8-2018

Care Givers: Motivating and Enhancing Non-Profit Caregivers' Experiences

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CARE GIVERS: MOTIVATING AND ENHANCING NON-PROFIT CAREGIVERS' EXPERIENCE.
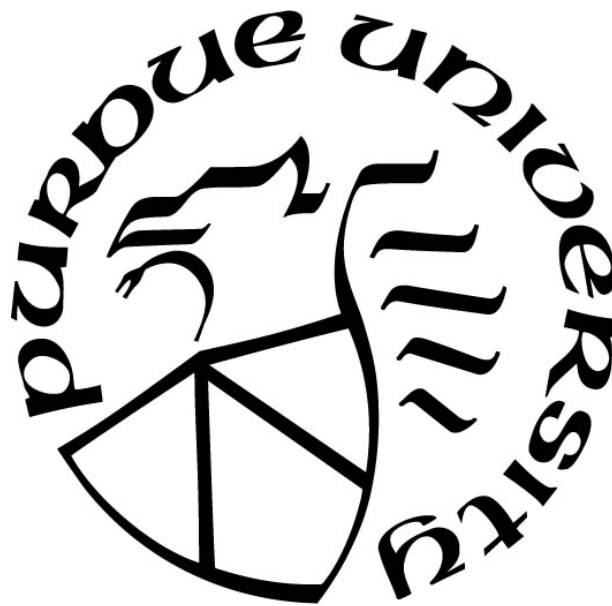
by

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A Thesis

Submitted to the Faculty of Purdue University
In Partial Fulfillment of the Requirements for the degree of

Master of Fine Arts

Department of Visual and Performing Arts

West Lafayette, Indiana

Aug 2018

THE PURDUE UNIVERSITY GRADUATE SCHOOL
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ACKNOWLEDGMENTS

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ABSTRACT

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Degree Received: August 2018
Title: Care Givers: Motivating and Enhancing Non-Profit Caregivers' Experiences
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The challenges of the aging world population continue to become more and more serious. Caregivers play a very important role in the caregiving system. There are different types of caregivers: family caregivers, who are typically a patient's family member; and professional caregivers, who are trained and paid to care for their assigned patients. Another group yet are volunteer caregivers, the primary targeted user group of this research. Volunteer caregivers are both dramatically overlooked and making significant contributions to society. People who work as volunteer caregivers are mostly motivated by their kindness. Volunteer caregiving is typically a part-time job provided by a non-profit organization. Though such organizations may have unique systems, they often share many issues in common. Accordingly, this thesis' aim is to enhance the experience and solve the problems encountered by volunteer caregivers.

To achieve the goals, I completed some literature reviews, and market research to get the big picture of the current caregiving system and figure out the direction to go, where I found mentally stressed has been mentioned frequently. Then some user research has been done to identify the problem such as user interview emphatic study, observation, etc. Throughout the research process, the emphatic study gives me more insight into this design problem, where I basically try to be a volunteer caregiver in a non-profit caregiving organization. Based on all these research, then I made the user persona, and user journey map, where I figured out the problems that I need to solve are Lonely, lack of motivation, Communication, Mental health, Credibility and lack of information.

Following several design processes and iterations, I developed a new caregiving system as the solution. Care Givers is a mobile application and smart nametag. With the help of the application, caregivers can work as a small team to provide services to a patient. They can take a shift or just work at the same time. Also, caregivers can share

their photos, videos, and experiences with other users. What's more, the smart nametag's capacity to connect to the application efficiently establishes the caregivers' credibility and ensures their safety. Care Givers offers these caregivers an improved user journey by creating a small team and supportive community in order to alleviate their reported loneliness. Also, the application provides all the information a caregiver needs.

CHAPTER 1   INTRODUCTION

When speaking of the caregiving system, the caregivers, especially the volunteer caregivers, are always overlooked that they need to be taken care of as well. What I am trying to do here is standing in caregivers position and help the caregivers doing their job easier and better. This chapter will mainly talk about how I narrow down and define the topic and how I planned to finish the design.

1.1 Define the topic

From the very beginning, the topic that drew my attention is the population aging problem, which is always a hot topic and tricky question all over the world, and there have been many people who tried to solve or even just ease the problem. According to the "Selected Caregiver Statistics" from Family Caregiver Alliance, the world population of the people elder than 65 will be doubled from 2000 to 2030: 35.1million to 71.5 million. With the research going deeper, I found there are a lot of products and services are specifically targeted at the elderly people in many different ways, and more importantly, when people getting older, they will encounter different types of problems depends on their health situation, family, gender, and even nationality, which means that I need to narrow down and focus on a more specific problem. However, while I have read so many papers and finds out many harsh problems, I noticed that it is inevitable that our body will not function perfectly, especially when we are getting older or being sick with no exception. Which means, everyone needs others help, no matter it is from a family member or a professional worker. We call them caregivers in general.

In fact, 51% of care recipients live in their own home, 29% live with their family caregiver and 4% live in nursing homes and assisted living. (AOA, 2013), most of the elderly highly rely on caregivers. Caregivers can be divided into two, one is formal caregivers who are trained and more professional, it is their job as a caregiver and they get paid for doing that, they can do more medical related works usually are experienced and taking care of multiple patients; the other one is informal caregivers who are mostly unpaid family members and friends. The main duty of the caregivers has three types: (1) ADLs, which is brief for 'activities of day by day living', it incorporates offer assistance to the patient with eating, showering, toileting, dressing, etc. (2) instrumental activities of daily living (IADLs) which includes cooking, cleaning, transportation, grocery shopping); and (3) health-related activities such as, managing medications, performing wound care (Lindquist et al, 2010; Noureldin, 2015& Wilkinson and Lynn, 2005). There are also many researchers point out the importance of the caregiver as well as the risk of being a caregiver. Thus, I shifted my focus to the caregivers, which plays a very important role in the whole caregiving system and also need more help relatively, what's more, to help the caregivers do their job better and easier would also benefit the whole caregiving system and help the initial problem I had at the very beginning--aging population.

Then I started to do the user research to identify the problems, to be honest, I didn't have many resources at the very beginning, where I have the idea that I could to be a caregiver, just put myself into caregivers' shoes and I will have the first person and the third person perspective. I found a non-profit caregiving organization and volunteered to be a caregiver for a year. Soon I felt that volunteer caregivers are a huge asset for the

whole society, but lack of attention and help from the society, I saw a great design opportunity that I could do some design to enhance the volunteers in the non-profit organizations. Accordingly, I defined my topic.

1.2 Design the solutions

 As a user experience project, the targeted users are the volunteer caregivers who work in non-profit organizations, In addition, the potential users also include formal caregivers, family caregivers, and the organization who run the business. Namely, it is an user-centered design project which aims to improve users experience and solve the problems.

To achieve the goals, my design contains two-part, research, and design. The research part is where I tried to identify the problems, namely the 'pinpoint', followed by many user-centered the design methods (interviewing, contextual inquiry, usability testing, etc.) (Gulliksen et al., 2003). I will elaborate more in the following chapters. In general, it tries to collect data and analyze 'active user participation' (Massanari, 2010). The design part is where I tried to come up with some ideas and find the most feasible solution. It contains several sub-phases: brainstorming, sketching, prototyping, evaluation, etc) where iterative designing happening all the time to make sure the I got the details.

Eventually, I had the solution as a combination of a mobile application called Care Givers and a smart name tag. The main functions are: (1) Creating a dynamic three to three team for the caregivers to work, in that way, caregivers will not only have one particular patient, they can meet more people and interact with them, they also have teammates who can help them. (2) Providing a big caregiver community, Users could

share their life as a volunteer caregiver and also know how other caregivers work.

(3) Providing the Caregivers with the essential information and training in the App.

(4) Tracking and taking care of the mental health of the caregiver. (5) Smart nametag

enhances the credibility of the caregivers and ease the burden and hassle for them as well.

CHAPTER 2   LITERATURE REVIEW

This chapter reviews related literature from existing studies and research. It mainly contains three different parts of the messages: (1) prove the existence and severity of the statistics and reports related to the aging population and its caregivers; (2) synthesize the previous literature in order to identify the problems and some potential solutions; and (3) identify feasible solutions, supplementary theory, and supportive methodology.

2.1 Caregiver and care-recipient

The session talks about a bigger picture of the current caregiving system and their roles. Today's caregiving system is huge, there are so many people get involved and play different roles.

2.1.1 Aging population and caregivers

According to the statistics,14.2% of the U.S. population are 65 years old or older(AOA 2014), Most of the elderly chose to live at home.(Feder, Komisar, & Niefeld 2000) In that case, the elderly who is in need of care become highly dependent on informal caregivers. The caregiver community is not limited to the nurses who work in a hospital or professional organization. By definition, caregivers are the people who provided the care and services to the care recipient who are chronically or terminally ill and need assistance to accomplish their daily living tasks (Collins & Swartz,2011).

2.1.2 Caregiver and care-recipient characteristics

The major difference between formal caregiver and informal caregiver is whether the caregiver get paid.(Collins & Swartz, 2011; Family caregiver alliance,2004). In addition, informal caregiver could be related to the care recipient such as a spouse, child, sibling or another relative, and informal caregiver usually giving the care at their home.(Bryant, 2016).

Among the caregiver from 50 years old and above, about 67 percent of them are female.(NAC/AARP, 2009). 29 percent of informal caregivers have been providing care for more than five years and 11 percent of them provide more than 40 hours of care each week. There are many reasons that a senior need a caregiver, for instance, it could be old age dementia/Alzheimer's disease, mental illness, cancer, heart disease, and stroke as the top conditions (Bryant, J. R. 2016). And the responsibilities of the caregiver are mainly assisting with activities of daily living, financial management, or activities designed to foster the social, spiritual, and emotional well-being of the terminally ill person.

2.1.3 The situation and the challenges of being an informal caregiver

Unlike formal caregivers who are trained and skilled, most informal caregivers do not have professional knowledge and skills. However, 46% of informal caregivers provided a medical or nursing task in 2012 (Reinhard et al., 2012).

HCT stands for health care task which is the basic activities and tasks caregiver should provide good health care for the patient. HCT includes assistance with supporting the patient with the clinical appointments as well as gain and administer their medications, making choices about medicine doses, managing clinical bills, arranging

transportation, acquiring health-related information, managing a endorsed eating regimen plan, monitoring patients' health, acquiring medical equipment, and obtaining community carrier aid. Spouses take up 46 percent of all the caregiver who provide HCT (Giovannetti et al, 2011). In that case, researchers Moorman and Macdonald have conduct an investigation about the relationship between the complexity of HCT that caregivers provided and the caregivers' strain. The result indicates that caregivers' strain used to be related with excessive or reasonable complexity tasks in contrast to low complexity tasks. Caregivers tend to feel higher pressure, when the healthcare task will risk their patients safety if the caregivers make certain mistakes, (Moorman & Macdonald, 2013).

In the case we talked above, providing the access to reliable and accurate information and instruction about disease and treatment will be very helpful and ease the stress of the caregiver. According to the data provided by NAC and AARP, 78 percent of the caregiver take Internet as a resource of the information they need. However, even though the Internet is becoming much more comprehensive and smart, a more reliable and authoritative resource of the essential information is still required. and study also prove that the lack of these information will aggravate caregiver's stress.

Not only health care tasks may cause stress and problem to the caregiver. As a matter of fact, many patients would like to stay at home to receive care, especially patients diagnosed with a terminal illness (Beland, 2013). In that case, their family members often try to be an informal caregiver, however, as time pass by, they are more likely to develop signs and symptoms of depression and anxiety or some chronic disease.

Compare to other care recipients, recipient with cognitive problems increase burden of the informal caregiver. As an informal caregiver, providing care service to a patient with the cognitive problem will have a relative less feeling of satisfaction and reciprocity which are quite important for informal caregivers. (Nordtug & Holen, 2011;Sequiera, 2013; Wenzel & Poynter, 2014). A study has been done in order to research and invest the problem that informal caregiver will encountered. The result demonstrates as three major categories of the problems: demand on the caregiver, the safety of the care recipient, and social-relational issues. Safety issues were not frequently mentioned, but when that occurs, it usually rated as a difficult problem. The most frequently occurred problem is social-relational problem which specifically are a preexisting relationship, shifts in responsibilities within the relationship, and social interaction with others. The role and the relationship change bother the informal caregiver a lot, next is shift in responsibilities.(as Figure 1) (Bruggen, Gussekloo, Bode, Touwen., Engberts& Blom, 2016)

To sum up, to be an informal caregiver may encounter a variety of problems, a lot of them would have relative negative influence on them that might result in the informal caregiver have a risk of being stressful and showing some symptom of physical, mental, and financial strain.(Bruggen, Gussekloo, Bode, Touwen, Engberts & Blom, 2016; Grant et al., 2013).

	% with problems			% with difficulty			% impact		
	Without[a]	With[a]	p	Without[a]	With[a]	p	Without[a]	With[a]	p
Demand on informal caregiver									
This person doesn't seem to realize how much time and energy it takes to provide the care.	66	84	< .001	48	57	< .001	32	48	< .001
Since I can't let this person alone very often, I hardly have any personal time.	47	69	< .001	55	63	.005	26	43	< .001
Sometimes I need to say "no" to this person, otherwise providing support becomes too much for me.	47	59	< .001	60	71	< .001	28	42	< .001
I consider the intimacy of physical assistance as complex.	43	51	< .001	73	74	.808	31	38	.063
I provide much more care than other beloved persons.	84	88	.002	31	40	<0.001	26	35	< .001
I provide much more care than I would actually prefer.	50	63	< .001	50	56	0.048	25	35	<0.001
Safety of care recipient									
The older adult refuses to use support instruments (e.g., walker or alarm button).	38	60	< .001	64	80	< .001	24	48	< .001
The older adult forgets to take his medication.	31	75	< .001	55	62	.015	17	47	.017
Sometimes I use deceit to get the older adult to take the right medication.	5	23	< .001	35	42	.348	2	10	< .001
The older adult forgets the gas or pots/pans on the fire.	20	45	< .001	72	82	.002	14	37	.007
The older adult uses a car or bicycle although, in my opinion, this is irresponsible.	11	15	.006	76	92	.001	8	14	< .001
Actually, it's irresponsible to leave the care recipient alone at home.	43	74	< .001	73	80	.001	31	59	< .001
Social-relational problems									
Due to the need dependence of the older adult, nice trips together become difficult to realize.	80	87	< .001	65	74	< .001	52	64	< .001
Sometimes I feel ashamed of the behavior of the older adult.	30	44	< .001	69	75	.038	21	33	< .001
The older adult doesn't show much appreciation for the care that I provide.	35	51	< .001	50	56	.058	18	29	< .001
The older adult is becoming increasingly unkind to me.	33	55	< .001	65	67	.685	21	37	< .001
The older adult often asks the same questions, and forgets them again every time.	65	98	< .001	34	64	< .001	22	63	< .001
The older adult can become extremely sad or angry, caused by nothing in particular.	59	79	< .001	51	68	<0.001	30	54	< .001
The roles between the older adult and myself are, so to speak, reversed.	60	89	< .001	37	54	< .001	22	48	< .001
The older adult is no longer able to pay attention to the things that happen in our life.	56	88	< .001	45	62	< .001	25	55	< .001
Sometimes I need to say "no" to the older adult, otherwise an irresponsible situation is created.	44	77	< .001	41	55	< .001	18	42	.093
The care recipient hides his/her inabilities and handicaps from others.	59	82	< .001	50	60	< .001	30	49	< .001
The person who I take care of "claims" me completely.	49	67	< .001	53	61	.004	26	41	< .001

Note. [a]Without and with cognitive impairment.

Figure 1: Demand on informal caregivers

2.2 Volunteer caregivers

Although the paid caregivers and the family caregivers take a huge proportion of all, volunteer caregivers still make a lot contribution to the whole caregiving system. What's more, they do that for a nobler reason, either purely want to help people who are in need or want to have the sense of achievement. Thus I think we need to get to know them better and help them do their job. Accordingly, this section will explore the profile of the volunteer caregiver in more depth.

2.2.1 The importance of volunteer caregivers

There is no doubt that family caregivers are crucial to a recipient' caregiving experience, and the professional caregivers are also irreplaceable that they are able to provide more medical related job. However, the gap of the demand of caregivers and the supply of the caregivers is still getting bigger. One of the reason is that the family is

getting smaller and the divorce rate is going higher, also women are dramatically more active in the work force, which was taking up huge proportion of the caregivers (Zarit, Johansson& Jarrott, 1998). The other reason is the elderly is increasing, so does the demand for the caregiver resources. There is no machine can replace human' care in the short run. Which is where volunteer caregiver could fill the gap. (Jorgenson, 2002) Also there is also some report point out that informal caregiver can make the patient feel more emotional support which formal caregiver may not be able to. Some business caregiving organizations even opened some informal or volunteer caregiving service to match the needs of the patient. (Ellefson, 2001). To conclude, volunteer caregiver have the potential to fill the gaps in the current caregiving system and provide valuable emotional support. While this solution may not fully replace formal or family caregivers, it surely can support and benefit the caregiving cycle.

2.2.2 Volunteer caregivers' duty and performance

Even there is not as many as the researchers conducted in the formal or family caregivers area, the research reports a very positive result in general.

The research 'A Study of a Volunteer Caregiver Program' conducted by Tara Jorgenson MS & Gregory Sanders PhD answers two major questions: what are the duties of volunteer caregivers and how do the care receivers feel.

As the research shows, the service that volunteer caregivers could provide are : transportation" (63%), "errands" (63%), "companionship" (55%), "shopping" (48%), and "telephone reassurance" (45%). What's more, they also identify the service that volunteer caregivers would like to provide in the future: "letter writing and shopping" (15%), "companionship and telephone reassurance" (10%), "errands" (8%), "financial/bills, light

mending, transportation, and yard work" (5%), and "small housekeeping fix-it-jobs and personal care" (3%). (Jorgenson, 2002)

In terms of the caregiving quality, care receivers actually felt really great that 95% of care receivers strongly agreed or agreed that they were "satisfied with the Volunteer Caregiver experience" (Jorgenson, 2002). Volunteers caregiver are helpful to the receivers when their family members could not help. More importantly volunteer caregivers make the patient feel like 'at home' On the volunteer caregivers side, they do also show quite positive feedback that they feel their works are appreciated.

To sum up, volunteer caregiving is a 'win-win' service that both the provider and the receivers benefit from it, it fills the gap that we need more caregiver resources.

2.3 Concept of caregiving system

The problem is indeed existing in today's informal caregiving system, both caregivers and the care recipient have their own problem but actually they have the same goal and they should share a mutual benefit relationship. The following sections review the current typical relationship and new perspective of the relationship between the caregiver and the care recipient.

2.3.1 Person-centered care

Nowadays, person-centered care has frequently been emphasized when we are talking about caregiving system, which seems already being a standard of good practice. Person-centered care means putting the patient and their family in the center, seeing what they need, treating them as experts and customizing the healthcare for them. It has been

proven by certain intervention studies that person-centered care is helpful to improve the user experience in caregiving system.(Rader & Tornquist,1995)

In 2000, Nay R., Rowell conclude and present the idea of 'client-centredness' would be the watchword for good heath care. After that, the idea of 'person-centered' care was gradually fully articulated. As summarized by Talerico and Karen Amann in 2003, in his article 'Person-centered care', the key competent of person-centered care are:

- Knowing the individual as an individual and being receptive to individual and family attributes.

