

# Whole Care<sup>+</sup>

**An integrated health care  
for the elderly living in their homes**

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*How an integrated model of  
health care can help  
empower the elderly to live  
active and healthy in their homes?*





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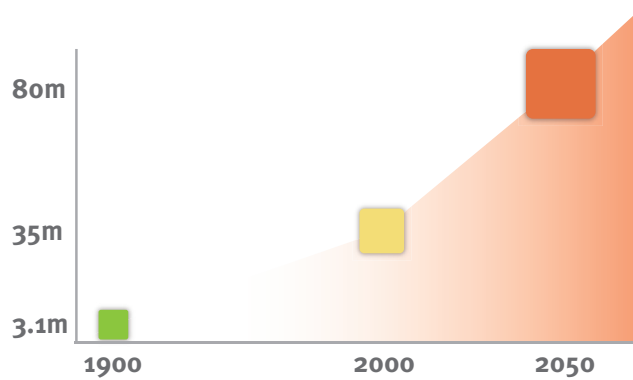
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## *Abstract*

### ***A rapid growth in the elderly population in the U.S.***

There has been a rapid growth in the elderly population in the United States during the 20th century. The U.S. Census Bureau showed that, the number of Americans aged 65 and older increased to 35 million in 2000, compared with 3.1 million in 1900. And this number is expected to be more than double to 80 million by the middle of the century. About 1 in 5 Americans would be elderly by the year 2030, compared to 1 in 8 Americans in 1994 (10).



A RAPID GROWTH IN THE ELDERLY POPULATION IN THE U.S.

## *The elderly and independent living*

The elderly experience their health getting significantly deteriorated as they age. They suffer not only from chronic diseases like asthma but from various geriatric diseases such as high blood pressure, arthritis and cardiovascular disease. Their mental health also retreats creating challenges for the elderly from the loss of short term memory to dementia. Furthermore, after they retire, the elderly's social network decreases as their social activities are inevitably limited to a small group of people like families and friends.

With the face of such impairments in their physical, mental and social health, many elderly cannot help but are being institutionalized or sent to specialized places like nursing homes, which provide them professional care. However, a study indicates that most Americans prefer to stay in their homes as they get older since they can maintain their social connections to neighbors and friends, be close to their medical caregivers in town as well as attain emotional comfort and security with familiar surrounding and environments (1). On top of that, Americans of all ages value on keeping their ability of independence and autonomy by controlling their lives in general (7).

Various health care-aid devices and services appear to offer a specific support for the elderly in their homes. However, such aids have more focused only on when the elderly's health is degraded or very specific areas such as tracking health data like blood pressure and calorie intakes.

The elderly need comprehensive understanding about their health problems, healthy daily habits and timely interactions with their families and caregivers, in order to keep independent living safely in their places. Smart Home technology has much potential to support the elderly's independent living as well as interactions with others. To better understand this, we conducted a user-centered design project which looks at the management of the elderly's health enabled by Smart Home technology.

## *Keywords*

*User-centered design, Interaction design, Health care system, Smart Home, The elderly, Caregivers, Voice user interface, Graphic user interface*

## *Introduction*

### *Healthy aging and independent living*

According to the definition by World Health Organization (WHO), active aging is “the process of optimizing opportunities for health, participation and security” and “maintaining independence and autonomy” (8). Independent living in their own places, when there are proper supports from others, can provide emotional security and an opportunity to enhance their ability to control daily activities. Moreover, the ability to perform autonomous health management and daily living is a key to the elderly’s well-being and self-esteem (5).

However, independent living requires the elderly to keep healthy lifestyles as well as fair attain knowledge about their diseases, impairments and the ways which will help improve their health conditions. More importantly, it is critical to be able to acquire timely help and support from families, friends and professional caregivers.

### *Comprehensive system to support the elderly in their home*

In the face of this situation, we observe opportunities for a holistic system to support the elderly to safely maintain independent living in their places.

We have conducted a user-centered design project to investigate such opportunities in which Smart Home technology can play a big role in helping the elderly better manage their health care and improve their health with healthier habits.

The research focuses on the design of health care system which will enable the elderly actively participate in their health care activities and be secured with timely interaction with professional caregivers. In addition, it also focuses on the development of user-friendly interface of voice and graphics for visual and verbal input and output options. In this paper, we describe our design process, findings and opportunities for a holistic system that provides a platform for the elderly to stay in their homes.

## *Project Goal*

The goal of this project is to help the elderly maintain healthy lifestyles as well as independent living in their places. Through a new model of health care system, they can better manage their health by active participation in their daily activities, attaining relevant health information and timely interaction with care givers.

With the new health care system, the elderly can educate themselves with useful information about their health issues and healthy habits which they can incorporate into their daily routines. By monitoring and getting feedback on their health conditions and daily routines, the elderly can be proactive in their health as well as improve to healthier lifestyle. In addition, they can attain emotional security through timely and friendly interaction with professional care givers through the system. Lastly, the system enables the elderly to be part of a community so that they can enhance their social well-being, along with physical and mental well-being.

The research showed an inter-related connection between physical, mental and social states for elderly's well-being. Those were affected closely by how well the elderly perform within and how much effort they invest into each component for their better health and living. From next chapter, you will see a course of research and development processes to enhance all three components of well-being.



## *Design Process*

### ***Our design methods include:***

- Literature reviews related to healthy aging, ODL(observing daily activities), Smart Home, voice recognition
- Contextual interviews with older adults
- Market research and analysis about health-related device / service / system
- Diagramming as a participatory design method to understand the things that bring the elderly emotional security in their health management
- Concept generation and elaboration based on our collected data and observation during the research
- Diagramming as a participatory design method to validate our concepts
- Interviews with adult children whose parents pursue an independent living in their home to explore various insights about the elderly's health management activities
- Concept elaboration and narrow-down
- Persona development
- Developing four scenario of use
- Wire frames based on the scenarios of use & visualization
- Evaluative research session
- Video sketch which shows the use of the system in essence

## *Article Review*

Before conducting in-person research, we needed to review a range of articles and literatures which would serve as a basis for healthy aging as well as strengthen our premise that technology could empower the elderly aging in their home. In addition, articles included voice recognition in health care arena and for the elderly. Below are the major four areas of articles we have focused on.

- *Health & healthy aging*
- *Observation of daily living (ODL)*
- *Smart Home for the elderly*
- *Voice recognition*

In each area of reviews, we could attain valuable insights which we may refer to along the way of research and development for our project. Especially, while reviewing literatures of health and healthy aging, we focused mainly on the fundamental ways which make people healthy. By keeping the ways for being healthy in mind, we may concentrate on the underlying purpose of our project in future development.

## *Health & Healthy Aging*

Now, let's start from a definition of "Health".

What is "Being healthy":

- *health is "a resource for everyday life, not the objective of living" (6)*
- *a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity (9)*
- *maintained and improved not only through the advancement and application of health science, but also through the efforts and intelligent lifestyle choices of*

*the individual and society*

*- improved via exercise, enough sleep, maintaining a healthy weight, limiting alcohol use, and avoiding smoking (3)*

According to the definition of “Being healthy”, in order to be healthy, it is critical to be able to maintain and promote both physical, mental and social well-being as well as to obtain proper resources for such maintenance and promotion of health in a timely manner. In addition, not only individuals need to invest their best efforts into adopting healthy lifestyles, but also the society and community should support these choices.

Then what is healthy aging for the elderly? According to World Health Organization(WHO), “active aging” is a “prevention of chronic disease” as well as an “access to age-friendly primary health care” and “creation of age-friendly environments”. Especially with the last two definitions of active aging, WHO focuses on the importance of social components of aging. Below are other definitions of active aging from different sources.

What is “Aging active”:

- the process of optimizing opportunities for health, participation and security*
- to realize their potential for physical, social, and mental well-being throughout the life course and to participate in society, while providing them with adequate protection, security and care when they need*
- maintaining autonomy and independence for the older people (8)*

### *Observations of Daily Living (ODL)*

For the elderly living in their places, being able to get access to proper resources and adhere to the ways for everyday healthy life is critical to healthy aging both physically, mentally and socially. Observation of daily living is

one of the ways for healthy aging as it encourages the elderly with health issues plan ahead and actively take actions on their own. Moreover, it helps the elderly achieve more of dependency in their health issues as well as lives in general. To physicians, ODL allows them with more holistic views on their patient's health problems, which often results in more qualitative diagnosis and prescription of treatments (4). While tracking and observing health are of importance for individuals with certain health issues, we thought it may be essential also for the elderly who try to maintain their later lives healthy at home as they inevitably experience deteriorating health as they age.

However, merely observing daily lives does not guarantee to shed a light on elderly's life. Then the biggest question would be "how"? What kind of health information the elderly need to track to achieve better health? How can they minimize pains of tracking health information and rather make it an experience of joy or relatively invisible? How can we motivate them to keep doing it in day to day life? In what platform the functions for ODL should be manifested in order to make it easy-to-use for the elderly? Is ODL enough to improve their health? What are others needed beside ODL? These are a few of many questions which started to arise as a challenge for the project.

### *Voice Recognition*

One of the focuses of our project is how to deliver functions to the elderly users many of whom have limited visual abilities or dexterity in using technology-based devices or systems. Some elderly may have difficulties in reading small texts because of their impaired eye vision. Some may have weak hearing ability which may obstruct them from proper reactions to sound. Although we cannot accommodate all possible hardships nor different levels of those that the elderly may have in using a device or system, we decided to focus on a combination of graphic and voice user interface, in order to promote usability for the widest range of elderly users.

Voice interface is what uses the human voice as the main communication mech-

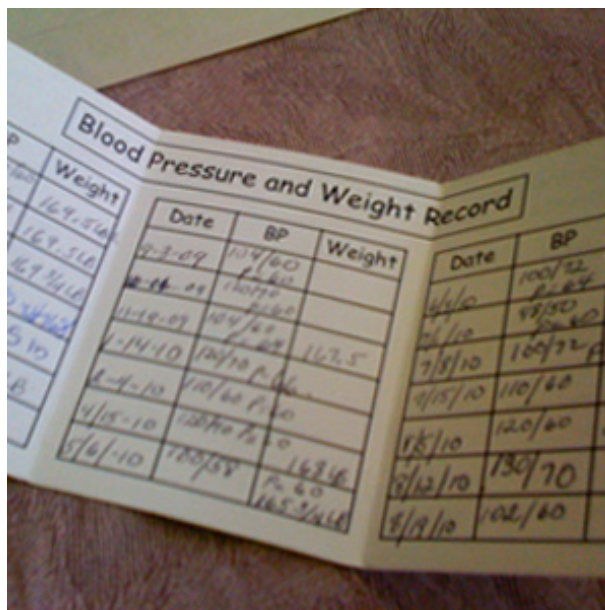
anism between the user and the computer. Voice interface, especially when users deal with relatively complex soft wares, may have potential benefits in that repetitive tasks such as data entry and form filling can be much easier and faster compared to those only through graphic interface. In addition, it helps the users especially who are unfamiliar with such state-of-art soft wares manipulate functions (2).

With such benefits of voice interface for the elderly users in mind, we need to conduct a course of hands-on research focusing on how our development with voice and graphic interface will affect the elderly user's experiences in their health care activities. Whether voice or graphic interface or a combination of two will be more effective may depend heavily on the information which will be delivered as well as the context in which the users handle the information. Hence, this is an open-ended question which we need to evaluate over various research and observations which we will conduct to propose a solution for our target group.

## *Contextual Interview*

We conducted contextual interviews with 5 older adults including 4 females and 1 male, with the age ranging from 59 to 92 years old. We explored how they manage their health on a daily basis in and outside of their home like senior center and the work place.

Our interview questions focused on their methods for health management activities, interaction with care givers and families, and overall lifestyles. During the interview, the interviewers were asked to tell their desires for better health management based on their stories. They covered a wide range of experiences in their health management activities, from being passive to being active in their health care, as well as from ill-informed to well-informed about their health issues.



Blood Pressure and Weight Record		
Date	BP	Weight
9-3-09	114/60	
10-11-09	110/70	
11-18-09	104/62	
1-14-10	124/70	162.5
2-4-10	110/60	
4/15-10	120/70	
5/6/10	100/58	163.6

Date	BP
4/4/10	100/72
5/1/10	98/50
7/8/10	100/72
9/15/10	110/80
1/8/11	120/80
3/12/10	130/70
8/9/10	102/60

HEALTH RECORD OF AN ELDERLY PARTICIPANT IN THE CONTEXTUAL INTERVIEW

Below are the need statements for better health, which we could commonly observe during the interviews.

*- Being proactive about possible diseases*

*"Being active helps me keep healthy."*

*"My concern about possible health issues in the future is having diabetes though I am not taking any effort to prevent it."*

*"I need to eat everyday healthy foods."*

*- Learning about current health issues*

*"I am learning how to use the internet and try to get to know about my Thyroid. But still, I prefer asking a doctor cause it's much faster and easier way to get information."*

*"It's useful to have both, information from medical sites and the voices of other patients about their experiences."*

*- Being in-tune with their body*

*"I felt like I became a slave of recording my health data. I just want to be more in-tune to my body."*

*- Enjoying daily activities*

*"I want to enjoy daily activities like eating and exercising."*

*- Feeling security about health*

*"In my age, anything could happen at any time. We are more vulnerable."*

*"When it gets out of routine, I am prone to forget things like medication intake."*

*"I like to keep track of my blood pressure because someday I don't feel just up to par and the pressure erupts on me. It makes me secured."*

*"There are days where you are unlike everything else. It's up and down. I just take day to day."*

*- Getting feedback from care givers with a holistic view*

*"I need to get suggestions and feedback from caregivers with a holistic view to get healthy lifestyle."*

*- Finding personalized ways to live well*

*"I think in order to live well, you should find the ways that are good for you, fit you."*

## ***Market Research***

In the meantime, we needed to research the kinds of health-aid devices, services and systems out in the market, in order to better understand the areas which need to be developed to serve the elderly's desires and needs in their health management activity. In researching various products in the market, we sorted them out by two criteria, the main function/purpose and platform which the device/service/system is delivered through.

### 1. Function/purpose of the health-aid device/service/system:

- *Tracking personal health information*
- *Reminder for daily routines*
- *Communication with other parties with regard to their health*
- *Tracking objects in house*
- *Social connection*
- *Helping to be proactive about possible diseases*
- *Helping with mental impairment*
- *Monitor behaviors*
- *Learning about health issues*
- *Emergency call*

### 2. Platform which the device/service/system is delivered through:

- *Small digital device*
- *Internet based*
- *Smart Home (embedded technology with wireless connection)*

Among a myriad of health care-related products in the market, we focused mainly on health-aid device/service/system which targets the elderly population. As a result, we came up with 18 products, some of which are yet to be released in the current market but rather being as an on-going projects in uni-





versities or institutions.

Most of them have more than one function up to four different functions which cover various needs in the elderly’s health management. For example, UBot-5 developed by researchers at the University of Massachusetts Amherst has multiple functions to serve the elderly living in their own places: reminding to take medication, carrying a heavy package in its raised arms, providing virtual communication through its computer screen, enabling doctors to call in via its secure Internet connection. Below is a diagram based on the paper diagram during the research to show 18 products with multiple functions. We used diagramming with two axis for two criteria and three color codes for three different kinds of platform.



A DIAGRAM SHOWING HEALTH-AID DEVICE/SERVICE/SYSTEM IN THE MARKET SORTED BY THE PURPOSE/FUNCTION/PLATFORM

After sorting the products out, we determined that there are certain activities that health-aid products have been already developed. However, there were other activities that have not been addressed. Below shows the purposes/activities which we observe that are opportunities for our project.

