

Study on the Model of the Elderly's Service Needs of Smart Home: Construction and Application

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Abstract: With the increasing number of the elderly population, many countries in the world are gradually entering a more and more serious aging society. According to the survey, 90% of people will choose to live at home when they become older. However, with the physical function and social function decline of the elderly, the independence and safety of the regular home-based life cannot be guaranteed. The smart home care system equipped with modern Internet technology can use systematic and information-based technology to help the elderly to achieve a more independent and safe retirement. The smart home is an emerging industry. At present, there is not much research on the elderly population in this field, and it mainly focuses on the technical field, a few kinds of research on demand and service. There are many problems in smart home products and services on the existing market, such as functional redundancy, technology is not mature enough, or does not really solve the pain points of the elderly, so the market penetration is not high until now. However, there is no doubt that the popularity of smart homes is an inevitable trend, and it has become one of the hotspots of current research, especially in the field of home care, which has great potential and will help the society and the government solve numerous aging problems. Based on the analysis of the literature, this paper puts forward an elderly service needs model based on Maslow's hierarchy of needs, aims to provide more high-quality smart home services for the elderly. Moreover, from the perspective of service design, it discusses the development stage of the smart home and the mechanism of service satisfaction of the elderly. The research can provide a good reference for the products and services development for the elderly from an user-centered aspect in the smart home field.

Keywords: *aging society; the elderly; service; needs; smart home*

1 Introduction

The 21st century is an era of aging population. The pension way of the elderly mainly includes three types: social pension, institutional pension, and home pension. The survey shows that 90% of the elderly will choose to live at home after retiring[1]. However, with the decline of both physical and social function of the elderly, the independence and safety of the regular home-based life cannot be guaranteed. Smart home, which is equipped with systematic and modern Internet technology, can help the elderly to live an independent and safe aging life.[2]. At the same time, smart products have a strong penetration, which has long-term effects on alleviating the shortage of social labor and reducing the economic

burden of social pension. But, the majority of contemporary smart home researches focus on the technical field, a very few researches on needs and service [3], however, there are many problems in the smart home products and services on the existing market, such as functional redundancy, immature technology, or does not provide service to solve the real pain points of the elderly, so the market penetration is not high[4]. In order to fully explore new opportunities for the development of smart home industry in an aging society, we need to analyze these questions in depth: What are the service needs of the elderly? What are the characteristics and contents of these needs? Which kinds of products can meet these needs? What are the development phases of a smart home? How to satisfy the elderly while providing smart home services? Our research will explore the questions above. This paper is divided into six parts. The second part of the paper is a brief literature review, the third part introduces the research method, and the fourth part constructs a service needs model of the elderly based on Maslow's hierarchy of needs. The fifth part discusses the application of service needs model in different development stages of smart home and the mechanism of service satisfaction of the elderly. The sixth part summarizes the whole thesis and looks forward to the follow-up research.

2 Literature review

At present, the research on the elderly mainly studies in three perspectives, physiology, psychology and sociology. The physiological and psychological perspectives mainly study the old age physiological and psychological problems. The sociology mainly focuses on the social behavior problems of the aging [5]. Some scholars have used empirical research methods to investigate different types of needs of elderly people and their satisfaction with life [6][7]. Some researchers have specifically discussed the issue of community care and medical security for the elderly [8]. In addition, some scholars have studied the behavioral characteristics of the elderly, and based on these characteristics, proposed the services that should be provided to the elderly [9].

With regard to smart home, the literature review has been done over major multiple scholarly databases including Scopus, IEEE Xplore, ACM Digital Library, SpringerLink, ScienceDirect, PubMed, and Web of Science. Depending upon the intended purpose and actual usage scenario, the smart home is segmented into five different dimensions for the elderly as health monitoring, environment monitoring, providing companionship, social communication, and recreation and entertainment [10]. The outcome of literature review of smart home for the elderly clearly indicates that a lot of work has been done towards their well-being. The majority of them are experimental projects that follow a technology centric approach. However, in order to promote and provide better smart home services, and improve the acceptance and market share of smart home products and services for older people. it is very important to analyze their services needs, from a human-centered aspect. However, there is a lack of theoretical approach and systematic model in this aspect of aging research.

