

Research on Service Design of Home-based Elderly Care for the Mildly Disabled Elderly in Chengdu Chongqing Area

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Abstract. In order to cope with the aging and empty nest trend, improve the quality of life of the disabled elderly, and enhance the experience and satisfaction of home care products and services. This article investigates the daily status and needs of mildly disabled elderly people in the Chengdu & Chongqing region with methods such as questionnaire survey, in-depth interviews, natural observation, literature review, big data mining and analysis, design testing and evaluation, and then analyze the characteristics of existing products in the market, and apply research on natural interaction technology and emotional design theory. Through theoretical application research, research, and experimental testing, the aging design strategy, methods, and principles of intelligent products were obtained. Through practice, a set of home-based elderly care service products and interface design solutions for the mildly disabled elderly in the Chengdu & Chongqing region were proposed. The aging design strategy can to some extent improve the experience and satisfaction of elderly people using intelligent products.

Keywords:The disabled elderly, home-based elderly care, aging design, service design, interaction interface.

1. Introduction

Against the backdrop of deepening aging, China's elderly care problem is facing severe challenges such as large population size, fast growth rate, heavy burden of elderly care, and difficulties for disabled elderly care. The Report on the Work of the Government in 2022 proposed: "actively respond to population aging and promote high-quality development of aging cause and industry". It can be seen that coping with social aging has become a national strategy. [1]According to the seventh national population census data, there are currently 260 million elderly people over 60 years old in China, with 46 million disabled and semi disabled elderly people. It is expected that by 2057, the number of disabled and semi disabled elderly people over 65 years old in China will reach around 80 million. Due to the physical and intellectual factors of the disabled elderly, there is a rigid demand for elderly care services. How to provide efficient services for the disabled elderly with personalized needs is an urgent problem to be discussed and solved in service design.

As early as the middle of the 20th century, the design discipline has emerged eight design concepts involving the elderly, including barrier free design, universal design, cross generational design, accessibility design, inclusive design, elderly well-being design, universal design, and elderly service design[2]. At the same time, among developed countries that are aging, the UK has taken the lead in developing a community-based and non-profit organization assisted community care and elderly care model. Japan promotes elderly care services that involve volunteers, civil society organizations, and businesses. Australia has established a dedicated department for elderly care services. With the improvement of reform, developed countries abroad have gone through a process of institutionalization, de-institutionalization, and home care services. The home care service system has been basically sound, achieving diversified supply entities and networked service processes. [3]Unlike community care centers in Western countries, the concept of home-based elderly care in China was initially proposed based on family support obligations, and it was only in the later stages that the development of community service industry became an opportunity. In recent years, China's urbanization has developed steadily and rapidly, establishing a framework for the elderly care industry that is "home based, community based, and institutional supported". The "9073" elderly care service model has been formed, gradually achieving a

home-based proportion of 90%, community-based proportion of 7%, and institutional based proportion of 3% among the elderly care population[3-5]. Influenced by traditional Chinese elderly care concepts, some urban mild disabled elderly with self-care abilities tend to prefer home based elderly care. In addition, the development of professional elderly care institutions is lagging behind and the cost of elderly care is high. The home-based elderly care model has gradually become the mainstream model to solve the problem of mild disabled elderly care in Chinese cities. Since 2020, the COVID-19 has broken the global “two points and one line” institutional work service model and presented a passive home-based state and dotted distribution trend, which provides new exploration ideas and design perspectives for China’s home-based elderly care services. Based on the experience of home based elderly care services abroad and the national conditions of China, the government led home based elderly care service system in China still needs to improve the effectiveness of service resource integration, strengthen the correlation construction between communities and internet service platforms, use interaction as the medium, uphold the people-oriented concept, and actively explore the core needs and personalized service measures of the disabled elderly group.

At present, the Chengdu & Chongqing region in China is in a stage where measures and mechanisms to address aging are not sound, and aging has a potential impact on economic development. It is facing an increasingly serious situation of “getting old before getting rich”[1]. According to think tanks, the Chengdu & Chongqing urban agglomeration will enter a stage of ultra deep aging by 2030. Against the background of the construction of the “Chengdu & Chongqing Double City Economic Circle” and on the basis of steady economic development, the Chengdu & Chongqing Double City Government still needs to actively respond to the call of the higher-level government, explore the path of intelligent products to promote the development of the home care service system, and release some market labor force, increase product added value and market competitiveness by providing potential breathing services for home caregivers .

With the development of technology driven and artificial intelligence, the research on service design for the elderly at home and abroad has moved from traditional to technological, with more emphasis on improving the user experience of the elderly. These studies, or focus on the development of experimental interaction design technology, explore and intervene the needs of elderly users through research, integrate services into products, and improve the usability of products; Or focus on user experience design, use participant design, reorganize the key contacts of elderly service, and rely on informatization and networking to create and plan the service system architecture; Or focus on using persuasive design methods for human-computer interaction and interface design. Although the research focuses on different directions, they have all carried out a certain degree of knowledge integration and integration innovation from the perspective of designers, providing important references for the establishment, improvement, and innovation of the elderly home care system. However, there is a lack of in-depth research and analysis on the experience and needs of disabled elderly people using intelligent products, and the integration of intelligence and experience needs to be further improved and improved.

2. Basic Methods and Theoretical Applications

2.1 Introduction to Basic Methods and Theory

This article first conducted market and user research and analysis through big data mining, questionnaire interviews, and other methods. Then, based on natural interaction and emotional design, a design plan containing functional products and platforms[6] was proposed. The round product design, interface layout, and decoration are simple, generous, and friendly, which can enhance the trust and willingness of the elderly to interact with the product, and promote the development of the perception cognition action interaction process. The touch screen interface and voice, fingerprint, and expression recognition functions[7] match interaction and skills, reduce learning difficulty, improve operational fluency, and thereby improve the pleasure of user

interaction experience and satisfaction with the product. This provides the possibility for the product to positively guide user cognition and behavior, reshape family roles, and create a good system of services for the elderly at home.

