E-Homecare
Towards a Touch-screen User Interface
Development for Home Care of Seniors

Qi Wang
Abstract

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In order to find good solutions to face the aging problems, a European Union project - MonAMI - was established with the main purpose of enhancing old people’s life by using mainstream technological platforms to deliver helpful services. This thesis project is a subproject of MonAMI project which focus on design and develop a graphical user interface for a touch-screen monitor that is used to deliver several useful services to old people who live in their home environment.

Universal design principles, evaluation results from older prototypes, characteristics are the fundamental design guidelines for the interface design. The development processes have followed both User-Centered Design process and a modified version of task-artifact development life cycle.

The biggest challenge for this thesis was to identify the most perceivable and acceptable design solution for the old user. This means the solution has to be good in both visual and logical way. Therefore, the solution is produced with an incremental progressive procedure. In this procedure, expert evaluation was used as the main method to filter out less perceivable ideas. A user test involved with two actual users was carried approaching to the end of the project and identified many critical issues in the solution. The final solution was presented with a low-fidelity prototype by using Microsoft PowerPoint Presentation to give the future product an insight view on the interface design for elder users.
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1 Introduction

As the global demographical distribution is biasing to the aged sides, the governments and society have to confront this growing problem and expect the possible consequences that could happen afterwards. Health care for the elderly would be the first issue that could arise from this global phenomenon. Instead of the traditional institutionalized care, home care for elderly seems to become a prevalent alternative among developed countries. To reinforce the caring system for elderly at home, technology could be lead into the eldercare.

MonAMI is the name of a European Union funded project which is searching for new opportunities of resolving the dilemma of the social caring system for the increasing population of elder group. It aims to design and develop accessible and usable services to exclude as few user groups as possible by using mainstream platforms. (MonAMI 2010). This thesis works for one sector of the MonAMI project which focuses on the User Interface design of a touch-screen monitor for the elderly at home.

1.1 Summary

To support healthy and long-live lives for the elderly, the thesis project set the aim of delivering useful services for those old people who are living in their own places by using a touch-screen monitor with a senior-friendly interface integrated. The purpose of having this kind of services is to help users to gain autonomy in their home environment. Previously, a text-based prototype of the interface has been developed by the MonAMI cooperation team to display the fundamental framework of the interface and perform the primary tasks in the framework in order to give the basic concept of how the interface could look like and how it works to the MonAMI project co-workers and potential users. However, according to the preview results of the MonAMI co-workers, there are many design problems in the text-based interface prototype which might cause serious misunderstanding and confusing for the old users. Therefore, it is better to amend some easy-discover problems and then provide the old users an understandable interface to the old users. So the old users can manifest more of their opinions on the interface structures and services instead of usability problems. To actualize the idea, this thesis topic is built to present the broad Human-Computer Interaction ideas of designing usable interface presentation for elderly started by testing existed text-based prototype and identifying issues from the testing. After that, ideas from the testing result, literature reviews plus some creations by myself were put together to formalize a new prototype of the interface. Then, an iterative incremental improvement process which used the
task-artefact cycle method was progressively made to formalize the prototype into a more user-centred product. The evaluations in the old prototype and new ones are carried out by experts to try to identify the most critical problems within the shortest time. Moreover, a small user involvement has been taken to test user’s preferences on different solutions and try to see if the ideas of design could be clearly understandable by the users or not. In the end, all the results and ideas are finalized into a Microsoft PowerPoint based prototype and some general advices and guidelines of designing interface for the elderly will be provided. The idea of produce these artefacts are:

1. Provide a usability design for the touch-screen interface to MonAMI project.
2. Establish a set of basic rules and principles that could follow while designing for elderly.

1.2 Purpose

The purpose of this master thesis is to do a deeper study by addressing the characteristics of old users to the interface design of a touch-screen based home control device to make it understandable, usable for the old users, and conclude the design principles that should apply while the elderly is the target user group. The main processes of developing the interface are the following:

1. Evaluate the original version of the prototype
2. Generate the design ideas for the new prototype
3. Prototype developing with iterative design method
4. User involvement and project finalizing

To implement those processes, the aim is to:

- Review and analyze the information that was displayed in the old prototype, and check the basis usability of the prototype.
- Create broad design ideas for the interface layout.
- Prove the feasibility of the design ideas by the real users.
- Develop a demonstrational prototype and present it to representative users and the client.

The client in here means the MonAMI co-workers who provided the project as a master thesis topic. They will receive the final result and decide if they will implement the prototype into product or not.

As the whole development process is an experimental process to explore design ideas and address the most useful ones for the target users. These ideas can be verbalized into a list of design principles and provided to those people or organizations who have the same user groups some insight views.
1.3 General method

During the whole prototype generating process, the task-artefact cycle, which is an iterative method for the prototype development, has been used. The opinions of HCI experts and actual users are obtained and always considered as the primary requirements for all versions of the prototype. An informal user test which can be called user involvement has been made with two test participants before the final prototype is delivered. The data and information which are gathered from all the tests and evaluations are all further implemented in the final prototype. The final prototype, which can be seen as the presentation of the most mature ideas is delivered to the client and might be tested with some more participants in the future.

1.4 Referring to a parallel project

There was a parallel project that has been worked on at the same time as mine, and it is carried by one of my HCI colleagues, Naichi Chen. The name of the project is “User interface design of Social care call centre system of MonAMI project” (Naichi Chen, 2010). She is responsible for designing and evaluating an interface for the emergency call centre. All the emergency events that are generated from homes of elderly will be first direct to the call centre, and they will arrange imperative visits for the caregivers to visit and take care of elderly for non-normal situations.

Many innovative ideas of usable services for supporting the lives of elderly are generated in Antia’s project, which means that those new services which are approved by the MonAMI cooperation might be added into the service list of the touch-screen interface later. Therefore, for the convenience in the future, the best solution for the present interface is to design the main graphical framework of the user interface to display the general services that MonAMI aimed to deliver.
2 Limitations

In this chapter, some limitations of the thesis have been observed and will be presented. These limitations which are caused by a variety of reasons may shape the result of original plan for the project. However, it is never too late to realize the problem. By identifying the possible problems now, it would bring chances for the future to resolve these problems when there are better resources or conditions available to do so.

1. Restrictions on functionality creating

There is little flexibility for the further development of functionalities. Since the main idea of this project is redesign and evaluation, all the services and functionalities in the interface were more or less finalized, which means there were many restrictions on the actual design part. For example, because of the hardware limitation, many services could not be designed. Since all the services of the projects are finalized, it makes things hard for me to make any changes in the service part. Therefore, the inside structure of the interface is more or less defined, and I could only try my best to improve the navigation and layout of the interface to show the functionalities in a better way. However, in the reporting part, I still would like to state some of my suggestions on the service issues, and hopefully they would inspire the project development in the future.

2. Design limitation

Although the target user group of the MonAMI interface is the elderly, like the limitation of design a perfect product for everyone, it is extremely difficult to cover all needs of target users in the interface design. As you can find detailed characteristic descriptions of old users in Chapter 3, it can be very easy to understand that user requirements and abilities can vary a lot from one individual to another. The solutions that are provided in the project are developed from the requirements of old users in general but may not include those old users in minor cases. This is the confliction between the idea of universal design and the conditions in the real life. The limitation can only be partially resolved by considering as many different situations as possible in the designing stage.
3. **User recruitment via narrowed ways**

The users for our usability evaluation are recruited by posting ads on newspapers, which narrowed down the diversities of the user groups. Since this project is done in Sweden and all test participants are recruited from Sweden, and the average education level of people and the penetration rate of technology in Sweden are comparatively higher than many other European countries. Thus, the samples of the users can only represent people in Sweden or at most in Nordic countries. If the product needs to be introduced to countries outside Scandinavia, I would suggest them to take a usability test with users from the same place before introducing the product into the market.

4. **Low constraint usability test**

Two real users participated in the user involvement phase. Since older users are identified as the target user group, there are many factors that may influence performance of the participants. For example, it may take the user a longer time to read through the tasks and execute them. Therefore, it is very unwise to make a limitation on time duration or similar aspects with an achievement point. Furthermore, the usability test for this interface was made under low constraint control to make users complete tasks patiently. However, this may also bring certain problems to the test. The interference needs to be made with much prolonged time for a single task. The time point and the way of interference are disputed issues for the moderator who will interact with the participants. If the interfering time is too early, it may interrupt the ongoing thinking of the participants. If it is too late, the participants may already give up about the task and jumped to another one. Because of the technical problem, one of the two questionnaire results was lost, so the summary of the user test was made from the observation and interview results. However, I will still attach the only questionnaire result in the same Appendix which provides the test plan, and it is Appendix 5.
3 Background

Many theories and ideas that are used in this thesis are from some researches and studies that have been carried out a long time ago. In this chapter, some of the topics that are related to our project are being studied to gain deeper understandings. Many theories that are widely used are further introduced and explained here.

3.1 General aging problems and solutions

3.1.1 Overview of the eldercare situation

"The graying of Europe" which indicates the demographic changes in many European countries is becoming one of the biggest concerns in recent days. As both birthrate and mortality rate keep declining, the Economic Policy Committee and the European Commission announced that the population of elderly will increase 77% between 2010 and 2050 (Paul-André Rosental 2003). Those elderly who cannot take care of themselves would bring huge pressure to social caring systems. Many countries try to put up money and concentrate together to enhance their social caring systems in order to adapt both mental and physical needs of bigger and bigger amount of elderly. However, this soon-to-be panic can be resolved by introducing new ways of caring. The recent new trend of elderly supporting system is moving from the earlier institutionalised care to nowadays home care. Previously lots of EU research studies focused on how to support old people who live longer at home with or without any companies, and many important issues have been identified such as dealing with insecurity factors and mental problems. Some laboratory researches augmented that elderly with certain living space of their own can enjoy themselves better, have higher life quality and need less institutionalised help, respectively (MonAMI 2010).

