

Echat: a floating device for mediating positive conversations between elders and related people

Yuan-Chi Tseng*, Yi-Chia Tseng*, Ya-Chu Chang***, Chung-Hsien Wu****

**Department of Industrial Design, National Cheng Kung University, yctseeng@mail.ncku.edu.tw*

***Department of Industrial Design, National Cheng Kung University, grace0733@gmail.com*

*** *Department of Industrial Design, National Cheng Kung University, yachuchang102@gmail.com*

**** *Department of Computer Science and Information Engineering, National Cheng Kung University, chwu@csie.ncku.edu.tw*

Abstract: We developed a new telecommunication system: Echat, to mediate related people of the elders, such as relatives and friends, to call the elders to remind their daily routines, which can help them to create more positive conversation. In addition, it provides minimum functions of emergency call out, reading and lamp for the elderly, particularly when their hands are not available. The design research and the follow-up design particularly focused on enhancing cognitive and affective functioning in elderly people. Two older adults took part in our contextual inquiry interview and a 24-hour time lapse recording in their living space. We revealed several problems when the elders had conversations with relatives via telecommunication. For example, elders were very concerned with the proper time to call, but they often missed the timing. Elders were more distressed than young people when facing inappropriate technologies. Our device, Echat, using floating techniques can avoid human and device bumping into any obstacles and can easily provide comfortable human-computer conversation distance. The design only uses general telecommunication technology, cheaper and more available, to let elderly's related people to assist elders' life at home often and serves as a mediator between their children who live apart from them.

Key words: *Elders, Human-Computer Distance, Telecommunication, Contextual Inquiry, Mediator*

1. Introduction

Aging society has recently gained much more attention in developed countries. Researchers predict that in the U.S., the number of people over 65 years old will double from 34.7 million now to 69.4 million by 2030 [1]. Taiwan is also facing a serious aging problem currently. According to the definition of WHO, when a society's 65 years old people reach to 7%, it is called "aging society" [2]. The proportion of elderly population in Taiwan will be more than 14% in 2018, officially entering the "aged society" [3].

There are more and more elders who live in their house independently. Recent researches have indicated that fewer and fewer elders want to stay in nursing homes or hospitals. Most people who live in nursing houses and hospitals feel weaker not only in physical but also in mental health [4]. Some studies have also shown that elders who live in their house are healthier and happier [5]. Besides, those elders who have good relationships with their friends and relatives can adapt socially and psychologically themselves better to their aging [6].

When elders live independently, due to the cognitive and physical health decline, there are many potential dangers. Therefore, their relatives are often worried about them. Most people use telecommunication to care for each other in modern society. It seems to elders that the telecommunication is the most common way to connect with their friends and relatives. However, adult children living apart from their elderly parents are typically too busy to remember to call their parents regularly. On the other hand, calling elders often ends in hanging up due to slower reply. Although many technologies try to support elders, they cannot match the ethical needs. Consequently, elders do not want to use them at all. Sharkey and Sharkey [7] suggest six major ethical issues: (1) the potential reduction in the amount of human contact; (2) an increase in the feelings of objectification and loss of control; (3) a loss of privacy; (4) a loss of personal liberty; (5) deception and infantilisation; (6) the circumstances in which elderly people can control robots.

Facing above problems, here, we aim to build a design which can actually improve the social relationship between elders and relatives. We use technology but see technology as a tool to mediate people in different generations.

2. Research

In order to explore the interactive relationship between elderly who lives independently and their adult children, we conducted a contextual inquiry. We expected that the results of contextual inquiry can shed some light on our understanding of users' expectation and the way towards better interactions.

2.1 Contextual Inquiry

By the contextual inquiry, researchers can understand users' everyday activities in some of their specific situations and real environment to find out what they mostly care and what they really need. Sometimes, unexpected results occur, and the unexpected findings help researchers to dig out the true user requirements underlying their normal behavior. In contextual inquiry, researchers normally observe carefully how people use tools and technologies in their daily practices and what kind of problems they face in this process. Moreover, interview is one of the most essential ways of collecting data in contextual inquiry. This methodology focuses on user's background and lifestyle. After researches get data from interviews, they can organize them into an affinity diagram by using KJ methodology. Then, based on the affinity diagram, the essential insights and user's model can be drew accordingly.