3 Research method

This paper mainly uses the combination of deductive method and literature analysis method to conduct research. Deduction is a logical method of deriving individual conclusions and new information from universal theory or general affairs [11]. We can interpret the needs of the elderly with reference to the general needs of human beings, and then interpret the elderly service needs toward smart home. Maslow's hierarchy of needs is one of the important theories of behavioral science, was proposed by American psychologist Abraham

Maslow in 1943 in the paper "A Theory of Human Motivation"[12]. It argues that human needs have a process of development from low to high, and divides human needs into five levels, namely, the physiological needs, the safety needs, the love and belonging needs, the esteem needs and the self-actualization needs, which is a general law that conforms to the needs of human development with a wide range of applications.

4 The elderly service needs model

This paper uses literature analysis methods to extract and generalize the needs of the elderly, use the Scopus, IEEE Xplore, ACM Digital Library, SpringerLink, ScienceDirect, PubMed, and Web of Science database to search, set the search terms as "titles", search terms "old age" and "needs", and " the elderly" and "demands", accurately searched the data from 1980 to 2018; Due to limited energy, we have studied 40 articles, as well as the recommended topics "Elderly Needs" and "Analysis of the needs of the elderly", 25 documents with full texts retrieved by subject search. In the process of reading these 65 literatures, we extracted keywords about the needs of the elderly, such as: diet, clothing, emotions, nursing, etc., and divided these keywords into five categories according to Maslow's hierarchical needs theory. They are physiological, safety, emotional, esteem, and self-actualization needs. Table 1 summarizes the needs keywords with higher frequency and the cumulative frequency of each need level appearing in the literature.

Table 1 The elderly needs analysis

	Cumulative frequency	Frequently occurring keywords	Inductive demand
Physiological needs	54	Longevity, material life, diet, clothing, health products, convenient transportation, elderly apartments, elderly communities, disability, nursing services, long-term care, daily life care, escort center, living alone, reducing children Burden, pension in different places, emergency response, etc.	Clothing, food, housing, transportation, healthcare
Safety needs	47	Physical and mental health, medical treatment, medical conditions, health care products, medical health knowledge, medical expenses, medical security, disposable income, economic security, poverty risk, healthcare products quality, legal rights services, children abuse parents, old-age care institutions , safety protection facilities, government assistance, collective assistance, social security, welfare policies, etc.	Life safety, property safety, pension security, social security
Love and belonging needs	40	Family warmth, love, psychological and emotional crisis, loneliness, spiritual comfort, spiritual support, mental health, social activities, religious beliefs, senior clubs, old-age leisure, online chat, senior TV programs, community culture, elderly toys, seniors tour groups, entertainment activities, spiritual consumption, etc.	Family, friendship, love, community, faith
Esteem needs	7	Face-loving, self-respect, attitudes, body, clothing, knowledge, self-cultivation, family status, self-evaluation of health, "healthy old people" selection, social discrimination for the elderly, respect for the elderly, etc.	Self-affirmation, family/group/social status
Self-actualization needs	18	Self-improvement, find work, achievements, senior university, specialties, advance with the times, knowledge contest, the elderly enterprise, social contribution, play the heat, re-employment, etc.	Master new knowledge and create value

From the selected keywords, we can see that the elderly have the same physiological needs as the average person, but because of the physiological functions decline, such as vision, hearing, language ability, positioning ability, memory ability, the aging population has other relatively prominent needs[13]. Referring to the Maslow's hierarchy of needs, the elderly needs model is analyzed and summarized, see Table 1.