In Sweden and many European countries, the age of retirement is 65. People who are over 65 can therefore be considered as the elderly group. According to the council of Europe statistics report in 2003 (European demographic year book, 2003), the inhabitants in Sweden who are 65 years old or above have reached 17.3 percent of the entire population. This makes Sweden one of the countries who have the largest group of people over the age of 65. The average life expectancy was 79 for men and 83 for women in Sweden from the report of 2006. The number of people who are over 80 will increase by around 240,000 from 2020 to 2030. Many people may think that the consequence of aging would be the increasing investment of caring and support from government. However, the fact is that between 1980 and 2005, the numbers of elderly who needed support from government or municipality have dramatically reduced.
from 400,000 to 245,000 which were about a 40 percent decrease. More than 94 percent of the citizens who are older than 65 still live in their own places (Swedish Health Care 2007). The above overall evidence indicates the trend that more and more elderly are living longer and healthier than before, and they apparently prefer to live in their own places where they feel more comfortable and have higher living quality than the unfamiliar nursing home.

As people age, there are many associated issues appearing. The issues include both physical and mental problems which may directly and indirectly affect the adaption of the technology to the daily life of elderly. In order to design from the perspective of old users, it is imperative to get to know and understand these problems and try to find out the solutions for them. In the following paragraphs, the most common aging problems have been identified in sector 3.1.2.

### 3.1.2 Common problems for seniors

There are several common problems that happens frequently among the old group, and some main problems are listed in the followings:

1. **Visual problems**

   There are many kinds of visual problems that we should consider carefully while we are designing for the elderly. The decline of the eyesight makes small font sizes hard to be noticed or identified by the elderly. The decrease of visual field and the colour blinding problems are the most difficult visual problems to solve while designing for the old users. In order to guarantee a wide range of the information accessibility of the interface for users, it is necessary to provide several accessible ways for users who have different degrees of ability loss. Thus, for those people who have visual problems should be able to access information by other ways such as hearing and tactile.

2. **Hearing problems**

   Hearing loss is mainly represented in different levels: full loss, partial loss and insensitive hearing. Those who have different degrees of loss need to be helped in different ways. Users with partial loss and insensitive hearing abilities can obtain information through hearing ways but with higher sound volume. But for those who lost their hearing ability completely, some other ways should be used to replace the hearing way to obtain the information. One
suggestive solution for this problem is to enhance the visual design of the interface and make it intuitive enough for those users who have problems to accept sound helps and feedback.

3. **Mobility problems**

Another major problem of aging is the different degrees of mobility loss or paralysis with elderly people. The access of the user interface should require the minimum physical effort from users. When designing interface in a touch-screen interface, the dexterity loss of old people which may cause imprecise actions in the task performance should be considered. Trembling problem is another issue that we should face and provide solutions while designing for elderly.

4. **Cognitive problems**

Cognitive problems are associated with different aspects of problems in the following areas:

- **Memorizing problems**: it is normally very difficult for old users to remember more than three levels of hierarchical structure without any guidance instruction to follow.
- **Attention and problem solving**: while designing tasks for old users, the task difficulties must be carefully defined. The task should be simplified and performed one at a time, because it is difficult for users to tackle tasks simultaneously.
- **Learning slower**: due to the lack of computer using experience and the loss of many perceptual abilities, the learning speed of old users to use the computer-related interface can be much slower than the younger users (Dan Hawthorn 2003).
- **Risk fearful**: since many elderly people are unfamiliar with many of the technology-related user interfaces, the errors during the task performance stage will make inexperienced elderly suffer more than the experienced younger users. Several continuous fails or errors may destroy all the confidence of the elderly to use the interface again.

### 3.2 Similar work that have been done before

There were many similar works that have been done before. In order to distinguish the differences of our project from the others, I have studied many other products and selected some representative ones to analyze and present them here:
**Novatouch**

Novatouch contactscherm is a touch-screen based multi-functional computer application for elderly. It mainly provides video call, email, Internet exploring, personal schedule management and entertainment like photo viewing, music listening and gaming. The very good thing about this application is that it is quite easy to find and use. The user just needs to download the software to their touch-screen computer from the software website and then they can start enjoying all the integrated services immediately. This application is developed by a company called Novatouch in Holland (Novatouch 2010).

**I2 Home**

I2 HOME used the industrial standard Universal Remote Console (URC) to build up the intuitive interface for the purpose of making the home environment more accessible and controlled for everyone. To implement the idea, the home appliances are networked and incorporated by a Universal Control Hub (UCH). The users can then easily use the information from the interface which is generated with the hub to manage all the home appliances (I2Home 2010).

**Eldy—computer for elderly**

Eldy is a free software which provides internet surfing functionalities for old users. The main idea of Eldy is to let old people unite with internet activities by using a senior-friendly interface. The following functions are presented as the most important functions of the elderly: sending/receiving emails, chatting through online communities, World Wide Web Internet surfing, weather checking, text editing, streaming and many other things (Eldy 2010).

These three products are just some examples of typical solutions that are invited through new technology which are trying to adapt the technological intelligence into daily lives of elderly. Although there are many other solutions having the similar requirements and achievements, we will try to distinguish the MonAMI interface from the other products.
4 Methodologies

4.1 Design methods

To design a successful product, the methods and guidelines that are utilized to support the design process and ideas are rather critical. In the real product development process of this project, universal design themes (Wolfgang F. E. Preiser, Elaine Ostroff, 2001) are applied everywhere to support the ideas of ambient design. The User-Centered Design ((Janet M. Noyes, Christopher Babe 1999) is treated as the guidelines of design process for each design life cycle. The idea of Task-artifact cycle is the incremental progressing flow that is used in the prototype improving development. The usability testing is the evaluation technique that is used to find the potential problems of the products while users are using them. These design and evaluating methods combined with some scientific design guidelines and rules become a unique and substantial methodology that support the whole design and development process in this project.

4.1.1 Universal design themes

“Universal design is not a trend but an enduring design approach that assumes that the range of human ability is ordinary, not special.”--Wolfgang F. E. Preiser, Elaine Ostroff (Wolfgang F. E. Preiser, Elaine Ostroff, 2001)

Universal design, also known as “Inclusive Design” (John Clarkson, 2003), is a philosophy and a broad idea for design. It was derived from the ideas of “barrier-free” (James Holmes-Siedle, 1996), “accessible design” (Robert F. Erlandson, 2008), “assistive technology” (Beverly K. Bain, Dawn Leger, 1997) and the importance of designing the exterior of different products. With the idea of universal design, the product will be developed as suitable for all kinds of people; for example, people with or without disabilities, elderly, children, etc. Although in our case the main focus of the product is design for elderly, as the general principle of usability design, we should exclude as few people as possible. That is why I used the principles of universal design as the guidelines of my whole project and tried to accommodate these principles to all of my designing ideas.

There are seven principles of universal design that we would follow, and they are listed as the followings (Center for Universal Design at North Carolina State University, 2008):
1. **Equitable use**

   The design should be capable to use for people with different abilities. This means that the users of the product need to exclude as few people as possible.

2. **Flexibility in use**

   The product or artefact should have flexible accessibilities, which means that the user will be able to use or access the product or artefact in more than one way. For example, some users prefer to use left hand than the right one. Therefore, the product needs to be designed for both left-hand and right-hand users.

3. **Simple and intuitive**

   In general, designs always need to be kept as easy-to-use as possible, regardless of the user’s education level, language skills or any other abilities of users.

4. **Perceptible information**

   The design ought to pass the information effectively and accurately to the users by using different perceptive ways. This means that the information should always be perceptible for the users no matter what kinds of abilities they have.

5. **Tolerance for error**

   Any actions which may cause errors or hazards need to be treated carefully. The arrangement of elements and colours ought to minimize the possibilities of errors. Even if the error happens, there ought to be a quick way to quit the error status and return to the normal interface.

6. **Low physical effort**

   Since the product will be used by people with different abilities, the physical efforts from the users to perform certain tasks should be as low as possible. For example, a little child with low physical ability should not need a big effort to accomplish an easy task.

7. **Size and space for approach and use**
The appropriate spaces for executing certain operations need to be provided for the users. The size of any interactive devices or interfaces should be carefully designed to accommodate the size of a user’s body.

4.1.2 User-centered system design processes

User-centered design is both a method and a philosophy of design. It focuses on the user throughout the whole design, development and evaluation process. An international standard was exploited base on the user-centred design. It describes a model of development process which supports human-centred design activities. However, it doesn’t specify the detail methods. The working loop of User-centered system design process is displayed in Figure 1.

![User-centered system design process](image)

Figure 1. User-centered system design process (Michigan State University 2010)

There are four main activities that are involved in the whole development procedure, and they are listed and described in the following:

1. **Specify the context of use**
   User groups and the working environment of the product should be specified and studied. The using environment is a very critical factor to consider while creating new solutions for the product. The result will fit in better if the context of use has been studied well in advance.

2. **Specify requirements**
   By identifying goals of product for users and market, the future product will meet better to users’ needs. The user’s requirements can be presented in many different
ways; for example, use case, persona, user scenarios and some other methods are normally used to formalize requirements.