2.2 Natural interaction

The concept of natural interaction mode originates from the field of human-computer interaction, namely the so-called natural user interface. It breaks away from the shackles of mouse and keyboard[8], and operates computers based on the most natural operation mode of users. With the development and popularization of technology, machines have gradually become a natural extension of the human body[9], and natural, intuitive, and psychological interaction methods have become the trend.

For the natural interaction of elderly people with mild disability, the key word and focus should be on “home”[10], amplifying the core functions of energy conservation, and saving the physical and mental energy of the elderly during use. At present, the natural interaction design based on smart home has problems such as low accuracy, lack of reasonable feedback, and user understanding differences. In order to achieve the interaction between the elderly and the product more accurately and efficiently, designers should strengthen the research on users, tasks, time, and environment, understand the interaction objects in their own positions, and transform the demand points discovered into design points to create multisensory, multimodal[10] and strongly correlated interactive product information output and experience, improving the coupling and coordination between users and product services.

2.3 Emotional Design

The term ‘emotional design’ originated from Donald Norman’s work of the same name, which focuses on the emotional needs of users and belongs to the design concept of “people-oriented”[11]. One of the currently recognized theoretical systems for emotional design is the three-level theory proposed by Norman. Compared with the traditional humanized design from a rational point of view, the emotional service design of products for the elderly focuses more on the emotional factors. It is not a specific technical problem, but a concept and attitude that guide us to put ourselves in others’ position. According to Norman’s “Emotional Design Hierarchy Model”, the cognitive processing of elderly users is divided into three levels: instinctive level, behavioral level, and reflective level. The first two levels of emotional design are both the immediate feelings that the product itself brings to the elderly, while reflective level design is the continuous emotional projection that the product brings to the elderly. It promotes the establishment of long-term relationships between the product and users, increases user loyalty to the product, and generates long-term effective emotional release[12]. Therefore, emotional design for elderly people with mild disability still requires more effort at the level of reflection, increasing the emotions and connotations attached to the product, so that the product can truly transition from a useful and user-friendly design to a design that users want to use[6].

3. Research and Analysis on the Design of 2 Intelligent Home-based Elderly Care Products

3.1 Overview of Intelligent Home-based Elderly Care Products

From a macro perspective, socialism with Chinese characteristics has entered a new era, and the main contradiction in our society has been transformed into a contradiction between the growing needs of the people for a better life and imbalanced and insufficient development. In terms of the silver economy, it is expected that the market size of China’s elderly care industry will exceed 16 trillion yuan by 2027[4]. In the current situation where the contradiction between supply and demand for elderly care and the “digital divide” problem is increasingly prominent, intelligent home

care products use electronic information technology to optimize resource allocation efficiency and improve the quality of elderly care services, becoming an important means for China to solve the elderly care problem. However, China's intelligent elderly care products are still in the exploratory stage, and the most prominent issue at present is the contradiction between the increasing elderly care consumption capacity and market demand, and the low efficiency and severe two-stage differentiation of China's intelligent elderly care products[5].

3.2 Problems and Factors in Intelligent Home-based Elderly Care Products

Through data collection and network analysis, it was found that intelligent elderly care products for disabled elderly people have the following problems:

(1) Disabled elderly people generally do not understand intelligent products. On the one hand, due to the lack of recognition of concepts, market distrust, and the fact that most disabled elderly people with physical disabilities rarely actively seek employment after retirement[13], their social connections are reduced; On the other hand, as the elderly age, their progressive aging worsens, their self-care ability and social relationships weaken, and they gradually become disconnected from society. With the popularization of the Internet and the need for epidemic prevention and control, some disabled elderly people have increased their awareness of cloud services, but they have certain difficulties in understanding, selecting, trying, and purchasing intelligent products on site.

(2) Disabled elderly people have obstacles in using intelligent products. On the one hand, due to the fact that most elderly people have not been exposed to intelligent products during their youth and middle age, their learning ability weakens and their ability to accept new things decreases as they age. In addition, multiple impairments such as visual, auditory, verbal, and physical impairments caused by physical disabilities, intellectual decline, and progressive aging, such as inability to remember operating procedures due to memory decline, make disabled elderly people more likely to experience perceptual and cognitive impairments in the "access use feedback" process of intelligent products, resulting in psychological disparities and gradually developing negative and repulsive emotions towards intelligent products, ultimately becoming "digital refugees"[14]. On the other hand, the insufficient aging adaptation of current intelligent products has increased cognitive friction during the use of products by the elderly, which can easily exacerbate their fear of technology[15] and lead to usage barriers.

The main reasons for the above problems are as follows:

(1) The elderly have low willingness to learn, limited learning opportunities, and insufficient learning channels. Since the reform and opening up, China's population mobility has become stronger, the original concept of "filial piety" culture has weakened, and the phenomenon of intergenerational separation[16] has intensified. The children of the elderly have less leisure and patience to lead them to understand intelligent products, making it difficult to help the elderly proficiently use the functions of intelligent products to solve comprehensive problems in life[14]. Due to the physical factors of disabled elderly people, they cannot obtain learning opportunities and information exchange through huddling for warmth like normal elderly people, which increases the difficulty of learning both objectively and subjectively.

(2) Intelligent elderly care products have high prices and low practicality[10]. From the perspective of Porter's Five Forces Competition Model, as one of the major trends in the future of the elderly care industry is intelligence, even traditional mechanical products as substitutes will further weaken their threat to intelligent products; In terms of upstream and downstream, suppliers with core technologies have strong bargaining power, and buyers have significant bargaining power. At the same time, the country is gradually increasing its financial support for the field of intelligent elderly care, posing a significant threat to potential entrants[17]. Throughout the market, the intelligent product market has low concentration ratio, serious homogenization[16] and fierce competition. Most smart products on the market have multiple functions but are not precise, and are

expensive and not very practical, resulting in situations where the elderly and middle-aged children share sports bracelets, and children's smart speakers with grandchildren.