- *Tracking objects in house*
- *Social connection*
- *Helping be proactive about possible diseases*
- *Helping with mental impairment*
- *Learning about health issues*

## *Participatory Research I*

During the contextual interviews, we could observe that most participants showed discontent in their overall health management activities. However, getting relaxation and emotional security in health closely relate to attaining physical and mental well-being as well as a quality of life to the elderly. Hence, we decided to conduct diagraming sessions as a participatory research focusing on what could bring emotional security to the elderly's health management activities.

In the participatory research conducted, there were 4 older adults, 1 female and 3 males. The research was conducted to understand tangible and intangible things may bring them emotional security in their health management activities. They were given various images like healthy foods, a doctor, nurse, health management devices, exercising, families, which they could select from and attach on a piece of paper in an order from the ones that bring them the most emotional security to the least. Then they verbally elaborated about each image with an emotive word to show how they feel about the things selected. Then they explained the diagram which they created in detail.

Below are the examples of images given to the participants, which may give them emotional security in their health management activity.



IMAGES GIVEN TO THE PARTICIPANTS DURING THE PARTICIPATORY RESEARCH SESSION 1



Below are the examples of emotive words which describe their feeling toward each selected image.

*relaxed / happy / balanced / joyful / assured / wholesome / strong / active / responsible / cared / protected*



DIAGRAMS CREATED BY PARTICIPANTS DURING THE PARTICIPATORY RESEARCH SESSION 1

After the participatory research session, we could extract four key elements which bring them emotional security in their health management.

Four key elements which bring emotional security:

- *Daily physical well-being*  
: *being active /exercising / a balance for food / resting*
- *Social well-being*  
: *good relationships with friends and families*
- *Close relationship with a doctor or other care givers*  
: *getting informed about heath issues from caregivers / communication in a timely and convenient manner / building a sincere relationship*
- *Healthy mental ability*

## ***Concept Generation & Elaboration I***

Based on the market research and participatory research session with older adults, we could generate ideas which may help the elderly improve their health as well as bring them emotional security while maintaining safe independent living in their home. Below are the underlying questions we had in mind during a brainstorming session for concept generation.

*How can we help the elderly:*

- *get healthier lifestyle for better health while living independently at home?*
- *be proactive before their health actually breaks down?*
- *be enlightened about their concerned health issues?*
- *be more connected to their families, friends and neighbors?*
- *get timely care from and intimate interaction with professional caregivers?*

Before getting into detailed ideas, we drew three major areas we may specifically address, which are education, healthy lifestyles and others.

*Education:* getting information about concerned health issues and health conditions/concerns as well as listening to other patients in similar situations about their experiences

*Healthy Lifestyles:* setting goals in specific areas of interest like diet and exercise, getting suggestions for real actions in those areas of interests from grocery items to community activities, seeing analysis of how they have done so far in improving daily routines, and finally getting prompts/suggestions with a holistic view from professionals in relations to their health conditions

*Others:* It could be areas which provide avenues for social connections or timely interactions with caregivers for the elderly.

## *Education*

### **Health information search**

The elderly can search for information about current health issues or possible diseases in mind, similar to getting from medical web sites. Yet, a benefit, compared to the existing methods, is such that information will be delivered via voice and graphic interface in an easy and intuitive way for older people. The elderly can either get the information on a need basis or be educated on a regular basis in a virtual class.

### **Connect with people through their stories**

The elderly can join a virtual forum where patients with similar health concerns share their own experiences. The experiences include how pains were like, how they have gone through the period of time, what treatments they have used, how they could prevent from further deterioration. They can leave comments on other people's experiences or post questions to them. The virtual forum is a place where people casually share their own experiences, provide diverse information about their health issues and interact with others with similar interests.

## *Healthy lifestyle*

### **Goal setting**

The elderly can set a specific goal for a week or a month in any area of interest like diet, exercise and medication intake so that they can take real actions in a day to day life based on their set goals. This will help them keep healthy lifestyles in order to prevent from further deterioration of any concerned disease as well as to improve their health and a quality of life.

### **Tracking and recommendations**

When inputting health or daily routines data such as data of blood pressure, exercising and eating routines, the system provides an easy way to do so. The



elderly users can simply tell the system what they ate for lunch or what exercise they did for how long, then the system will store the data automatically. As more and more data is collected, they can see a visual pattern along with descriptive analysis of how their health data changes over time in relations to daily activities. They also can share this information with others including caregivers to get more detailed feedback and suggestions.

### **System suggestions and prompts**

The system makes prompts or suggestions on the elderly's daily activities, based on their set goals in specific areas of interest, health issues as well as how they manage daily routines. This is a facilitator to prompt users to manage healthier lifestyles. For instance, if the system identifies a user procrastinating for a day, it will motivate to do some more exercise or walk outside, in order to meet an exercise goal. Another case can be where the system suggests the user with a list of healthy meals, which contains materials good for his or her health.

### **Professional recommendations**

Based on set goals, health data and daily activities over time, a user can get feedback and suggestions from professional caregivers behind the system on the user's health in relations to his or her daily activities and the ways to improve the user's health with a holistic view point.

### **Actionable items**

According the set goals, a user gets an optional list of actionable items in each area of interest. In an exercise arena, the user gets a list actionable exercises from which s/he can choose such as a tennis club with appropriate age or skill levels. If the user is interested in joining a community activity for social connection, the system will pull out a list of community events for the elderly which may attract the user.

**Virtual forum**

A user can meet other older adults with similar interests in a virtual forum based on his or her interests, hobby and health issues. The user can interact with others within a specific topic as well as extend the relationship to physical meet-ups.

*Others***Motivation button**

Whenever a user wants to be prompted by the system to meet the set goals, s/he can press a motivation button of the system. Then the system will suggest what the user can do for the day in the area of interest.

**Play a Game**

A user can join a virtual competition with others in such areas as exercise, diet and social outing. If the user gets more active than others, s/he will be awarded.

**Logging days**

A user can write thoughts down on a virtual diary or record their own voice to reflect on how the user manages health and daily routines.

## ***Concept Validation: Participatory Research II***

Participatory research II was to explore ideas, which were generated from the previous brainstorming session, to see which ideas are more of value for the elderly's health management activities over the others. There were fourteen ideas given to the participants.

- *Health search*
- *Education for health*
- *Connect/share with others*
- *Goal setting*
- *Physical activity tracking & recommendations*
- *Health data tracking & recommendations*
- *Diet tracking & recommendations*
- *System(buddy) prompts and suggestions*
- *Professional recommendations*
- *Actionable items*
- *Virtual forum*
- *Motivation button*
- *Play a game with others*
- *Logging days*

There were 5 participants, 2 females and 3 males, in the participatory research session II. They were given a collection of Health ideas each of which had a brief explanation about its core function. Then they selected the ones which they consider would be useful for them in maintaining healthy independent living in their places.

They used a diagramming method where they attached the Health ideas which they thought would be more valuable to them in two levels, most valuable and less valuable ones. After the diagramming, each participant was given around 15 minutes to explain their reasoning behind the selection. During this time, we could delve more into what they need as well as what they do not want for their

health management activities. The following is what the participants had to say in regard to their selection of the given ideas.



DIAGRAMS CREATED BY THE PARTICIPANTS IN THE PARTICIPATORY RESEARCH II

*“I consider health private for me. I feel like nobody knows as well as I do. So I like feedback for myself and then think it through for a long time.”*

*“I like the word “behind the system”. When I get so bad, I go right to the doctor. If there’s some way that I can do that in more of an informal way, so that I really can be in charge of it, that will be great.”*

*“When the doctor tells me that my obesity is the result of my ignorance about nutrition, then that’s where I have to go and learn what to eat. If I have to be healthy, I need to go to these people who study how the body is healthy and find out what I am doing wrong and change it.”*

*“I wanna know more about my health issues. I don’t know enough about how the medicines take care of it, what’s the best exercise to do for it, what food bothers it or not, does it help.”*

*“My doctor tells me what my weight is but I have never been on a diet. She never suggests to me. She has never said to quit smoking. I guess my doctor does not have even 15 min with me.”*

Below are the Health ideas selected the most by the participants.

- *Heath Search:*

*getting general & professional information*

- *Goal Setting:*

*allowing users take a lead in their plans*

- *Tracking & Recommendations:*

*micro establishment / holistic feedback*

- *Professional Recommendations:*

*holistic approach / easy access / trust-based relationship*

- *Connect / Share with Others:*

*Sharing their health information with other parties at their discretion*

- *Education for Health*

In addition to the most selected ideas, included several more ideas which we thought may have values for the elderly, according to what they have shown us during the course of research sessions. For example, we found that many elderly did not know what they could do in their daily lives to improve their diseases while they felt that their health conditions required them to change to better lifestyles. Some elderly felt depression as their spouse, friends and neighbors in similar ages had passed away while they did not know how they could create new social relationships. Below are the ideas which we found may be helpful for the elderly in such circumstances.

- *Actionable Items*  
: *an optional list of real actions in each area of interests*
- *Virtual Forum*  
: *a place to build social relationships with other elderly*
- *System Prompts*  
: *a facilitator to motivate a user for a healthier life*

### ***Interview with Adult Children***

One of the important stakeholders in the elderly's health care is their family members especially their own sons and daughters. Though there are differences in the level of involvement in their parents' health management activities and lives in general, adult children are closely connected to the elderly's health problems and management of later lives. For instance, the elderly inevitably become gradually dependent on their adult children in various aspects as their economical, physical and social abilities get deteriorated as they age. In this sense, we decided to investigate what adult children say about their parents' health management activities.

Interviews with adult children, whose parents pursue an independent living in their home, introduced new and valuable insights about elderly's health management activities in relation to their independent living. Adult children, regardless of levels of communication frequency and intimacy with their parents, their perspectives showed the importance of taking various approaches in developing the health management system for the elderly. Examples of the interview questions are below.

- *What health management activities do you think are helpful for your parents?*
- *How do you help your parents manage their health?*
- *As an adult child, what are the difficulties in regard to helping your parents keep healthy?*
- *If your parents do not feel secured about their health, what do you think makes them nervous?*
- *How do the health issues of your parents affect your life?*

By exploring adult children's thoughts to the various questions, we could figure out what they think their parents need in health care in order to pursue a healthier and more stable independent life in their homes. The adult children, who are unable to provide regular visiting or care to their parents, thought that their parents require intimate, proper and timely care from professional care givers. In addition, they touched on the importance of pre-planning for proper

actions before the elderly's health gets badly impaired. In order for such proper actions to be taken, they thought a proper nudge and follow-up to the elderly parents for healthier lifestyles are necessary. Below is a list of components which the adult children think the health care system should cover for the elderly's healthy and independent living.

- *Instant help*  
: *being able to get in touch with professional caregivers and receive an instant help in case of emergency*
- *Pre-plan proper actions*  
: *identifying changes in the elderly's health conditions and pre-planning proper actions before it gets worse*
- *Motivation for improvement*  
: *helping the elderly change their unhealthy habits into healthier ones*
- *Professional's insights*  
: *incorporating professional caregivers' insights on the elderly's lifestyles to improve their health conditions*
- *Taking care of the elderly*  
: *taking care of the elderly for a certain amount time within a day when needed*
- *Availability*  
: *the system which is always there as a buddy whenever the elderly have questions regarding their health*
- *Useful information & Follow-up*  
: *delivering useful information like medications and treatments and following up afterwards to motivate the elderly to take actions*



## *Concept Elaboration II*

With a number of interviews revealing diverse insights on the elderly's health management activities, we could identify what components the health care system for the elderly should deliver. In the previous concept generation phase, we brainstormed and generated ideas for the health care system to satisfy the elderly population with an independent living. Then we could filter the ideas which are less critical than the others during a series of interviews and research sessions.

In the phase of Concept Elaboration, we focused more on “care” aspect of the system, where the elderly are able to reach at the professional caregivers behind the system whenever they need. Through this easy-to-access “care”, the elderly can receive an instant help from the caregivers or request a care session where the caregivers keep an eye on them through camera to prevent any dangerous situation. This component is in addition to their current primary caregivers who are, in many cases, too busy to provide timely and sufficient help to their patients.

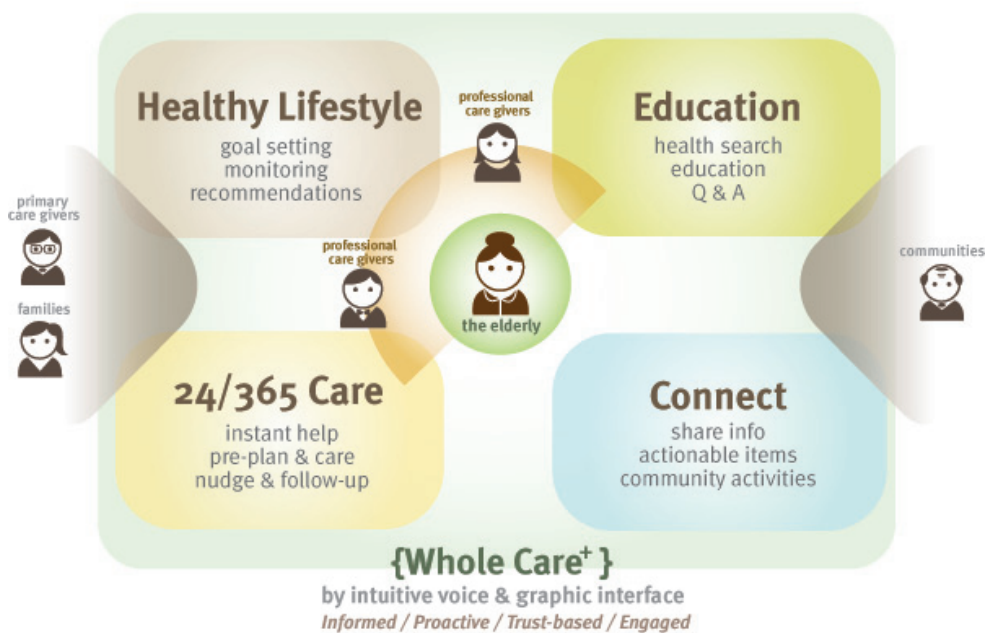
There are services in the market like Mayo clinic where patients can find a right doctor from their broad network of medical professionals. But still, it requires patients to physically visit a medical professional. In contrast, we perceived that the elderly, especially with physical difficulties, need a wide range of timely supports from caregivers, from casual daily check-ups to an instant Q&A session for their sudden health break-ups. In this sense, our system will provide the elderly 24-hour access to caregivers behind the system, who are dedicated to a certain patient.

We created four major areas which the health care system, Whole Care+, will cover: Education, Healthy lifestyle, 24/365 Care, Connect. “Education” is to inform the elderly about their health problems, available treatments and healthy lifestyles, which will help the elderly make their health conditions better. The elderly can set concrete daily goals in the areas of interest like diet and exercise through “Healthy Lifestyle” and take real actions on a daily basis for better lifestyles. In addition, the elderly can be emotionally secured with “24/365 Care”, since they are able to request either an instant help or a temporary care

session through camera to professional caregivers behind the system. The elderly are able to strengthen their social network through “Connect” where they can share useful information and experiences in regard to their health problems through virtual interest groups as well as meet up with others to do physical activities together.

### **Education**

*The system educates the elderly with general & professional knowledge about health issues, available medications, treatments and healthy lifestyles. The elderly can customize what information they get and how they access to such information. Moreover, information on healthy lifestyles will be specific to individuals according to their health conditions.*



WHOLE CARE+ WITH FOUR MAJOR COMPONENTS

### **Healthy Lifestyle**

*The elderly can be proactive in their health, by setting concrete goals in the areas of interest like diet, exercise and social activity and monitoring their daily activities and health data. Then, with those tracked data over time, they can get feedback and suggestions on their lifestyles and health conditions from the professional caregivers behind the system so that they can improve their daily routines to healthier habits. The system enables them to manage such health care in an enjoyable way.*

### **24/365 Care**

*Whenever they need, the professional caregivers behind the system provide an instant help and care as well as pre-plan proper actions in a timely manner on a need basis.*

### **Connect**

*The system creates social connection avenues for the elderly's social well-being such as a virtual interest group, competition group for better lifestyles, virtual exercise class and physical meet-up.*

Not only that what the components of the Whole Care+ will be, but also that how those functions will be delivered to the users is critical. Most elderly users are not as experienced as younger users in understanding and manipulating digital-technology. The user interactions of the system should be developed in a way which they are able to intuitively utilize what they need from the system.