3. Create design solutions
   After the information gathering from context of use and users, the solutions should be made based on the information gathered and some creativities. In a common situation, a conceptual prototype will be created in this stage.

4. Evaluate designs
   As “user-centred” is the core idea of the design method of this project, the user’s perspective is always treated as the most important requirements in all processes. So here the user is involved to evaluate the prototype that was created in the last step. Once the prototype is approved by the actual users, the next step is to develop the prototype into a real product.

As User-centred Design states, users should be involved in the design processes in one way or another in order to have a deeper influence on the shape of the design. (Janet M. Noyes, Christopher Babe 1999) The methodology is feasible if a clear user group is identified in the design process. In our project, it is quite sure that the elderly as a whole are a unique user group. Despite the fact that we already have the identified user group, the differences inside the group are still too big to treat all the old people in the same way. It seems that using User-centred Design in this case is difficult to cover the characteristics of the whole group. Hence, we also need to take the diversities of the group into our design account. That is why the ideas of Universal Design need to be applied throughout the whole project.

4.1.3 Usability testing

According to ISO 9241-11 international standard, usability is defined as the following:

“The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.” (Usability Net 2006)

This standard describes the three main goals of achieving a usability product, and they are:

- **Effectiveness**: the effectiveness of the design can be tested by measuring the accuracy of task achieving from users. The more accurate it is for user to understand and execute tasks, the better the design is.

- **Efficiency**: If the user can complete the required tasks in the required time, then the efficiency is guaranteed.
- **Satisfaction**: Satisfaction level can be seen from the user’s opinions on using the product. A high satisfaction should be defined as the user can use the product without feeling any obstacles or difficulties.

In order to achieve the three goals above, there are some factors that need to be considered into the product design as well:

- **Specified users**: users or user groups need to be identified and studied to understand them better.

- **Specified goals**: the purpose of the product should be identified and then tasks which are used to test the goal achievement need to be designed.

- **Specified context of use**: the work environment should be defined in order to understand which kind of circumstance the product would be used for.

A good design should consider all the important aspects of usability, so I followed the usability international standard to identify the required information and design for a usable product.

There are several ways that can be used to address the basis usability of a product. In this thesis, the following two ways are employed:

- **User involvement**

  User involvement is one way to invoke real user’s opinions to design ideas in the development process of a typical user-centered design (William S. Green, Patrick W. Jordan, 2002). A formal usability test normally contains at least 5 test participants. This part should be done after a product prototype is fully built. Our project records the development process of the prototype and this is in rather early stage of the whole product development, so it is not necessary to make a formal usability test in this project, and instead a user involvement with smaller quantity of users is used. The user involvement will also value the user as a very critical factor in the designing stage. Although the user involvement in this project was less controlled and quickly tested compare to a formal usability testing, it addressed the most important and obvious usability issues within very short time.

- **Expert evaluation**

  Expert evaluation is a method of measuring product usability, and it is normally done by those people who are knowledgeable in the usability and familiar to the domain of the system or product. (Winfried Lamersdorf,Volker Tschammer,Stéphan Amarger, 2004) The process of an expert evaluation is rather simple and effective: With the expertise and experience of professionals, most of critical issues in the interface designing procedure can be identified in a very short time, so the basis usability of the interface can be guaranteed.
4.1.4 Task-artifact cycle

Task-artifact cycle describes how both task and artifact are involved cyclically in the software development process. The relationship between these two can be explained as: the development of the product starts from the identification of a task and then, requirements are made into forms according to the goal of task. Artifact is developed through the requirements to assist users to perform tasks. Feedback about using the artifact can be generated by the users or experts, then the new ideas may come up and new tasks will be designed for those ideas which result in new requirements and a new version of artifact and this is a typical working loop of a task-artifact cycle. This loop can continue working again and again as long as the market needs. Task-artifact cycle can be treated as an iterative co-dependent process for the changing work process of software development. The following figure shows the correlation of task and artifact in the task-artifact cycle (Carroll & Rosson 1992).

![Figure 2: The task-artifact cycle. (John Millar Carroll, 1991)](image)

All the entities in Figure 2 already have individual presence in the practical field and they are existed as following three entities:

Design rationale is the historical, meaningful and concrete descriptions of the artifact.

Scenario-based design is a technique that focuses on the task design. It envisions the functionalities and everything about the artifact before the artifact is actually developed.

Psychology of tasks describes how the interface should react according to the requirements that are generated from the tasks.

This method is generally used in the process of software development because it provides an opportunity for changing the product according to the new need of user. In the prototyping phase of the project, this method is applied to make incremental improvements.
4.2 Scientific design principles and rules

4.2.1 Design science about information and data display

The ways of presenting information and data to users should be chosen carefully. There are several guidelines from Smith and Mosier (Smith & Mosier 1986) that suggest the goals of data displaying, and they are described as the following five terms:

1. Consistency of data display
2. Efficient information assimilation by the user.
3. Minimal memory load on the user.
4. Compatibility of data display with data entry.
5. Flexibility for user control of data display.

4.2.2 Design for multiple user groups with varied skill levels

With different levels of knowledge background about computer and technology, users can be classified into three main groups (Shneiderman & Plaisant 2010):

- **Novice or first-time users**
  Users who have never used a computer before or hardly have any experience on the technological products can be considered as novice users. Tasks with low ability requirements need to be designed for them.

- **Medium or experienced users**
  Users who have experience on using a computer and understand the working mechanism of computer interfaces can be seen as experienced users. Any interfaces which work the same way as normal computer interfaces can work very well with those users.

- **Frequent users**
  Frequent users are those people who work with computers everyday and have no difficulties tackling any level of task.

Although users in different groups have different knowledge background and those who have higher knowledge in computers can work with more advanced interfaces, the overall goal of broadly design and development of interface for the elderly is to minimize the ability requirements for them so that no matter which user groups they are, they can always solve tasks easily and conveniently.
4.2.3 Identify the priority of tasks

In order to design a user-centred interface, the importance and the priority of the tasks should be clarified by the designers and users together. All the tasks can be classified into three categories according to their utilization frequencies (Shneiderman & Plaisant 2010):

- **Frequent actions**
  Frequent actions are either the most used or the most important actions. For those actions, special buttons should be designed for them, and those buttons should be put in a special and easy-to-touch place that users can reach them easily.

- **Less frequent actions**
  Those actions that are less important and less used are not necessarily designed as the frequent actions. They should be reachable through easy steps but there is no need to show them all the time on the interface.

- **Infrequent actions or complex actions**
  For those actions that are the least important and used, they can be hidden somewhere deeper in the hierarchy structure, but the information about how to reach them should be clear enough for users to find them without feeling exhausted.
5 Design and implementation

In this chapter, the ways that were used to design the flow of the project are described in detail. Many methods that have been in the previous chapter will be used here in order to reach the goal of creating a broad idea of senior-friendly home-device control interface.

In general, there are four main phases proposed in order to complete the whole new prototype development, and they are: expert evaluation with the old prototype, information gathering and concept creating for new prototype, iterative design process by using task-artifact cycle, project finalizing and prototype stabilizing.

5.1 First phase: Expert evaluation with the old prototype

The MonAMI project has been planning the development of this touch-screen based interface for few years. Previously there was an extant text-based prototype which was developed from general ideas and requirements of the interface, and the focus of the old version prototype is to present general functionalities and services in a visual interactive way. The old prototype can be found in the appendix 1. Since the original idea of producing such a prototype is to try to see the visual effect of services and how can they fit into the interface, many graphical design issues are existed. By considering that the possibility of real users having very limited knowledge about computer-related interfaces is high and the careless design of the prototype from the graphical concerns, it would be harmful to test the old prototype which is difficult to perceive information correctly with the old user since the possibility of creating frustrated feelings for the users is comparatively higher than the interface without graphical problems. The interface can be either useful or useless depends on the way we use it. Besides the graphical design part of the prototype, data presentation and information structure were designed and considered while developing the old prototype, so it could be interesting to make some simple evaluations on these parts and use the those results to the prototype development of the next version. The easiest and most effective way of addressing the critical issues of the design is to make expert evaluation on the old prototype. The beginning page of the old prototype is displayed in figure 3.
In this phase, two experts were invited to review the old prototype. Both of them are professors in the department of Human-Computer Interaction at Uppsala University. MonAMI cooperation teams have also provided some feedback about problems of the old prototype from their perspective. All the later expert evaluation is also made mainly by the same professors and teams to make comparative improvements according to their feedback of the interface. Expert evaluations are completed by asking the experts to point out all the usability problems they can find on the interface according to their expertise of the interface design. Issues with the following aspects are identified by the experts through the evaluations:

- **General graphical design:** this part is not considered as the central concern of the evaluation, because the prototype is not designed to the purpose of having a very good graphical result. As far as the graphical presentation in the prototype is understandable by a normal, logical way of thinking, it would be acceptable.

- **Information presentation design:** this is one of the main parts that were examined during the evaluation. It includes the understanding of ways that are used to present information and how the information is sorted and arranged. For example, the information can be shown as text, pictures, icons and some other ways, and if there may be several sub-menus under a main menu, it makes sense to put those sub-menus into this main menu. This aims to examine not only the presentation of the information but also the structures of the information.

- **Task design:** this is the most scenario-related area of the evaluation. In the beginning of the project, it is already realized that several functionalities are compulsory for the interface, so it is imperative to test if there are good designs on the task performances.
corresponding to certain functionalities. The scenarios are used to explicit the task requirements of the interface.