Holtzblatt [8] suggests that we can use the following five models to understand users in their daily context.

- 1) The flow model captures communication and coordination between people to accomplish work. It reveals the formal and informal workgroups and communication patterns critical to doing the work. It shows how work is divided into formal and informal roles and responsibilities.
- 2) The cultural model captures culture and policy that constrain how work is done. It shows how people are constrained and how they work around those constraints to make sure the work is done.
- 3) The sequence model shows the detailed steps performed to accomplish each task important to the work. It shows the different strategies people use, the intents or goals that their task steps are trying to accomplish, and the problems getting in their way.
- 4) The physical model shows the physical environment as it supports or gets in the way of the work. It shows how people organize their environments to make their work easier.

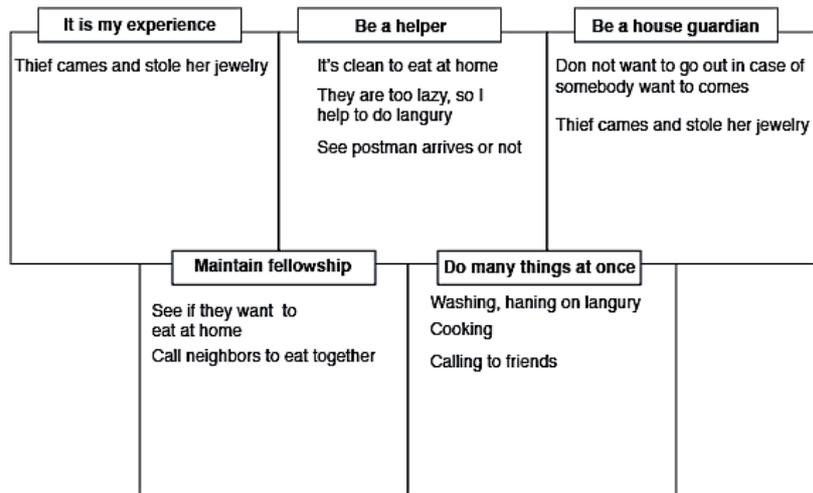


Figure 1. Affinity Diagram

5) The artifact model shows the artifacts that are created and used in doing the work. Artifacts reveal how people think about their work – the concepts they use and how they organize them to get the work done.

In this study, we observed and analyzed users at their home and figure out whether the current technologies appropriately assist them in the physical and mental requirements. At the beginning of our research, we prepared a list of basic questions to interview 4 elderly people and 3 adult children to gain the basic idea of the relationship between parents and children. We videotaped their daily activities during the in-depth interview and ran a verbal