- Providing care that is significant to the individual in ways that regard the person's esteem, inclination, and necessities.

- Viewing care beneficiaries as biopsychosocial individuals.

- Fostering the improvement of steady and confiding in providing care connections.

- Emphasizing flexibility of decision and independently characterized, sensible hazard taking.

- Promoting physical and enthusiastic solace.

- Appropriately including the individual's family, companions, and informal community.

Actually, person-centered care has already been applying in several scenarios. For example, it has already been using in the bathing process of caregiving to reduce agitated and aggressive behaviors; In the nursing home, person-centered care could decrease the limit and the constraint to the patient. However, although the person-centered care is useful and functional to the patient, it is facing many difficulties to generalize and applied

broadly due to the cost. In fact, many U.S. facilities still mechanized and depersonalize their service. The is a big gap between what is already known as a good care service and the actual service the patient could get. (Talerico, 2003; Slocane et al., 2002).

2.3.2 Relationship-centered care

Relationship-Centered care was first proposed by Task Force which was established in a US 'intense national debate' about the future health care in the early 1990s.To solve the problem in this debate, Task Force presented a perspective named 'relationship-centered care' which means 'the importance of interactions amongst people as the foundation of any therapeutic or healing activity'(Tresolini et al., 1994, p. 22).

In the illness, care and healing process, there are different people playing different roles, instead of focusing on which role is more important or need more attention, the relationship-centered care encourage people to value and appreciate the importance of relationship between different parties in the whole caregiving system.

As Mary Beach proposed (Beach, 2006), the relationship-centered care has four principle, which could help people understand the concept and also guide the people:

(1) A healthy caregiving relationship should satisfy all the participants,

(2) The emotions and its long-lasting influence should be taken into consideration as well,

(3) A healthy caregiving relationship should benefit all the participants.

(4) It is important and valuable to put more effort on format and maintain a genuine relationships.

2.3.3 The senses framework

With propose of relationship-centered care idea, the relationship of the caregiving system was emphasized, following that, more detailed investigation, research and conclusion have been done. 'The Senses Framework'(Nolan, 1997; Davies et al., 1999; Nolan et al., 2001, 2002) has identified the key components of the relationship, the Framework claim six senses which is essential and need attention to all the different roles (older person, family/informal care givers, formal caregiver and the Clinician)in the relationship(Nolan, Davies, Brown, Keady & Nolan, 2004), there are:

- security – feeling safe in the relationships;

- belonging – having the sense of belonging;

- continuity – the feeling in the relationship is stable and consistent;

- purpose – having a clear and motivative goal;

- achievement – getting the feedback of making any effort;

- significance – feeling being appreciated.

In terms of the Senses Framework, all the role in the caregiving providing system should have these six sense which count as a good care and a virtuous circle. In addition, all the parties involved in this caregiving system need these six senses, the focus of their is differently.

As Nolan analyzed, for older people, their sense of security is about being provided will essential physiological and psychological demand to support their daily life even their lives, they also need a feeling of safe, free from threat, harm, pain and discomfort. Their sense of continuity is focus on seamless, consistent care delivered within an established relationship by known people. The sense of belonging is talking

about the elder people need to have the relationship make them feel they are part of an community or group. The sense of purpose means they need a goal or challenge, and have the chance to be engaged in some purposeful activity. A sense of achievement for the older people, the satisfaction of accomplish a goal, do something helpful to others, something could reward their efforts. The sense of significance is saying that older people need to feel recognized and valued as a person of worth, which giving them a feeling that they 'matters'

For the family caregivers and informal caregivers, the sense of security they need is the trust in learning and capacity to give great care, without impairment to individual health. Satisfactory encouraging groups of people and convenient help is vital with a specific end goal to give up when proper.(Vogelzang,1997) Their need for continuity is the maintenance of the care recipient's standards of care by all care providers (Sroufe, 1988). A sense of belonging means that to be able to maintain and improve relationships with the care recipient, to feel that they are not 'in this alone'. A sense of purpose is talking about the caregiver want to provide a very good care and maintain the dignity and integrity, well-being and 'personhood' of their care recipient. A sense of achievement is saying the family caregiver can feel that they have provided the best possible care and self-recognize that they have done their best. They also accomplish challenges successfully, in the whole experience, they feel they develop new skills and abilities. Their sense of achievement is the feeling that they have provided the best possible care and done their best. Their sense of significance occurs when they feel successful and appreciated.

To sum up, person-centered care is the trendy and broadly accepted concept regarding caregiving. Giving the fact of that, it is still far from being wildly preformed and practice. The relation-centered care give us a new perspective and thoughts of what is a good caregiving system and how to realize that.

2.4 Summary

The demand for elderly caregiving will always exist, and most people become involved in this industry at some point in their lives. For now, the industry is more like a triangle relationship of the patient, the patient's family, and the caregivers. Both informal caregivers and formal caregivers are necessary for the elderly. However, volunteer caregivers have the potential to address the currently growing gap between the supply and demand for elderly caregivers. The research shows that volunteer caregivers are able to provide high-quality service that is mutually beneficial.

Volunteer caregivers would benefit from more attention to their own personal needs. They do not work for money, but they are immensely valuable to society. The problems they encounter are similar to formal and family caregivers, except that they don't get paid or may not be related to their care recipients. Both of these factors mean they need more motivation, either from society or the care receivers.

Today's caregiving system works, but it does have problems and could be improved. Many studies and theories have addressed improved caregiving system relationships. What I found is that volunteer caregivers offer a great value to the caregiving system and provide a solution to its problems.

CHAPTER 3   METHODOLOGY

To better understand the pain point of the targeted user and to get a more practical and satisfactory solution and design, serval design methodologies and concepts have been used and applied during my design process. User-oriented research is essential to a user experience design project. The user experience is the response of the individual after being stimulated by the outside world. Viewed from different angles, it has various divisions (Jiang, Tian & Zhou, 2017).

3.1 Process overview

Both qualitative and quantitative provided ideal support to my design. This chapter details the methods I used. I divided my whole design process into three phases: research, design, and evaluation. In the research phase, I identified the main points, problems, and user requirements. To collect the necessary data, I conducted interviews, personas, empathetic studies, and observations. To analyze the data, I used affinity diagramming, coding, user experience maps, and user mental models. In the design stages, I completed brainstorming, HTA charts, sketches, low-fidelity and high-fidelity prototypes, and 3D modeling. In the evaluation stage, I utilized heuristic evaluation, usability testing, paper prototyping, observation, and affinity diagrams to revise and refine my design.

3.2 Research method

I used several research methods to collect and analyze both qualitative data and quantitative data in order to comprehensively understand my users' main points and needs. Different methods feature pros and cons that are often complementary, so combining and integrating them was very effective.

3.2.1 Literature review

First comes the literature review, reading other research results would bring me more insight about the industry. And also during the literature review stage, with all the new information, the original design topic and the direction may be refined or even changed to make sure the further steps of the research and design are on the right track.

3.2.2 Empathic study

Giving the fact that my topic is volunteer caregiver that I do not have much experience about that neither the resources to interview them, I choose to do an empathic study first, which means I tried to be a really volunteer caregiver in a non-profit caregiver organization called Caregiver Companion. I was doing that for a year and I got a lot from that experience. Being a real caregiver give me the chance to understand the real situation of the current caregivers and to find out the 'real' pain point. I took photos, wrote down my caregiver diary and report, collected all the useful information and product that are related to whole caregiving process. Actually, an empathic study is very efficient way of bringing contextual and meaningful factors into a design task (Kouprie & Visser, 2009).

It let designers step into the role of the user and use a role-playing approach to feel

experiences. (Buchenau & Suri, 2000)

3.2.3 User interviews and observations

In addition, being a caregiver allowed me to interview more people in this

industry, so I also did a semi-structured interview. Interviews are a crucial research

technique for coordinate contact with members, to gather firsthand individual records of

involvement, assessments, mentalities, and observations. (Hanington, Bruce &Bella,

2012) I did ask some pre-set questions, to get the answer to the question I thought would

be useful, I also did a conversational talk about their caregiver experiment by asking

some open-ended questions. All the interview s were recorded with the permission of the

interviewees for future analyze. I was also responsible for taking notes during the

interview.

3.2.4 Peer product review

In addition, a peer product review would also be helpful, not like the literature,

product review reflect the demand and the requirement on the market. It may bring some

inspiration and avoid repetitive work. A peer product review would also make

contributions to shape the design requirement.

3.3 Method of analyzing data

3.3.1 Affinity diagramming

After I got all these data, I coded them into transcripts first and then conduct the affinity diagram. Affinity diagramming is a process used to externalize and meaningfully cluster observations and insights from research, keeping design teams grounded in data as they design. (Hanington, Bruce & Bella, 2012). I put the keywords on the colored sticky notes that all the notes reference their original interview transcript, in case a question comes up about it. Following that, the notes should be laid on the wall or blackboard to see the big picture and allow the researchers to re-organize it. The design team could do more discussion about it. After that, the affinity diagram would provide researchers a clearer view of the previous data, and help identify the problem, at least point out the direction.

3.3.2 Personas

A persona was built to help analyze the users' need. Personas consolidate archetypal descriptions of user behavior patterns into representative profiles, to humanize design focus, test scenarios, and aid design communication.(Cooper,2004). In the user-centered design, it is a very important step to build a user profile to help identify the problems and design requirements, a persona is also a good resource to exam if the solution fit the users' need at the first place. To do a better user experience design, only solving the problem would not be enough, the using scenarios, user flows need to be taken into consideration as well, and a persona would bring a vivid targeted user image to

the designer. Also, persona is a great media when explaining the targeted users to other audience.

3.3.3 User experience journey map

As mentioned above, to get a better user experience design, a understanding of user's journey is essential. Drawing a user journey map is a very effective way to clearly understand the current users flow and to explain why the new user flow is better. Basically, Journey maps are visual representations of the user's journey, which concentrate more on the current users behaviors and is more used in the investigation stage of design. A user journey map demonstrates a flow around a person's activities, emotions, observations, and outlook—including the constructive, contrary, and impartial minutes—as he or she associates with a multi-channel item or service over a time frame. (Howard, T,2014). Journey maps usually contain some essential elements, containing touch-points, persona, timeline, user feeling, context.

3.4 Method of design

This session talks about some method that I used to implement my design. Certainly brainstorming, sketching, computer rendering plays an important role in the whole design process, visual design part in particularly. However, since I chose to do a mobile application as the solution to the problem that I identified before. So the following method help me get to the design framework, which the 'bone' structure of my design.

3.4.1 Hierarchical task analysis

Hierarchical Task Analysis (HTA) Chart is one of the first steps when building an mobile applications. HTA chart put the users behavior and application together to build the network. The task analysis is a method for systematic analysis of user usage patterns. When the user to use the product or service. And to analyze the user's usage patterns and user experience(Lee & Kim, 2015). It helps break the entire human-computer interaction process down to many small steps. So sometimes, when doing observation, we just focus on their flow of doing different things, but may ignore how exactly they complete the task step by step. So doing task analysis helps us understand what steps they take to get there, instead of just a holistic observation. Actually we can conduct the task analysis on our paper prototype, low fidelity prototype, high fidelity demo, final product, and the product we want to redesign. Therefore, I think task analysis can be used in the entire process of design.

3.4.2 Wireframing

Wireframing is the pre-step when start to build the applications. Angeles defined a wireframe as "a schematic or other low-fidelity rendering of a computer interface, intended to primarily demonstrate functionality, features, content, and user flow without explicitly specifying the visual design of a product" (cited in Barnard, 2016). It also created to ensure the mobile applications has a clear structure and meet users work flow. The process of HTA is to decompose tasks into subtask at multiple level of details.(Annett, 2003). As a functional product, user's experience is high depends how well the application organized. Instead of just get into the detailed design, it helps figure

out the relationship and the interaction between each pages as well as the elements arrangement. Moreover, a functional mobile application may have many pages, as presented in wireframe, it allow designer and the whole team to further discuss it and we can fix the problem before getting into the prototype stages.

3.5 Method of evaluation

To ensure the design could match the design requirement and function as designed, multiple evaluation methods were conducted. It would get both negative and positive feedback for further refinement.

3.5.1 Usability testing

Usability testing is an evaluative strategy that enables teams to watch a person's involvement with a digital application as he or she walks through the steps of a given task (or set of tasks)(Dumas, Dumas & Redish, 1999). The method is intended to enable groups to distinguish the parts of an interface that most routinely disappoint and confound individuals with the goal that they can be organized, settled, and retested preceding launch. (Kaikkonen, Kekäläinen, Cankar, Kallio& Kankainen, 2005) The whole process followed the Think-aloud protocol technique, and few instruction will be provided during the test period. we have to observe the participant carefully as well, like the emotion and reaction, not just the performance, that express may not a good indicator to reflect user's change of mood. It will reflect user's change of attention.

3.5.2 Heuristic evaluation

Heuristic evaluation is another evaluation method for feedback from experts in the related field. Usually five participants are recruited to examine the whole design based on the usability principles and heuristics of efficiency, affordance, aesthetic, usability, etc. Several questions are provided for each heuristic as well as the following 0-4 degrees of severity: 0 means no usability problem and 4 means that the design should be fixed immediately.

3.6 Summary

To conclude, the aforementioned methodology are tools for collecting, analyzing, and verifying design data. For my volunteer caregiver design project, I believe the methods I chose were appropriate. Moreover, iteration is always very important to produce a better result. Accordingly, some methods were used more than once. The details of the implementation and results will be discussed in the following chapter.

CHAPTER 4   USER RESEARCH & PEER PRODUCT REVIEW

This chapter talks about the user research where I could collect more tailored information and analyze them to get the information that I could not get by simply conducting literature reviews. The user research mainly consists of two part, empathic study, and user interview. I got both first-person perspective and third-person perspective by doing that. I put the peer product review in this chapter because they are complementary to each other, one is talking about the user's feeling and need, the other is talking about what the company and market have already done for the users. With knowing both of them, I can conclude my design requirement.

4.1 Data collection: semi-structured interviews

I have interviewed four people in total to participate the research, they aged differently from 20 to 55, but they all have the experience of being volunteer caregivers. One of them is the manager of the organization that I worked for, from whom I got more extra information about the caregiving system. One of my interviewees' story is that she was a family caregiver for her husband, and after her husband passed away, she still wanted to use her experience to help others. The other three are more like me, they are all student in the nearby colleges, two of them are nursing-related major. Four of them only has the experience working in this particular organizations, one has multiple organizations working experience.

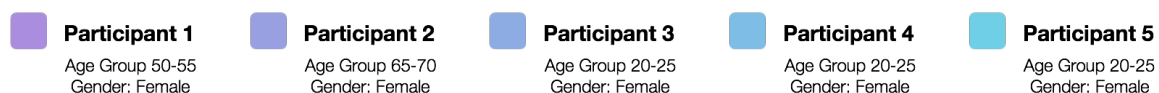| Participant 1	Participant 2	Participant 3	Participant 4	Participant 5
Age Group 50-55 Gender: Female	Age Group 65-70 Gender: Female	Age Group 20-25 Gender: Female	Age Group 20-25 Gender: Female	Age Group 20-25 Gender: Female

Figure 2: Profile information of interviewees

The interviews were semi-structured with an informal list of questions (see Table 1). It took about 20~30 minutes each person, and I record the whole interview process with their permission, and after that I sorted out them. The questions I generated has five different section which are : (1) General information; (2) Motivation of being the caregivers; (3) Pain point and frustration; (4) Assistance tools that they used; (5) Record and share experience. All of them were able to answer all the questions, and they were very friendly to share their experiences and stories with me.

Table 1: Interview questions

	Questions	Participants1	Participants2	Participants3	Participants4	Participants5
A.General Questions	How many patients have you every had?	more than 30	More than 40	1	2	1
	What's your occupation?	manager of caregiver companion	Retired	Retired	Student	Student
	How long have you been providing caregiving?	5 yrs	20yrs	3mons	1yrs	0.5 yrs
B.Motivations	Why do you want to be a caregiver?	To help others	Help others and I was running a caregiver agency so I get paid.	To help others. My husband just died and I like to help others and that make me feel better	To help others.	To help others and that kind of work is also related to my major
	What makes you keep doing it, if not, why?	Loving helping others, I have been through a lot, so I want to use my experience to help others.	My job and I love my job it is not well-paid but very meaningful and I can get a lot from there.	same as above	To help others.	Loving helping others, and this work is related to my major so I benefits from that as well.
C.Pain point and frustration.	Have ever feel angry about the patient or anything frustrated happened? How did you do that?	Very rare, but I understand that and I am very experienced to handle that.	Sometimes, but since this is my job I have encountered many circumstances	Never so far.	Yes, sometimes I felt hard to communicate and not being appreciated before. But now everything is fine.	For now everything is perfect, I get along with my patient very well.
	What make you feel inconvenient or bad of the whole caregiving process?	Sending informations and matching and paring people together.	Not really	Get prepared and get help.	Reschedule.	Get access to the information.
	Have you ever feel depressed or anxious because of the caregiving?	Yeah, I remember feel depressed once for quite a while.	Yes, when the person I've been taking care for a long time passed away, that makes me feel bad.	No. Actually this work makes me feel better	No.	No.
D. Assistance tools	How did you know the organization?	Friends.	Websties	I received help from this organization before.	Websites	School
	Have you ever visited the website?	Yes	Yes	Yes	Yes	Yes
	How do you talk to the manager and the stuff there?	Through email or in person	Through email or in person	Through email or in person	Through email or in person	Through email or in person
	How do you find and talk to other caregivers?	Some events here.	Some events here.And I make friends here.	Some events here.And I make friends here.	Some events here.And I know some students doing the samething	Some events here.
E. Record and share	Do you like to share your experience with others?	Yes, absolutely	Yes, often	Yes, often	Just ok	Yes, but not everyone.
	Do you keep anything or record anything of the whole experience?	Photos.	Photos.	Not really.	Yes, photos, and the cards the organization sent to me	No.

4.2 Data analysis: affinity diagramming

The data I got from the interview was very rich and informative, then I create an affinity diagram to help me analyze the data. I followed a standard procedure that I

transcribe the conversation from the interview and write the keywords on the sticky notes. Then I just place every note on the whiteboard and try to rearrange it by similarity. After several iteration and discussion with others, I got five major groups which are surprised to me that there is a lot of overlapping notes.(see Table 2)

I gained several insights from the diagram: (1) The way people schedule are different depends on different people, the average frequency is once a week. However, scheduling is a slight problem for some of the caregivers. (2) Most of them want to keep working as a volunteer caregiver cause they did feel great with the overall experience. (3) The frustrations that the caregivers have are mainly about the receivers, they might not be a big problem, for instances, sometimes the caregivers are sensitive and emotional and feel bad for not being super helpful, sometimes the caregivers fell frustrated cause the communication did not go well. (4) They feel lonely sometimes, especially when they need someone to talk to and share their story. (5) Even they know people will not expect a lot from them cause they are not professional, caregivers still feel like they need to have more knowledge about how to taking care of others, especially the elderly.

Table 2: Results of affinity diagramming

Duty and service	1. cleaning, household, 2. Accompany, talking. 3. Running an errand.
Frustration	1.Feeling lonely. 2.Not enough training and resources 3.Not get appreciated. 4.Sometimes feel stressed. 5.Sometime feel depressed.
Motivation	1.Help other people who are in need 2. Sense of achievement. 3.Interaction with other people 4.Hearing different stories from others
Preparation and information	1.Referred by friend 2.Online resources 3.Ask other more experienced people.
Frequency	1. Once a week. 2. frequently changed, too busy to have a fix schedule. 3.Schedule for next time at every meet.