Through long discussions about which platform the Whole Care+ may be manifested, we decided the system to be part of Smart Home technology with wireless connection throughout the house. The system connects various types of display screens such as TV and computer screens. In addition to these familiar technology, a small wearable device with a small LCD screen, which is specialized for the Whole Care+, can be used as a mobile device for various functions such as health monitoring and receiving prompts from the system. Moreover, the wearable device acts as a remote control when manipulating display

screens.

Information of the system will be delivered through a combination of voice and graphic interface. The wearable device, Care+ Buddy will systematically combine voice with graphic output to best deliver relevant information. Voice interface will also be used as a strong reminder for medication intakes and daily plans. When logging daily routines and monitoring health data, the elderly users may input those into the system by simply speaking out loud. Then the Whole Care+ will recognize and save the data securely into its database.

## *Poster Session*

The CMU School of Design conducted a poster session on campus to at a mid-term date for public review and critique of the research process. Each of the students had one big poster to present what they have done to the visitors from various disciplines.

In our poster titled “Health Foci”, we illustrated project background, goal, research processes as well as four major components of the Whole Care+ and the reasoning behind those ideas. Though there was a sufficient description in the poster, conversations and discussions during the poster session occurred mostly around graphics and verbal explanation.

The poster session was valuable in that we could not only show our hard work to the public but also get a diverse feedback on what we have found in the last four months from people with different backgrounds. Below are some of the reflections from visitors, which we thought were useful for the future work.

- Now that we have a firm concept of the system, we need to focus on developing an actual prototype showing how the Whole Care+ will be manifested.*
- Developing an easy-to-use interface and designing a course of experiences which the system will provide to the elderly users will be challenging.*
- We need to focus on one or two of four components of the Whole Care+. Then we can focus on developing those components during the next semester.*
- We should think about how the Whole Care+ caregivers behind the system will communicate with primary doctors of the elderly. How and with what information should those caregivers interact each other for the elderly patients?*

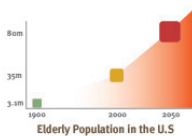
Empower the elderly with a new model of Health Care

# HEALTH FOCI

How a new model of Health Care system can help the elderly be empowered and age healthy in their home?

## INTRODUCTION

A rapid growth in the elderly population  
The U.S Census Bureau showed that, the number of Americans aged 65 and older increased to 35 million in 2000, compared with 3.1 million in 1990. And this number is expected to be more than double to 80 million by the middle of the century. About 1 in 5 Americans would be elderly by the year 2030, compared to 1 in 8 Americans in 1990.



The elderly feel much happier when they live in their own places.

What is healthy aging?

- The process of optimizing opportunities for health, participation and security
  - Allows people to realize their potential for physical, social, and mental well-being
  - Maintaining autonomy and independence
- definition of "active aging" by WHO



## PROJECT GOAL

The goal of this project is to help the elderly maintain healthy lifestyles as well as autonomy in health care while they pursue an independent living in their home. Through this new model of Whole Care+ system, they can better manage their health by active participation in their health care activities and timely interaction with care givers.

The elderly can educate themselves with useful information about their health issues and healthy habits

which they can incorporate into their daily routines. By monitoring and getting feedbacks, the elderly can be proactive in their health as well as improve their daily routines to healthier lifestyle. In addition, they can attain emotional security with timely and friendly interaction with professional care givers behind the system. Lastly, the system enables the elderly to be part of a community so that they can be reassured as they retire, along with physical and mental well-being.



## A NEW MODEL OF HEALTH CARE: {WHOLE CARE+}

{Whole Care+} with user-friendly voice & graphic interface for the elderly living at their home

Health improved by healthy habits

Health is affected heavily by daily routines and lifestyles, and vice versa. By monitoring daily health as well as improving their lifestyles to healthier habits, the elderly can be empowered by being proactive and active in their health care activities.

"Being proactive about what I eat and how I sleep, reacting to important."

"I wanna be more in tuned to me, rather than reacting about me."

"I think in order to live well, you should find the ways that are good for you, Dr. Kim."

### Healthy Lifestyle

The elderly can be proactive in their health, by setting goals, monitoring daily activities & health data, and getting feedback/suggestions from care givers on their lifestyles and health conditions so that they can change their daily routines to healthier habits. The system enables them to manage such health care in an enjoyable way.

Caregivers as a buddy

In order to pursue an independent living, it is critical for the elderly to be able to reach out for caregivers whenever they need. In addition, they need a care giver as a buddy who always talks with them and pre-plan before their health breaks down.

"I just stop by my doctor to see him because I want to be one on one."

"In my age, anything could happen at any time."

"I want to be relaxed and comfortable with my doctors."

### 24/365 Care

Whenever they need, professional caregivers behind the system provide instant help and care, and pre-plan proper actions in a timely manner. The caregivers consistently motivate them for improvement of healthy habits and follow up with things in their health care.



Shortage of what they know now

The elderly lack knowledge about their health issues and the ways by which they may improve their health. They want to get such information both from other patients' experiences and professional care givers.

"Every time I go to a doctor, I make him tell me everything. I am the person who wants to know everything. I am very inquisitive."

"What has been very useful for me was when patients past information about the diseases they have."

### Education

The system educates with general & professional knowledge about their health issues and healthy lifestyles.

How to be socially active?

Being socially active is a key in keeping the elderly's health. However, as social connections for the elderly are likely to be deteriorated after they retire, their social well-being significantly deteriorates as they age.

"When I feel depressed, I don't know some other things to do. So I am trying to be active."

### Connect

The system creates social connection avenues for the elderly's social well-being.

## PROCESS REVIEW



THE POSTER "HEALTH FOCI" SHOWING THE PROJECT OF WHOLE CARE+



## Persona Development

With what we have observed from a course of interviews with older adults and adult children, we developed personas representing the elderly target group for our project. Before finalizing one persona, we developed four personas, each one representing its own age group from 50s to 90s. Each persona describes their demographics, health conditions, current health management and pains and needs in their health care activities.



**"I think health as mental health as well as physical health. I see the mind and the body terrifically interrelated."**

**About Current Health Status**  
"I am quite healthy in my age and have healthy lifestyle. And because I am healthy, I am not nervous about my health. Yet, you know, in my age, anything could happen at any time. We are more vulnerable."

**About Health Management Activities**  
"When a sudden back pain strikes, I get on the internet immediately and google to understand what the pain may be, what the symptom may be, and to see whether there is something I should look at more. I look at patient's comments on the b-boards where they share their symptoms as well as medical sites like Mayo site. Then my second step would be my friend who is a medical doctor, and finally the last step I take is visiting my doctor."  
"I found more useful information from other patients' posts than I did for medical sites. I could get all the range of treatments that are out, it's important to have voices of other patients."  
"In the past, I had to purposefully eliminate low cream, to which I addicted, from my diet, as it made me develop serious digestive problem. But back then, no doctor brought up diet with me, and that made me mad."

**About attitudes toward technology**  
"I use the internet for so many aspects of my life and health is one of them. Internet is part of my daily routine."  
"I do not want to be dependent on another device. I do not want another machine to tell me something. Rather, I want to be in-tuned in, feel and understand my body."

**Name:** Jessica  
**Age:** 51  
**Profession:** University Professor  
**Location:** Mountain View, CA  
**Home Life:** Living with her husband, one daughter and two dogs  
**Health Status:** Quite healthy in her age. She has high cholesterol and once in a while gets back pain.  
**Computer Literacy:** Computer and Internet savvy

Pains	Needs & Desires
<ul style="list-style-type: none"><li>Anything bad could happen at anytime.</li><li>Doctors only prescribe medications when I have pain.</li><li>Do not want to be dependent on another machine.</li></ul>	<ul style="list-style-type: none"><li>Combination of patients' comments about their experiences and general information from medical sites helps being educated before going to a doctor.</li><li>Getting feedbacks and suggestions from a doctor with a holistic view to get healthy lifestyle.</li><li>Getting a close connection with doctors.</li><li>Want to be in-tuned in my body.</li></ul>



**"I felt like I became a slave of recording my health data. I just want to be more in-tuned to my body."**

**About Current Health Status**  
"I have several chronic health issues and I take medication on a daily basis. My blood pressure and cholesterol tend to be a little high, but it's pretty much in control."

**About Health Management Activities**  
"I used to monitor my blood pressure and cholesterol once in a while. But it started making me very anxious about the recording itself, which in turn made my blood pressure higher. It made me too analytical as well as feel worse by seeing the patterns of the data. In addition, I kept the log for my diet and exercising, but it was cumbersome and I made me unable to enjoy the activities. For instance, I felt I became an accountant with calculating all the calories of my food. I felt like I became a slave of the notebook for log. Then I quit recording."  
"After quitting the recording, I could be more in-tuned to my body and how my body feels."  
"I should have routines for my daily activities. I follow routines for my diet and medication. I am likely to forget to take the medication when my day is out of routine."  
"I try to be aware of my diet. I always pay attention to what goes into my foods."

**About attitudes toward technology**  
"I am quite familiar about using my laptop and the internet. Yet I am not the person with all the digital devices around."  
"Since I tend to get really obsessed with the devices, I am hesitant to bring any kinds of tools in my routines. Rather, I want to feel more of my body, the rhythm of the body."

**Name:** Chris  
**Age:** 63  
**Profession:** NA  
**Home Life:** Living with his wife and one dog  
**Health Status:** Has several chronic diseases.  
**Computer Literacy:** Quite familiar with the use of Internet but a little hesitant being with all the digital devices around.

Pains	Needs & Desires
<ul style="list-style-type: none"><li>Monitoring the health data produces more stress.</li><li>When a day is out of my routine, it is easy to forget the things like medication intake.</li><li>Do not want to be bothered with all the devices around.</li></ul>	<ul style="list-style-type: none"><li>Want to be in-tuned to my body.</li><li>Want to enjoy daily activities like eating and exercising.</li><li>Follow routines for daily activities.</li><li>Eating everyday healthy foods.</li></ul>



**"I think, in order to live well, you should find the ways that are good for you, fit you."**

**About Current Health Status**  
"I am a breast cancer survivor and still in treatment. I have Thyroid problem and my blood pressure and cholesterol tend to be a little high."  
"I barely know about Thyroid except that it's quite serious one. I want to know more about what it does to me, why I should take medicines and how it affects me."  
"My concern about possible health issues in the future is being in diabetes though I am not taking any efforts to prevent it. However, I am far more concerned about my mental health than physical health."

**About Health Management Activities**  
"I take medication everyday. Taking pills every morning and night is critical for my health. I manage to remember taking medication by putting my pills on the table so that I can be easily reminded."  
"I have medical card for the record of my blood pressure, in which a nurse writes the data down once in a while at the senior center. I feel secured by having it."  
"My doctors check my medical card and change the prescription for medicines. I think it helps my doctors decide the treatment for my health issues."

**About attitudes toward technology**  
"I am learning how to use the internet and try to get to know about Thyroid. But still, I prefer asking to a doctor cause it's much faster and easier way to get information."

**Name:** Elaine  
**Age:** 75  
**Profession:** NA  
**Home Life:** Living by herself at her house  
**Health Status:** A breast cancer survivor and still in treatment  
**Computer Literacy:** Intermediate level, using the Internet as a communication channel

Pains	Needs & Desires
<ul style="list-style-type: none"><li>Barely know about the current health problems.</li><li>Possibility of being in diabetes.</li><li>Concerned about the possibility of mental impairment.</li><li>Using the internet to search for the information about her disease is difficult.</li></ul>	<ul style="list-style-type: none"><li>Want to know more about the current health issues.</li><li>Prevent from being in diabetes.</li><li>Keep healthy mental ability.</li><li>Being reminded the times for taking medication.</li><li>Faster and easier way to get information about the current health issues than searching through the internet.</li><li>Finding the ways that are good for her to live well.</li><li>Feeling the security by tracking the health data.</li></ul>



**"There are days where you are unlike everything else. It's up and down. I just take day to day."**

**About Current Health Status**  
"I have just general things like heart problems, arthritis and high blood pressure."  
"There are days where you are unlike everything else, then I think, Oh, am I going to make it through these days? It's up and down and I just take day to day."

**About Health Management Activities**  
"I keep active doing things around. I go grocery shopping with my son, I visit my girl friend's once a week and I come down to the senior center once a week."  
"I keep track of my blood pressure on a regular basis on a notebook. I like to keep track of it because sometimes I don't feel just up to par and the pressure enlightens on you. It makes me secured."  
"I also keep the list of medication I take. I show this paper to my doctors to inform them what kinds of medication other doctors prescribed on me. I keep it in my purse in case something happens."

**About attitudes toward technology**  
"I do not use any digital device or internet for health management activities. Mostly I watch TV in my room."

**Name:** Christina  
**Age:** 91  
**Profession:** NA  
**Home Life:** Living with her son, daughter-in-law and a dog.  
**Health Status:** Quite healthy in her age. She has heart problem, arthritis and high blood pressure.  
**Computer Literacy:** Computer and Internet illiterate.

Pains	Needs & Desires
<ul style="list-style-type: none"><li>Insecurity about health.</li><li>Emotional fluctuation from day to day.</li></ul>	<ul style="list-style-type: none"><li>Emotional security about her health.</li><li>Keeping the record of her critical health information.</li><li>Keeping herself active makes her healthy.</li></ul>

### FOUR PERSONAS REPRESENTING EACH AGE GROUP FROM 50S TO 90S

However, we decided to narrow the age range of our target group to over 65 years old, because we found that older adults after 65 years old may require

more assistance from others for their health management. In addition, it was necessary for us to narrow our target group in order to concentrate on a couple of critical functions of the Whole Care+ when developing the prototypes.



Name: **Elaine**  
 Age: **75**  
 Profession: **NA**  
 Home Life: **Living by herself at her house**  
 Health Status: **A breast cancer survivor and still in treatment**  
 Computer Literacy: **Intermediate level, using the internet as a communication channel**

**"I think, in order to live well, you should find the ways that are good for you, fit you."**

#### *About Current Health Status*

"I am a breast cancer survivor and still in treatment. I have Thyroid problem and my blood pressure and cholesterol tend to be a little high."  
 "I barely know about Thyroid except that it's quite serious one. I want to know more about what it does to me, why I should take medicines and how it affects me."  
 "My concern about possible health issues in the future is being in diabetes though I am not taking any efforts to prevent it. However, I am far more concerned about my mental health than physical health."

#### *About Health Management Activities*

"I take medication everyday. Taking pills every morning and night is critical for my health. I manage to remember taking medication by putting my pills on the table so that I can be easily reminded."  
 "I have medical card for the record of my blood pressure, in which a nurse writes the data down once in a while at the senior center. I feel secured by having it."  
 "My doctors check my medical card and change the prescription for medicines. I think it helps my doctors decide the treatment for my health issues."

#### *About attitudes toward technology*

"I am learning how to use the internet and try to get to know about Thyroid. But still, I prefer asking to a doctor cause it's much faster and easier way to get information."

#### **Pains**

- Barely know about the current health problems.
- Possibility of being in diabetes.
- Concerned about the possibility of mental impairment.
- Using the internet to search for the information about her disease is difficult.

