the setting button for connecting the watch as well as the log out

button.

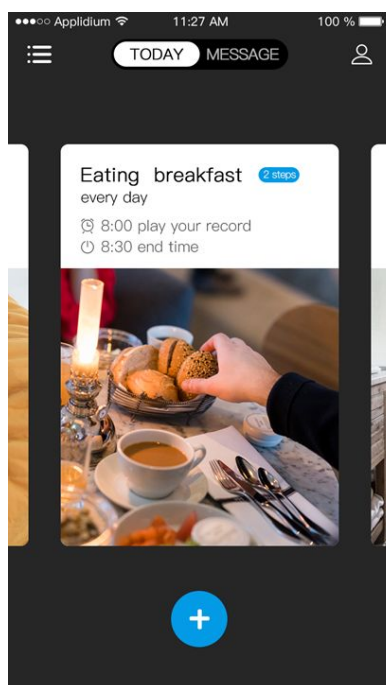


figure 3.1 home page

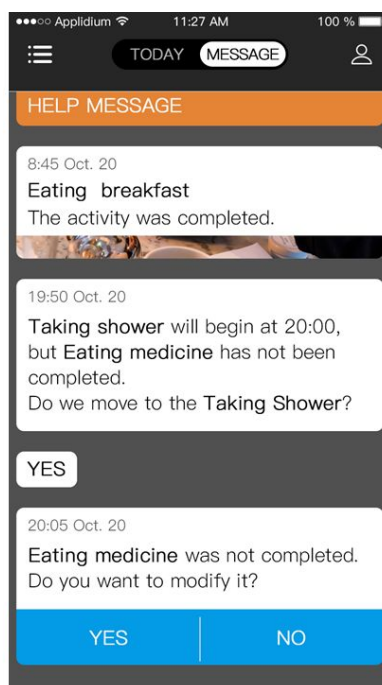


figure 3.2 message page

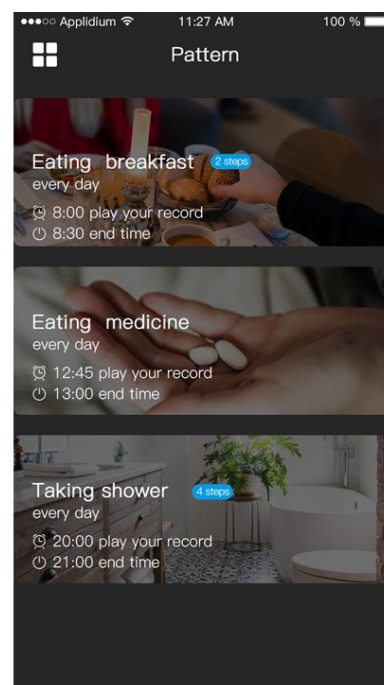


figure 3.3 pattern page

There are many information of an activity and a step, which shown in the *activity page* (figure 4.1) and the *step page* (figure 4.2), In these two page, caregivers are able to edit and delete the activity/the step by pressing the setting button on the top right. Beside, caregivers are also able to save the activity as a pattern through the setting button. In order to create an activity or add a step, there are several steps. Comparing with the *create activity page* (figure 4.3) and the *add step page* (figure 4.4), two steps are different. The first difference the the begin time. An activity will start according to time, while the step in an activity will start when the last step finished. Thus, there is no begin time in each step. This design helps us to organize activities and steps. When we interviewed our target users, we found that PwD may do an activity one time in many days, so the second difference is the repeat potion, in which we provide options, such as every day, once in two days, once in three days and so on.

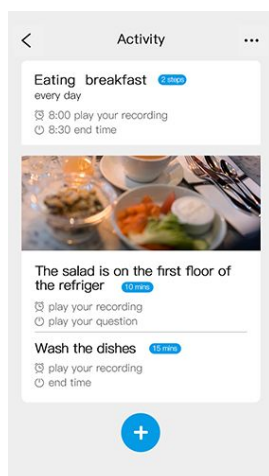


figure 4.1 activity page

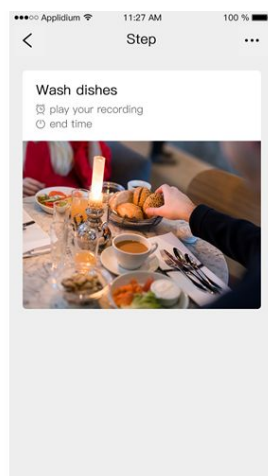


figure 4.2 step page

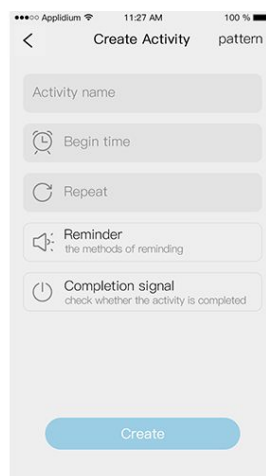


figure 4.3 create activity page

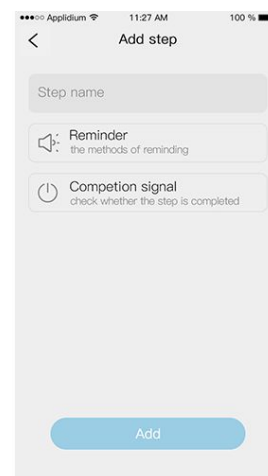


figure 4.4 add step

The methods of reminding and the completion signal of creating activity and adding step are same. When choosing a methods of reminding, caregivers are able to choose recording their own sounds or setting a ringtone as the alarm. Because we hope they will record their voice, we put the recording button on the top (figure 5.1). After choosing the alarm, caregiver need to upload a relevant picture or select one from the database. In the picture database (figure 5.2), we have provided many pictures which were classified according to different activities. From our interview, we discovered the difficult activities and things that are easy to forget, so we provide pictures that are relevant with these activities. We also designed the most frequent options of types and put them in front of those picture, so that caregivers are able to find the picture quickly. Beside, using the search bar is another good way to find a relevant picture (figure 6.1).