4.3 Empathic study

As I mentioned before, I did not have any resources to do the research, so I intended to do a Empathic Study. Technically, user interview is part of the Empathic study that research tried to understand the interviewees by talking. However, there is another types of empathic study which is more like a 'role-play. So I contacted with the non-profit caregiving organizations, and Luckily, I got accepted by the caregiving organizations called Caregiver Campaign which is a non-profit organization located at West Lafayette in Indianan state of the U.S (as Figure 3).

Figure 3: The manager and I in the Caregiver Campaign organization

Before I got into the organization, I was interviewed by the manager and they ran a background check. They give me a small training session with a few other new volunteers together.(see Figure 4) Then they asked me about my preference and tried to match with a patient. A few days later, they gave me the information about the person that I paired with. I called her by the number on the info sheet and scheduled out first meet. She is a nice lady, we talked to each other about our situation and we decided to meet every Monday afternoon, which did not work afterward, cause we all had different

things came up and we had to reschedule. The job I did is household mostly, like

cleaning, helping her with cooking, moving heavy thing for her, etc. We did talk a lot, I

enjoyed the story that she told me, which are the stories I won't hear from my friends (as

Figure 5).
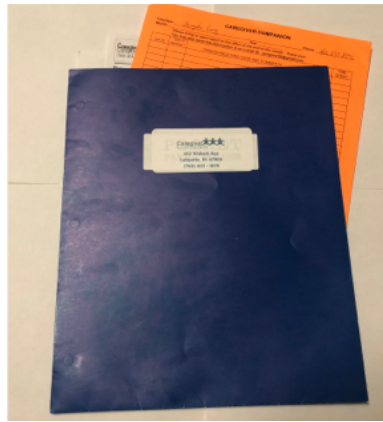
Figure 4: Caregiver Companion organization welcome package
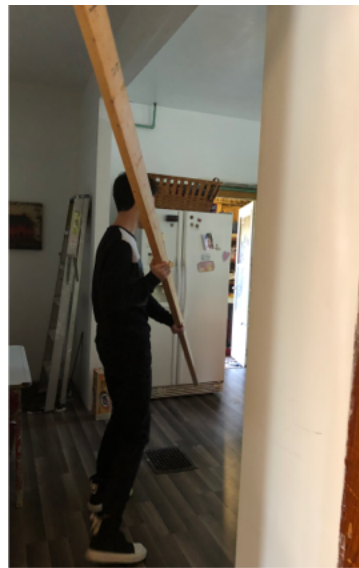
Figure 5: I helped with moving heavy things

I have also helped other people which is a one-time visiting (as Figure 6), the lady

needed someone to teach her how to use her new iPad. The manager knew that I was

teaching at my college and my major is related, so they contacted me to see if I can help. The experience with that lady was not very good; I feel like I failed that I did not really solve the problem. Also the way we communicate was not very efficient as well. After that, I went back to the manager, and she told me it is common and shared some of her experiences and tips with me, which are helpful.
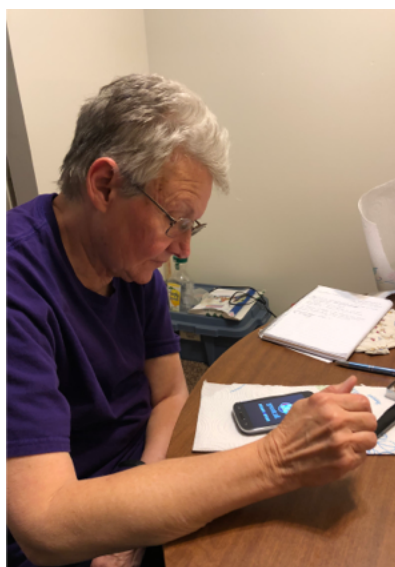
Figure 6: A one-time visit healthcare case

The organization, Caregiver Companion, always send some poster card to the caregivers. Personally, When I got the hand-writing card, it felt good that my work was appreciated. In addition, Figure 7 shows the whole process that I experienced.

Make a appointment ⟶ Register & Interview ⟶ Background check ⟶ Match caregiver with patient ⟶ Training & Document ⟶ Call patient and schedule 1st meet ⟶ Visit and help once a week ⟶ Monthly report back to the organization ⟶ Help others occasionally (one- time visit)
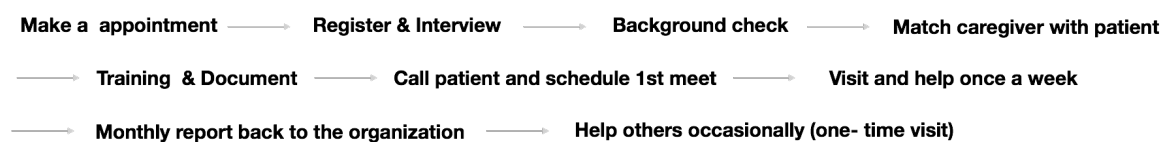
Figure 7: Procedure of being a volunteer caregiver
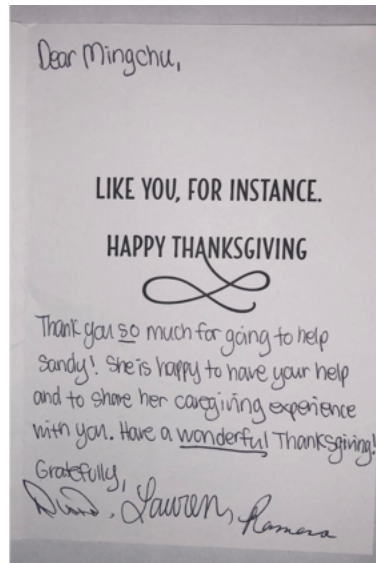
Figure 8: Thank card from Caregiver Companion

4.4 User experience & behavior modeling

After I got those data and analyzed them, the next step is to organize and present then in a more intuitive for further analysis. Therefor I chose to build a persona and draw a user experience journey map.

4.4.1 Personas

Personas are an approach to telling a vivid story of the targeted users, instead of just listing all the users' needs and problems. Personas build a character with background in order to better understand the entire user scenario.

The targeted users of this project are volunteer caregivers, so I created the persona of Mary (Figure 9), a college student studying a nursing-related major. She likes to take care of other people and she thinks it would better to practice before she begins her career. So she joins a non-profit caregiving organization near her college campus. She

usually goes to visit her patient once a week, though her schedule may change depending on her course workload. She makes many friends while caregiving. At times she feels frustrated by her stressful responsibilities, and she is trying to figure out a way to deal with her negative emotions.

Mary

Volunteer Caregiver

'I like taking care of people, but who is gonna taking care of me.'

About

Age: 24
Gender: Female
Location: West Lafayette, IN
Marital Status: Single
Children: 0
Education level:
College Student

Personality

Extroversion
Neuroticism
Conscientiousness
Agreeableness
Openness to experience

Bio

Mary is a volunteer caregiver who is also a college student, she lives with her friends together off-campus. Usually, she has a quite busy schedule. Her major is nursing which is related to taking care of people, and she likes taking care of old people as well, so she goes to a non-profit caregiving organization to be a volunteer caregiver. Even she loves that job, sometimes she still feel very frustrated and stressful because of the work. However she does not have many friend who can relate. She will not give up but she is trying to figure out how to be a better caregiver and do it in a more professional way.

Core Needs

Some peers works who can be friends and talk. Some community that gives her sense of belonging.

Pain Point

Emotion management and help. Want the feeling of achivment by getting some feedback and rewards.

Figure 9: Persona to represent a caregiver

4.4.2 User Journey Map

The user journey map (as Figure 10) demonstrates the caregiver's working flow, which has been divided into three phase: Before Caregiving, During Caregiving and After Caregiving. From top to down there are five different components: (1) Users' action at each different phase; (2) The questions that the users may be have at each phase; (3) Happy moment; (4) Pain point; (5) Users mood flow. As the map shows, the current user journey is not very ideal that the focus should be the caregiving service itself. However, it seems caregivers spend too much time on the scheduling and filling the paperwork. Also searching for help could be improved as well. Every steps has some pain points which maybe small but giving the fact that the volunteer caregivers do not get paid, it is important to reward them in different ways. The good thing is when proving the caregiving service; caregivers have positive feedback. Therefore, by analyzing the user journey map, we see the whole experience in a global perspective. In addition, it gives me some inspiration and ideas of how to solve the problem.
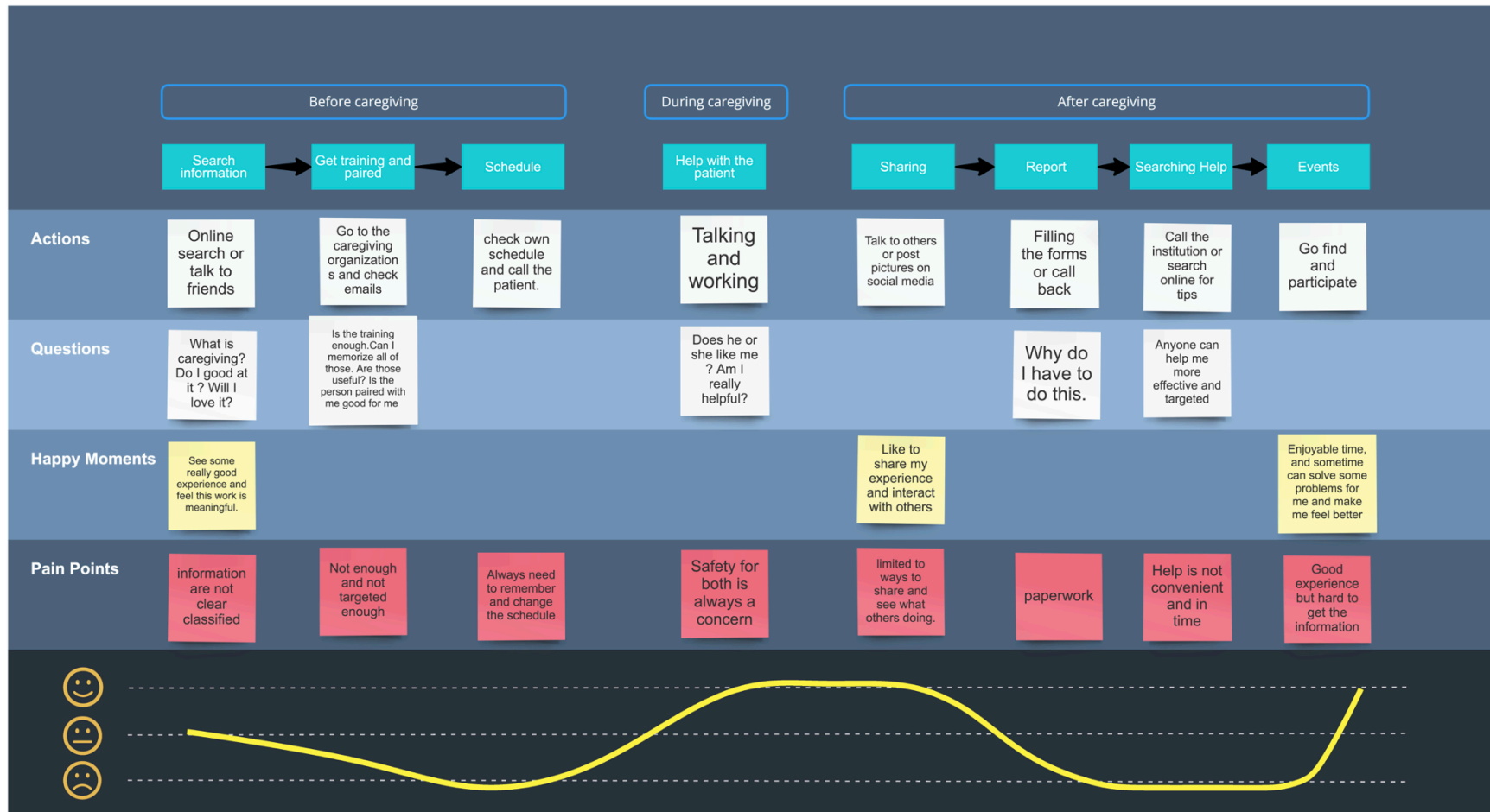
Figure 10: User journey map

4.5 Peer product review

4.5.1 MED care application

Applications of mobile devices are changing our way of living, with today's technology, the way we go and see a doctor in a hospital has change dramatically. Appointment making, medical history, data collecting and analysis, all of them today is more effective and efficient.

Speaking of elderly people, the most popular and useful apps today is medication reminders. As we all know, when we age, we tend to develop more than one long-term health issue that requires ongoing medical attention. as a matter of fact, it is estimated that three-fourths of Americans over age 65 have multiple chronic conditions (AOA, 2013). Even though for their family, it is far more challenging to understand and manage all the ailments, treatments and medications as well as how they interact with each other.
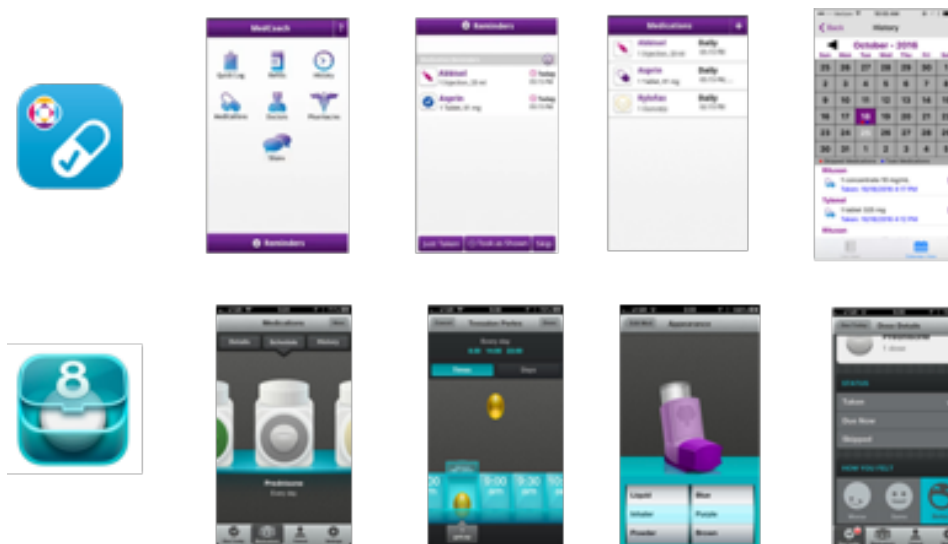
Figure 11: Medication management application

As shown in Figure 11, these are two very popular and useful app which could help the patient to memorize and control their pills and medications.

Med Coach is an easy-to-use medical app that helps user remember to take their medications and pills at the right time and day in case patient forget to take their meds. Med Coach can also connect to user's pharmacy to refill your prescriptions. The main function of this app is shown in the first interface; there are reminder, refills, history, medications, doctors and pharmacies. The interface of the Med Coach is not every beautiful but very clear and does not cause any inconvenience for users.

Generally speaking, Med coach is a very comprehensive mobile application for med care, and it is indeed a very typical med care system on the market.

Pillboxie is an easy way to remember your meds. One of the feature of this app is that Pillboxes is not either too complicated or just boring. What's more, Pillboxie is easy because it lets users visually manage their medications. Scheduling a reminder is as easy as dropping a pill into a pillbox.

Nowadays, Pillboxie's skeuomorphism design is out of style, Instead, the Flat design is commonly used because it looks more elegant and save devices' resource. However, in this care, I think the situation is different, The app pillbox's User Interface (UI) design idea is to use the skeuomorphism design method, trying to make the icons and items in the application as vivid as possible. I think that is a good idea, which is good for the users. As we all know, the user who use this app most frequently is the patient and they want to use this app to help manage their pills and medications. The skeuomorphism design will help their patient recognize and memorize the different pills by making the whole app very intuitive. The pills color and shape in the app match the really pill's

characteristic and the interaction is also adapted from the real life experience. The Pillboxie app choose the correct design direction and style and satisfy exactly what users need, instead of just follow the trend blindly.

To sum up, there are plenty of MED care mobile application on the market and there all have their advantages and disadvantages. With the fast growing of technology, the mobile application should evolve accordingly. For now most of the application could solve the patients' problem. However, the common problem of the med-care application is they overlooked the user experience to some extent. Taking different medicine following the doctor's prescription is quite a complicated task flow, and the user is relative weak in using mobile application or even finish complicated tasks. Given this scenario, the user experience should ensure that the app is not only solving the problem but doing so via very smooth interaction user-interface interactions.

4.5.2 MED alerting and supervision application

Many disease have the feature like sudden onset, dramatic symptoms, and rapid deterioration requires immediate and professional help. Some mobile application have tried to make use of the technology to help with detecting the safety of the patient.

As shown in Figure 12. Fade is an fall detector mobile application that detects falls using the information collected by some of the mobile sensors (e.g., the accelerometer). Fade is designed for people who are at risk of falling in an isolated environment without any supervision. Falls are a serious threat to the health and safety of the elderly. It is possible that an elderly person fall accidentally and lay there for hours in some area. This is especially true for those who live alone (Byron, 2017) Thus, Having an app for fall detection is always a good choice.

When using this app, it will detect if the user fall down, and it the user is not able to get up or in a coma, it will automatically send and message to the people who have been set in this app earlier. As we can see in the picture, the interface not good-looking but very simple and straightforward. There is no complex task flow and all the necessary functions are easy to find.

Figure 12: Fall detect application

Figure 13: Alert mobile application

Alert (as Figure 13) is another app designed for a similar purpose. The interface and the interaction of this app are well-designed. The layout of the icon and button is reasonably organized. The task flow is logical and the hierarchy makes sense. Also, it takes advantages of the current wearable devices by making the Alert compatible in-app

watch. That is a smart move because a watch seems more reliable when an emergency

occurs. What's more, there is a function designed for Diabetes-related patients. It allows

the app to send an ASAP ALERT will be sent to nearby users.

However, Alert requires the user to tap the Alert button to notify three emergency

contacts, which means it requires the user to be conscious and at least could move the

finger and their arms .(Alert, 2017)

More and more Med-alerting app is developed to help patient and not like the

med-care app, Alerting and supervision apps are using different ways of thinking

technology and interaction method to design. It is a good thing to make use of the new

technology, whereas, for the seniors, that is too much product on the market and too

much information.

Figure 14: Mobile device for the elderly

4.5.3 Easy-to-use product

Service and application always need a carrier, product. Thus, product design for the elderly needs to be taken into consideration as well.

As it is shown in Figure 14, there are many types of product are designed for the elderly, and they do share something in common. Most of them have relatedly big size of font and button, not very heavy, simple logic structure and great error recovery design.

Nowadays, simplicity is a very trendy design style, but simplicity does not necessary means easy to use, it might cause confusion instead.

Therefore, the bottom line of product design for elderly is practical which requires many iterations of evaluation and refinement.

4.6 Research findings & user requirements

By researching with the preliminary research together, it proves that this is an available design opportunity. The volunteer caregivers is a group of people whose experience could be improved, and it also has the potential to benefits the whole caregiving system.

From the research, I get to know a typical work mode of volunteer caregivers, and found out their 'happy moment ' and 'pain point'. Also, the targeted users are clear by doing the persona. I will elaborate on the identified problems in the following next chapters.