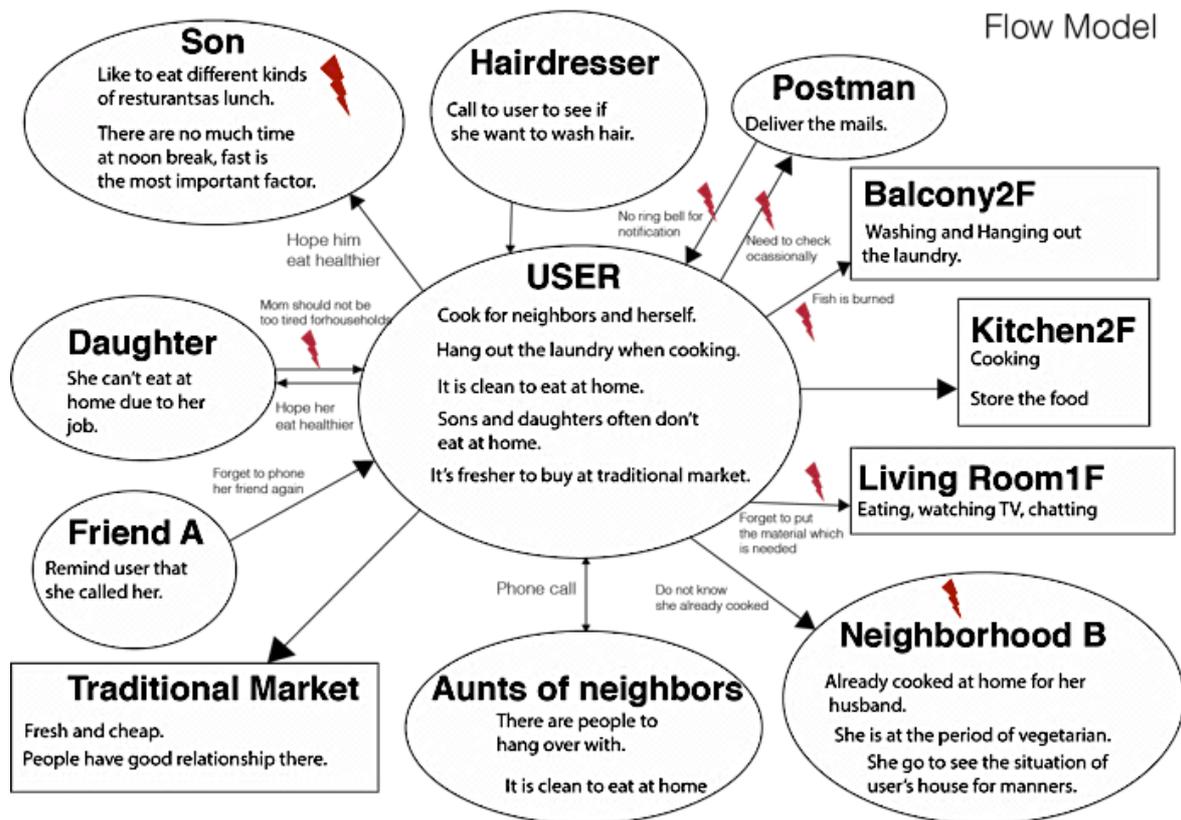


Figure 2. Flow Model



Figure 3. Sequence Model

protocol analysis to find out user's real difficulties in these activities. Accordingly, their work models were drawn. Then, we dug out the conflicts between the user and his/her related people, and between the user and his/her context or artifacts in each model. Models help us to describe the situation objectively in the context.

Then, we focused on two elderly people. We recorded and analyzed their daily lives in more detail. We drew five work models of these two target users. In affinity diagram (Figure 1), we found that there are five major issues when elders at home: 1). Elders used to do things according to their own experience, 2). They want to feel they are still needed by their relatives and friends, 3). They are highly concerned about the security of their house, 4). They like to maintain friendship with people, and 5). finally they like to do many things at once.

In figure 2, the flow model shows a clear classification of user's work and interactions with other people. The flow model indicates that the main works that elders did at home, such as cooking, social communication, and other houseworks, such as doing laundry.

Figure 3 shows how users organized their activities and what kind of obstacles they encountered. In the sequence model, we found that our users did not just cooked in the kitchen, but also they were engaged in other activities at the same time. For example, they called friends, gave things to a friend, did laundry, and chatted with her neighborhood simultaneously.

Figure 4 shows the physical environment of our target users, we found that users often shifted to next task while the current task was still unfinished. Moreover, she often forgot the former things she had been doing, For example, she forgot to call her friends back, to take plates, to take care of the fish on the stove, and to put the spicy into the food. It was very inefficient to do many things at the same time for her. (In our investigation, the whole cooking process was 1.5 hours). Besides, the worst part was the tiredness and back pain she suffered after the long time cooking.