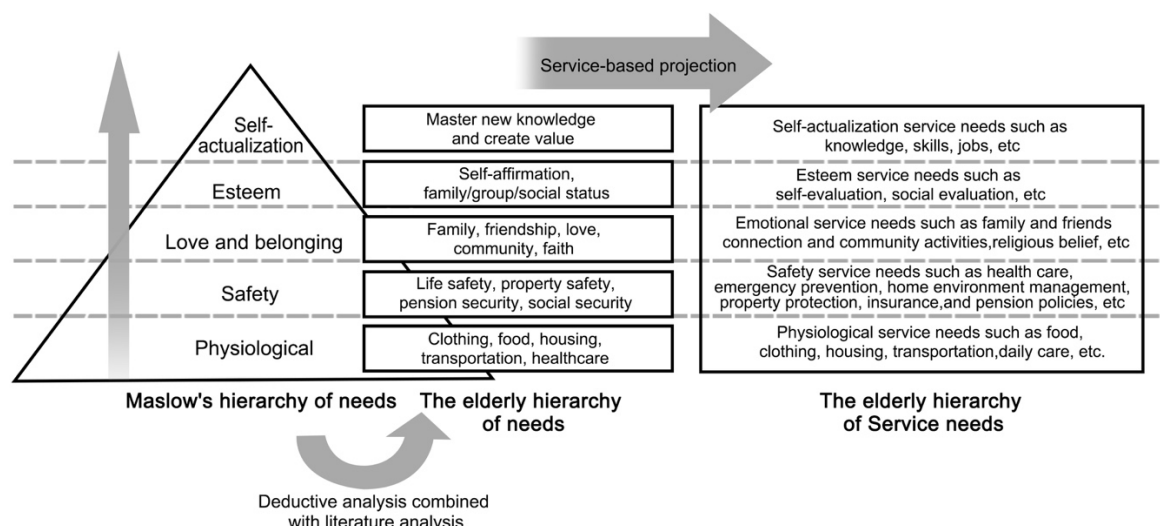


Figure 1. the analysis process of the elderly service needs model

Based on the previous hierarchical model of the elderly needs, we project the elderly service needs model from the user-centered perspective. The service needs of the seniors at each level in Figure 1 are briefly described below.

4.1 Physiological service needs such as food, clothing, housing, transportation, daily care, etc.

In addition to the needs of the general human physiological needs such as clothing, food, housing, transportation, etc., the physiological needs of the elderly should also include the healthcare and daily care, due to their certain mobility disorders and cognitive impairments. In the smart home environment, all kinds of products should follow the cognitive and behavioral patterns of the elderly, and in the principle of easy to use and ensuring safety, maximize the help of the elderly to overcome their physical and psychological barriers and help them to enjoy independent and safe life and improve the quality of life for the elderly[14].

4.2 Safety service needs such as healthcare, emergency prevention, home environment management, property protection, insurance, pension policies, etc.

For the elderly, security needs are embodied in four aspects: life safety, property security, pension security and social security. Among them, the demand for life safety is embodied in the demand for the health and medical security system; the demand for property security is the protection of property at home and the prevention of fraud; the pension security guarantees the elderly from the system and policy; the social security refers to the security guarantees formed by the society for the elderly, such as the public facilities that fully consider the special needs of the elderly. With the increase of age, and physiological and psychological functions decline, the demand for medical and health services of older people is more abundant than that of young people [15]. Moreover, the elderly have limited

economic income and weak self-protection ability, they need to obtain policy protection information and understand the legal information to protect their rights and interests [16].

4.3 Emotional service needs such as family and friends' connection, community activities, religious belief, etc.

For the average person, the emotional needs include two aspects, one is the need of love, including the need of friendship, family and companion; the second is the need of belonging, that is, to become a member of the group, and care for each other. In fact, the elderly need more emotional care than the average person [17]. Older people need not only information from their children, but also from their friends. Similarly, in order to give the elderly a sense of belonging, they also need information about the social groups and religious beliefs they care about, such as social news and community, and information on activities of the elderly groups.

4.4 Esteem service needs such as self-evaluation, social evaluation, etc

The needs of the average person to be respected can be divided into internal respect and external respect [18][19]. Internal respect refers to the individual's need for confidence and independence in their own strength; external respect refers to the individual's desire for external respect, trust and high evaluation. Combined with the analysis of the characteristics of the elderly, their respected needs are embodied in four aspects: the self-affirmation, the status in the family, the status in the groups, and the general social status. At the service demand level, internal respect and external respect requires tools and information that separately rely on self-evaluation and social evaluation.