(3) Intelligent products have fast iteration, complex functions, and are difficult to operate, lacking emotional integration with disabled elderly people. Regarding the development prospects of intelligent elderly care products, the movie "Robots and Frank" expresses an optimistic attitude, while the animation "Old Man Z" raises the common question of "valuing the life of the elderly while neglecting the natural emotions of the elderly who are also members of humanity". For the disabled elderly, in addition to the basic needs of daily care and health care, they also need a safe and comfortable living space, perfect scientific medical conditions and normal and pleasant life experience, which puts forward higher requirements for smart aging products to adapt to today's active aging[15].

3.3 Analysis of Market Competitors for Intelligent Elderly Care Products

According to the demand graph analyzed by the "Ocean Counting" big data platform, among the words with the highest correlation and fastest increase with "elderly products", "elderly products", "middle-aged and elderly products", and "elderly care products" all rank in the top six, with the total index far exceeding the top ranked terms. This indicates that people generally pay high attention to elderly products. According to the analysis of the geographical distribution of population portraits in the Baidu index, it can be seen that compared to other provinces, the population in Sichuan has a higher level of attention to elderly products.

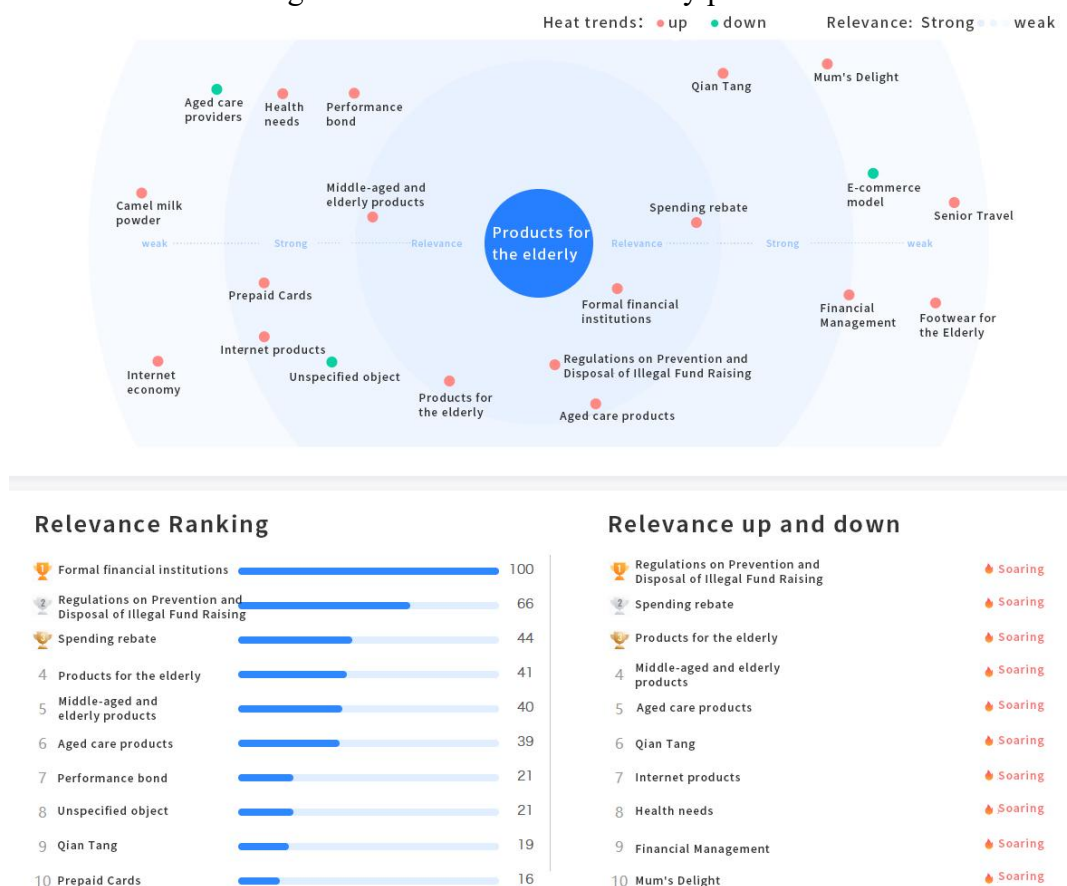


Figure 1 Big Data Analysis of Words Related to "Elderly Products"



Figure 2 Regional Distribution of Search Population for “Elderly Products”

In this article, smart monitoring products, smart pillboxes and smart home products are selected for comparison and analysis in three aspects: safety monitoring, medication taking and smart companionship[5], with respect to the level of needs and applicability of home care for the elderly with disabilities. It is found that currently, smart elderly care products in the domestic and foreign markets have strong substitutability, low cost-effectiveness, and poor quality.

Table 1. Competitor analysis of smart ageing products

Analysis Type		Advantages	Disadvantages
Intelligent monitoring products	“Love on your back” bracelet	Affinity calling, multi-mode positioning, one-touch help, affordable, easy to learn, easy to press	Slow and inaccurate positioning, high power consumption, not waterproof, ugly interface, not suitable for setting
	“Settle” bracelet	Focus on health testing with good quality and accuracy	Expensive
	360 Health Watch	More features at an affordable price	Marketed towards children
	MiDOT Health Watch, Honor Bracelet	More features and better quality	Marketed to young and middle-aged people, with a bias towards sporting functions
	Healthbox Vitals	Advanced smart terminal with non-contact detection for in-bed monitoring of the elderly	Primarily for medium and large organisations, not for individual consumers
	BioBalance Patch	Mobile monitoring, lightweight and easy to attach, waterproof and wirelessly rechargeable	Not very accurate
	Heartbeat Lite Smart Signs Monitor	Through big data mining, a medical model is derived, and after customer information interaction, an individualised health model is derived to give a	Higher prices

		comprehensive health assessment and operational personalised nutrition and exercise advice	
Smart Pill Box	HiPee Smart Pillbox	Stylish and compact, can be tied to WeChat, set up a medication schedule through the WeChat app and have regular reminders in bins	Poor timing and low value for money
	Bingzhu Smart Chinese Medicine Box	Large capacity of herbal box, automatic dosing, regular reminders by WeChat, visualisation of dosage records, long battery life	There is a requirement for pill diameter and each machine can only intelligently dispense one type of medicine
	Aihui Health Care	Automatic medication dispensing, medication reminder from slow to urgent, large touch screen with colourful fonts, code recognition and automatic medication entry, password protection + quick access to avoid misuse, easy to understand	Expensive
Smart Home	Intelligent ground for Digital Diffusion Technology	Real-time, accurate movement data collection under carpets, floors and mats in the home	Limited scope of collection
	Enabot intelligent companion robot	Intelligent accompaniment with both monitoring functions, fixed-point security, automatic cruising, support for remote control operation, multi-user login, two-way bionic interaction and lower price	Limited shooting angles, no video playback support, only on flat ground, cannot cross 1m mats
	Long-necked cat robot	Wide screen with mobile dock, minimalist desktop, automatic video connection, support for remote screen control and monitoring of movement tracks, rich age-appropriate applications for added enjoyment	Poor signal and pixels, needs to be plugged in, high price