Similarly, when setting the completion signal, we also hope that caregivers will record their sound, so the recording button was put in the primary position (figure 5.3). There is another option -- setting the end time as the completion signal, which means that when time arrived at the end time, the activity/the step will be regarded as being completed by our product. When caregivers choose to record their question, they still need to estimate the time that the activity/the step will take. Their question will be played when the time goes by. After playing the question, the watch will record PwD's answer which will be used for matching the keywords. Therefore, caregivers need to input the keywords that their loved one may answer (figure 5.4, figure 6.2).

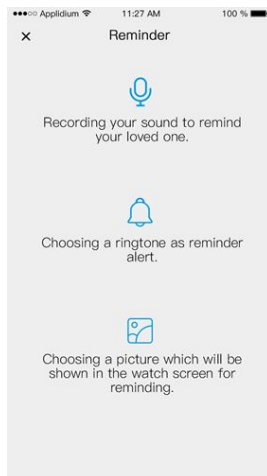


figure 5.1 reminder

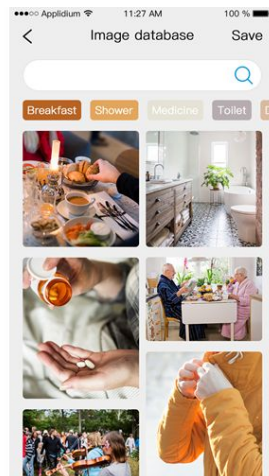


figure 5.2 image database

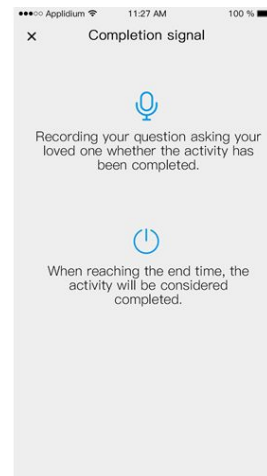


figure 5.3 completion

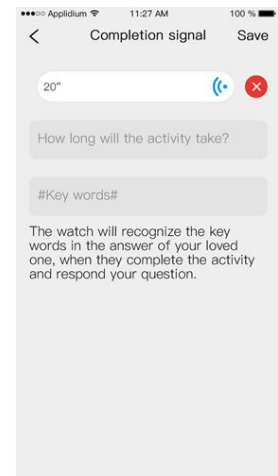


figure 5.4 record question

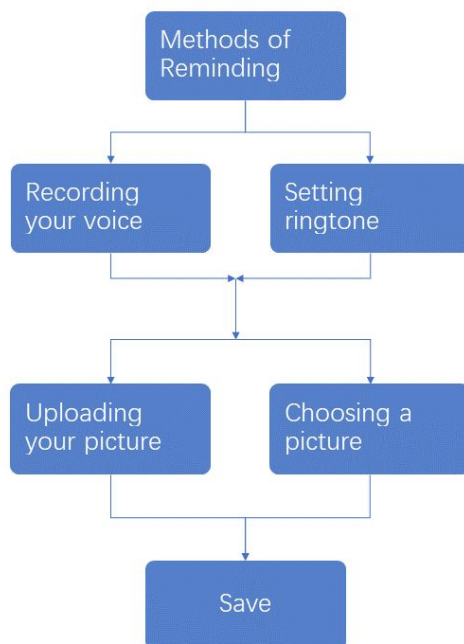


figure 6.1 task flow of setting reminding

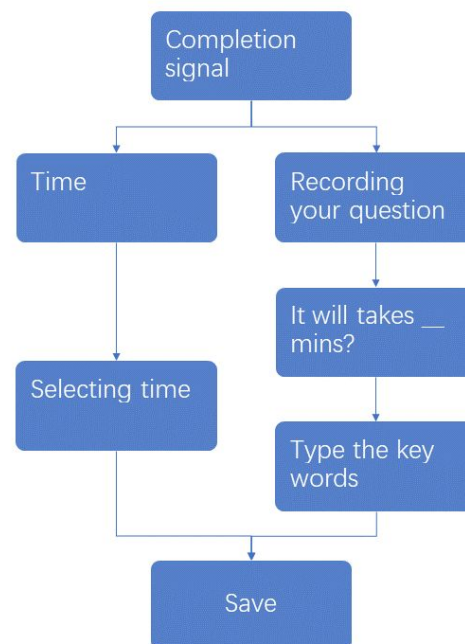


figure 6.2 task flow of setting completion signal

Here is the link for using hi-fi prototype: <https://invis.io/DVOO9VXCOKH>

More pages will be shown in the appendix 5.

