Analysis of the Aging Improvement of Intelligent Equipment

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Abstract The rapid growth of the global aging population has posed challenges to the sustainable development of public service provision, healthcare resources, and the social security system. In this article, combined with the development of intelligent devices in the context of digitalization, through literature analysis, questionnaire survey, and face-to-face interviews, 415 elderly people in Wuhan were selected as the research object to understand the current situation and problems of elderly people using intelligent devices. The aim of this paper is to investigate the utilization of perception, judgment, and learning functions of smart devices in enhancing the implementation of digital services for the elderly population.

Keywords Intelligent devices; Digital services; Aging; Virtual life assistant

1. Introduction

With the intensification of the global population aging trend [1], aging has become a focus of global attention. China, as a populous country, is facing more severe challenges of population aging. To meet this challenge, the Chinese government and various sectors of society are actively exploring various elderly care products and models.

According to statistics, the aging of the world's population is accelerating, and it is estimated that the number of elderly people will increase to 1.6 billion by 2050 [2]. This trend will pose enormous challenges to relevant governments and put tremendous pressure on the economy and society [3]. As the country with the largest elderly population, China is facing serious aging, chronic diseases, the majority of only children, and the increase of empty nesters. In particular, chronic diseases, which have a long course and cannot be cured by oneself, have become a heavy burden on the lives of the elderly in China. As the elderly age and their physical functions decline, their ability to take care of themselves and to think gradually decreases, leading to a decline in their self-esteem and sense of identity, resulting in psychological problems for the elderly and a negative impact on their physical health and social adaptability. Therefore, we cannot neglect their mental health either[4].

To address aging issues, China and other countries are promoting the "self-service elderly care" model [5]. This approach advocates for independent management of health and daily tasks by

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elderly individuals. Through self-help and mutual assistance, the elderly can support one another and achieve a beneficial cycle of elderly assistance. Moreover, more than 200 Chinese firms, including Tencent[6] have created a range of smart elderly care products, such as smart homes and health monitoring systems, utilizing technology to enhance the life quality of senior citizens. Implementing these products and the "self-service elderly care" approach not only enhances elderly life, but also diminishes social burdens.

This article examines the present state and future trends of smart devices, and investigates how they can be utilized in digital elderly care services. It aims to maintain objectivity by excluding any subjective evaluations, using clear and concise language, and avoiding biased language. The content follows a conventional academic structure and maintains a formal register. Precise word choices are made, and there is a focus on grammatical correctness. Additionally, consistent citation and footnote style are utilized.

2. Methods

This study utilized the questionnaire survey method for data collection. The questionnaire was designed through a comprehensive literature review, expert discussion, and pre-survey.

2.1Data collection

Before distributing questionnaires, it is essential to communicate fully with participants and inform them of the necessary matters to complete the questionnaire accurately. Respect their right to knowledge and secure cooperation. A total of 450 questionnaires were distributed, but only 415 were considered valid after eliminating invalid responses. The resulting effective response rate was 92.2%.

2.2.Participants and recruitment

This study was conducted in Wuhan, China during the period of March 2023 to September 2023, using a convenience sampling method to select 415 elderly participants. The inclusion criteria comprised individuals who were 60 years old or above, had normal cogitative function, unobstructed communication, were capable of self-care, and expressed willingness to participate in the survey (Tab1).