- **Non-exclusive design:** this part should be always considered in any version of prototype.
  To provide a good interface for any user, the aim is to exclude as few people as possible.
  To find out if the prototype is suitable for everyone or not, we can just simply see what kind of ability is required to make normal interaction with it.

### 5.2 Second phase: information gathering and concept creating for new prototype

Besides the results that are generated from the first phase, some further information that are needed for new prototype development will be obtained and analysed in this phase. As we followed the design process of user-centred design method, both context of use and specific user profiles are studied. The information about context of use will be collected from the users or related people such as project colleagues. The user profiles are presented through personas.

Persona is a way to learn users’ need and try to simulate the reality scenes into test tasks. It supports the user centred design activities.

Personas are virtual representative user profiles to show individual aims and characteristics. They act like “real users” with different kinds of requirements and expectations and help designers to identify the important issues and improve the functionalities of the design. Personas give specific information about virtual users and include name, background and personalities. All the characteristics and knowledge of personas are based on real users and are very representative. With personas, perspectives of actual users can be assumed and used directly to the design (Tina Calabria, 2004).

After the needed information about users and context of use are gained, the concept of a new prototype will be created from requirements of designing for target user. The products in this phase will include the description of context of use, personas, list of data arrangement for the new prototype and at last, a paper prototype which contains all above information.

### 5.3 Third phase: iterative design process by using task-artifact cycle

The paper prototype from the second phase was just a starting point of the prototype development. Although paper prototype could be considered as a visual instantiation to
illustrate design ideas, the final goal of the prototype is to produce a low-fidelity instantiation by using Microsoft PowerPoint Presentation. So after gathering the ideas and prototyping on the paper, it is time to move the approved paper prototype into computer interface. The basic idea of the third phase is to use task-artifact cycle method to make the design-evaluate iterative process in order to achieve a high level satisfactory prototype in the end. All the evaluation in this phase will continue to use the same “experts” as we used in the first phase. Therefore, evaluations are made many times for different versions of prototype ideas. Expert evaluations are the main evaluation methods that have been used in this phase, and tasks are varied for different versions of prototype. In the end of this phase, many versions of prototypes and their expert evaluation results will be listed and compared to their earlier versions. In each version of the prototype, some improvements can be found in the explanations along with the screenshots of the designs.

5.4 Last phase: project finalizing and prototype stabilizing

To get the full qualification of becoming a mature product, the product always ought to be examined by the real users. This also applies to our prototype. Although the prototypes have been tested many times throughout the whole design process by experts, even many experts believe that “Users can always surprise you.” Therefore, in order to avoid bad consequences in the future, the only way to finalize the prototype is to test it with the real users. Therefore, we used the final version of the prototype that was created from the end of the third phase and evaluated it with some real users. Low-constraint user involvements are used in the beginning of this phase. Two old users are involved into this participatory design-evaluate process. Some scenarios are developed before the user involvements. You can find the design of this process in detail as follows:

5.4.1 User involvement for usability improvement

The last but not the least stage is to test our redesign. A concrete test plan is provided before the actual test. In order to ensure the feasibility of the evaluation, all the information will be explained to the users more than one time. All data and results will be collected and reported in the results chapter and some more suggestions on interface improvements are also listed in the same chapter.

The test plan of the user involvement is documented and listed in the appendix 5 as reference.
5.4.2 Create the last version of the prototype

After the whole process is completed, the overall result of the process will analyzed and used for the design of the final prototype. The final prototype will be evaluated again by the experts until the experts approve everything in the design. Then, some interactive actions might be added into the prototype depends on the timeline of the project in order to demonstrate the prototype better to the other users and producers in the future.

After all procedures are done, a concluded list of design principles and guidelines will be provided to help the designer who will design for the elderly in the future.
6 Results

By following the same procedures of the design processes in Chapter 5, results are collected and will be presented in this chapter.

6.1 First phase: Expert evaluation with the old prototype

After the expert evaluation has been made with the old version of the prototype, some main problems have been identified and they are listed in the following, and each page of the old prototype can be found in Appendix 1:

- **Texts**
  There are four kinds of problems for the text in the old interface: font, size, meaning and consistency. In order to explain the problems clearly, some instances are used here. The good thing about the text of the old prototype is the consistency of the text font that has been used in the layout. However, it is hard to say if the font is a good choice for old users or not. The size of the texts for different purposes differed, and the use of text effect should also be considered carefully. Moreover, the texts that are used for the purpose of description ought to be consistent all the time. For instance, on the main page of the prototype, the texts that are used to describe buttons differ from the titles of some sub pages. Like “I want to start/stop service” button, in the sub page, it is shown “available services” as the title of the page. (In appendix 1) With such kinds of inconsistencies on the text, it might bring many unnecessary misunderstandings to the users and cause a lot of problems.

  The most important and difficult problem for text is how to use them to express the right meanings to the users. The right meanings here mean not only to express things clearly but also try to be intuitive to the users by using simple meaning words. According to the test result, many of those words did not explicit their meanings. For example, the expression of “I want to control” button is not intuitive enough for the users about what will happen if the button is pressed.

- **Colours**
  The wrong ways of utilizing colours in the interface may result many severe problems to users in the future. It can cause many unnecessary misunderstandings in many situations. This issue needs to be particularly considered for people who are colour-blind and people in multi-cultural backgrounds. For example, in the old prototype, the colours of red, yellow and green
are used to show the power status of devices, which is not a perfect way to present the differences for those people who do not understand the meaning of those colours.

- **Icons**

Although there are only few icons in the old prototype, they did not work very well. For example, the icon for calling the call centre was quite confusing. The icon was built up by an “information” picture and the text “call centre” under the picture. In most times, the “information” passes the idea of asking for help or showing more information. But in this case, it means to press to generate emergency calls to the call centre. Once we use such kind of icons for practice, it may bring many problems to both the users and the related work staff. So, the icons need to be carefully used.

- **Structure of information**

The way that the information is organized in the old prototype is not easy enough for the old users. For example, the choices under “I want to control” menu are too complicate and hierarchy to understand. It even took younger users a while to “guess” the logic behind the selections. This is a major problem that needs to be re-thought.

- **Non-exclusive design:**

Almost none idea of inclusive design is appeared in the old version of prototype. As it displayed, only texts and icons have been considered while designing for those people who have declined eye-sight. Besides this, it is hardly to find any other design ideas to assist people with other mental or physical disadvantages to navigate the interface. Therefore, in the later redesign session, non-exclusive design should be considered and used in the interface design.

### 6.2 Second phase: information gathering and concept creating for new prototype

I have re-organized the structure of the services and put them into the following categories:

The following three services are displayed as buttons, and shown to the user all the time:

- **Emergency**: this is the primary function of the interface. The emergency call window will be generated if the button is pressed by the user.
- **Time**: this is not actually a button, but the display of the time information.
Sound control: This is a new function that I added to the redesigned interface to provide more opportunity for the users who have vision problems.

All the other services will be categorized into the following four options:

- **Smart services**
  Smart services are those default settings for home devices that are provided by the touchscreen interface. For instance, the light of the room will be automatically turned on if people walk into the room after the LightSure service is selected.
  In here the user can activate or deactivate different services. The services are listed as the following: ConnectSURE, DoorSURE, WindowSURE, DoorVUE, WindowVUE, LightSURE, LightVUE, SUREZone, PresenceVUE, TempSURE, TempVUE, SmokeSURE, GasSURE. The main purpose of having this option is to provide users available smart services with explanatory information and control.

- **Calendar**
  To perform personal information tracking function here. The user will able to add, delete, modify, monitor his/her personal schedule here, and receive reminding messages if alarm services are set.

- **Home control and monitor**
  In this section, user can both observe and control the following home devices with their own autonomy: light, door, shutter, as well as some other appliances. Moreover, the user can use the scene function from here to control many different devices at the same time according to certain scenario needs.

- **Entertainment**
  Here user can find some entertainment activities and join them. Besides presenting the availability of this option to the users for later user, this option will not be further discussed or developed in this project.

- **Climate**
  There are two main parts underneath the climate menu, they are thermostat and weather display. Thermostat will include thermal information inside the house and weather will contain information about the weather.

After the re-arrangement of the information, some personas are exploited to elicit the characteristics of typical users. Personas are developed for the purpose of identifying
appropriate user profiles as the need of design context and requirements. They are described as the following:

Persona 1
Patrick Aronsson is 75 years old and he has been retired for about ten years since the last time he worked for any company. Before his retirement, he was working as a construction worker. In most of the time, his work is only related to practical area and paper work, and computers are rarely used, so he barely has any experiences on using computer interfaces. All the electronic devices he ever used are only the normal home devices such as mobile phone, TV set, washing machine, etc. Although he is approaching 76 years, he is still very healthy and he lives alone in a big house in the countryside.

Patrick has three children, and all of whom are living in big cities and only visit him twice a month. Although they are quite concerned about Patrick living alone in the big house, they do not have a better solution for him: they are quite busy with their own work, and they tried to persuade Patrick to find a homecare person for him. But Patrick did not follow the suggestion. For him, it is more comfortable to live alone since he is still very healthy. However, things can become different when people start aging. This change affects more and more on Patrick’s daily life. Because of the aging, his eye sight and hearing condition are getting worse. The same situation also happens to his memorial system. Sometimes he finds that it is quite easy for him to forget things, such as turning off the lights after going out of the room, when someone is coming to visit him, etc. His children worry about his living situation. They are afraid that if any accident happens in the house, it would be difficult for other people to find out and help him instantly because the closest neighbourhood lives about 20 meters away. Some assistance in the daily routine and instant help of first aid is very necessary for Patrick.