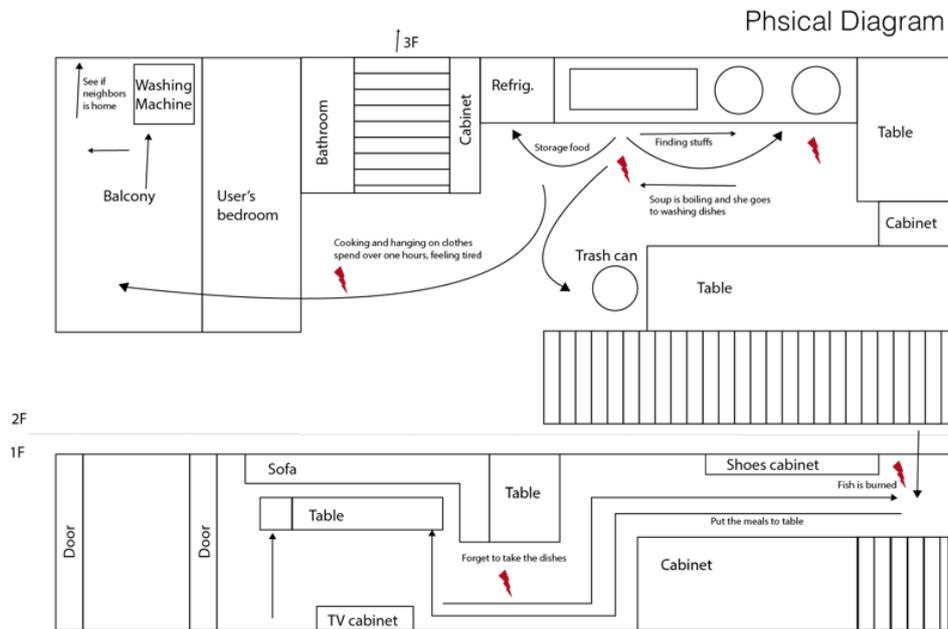


Figure 4. Physical Diagram

In figure 5, in the setting of kitchen, the user always used phone and mobile to connect with her relatives or friends. Due to lacking of literacy, our user didn't use memo as reminder but tried very hard to memory everything.

In figure 6, the culture model shows the mental model of the user. We found our participant expected every family member can be together often. They also wanted to have good relationships with friends and neighbors. Also, she regarded herself as the house helper. Namely, she helped her children and friends to have good quality foods.

After doing this survey, we discovered several obstacles that our target user normally encountered when living

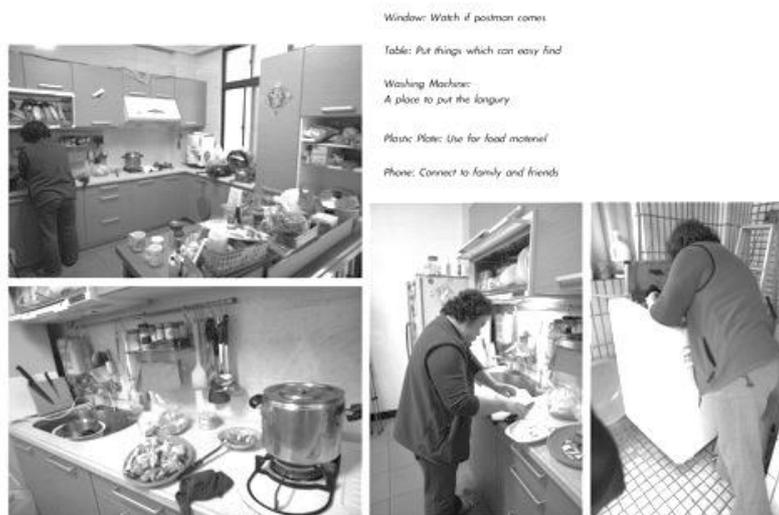


Figure 5. Artifact Model

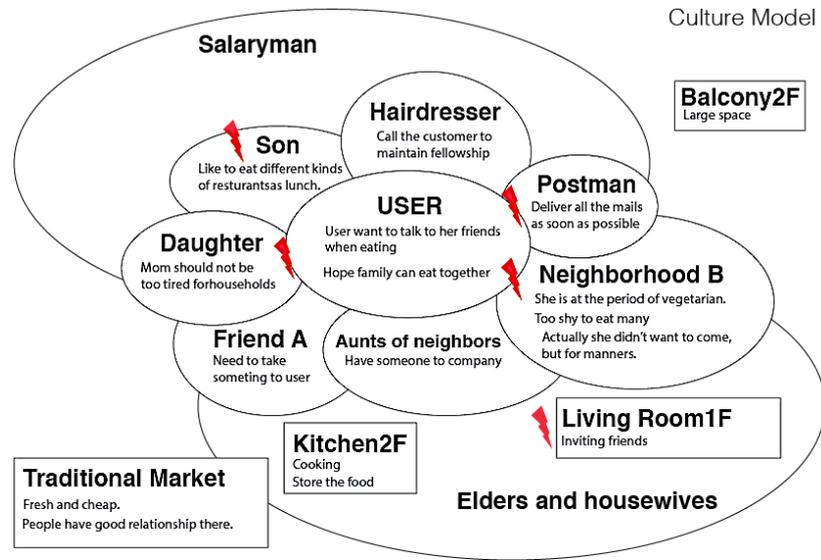


Figure 6. Culture Model

at home independently:

- 1) User can not answer a phone call immediately, because her/his both hands are often engaged in other activities, such as washing dishes.
- 2) They forget things easily.
- 3) They tend to use high-tech in more natural way. For example, when they used voice device, they always tend to say "hello" as if they were talking to real man.
- 4) Elderly feel anxious when they do not know the schedule of children, and they tend to have negative thoughts. For example, they think the reason why their children do not call them is because they just care about themselves.
- 5) Children are too busy to call parents.
- 6) They do not know how to set up directory in the cellphone and always need helps.
- 7) They like to support others and feel they are still needed.
- 8) When using existed communication tools, such as facetime and skype, the elderly often feel awkward and uncomfortable when dressed informally. However, they tend to dress informal and casual at home.

3. Design process

Due to former issues, we came up with some insights. We conducted a workshop including 6 mature students of design school to gather more creative ideas (Figure 7). Our design concept focused on using technological devices as mediator between elderly parents and adult children who did not live together. Users can easily and naturally control the machine by voice. Our findings show that elderly people's houses are often full of stuffs. Consequently, it takes time for them to look for items. For elderly, it is hard to searching things and easy to lose things. Moving around in the packed house is also very difficult, because they are physically weaker. Besides, when elders are doing housework, their hands are usually too busy or dirty to pick up the device. According to the constraints, we concluded that the way to overcome the difficulty is that machine must be able to fly or float. The



Figure 7. Brainstorming

most appropriate technology is the controlled air balloon because it flies more gently. Slow moving is also more preferred by elderly people.

One of scenarios is that when elderly are cooking in kitchen, their hands are normally wet so that they cannot pick up the phone. The floating device can fly close to the user automatically, and the user can call or answer their relatives and friends effortlessly except for speaking. It can decrease the problem that elderly always answer the phone in a rush, which can lead to serious dangers such as falling down or forgetting what they do before they answer the phone.

Therefore, this machine can also improve the interactive relationship between elderly people and their social network, because it would be a mediator between people. We hope that the user will not only talk to machine and ignore the relationship of their family and friends. It shows a new interaction approach that makes people communicate more often without awkward feeling.

We hope the machine can be the initiator to start a nice and wonderful chat. If the elderly need help or want to communicate with others, the machine will automatically come to them, in order to assist.

In the early stages of design, we had couple of ideas:

A pet accompany with him/her. Users can put it on their shoulders and the device will can to them intimately as friends. By the natural interaction, such as sliding the pet's back, it can be easily turned off/on. This device can also accompany with them wherever they go (upper left, Figure 8).

The little Newspaper reading machine. This device can read printed text and speak out loud to the elders whose eyes sights are decreased. It helps elderly people to get information from prints efficiently. This device rolls on the ground and follows users wherever they go. The device also projects the family pictures on the wall, in order to preserve good memories to user. When users go out, it can also be a music player, just like I-Pod. It can let user no longer feel lonely (upper right, Figure 8).

Voice navigation system. Users can ask the device for direction when they get lost and the device can project the route and gives correct direction. If users deviate from the destination, it will alarm to notify them (bottom left, Figure 8).