Table 1 Sample basic information

Variable	Category	Proportion (%)
Gender	Man	49.50
	Woman	50.50
Age	60~74	73.28
	75~84	23.75
	≥85	2.97
Long term residence	Rural area	17.82
	Urban area	82.18
Level of education	Primary school and below	7.92
	Middle school	19.80

	Senior school(including vocational school, technical school)	48.51
	College and undergraduate	19.80
	Master or above	3.96
Marital status	In marriage	70.30
	Never married	1.98
	Divorce	5.94
	Bereave	11.88
	Remarry	4.95
	Long term separation(over 1 year)	4.95
Living condition	Live alone	19.80
	Elderly care institutions	3.96
	Friends or caregivers	2.97
	Spouse only	40.59
	Two or more generations	32.67
Children	0	0.99
	1	61.39
	2	27.72
	≥3	9.90
Living siblings	Yes	23.76
	No	76.24
Close friends	0	6.93
	1~2	37.62
	3~5	25.74
	≥6	29.70

3. Physical and psychological problems in the elderly

With advancing age, the physical function of older adults gradually declines, accompanied by an increase in the prevalence and complexity of diseases. Furthermore, due to China's societal dynamics, which include a large number of working adults, only children, and empty-nesters, elderly individuals may encounter certain psychological challenges. A survey was conducted involving 415 older adults in Wuhan, which uncovered that a majority experienced chronic diseases and assorted emotional disorders (Tab2). Many older people have multiple medical conditions and mood problems (Fig1).

Table 2 The elderly suffer from various chronic diseases

Disease	Proportion (%)
Hypertension	46.53
Diabetes	33.66
Hyperlipidemia	26.73
Osteoarthritis	21.78
Cervical spondylosis	21.78
Coronary heart disease	14.85
Anemia	10.89

Cerebrovascular disease	9.90
Abnormal thyroid function	8.91
Parkinson's	8.91
Brain injury	6.93
Depression	4.95
Carbon monoxide poisoning	2.97
No medical history	17.82

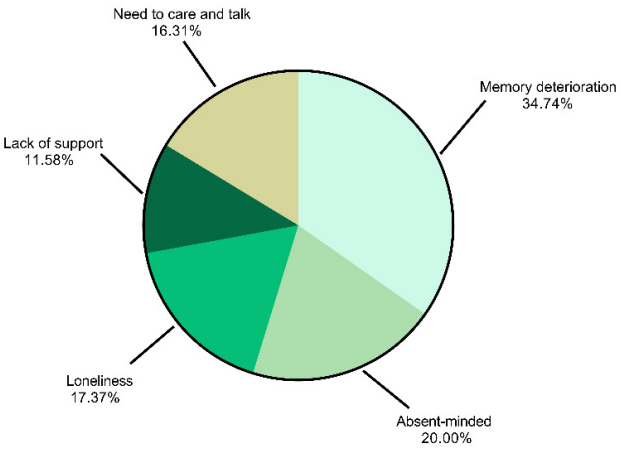

Figure1 The elderly suffer from various emotional issues

4. Status and Demand Analysis of Smart Devices

With the rapid development of information technology, such as big data and artificial intelligence, intelligent devices have become ubiquitous in people's lives, dramatically altering the methods of production and daily routines, and enhancing the effectiveness of social governance and services. At present, there are many intelligent devices available in the market, like smart medical devices, smart home systems, smart companion robots, and smart positioning bracelets. Some smart devices are capable of monitoring the physiological indicators of elderly individuals, including heart rate, blood pressure, and sleep quality. The collected data can then be visualized through mobile applications or cloud platforms, allowing for a better understanding of personal health status and easier management of daily activities at home. At the same time, the emergency button or voice call can be utilized to send a distress signal in case of sudden physical discomfort or falls experienced by elderly individuals [7]. While smart devices provide convenience, they also have drawbacks, including high costs, poor compatibility, and signal interference. These issues are particularly prevalent among the elderly population, who have a low adoption rate. According to a questionnaire survey, only 20% of the elderly have used smart devices other than smartphones, such as smart bracelets, smart homes, and smart assistants. Research has shown a digital divide between the elderly and digital society [8]. Many elderly individuals report difficulties with the functionality and user experience of current smart devices, including smartphones (Fig2). Age-friendly reforms are necessary to address these issues [9].