Although Patrick has never worked with a computer before, he is willing to get to know new technology. “I always heard people telling me the advantages of using a computer and how the technology changes people's everyday life, but I have never learned how to use nor understood the benefits of technology. If I can, I would very much like to learn about new stuff.”

Persona 2
Eliane Healkna
Eliane is a 78 year old lady. She has not worked after she aged 65. She used to work as a high school teacher and she knows basic knowledge of using a computer system. But since it has been a long time since last time she used a computer, so her computer skills nowadays are very limited. Eliane had a surgery on her heart three years ago, and ever since then her health condition is no longer good as before: she needs a wheelchair to make any movements. As
Eliane can take care of herself in most of the daily living stuff, such as cooking, doing laundry, etc, she only needs the caregiver to come and visit three times a week. The most inconvenient thing for her is to make movements inside the house in order to check the status of home devices. For example, if she is sitting in the living room and watching TV, she can start thinking about if she has turned off the light in the bedroom or not and she has to move from the living room to the bedroom to check the status of the light. This is quite annoying for her. She would prefer to have a remote controller for all the devices at home, so she does not need to move around to check their statuses. However, the controller should not be too hard to use, it must be as simple as a TV remote controller, so it would not make Eliane feel frustrated by learning how to use it.

The above two personas represented the two typical user profiles and in the later design procedure, these user profiles would be used as the target user characters and the aim of the new design would be to try to help users with their living situations. The two personas that we provided above describe two different living conditions of old users: both of the two people are old people who live with or without their family, but they have difference on the knowledge background, attitudes of using technological products, health conditions and requirements for the functions of the touch-screen interface.

With the expert opinions and use cases from the last two stages, then, it is time to make some designs. The scientific design principles and rules as we have described in Chapter 4 will also be used in the design process. A new prototype will be generated in this phase.

6.3 Third phase: iterative design process by using task-artifact cycle

With the concepts that are generated from the last two phases, the next step is to move the paper prototype to computer interface and make a concrete design of it. After completing the first version of the redesign, an iterative method which will be considered as an incremental design improvement process was used for the further development in this phase. The process is described in figure 4. Figure 4 shows the amended task-artifact cycle. As it displays in the figure, design, product and evaluation are the three new entities that have been added to the cycle according to our reality arrangement. By starting from the task, requirements for completing the tasks will be identified. These requirements will be evaluated by either real users or experts before moving into the next step-design. The ideas and concepts will be generated in the design phase and then, they will be presented by some visual ways, for instance, paper prototype. After ideas of the design are selected through evaluation, more interactive prototype will be developed and tested before the product is created and delivered.
to users. Each entity of the flow will not move into the next step of the cycle unless the product of the present phase is approved by evaluation. The evaluation methods that we used are mainly expert evaluation and occasionally with user involvement. This will be further described in the later sections of this chapter.

![Diagram](image-url)

**Figure 4. Iterative process for incremental design improvement**

### 6.3.1 First version of the prototype

**Design of the first version prototype**

In the first version of the prototype, the beginning page of the interface was initially designed with two different solutions. These solutions presented ideas that tried to solve the problem in two opposite direction. They will be further described in followings and the designs are enclosed in Appendix 2.

The following ideas are used in the first version:

Colour themes are used to categorize the themes of the alternatives: it is very easy to discover the fact that I used five different colours for five main options in the beginning page, green, red, blue, yellow and grey.
- **Text consistency:** the text fonts and sizes that are used in the same sections of design are always the same, and in capital. The purpose of insisting this consistency is to help users to recognize the displayed information.

- **Multiple alternative solutions:** it should be very easy to discover that not only the layout of the two solutions varies, but also the information structures are arranged differently between design 1 and 2. The first design only provides the conceivable selections and a quick setting list. If the user wants to view further information or make any changes, he/she needs to choose from one of the menus to do further operations. This kind of design may complicate the operational process but it also simplifies the layout of the design, and makes the selections clearer for users to browse. For the second design, the idea of the design is to show the most useful operations or information in the beginning page all the time, so most of the time the user does not need to browse any complex structure in order to make some simple changes or view information. However, as I could already predict while I was designing it, too much important information may bring out a cluttered result where no information is really clear and important anymore. The decision between the two solutions can be made after the expert evaluation to obtain opinions from professionals.

- **Simpler information display:** Compared to the old prototype, the first version of the new prototype has simplified the information display in many ways. For example, the old text-based icons are replaced by the pictorial icons. Scene options from the previous design are replaced by the quick setting list and are put in the beginning page instead of listing in the sub-structures.

- **Blocks for information classification:** Since there are several kinds of information, the information blocks are used to sort the information into clear structures.

- **Multi-accessibility:** one of the biggest problems of the old prototype is to provide only visual way to access the interface, which did not include many potential user groups. In the new design of the interface, the concept of inclusive design wanted to be used to provide broader accessibilities for different users. So the following users groups have been considered into the account of the design:

  1. **People with visual problems:** with evident colour differences of the main categories, the aim of introducing the colour themes is to help people with weak eye-sight to recognize the options. A new function which provides text-reading service for users has been added into the new design to assist those people who have different kinds of visual problems.
2. People with hearing problems: all the visual design concepts that are used in the prototype are supposed to help people with visual ability to navigate the interface.

3. People with literacy problems: Both pictures and texts are provided to display the different options to guarantee the user understand the meaning of those options.

Evaluation results of the first version of the prototype

From the results of the expert evaluation, we conclude ideas as followings:
The first beginning page is preferred to compare with the second one. It appeared to experts that the first beginning page is more organized and less complex. However, the idea of bringing the most important functions to the beginning page is very good and should be encouraged to try in the later versions. The rest of the pages to show some other functions of the interface should be developed according to the layout of the first beginning page.

6.3.2 Second version of the prototype

Design for second version of the prototype

The feedback from the results of evaluation on the first version of the prototype is absorbed and used in the design of the second version of the prototype. In the second version, the detailed solutions for each page of the interface are provided. The beginning pages of the second version are displayed in the figure 5, and all page designs of the second version can be found in Appendix 3.

Figure 5. Beginning pages of the second version of the prototype
Evaluation results of the second version of the prototype
- In general, icons should be placed consistently to ease navigation and search routines of the affected users.

- The whole screen should be used to place icons or navigation bars to simplify the selection with regard to the multi-touch screen.

- Selection of items should be indicated in more than one way, not only by using colours.

- Time limitations can confuse blind and visually impaired users because they may need more than the given time to read the content of the screen.

- A list view should be provided additionally for blind and visually impaired users to simplify navigation and search routines.

- Different views should be provided to answer the needs of the target group. List views or similar views should be provided that use the available space of the screen.

- Appropriate colours and high contrasts should be used.

- A list view should be provided. The house map seems to be a nice idea but what happens if the apartment has 15 rooms? Is this concept still useful with more than 5 rooms?

- The states of buttons should be provided in more than one way. Appropriate colours and high contrast should be used. The states of appliances and devices should be indicated more obviously.

6.3.3 Third version of the prototype

The design of the third version is based on the result of both first and second version, the beginning page of the third version is displayed in figure 6 and 7, and the layout can be found in Appendix 4.
Evaluation results of the third version prototype

Since there are two conceivable solutions for the prototype and there are cons and pros for both of them, it is rather difficult for the designer to choose either of them based on personal preference. Therefore, users should be involved in the next step to make the choice between the two cases with their own perspectives.
6.4 Last phase: project finalizing and prototype stabilizing

6.4.1 Results of user involvements on the third version prototype

The user tests with the third version of the prototype were very effective by following the test plan which is shown in Appendix 5. Although there were only two users and both of them had some experiences on computer interfaces before, many critical issues were discovered and some new ideas were brought up by the users which should be considered as inspirations for future work. Due to the technical problems of the computer, one of the questionnaire result was unsaved and impossible to retrieve. However, the only questionnaire result will still be presented in Appendix 5 right after the test plan. The results of the users’ tests are formalized and listed in the followings:

1. *In general, the overall layout of the first solution is preferred than the second one.* Compared to the second idea, the first one is much easier and clearer, so the next generation of the prototype should be developed from the main ideas of the first solution.

2. *Although the colours are designed on the purpose of helping users to identify the different categories, there are so many different colours used so the users would no longer treat the colour as the variable to distinguish the categories. This means that the colours should be used more conservatively and accurately to express ideas precisely.*

3. *The confusion between icons and buttons.* As both icons and buttons are displayed by pictorial representations, the similar ways of representing two different things made users conceive them as the same thing. For instance, one of two participants tried to use the “smart setting” option when he was asked to turn off a light in one task. Moreover, icon labels are put inside the icons which can easily be ignored by users, so they should be placed consistently, either under or above, but never within the icons.

4. *Left-side menu is not an effective solution for the old users.* Although the idea of having the left-side menu is to show the available choices to the users and let them decide what kind of information they want to see, the fact is that both participants did not notice the existence of the left-side menu. For instance, when the participants were asked to turn off the light, one of them went to the ”security control” page and tried to use the button to turn off the light which would not only turn off the light but also close the door and shutter in the same room.

5. *Information should not be hidden from the users.* This has been proven from both user tests. None of the participants like the solution of hiding some choices when they are not
being used. For instance, in the beginning page, there is a quick setting list which shows some choices for the user to make quick settings to the home devices with his/her status. The user needs to press “What I do” button to find out the available quick setting options and then make a choice. This procedure is unnecessary complex for the old users, and neither of the two participants liked it.