And the user requirements are:

1. Provide beginners with a comprehensive but tailor training.

2. Provide a platform let users easily share information and help each other.

3. Provide users with a scheduling tool to save time and enhance efficiency.

4. Allow users to exam their own mental health status and provide them with reports and suggestions.

5. Use reward system and photo record system to motivate users.

6. Enhance their safety and credibility.

7. Find peers, community, and events easily.

4.7 Summary

All these user research plays a very important role in getting ready for the design stage. It creates a strong stance of doing this design and also points out the direction that I could go.

CHAPTER 5   DESIGN PROCESS

In this chapter, the design process is illustrated step by step, first I need to identify the problem and make clear design goals. Following is brainstorming, in that step I decided to do a mobile application and a smart supportive device together. Actually I was working on both of them together cause they are closely connected, but for a clear explanation, I intend to introduce them separately.

5.1 Identified problems & design objectives

Based on all the research above, Volunteer caregiver are playing a more important role in the elderly patient in-home care, but they are not working in a very user-friendly and encouraged environment. There is not even any mobile applications and very rare product design for them. The problem that volunteer caregivers are facing mainly are :

 1) Lonely: Feeling lonely and 'fight alone', when they feel stressed, they do not know who to talk, they also wonder how other caregivers performs.

2) Lack of motivation: Even doing volunteer job like this is very nice and kind, people who choose to be a volunteer caregiver is usually very warm-hearted and self-motivated, but they sometimes still feel lack of motivation and frustrated..

3) Communication: Communication between the health advisor and the caregiver, caregiver and caregiver, caregiver and the care recipient(reward) is not very efficient and smooth.

4) Mental Health: Communication between the health advisor and the caregiver, caregiver and caregiver, caregiver and the care recipient(reward) is not very efficient and smooth.

5) Credibility, Safety: Caregivers credibility problem, security and trust issues.

6) Information: The resources and professional knowledge of caregiving is hard to get for most of the caregiver, some of them even never pay attention to using a scientific method.

Therefore, I make the design goals as follow: (1) Bring volunteers closer, connect them. (2) Providing the knowledge and information (3) Enhance their sense of achievement (4) Taking care of caregivers' mental health. (5) Helping caregivers manage their schedule.

5.2 Mobile application design

As the problems have already been identified, I have a general idea of what main function that my application need to have. Firstly, the HTA chart was built to create the framework of the whole app. Secondly, I drew the wireframe of each component to discuss the overall arrangement. Finally, I did detailed visual design, including icons, logos, branding. Design iteration happened at every phase to fix the problem and refine the details.

5.2.1 HTA & concept development

As the identified problems listed above, I decided to make the app have 5 component targeting the problems. With the HTA chart expanding and growing, the detailed structure would be changed.
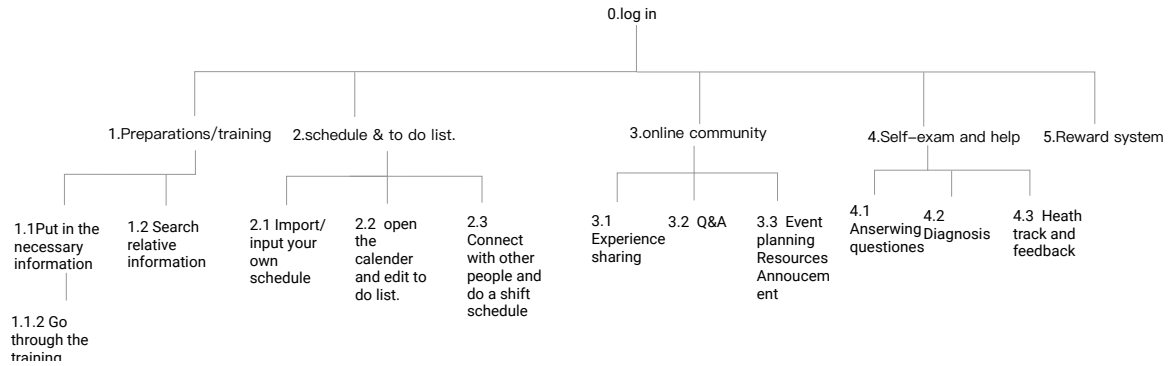
Figure 15: HTA chart- overall structure

Figure 15 shows the higher structure that there are five components in the app which are: preparation and training; schedule and to-do list; online community; self-exam and help; reward system. The detail chart are presented in Figure 12, Figure 13, Figure 14, Figure 15 and Figure 16 as below. Figure 11 shows a rough idea of the function and arrangement of the app. While I refining the detailed chart, the structure has changed a little bit.

Figure 16 is the information component which includes six small part. All the needed and necessary information are categorized and placed, providing help and save new caregivers' time. The users could get a tailored training exercise after providing some specific information.

Figure 17 is the schedule and team working component; it has four small part: team information, schedule information, group message and contact the organization. A "3 to 3" caregiving team could be possible when using this app. The caregiver organizations would gather all the information and the pair the three caregivers with three patients. Then the caregivers can easily read the app and know what to do. By clicking the Team button, the user would know their teammates and the elders that they are

assigned. They are also provided with more detailed information to help them know each other. By clicking the Schedule button, the user could upload their existing schedule and the AI and the caregiver organizations would automatically generate a schedule for this group. There is also a team channel for teammates to talk or even "complain." Users could also talk to the caregiver organizations easily.

Figure 18 shows the online community function; it is a platform that allows caregivers to get involved in a large community, where users can see what other caregivers are doing, all the updated news, some interesting story. Users could also share their pics and short videos of their caregiving life as well.

Figure 19 is the mental health component, A convenient but effective mental health monitoring system. Caregivers' mental health status should get more attention than we thought.

Figure 20 is the personal page; it includes setting and reward systems. It allows the user to see their own setting such as profile and pics, and more importantly, it keeps the user working record and create rewarding and data visualizing feedback pages to motivate the users. Later when I had the smart badge idea added into the whole design, there is several pages for the QR scanning function.
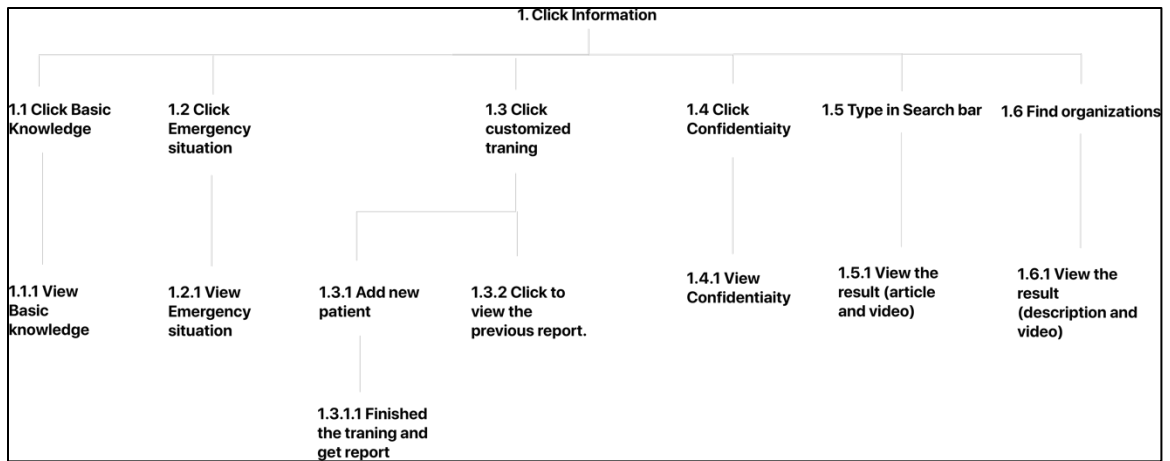
Figure 16: HTA chart- task 1
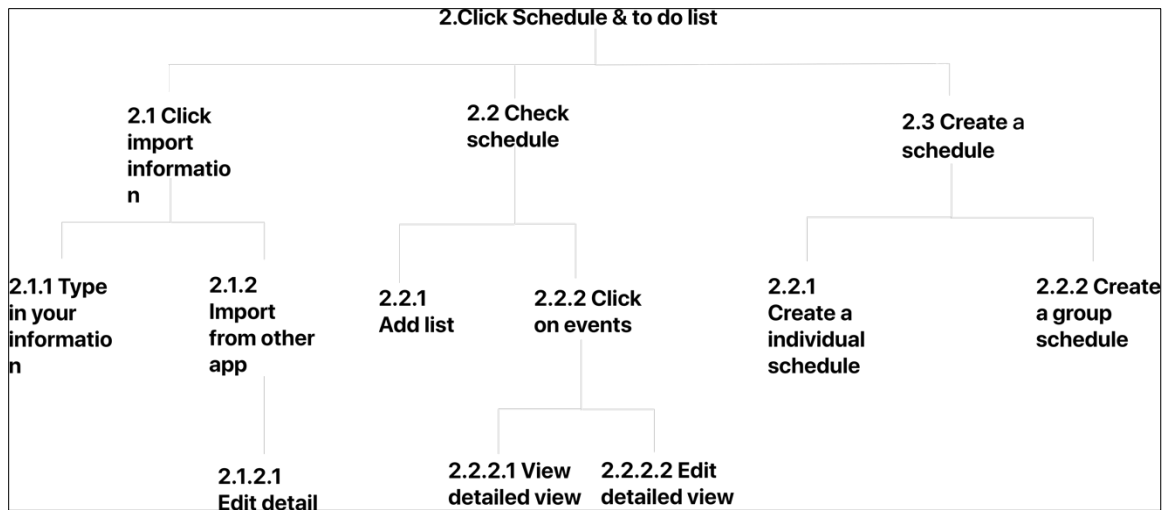
Figure 17: HTA chart- task 2
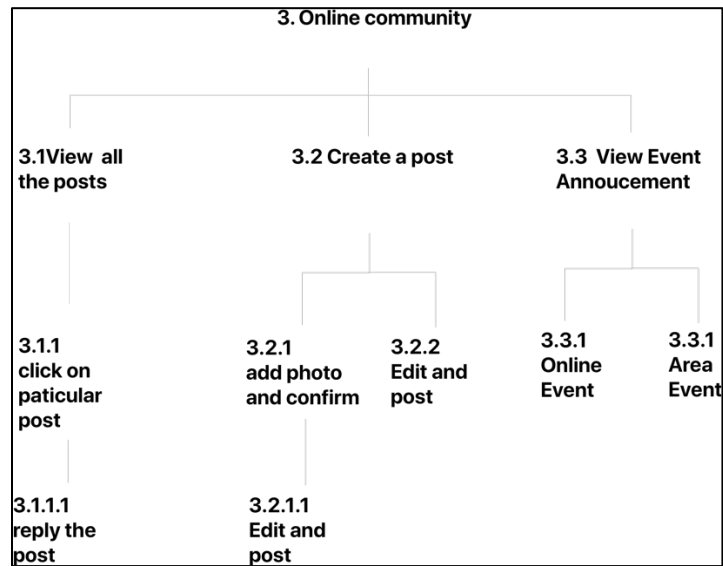
Figure 18: HTA chart- task 3
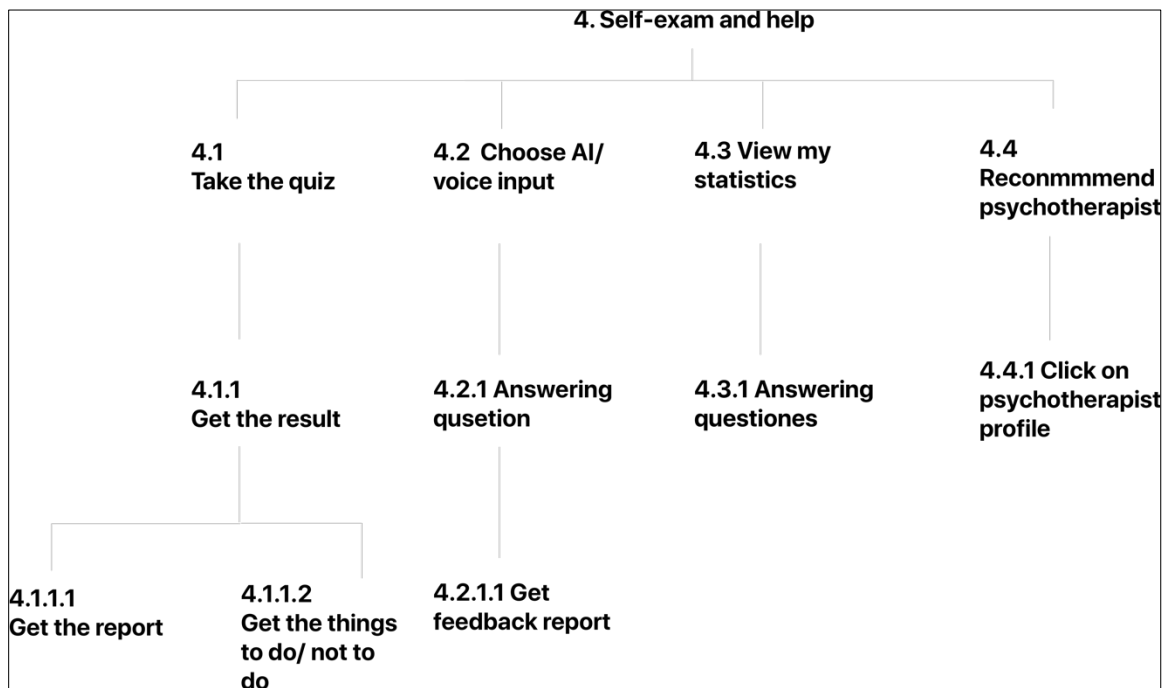
Figure 19: HTA chart- task 4
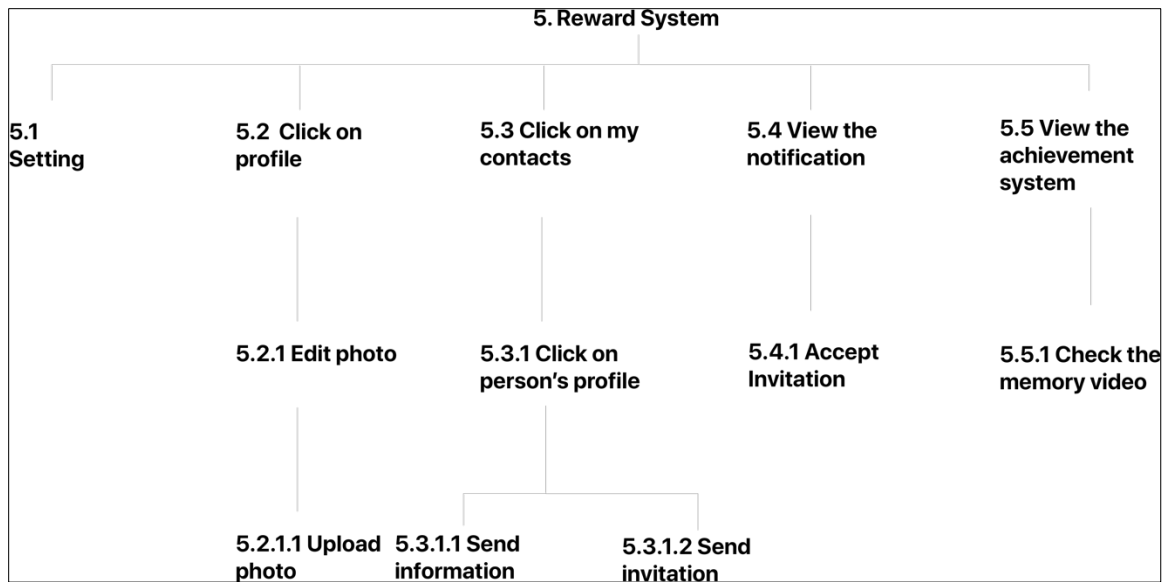
Figure 20: HTA chart- task 5

5.2.2 Wireframe

After I got the HTA chart, I started to make the wireframe to test if the structure function well. Firstly, I drew a quick wireframe to see if I put the five buttons on the button bar works, and the result turned out to be great.(as Figure 21). Then I finished the wireframe of each component. The wireframes are shown as below:
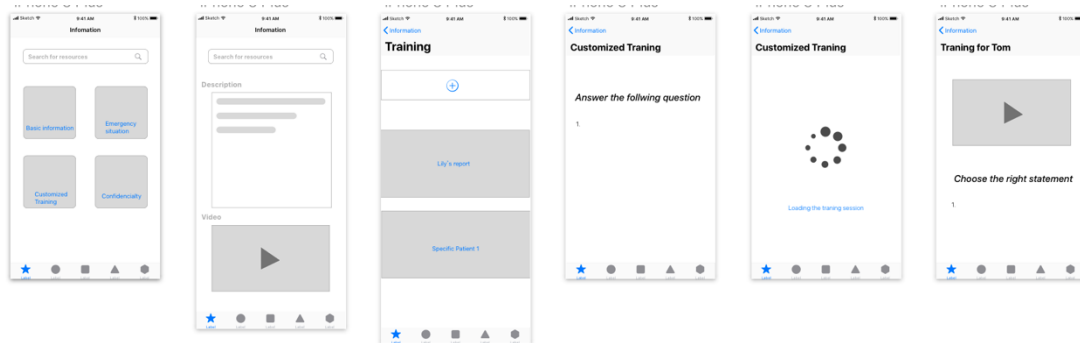
Figure 21: Sketch wireframe
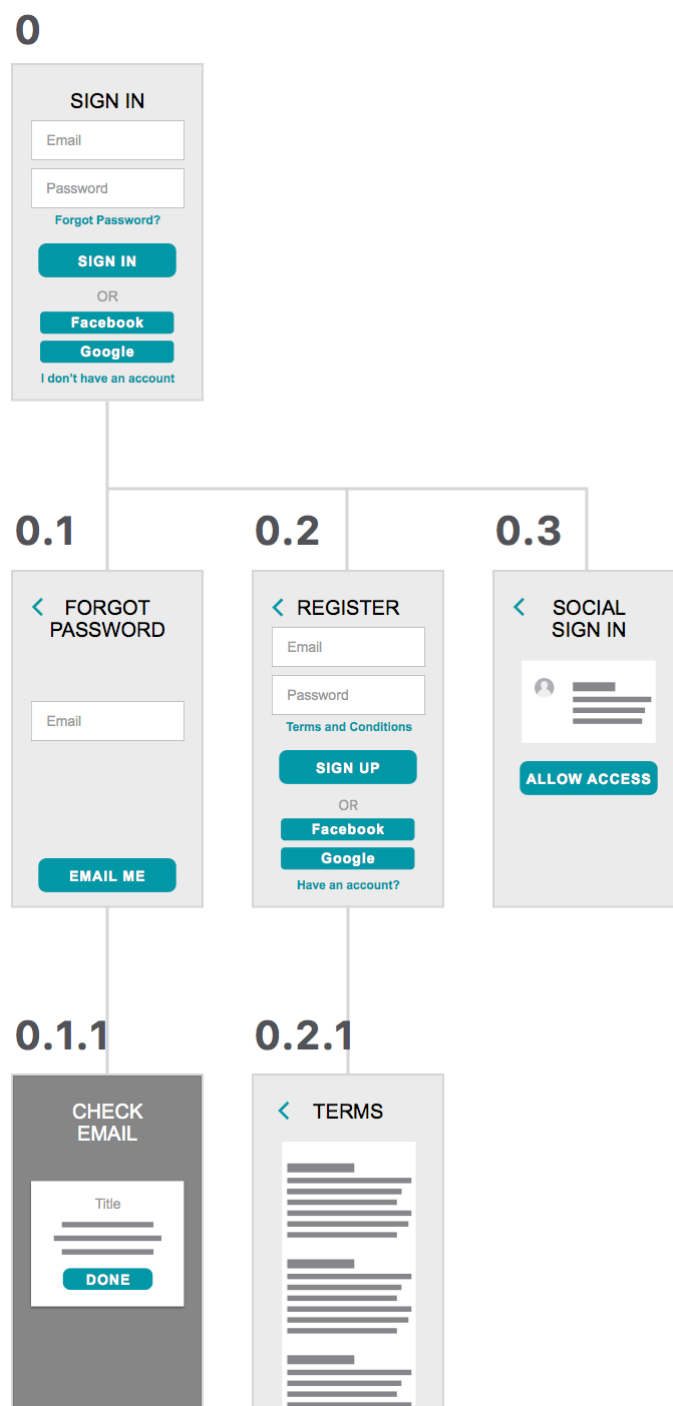
Figure 22: Sign-in pages (wireframe)