The technology of the product

For syncing activities and steps, the watch needs to connect the Internet anywhere, so the solution is to put a SIM card in the watch.

In order to connect the application with the watch, in the application, user needs to sign up by providing name, telephone number and a unique password (figure 7.1). They need to verify their details by a verification code. After signing up, Caregivers can sign in using Name and telephone number. To connect to the watch- they need to input the number of SIM card in the watch as well as input the serial number (SN) code (figure 7.2) which will be shown in the watch when keeping pressing the physical button. For syncing with the app,

watch will ask users for the connection, if yes or no (figure 7.4). In this way, the application is able to sync the activities and steps with the watch. The watch will show timely updates and reminders and will be used as a tool for interaction.

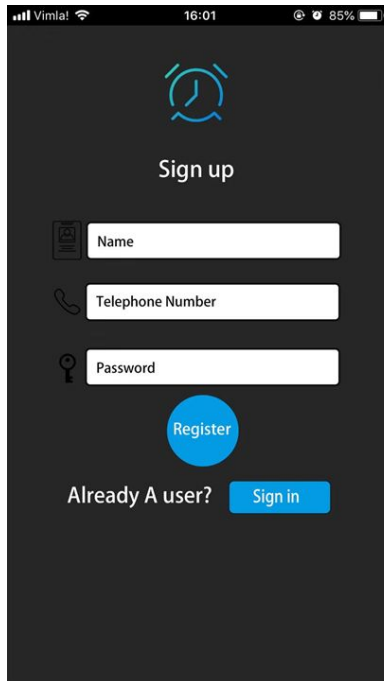


figure 7.1 register page

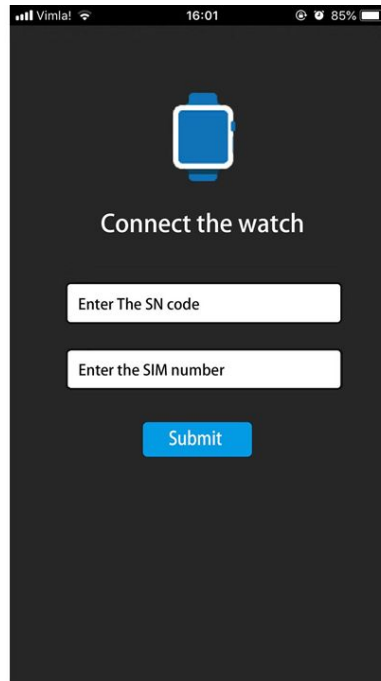


figure 7.2 connection page

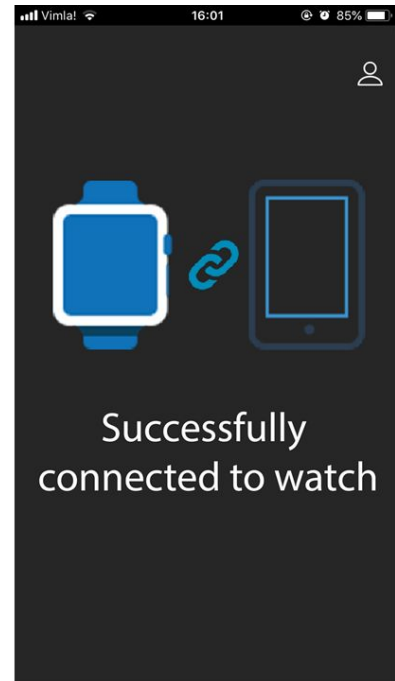


figure 7.3 connecting successfully

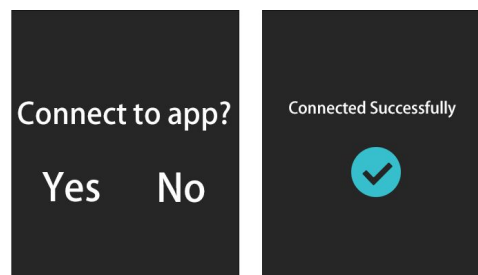


figure 7.4 watch connection activity page

Expert evaluation

Guideline of evaluation

We decided to use expert evaluation for evaluating our product and improve. The following steps will guide us to evaluate. The first step is listing the heuristics according to Nielsen and Molich's 10 heuristics and Ben Shneiderman's 8 golden rules. We used three rating scale for measuring the problems in each heuristic and rule, in which the higher score means more serious problems (appendix 6). And then in second step we invited evaluators who have experience of designing mobile phone application. The third step is briefing our evaluators. In this part, we need to introduce our product, the personas and the instruction of evaluation.

We estimate that the evaluation will cost 30 minutes, in the first 10 mins, experts are able to explore the product freely to gain a feel for the methods of interaction and the scope. In the next 20 mins, evaluators will complete the tasks that we gave them. They will also take notes and organize notes according to the heuristics and golden rules as well as give a score.

Result of evaluation

After a lot of discussions, interviews and evaluating, we came up with certain facts that most of the people suffering from dementia remember certain things, like if it's in their muscle memory and can remember one task at a time or can recollect if reminded. For example most of the people remembered to make, eat or drink their morning breakfast if considered one at a time but they would forget one of them or wouldn't recollect whether they had their breakfast or not.

we found out that with the help of some subtle hints they could do things like normal people but age was a factor in some cases. As age can cause increased level of care and need more hints or steps in the reminder because the stages of dementia might increase.