#### **Needs & Desires**

- Want to know more about the current health issues.
- Prevent from being in diabetes.
- Keep healthy mental ability.
- Being reminded the times for taking medication.
- Faster and easier way to get information about the current health issues than searching through the internet.
- Finding the ways that are good for her to live well.
- Feeling the security by tracking the health data.

THE FINAL PERSONA AFTER NARROWING DOWN FROM FOUR PERSONAS

Let's look at what Elaine, our final persona, has to say about pains in her current health care as well as her needs and desires for better health.



***Elaine's current health issues are:***

- *Lack of knowledge about her current health problems*
- *At risk for diabetes, high blood pressure and cholesterol*
- *Possibility of cognitive impairments in regards to everyday tasks*
- *Poor accessibility to information about her diseases*

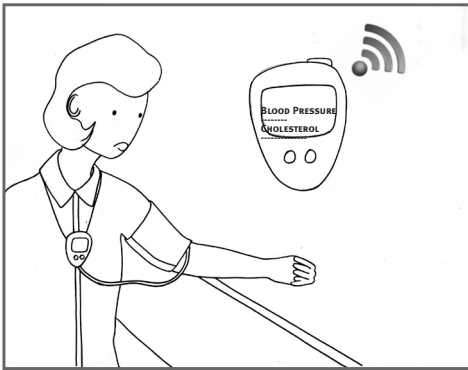
***What Elaine needs for future health care are:***

- *Knowing more about her specific and current health issues*
- *Finding personalized ways to live well at her current home*
- *Good habits for eating and exercising*
- *Improving her high blood pressure, cholesterol and arthritis*
- *Early prevention of diabetes*
- *Exercise her mental and cognitive abilities*
- *Being reminded of the times for taking medication*

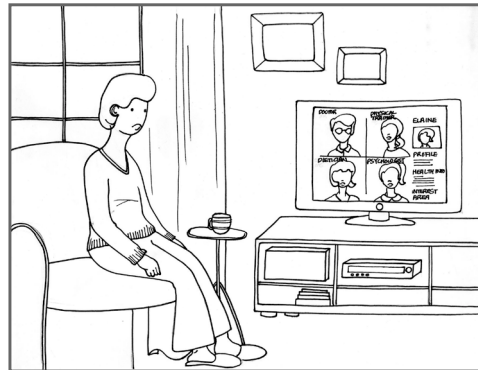
## *Scenario of Use*

We developed scenarios of use describing how the Whole Care+ supports Elaine's daily activities as well as how she experiences the system for better health and healthier lifestyle choices. There are four parts in the scenario, which are set-up, diet, exercise and overview & feedback.

### *Set-up*

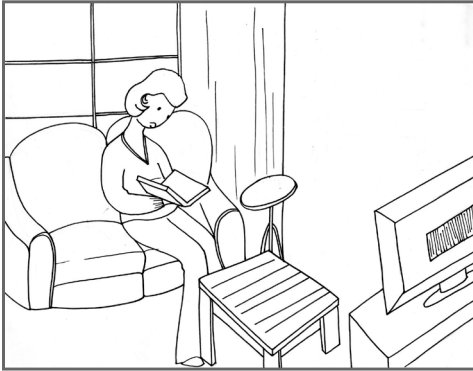


Elaine once in a while tracks her blood pressure and cholesterol with a portable Care+ Buddy to record her health status over time. Then the Whole Care+ stores the data into its secured database.

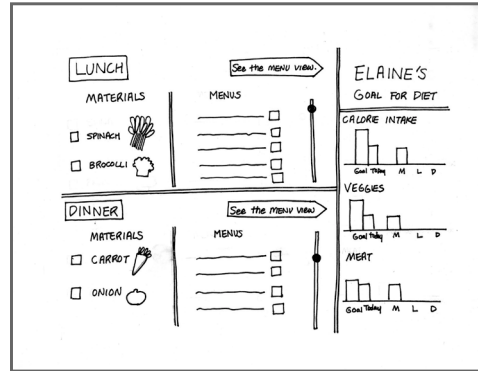


Elaine consults with Whole Care+ caregivers-a doctor, dietitian, physical trainer, psychologist-to set up her Whole Care+. They carefully review her lifestyle and health issues to figure out customized health plans for Elaine. Then they set practical daily goals in each area of interest- diet, exercise and social activity -which may help her get healthier.

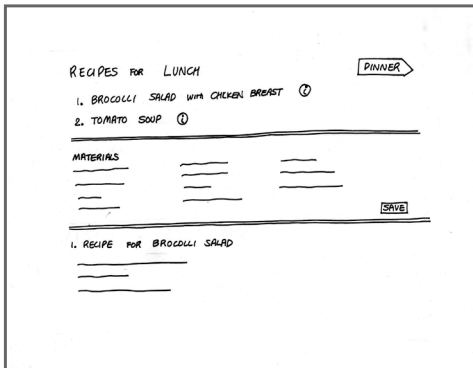
## Healthy lifestyle: Diet



In the morning, the Care+ Buddy asks if she wants to see suggestions on today's lunch. Then she turns TV on to check the menu.



The system shows an optional list of menus for lunch. Among the menus, Elaine chooses greek salad, broccoli fried rice and banana. Here, it shows calories and trans-fat information of each menu selected. These items are chosen specifically by the team of specialists to address her at-risk diabetic state.



Elaine can also check recipes and materials for the selected menus. The Care+ Buddy already has the ingredients so that she can refer to it when she grocery-shops.



While grocery shopping, Elaine can see the required ingredients for her lunch through the Care+ Buddy. She can use a "voice function" of the Care+ Buddy, which speaks out the materials in case she is not able to read small texts on the screen well.

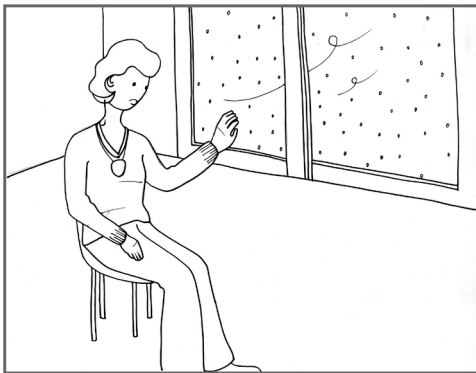


On a small LCD screen installed at a kitchen, Elaine can refer to the ingredients and recipes for her lunch. The system speaks out the steps of the recipe one by one as she cooks.

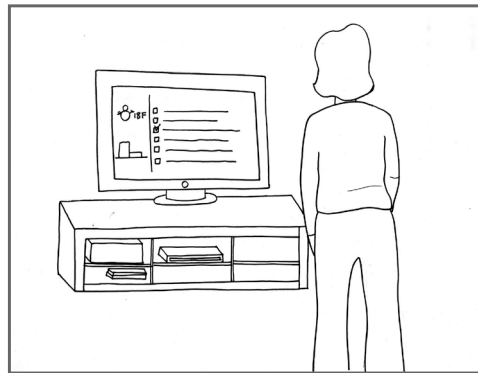


After lunch, the Care+ Buddy asks what she had for lunch. Elaine tells to the device about what she had with what amount. By logging her diet, the Whole Care+ can analyze the relationship between her diet routines and health conditions over time.

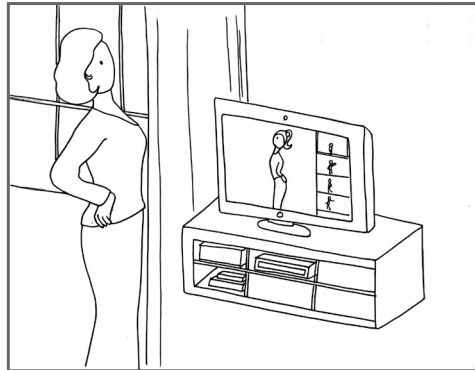
### *Healthy lifestyle: Exercise*



It is too cold and icy to exercise outside for Elaine. The Care+ Buddy asks if she exercised today. Elaine says no.

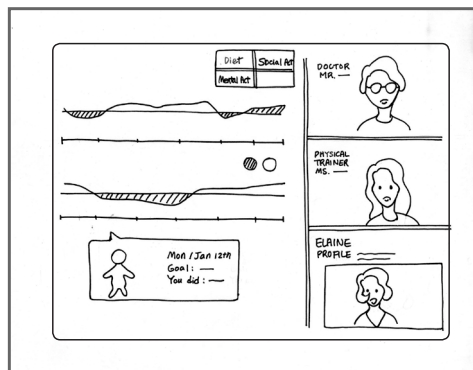


Then the system suggests an alternative exercise, aerobic dancing, which she can do inside her house. She can join a virtual dancing class where her close neighbors are also to join.



During the real-time dancing class, Elaine can easily and safely exercise by following an instructor on a TV screen. She can see other attendees dancing through camera as well as their energy consumption levels which motivate her to be more dynamic.

### *Overview & feedback*



Whenever Elaine needs to talk to the Whole Care+ caregivers, she can chat via camera about her concerned health issues and get feedback on her daily routines with holistic insights.

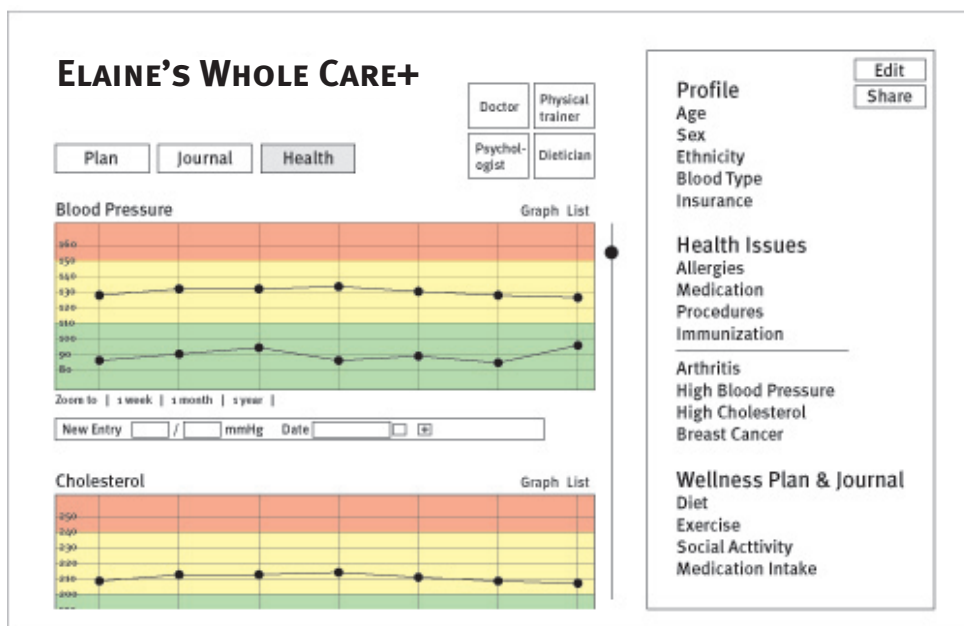
## Wireframe

Based on the story board, we started to develop a wireframe for screens of the Whole Care+. In developing wireframes, we focused on what functions the screens will contain and how it will flow between screens according to different behaviors of a user. There are four parts, which are set-up, diet, exercise and overview & feedback.

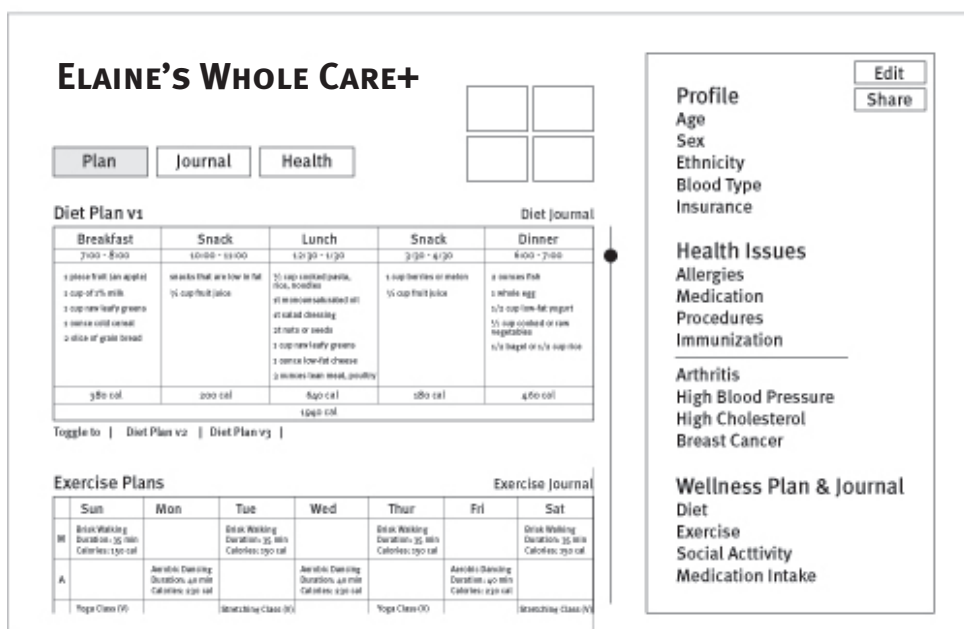
### Set-up

The wireframe for the 'Set-up' screen is titled 'ELAINE'S WHOLE CARE+'. It includes a navigation bar with 'Plan', 'Journal', and 'Health' tabs. Below this is a 2x2 grid of boxes for 'Doctor', 'Physical Trainer', 'Psychologist', and 'Dietician'. To the right of the grid is a box for 'Elaine's face'. On the far right is a sidebar with the following sections: 'Profile' (with 'Edit' and 'Share' buttons), 'Health Issues' (listing Allergies, Medication, Procedures, Immunization, Arthritis, High Blood Pressure, High Cholesterol, and Breast Cancer), and 'Wellness Plan & Journal' (listing Diet, Exercise, Social Activity, and Medication Intake).

1. Elaine sets her profile including ethnographic information and health issues.
2. Elaine chats with caregivers of Whole Care+ –a doctor, physical trainer, psychologist and dietician–through video chat, to review her lifestyle and health conditions as well as set daily goals in each area of interest for healthier lifestyle and better health.



3. Whole Care+ caregivers and Elaine have a deep conversation on her lifestyle, health conditions and expectation on Whole Care+ to set achievable daily goals in each area of interest-diet, exercise and social activity-for better health.



4. Diet plan: From breakfast to snacks to dinner, they designate Elaine's meal times for a systematic meal habit, preferable materials, as well as approximate amount of required calories and trans-fat intake for each meal, in order to prevent high blood

pressure and cholesterol.

5. Exercise plan: From Monday to Sunday, they set actionable exercise plans and each day, which will fit Elaine's health conditions and lifestyle. However, if Elaine wants to do a different exercise later, the system will suggest other options for alternative exercise or she can create one on her own.

### *Healthy lifestyle: Diet*

1. On a TV screen, home screen shows today's plans and journals in the areas of diet, exercise and social activity. Depending on when she checks the screen, the system will pull out the closest plans to the moment of checking.