Figure 23: Information pages (wireframe)
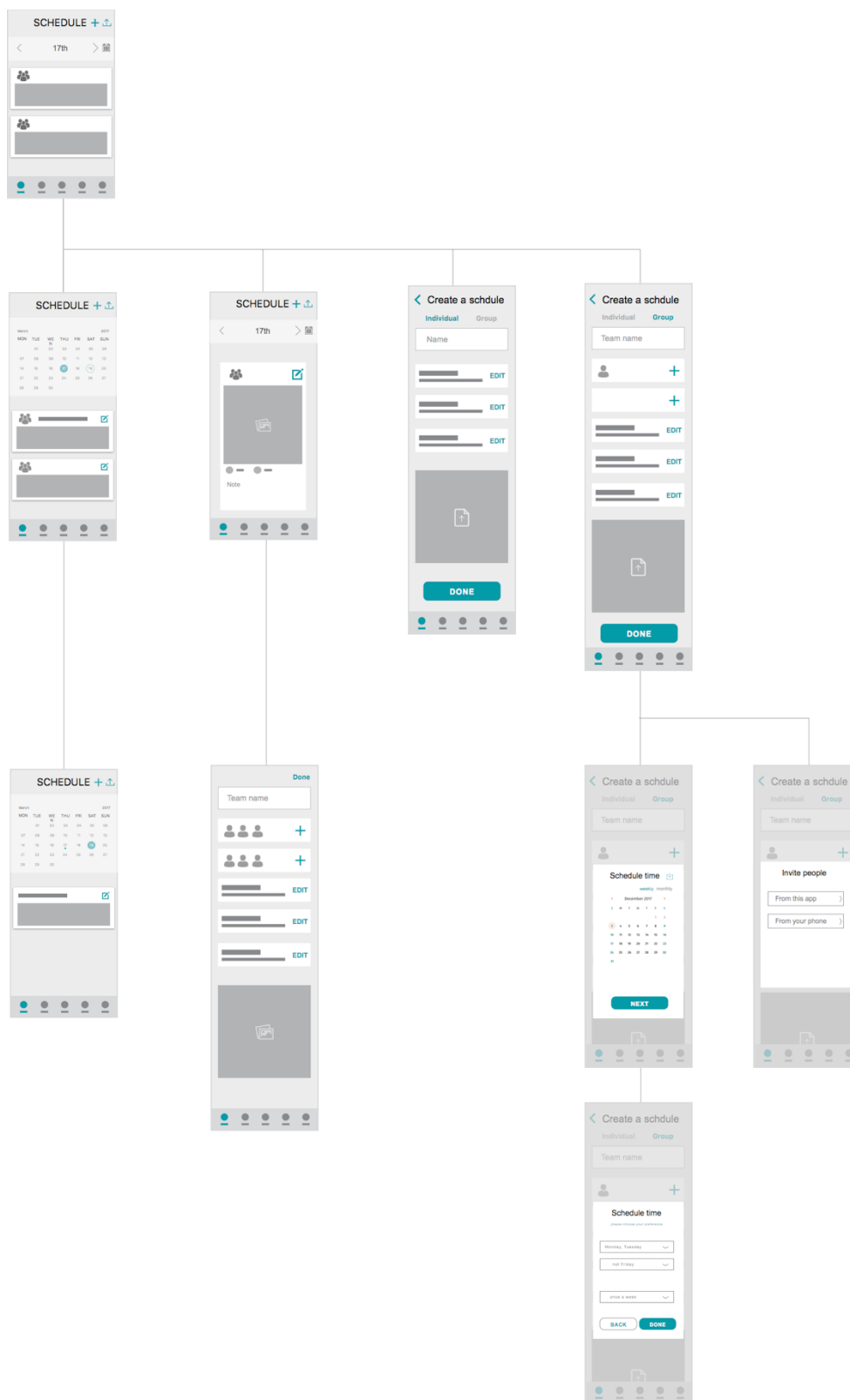
Figure 24: schedule pages (wireframe)
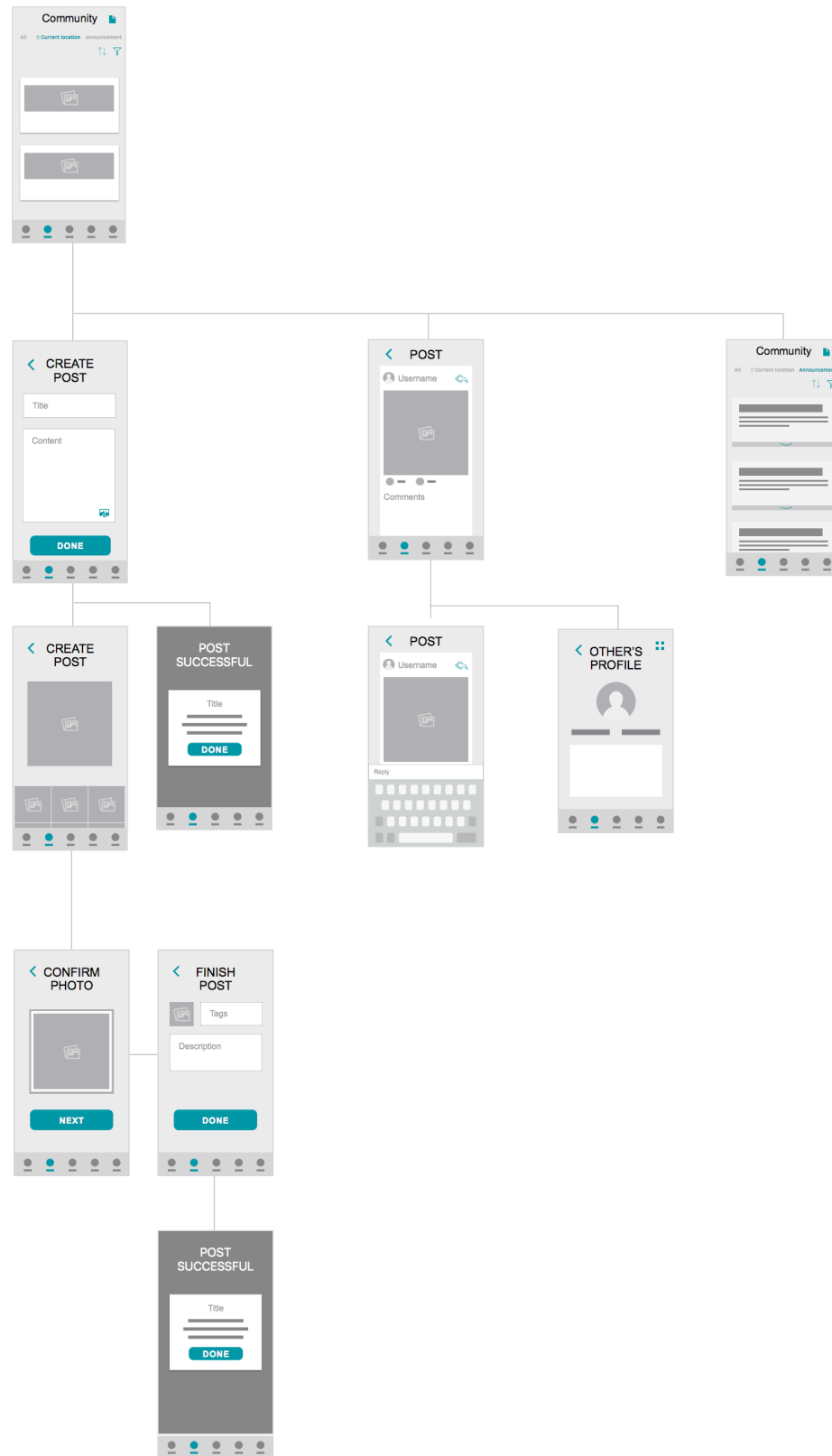
Figure 25: Community pages (wireframe)
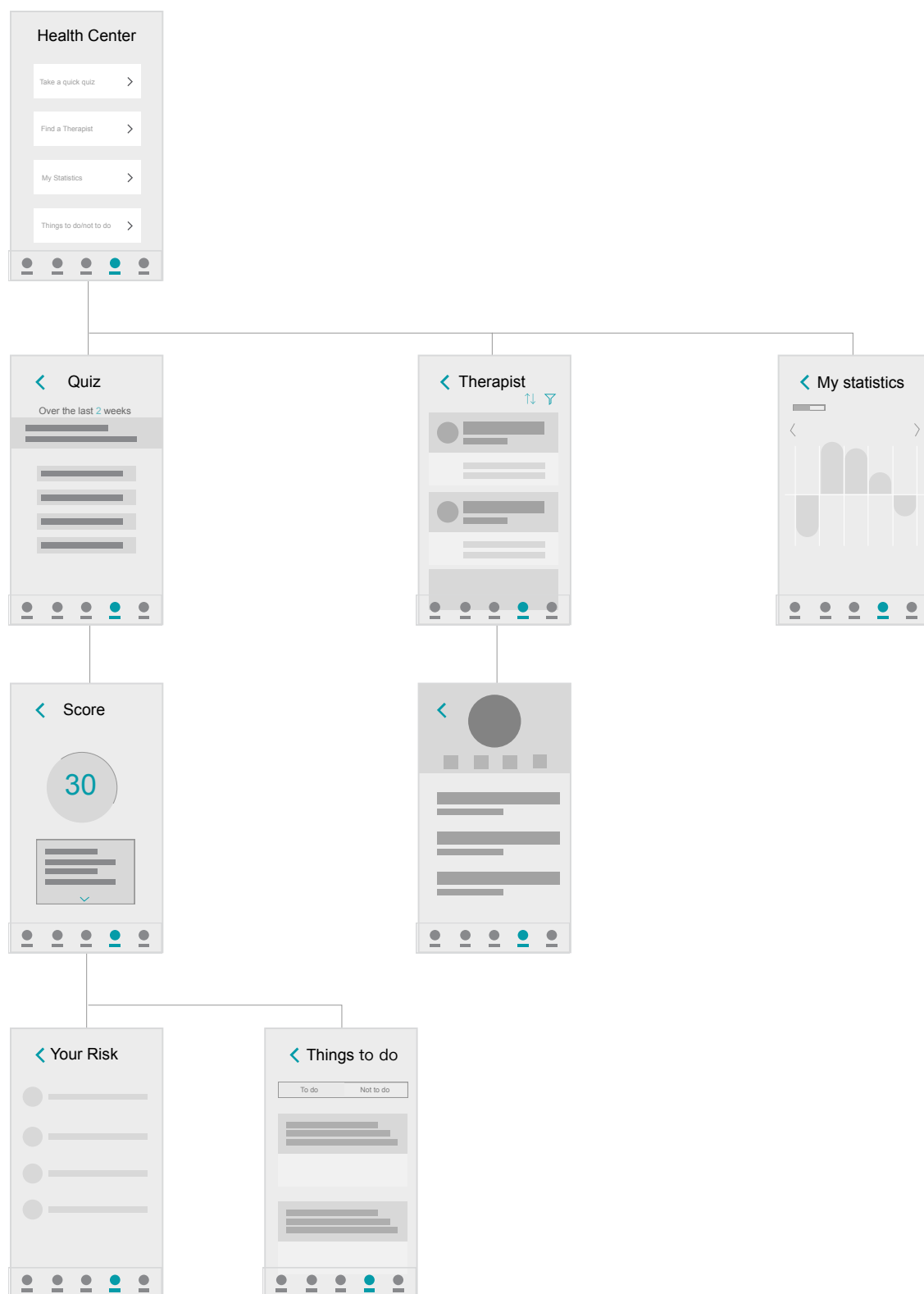
Figure 26: Mental health pages (wireframe)
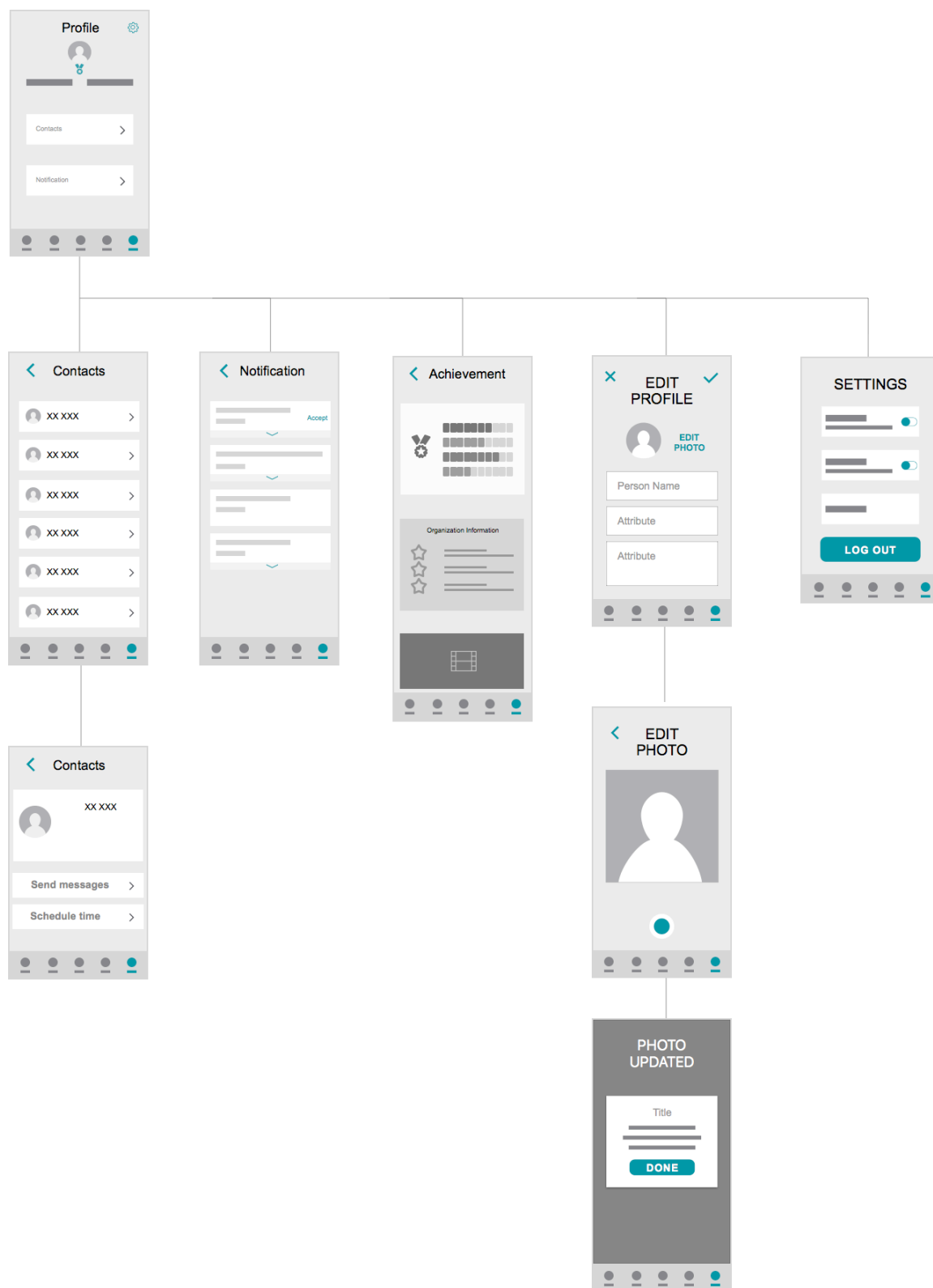
Figure 27: Personally setting pages (wireframe)

In the log-in page, freely sign in is required, Multiple ways to sign in and connect with and confidentiality agreement and terms are provided (Figure 22). In the information page, the user could find the basic and necessary information which is clear organized and lay out. If the user is interested, resources of organization could be found conveniently. In addition, Targeted training is available with the information typed-in (Figure 23).

For the schedule page, its layout is clear and could be uploaded to other application and the schedule could be edited at any time. It also allow the user to create a group caregiving schedule, users could send invitation, schedule time, and generate smart schedule (Figure 24).

People could share their information and ask questions one the community page. Users could filter by location, announcement or more dimension. Users could also reply others post. (Figure 25). The mental health page is at the fourth section to remind users to take care of their metal heath and provide them basic resources to keep they are on the right track. More intuitional visual data is available to user to encourage them to keep track their health status, In addition, therapist information is provided in case the user need to talk or have a more formal examination (Figure 26).

In the personal setting page (Figure 27), it shows user's information on the top part of the interface, also there are buttons that bring users to the achievement pages, which shows users' caregiving record and using some achievement system to motivate the users.