4. Research on Mild Disability Elderly and Their Home-based Elderly Care Needs in Chengdu & Chongqing Region

4.1 Definition of the mild disability elderly in cities

In this article, the mild disability elderly in cities refer in particular to these people who have lost their ability to take care of themselves, called "disabled elderly people". According to internationally accepted standards, eating, dressing, getting in and out of bed, using the restroom, indoor mobility, and taking a shower are defined as "mild disability" if one or two indicators cannot be achieved.

4.2 Research Purpose and Content

The disabled elderly is divided into disabled elderly, semi disabled elderly, dementia elderly, and self-care elderly. The core group of this study is the lightly disabled elderly aged 55-80 in urban areas of Chengdu and Chongqing. This study aims to design interactive products that are more inclusive and meet the specific needs of the target group through user research.

4.3 Survey Method Design

The study used questionnaire survey, interview, observation, copywriting survey, and data collection methods. Firstly, a questionnaire survey was conducted. Through the accumulation of relevant literature and divergent thinking, non-scale questionnaires were designed and adjusted from three perspectives: disabled elderly, children, and service personnel. Basic information and elderly living conditions of disabled elderly were collected, and demand research was conducted from three aspects: life services, medical care, and social entertainment[6-7]. Then, using interview and observation methods, interviews were conducted with elderly people who cooperated in entering the household to observe the behavioral habits of disabled elderly people and explore their potential needs. Finally, further mining and analysis will be conducted through big data to form user profiles.

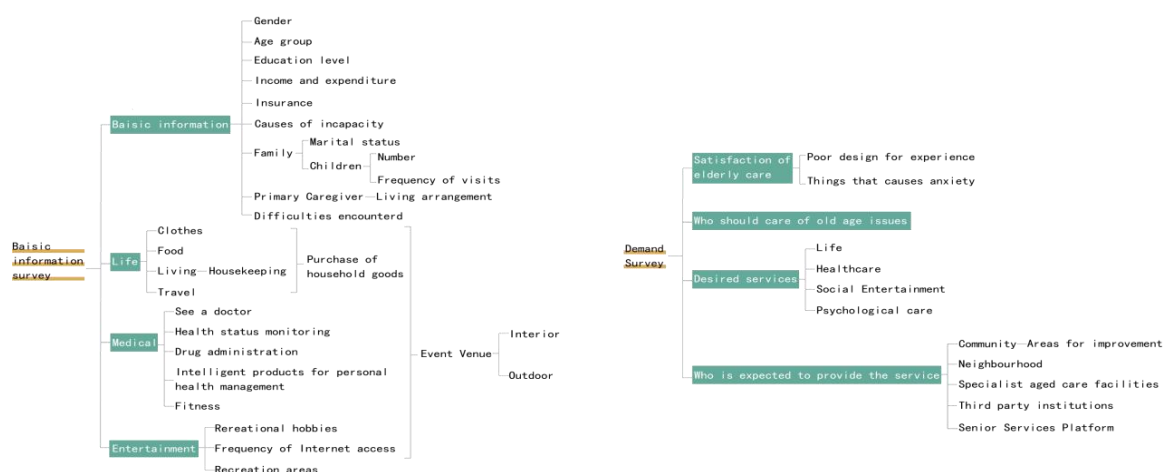


Figure 3. Composition of Survey Questionnaire

4.4 Analysis of research results

Due to the impact of the epidemic, a total of 50 questionnaires were distributed in this survey, and 46 valid questionnaires were collected, including 15 questionnaires for the elderly, 28 questionnaires for their children, 3 questionnaires for service personnel, and 3 valid interviews with the elderly. Among the surveyed urban elderly with mild disability, women are about twice as many as men. They are more likely to be over 70 years old, having better education, frequent internet access, stable marital status, and 1-3 children. Most of them live with their spouses or children, or live in close proximity to their children. The frequency of visits from their children is relatively

high, with only 10% of the elderly living alone. Their monthly living expenses are mostly between 2000 and 4000 yuan, and their main source of income is pension or social security, equipped with basic pension insurance for urban employees. Most of them are disabled due to old age, and their daily lives can be taken care of by themselves or by their spouses or children.

Through analysis, it was found that the elderly with disabilities have the following problems in their elderly care: in the process of home care, the elderly most hope to receive assistance from the community and elderly care service platforms, followed by mutual assistance from the community and neighbors; The elderly and their children are more inclined towards community and professional elderly care institutions. For service needs, all three parties most hope to receive services in daily life and health management/healthcare, followed by social entertainment and emotional comfort. Most elderly people believe that the main bearers of elderly care should be the government, followed by themselves and their spouses; Children and service personnel are mostly believed to be jointly borne by children, the elderly themselves, their spouses, and the government. For the difficulties in life, most elderly people believe that the main reasons are firstly physical health, electronic device or software operation issues, followed by fewer children coming home and less cultural and entertainment; The perspective of their children, and staff on the difficulties faced by the elderly is, however, relatively average and lacks emphasis. Based on Ocean Counting, it can be seen that the words closely related to “home care” include “community elderly care” and “disability”, indicating that the community form of home care for disabled elderly people is widely accepted and concerned by the public.