The relatives were happy with the idea as they could keep a track of their loved one's daily activity and wouldn't have to worry and the app isn't much of a burden on their daily routine either.

Critical points

When a family member are involved in nursing home, families report showed reduced emotional burden, while staff report showed reduced stress from the care recipient's behavior, and both family and staff caregivers report showed improved perceptions of their relationships with one another, the care provided, and facility management (Smith, Buckwalter, 2005).

Besides, in the official website of Alzheimer's Disease International, the Swedish government commits to develop national dementia strategy, in which it shows that *"equality in care for persons with dementia will require a national standardized care-process applied by all Swedish communities, equal for all Swedish persons with dementia, going forward."* However, *"Currently, most care of patients with dementia takes place in the social services sector targeted at the elderly, in the severe stages of the disease, where assisted care-home staff are not trained to discern or meet the needs of the person with dementia or the surrounding care-givers."*

It might cause an overhead burden for the elders to wear a device and do domestic chores, or they don't like to work with it.

Sometimes they might forget to wear or deny it's usage due to lack of interest.

Discussion

Creating a device which can help people is a tedious task sometimes. Different people

have different choices and have different needs. We tried to come together with a simple user interface with a portable wearable technology which will help the elders and relatives taking care from distance and help them remember things and not become an extra burden on their daily livelihood. we hope to help the families fight the dementia without much efforts.

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Appendix

1. Interview Guidelines

Introduction to the project

Our project topic is “Treatment of Alzheimer patient’s”. The classical feature of dementia is memory loss, while behavioural and psychological symptoms are also salient (Cerejeira, Lagarto and Mukaetova-Ladinska, 2012). It negatively impacts the ability of people with dementia (PwD) to negotiate their environment and independently complete activities of daily living (ADLs) (Hersch, Falzgraf, 2012). When dementia patients gradually cannot live independently, it also burdens family caregivers (Black, Almeida, 2004) who are responsible for cognition prompting, remind and support PwD in the performance of ADLs (O'Neill, Gillespie, 2008).

The goal of the project is to design a device for the people suffering from dementia to enable them to do their daily activities and for the caregivers to have a daily information about their dear ones and can assist them to do necessary activities.

Interview Consent form

The interview will take 30-40 minutes. We don't anticipate that there are any risks associated with your participation, but you have the right to stop the interview, withdraw or discontinue your participation from the research at any time.

If you feel uncomfortable in any way during the interview session, you have the rights to decline to answer any question or to end the interview. We will take care of your time and ethical values.

Thank you for agreeing to be interviewed as part of the above project. We the students from Uppsala University will be using this interview answers for our academic project. This consent form is necessary for us to ensure that you understand the purpose of your involvement and that you agree to the conditions of your participation.

Would you therefore read the information sheet and then sign this form to certify that you approve the following : -

- I understand that my interview will be noted down by a person.
- The interview will be recorded and will only be used for the analysis of the data from the interview. This will not be used in any other research and my confidentiality as a participant in this academic project study will remain secure. Subsequent uses of records and data will be subject to standard data use policies which protect the anonymity of individuals.

- I understand that interview research will not identify by my name in any reports of project. I understand that my responses will be kept strictly confidential and my name will not be linked with the research materials.
- I volunteer to participate in an academic project by students from Uppsala university, Sweden. I understand that project is designed to gather information about the people suffering from dementia and the caregivers.
- I agree that the data from the interview will be kept for the future research if necessary.
- I don't expect to receive any benefit or payment for my participation
- I can request a copy of the transcript of my interview if necessary.
- I have been able to ask any questions I might have, and I understand that I am free to contact the student researchers with any questions I may have in the future.
- I have read the information sheet and understand the explanation provided to me. I have had all my questions answered to my satisfaction, and I agree to participate in the project research.

Warm up Questions

1. How was your day? How are you feeling right now?
2. What do you really like to do on daily basis?
3. Tell me more about you, your background and family members?
4. How often you do something you enjoy with your dear ones?
5. How do you react seeing a new device?

Substantive Questions

There are three themes involved and there are several questions in each theme (table 1). When interviewing, interviewer is able to rephrase those questions and change the order of them according to the situation.

Theme	Question
Personal Information	1.How old are you? (both patients and caregivers)
	2.Which stage are PwD is in?
	3. What do caregivers and PwD do regularly in every day?
The daily activities	4. What things need to be reminded for PwD?
	5. What degree do these things are easy to be forgotten for PwD?
	6. What things are difficult to be completed for PwD, why?
	7. Are there any difficulty for caregivers when taking care of PwD?
Methods of reminding	8. How to remind when PwD forget somethings
	9. How to help PwD to complete those difficult activities
	10. Are you using digital devices or applications as a reminder? And what is the advantages and disadvantages of them?

Table 1 the questions of interview in three themes

Notes

There are two things which need to be noticed. Firstly, from literatures, the patients in the late-stage normally are not able to take care of themselves independently, but if the interviewee is willing to recall, we could ask the situation before. The second one is that when asking question, we should not use the word like patient, Alzheimer's patient, people with dementia, because these words may make those families feel sad. We should remember the relationship between caregivers and the elderly and using the words like, your father, your mother and so on.

2. Explanation of the questions

When asking question 2, if interviewee is not sure what stage the elderly is in, we will take some examples, helping for judging roughly.