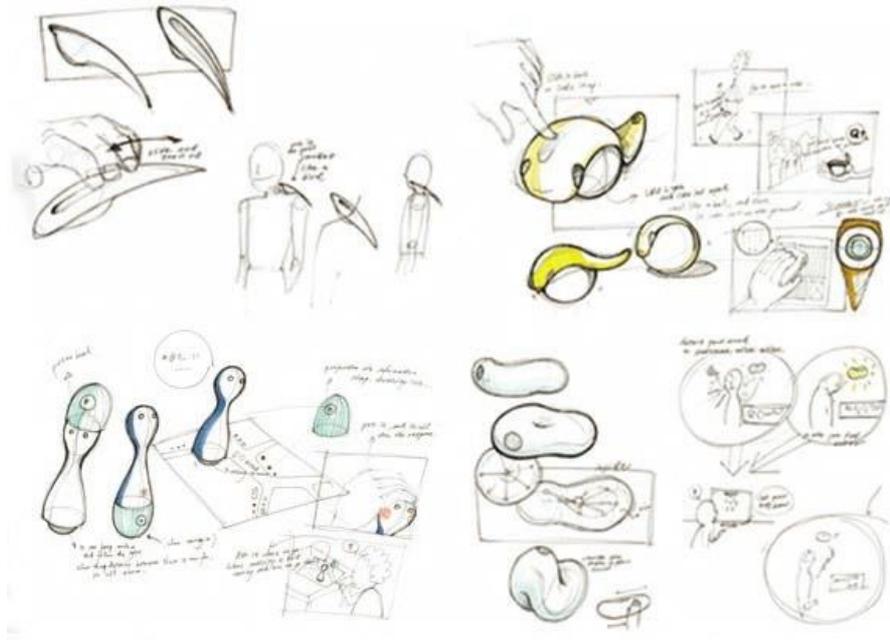


Figure 8. Four ideas during ideation



Figure 9. The features of the Echat

Be aware of your mood. The device can detect users' mood from their heartbeat, tone contour and actions. Their relatives can receive the mental status via computer and select elders' favorite songs or leave some voice message to make them happy (bottom right, Figure 8).

After discussion, we considered the constraints and combined the advantages of these concepts and resulted in our final design solution.

3.1 Echat – the new communication mediator

Echat (Figure 9) is a mediator that enhances mental support between elderly parents and adult children. It reminds children to care about their parents periodically and make the home environment of the elders comfortable and secure.

The main functions and scenarios are as follow (Figure 10):

- 1) The device reminds children with SMS automatically, in order to let the child to inform parents remember to take medicine.
- 2) Built directory by voice to help elderly people who have bad sights or are illiterate.
- 3) It can detect simple emergent situation, such as falling, of the elderly.
- 4) The device shares the children's schedules with parents to make them feel relieve.
- 5) Children can leave messages to parents.
- 6) It can read newspaper out loud to elderly people.
- 7) It can automatically measure time so that they know how long they did not call back.
- 8) The device follows elderly people as a pet, providing the mental security. The flying device can also serve as flashlight to assist them when walking in the dark midnight.
- 9) The machine will charge by itself automatically, so that elders do not need to worry the machine would be out of battery.
- 10) The volume adjusts automatically when elders speak too loud to children and increases volume for elders when they can barely hear from their children.

Our goal is to make our device friendly to users and provide a nice relaxed atmosphere through its form and slow and float actions. Therefore, we use animals' shape for our device, such as bird, goldfish, fish, and whale (Figure 11). Finally, our design team decided to choose whale shape due to its charming character – calm, relax, intelligent and friendly. The image of smile whale is chosen because it can be a metaphor, to bring cheerful feeling to elderly users. Instead of choosing cold high-tech product images, we chose the warm image and color, such as green grasslands, yellow lighting, to build a warm environment for the elderly. Our design increases the elderly's motivation to use the device, to efficiently eliminate the distance between elders and technologies.

We also created a prototype for user testing (Figure 12). We presented our prototype and described Echat's function to four potential users, including elderly parents and children, to get their feedbacks. Most people think it is fun and gentle to use. One participant said that it was a bit wired that an item is suspended but after more interactions with our device, the participant love to use it.

4. Conclusions



Figure 10. Scenarios

Our device, Echat, uses techniques to avoid human and device bumping into any obstacles and easily provides comfortable human-computer conversation distance. It serves as a mediator to automatically remind the related people to call elders and provides more conversation chances. The design, using appropriate technology, can