5.2.1 Visual design first round

Visual is also a very important part of the mobile design, the style should be consistent in case of causing any confusion. The color scheme would determine the branding position. So after I got the whole wireframe flow designed, I moved to the stage of first round of visual design. The interfaces I designed first are presented as below.(Figure 28)

In the first round, I tried to use some gradient color as the theme color, as well as the log in page and some introduction pages. Then I discussed the overall design ideas with my professors and peers and figured out the problems and the future direction. Firstly, the whole app needs to follow a more consistent style, and I planned to change the color scheme. Secondly, the function of schedule a group caregiving is a little bit too complicated and could be improved. Actually, the calculation of computer could be a very good assistance that it could automatically generate a schedule to help users by using the technology of big data and artificial intelligent Lastly, this application could be designed to fit more organizations rather than just Caregiver Companion.
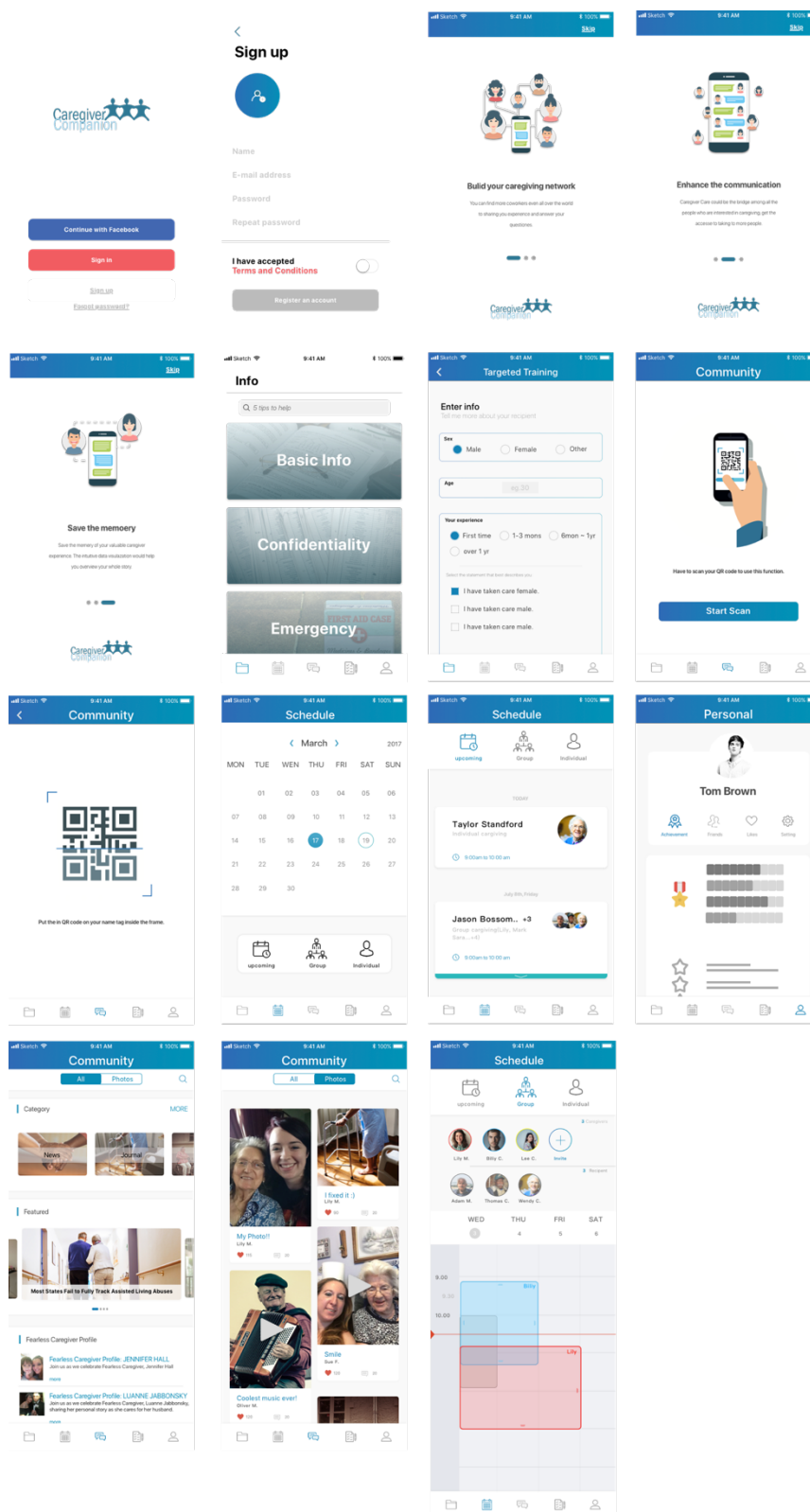
Figure 28: Interfaces of the first round visual design

5.2.2 Visual design second round

Based on the first round, the second round aimed to build the detailed the interfaces and try to nail down a consistent style. The Logo is a combination of the letter C and G, which is the initial of the application's name, Care Givers. The primary color is dark blued(Hex #4A7FC0) and pink(Hex #F7sF9D). (see Figure 29.) The detailed page design and icons are presented as follow:
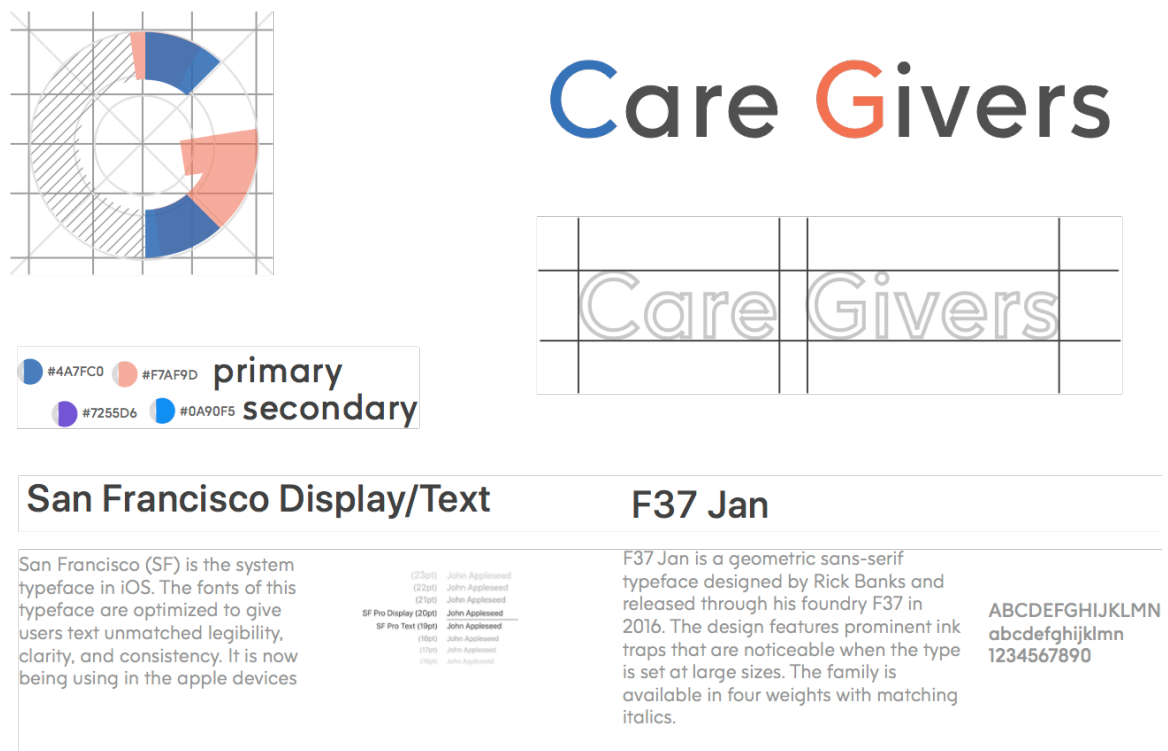
Figure 29: Style guide and logo design
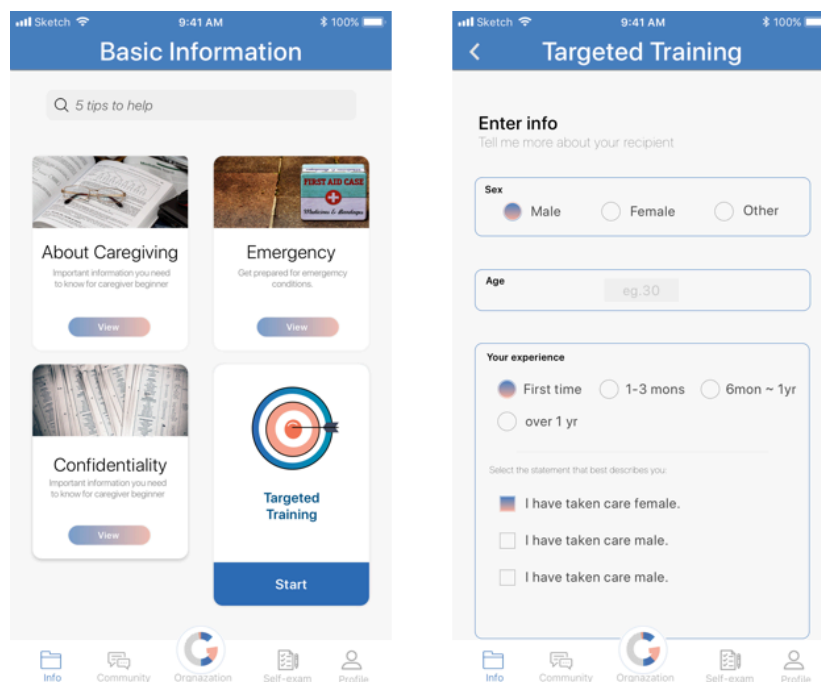
Figure 30: Information pages
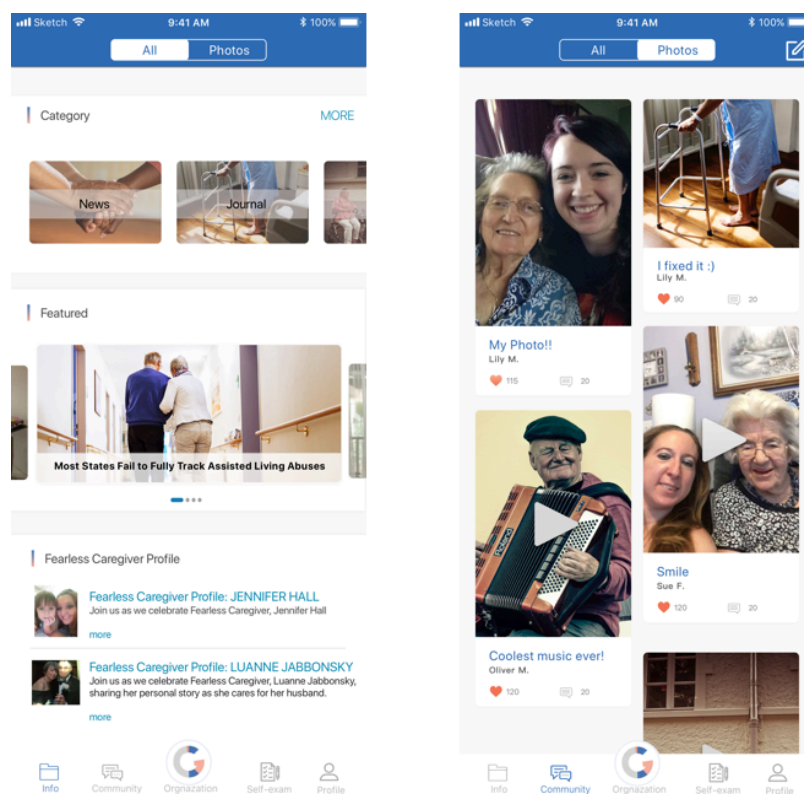
Figure 31: Community pages
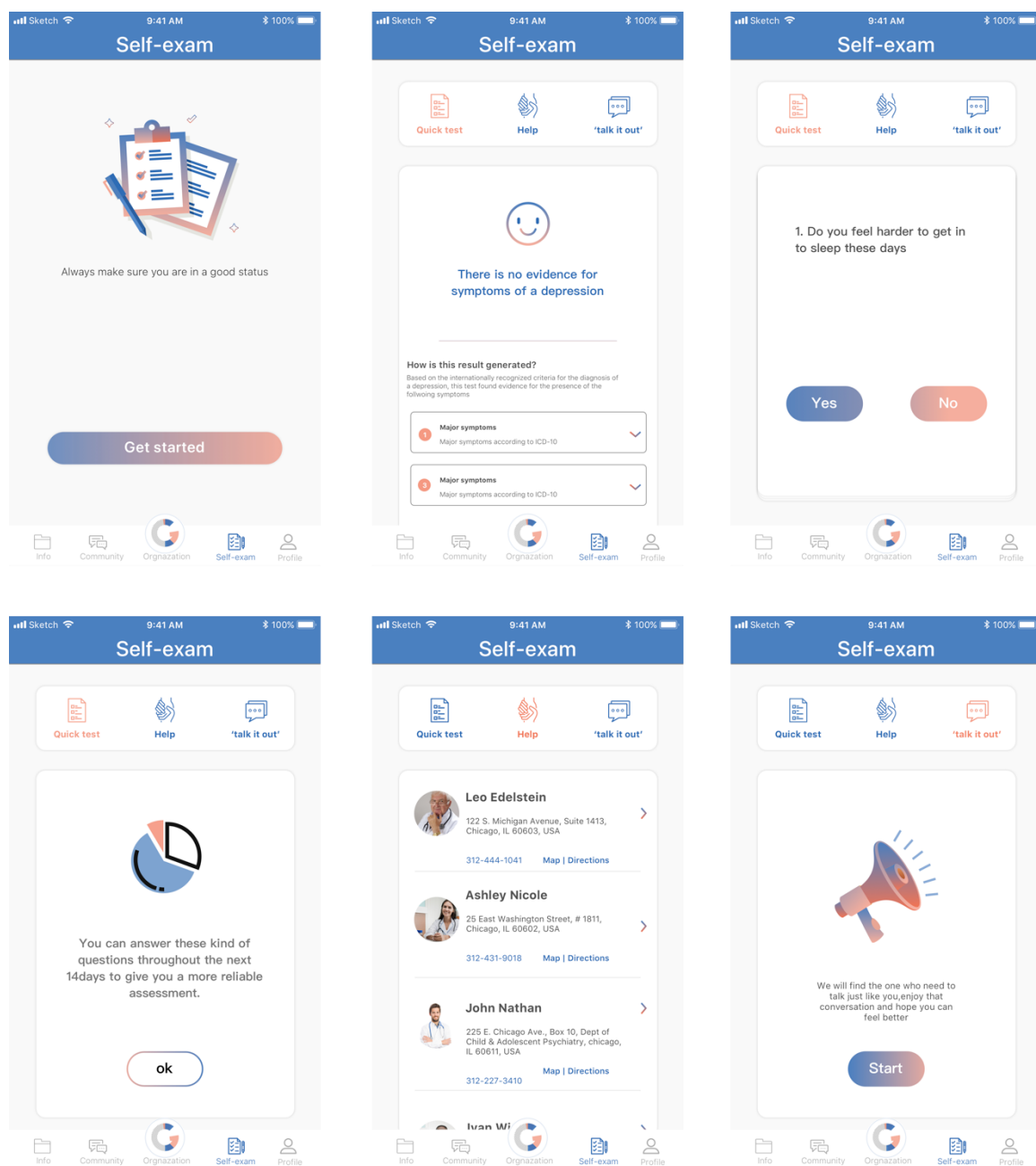
Figure 32: Mental health pages
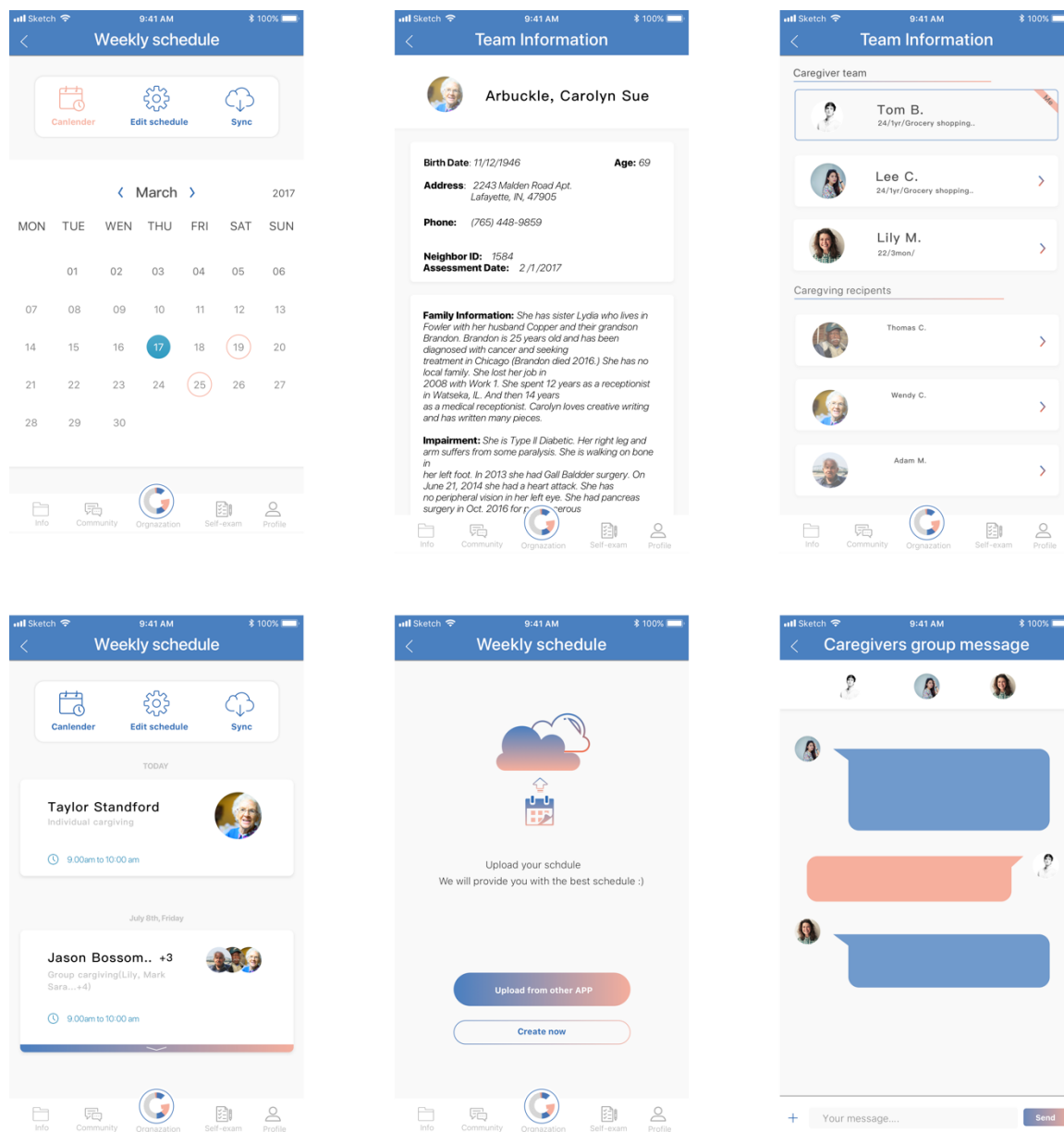
Figure 33: Group caregiving pages
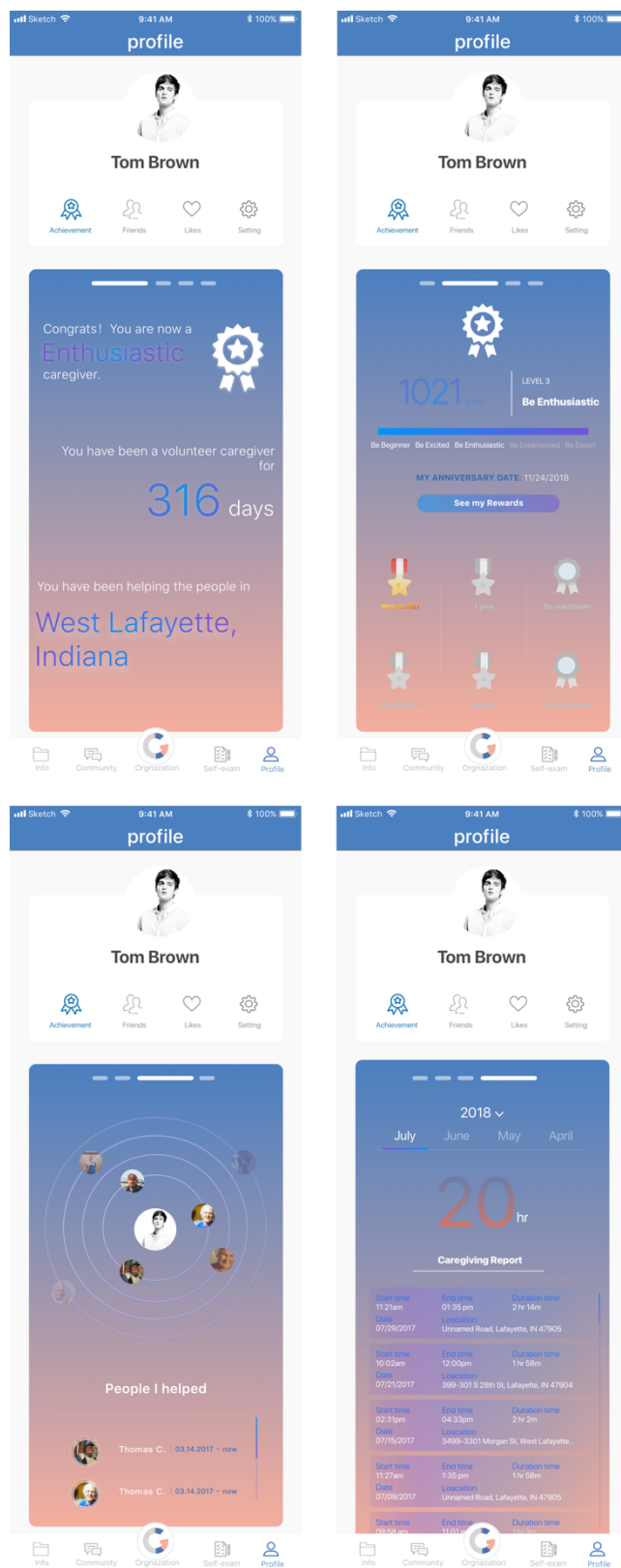
Figure 34: Achievement pages
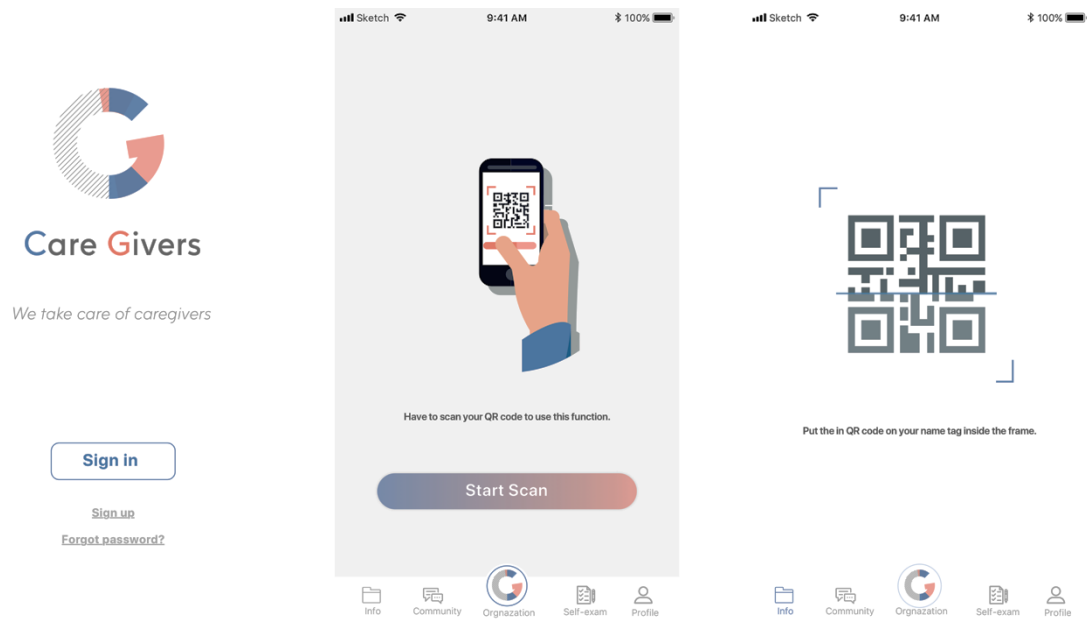
Figure 35: Log-in and scan pages