Home

Setting

ELAINE'S WHOLE CARE+

Diet

Exercise

Social Activity

Medication Intake

January 30th, 2011

Start with materials

View for a different day

Diet Plans for Breakfast

Skip

<div>Steps: Choose one you prefer to have.</div> <div> <input type="checkbox"/> 1 cup of 1% low fat milk </div> <div> <input type="checkbox"/> 1 bowl of cold cereal + milk </div> <div>80 cal</div>	<div>Steps: Choose one you prefer to have.</div> <div> <input type="checkbox"/> Apple green salad  <input type="checkbox"/> 1 piece of apple pie  <input type="checkbox"/> 1/4 apple  <input type="checkbox"/> Dried banana chips </div> <div> <input type="checkbox"/> Apple green salad </div> <div>120 cal</div>	<div>Steps: Choose one you prefer to have.</div> <div> <input type="checkbox"/> Grain bagel with cheese  <input type="checkbox"/> Baguette with jam  <input type="checkbox"/> Garden salad with olives  <input type="checkbox"/> Green salad with nuts  <input type="checkbox"/> Raisin bread with jam  <input type="checkbox"/> Grain bread with nuts </div> <div> <input type="checkbox"/> Grain bagel with cheese  <input type="checkbox"/> Baguette with jam </div> <div>180 cal</div>	<div>What you chose</div> <div>           1 bowl of cold cereal + milk            Apple green salad            Grain bagel with cheese         </div> <div>380 cal</div>
--	---	--	--

Toggle to

Diet Plan v2

Diet Plan v3

Create your own

Recipe

Diet Plans for Lunch

Skip

<div>Steps: Choose one you prefer to have.</div> <div> <input type="checkbox"/> Shrimp with garlic sauce  <input type="checkbox"/> Broccoli with olive oil  <input type="checkbox"/> Veggie ravioli  <input type="checkbox"/> Rice  <input type="checkbox"/> Chicken fried rice  <input type="checkbox"/> Shrimp fried rice </div>	<div>Steps: Choose one you prefer to have.</div> <div> <input type="checkbox"/> Greek salad with walnut  <input type="checkbox"/> Taco salad  <input type="checkbox"/> Chicken salad with olives  <input type="checkbox"/> Blue cheese spinach salad  <input type="checkbox"/> Crisp chicken salad  <input type="checkbox"/> Salmon salad </div>	<div>Steps: Choose one you prefer to have.</div> <div> <input type="checkbox"/> 1/2 low-fat yogurt  <input type="checkbox"/> 1/2 cup canned fruit  <input type="checkbox"/> 1/2 apple  <input type="checkbox"/> 1/2 banana  <input type="checkbox"/> 1 cup grape  <input type="checkbox"/> 1 slice pineapple </div>	<div>What you chose</div> <div>           Pasta            Broccoli with olive oil            Salad            Greek salad with walnut            Dessert            1 cup grape         </div>
--	--	---	---

HEALTH TRACK

Blood Pressure

Graph List

Zoom to

1 week

1 month

1 year

New Entry

/

/

mmHg

Date

Blood Cholesterol

Graph List

Zoom to

1 week

1 month

1 year

New Entry

/

/

mmHg

Date

Arthritis

Graph List

Zoom to

1 week

1 month

1 year

- On a Diet screen, the system suggests a list of optional menus from which she can choose for her meal. By clicking each menu, she can see how much calories she will get from the selected menu. She can combine two or three menus for her meal.
- Then Elaine can check details of the menus such as recipes and required ingredients.

Home

Setting

ELAINE'S WHOLE CARE+

Plan

Journals

Recipes for January 30th, 2011

Breakfast

Lunch

Dinner

Breakfast

1 bowl of cold cereal + milk

Apple green salad ●

Grain bagel with cheese ●

Apple green salad

Materials

Garden salad

Apple 1/2

1/2 walnut

low fat dressing

1/2 medium olives

1/2 celery

send to grocery basket

Recipes

1. Mix all the chopped ingredients (cereal, apple, walnuts, olive, celery) together.  
 2. Add low-fat dressing to the salad and mix.  
 3. Add more dressing if needed to taste it.  
 4. Chill and serve.

Grain bagel with cheese

Grocery basket

Garden salad  
 Apple 1/2  
 1/2 medium olives  
 1/2 celery  
 low-fat swiss cheese

Add

Send

- Elaine checks ingredients and recipes of the selected menus for her breakfast.
- Among the required ingredients for her breakfast, Elaine can select the ones which

she needs to grocery shop and syncs it to the “Grocery Shopping Basket” of the portable Care+ Buddy. This helps Elaine grocery-shop by providing an external reminder.

**Grocery basket**

**Fruit & Veggies:**  
Garden salad  
Apple 1/2  
1/2 celery

**Canned:**  
4 medium olives

**Dairies:**  
low-fat swiss cheese

6. Grocery basket: A grocery shopping list shown on the portable Care+ Buddy which she brings along to a grocery store. The list helps Elaine remember what she needs to buy for her breakfast. In addition, the device allows Elaine to use a voice function to listen to the list of materials one by one in case texts on the screen are too small to read.

**Diet Journals**

Breakfast on Feb 01, 2011

Did you have planned breakfast?  
Yes.  
Yes, but I had more.  
No.

Did you have right amount?  
Yes.  
No. (go over one by one)

Did you have extra ones?  
Yes.  
No. (go over the name, amount)

7. After breakfast, the Care+ Buddy asks her about what she had with what amount for her breakfast to track her diet activities. It is simple and fast process of logging as Elaine can speak out what she has to tell to the questions about her meal. Then the device will store the data securely to its database.

## Healthy lifestyle: Exercise

ELAINE'S WHOLE CARE+

Home

Setting

Overview

Connect

Chat

Wednesday, Feb 02, 2011

Today's Plan

Diet

Breakfast

7:00 - 8:00

- 1 piece fruit (an apple)
- 1 cup of 1% milk
- 1 cup low fat yogurt
- 1 ounce cold cereal
- 2 slices of grain bread

more

Exercise

Aerobic Dancing

Location: Care+ class #7

Time: 2:30 pm

Duration: 40 min

Calories: 230 cal

more

Social Activity

1. Senior Center

Card gaming / etc

10:00 am - 2:30 pm

2. Dinner with Jenny

more

Today's Journals

Diet

Calorie

Saturated/Trans fat

Dietary Cholesterol

more

Exercise

Total Calorie:

Aerobic Duration:

Other exercise:

more

Social Activity

Senior Center visit:

Dinner:

more

PROFILE

HEALTH TRACK

CALEDER

DAY | WEEK | MONTH

1. Elaine checks the home screen of Whole Care+ and clicks “more” to see the details of her exercise plan today.

ELAINE'S WHOLE CARE+

Home

Setting

Diet

Exercise

Social Activity

Medical Information

January 30th, 2011

Exercise Plan

View for a different day

Skip

Exercise Plan

Aerobic Dancing

Location: Care+ class #7

Time: 2:30 pm

Duration: 40 min

Calories: 230 cal

Join

other class options

Enter time window:

00:00-24:00 | 00:00-24:00

Search

1. Aerobic Dance class #7

12:00 pm - 12:40 pm

Calories: 230 cal

2. Aerobic Dance class #8

1:00 pm - 1:40 pm

Calories: 230 cal

alternatives

1. Walking

Duration: 45 min

Calories: 195 cal

2. Aerobic Dance class #6

9:00 pm - 9:40 pm

Calories: 230 cal

Rescue

PROFILE

HEALTH TRACK

Blood Pressure

Graph List

Days for | weeks | months | years

New Entry | Monday | Date

Blood Cholesterol

Graph List

Days for | weeks | months | years

New Entry | Monday | Date

Arthritis

Graph List

Days for | weeks | months | years

New Entry | Monday | Date

2. Elaine checks the details of today's exercise plan including how much calories she will burn for the aerobic class. If she does not want to follow the plan, she can always

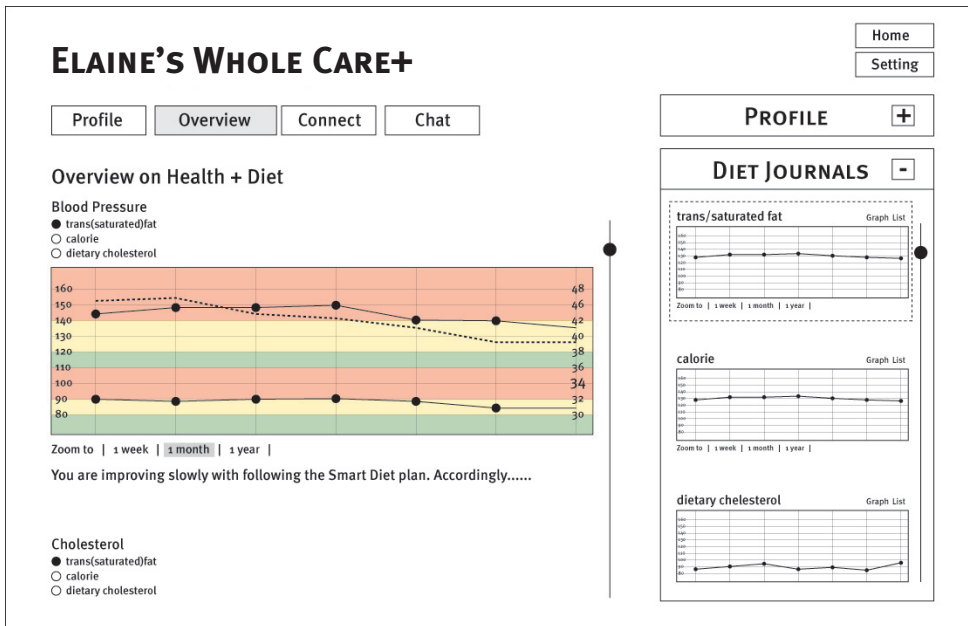
55

change to a different one with a different time. She can choose among other options suggested by the Whole Care+ or create one on her own.

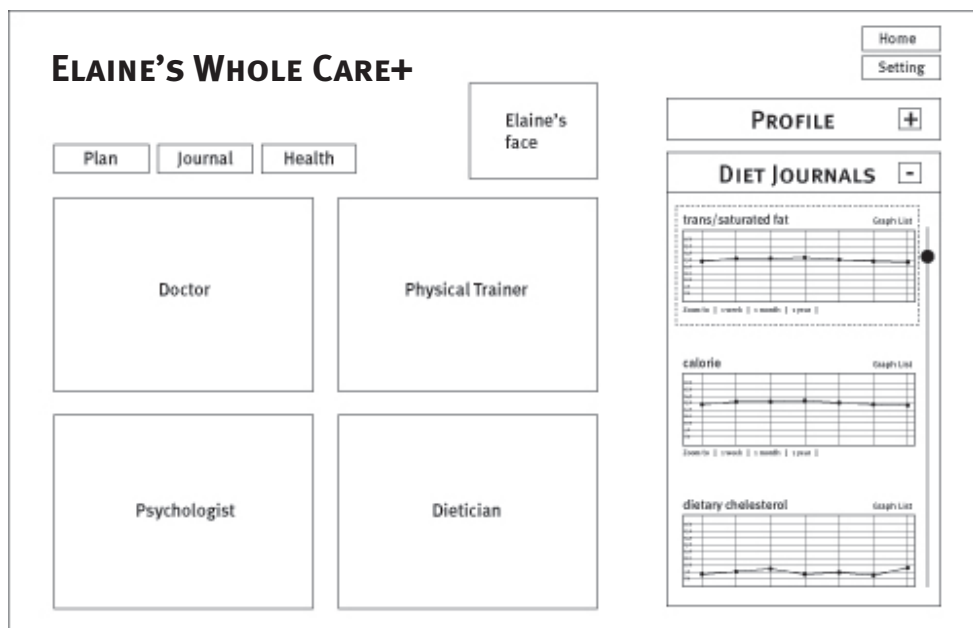
The screenshot shows the Elaine's Whole Care+ web application. At the top right, there are 'Home' and 'Setting' buttons. Below them, on the left, are buttons for 'Diet', 'Exercise', 'Social Activity', and 'Medication Intake'. The main content area is divided into three columns. The left column displays the date 'January 30th, 2011' and the class name 'Aerobic Dancing class #7'. The middle column features a large 'Instructor' box and a smaller box below it containing a welcome message: 'Hello, everyone. Welcome to our class. Today, we are going to start with stretching to smooth yourbody...'. The right column has a 'Quit' button at the top, followed by a grid of 12 boxes arranged in 3 rows and 4 columns. Each box contains the name 'Elaine' and 'energy level'.

3. In the aerobic class, Elaine can see an instructor dancing because of real-time video conferencing. Moreover, she can check other elderly attendees dancing like a real class as well as their energy consumption levels while dancing, which may motivate her to exercise longer.

## Overview & Feedback



1. After a while later, Elaine checks an overview which the Whole Care+ analyzed with collected Elaine's data overtime. She sees the relationships between her health conditions and daily routines with the Whole Care+ plans, such as changes of her blood pressure and trans-fat intake. The system delivers the analysis in an easy-to-read graphic as well as through text.



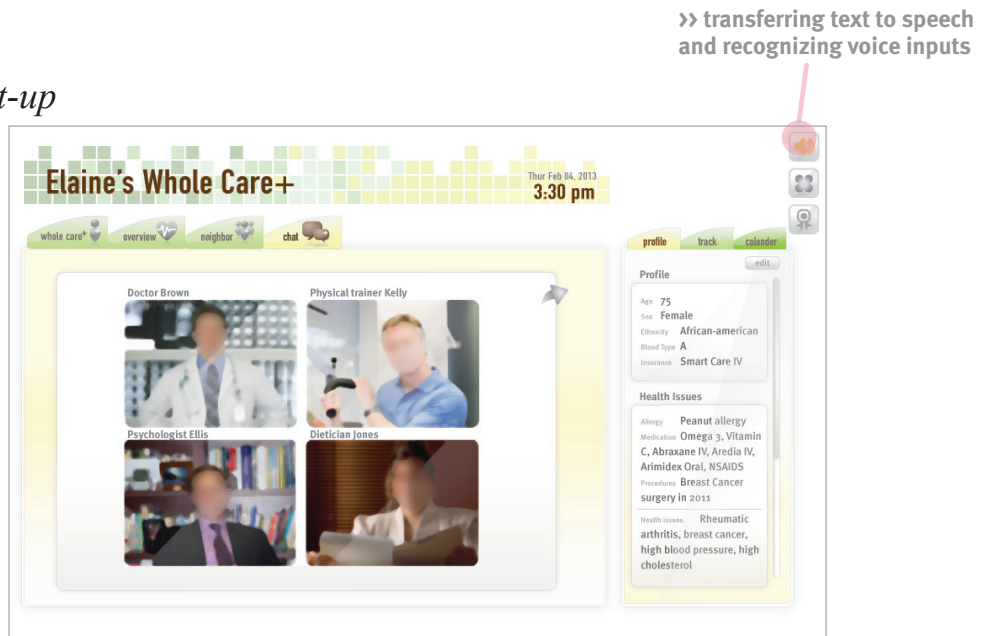
2. Whenever Elaine needs to consult with the Whole Care+ caregivers about her health conditions, daily habits and relationships of those, she can always request a video chat session.

3. Whole Care+ caregivers will review her records prior to the video chat session. The original and important overall goal is to provide feedback on her lifestyle from a holistic view. If needed, the caregivers will revise Elaine's Whole Care+ plans.

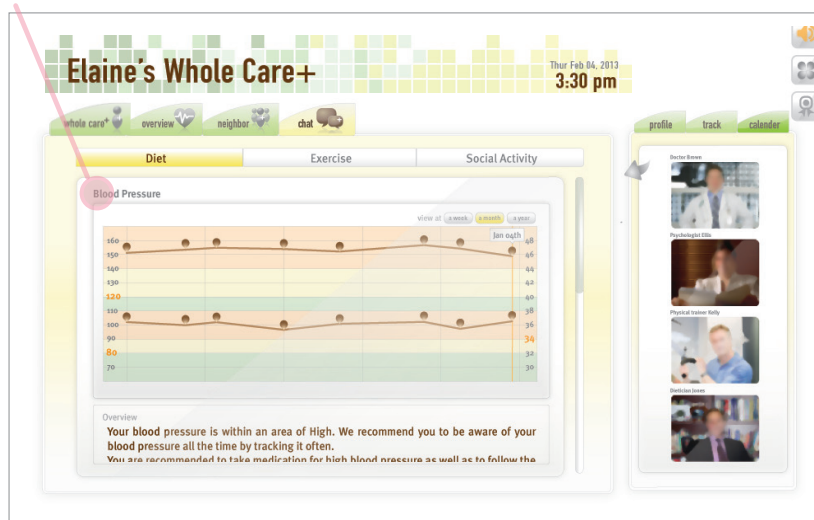
## Visualization

Based on the wireframes developed in the previous process, we started developing visualizations for screens. Through out the process, one of the main focuses was to develop easy-to-use graphics for the elderly users combined with voice interface. A flow of the screens is based on the four scenarios from “Set-up” to “Overview & Feedback”.