Stage of dementia	Symptom of each stage
Early Stage	Problems coming up with the right word or name
	Trouble remembering names when introduced to new people
	Challenges performing tasks in social or work settings
	Forgetting material that one has just read
	Losing or misplacing a valuable object
	Increasing trouble with planning or organizing
	Changing in mood and behaviour
Middle Stage	Forgetfulness of events or about one's own personal history
	Feeling moody or withdrawn, especially in socially or mentally challenging situations
	Being unable to recall their own address or telephone number or the high school or college from which they graduated
	Confusion about where they are or what day it is
	The need for help choosing proper clothing for the season or the occasion
	Trouble controlling bladder and bowels in some individuals
	Changes in sleep patterns, such as sleeping during the day and becoming restless at night
	An increased risk of wandering and becoming lost
	Personality and behavioral changes, including suspiciousness and delusions or compulsive, repetitive behavior like hand-wringing or tissue shredding
Late Stage	Need round-the-clock assistance with daily activities and personal care
	Lose awareness of recent experiences as well as of their surroundings
	Experience changes in physical abilities, including the ability to walk, sit and, eventually, swallow
	Have increasing difficulty communicating

	Become vulnerable to infections, especially pneumonia
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table 2 the symptoms of each stage

The purpose of asking question 3 is helping interviewee to recall their daily life, preparing for answering the following questions.

When asking the question 4, 5 and 6, interviewer need to fill the table 3. Qualitative researchers find PwD living alone value their independence and will adapt as necessary to remain at home as long as possible (Duane, Brasher, Kock, 2011; Harris, 2006). There are twenty models that predict the level of difficulty care recipients with different ADL, including preparing food, eating, preparing a drink and so on. The table 3 using this models, for recording the situation of people with dementia. If PwD does those things in the list, ticking them in the first column. If they talk something we didn't prepare, adding them. We used three rating scale to measure the degree of difficulty and the degree of easy to forget. The standard of three rating scale shown in table 4. The higher score of the degree of difficulty means the activity is more difficult, while the higher score of the degree of easy to forget means the thing is easier to be forgot. There is the "times/day" column which is used to measure the frequency of the activity.

When asking question 8 and question 9, we have written down the list in table 5, according to the advice from *Alzheimer Society Canada*, which helps us to take note quickly. Using the most difficult things and the easiest forgettable thing in the table 3 as an example, interviewer should explore more details. For example, the relative may say that in the first step, I will write a sticky note for tomorrow breakfast and stick it on the fridge at night; when my father begin to cook, I will help him; after my father finished it, he will cross off the note. From this information, we are going to analyze the mental model of relatives and elderly people.

	To do list	Difficulty	Easy to forget	Times/day
	Dressing			
	teeth cleaning			
	toileting			
	preparing a drink			
	drinking			
	preparing food			
	eating			
	taking a walk			
	taking a shower			
	watching TV (using remote control to transfer station)			
	talking with other elderly people outside			
	telephone			
	shopping			
	house working			

	games / hobbies			
	taking transportation			
	eating medicine			

Table 3 the daily activities of people with dementia

Degree of difficulty		Degree of easy to forget	
0	like normal people	0	like normal people
1	complete the activities independently	1	remember by themselves
2	need assistance	2	only remember after reminding
3	totally depend on others	3	totally can't remember

Table 4 the standard of three rating scale

To do list	Times/day
write notes on the fridge to remind her to eat	
sign on a cupboard to tell her what is inside	
lay out clothes in the order so that the elderly put on easier	
remind the elderly to go to the bathroom	
cook meal (together)	
walk together	
help to take a shower	
ask elderly people to go to sleep	

Table 5 the daily activities of caregivers

3.Result of interview

The personal information is shown in the table 6. The degree of difficulty of daily activities and the degree of easy to forget among these activities are shown in the table 7. The activities which will be done in interviewees' daily life with the average degree of difficulty and easy to forget are shown in the table 8.

No	Age of the elder	Gender	Stage	Age of caregiver	Relationship
1	81	female	early	57	mother and son
2	80	male	middle	52	father in law and daughter in law
3	40	male	early	20	uncle and nephew
4	89	female	middle	24	grandma and granddaughter

Table 6 interviewees' information

Degree of difficulty		Degree of easy to forget	
0	like normal people	0	like normal people
1	complete the activities independently	1	remember by themselves
2	need assistance	2	only remember after reminding
3	totally depend on others	3	totally can't remember

Table 7 the degree of difficulty of daily activities and the degree of easy to forget

To do list	Difficulty	Easy to forget	Times/day
Dressing	1	1	2
teeth cleaning	0	0	2
toileting	1	1	4-5
preparing a drink	1	1	2
drinking	0	0	4-5
preparing food	1	0	2-4
eating	1	1	2-4
taking a walk	0	0	1
taking a shower	0	0	1
watching TV (using remote control to transfer station)	0	0	3
talking with other elderly people outside	1	1	2
telephone	0	0	2
shopping	1	1	1
house working	1	1	2-3
games / hobbies	0	0	1
taking transportation	1	1	2
eating medicine	2	2	4

table 8 the activities with their degree of difficulty and the degree of easy to forget

4. Data analysis

From the daily activities of people with dementia (PwD), and the personal information of our interviewees, we created the two personas representing PwD and two personas representing caregivers, with the following features. The features include age, stage of dementia, activities pattern (including the most difficult activities and the easier forgettable thing), methods of reminding. Two of the personas are shown below (figure 1, 2).