6. **Interactions and feedback are not clear enough.** The interactions that are designed for the users should be as simple as possible. For example, in the light control page under the “security control” option, a triangle slide bar which is not very familiar to the old user is used to control the lightness, with no clear indication to show which side is the maximum level and which the minimum is. Such kinds of confusing interactions should be avoided from the next version of the interface prototype. Besides the interactions, the feedback of the actions is not direct and obvious enough for the users. For example, when one of the main options is chosen by the participant, the button will go a little bigger and become luminous. This change is not obvious enough to get user’s attention.

### 6.4.2 The last design of the prototype

After the user involvement in the earlier part of this phase, some more improvements according to the test results are added to the last version of the design.

Re-arrangement of some content information and some names from the menu has been re-defined to make more intuitive sense to users. The following names and information have been changed:

1. **Multiple colours for different categories have been removed, and only two different colours are used to classify the different states of the buttons.** These two colours are green and brown. The brown colour represents the normal state which is the inactivate state of the buttons, and the green colour represents the activated state of them. To make sure the consistency of the design, the same green colour has been used almost everywhere in the whole interface to indicate the activated state.

2. **The idea of customization has been used in the newest design.** Since the interface could be used for multiple user groups, a specific solution should be designed to meet the specific needs of a user group. This idea was used by building up different interfaces for different user groups. In the beginning page of the latest design, there are two main options for the two characters: the caregiver and the old user. Since the interface will be placed in the old user’s home, both the old user and the caregiver will use the interface to make some controls and observations. It would become more efficient for both of the user groups if the individual page could be made according to their specific characteristics.
3. *Almost the same layout frame for all the pages.* All the subpages were using the same layout frame to display information: the same main menu options, the same background colour and the same information displaying areas. From the experience of the third version of prototype, the left-side menu was a bad choice to get user’s attention. So this time, right-side menu is used to place the options and the options have been carefully designed to become more obvious to the users.

4. *Interactions and feedback are much clearer than before.* To show the activated option, the colour of the button or option will be turned into green, the picture or text in the button or option will become bigger, and the pressed down effect will be shown on the button respectively.

5. *Information display in a clear and direct way.* In the new version of the prototype, all information is shown to the users and there is no more shrink-stretch buttons available.

The information in the last version of the prototype has been once again re-arranged according to the result of the user involvement. From the user involvement result, we can conclude that the elderly always prefers the information are arranged in less hierarchy, more intuitive structure.

In order to keep the unchanging main layout and structure of the interface, five main options will still be provided with some adjustments on contents and names. The new five options will become:

- **Calendar**
  This category provides the personal schedule management function to multiple users who share the same interface. The user can create, change and delete his/her own schedule under this category and alarms can be set to certain schedule event as a reminder for the user.

- **Weather**
  The original “Climate” option is replaced by “Weather” option, and there is no temperature control under this option anymore. So under “weather” option, the only information that is provided to the user is the weather information. In this section, weather information includes options of many cities and in many days.

- **Device control**
In order to make more sense of the text for old users, the original title “Security control” is changed to “Device control” to tell that the option is used to control the different home devices. The temperature control is also moved into this option.

- **Smart services**
  For this option, only the name is different but all the other functions are still the same.

- **Fun**
  This is also the name replacement for the previous “Entertainment” option.

Figure 8 shows the beginning page of the latest version of the prototype.

![Prototype Image](image)

**Figure 8. The beginning page of the latest design**

User scenarios are also used for the designing of the last version of prototype, and those are attached in Appendix 6. The layout of the prototype is attached in Appendix 7.

**6.4.3 Last evaluation of the prototype**

Expert’s opinion on this prototype: there are many ideas and solutions in the newer prototype. Those ideas seem easier and more intuitive than the older versions. However, no expert or designer can make the final decision for the users. Therefore, the way to choose the final solution is to take another user involvement testing.
6.4.4 Concluded design principles and guidelines of design for the elderly

After designing and evaluating different versions of prototype, some conclusions can be made to fulfill a list of design principles and guideline of design for the elderly. They are listed as followings:

- **Consistency of the layout**
  
  All the design entities in the layout should be placed consistently. These entities include icons, text, pictures, states of icon effect, the way the important information are presented and some other things which will appear in every single page of the design. To keep the consistency of the layout can help old users to classify the information difference from page to page. This can help the elderly to recognize the key information of each page and speed up their decision-making procedure.

- **Make all information visible**
  
  The most information always has the priority to display. Once the information is decided to show to users, it should not be hidden or presented unclearly. It is necessary to provide some explanatory text for information that cannot be perceived directly.

- **Simple and clear logical tasks**
  
  The fundamental tasks which might be performed frequently by the users should be simple, clear and logically understandable, respectively.

- **Always clarify the present location**
  
  The present location of the user should be clearly indicated. So the user would never feel lost and panic wherever they are in the interface.
7 Discussion

In this project, a home-use interface was designed and developed into an interactional interface. The main idea of the project is to find out the most suitable solution for the old users who have limited knowledge and experience in the computer-related interface to live an easy and comfortable life. Many proposals are tried to address the specific characteristics of the old user to the designs. The biggest challenge of this project is to use very simple and intuitive way to express information concretely and exactly.

7.1 The platform of prototype presentation

In both earlier interface design and later result demonstration sessions, the prototype was always developed and shown using Microsoft PowerPoint tool. The reason of using PowerPoint as the prototype generating tool is simply because of its ease of use and because it can produce good enough quality to show ideas in brief to the users and client. However, it does not mean that PowerPoint is an ideal way to show the solutions. Since PowerPoint is used mainly for idea demonstrating, the interactions that the tool can provide are very limited. This restriction can easily bias the results, especially when the old users are involved.

7.2 The iterative design process

Due to the use of iterative design method, several versions of prototype have been developed and evaluated by focusing on different aspects. Some design ideas have been repeatedly tested to prove either they are good or not. However, the varieties of different prototypes may cause controversies to each other.

7.3 User involvement in the project

In the user involvement part, there were only two users that have tested the prototype. The reason for using such a small amount of users is simply because there are difficulties to find voluntary users to test. However, some of the design ideas could not be decided by designer or expert because they are treated as equally good. Therefore, it was very necessary to hear the opinions from some users directly and concretely. The result could be more accurate and reliable if there were more real users are involved in the test.
7.4 Overall look of the project design

In general, the overall results have met the goals in the beginning of the project. As the old prototype was evaluated by experts, the new prototypes were developed and tested by both experts and some users. The final version of the prototype which is the most important outcome can become a new start for the MonAMI project in the next actual product development stage. With the available services that are provided by the MonAMI interface, the quality and the security of old people’s life can be improved.
8 Future work

One of the possible changes of the interface for the future is to identify and provide more useful services to users through the interface. In Naichi’s project (Naichi Chen 2010), she is working on the part of identifying the related services which can be used within the living environment of the elderly. These services can be very useful from both the old people who are living in their houses and the staff who are working in the call centre to support the services. With new services, the old people who live alone can be more comfortable and secure, and the staffs who work in the call centre can be more helpful without having more extra work to do. The integration of new services will make the interface even more powerful than the one that exists nowadays.

Multicultural background of users from different countries should be further studied. As MonAMI project is a European Union funded program which aims to support and enhance the old people’s lives in order to resolve the predictable aging problems in Europe, there are many European countries which have different cultural backgrounds and will possibly use the result of this project in the near future. In order to engage into those countries with different cultures, a thorough old user background research for each country should be made and treated as a unique variable of the interface so the main layout of the interface can be constant and the variable can be changed from country to country. This can help the interface to survive within a competitive marketing environment.

In the final of this project, a demonstrational prototype which was built from the Microsoft PowerPoint Presentation tool was presented. Although the result is adequate enough to show the design concept and ideas to the client, an interactive, high-fidelity prototype should be developed and used for the further purpose of a formal usability test and interface demonstration. First of all, an operable interface prototype should be produced by later MonAMI project workers. Then, the prototype should be examined by a group of real users to test the feasibility of it. The idea number of test participants is 8 to 10 with half male and half female. The participants should be recruited through more than one way. The background and the previous knowledge and experiences on computer using are very important variables which may shape the results a lot if they are not treated carefully. With new findings, a product demo can be developed and placed into some apartments for experimental use.
References

Ben Shneiderman, Catherine Plaisant (2010). Designing the user interface-Strategies for effective Human-Computer Interaction, fifth edition. Published by Addison-Wesley.


Janet M. Noyes, Christopher Baber (1999). User-centered design of systems. Published by Springer.


Appendix 1 - The text-based prototype

The beginning page

“Control” page

Room control subpage of the “control” page

Device control subpage of the “control” page

Scenes control subpage of the “control” page

“Observe” page 1
Appendix 2 –First two designs for the beginning page

Those are two designs on the beginning page of the first version of the prototype, they showed ideas in two different ways: simple and concrete. Design 1 is easier to read and design 2 is less complicate to reach some fundamental functions.
Appendix 3-Second version of prototype

This is the concrete design of the second version of the prototype. Some features from the first designs have been kept in this version of the design. Some new features have been added in order to achieve better user performance in the results.

The beginning page 1

The beginning page 1 with quick setting list being opened

The beginning page 1 with alarms being activated.

The emergency page is triggered by pressing the emergency button

Second option for the beginning page

Second option for the quick setting list
<table>
<thead>
<tr>
<th>Security control page 3, individual device control</th>
<th>Smart settings page 1, overall service display</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Security control page 3" /></td>
<td><img src="image2" alt="Smart settings page 1" /></td>
</tr>
<tr>
<td><img src="image3" alt="Smart settings page 2" /></td>
<td></td>
</tr>
<tr>
<td>Smart settings page 2, service description and control</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 4- third version of prototype

Here describes the two solutions of the third version of prototype. Both of the versions are tested with some real users. The results of the test are contributed for the development of the next version of prototype.