### Set-up



>> an easy-to-read graphic allowing both macro and micro view



>> customized diet plans which may help Elaine take actions for a healthier lifestyle

**Elaine's Whole Care+** Thur Feb 04, 2013 3:30 pm

whole care+ overview neighbor chat

**Diet** Exercise Social Activity

**Diet Plan 1**

Breakfast 7:00 am - 8:00 am	Snack 10:00 am - 11:00 am	Lunch 12:30 pm - 1:30 pm	Snack 3:30 pm - 4:30 pm	Dinner 6:00 pm - 7:00 pm
1 piece fruit 1 cup of 5% milk 1 cup raw leafy greens 1 ounce cold cereal 2 slices of grain bread	low-fat snack 1/4 cup fruit juice	1/2 cup cooked pasta/ rice/ noodles 1t monounsaturated oil 2t nuts / seeds 1 cup raw leafy greens 1 ounce low-fat cheese 3 ounces lean meat, poultry	1 cup berries / etc 1/4 cup fruit juice	2 ounces fish 1 whole egg 1/2 cup low-fat yogurt 1/2 cup cooked or raw vegetables 1/2 bagel or 1/2 cup rice
380 cal	200 cal	640 cal	180 cal	460 cal
1940 cal				

view Diet Plan 2 Diet Plan 3

profile track calendar

Doctor Brown  
Psychologist Ella  
Physical Therapist Kelly  
Dietician James

>> Whole Care+ caregivers setting customized daily plans after comprehensive conversation

**Elaine's Whole Care+** Thur Feb 04, 2013 3:30 pm

whole care+ overview neighbor chat

**Exercise** Diet Social Activity

**Exercise Plans**

	Sun	Mon	Tue	Wed	Thur	Fri	Sat
morning	Brisk Walking Duration: 35 min Calories: 150 cal		Brisk Walking Duration: 35 min Calories: 150 cal		Brisk Walking Duration: 35 min Calories: 150 cal		Brisk Walking Duration: 35 min Calories: 150 cal
afternoon		Aerobic Dancing Duration: 40 min Calories: 230 cal		Aerobic Dancing Duration: 40 min Calories: 230 cal		Aerobic Dancing Duration: 40 min Calories: 230 cal	
evening	Yoga Class (V) Duration: 25 min Calories: 80 cal		Stretching Class Duration: 20 min Calories: 75 cal		Yoga Class (V) Duration: 25 min Calories: 80 cal		Stretching Class Duration: 20 min Calories: 75 cal
	230 cal	230 cal	225 cal	230 cal	230 cal	225 cal	225 cal

Exercise Journal

profile track calendar

Doctor Brown  
Psychologist Ella  
Physical Therapist Kelly  
Dietician James

>> customized exercise plans which may help Elaine engage in improving her health conditions



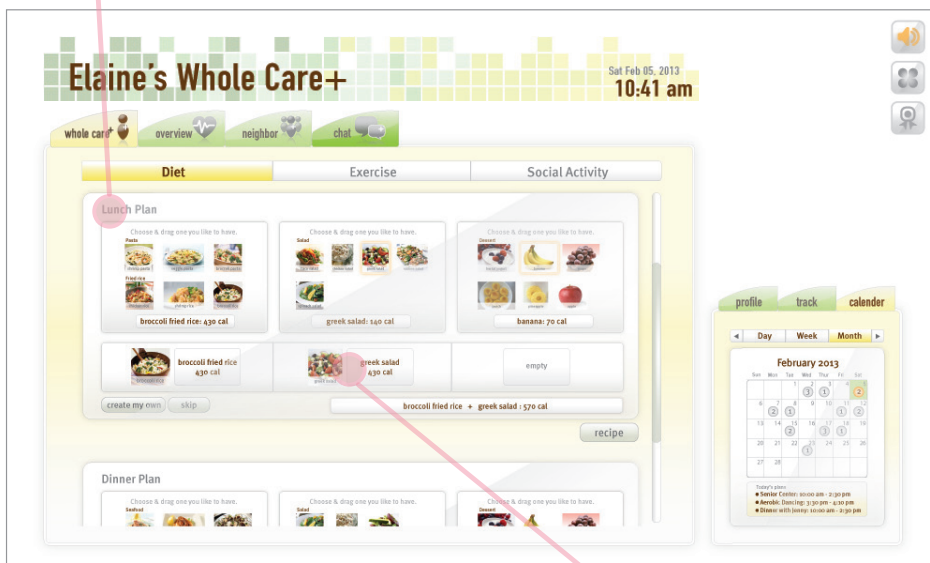
## Healthy lifestyle: Diet

>> showing today's plans  
in each area of interest



>> an optional list of lunch  
menus suggested by the system

>> a push note as a reminder  
for today's daily plan

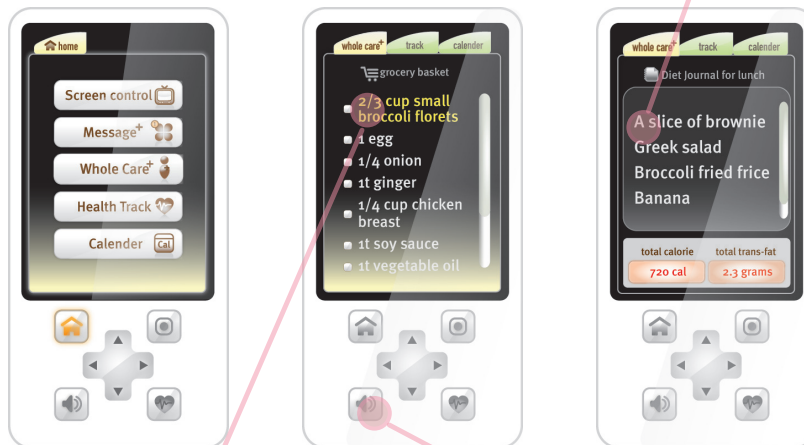


>> allowing Elaine to make her own  
lunch from the suggested menus

>> Recipe through graphic and voice interface: showing the steps of the recipe through voice and graphic as Elaine cooks in the kitchen



>> logging her daily activities simply by speaking out about what she had with what amount



>> grocery shopping list: helping Elaine remember the ingredients which she needs to buy for her meal

>> voice interface: helping Elaine read small text by speaking out the list of ingredients

## Healthy lifestyle: Exercise

**Elaine's Whole Care+** Wed Feb 02, 2013 2:23 pm

whole care+ overview neighbor chat

**Diet** **Exercise** **Social Activity**

**Diet Plan**  
Breakfast 7:00am - 8:00am  
1 bowl of cold cereal  
Apple green salad  
Grain bagel with cheese  
Lunch 12:00pm - 1:00 pm  
You have not chosen yet.

**Exercise Plan**  
Plan 1 3:30pm - 4:10pm  
**Aerobic Dancing**  
location: Care+ class #7  
time: 3:30 pm  
duration: 40 min  
calories: 230 cal

**Social Activity Plan**  
Plan 1 10:00am - 2:30pm  
Senior Center  
card gaming / etc.  
Plan 2 6:00pm - 8:30pm  
Dinner with Jenny  
location: Plum

**Diet Journal**  
calorie intake: 0 cal  
saturated/trans fat: 0 g  
dietary cholesterol: 0 mg

**Exercise Journal**  
calorie burnt: 0 cal  
planned exercise: none  
other exercise: none

**Social Activity Journal**  
planned activity: none  
other activity: none

profile track calendar

February 2013

Day Week Month

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

Today's plan:  
• Senior Center cardio sat - 10:00 am  
• Aerobic Dancing 3:30 pm - 4:10 pm  
• Dinner with Jenny: 6:00 am - 8:30 pm

>> today's exercise plan suggested according to Elaine's health conditions

**Elaine's Whole Care+** Wed Feb 02, 2013 2:23 pm

whole care+ overview neighbor chat

**Diet** **Exercise** **Social Activity**

There are 1 exercise planned today.

**Exercise Plan**  
Aerobic Dancing  
Location: Care+ class #7  
Time: 2:30 pm  
Duration: 40 min  
Calories: 230 cal  
Neighbors (3)  
Jane  
Kimmy  
Scott  
Join Cancel

**Other class options**  
Enter time you like.  
00:00 pm to 00:00 pm  
search  
Bring what you should grocery shop.

**Other options by yourself**  
Enter time you like.  
00:00 pm to 00:00 pm  
search  
Bring what you should grocery shop.

profile track calendar

February 2013

Day Week Month

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

Today's plan:  
• Senior Center cardio sat - 10:00 am  
• Aerobic Dancing 3:30 pm - 4:10 pm  
• Dinner with Jenny: 6:00 am - 8:30 pm

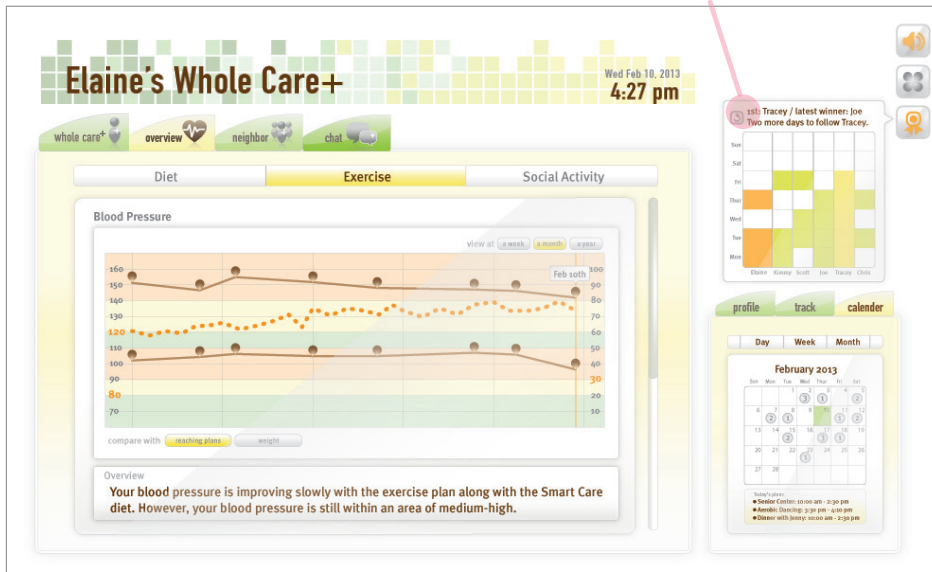
>> Elaine's close neighbors who will join the dancing class

>> alternative exercise options either suggested by the system or created by her own



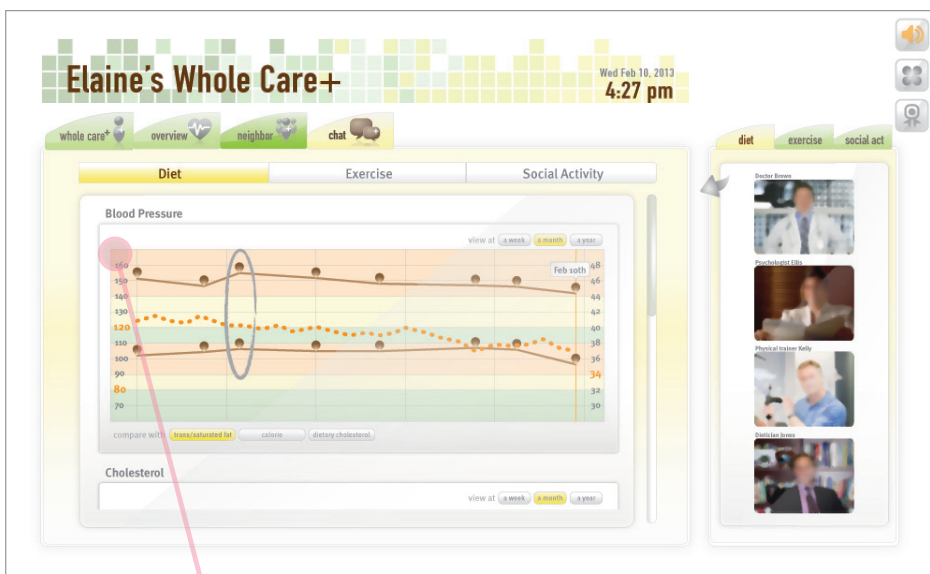
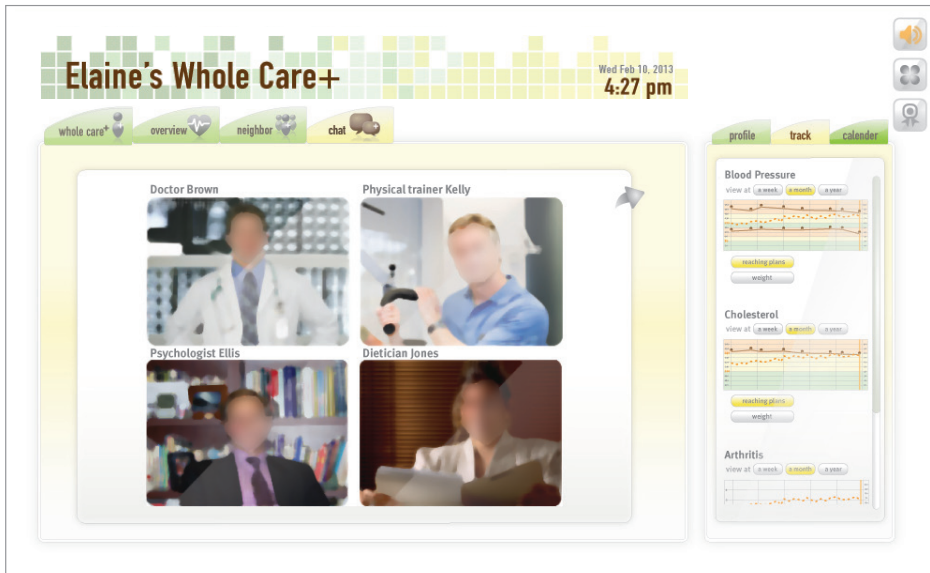
## Overview & Feedback

>> competition group: motivating Elaine to achieve her daily goals by competing with her close neighbors



>> requesting a chat session with Whole Care+ caregivers to overview and get feedback with holistic insights

The screenshot shows the 'Elaine's Whole Care+' interface with the 'Request for Chat' form open. The form is titled 'Request for Chat' and has a 'send' button. It contains several sections: 'When do you want to chat?' with a 'Now' button and a 'date' dropdown; 'With whom do you want to chat with?' with four options: 'Doctor Brown', 'Physical trainer Bruce', 'Dietician Jones', and 'Psychologist Ellis', each with a small photo; 'What do you want to report?' with three options: 'Smart Care+ Plans & Journals', 'Diet', and 'Exercise'; 'Health Issues' with four options: 'Blood Pressure', 'Blood Cholesterol', 'Arthritis', and 'Breast Cancer'; and a 'Note' field. The 'send' button is at the bottom right. The background shows the same interface as the previous screenshot, but the 'Request for Chat' form is the primary focus.