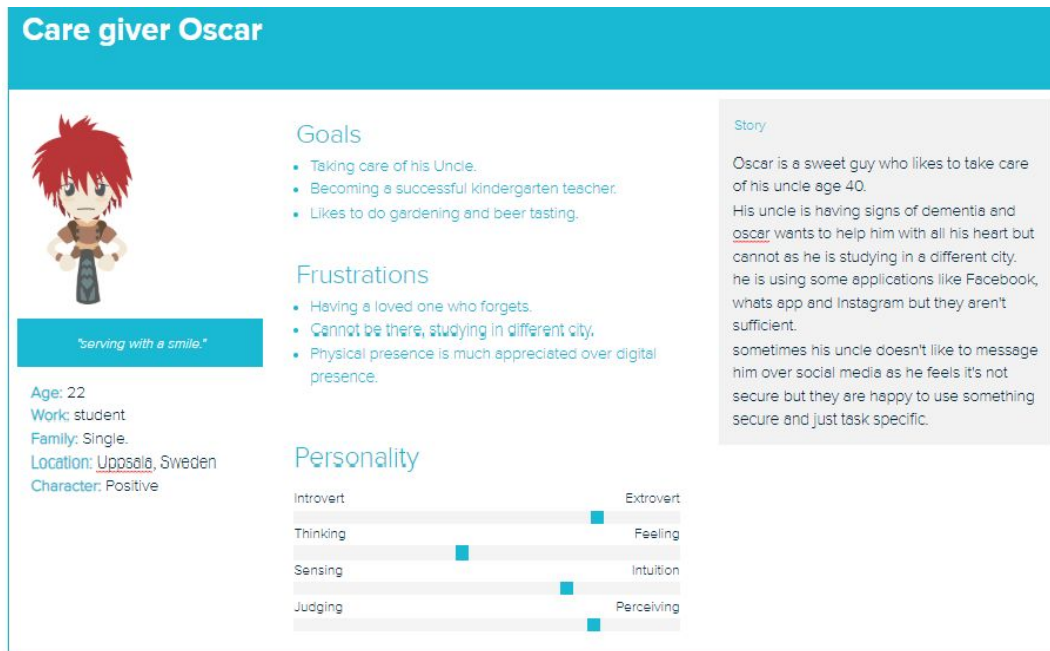


figure 1 personas of caregiver

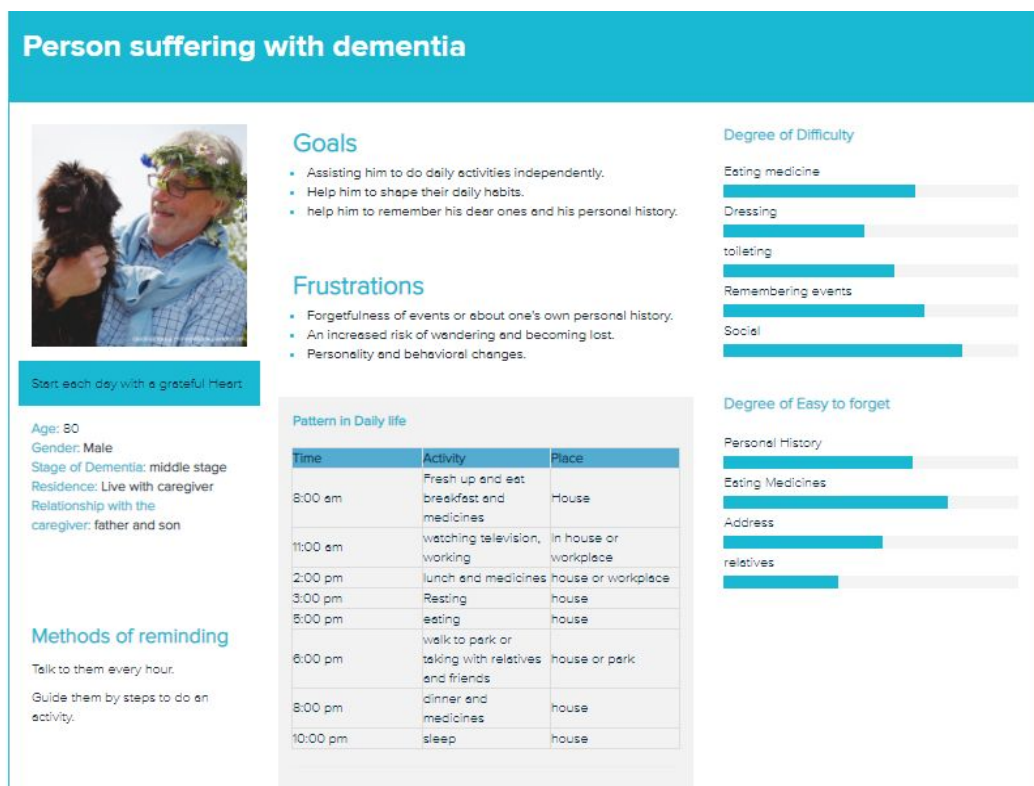


figure 2 personas of PwD

The list below is the functions of our product according to the data collected in the interview section (table 9).