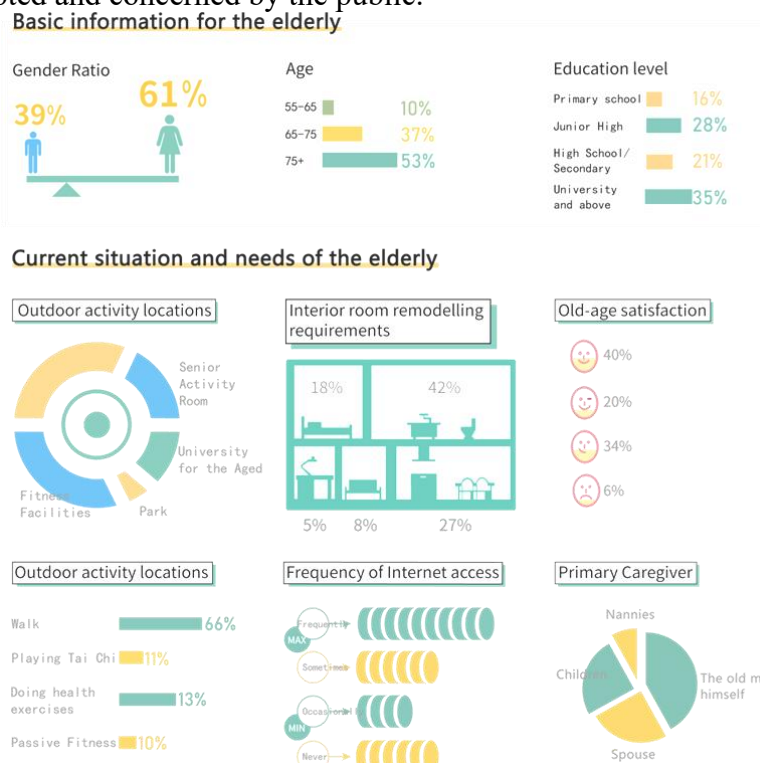


Figure 4 Questionnaire survey results

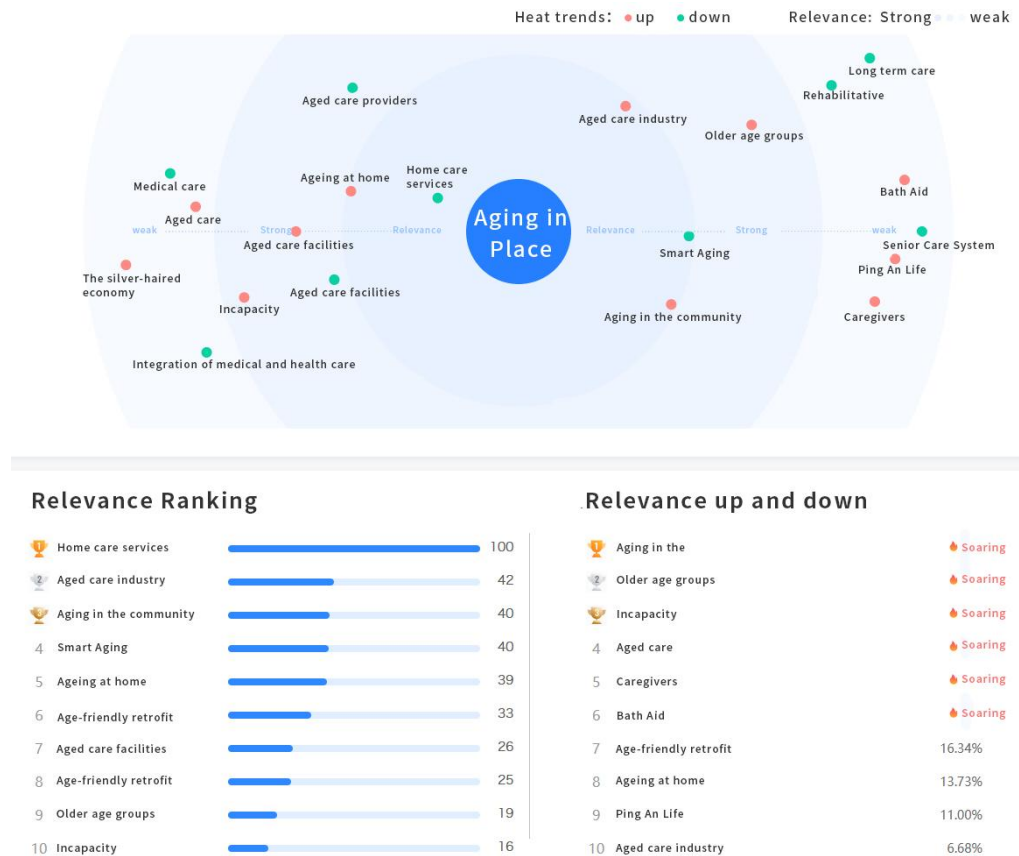


Figure 5 Big Data Analysis of Words Related to “Home-based Elderly Care”

Masno’s needs theory proposes that human needs are divided into five levels: physiological needs, safety needs, belonging and love needs, respect and self-actualization needs, which can be specified to the level of elderly people’s needs for services. Combining the analysis of the Masno model, it can be found that the elderly first needs to address their physiological and life needs, followed by their psychological needs. Compared to professional institutions for elderly care, most elderly people tend to prefer home care and community care, indicating that the service model of home care and community care is more able to meet the personalized living needs of the elderly compared to professional institutions for elderly care. After meeting basic living needs, the elderly will pursue higher levels of social needs. From the survey results, it can be seen that whether it is basic elderly care issues or issues related to the operation of electronic devices in daily life, elderly people often choose to solve them on their own and are less willing to trouble their children. On the one hand, due to the fact that children are more likely to provide only material assistance to the elderly and lack interaction and communication with them, it is difficult to identify the difficulties they encounter in life. On the other hand, the mentality of elderly people to solve problems on their own may seem to be a maintenance of their independence, but fundamentally it is a form of “emotional silence”[18], which is caused by factors such as past education, changes in physical and mental health and environment after aging. The inevitable progressive aging exacerbates the elderly’s dependence on the outside world, requiring immediate and effective communication with those around them. However, at the same time, the decline in hearing, vision, and other functions leads to communication barriers, which can easily lead to misunderstandings and conflicts. The weakening of physical function and communication barriers make elderly people more cautious and stubborn, further exacerbating their tendency to suppress. Especially for disabled elderly people, they are hindered by conflicts caused by communication difficulties, wandering between independence and dependence, communication and silence, and unconsciously transitioning from

independence to dependence. They are more likely to develop depression and affect their physical and mental health.