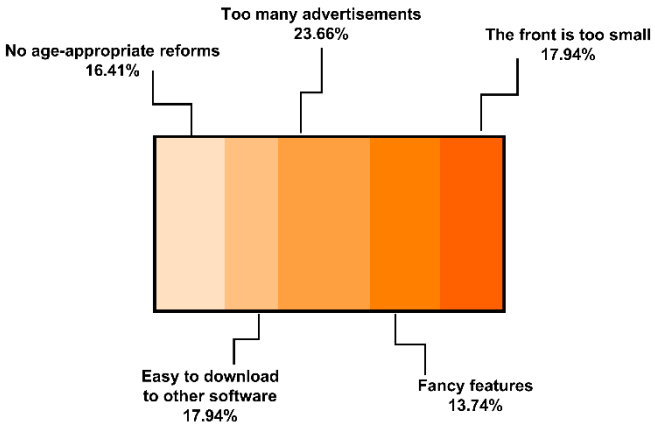

Figure2 The elderly see problems with smart software

Although there are many types and functions of smart devices. According to our survey, the elderly also often use a variety of functions, but the most used function is chatting, which indicates that they have a strong emotional need for smart devices. The use of medical consultation and medication-related functions was low (Fig3).

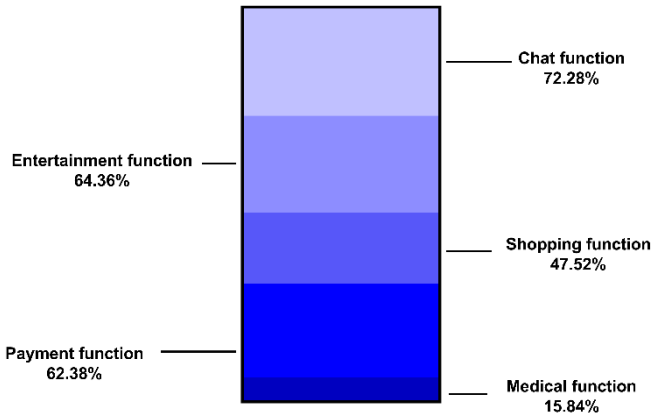

Figure3 Functions commonly used by the elderly on smart devices

In our survey, more than 60% of senior citizens expressed their desire for health monitoring, intelligent companionship, social functions, and cultural entertainment in smart devices. The current smart devices on the market mainly focus on health monitoring, ignoring the intelligent needs of the elderly for mental health, companionship and social entertainment (Fig4).

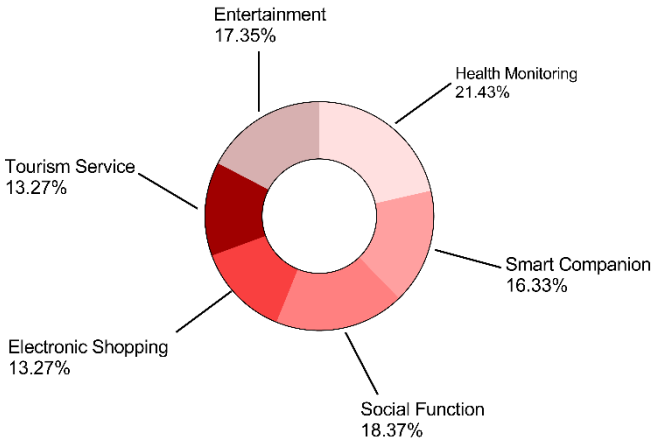

Figure4 Prospects for the functions of virtual living assistants in the elderly

5. Problem analyses and Future Directions

The gradual decline in the elderly's adaptability to external changes is caused by their internal environment imbalance. This reduction results in a decrease in their physiological and psychological adaptation abilities, ultimately impacting their health in natural and social environments. Furthermore, the degeneration of organs due to aging increases vulnerability to chronic conditions, such as hypertension, diabetes, and respiratory infections. Consequently, these ailments can lead to mental health issues, including depression and anxiety. As a result of these factors, there is an increasing demand for medical services among the elderly population. Accompanied by China's aging society, empty-nest elderly individuals face growing challenges in life and healthcare access. Particularly concerning are weakened family support systems and inadequate community nursing services for seniors that further exacerbate their health needs.