	Theme	Evidence	Function for PwD	Function for caregivers
1	reminder	Caregivers need to tell PwD what thing should be done. Sometimes, it needs several times.	the reminding alarm need to repeat	set up the times and time of a reminder
2		PwD may be unwilling to do something through giving some rewards.	the reminding alarm can be paused and selected again	allow the activity can be paused
3		Caregivers need to do the first few steps for reminding PwD what the next steps; Caregivers need to assistance PwD during doing activities.	showing the steps and guiding the next few steps	set up the steps according to their patients' situation
4	notification	there are many unpredictable situations	upload the stage of activities	show the stage of activities
5				modify the alarm or the steps
6	methods of interacting	PwD and caregivers always communicate by talking rather than sending message	upload the new stage through speech recognition	set up the key words for speech recognition
7		Caregivers need to tell PwD what thing should be done	reminder can play caregivers' voice	upload their voice as the alarm
8		Caregivers need to use photos to remind PwD of recent events and new friends;	reminder can show the photos	upload the photos
9		Caregivers need to write notes and stick them to remind PwD somethings.	reminder can show text	input the text

table 9 the functions of our product according to the interview data

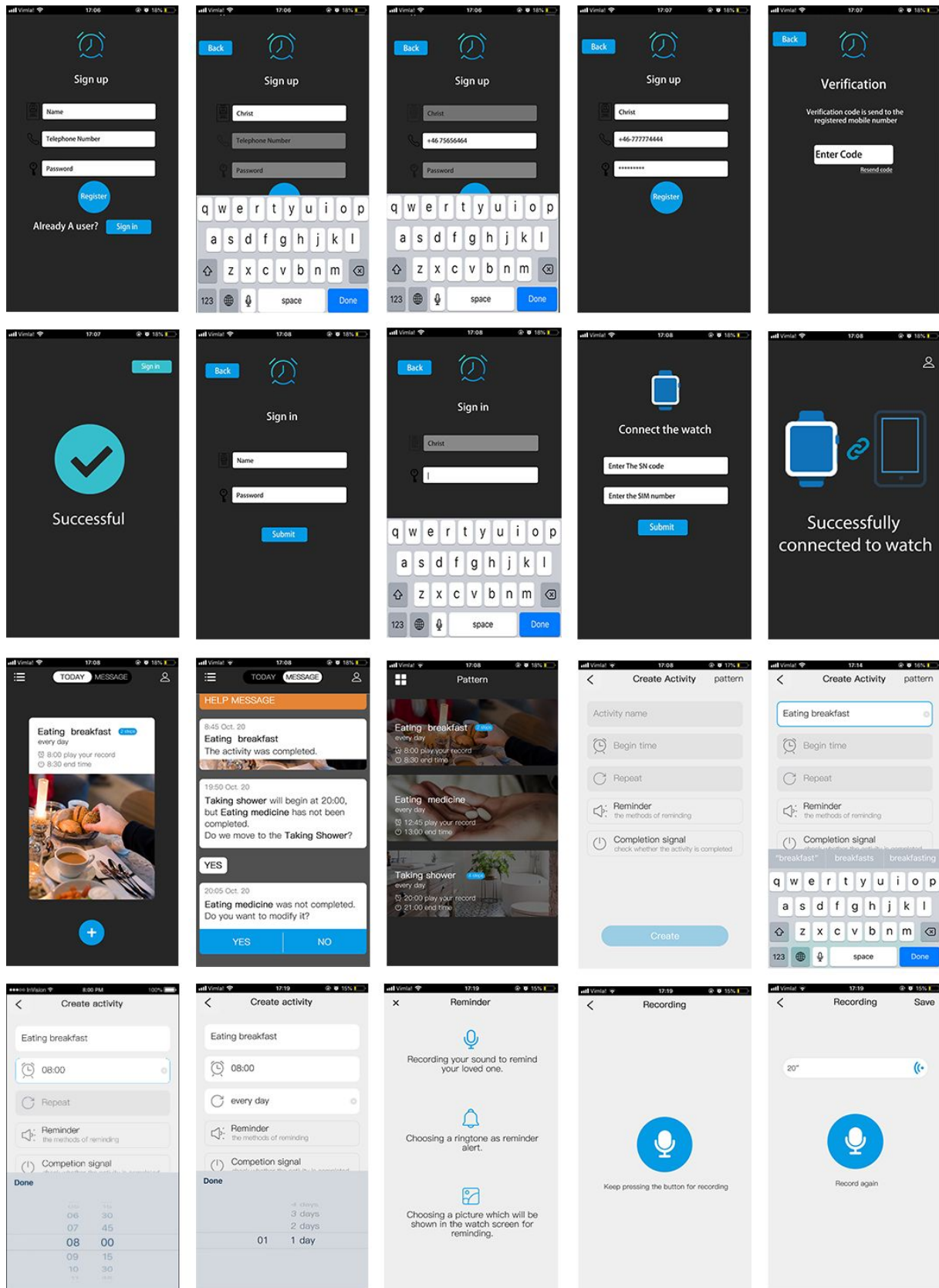
Finally, we created the wireframe (figure 3).