Solution 1:

<table>
<thead>
<tr>
<th>The starting page of the interface</th>
<th>The starting page with the quick setting list opened</th>
</tr>
</thead>
<tbody>
<tr>
<td>The starting page with a quick setting selected</td>
<td>The emergency function is activated by pressing the “Emergency” button</td>
</tr>
<tr>
<td>The starting page with an event alert</td>
<td>Calendar page solution 1 with the present date selected</td>
</tr>
</tbody>
</table>
Calendar page solution 1 with another date selected

Calendar page solution 2 is selected to check the schedule

Temperature control subpage of the climate page

Weather subpage of the climate page

Room control subpage of the security control page

Light control subpage of the security control page

Observation subpage of the smart setting page
Choose subpage of the smart setting page
Solution 2:

<table>
<thead>
<tr>
<th>The starting page</th>
<th>The starting page with the control panel opened</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room temperature subpage of the climate page</td>
<td>Weather subpage of the climate page</td>
</tr>
<tr>
<td>Room control subpage of the security control page</td>
<td>Light control subpage of the security control page</td>
</tr>
<tr>
<td>Observation subpage of the smart settings page</td>
<td>Choose subpage of the smart settings page</td>
</tr>
</tbody>
</table>
Appendix 5-Test plan for user involvement

Introduction
The prototype is developed for MonAMI project, which aims to provide useful services by using mainstream platforms to elderly and disabled people. This prototype is designed as a touch-screen interface which will try to integrate all the required services for the old users. In order to find the potential errors and problems of the prototype, and also for the improvement of the later version, a short version of usability testing which is called as the user involvement is conducted.

Overall objectives for the study
The primary goal of this study is to assess the effectiveness of old users of the touch-screen interface prototype and to find potential usability problems in the layout and design.

Purpose of the pilot test
1. Address the most important services from user’s perspective.
2. Find out the potential usability problems of the interface for old users.
3. Study the reflections of old users (as a novice computer users) and opinions on using the new technological interface.

Research questions
In addition, in this study will try to answer these questions:

Can an old user find the emergency function quickly and correctly?
Can an old user find the weather function and the thermostat function easily and correctly?
Does a user know where and how to control a home device?
Does a user know how to activate/deactivate a smart service?
Does a user understand the meaning of quick settings and the way to control them?

Recruiting participants
Two old people are chosen as the test participants of the user involvement. Both of them are men and recruited from the commercials that are posted in the public newspapers. One is 75 years old and the other is 78 years old. The most important thing during participant selecting process is that we will exclude people who have high computer skills,( such as programming, system developing, etc.) and instead, the old people who have normal average levels of computer skills are the best candidates for our test.
Methodology
This study will be somewhat exploratory but will also gather assessment data about the effectiveness of the prototype based touch-screen interface. The ideas of how the interface should work will be introduced in the beginning session of the test and then the tasks will be used to test the participants. We will collect data about error and success rates as well as qualitative data about participants’ perceptions of the prototype.

Session outlines
Pre-test arrangements (5 minutes)
Have the participant:
1. Fill out a background questionnaire.
    1. Are you a man or woman?
       Man           Woman
    2. How old are you? ______________
    3. Have you used a computer before?
       No          If yes, please also answers the following questions:
                      3.1 How long have you been a computer user?
                          Less than one year/1-5 years/more than 5 years
                      3.2 When was the last time for you to use a computer?
                          Within one month/within one year/within 3 years/within 3-5 years/more than 5 years
    4. Do you know what a touch-screen interface is?
       Yes            No            others, what? __________
    5. Have you ever used a touch-screen interface before?
       Yes, where? ___________________________            No

Introduction to the session (3 minutes)
Discuss:
1. Participant’s experience with usability studies and focus groups.
2. Importance of their involvement in the study.
3. Moderator’s role.
4. Room configuration, observers, etc.
5. The protocol for the rest of the session.

Introduction to the prototype functionalities
The prototype will be demonstrated by the designer step by step. The purpose of each function and how they should work will be explained to the participants here. This session will take no more than 5 minutes and questions are opened to answer after the demonstration.

Scenario and task
The scenarios are used to test the tasks with the users. There are seven tasks in total, and you can find them in the followings. Time will not be considered as a very critical factor in the test. In order to let old users perform tasks in a comfort condition, all the tasks will not be timed. However, we would consider giving some small hints to the participants if the tasks take too long time for them to finish because that may results the exhausting and frustrating of the participants quite easy and we don’t want to risk it.

**User scenarios**

### Task 1

<table>
<thead>
<tr>
<th>Task description</th>
<th>Make an emergency call</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Concern</strong></td>
<td>To see if the participants understand the meaning of emergency button and know how to use it.</td>
</tr>
<tr>
<td><strong>Scenario</strong></td>
<td>An accident happened in your house, you need to inform people to come and help you.</td>
</tr>
<tr>
<td><strong>Starting point</strong></td>
<td>Main page</td>
</tr>
<tr>
<td><strong>What to measure</strong></td>
<td>Reasons for fail</td>
</tr>
<tr>
<td></td>
<td>Time</td>
</tr>
</tbody>
</table>

### Task 2

<table>
<thead>
<tr>
<th>Task description</th>
<th>Check personal schedule at a specific time of the day</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Concern</strong></td>
<td>To see if the participants understand the different layout of the calendar page in the different versions of the prototype</td>
</tr>
<tr>
<td><strong>Scenario</strong></td>
<td>You forgot what you need to do at 15:00 of today, and you want to check it.</td>
</tr>
<tr>
<td><strong>Starting point</strong></td>
<td>Main page1, 2, 3</td>
</tr>
<tr>
<td><strong>What to measure</strong></td>
<td>Reasons for fail</td>
</tr>
<tr>
<td></td>
<td>Time</td>
</tr>
</tbody>
</table>
### Task 3

<table>
<thead>
<tr>
<th>Task description</th>
<th>Check the temperature of the bedroom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concern</td>
<td>To see if the user understand the meaning of “climate” and “thermostat” in the prototype.</td>
</tr>
<tr>
<td>Scenario</td>
<td>You feel a little cold, so you want to find out the temperature of the bedroom.</td>
</tr>
<tr>
<td>Starting point</td>
<td>Main page</td>
</tr>
<tr>
<td>What to measure</td>
<td>Reasons for fail</td>
</tr>
<tr>
<td></td>
<td>Time.</td>
</tr>
</tbody>
</table>

### Task 4

<table>
<thead>
<tr>
<th>Task description</th>
<th>Check the weather of the day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concern</td>
<td>How to find the weather information</td>
</tr>
<tr>
<td>Scenario</td>
<td>You want to go out on Wednesday, but you don’t know what kind of weather it will be, so you want to check the weather in Uppsala on Wednesday.</td>
</tr>
<tr>
<td>Starting point</td>
<td>Main page</td>
</tr>
<tr>
<td>What to measure</td>
<td>Reasons for fail</td>
</tr>
<tr>
<td></td>
<td>Time.</td>
</tr>
</tbody>
</table>
### Task 5

<table>
<thead>
<tr>
<th>Task description</th>
<th>Check the status of the light in the toilet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concern</td>
<td>To see if the participants understand the meaning of “security control”.</td>
</tr>
<tr>
<td>Scenario</td>
<td>You want to turn off the light in the living room. So find out the right way to do it.</td>
</tr>
<tr>
<td>Starting point</td>
<td>Main page</td>
</tr>
<tr>
<td>What to measure</td>
<td>Reasons for fail</td>
</tr>
<tr>
<td></td>
<td>Time.</td>
</tr>
</tbody>
</table>

### Task 6

<table>
<thead>
<tr>
<th>Task description</th>
<th>Find a smart service and enable/disable it</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concern</td>
<td>To see if the user understand the meaning of “smart settings”</td>
</tr>
<tr>
<td>Scenario</td>
<td>You want to see if there are any services that can control some home devices automatically, so try to find one and enable it.</td>
</tr>
<tr>
<td>Starting point</td>
<td>Main page</td>
</tr>
<tr>
<td>What to measure</td>
<td>Reasons for fail</td>
</tr>
<tr>
<td></td>
<td>Time.</td>
</tr>
</tbody>
</table>

### Task 7

<table>
<thead>
<tr>
<th>Task description</th>
<th>Find the feasibility of using the quick settings to control home devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concern</td>
<td>To see if the user understand the meaning of “what I do” buttons</td>
</tr>
<tr>
<td>Scenario</td>
<td>You want to go sleep now, try to set interface about this status.</td>
</tr>
<tr>
<td>----------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Starting point</td>
<td>Main page</td>
</tr>
<tr>
<td>What to measure</td>
<td>Reasons for fail</td>
</tr>
<tr>
<td></td>
<td>Time.</td>
</tr>
</tbody>
</table>

**The post-test and debriefing (10 min)**

**Post-questionnaire (10 min)**

**Question-list 1. Answer the following questions and put a cross(x) on the blank of your answer**

**Layout grading scale questions:**

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly disagree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I understand everything about the interface.</td>
<td>![Blank]</td>
<td>![Blank]</td>
</tr>
<tr>
<td>2. I think the first mainpage is very easy to understand.</td>
<td>![Blank]</td>
<td>![Blank]</td>
</tr>
</tbody>
</table>
3. I like the second mainpage and understand it very well.