» receiving holistic feedback on her daily routines in relations to health conditions from the caregivers



## *Video Sketch*

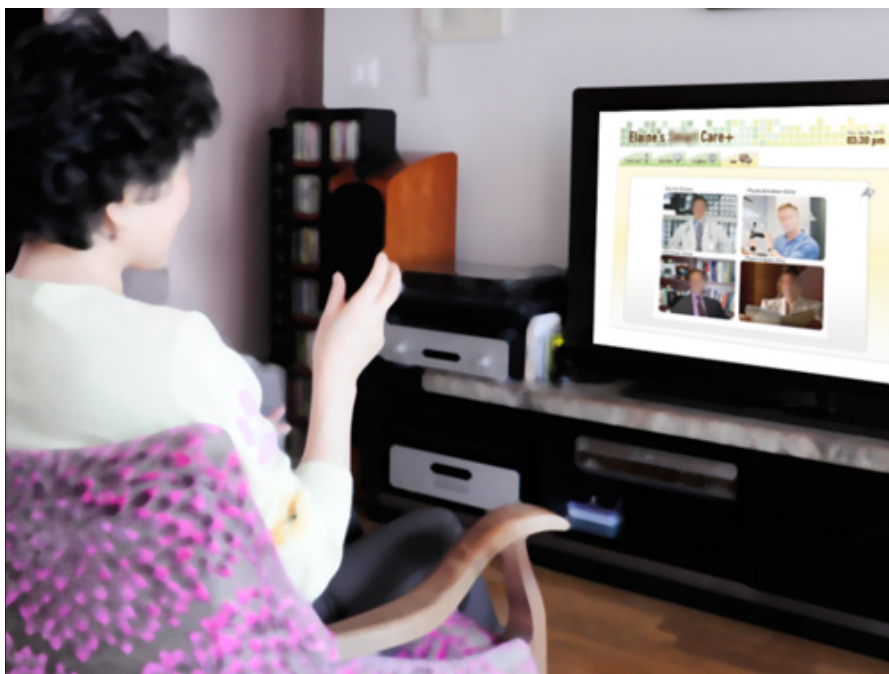
In order to promote audiences' understanding on how the Whole Care+ works in various situations, we created a video sketch where Elaine manages her health care with the system in her daily lives. The video sketch is based on the four scenarios of use, from “Set-up” to “Overview & Feedback”, on which the wireframes and visualizations in the previous processes were built.

Below are screen shots taken from the video sketch. In the video sketch, you will see Elaine manages her health with Whole Care+ within her ordinary daily routines where she confronts specific needs in regard to her health conditions.

### *Set-up*



Elaine can use an optional voice function to read text on the screen. Then she inputs her profile and health information by either typing a keyboard or speaking out.



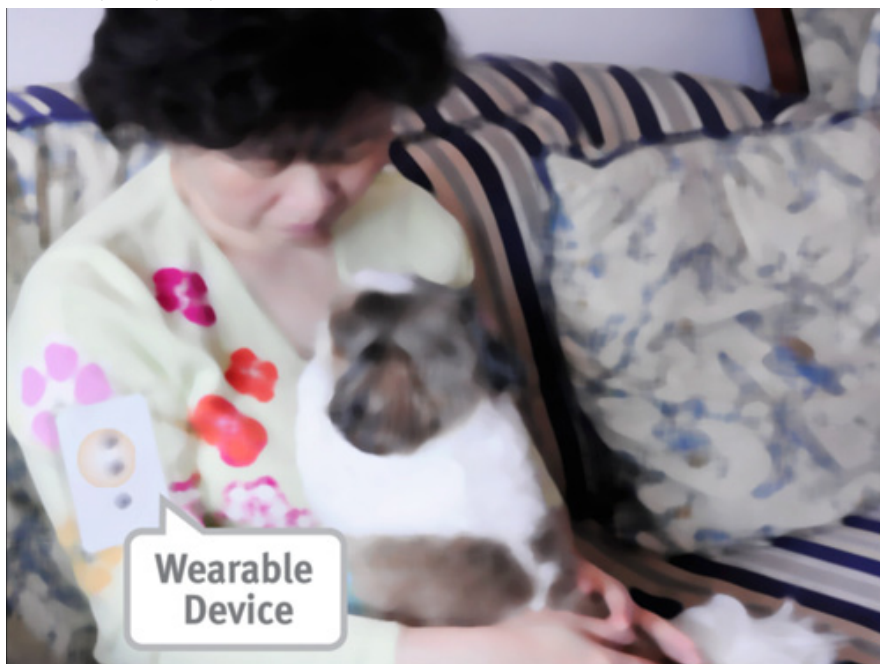
Elaine chats with Whole Care+ caregivers through camera.





After a deep conversation, Whole Care+ caregivers designate Elaine's daily plans for diet and exercise. Elaine can select each of the plan to see more detailed information or use the voice function to read the text.

## *Healthy Lifestyle: Diet*



The Care+ Buddy pings to remind Elaine about today's lunch plan.



The device speaks out the push note. Then Elaine selects a check button on the screen to see her lunch plan.



Elaine checks her lunch plan on the TV screen.

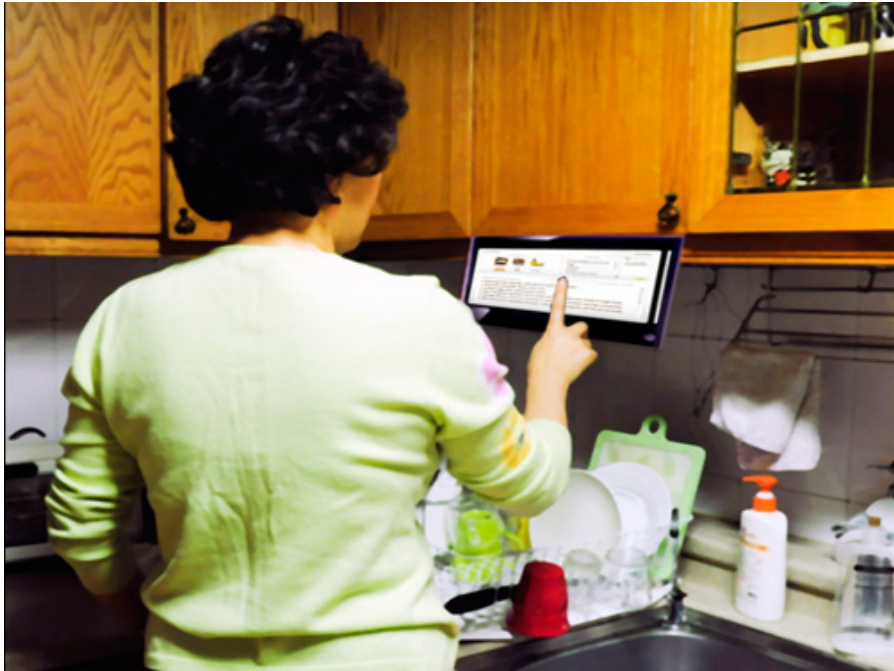


She drags and drops the menus into a box which she wants for her lunch. For each selected menu, the system speaks out its information such as name and calories.

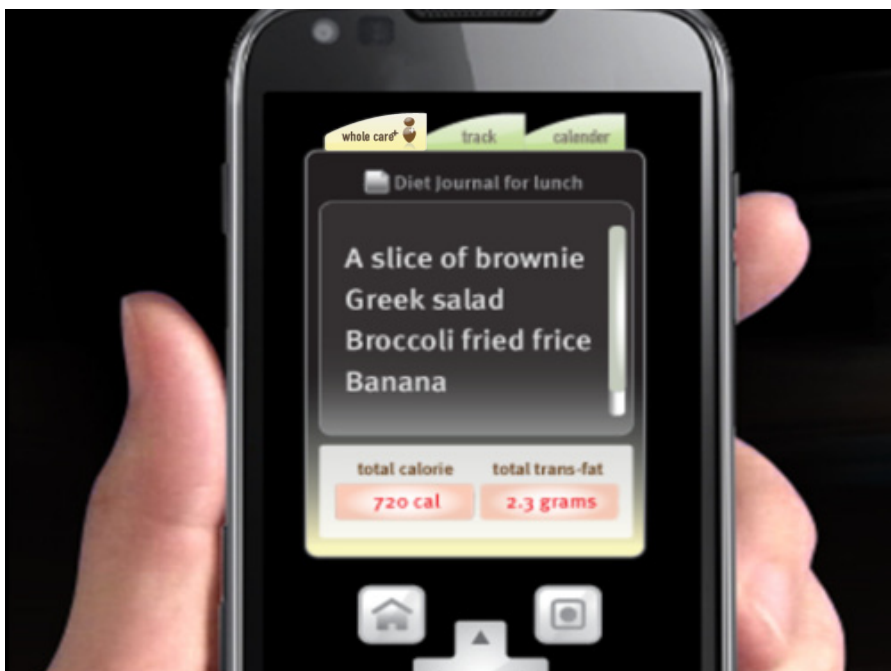
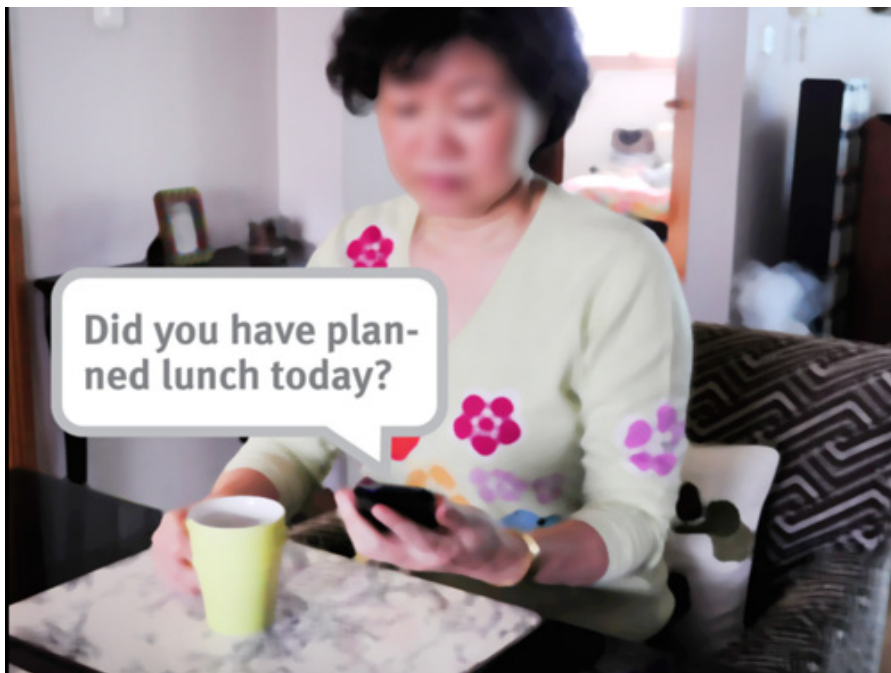


In a grocery store, Elaine checks the ingredients for her lunch on the wearable Care+ Buddy. She can use a voice function to listen to a list of ingredients one by one.





Elaine is in the kitchen to cook. For the selected menu, the screen shows its ingredients and recipe. The system also reads the recipe step by step as she cooks.

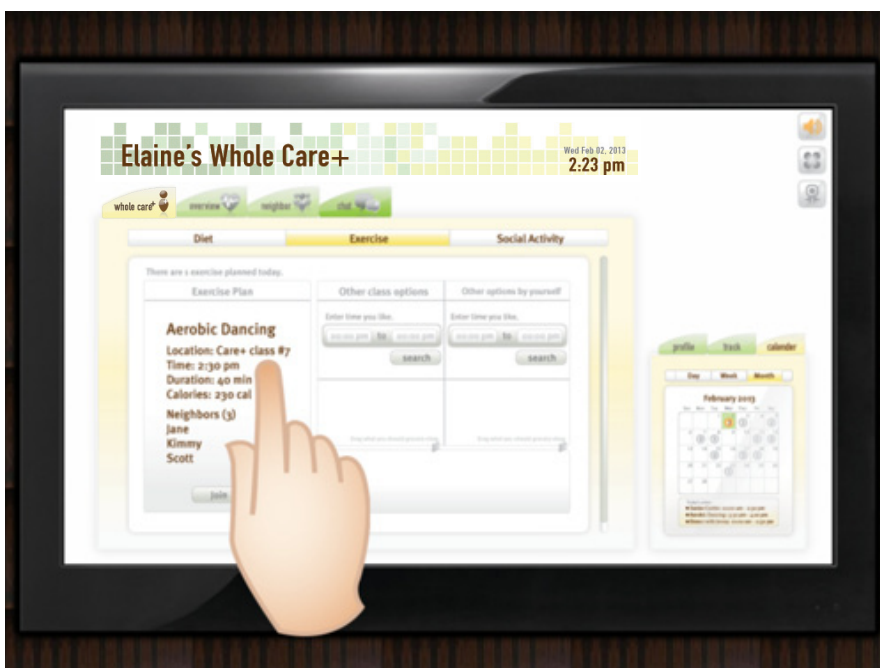


After lunch, the Care+ Buddy asks Elaine what she had for her lunch. She logs what and how much she had for her meal simply by voicing out to the device. Then the system stores the data into a secured data base.

## *Healthy Lifestyle: Exercise*

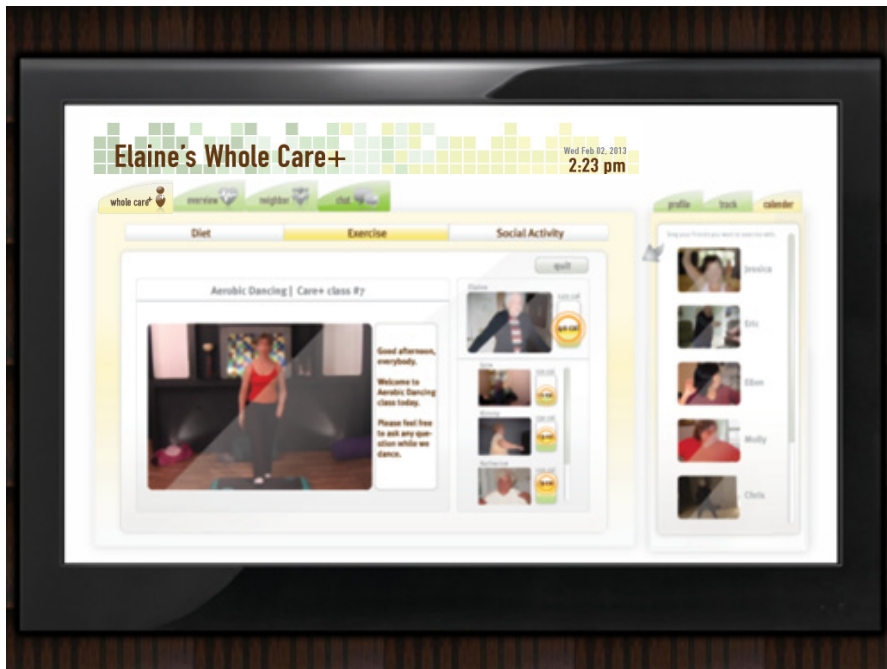


The Care+ Buddy pings her with a push note to notice an appointed aerobic dancing class .



Elaine checks the details for the aerobic dancing class this afternoon. If she wants other options for her exercise, she can always search for alternatives.