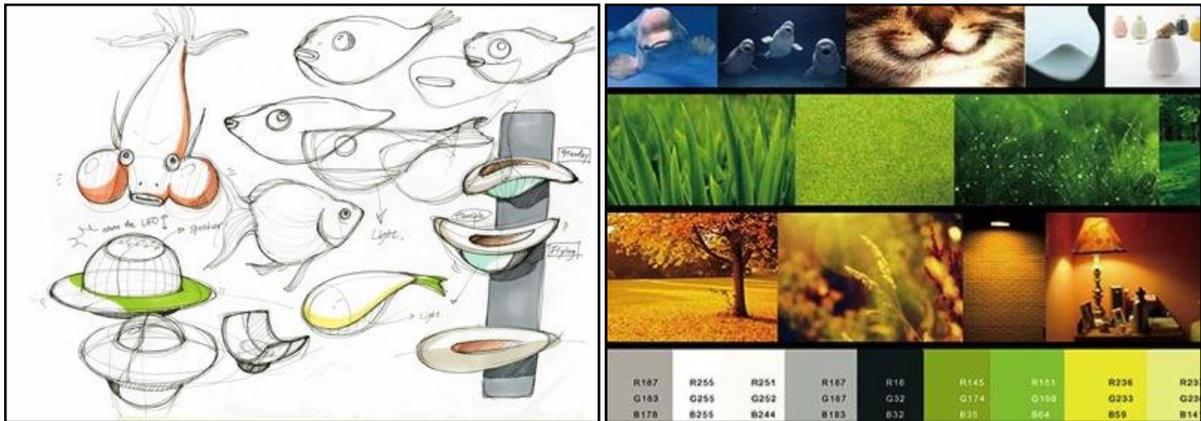


Figure 11. Sample of sketches and color plan

easily engage people, particularly the elderly, in a happier conversation and better relationships with relatives and friends.

Children who are busy at work can easily know their elderly parents' physical and mental situation, such as mediation, their emotion, and caring about their lives. Elders can also check what their children are engaged by asking the device, which in turn can check the child's schedule and answer to the elderly. Therefore, when they are worried about some one, they just ask our device. In this way the device provide elders with high sense of security.



Figure 12. Prototype

However, in this research, we also noticed that the current technologies still have many challenges. For example, voice controlled devices can only 100% recognize voice in a very constrained environment. Our researches show that if the device didn't recognize voice information right or gave meaningless responses, elderly users easily feel depressed and even gave up using it anymore.

Finally, we do not intend to use the state of the art technologies, but rather, we want to use appropriate technologies, which are good enough, cheaper and more available, to mediate human interaction. Echat interacts with elderly people in more natural ways. It only uses general technology of telecommunication to let elderly's related people to assist elders' daily life at home and serves as a mediator between their children who live apart with them.

5. Acknowledgments

This research was partially supported by Grant No. NSC 101-2218-E-006-024 and NSC 101-2218-E-006 -021 from the National Science Council, Taiwan to Yuan-Chi Tseng and partially by the Ministry of Education, Taiwan - The Aim for the Top University Project to the National Cheng Kung University (NCKU). This work got the annual best design in NSC 101 Interdisciplinary Collaboration for Value Creation – Future Concept Development Project. We particularly thank Mei-Feng Lin, Ting-Hsuan Chang, Pei-Yi Cho, Bao Chung Cheng and Yu-Fang Huang from Department of Industrial Design of NCKU for their active participation and help in the ideation workshop in this design project.

6. References

- [1] Haigh, K.Z. and Yanco, H. (2002) *Automation as caregiver: A survey of issues and technologies*, in AAAI-02 Workshop on Automation as Caregiver: The Role of Intelligent Technology in Elder Care. pp. 39-53.
- [2] Sheng, Y.-C. (2011) Available at <<http://taiwanpedia.culture.tw/web/content?ID=26376>> [Accessed 18 February 2013]
- [3] Huang, H.-C. (2008) *A Study of Retirement Financial Planning during Accumulation and Decumulation Periods*.
- [4] Megalingam, R. K., Radhakrishnan, V., Jacob, D. C., Unnikrishnan, D. K. M., and Sudhakaran, A. K. (2011) *Assistive Technology for Elders: Wireless Intelligent Healthcare Gadget*, in *Global Humanitarian Technology Conference (GHTC), 2011 IEEE*. IEEE, pp. 296-300.
- [5] Forlizzi, J., DiSalvo, C., and Gemperle, F. (2004) *Assistive robotics and an ecology of elders living independently in their homes*, *Human-Computer Interaction*, vol. 19, no. 1-2, pp. 25-59.
- [6] Adams, R. G., & Blieszner, R. (1995) *Aging well with friends and family*, *American Behavioural Scientist*, vol. 39, pp. 209-224.
- [7] Sharkey, A. and Sharkey, N. (2012) *Granny and the robots: ethical issues in robot care for the elderly*, *Ethics and information technology*, vol 14, no. 1, pp. 27-40.
- [8] Holtzblatt, K. and Beyer, H. R. (2013) *Contextual Design* in *The Encyclopedia of Human-Computer Interaction*, 2nd Ed., The Interaction Design Foundation. Available at <http://www.interaction-design.org/encyclopedia/contextual_design.html> [Accessed 18 February 2013]