Figure 6. User Profile

4.5 Mining of Product Functional Design Requirements

Classifying the needs of the elderly through the four levels of Masno's theory can be summarized and transformed into the functions of the product: "protection" and "companionship". "Protection" corresponds to physiological and safety needs, referring to the monitoring and reminder functions of the product. This requires the product to have sufficient safety on one hand, be able to warn of dangers, and have the ability to respond quickly, make accurate judgments, and efficiently solve unexpected situations; On the other hand, it is necessary to maintain close contact with the guardians of the elderly around the clock, assisting them in monitoring their movements and conveying danger signals in a timely manner. "Companion" corresponds to two higher-level needs, which refer to machine chatting and online social, learning, and entertainment functions. It requires products to have the ability to interact with users frequently, which is specifically divided into physical and online interactions.

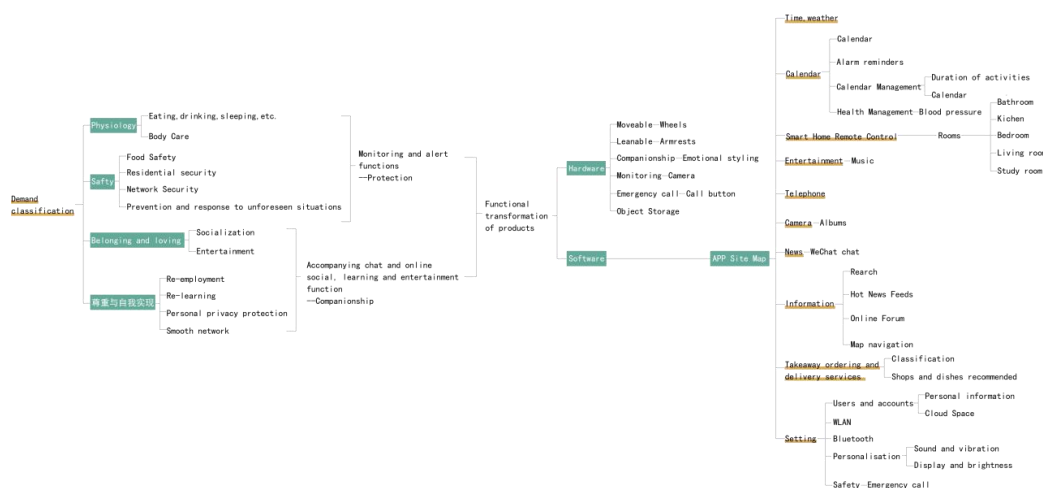


Figure 7. Requirements Classification and Product Function Transformation

The elderly, especially those with mild disability, need not only inclusive and foolproof products with high cost-effectiveness, but also products with accompanying services. The design of elderly products should not only meet their daily physiological needs in terms of functionality, but also meet their emotional needs in terms of psychology. The basic needs of elderly people for products are safety monitoring functions, expected needs are companionship functions, and excited needs are social entertainment functions and high cost-effectiveness of products.

Based on the trend of high-end, convenient, and intelligent elderly care products, the author of this article believes that the design of intelligent home care products for mildly disabled elderly people should be positioned as electronic guided "blind dogs", which have interactive functions of

protection and companionship, ensure safety monitoring functions, and focus on improving companionship functions and social entertainment functions to help the elderly overcome various inconveniences caused by physical disabilities. Therefore, this article aims to design a smart product with a tablet-like touch screen to meet the diverse needs of the elderly with more functions, so that they can find a sense of belonging and thus enhance their identification with the product.[6]

5. Service design Scheme for the Elderly with Mild Disability in Chengdu & Chongqing Area

5.1 Hardware Product Design

(1) Dimensions

By reviewing physiological data of the elderly and conducting actual investigations, the size design of the product is shown in the following figure. The product lengths 900 mm, width 800 mm, height 1200 mm, which conforms to ergonomics and the average height of elderly people in Sichuan and Chongqing regions.

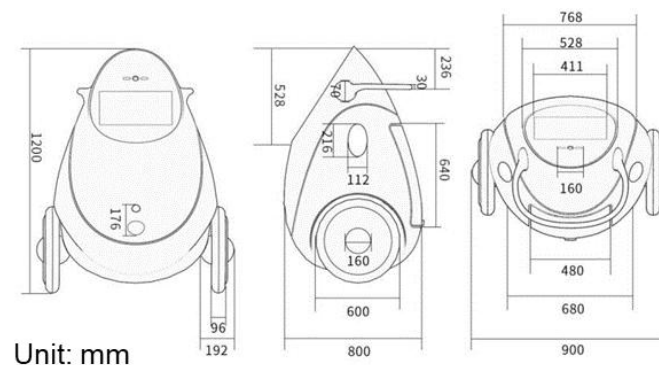


Figure 8 Product Three Views and Dimensions

(2) Materials and Colors

Four color schemes were designed based on the physiological characteristics of the elderly in the Chengdu & Chongqing region, including black and white gray, orange, light green, and light blue. The design screen is made of TFT glass material, with low power consumption and environmental protection. The displayed image is delicate and realistic. The armrest is painted with metal and covered with soft silicone material, which has a long service life and strong self-cleaning performance. The plastic wheels are made of rubber with high elasticity on the outside, and the buttons on the front lower and left and right sides are also made of rubber. The other parts are made of engineering plastic ABS, which is wear-resistant and stable.

(3) Function and Structure

Inspired by Baymax and Penguin, this hardware product has a rounded and approachable overall appearance, with a narrow top and wide bottom, and a downward-facing centre of gravity, making it stable and less likely to fall over. Based on the design of the car handle and trunk door of the car, a handle and a lower automatic storage door are added to the rear of the product, and a USB interface is installed below the storage door. And the product is also equipped with wheels and oval handrails on both sides. Above the front screen is a camera with photo and monitoring functions. Below is an emergency call button, which can help elderly people quickly seek help when they accidentally fall.