4.5 Self-actualization service needs such as knowledge skills and jobs

This is the highest level of need for the elderly. Older people need to master new skills and learn new knowledge, as well as corresponding jobs, in realizing the ideals of their lifelong dreams or using their personal strengths to create value for the society. The knowledge and experience of the elderly is a valuable social asset. The society should integrate a variety of resources to provide more opportunities to the elderly with job needs, so that the elderly with work ability can find space to play their own heat [20].

5 The application of service needs model in smart home

The development of smart homes for the elderly can be divided into three phases, which are mutually progressive, as shown in Figure 2. At the same time, the five levels of the elderly needs are at all phases of the development of smart homes. The higher the level of need, the higher the requirements for smart home technology, products and service systems. Only by taking users as the center and using user needs as the foundation of technology and system development can we develop suitable smart home products and services for the elderly.

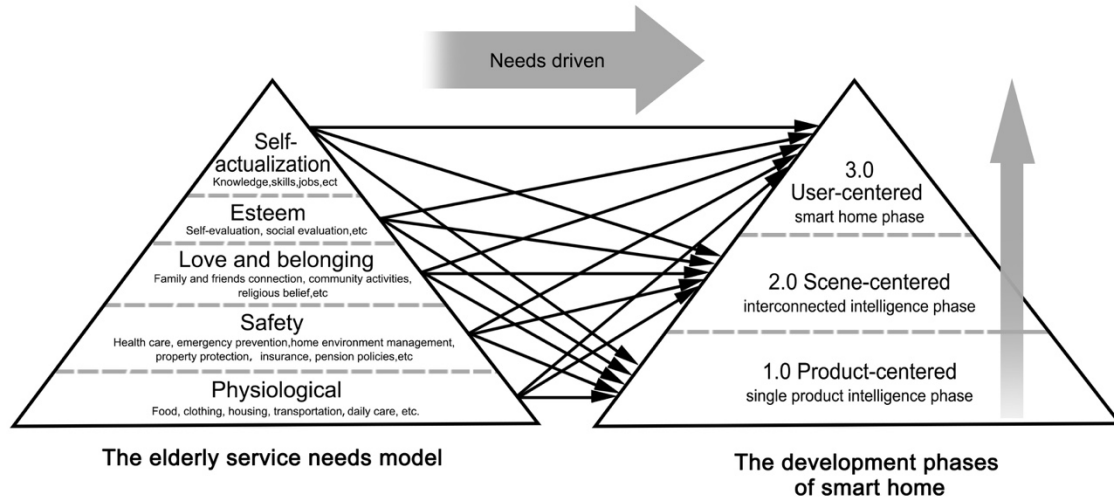


Figure 2. The elderly service needs model and development phases of smart home

5.1 The development phases of smart home

At all stages of the development of smart homes, considering the physical and psychological characteristics of the elderly population and their behaviour model, living habits, etc., developers and enterprises should focus on every service touchpoints during the service delivering process, including physical touchpoints(hardware), digital touchpoints(software), interpersonal touchpoints (humanware) [21], to improve the service experience of smart homes for the elderly. Figure 3 summarizes the features and contents of each stage of the smart home.

5.1.1 Product-centered phase

The networking and intelligentization of a single product, may include smart home appliances, furnitures, wearable devices, medical testing devices, healthcare devices, entertainment devices, transportation devices, gateway devices, social devices, environment adjustment devices, lighting systems, security systems, smart control systems, etc;

5.1.2 Scene-centered phase

This phase is the interconnection between smart home devices, to realize systematic control and intelligent adjustment, according to the life scene requirements of the elderly, the application scenarios may include sleeping mode, wake-up mode, leaving home mode, eating mode, working mode, learning mode, security mode, guard mode, bathing mode, exercise mode, theater mode, entertainment mode, party mode, birthday mode, romantic mode, family interaction mode, festival celebration mode, etc ;

5.1.3 Use-centered phase

This phase provides differentiated smart home services to specific user needs, while the home system can conduct self-learning, with the ability to collect, analyse data and make decisions. It can sense and observe the physiological and emotional situation of the elderly, judge their needs, give active services provision, the main features of this phase are service module selection, individual customization, system self-learning, automatic adjustment, etc