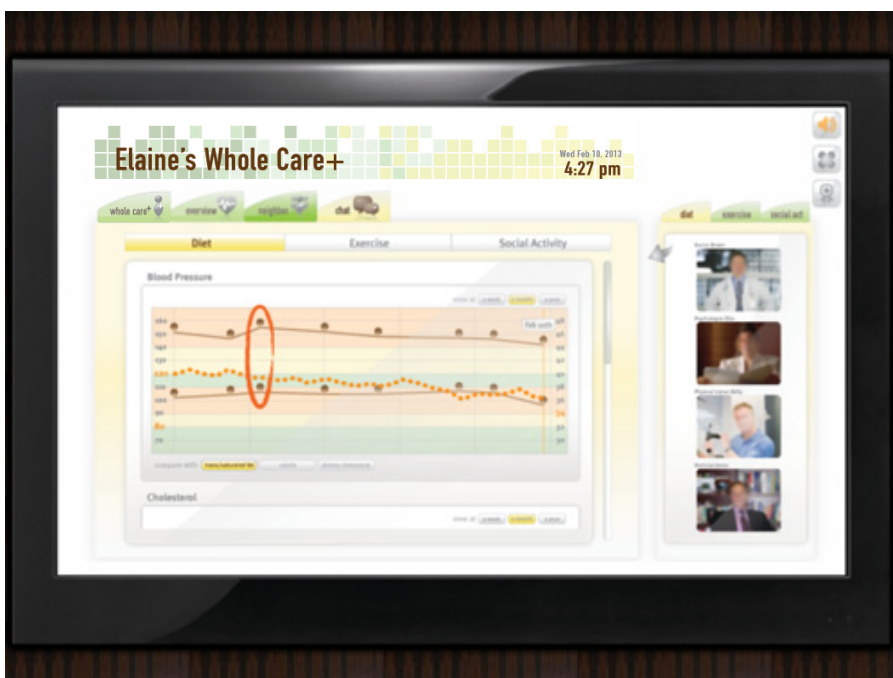


An instructor and participants can see each other dancing through camera. Elaine follows movements of the instructor and the instructor gives her feedback to motivate Elaine to be more dynamic.

## Overview & Feedback



Elaine checks the change of her blood pressure and cholesterol over time through an easy-to-read graphic. She can compare these to how she has done with her daily activities so that she can improve her lifestyle to healthier habits.



Elaine consults with Whole Care+ caregivers about her health issues and get feedback on her daily activities from them with holistic insights. In addition, they may revise Elaine's daily plans to make it more customized.

## *Final Presentation*

Before finalizing our thesis project, we had another chance to show our thesis works to and get feedback from the public. The Design Department at Carnegie Mellon university planned to hold a second poster session where graduate students were to present what they had researched, found and developed for past 8 months for their thesis projects to audiences. It was a great opportunity for the students in that they could not only show their hard-worked projects but attain diverse insights from visitors with various disciplines. Followed by the poster session opened to the public, there was a jury presentation time where each student presented their thesis work in front of a designated jury team composed with three faculty members.

We had a final poster of the Whole Care+ describing about the project goal, concept of the system, persona and scenarios of use. Then we had a laptop set up beside the poster for the video sketch to help visitors understand better about the system. Below is the poster of the Whole Care+, titled as “Health Foci”, which helped us start conversations with visitors.

# Empower the elderly with a new model of Health Care

# HEALTH FOCI

How a new model of health care system can help the elderly be empowered and age healthy in their home?

## PROJECT GOAL

The goal of this project is to help the elderly maintain healthy lifestyles as well as autonomy in health care while they pursue an independent living in their home. Through this new model of Whole Care+, they can better manage their health by active participation in their health care activities and timely interaction with care givers.



## A NEW MODEL OF HEALTH CARE: {WHOLE CARE+}

with user-friendly voice & graphic interface for the elderly living at their home

### Health improved by healthy habits

Health is affected heavily by daily routines and lifestyles, and one person, for the majority, only manages to stay in or out of improving their health by making habits. The system helps by providing a proactive and active in their health care activities.

### Healthy Lifestyle

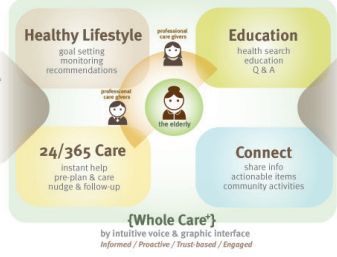
The elderly can be proactive in their health by setting goals, monitoring daily activities & health data, and getting feedback & suggestions from care givers on their progress to maintain healthy habits. The system enables them to change their daily routines by healthier habits. The system enables them to manage such health care in an appropriate way.

### Care givers as a buddy

In order to provide an independent living, it is critical for the elderly to be able to get an appropriate monitoring from care givers. The system can provide a buddy who always talk with them and provide feedback for health care.

### 24/365 Care

Whenever they need, professional caregivers (nurses, doctors, etc.) provide instant help and care, and pre-plan proper actions in a timely manner. The caregivers consistently monitor them for any emergency to maintain health and follow up with things in their health care.



### Enlightening of what they know

The elderly lack knowledge about their health issues and the ways to avoid them from making their health. The system helps them learn from their patient experience and professional health resources.

### Education

The system educates with general & professional knowledge about their health issues and healthy lifestyles.

### Socially active

Being socially active is an important part of the elderly's health. However, they often lack the ability to do so. The system helps them to be more active in their social and being significantly interactive in their life.

### Connect

The system creates social connection avenues for the elderly's social well-being.

## PERSONA

**Name:** Elaine  
**Age:** 75  
**Living alone** (Living by herself at her house)  
**Health Status:** A breast cancer survivor / High blood pressure / Cholesterol / Arthritis / Complete (long-term) memory loss, using the system as a communication channel

**What she needs**

- Knowing more about her current health issues.
- Finding the ways that are good for her to live well.
- Enjoying daily activities like eating and exercising.
- Preventing from being in accidents.
- Improving healthy mental ability.
- Being motivated to take care of her health.
- Being herself active in her health.

## SCENARIO OF USE & VISUALIZATION

### 1. Set-up with Whole Care+

**Health track**

- In downloading a sample health care app from the app store.
- In downloading the app from the app store.
- Elaine uses a while tracks her blood pressure and cholesterol for monitoring. Then the system stores the data into a secured database.
- In downloading the app from the app store.
- In downloading the app from the app store.
- In downloading the app from the app store.

**Setting plans**

- Elaine consults with professional care givers, based on the system, reviewing her health issues and setting daily goals which may help her health get improved.
- In downloading the app from the app store.
- In downloading the app from the app store.
- In downloading the app from the app store.

### 2. Healthy lifestyle: Whole Care+ Diet

**System suggestion on lunch**

- In choosing today's lunch plan from the system.
- In choosing today's lunch plan from the system.
- In choosing today's lunch plan from the system.
- In choosing today's lunch plan from the system.
- In choosing today's lunch plan from the system.

**Preparing lunch with Whole Care+**

- In a new grocery store, Elaine can easily shop with Whole Care+ as it shows medical materials through graphs and data. When she shops, a small screen at the kitchen shows the list of the items, enabling her to shop more easily by eye.
- In a new grocery store, Elaine can easily shop with Whole Care+ as it shows medical materials through graphs and data. When she shops, a small screen at the kitchen shows the list of the items, enabling her to shop more easily by eye.
- In a new grocery store, Elaine can easily shop with Whole Care+ as it shows medical materials through graphs and data. When she shops, a small screen at the kitchen shows the list of the items, enabling her to shop more easily by eye.

### 3. Healthy lifestyle: Whole Care+ Exercise

**System suggestion on exercise**

- In downloading the app from the app store.
- In downloading the app from the app store.
- In downloading the app from the app store.
- In downloading the app from the app store.
- In downloading the app from the app store.

**Virtual aerobic dancing class**

- By attending a virtual aerobic class provided by the Whole Care+, Elaine can safely exercise inside her house. The class motivates her to be more active as she can see other attendees exercising through video as well as their energy levels while dancing.
- In downloading the app from the app store.
- In downloading the app from the app store.
- In downloading the app from the app store.

### 4. Journaling & Overview

**Reminder & journaling**

- After lunch, Elaine tells to the Care+ Buddy what she had for lunch. By logging daily routines, the system can improve the relationship between Elaine's lifestyle and health condition over time.
- In downloading the app from the app store.
- In downloading the app from the app store.
- In downloading the app from the app store.

**Overview & feedbacks**

- Whenever Elaine wants, she can chat with Whole Care+ caregivers who have the idea about her health issues and get health feedbacks on her daily routines.
- In downloading the app from the app store.
- In downloading the app from the app store.
- In downloading the app from the app store.



Overall responses from the visitors were positive and some of them showed excitement in regard to the holistic approach and actual need for such a system. They acknowledged hardships that the elderly encounter when living independently as well as perceived potential benefits of the Whole Care+. However, people raised open-ended, worrisome questions toward the system, mainly from the faculty jury. Below are the questions and feedback we could gain during the presentation.

- *The Whole Care+ can be too intrusive in the elderly's daily lives, which may make the users hate or not use the components of the system including colors, voices and graphics.*
- *How will we deal with the reality where people are prone to lie about what they have not done in regard to their health care activities to doctors? We should take highly-possible dishonest behaviors of the users into account in contrast to the idealistic Whole Care+ world shown in the video sketch.*
- *We should focus rather on a small part of the system than the system as a whole in order to develop more concrete and realistic health-care system for the elderly.*

## *Future Works & Challenges*

With the feedback and questions from the poster session, we recognized that there are challenges for the Whole Care+. There are some significant cultural, behavioral and situational issues that need to be addressed to ensure our holistic system will be adopted and used in the manner intended. Now that we have developed a firm concept, visualization of the screens and interactive components of the system, we need to select and focus on one or two major components of the system in the future process. By starting with a critical part of the system, we may be able to develop more practical and realistic health care system in detail.

On top of that, extended user research is needed to validate usability and effectiveness of the system as well as to see which components can be prioritized over the others in the future works. The user research should be designed in a way which the elderly participants are able to utilize the Whole Care+ in various given situations in a home setting. Considering that the Whole Care+ visions to be realized through Smart Home technology after at minimum five years from now, there will be challenges in designing a Smart Home setting in the research as well as in asking participants to be familiarized with such futuristic environment.

However, although there may be difficulties and challenges in elaborating the Whole Care+, we have a great deal of opportunities to further develop the system in more concrete and practical way. With more time and resources, the

project will be continued to a next level of development.

Besides proposing concrete solutions, the fact that our research uncovered the lack of recognition for a holistic system integrating health in medicine and daily activities as well as addressing physical, mental and social wellness. Hopefully, this research and the findings are corroborated with additional research so that more resources are directed to this complex problem.



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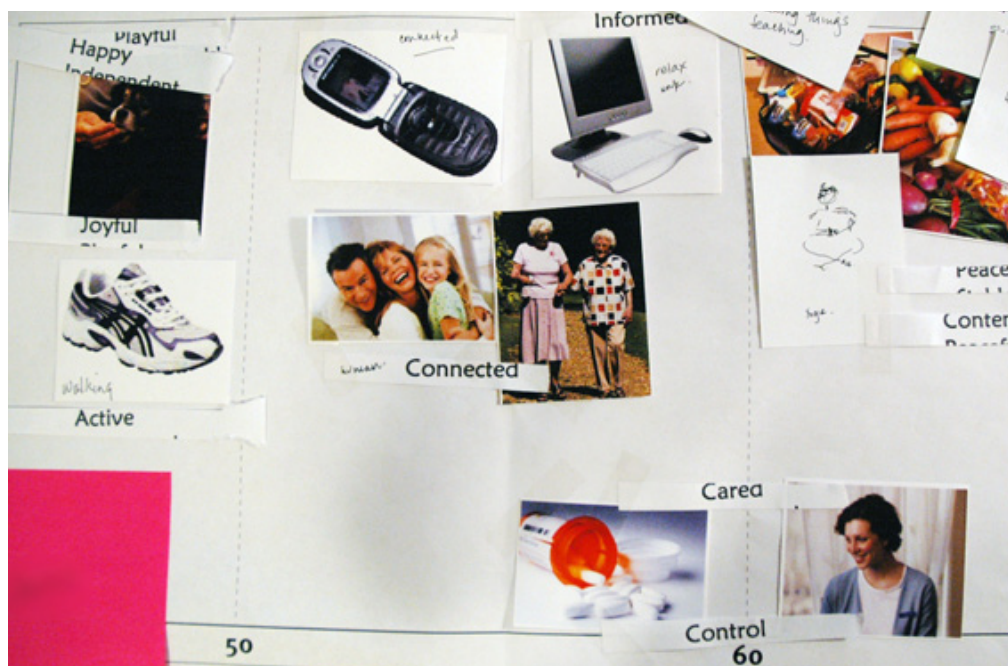
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### **Images shown in the prototypes/video sketch were used from sources below:**

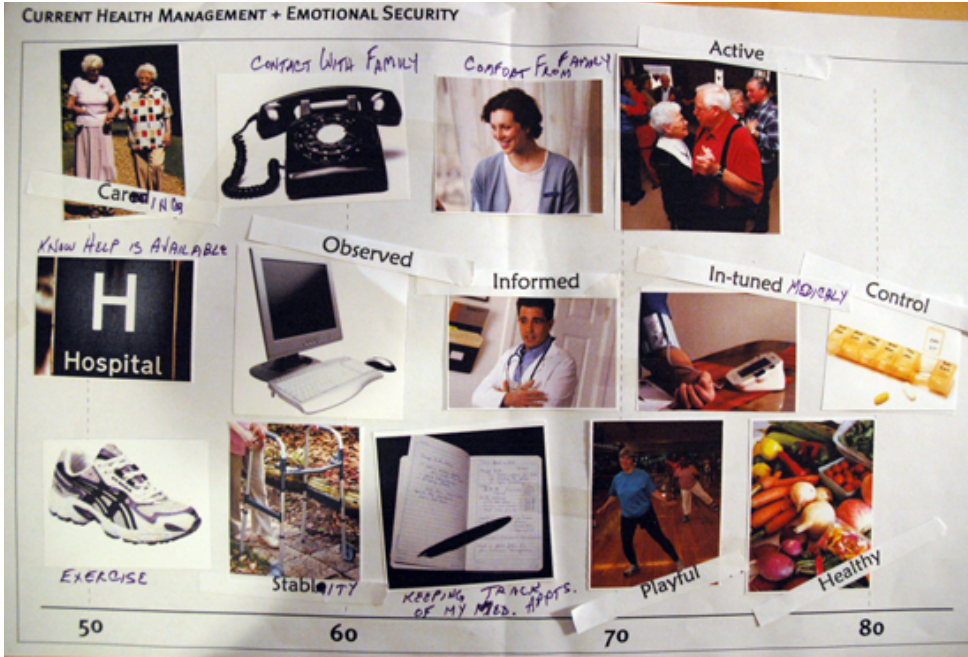
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	Emergency call	Learning	Monitor behaviors	Helping with mental impairment	Helping be proactive	Social connection	Tracking objects	Communication	Reminder for daily routines	Tracking health info
Smart home	30UBOT-5	30HEALTH GUARD PH56000	30THE iSHOC						30MIRROR MIRROR	30Elderly Assessment of Elderly Activities
	30UBOT-5	30HEALTH GUARD PH56000	30THE iSHOC						30MIRROR MIRROR	30Elderly Assessment of Elderly Activities
	30UBOT-5	30HEALTH GUARD PH56000	30THE iSHOC						30MIRROR MIRROR	30Elderly Assessment of Elderly Activities
Internet-based	30HEALTH GUARD PH56000	30HEALTH GUARD PH56000	30THE iSHOC						30MIRROR MIRROR	30Elderly Assessment of Elderly Activities
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Small digital device	30UBOT-5	30HEALTH GUARD PH56000	30THE iSHOC						30MIRROR MIRROR	30Elderly Assessment of Elderly Activities
	30UBOT-5	30HEALTH GUARD PH56000	30THE iSHOC						30MIRROR MIRROR	30Elderly Assessment of Elderly Activities
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DIAGRAMS CREATED BY PARTICIPANTS  
DURING THE PARTICIPATORY RESEARCH SESSION 1







DIAGRAMS CREATED BY THE PARTICIPANTS  
DURING THE PARTICIPATORY RESEARCH SESSION 2