Figure 9. Product Color Scheme

(4) Scene display

The following two images show two side views of the product, one from the front and one from the rear, as well as the posture of an elderly person standing and holding the product handle, and crouching down to close the storage door.



Figure 10. Product Scenario Display

5.2 interaction design of software interface

5.2.1 Interface design

According to the 7 laws of interaction design and age-appropriate requirements, the overall interface has a large click area, few options, simple operation, and strongly related functions such as entertainment and WeChat leaning together, in line with the “grandma” rule, and strong guidance for users. According to the 7+2 rule, set the primary directory into 9 main sections: schedule, smart home, entertainment, phone, WeChat, information, takeout delivery, camera, and settings, and display the time and weather. A hidden conversation function is set up so that when the elderly person calls the robot by name, the robot will respond to the elderly person’s needs and pop-up hidden search, map, news hotspots, and forum interfaces. The secondary interface of the schedule contains a calendar, alarm clock, as well as blood pressure, schedule progress, and activity duration records to help the elderly plan their daily life, health management, and entertainment activities wisely. Smart home specifically involves remote control of rooms such as bathrooms, kitchens, bedrooms, living rooms, and study rooms, which are ranked left and right based on the survey-derived need for interior room renovation (Figure 4). Taking the living room as an example, this product supports remote control of lighting, television, air conditioning, cameras, and music, where the light can be adjusted by switching the total brightness of the lighting and curtains. The information page includes search, maps, news hotspots, forums, and can be called by voice to pop up:

<https://modao.cc/app/57JZMGLxrks5onQNzn8mTj> #Prototype Presentation - Home Care Interactive Interface

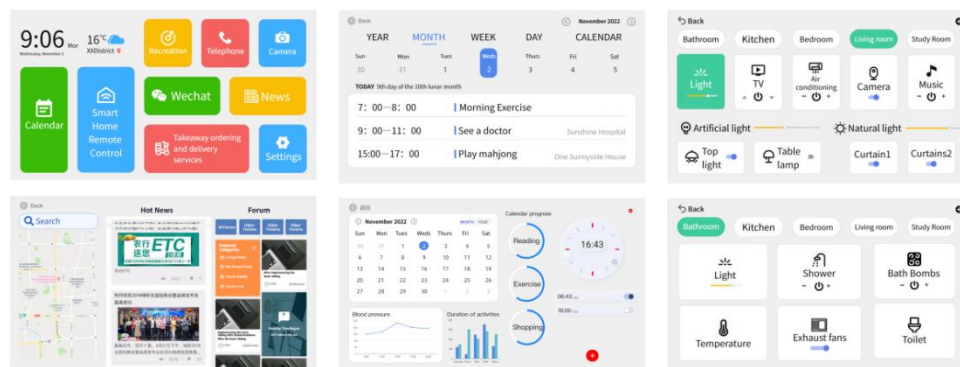


Figure 11. Product Interface 1

5.2.2 Interface testing evaluation and improvement

In order to improve the design, 200 questionnaires were set up and distributed, and 195 were collected. A scenario task was set up for the interface function in the questionnaire to test accuracy. The test results are as follows:

(1) User evaluation and satisfaction

The satisfaction of the participants with the overall interface reached 98%, mainly reflected in the comprehensiveness and convenience of service functions, specifically the implementation of intelligent machine integration, simple and centralized interface software for easy search, soft colors, and the provision of takeaway functions. This indicates that the diversity and richness of the preset interface for home scenes are sufficient. The main area that needs improvement is the font size, followed by the color. Due to the simulation and presetting of secondary page refinement for home scenes in other functions, the camera and phone without secondary interface display caused confusion among the participants.



Figure 12. User Evaluation and Satisfaction

(2) Task Setting and Test Evaluation

The task set is to “find the living room interface and adjust the light size”. The test results show that the task completion time varies greatly, with the fastest and slowest being 1 minute and 5 minutes, respectively. This indicates that the test subjects are not able to quickly infer the content contained in the smart home section of the homepage, and the language used to explain the task is written, making it difficult for the elderly to understand. According to the operation steps, it should be refined to “find the smart home icon on the home page, manually click to enter, find the light icon, slide the progress bar under the icon left and right to adjust the light size”. Although the layout and style of the interface should be as simple as possible, in order to avoid ambiguity when users operate, designers need to have empathy, to envisage in advance the scenarios and problems that users will encounter during the step-by-step operation, and to change the language interpretation outside the interface as accurate and detailed as possible. Combining subjective and objective

evaluations, it can be seen that the overall interface design has captured the itching points of the elderly, but further refinement is needed to grasp the pain points.