4. I like the first calendar page

5. I like the second calendar page

6. I can understand the security page very well
7. I can find the smart services easily

8. It is very simple for me to make an emergency call

9. I can find the sound adjusting icon easily
Question-list 2. Answer the following questions and put a cross(x) on the blank of your answer.

1. The time display function is very important to me

   ![Time Display]

   15:20 A.M

   Strongly disagree Strongly agree

2. I need the emergency call function a lot (In order to call the call center for emergency help).

   ![Emergency]

   Strongly disagree Strongly agree

3. I always need to check my personal schedule/calendar (list the things that need to be done in the day).

   ![Personal Schedule]

   Strongly disagree Strongly agree
4. I always need to check the climate of the day (it contains the thermostat information inside the house and weather information in local city or some other cities)

   Strongly disagree          Strongly agree

5. Home devices control is the most important function for me. (To control and monitor the status of some home devices, such as light, door and window, etc)

   Strongly disagree          Strongly agree
6. I always need to know what kind of smart services are available for me and I will able to select and deselect them. (Smart services are like when one person walk into a room, the light of the room will be turned on automatically, the user can enable to disable such kind of services under the smart service function)

7. I think with voice guidance and feedback, I will understand the system and the functions in a better way. (the voice function can provide guidance to certain functions, for example, read the text for you, give you auditory reply when you pressed something)
8. It is very necessary to have “What I do” choices. (under ”what I do” services, there are some choices that you can make. According to the different choices that you chose, the home devices will be set to proper statuses. For example, if you choose “Sleeping” choice, all the lights will be turned off and the main door will be locked, etc.)

Strongly disagree Strongly agree

Please write down more services that you want to have, if there is any.

___________________________________________________________________________
___________________________________________________________________________

Other questions:
1. If you have the chance to put the interface at your home, where would you like to have it? Living room/dining room/bedroom/hallway/entrance/others, where?__________

2. Icon understanding
I found that the icons are hard to understand.

Strongly disagree Strongly agree

3. I think it could be very easy to use a touch-screen interface to control my home environment.

Strongly disagree Strongly agree
4. The texts of the icons are all very easy to understand.

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Strongly agree</th>
</tr>
</thead>
</table>

**Debriefing**
Follow up on any particular problems that came up for the participant

Individual Interview will be shortly held to clarify the problems and ask for further explanation from the participants.

**Project schedule**

**Test plan, session script and materials**
All the testing materials are generated by the designer, and they will be reviewed and examined by both HCI professor in the University and client from MonAMI project. After getting the approval of the English version of the material, then they will be translated into Swedish for the actual testing purpose.

**Test environment**
We’ll use a low controlled setting to conduct the sessions. The study will take place at experimental elderly intelligence apartment in the health and building department of Royal Institute of Technology. There will be a testing room with a computer in it.

Participants will use a Windows PC and Microsoft PowerPoint to watch the whole demonstration. For the tasks, paper prototype will be provided for easier navigating and interacting purpose.

**Moderator role**
Moderator will sit in the room with the participant while conducting the session. She will introduce the session, conduct a short background questionnaire, and then introduce tasks as appropriate. After the participants finished their tasks, moderator will ask participants to clarify their behaviors and expectations.
**Questionnaire result from user**

**Post-questionnaire (10 min)**
Frågelformulär 1 Svara på följande frågor och sätt ett kryss på blanketten

| Håller inte | Håller med
<table>
<thead>
<tr>
<th>med alls</th>
<th>helt</th>
</tr>
</thead>
</table>

1. Jag förstår allt om gränssnittet.  
   ![Gränssnittbild](image1.png)

2. Jag tycker att startsidan är väldigt lätt att förstå.  
   ![Startsidabild](image2.png)

   ![Andra startsidanbild](image3.png)

4. Jag tycker om första sidan i Kalendariet.  
   ![Kalendarietbild](image4.png)
5. Jag tycker om andra sidan I kalendariet.

Håller inte  Håller med
med alls    helt


Håller inte  Håller med
med alls    helt

7. Jag hittar lätt dom ”smarta tjänsterna”.

Håller inte  Håller med
med alls    helt

<table>
<thead>
<tr>
<th>Håller inte</th>
<th>Håller med</th>
</tr>
</thead>
<tbody>
<tr>
<td>med alls</td>
<td>helt</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Håller inte</th>
<th>Håller med</th>
</tr>
</thead>
<tbody>
<tr>
<td>med alls</td>
<td>helt</td>
</tr>
</tbody>
</table>

Frågelist 2. Svara på följande frågor och sätt ett kryss (x) på blanketten.


<table>
<thead>
<tr>
<th>Håller inte</th>
<th>Håller med</th>
</tr>
</thead>
<tbody>
<tr>
<td>med alls</td>
<td>helt</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Håller inte</th>
<th>Håller med</th>
</tr>
</thead>
<tbody>
<tr>
<td>med alls</td>
<td>helt</td>
</tr>
</tbody>
</table>
11. Jag behöver alltid kolla min personliga kalender (lista saker som behöver göras under dagen).

<table>
<thead>
<tr>
<th>PERSONAL SCHEDULE</th>
<th>2010-04-15</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-10: do sth</td>
<td></td>
</tr>
<tr>
<td>11: do sth</td>
<td></td>
</tr>
<tr>
<td>12: lunch</td>
<td></td>
</tr>
<tr>
<td>13-14: do sth</td>
<td></td>
</tr>
<tr>
<td>15: do sth</td>
<td></td>
</tr>
<tr>
<td>16-17: do sth</td>
<td></td>
</tr>
</tbody>
</table>

Håller inte
Håller med med alls
helt

12. Jag behöver alltid kolla klimatet för dagen (den innehåller information om
termostat/temperatur inomhus och väderinformation lokalt och i andra städer).

Håller inte
Håller med med alls
helt

13. Kontrollpanelen är väldigt viktig för mig (för att kontrollera och visa status för några
funktioner så som belysning, dörr, fönster etc.)
14. Jag behöver alltid veta vilka smart services funktioner som är tillgängliga för mig och jag vill kunna välja/välja bort dom. (Smart funktionen innebär t.ex när en person kommer in ett rum så tänds belysningen automatiskt, användaren kan välja en sån function på kontrollpanelens Smart funktion)
15. Med röstguidning och återkoppling kommer jag ännu batter förstå systemet och dess funktioner. (Röstfunktion kan erbjuda vägledning till andra funktioner t.ex läsa en text och ge dig muntlig respons när du tryckt på kontrollpanelen).}

16. Det är väldigt nödvändigt att ha “vad jag gör” val (under vad jag gör funktion är det några val man kan göra beroende på olika val du gör kommer hemkontrollpanelen att reagera, t.ex om du väljer “sova” valet kommer all belysning att släckas och ytterdörren att låsas: etc.)

Var vänlig skriv ner fler funktioner du önskar skulle finnas med.
VÄCKARKLOCKSFUNKTION

___________________________________________________________
___________________________________________________________________________

________
Övriga frågor:

5. Om du hade möjlighet att sätta upp gränssnitt “kontrollpanel” i ditt hem var skulle du placera den?
Vardagsrum/Matrum/sovrum/hal/entre/annat, var? __ HALL

6. Ikonförståelse
Jag tycker icke defina ej att förstå.

Håller inte
Håller med
med alls
helt
X
1 2 3 4 5

7. Jag tycker att det skulle vara väldigt lätt att använda en pekskärm för att kontrollera min hemmiljö.

Håller inte
Håller med
med alls
helt
1 2 3 4 5

8. Texterna på ikonerna är väldigt lätt att förstå.

Håller inte
Håller med
med alls
helt
1 2 3 4 5
Appendix 6-Scenarios for the last version of prototype developing

Scenarios of the latest version of prototype:

Calendar scenario:

Jenny is 78 years old and she is living with her husband Anders in a big house. She will have a visitor later today, and the visitor’s name is Anton. Jenny can’t remember when Anton’s visit time is. So she tries to use the MonAMI interface to find out.

She wants to know when will Anton come and what are the schedules for herself before and after Anton’s visit. Anders also wants Jenny to help him to look up what his plan for tomorrow afternoon. So Jenny needs to check both herself and her husband’s schedule. Her eye-sight is not very good, so she wants to read as big text as possible. She thinks that she needs to set an alarm at the time when Anton comes to avoid herself forgetting this again.

Device control scenario:

Patrick is 80 years old and he lives in an apartment with a cat. He needs to use the MonAMI interface to check out several things. He finds it is very cold when he gets up in the morning. So he wants to know what the temperature in his bedroom is. His cat normally sleeps in the living room and during the night, it always tries to sneak out of the house. So another important thing for Patrick is to check out if the window and door are still safely closed in the living room.

Weather scenario:

Christoffer is 75 years old and living in Uppsala. He has a son who is living in London. Christoffer’s son will come and visit him by flight this weekend. He is very concern about the weather of this weekend. So he uses the MonAMI interface to find out.

He wants to know the weather in both London and Stockholm on Saturday and Sunday. Because his son will come on Saturday and Leave on Sunday.

Quick setting scenario:
Dominic is 82 years old and he is living in a house alone. It’s bedtime for him now, so he wants to use the MonAMI interface to make quick settings for his home devices. The quick settings would make sure that all the home devices would be in the safety mode while Dominic is sleeping.
Appendix 7-The final prototype

The final version of the prototype is demonstrated here, and new ideas are created based on the results that are gained from the user involvements of the earlier versions of prototypes. These new ideas are still ought to be tested with real users in order to prove the feasibility and usability of them and the best ideas will stand out in the result of the testing.