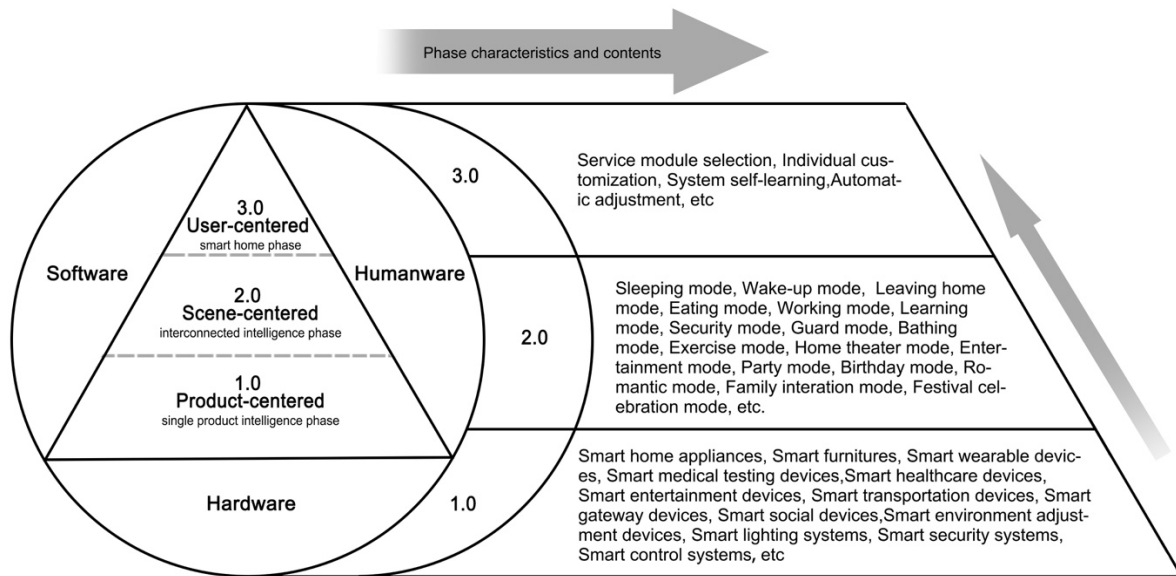


Figure 3. Smart home phases characteristics and contents

5.2 The mechanism model to improve life satisfaction of the elderly

We give the conceptual model of the action mechanism of the smart home to improve the satisfaction of the elderly, as shown in Figure 4. Figure 4 includes three constructs, where the independent variable is suitable smart home services and uses the five evaluation indicators from Servqual (Service quality) Model, which are tangibles, reliability, responsiveness, assurance, and empathy [22]. The intermediate variable is service satisfaction for the elderly with five different levels of service needs; The dependent variable is the elderly satisfaction, include both self and social aspects.

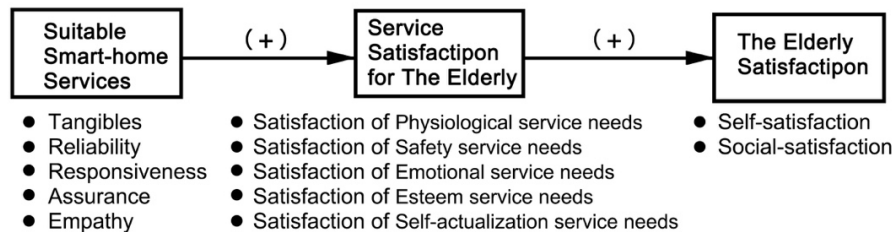


Figure 4. The mechanism model to improve life satisfaction of the elderly

6 Conclusion

The contemporary smart home industry not only needs technical development research, but also needs a user-centered perspective to explore the user's dominant and hidden needs, to design and develop smart home services and products that meet the needs of the elderly. Based on the interpretation of Maslow's hierarchy of needs, this paper proposes a theoretical model of service needs for the elderly. Simultaneously, the application of service needs model in the field of smart home is analyzed, and the mechanism of service satisfaction of the elderly is proposed. This paper only makes a preliminary theoretical study on the service needs of the elderly and their interaction with the smart home. In the future research, we will use the questionnaire survey and interviews to test the elderly service needs model and the satisfaction mechanism model by empirical data.

7 References

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