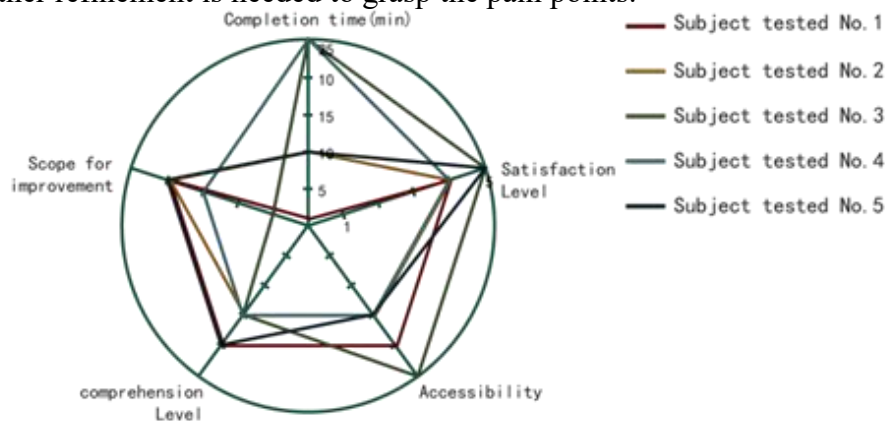


Figure 13. Subjective User Evaluation and Objective Test Evaluation

(3) Interface design improvement

In response to the issues exposed in test feedback, the large and shallow information structure has been further highlighted, and the interface color scheme and font size have been adjusted to be more suitable for aging - enlarged fonts and icons are beneficial for elderly people with poor vision to read; The main color tone has been changed from grass green to blue green, which not only protects the eyes but also adds a sense of sophistication. The desktop was simplified, with icons and textual symbols changed to more simple and clear icons. The bottom box of the icon is changed to a circular shape that fits the fingertips to guide and encourage users to try clicking through intuition and experience. Based on the natural behavioral characteristics from large to small, top to bottom, left to right and the 7+2 rule, functions of time, weather and camera and phone are placed on the left and right sides of the interface. And the 7 main functions are grouped into two primary directories: home management and social entertainment, which are enlarged and arranged above and below the home page, and displayed on the left side of the secondary page to help users build spatial memory. At the same time, the return button of the secondary interface is highlighted to help quickly re-locate key functions and content, reduce trial and error time and improve operational efficiency. The main functions of home management are smart homes, schedules, and takeout devices, aimed at improving the home environment for the elderly while helping them manage and plan themselves reasonably. And there are one click control function and indoor room 3D displaysmart home added in smart home segment, making it more intuitive and efficient:

<https://modao.cc/app/MvUp0FDerru3piUrFCvA24> #Home care interaction interface - sharing

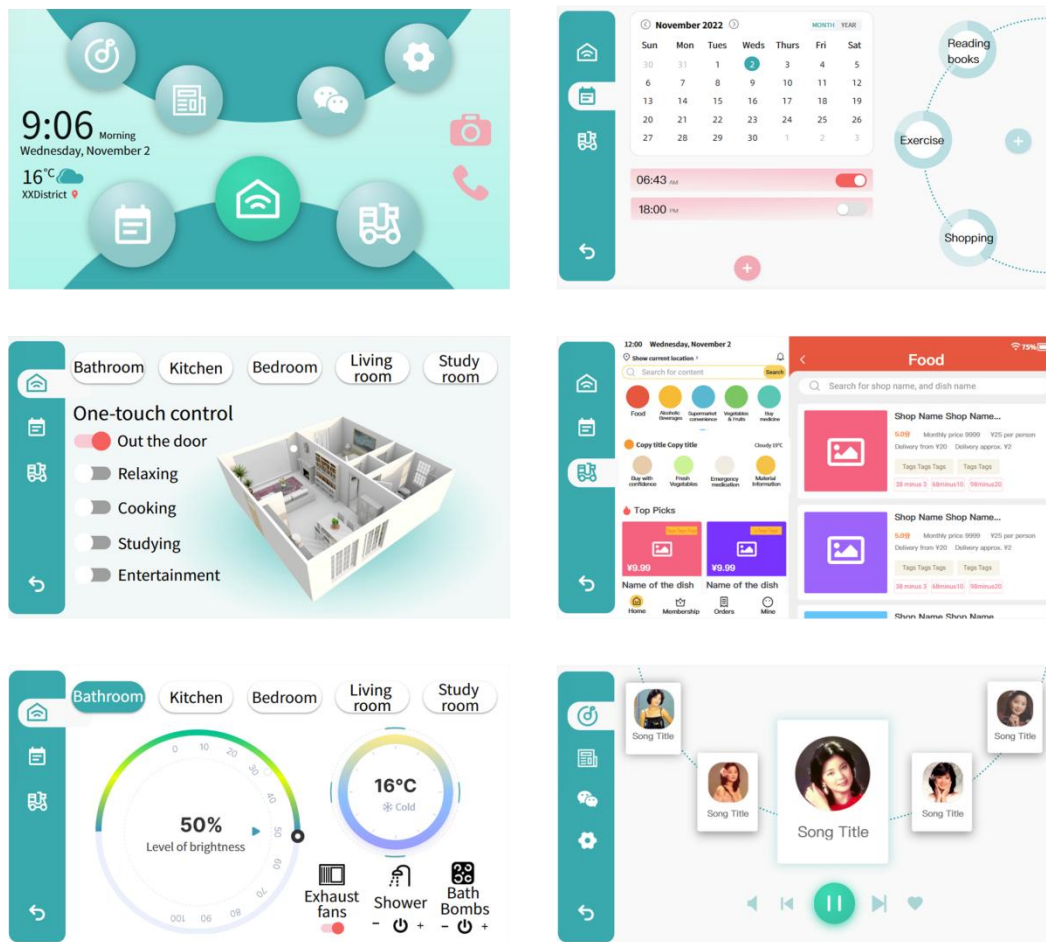


Figure 14 Product Interface 2

6. Conclusion

Today, with the increasing popularity of urban home-based elderly care and intelligent services, home-based elderly care service design urgently needs to work hard to provide the elderly with humanized, multi-level and diversified high-quality services, and strive for the parallel implementation of top-level design and projects to create more value. In addition to the usual survey methods such as questionnaires, in-depth interviews, natural observation and literature review, this article also innovatively adopts big data mining and analysis methods such as "Ocean Counting" and "Baidu index". On the basis of market analysis and user research, it extracts the keywords of "protection" and "companionship" of the aging service robot, extracts the key influencing factors and serves as the entry point of service design, and finally designs a model proposal with both hardware and software, makes further functional improvements for the personalized characteristics and needs of the elderly population with mild disability, and strives to improve the quality of life of the service group, improve their satisfaction, sense of achievement and happiness, guiding users to shift from passive family roles to active roles, promoting the vigorous development of China's elderly care industry, and feeding back the intelligent interactive product market. The scope of the research population in this article is limited to the elderly in the urban areas of Chengdu and Chongqing. The applicability of the design plan for rural elderly with low Internet frequency and elderly people with significant height differences in various parts of China needs further improvement. Due to the complexity of the characteristics of the elderly, this design scheme also needs to explore the cognitive boundaries of the elderly by combining different modalities, iterate on concrete interfaces, products and abstract text and scene presets to achieve a natural balance between simplification and recognition that fits the physiological and psychological needs of the

target group, enhance the bond between the product and the person, and improve the product durability .

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