figure 3 wireframe of the application and the watch

5. Visual design pages



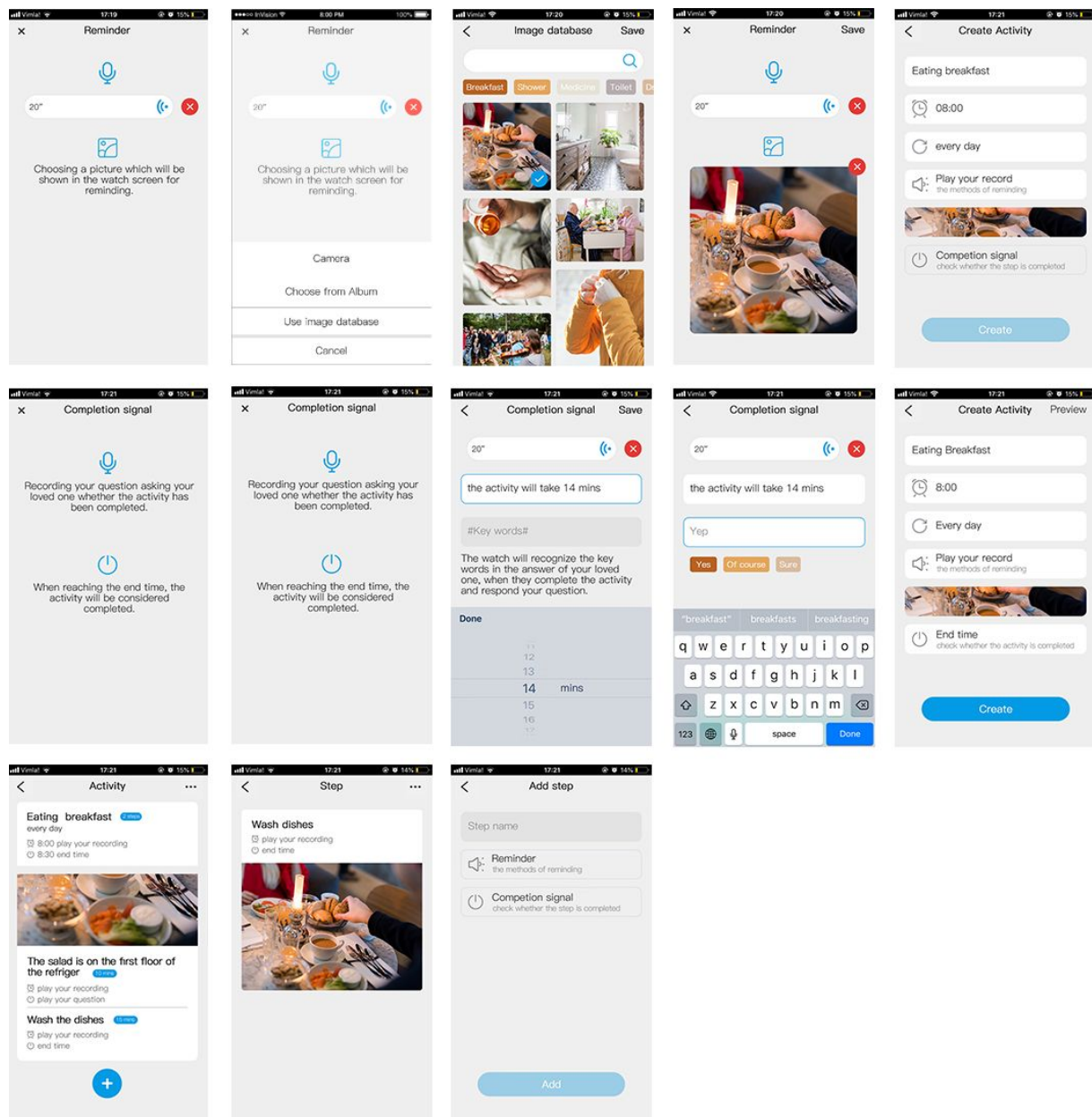


figure 4 visual design

6. The heuristics and the rules for expert evaluation

The heuristics and the rules we chose and the standard of rating scale are shown below in table 10.

Visibility of system status		
1: sometimes, there is no status of some tasks.	2: it is hard to understand visible status displayed on the screen.	3: user never be informed of system operations.
Match between system and the real world		
1: users understand the product, but some operation can be improved	2: some tasks are not in logical order	3: it is hard to use their experience in daily life when using the product

User control and freedom		
1: there are too many steps when user want to go back the previous page	2. there are some pages (≤ 3) which is hard to control undoing and redoing previous actions	3. there are many pages (> 3) which is hard to control undoing and redoing previous actions
Consistency and standards		
1: some graphic elements and terminology are not suitable, but they are able to be understand	2: the wrong elements and terminology make user spend more time to understand	3: the wrong elements and terminology make pages or tasks cannot be completed
Help users recognize, diagnose and recover from errors		
1: the explanation of error costs user lot of time to understand	2: the explanation of error is hard to understand	3: there is no explanation of error
Help and documentation		
1: the help and documentation cost user lot of time to understand	2: the help and documentation are hard to understand	3: there is no help or documentation
Offer information feedback		
1: some feedbacks cannot help user	2: need more feedbacks	3: there is no feedback
Reduce short-term memory load		
1: some recognitions cannot help user	2: need more the recognition	3: user needs to recall rather than recognition

Table10 the 8 aspects of evaluation and rating scores