5.3 Smart device design

5.3.1 Brainstorming & sketches

I had an idea of the design an IOT product comes with the mobile application together at the very beginning; the question would be: what should it be? Figure 36 shows the brainstorming sketches. At first, I was thinking of some common smart device such as a smart watch or a smart pen. However, it is a volunteer job which means an extra product would be a burden to the caregiver to keep and to use. Then I shift my direction to doing a redesign of the product which is already being used by the caregivers.

The name badge is required to wear by the organizations while the caregivers are on duty, it is mainly for the reason of credibility. However, the name tag I was provided is poorly design and even part of the caregivers not really wear it when they go to see their patient. Therefore, I see the name badge as an excellent design opportunity. If the

caregivers have to wear the badge every time they work, why not integrate the badge with more functions (Figure 37). Also, I tried to turning the welcome package which is just a pile of papers in to a more useful product which could also let the user store their badge. I came up with three different ideas: certificate, pen container and binder, and the designing a binder is the direction I went (Figure 38).
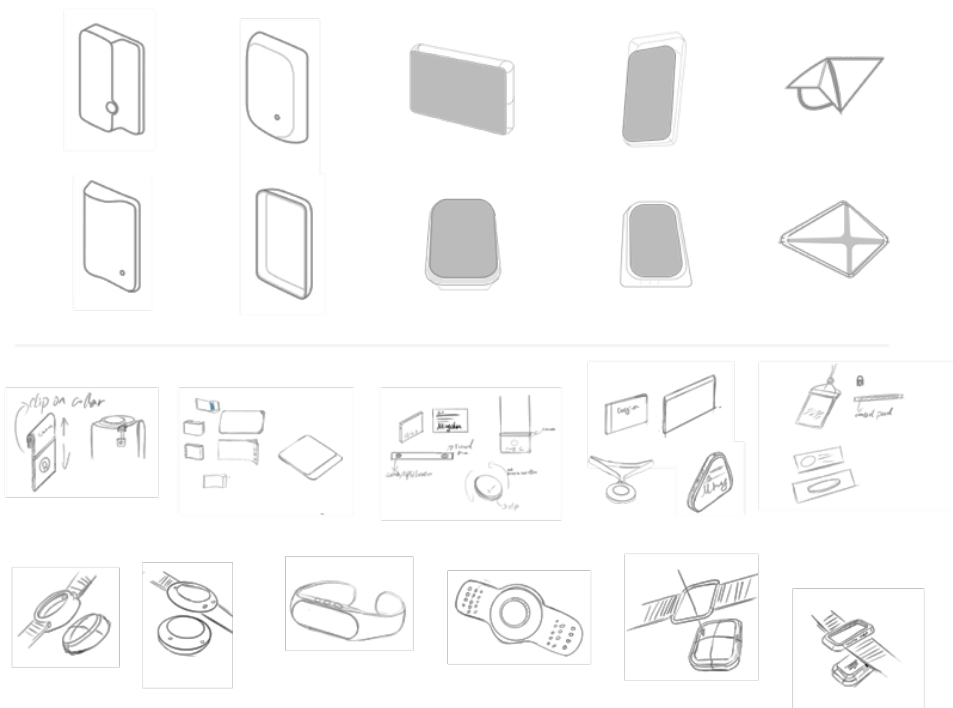
Figure 36: Smart device sketches

Certificate   **Pen container**   **Binder**
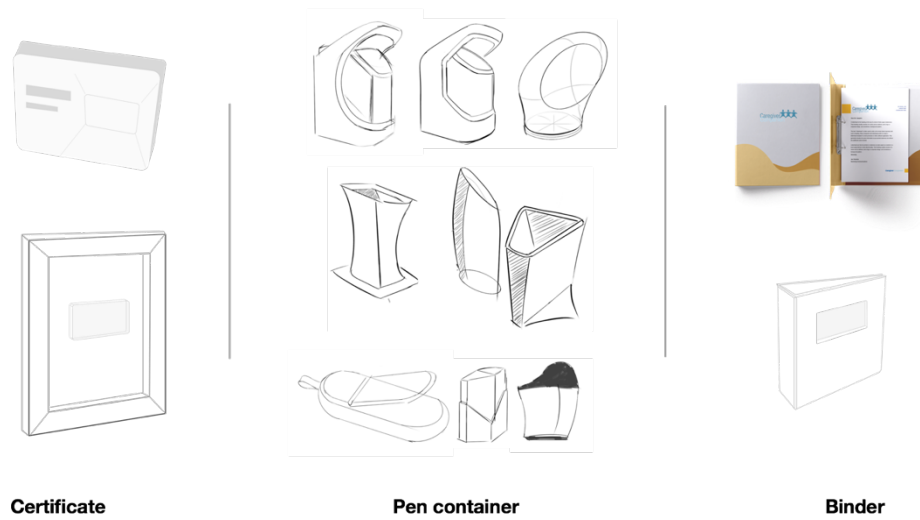
Figure 37: Package design sketches

5.3.2 Mock-up and test

To test the appropriate size of the smart nametag, I made several mock-ups and evaluate with different users. As it is shown in Figure 38, rigid foam core was used to make the mock-ups.
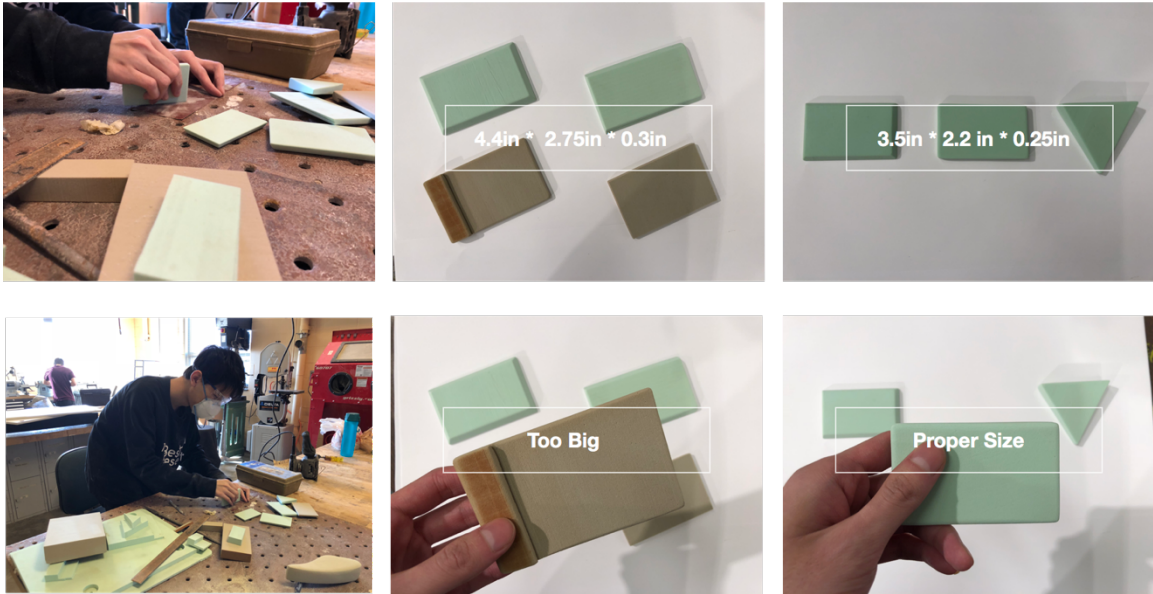
Figure 38: Photos if mock-up making

5.3.3 Computer rendering and physical model

Then I build a computer model to finalize the idea, the components and the functionality are illustrated in Figure 39, and Figure 40 shows the card with the binder together. Afterward, I made the physical model by 3D printing for presentation and evaluation (Figure 40).
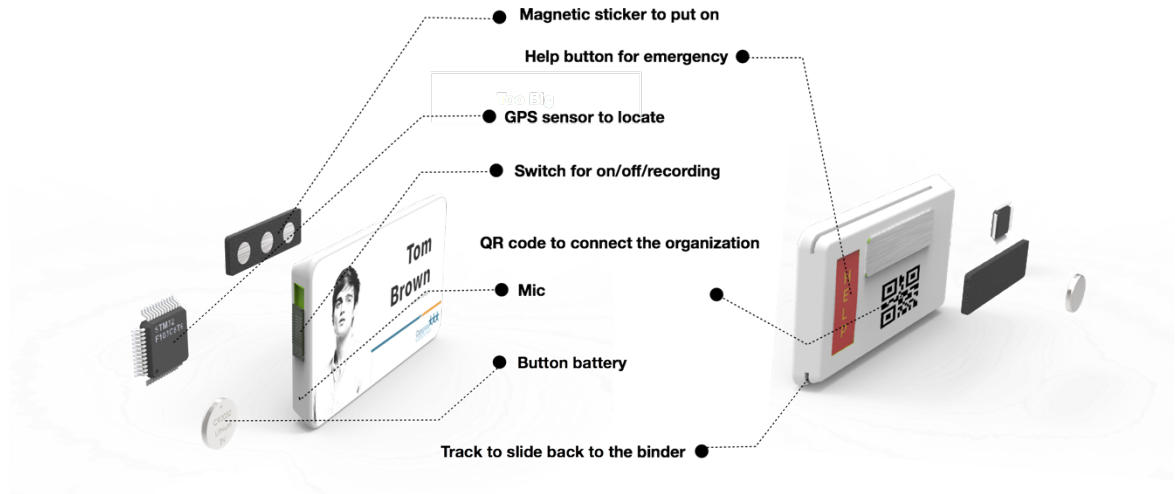
Figure 39: Computer rendering of smart badge

Figure 40: Computer rendering of the package

Figure 41: Photos of physical models

5.4 Design evaluation

5.4.1 Evaluation setting

To test if the design could solve the problems and achieve the design goals, a heuristic evaluation has been conduct. To identify the applicable heuristic, I reviewed some concepts from the experts in the interaction design field (See Figure 42)

Heuristics

The 6 Principles Of Design, a la Donald Norman

Visibility Feedback Constraints Mapping Consistency Affordance

Ben Shneiderman's "8 Golden Rules of Interface Design"

Strive for Consistency; Cater to Universal Usability; Offer Informative feedback;Design Dialogs to yield closure;Prevent Errors
Permit easy reversal of actions;Support internal locus of control;Reduce short term memory

10 Usability Heuristics for User Interface Design

Visibility of system status;
Match between system and the real world;
User control and freedom;
Consistency and standards;
Error prevention ;
Recognition rather than recall ;
Flexibility and efficiency of use ;
Aesthetic and minimalist design;
Help users recognize, diagnose, and recover from errors
Help and documentation;

Figure 42: Expert concept in interaction design

The heuristics that I filtered and used are as presented in Table 3, the participant and the data are shown in Figure 42 and Table 4. Five evaluators have participated in this heuristic evaluation, all of them have at least five years of industrial and interaction design experience. Their feedback was collected in the form of severity rating from 0 to 4,representing from 'No problem' to 'Catastrophic problem: critical or even fatal problem should be fixed immediately.'

Table 3: Heuristics of the evaluation

A. Aesthetic and minimalist design	A1. Attractiveness	Unique and appealing appearance(color, form, material, texture, proportion etc.).
	A2.Interface	The interface and the icons looks good and fit the whole design style.
B. Affordance	B1.Intuitive	An affordance is a visual attribute of an object or a control that gives the user clues as to how the object or control can be used or operated. At a very simple level, to afford means "to give a clue". When the affordances of a physical object are perceptually obvious it is easy to know how to interact with it.
	B2.Recognition rather than recall	User should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.
C. Visibility	C2.Visibility of System Status	Always keep users informed about what is going on. Provide appropriate feedback within reasonable time.
D. Usability	D1.Feedback	Feedback is about sending back information about what action has been done and what has been accomplished, allowing the person to continue with the activity. Various kinds of feedback are available for interaction design-audio, tactile, verbal, and combinations of these.
	D2.User control and freedom	Provide a clearly marked "out" to leave an unwanted state without having to go through an extended dialogue. Support undo and redo.
	D3.Consistency and standards	Users should not have to wonder whether different words, situations, or actions mean the same thing.
	D4.Flexibility and efficiency of use	Accelerators -- unseen by the novice user -- may often speed up the interaction for the expert user so that the system can cater to both inexperienced and experienced users.

Table 3 (*Continued*)

	D5.Help and documentation	Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Help information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.
	D6.Error Prevention	Even better than good error messages is a careful design which prevents a problem from occurring in the first place.
	D7.Mapping	Mapping is the relationship between control and effect. The idea is that with good design, the controls to something will closely resemble what they affect.
E.Maintenance	E1. Replacement	In case of system/components failure, the design should consider efficient way to inspect/fix errors/replace failure components.

Evaluator #1
male
6 years industrial design

Evaluator #2
female
6 years industrial design

Evaluator #3
male
4 years industrial design study
2 year interaction design study

Evaluator #4
female
4 years industrial design study
2 year interaction design study

Evaluator #5
male
4 years industrial design study
2 year interaction design study
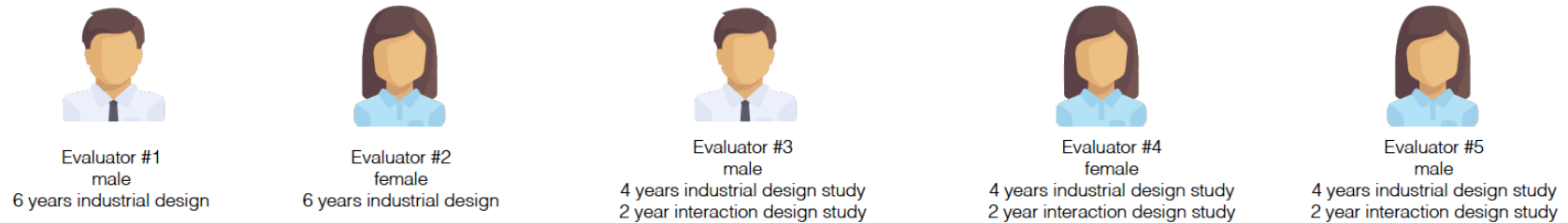
Figure 43: Participants of the heuristic evaluation

Table 4: Data of the heuristic evaluation

			0	1	2	3	4	comments
A. Aesthetic and minimalist design	**A1. Attractiveness**	The appearance of design in terms of shape and color looks good and fit the usage		⭐ 🔺	🟢	🟡 🟦		Color is pretty, but does not fit the usage scenario really well.
	A2.Interface	The interface and the icons looks good and fit the whole design style.		🟡	🟢 🔺	🟦 ⭐		Interface looks good , if the button could be more intuitive that will be much more better.
B.Affordance	**B1.Intuitive**	All the functions designed and presented in a way which is not against user's previous experience and common sense.	🟦 ⭐	🔺 🟡	🟢			The application is pretty intuitive, the use of the product could be improved.
	B2.Recognition rather than recall	Instructions to use the function should be visible or easily retrievable whenever appropriate and user do not have to memorize much information.	🟦 🟡	🔺 ⭐	🟢			Because the simplicity design style, it is pretty easy to user and most of the function are pretty clear represented by the icons.
C.Visibility	**C1.Visibility of System Status**	The menu instructions, prompts, and error messages appear in the visually effective and comfortable way	🟦 🟡	🔺 ⭐	🟢			The smart name tag could be improved, such as the buttons.
D. Usability	**D1.Feedback**	1.Provide appropriate feedback within reasonable time.	🟦 🟢	🔺 ⭐ 🟡				the whole using flow is quite smooth and straightfoward, but proper feedback is always welcome
		2.Feedback information is effective and not interrupting.	🟦 ⭐ 🟢	🔺 🟡				could add more feedback and return function
	D2.User control and freedom	1. User could stop and start a new command when the whole system is in progress.	🟦 🟢	🔺 🟡	⭐			
		2. When user interact with the application as well as the product, the whole operation flow is smooth and effective.	🔺 🟡	🟦 🟢 ⭐				

Table 4 (continued)

	D3.Consistency and standards	The whole design elements are follow a certain design format and none of them causes a confusion(icon, button,prep area and rack).						The achievement pages looks different than the others. probably because of the color and the style. and the icons style could be better as well.
	D4.Flexibility and efficiency of use	1. The app and product could fit the different type users.						
		2. Could memorize and personalize different user mode.						
	D5.Help and documentation	Help information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.						Whole design is very simple and high technology, should have more help or hint for the elder people and kids. and do not need to keep showing the helping hint, just when necessary is fine.
	D6.Error Prevention	The whole application system provide enough guidance						
	D7.Mapping	Different function and area divided visually effective and efficient.						
E.Maintenance	E1.Replacement	Is this product easy to maintain and fix?						
F.Overview		This product is functional and problem-solving.						

5.4.2 Evaluation result

Based on the evaluation and the opinions from my advisors, the positive feedback are:

(1) The problem that I identified is valuable and not get enough attention before. It is good to solve an old tricky problem from a new perspective.

(2) The idea of assign the volunteer caregivers in to groups is problem-solving and has the potential enhance the caregivers experience in a long run.

(3) The application could also be used by other types of caregivers and their organizations.

(4) The user flow of the application and smart badge is smooth and better than the current user flow.

(5) It provides well-rounded resources and help for the caregivers.

There are also some negative feedback and suggestions which I summarized as below:

(1) The style of the mobile application should be more consistent, the usage of the color and icons could be refined.

(2) The color scheme of the whole application could be changed to match users' mental model.

(3) The design of the smart badge can be improved, such as the button design and the binder design.

(4) The detailed scheduling system could be refined.

5.5 Design refinement

According to the feedback and the evaluation, a second round design of refinement has been done to fix the problem and improve the design. First of all, I have done some research about the color scheme, I tried to change the primary color to make the application have a more intuitive medical style. In addition, I have change icon and the illustrations in the application to improve the consistency including the achievement pages which have received some negative feedback of its style. The new application style guide and pages are as shown below, (see Figure 44 & 45).
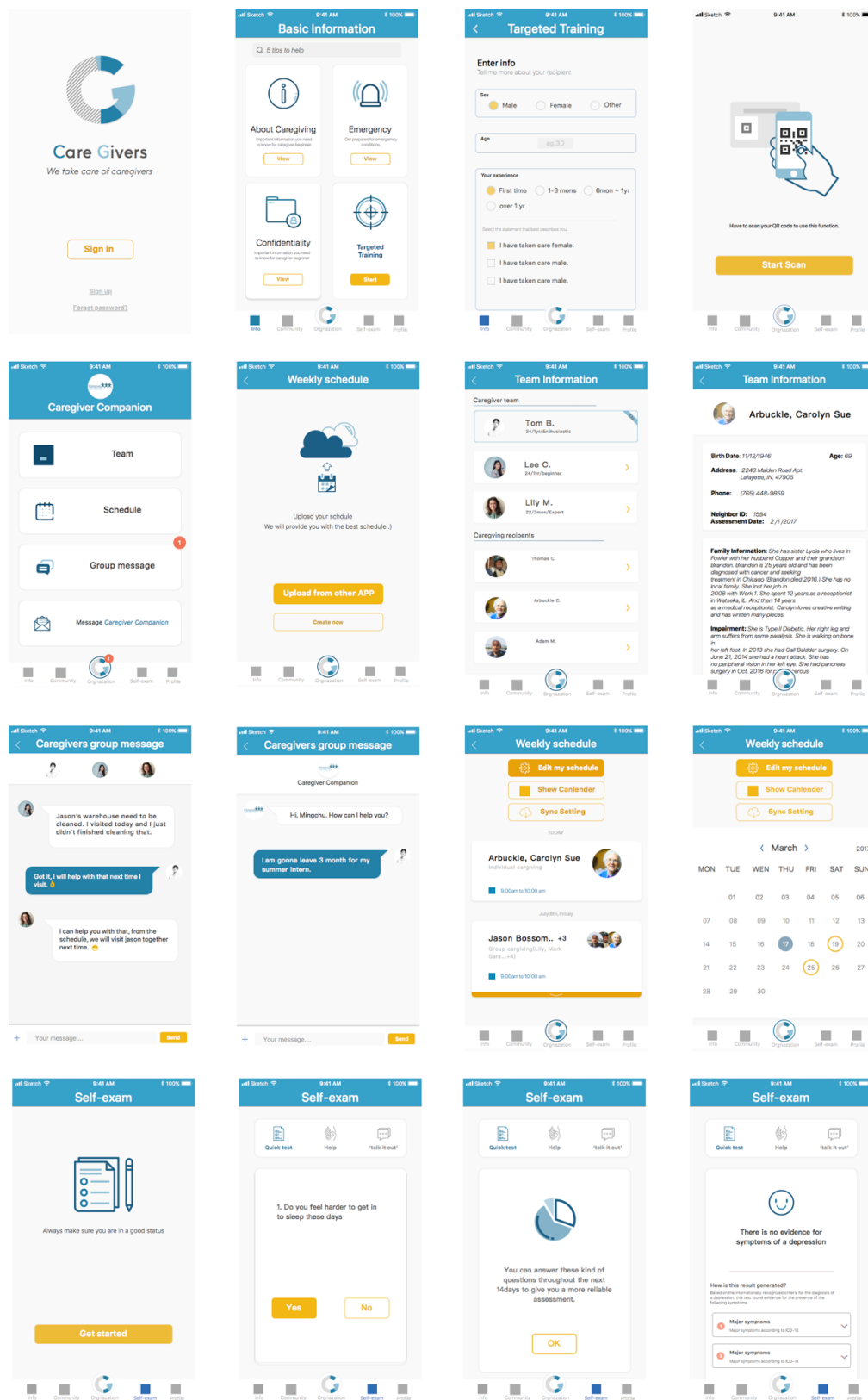
Figure 44: Refined pages (1)

Figure 45: Refined pages (2)

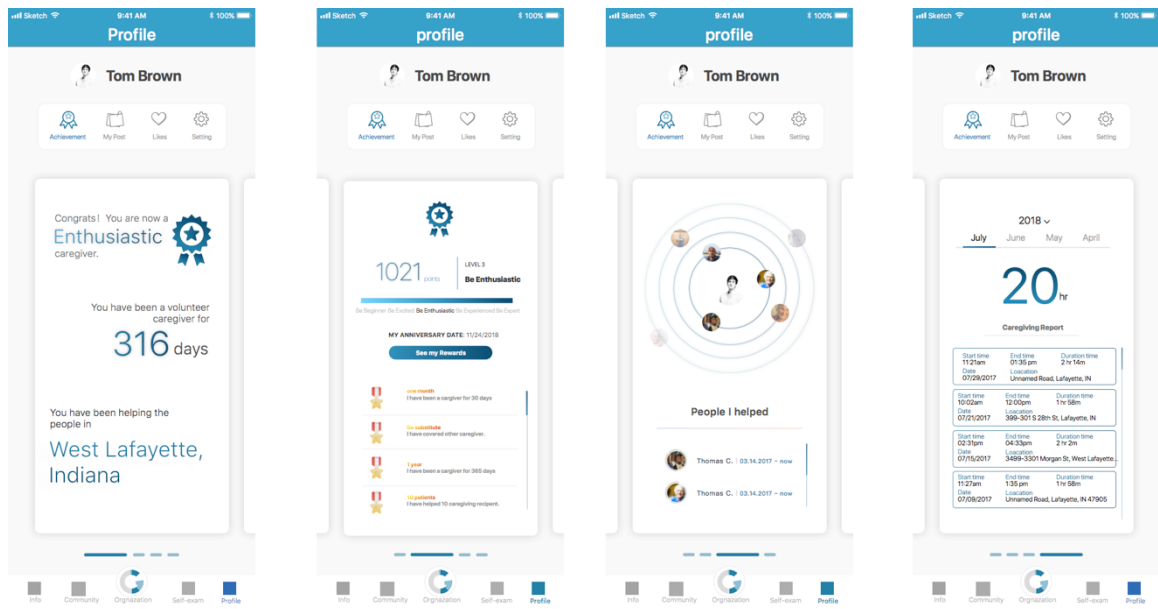Figure 46: Logo refinement

The logo is derived for the application's initials, 'Care Giver'. With combining

the C and G shape, the result's is like a circle which fit the image of 'helping each other'.

The logo has the lines left the side, and color chunk right side which means the caregivers

and the recipients, and two contrasting texture also bring variety into the logo design, (see

Figure 46).
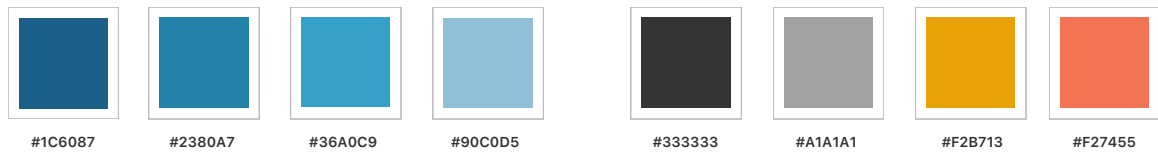
Figure 47: Color theme

Upon a lot of research, I've Implemented the color style above. The lead color is green-blue, but there are gradient variations to amplify the overall design. Base on the research, the green-blue color is widely used in the medical interface design, it looks professional in terms of the medical care (see Figure 47).

In addition, the orange yellow color is the secondary color which is also the complementary color with the green-blue. It makes the whole style a little bit more warm and vivid. And those two color is mainly for button and notification.

I also tried to design a very specific icon family that gives Care Giver its own look and feel with a complex language and functionalities.(Figure 48)

Figure 48: Refined icon family

What's more, A new iteration of the smart badge design has been done, First I came up with three new idea of the shape and the appearance of the name tang and three new binder design as well, then I picked the best one to do a detailed computer rendering (see Figure 49& 50).
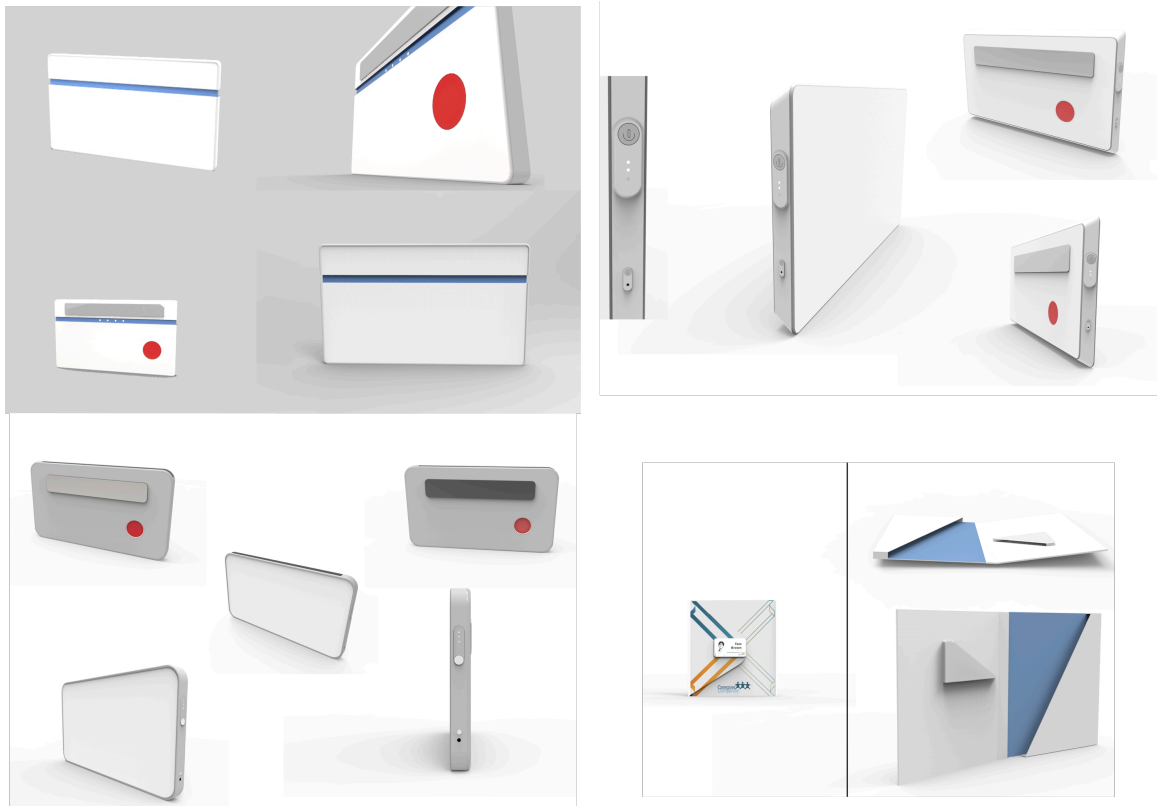
Figure 49: Design process in the refinement process
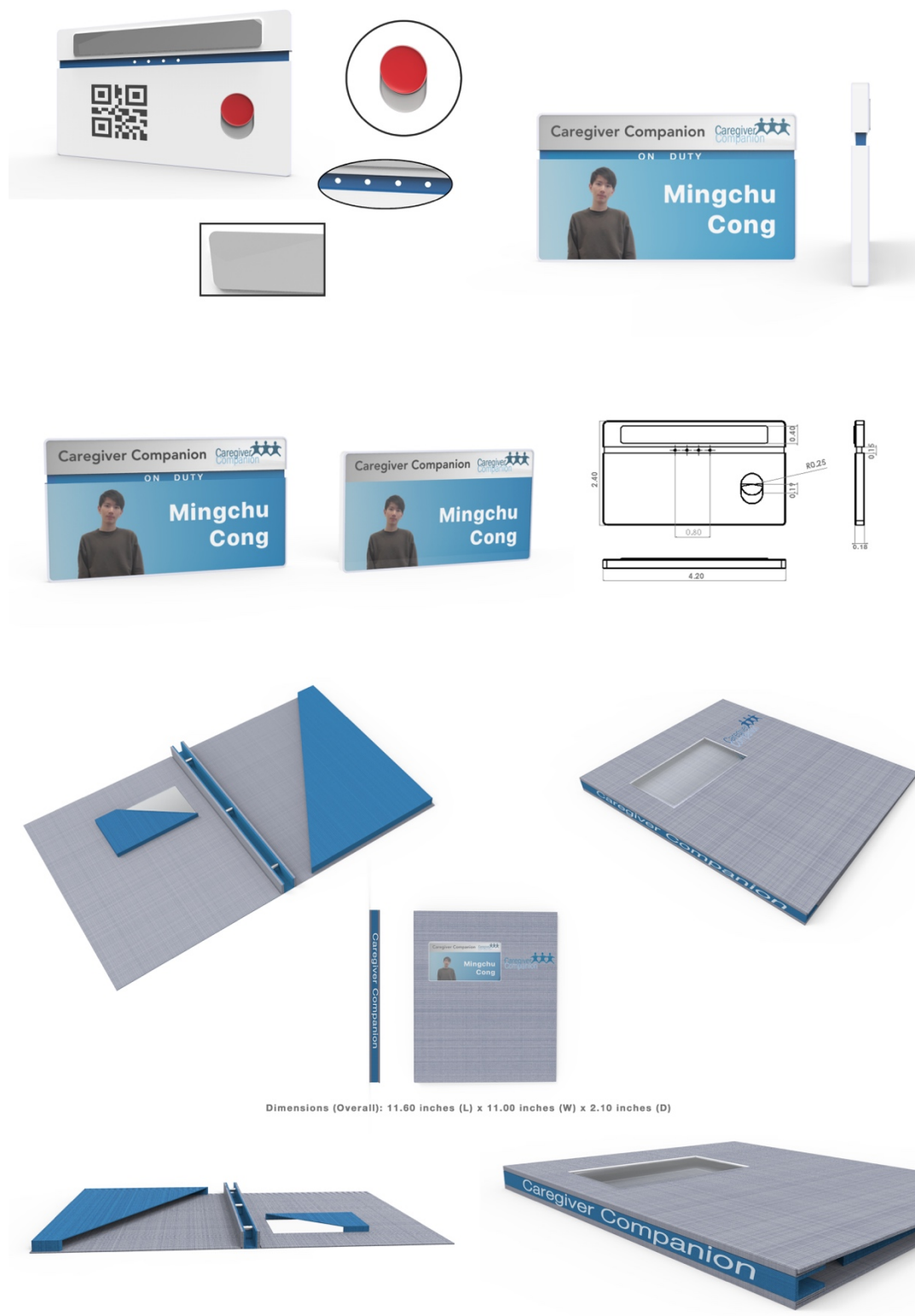
Figure 50: Refined smart badge and binder design

5.6 Future works

The evaluation's feedback was collected from multiple resources, I did see a few issues and take many valuable suggestion to improve it. However, more evaluation could be conducted to get insight from different perspectives.

Several things I think could be helpful to improve the design in future. Firstly, a high fidelity prototype could test the functionality of the mobile applications and gather more precise feedback of users experience. Secondly, there are some other evaluation method could provide other insight such as cognitive walkthrough and usability testing. Last but the least, Making the physically model of the new binder and the badge would be a important step to test a product.

CHAPTER 6   CONCLUSION

The projects I presented in the thesis includes literature review, user research, peer product review and problem identification. I found the problem that we lack of the recourses of caregivers to take care the increasing the aging population. What I also found is that the volunteer caregivers have been proved to ease the problem and even solve the problems. However, we did not pay enough attention to the volunteers in the non-profit origination and make effort to enhance their experience.

The solution I generated here is a system including a mobile application and a smart badge which could connect to the application. With the system, volunteers could work as a team to providing their help to a team of care receivers. In that case, volunteer caregiver won't feeling lonely cause they have teammate, their caregiving experience will not be limit in a one-to-one visiting schedule for a long time. The users could also see how other caregivers doing their job from the application, where they can post and share video or photos as well, it could bring the caregiver community tighter and closers. In addition, instead of spending lots of time searching some basic information online the user could get all the needed information from the application as well. The non-profit organization might not be able to provide a comprehensive training session, one of the reason is they think volunteer work is not demanding, another reason is some of them could not afford it. Now, the caregivers could get a targeted training from the application. What's more, mental health is always a big concern of all types of caregivers, the Care Giver application provide a daily quick quiz to make sure the caregiver is on the right track, also other helpful information could be found easily in the app such as tips and the

information of the doctors. The achievement component use a badge rewarding system to motive the users, it also keep the user's caregiving record to amplify the users' sense of the achievement. The new smart badge is a redesign of the current name tag that the caregivers are required to wear when they providing help, the built-in GPS chips ensure the safety on both sides and save the users time cause they don't need to fill in and submit a monthly report anymore.

All in all, this is an user experience design which tried to help the caregivers. The Care Giver app includes a large number of features that will help caregivers, especially volunteer caregivers do their job easier and more efficient and build a bond between every caregiver to create a larger, tighter caregiver community. It solve the problems of the volunteers caregivers that I identified from the user research, Feeling of lonely, lack of motivation, hard to schedule and concern of mental health.

Based on my research among many different domains, I used interaction design to solve the problem and enhance the experience of caregivers who volunteer for a non-profit organization. Care Giver also has the potential to be more broadly applied to all caregivers, and will hopefully benefit the entire caregiving system.

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