The popularity of smart devices is surging, propelled by the rapid advancements of the digital era. These devices' features, including mobile payment and online communication, have become omnipresent in daily life, providing greater convenience. The "Internet plus" wave has engulfed all sectors of society, embodying the broad digital transformation taking place. There is a mounting concern for smart devices that cater to the elderly in both healthcare and lifestyle sectors, particularly with the emerging and progressing aging demographics.

Due to various factors, we believe that the main reasons why older people fall into the "digital dilemma" of not using new smart devices include:

(A) Economic reasons: The elderly are more price-sensitive. Most elderly people have a single income and a low income and do not want to burden their children. Since various diseases cost a lot of money, they will show a rejection of expensive smart devices. At the same time, many smart devices have continuous consumption functions, which makes the elderly more resistant to using smart devices.

(B) Conservative attitudes among older people: Older people are also conservative in their

perceptions of digitization and the Internet. They tend to be reluctant to accept new things and are often passive in receiving information. They are subjectively less willing to use digital devices. Some older people are also anxious and wary of smart devices, fearing that their privacy will be compromised and their economic resources destroyed. At the same time, the subjective thoughts of the elderly have a certain resistance to smart devices. They believe that they have many difficulties in learning new things and memory operation methods, especially the decline of memory, which makes the elderly feel powerless and resistant, and make them more inclined to stick to the traditional way of life.

(C) The functions of smart devices are more complex: the functions of smart products are relatively rich. However, due to the declining memory of the elderly, it is easy to forget the operation process of functions, which affects the usage effect of smart devices and makes the elderly think that the operation of smart devices is inconvenient. There is no one to guide the learning process, which is also an obstacle for the elderly to use smart devices. Another reason is that due to the lack of learning channels and the inconvenience of smart devices, the elderly have difficulties in using smart devices and cannot get effective guidance and help.

(D) Health Awareness: Due to underinvestment in health, older adults lack awareness of the benefits of smart devices in improving healthy lifestyle self-management. Older people do not trust smart products and have difficulty communicating with them. The smart device itself is cumbersome to use, and each piece of software exists independently and cannot be managed in a consistent way. These challenges are compounded by the lack of incentives and specific models for older people.

(E) Insufficient government support: The government should invest money in bridging the digital divide of the elderly and promote the construction of the digital divide bridge. The traditional concept in society not only thinks that the elderly rarely need to use the Internet, but also finds it difficult to use the Internet skillfully, ignoring the spiritual needs of the elderly in an intelligent society. This traditional concept is not only recognized by the young, but also by the old. Therefore, the government should actively advocate a positive view of aging, help the elderly keep up with the times to learn basic information skills, and strive to expand knowledge and cultivate sentiment, so that the elderly life is more colorful because of intelligence. It is also necessary to guide and support the development of industries and disciplines related to information technology education for the elderly, and information technology education for the elderly is also given an important place in the national education plan. And the construction of the old-age industry system should be accelerated. Home care, community care and social care must be closely integrated with the comprehensive medical management service industry. The development of pension software information technology industry should adhere to the principle of appropriate age, actively advocate and promote.

At present, most of the smart devices on the market are not fundamentally designed for the behavioral characteristics and demand characteristics of the elderly to let the elderly really understand the elderly devices, but rather simple solutions such as increasing the font size. Smart devices for the elderly should not only guide them in using software and promptly answer any questions they may have while using smart devices, but also include features that encourage them to develop good habits. Therefore, we propose to design a "virtual life assistant for the elderly" that will serve as a central hub for all smart devices, including smart wearables, smart glucose monitors, smart medication boxes, etc. This virtual life assistant will be created using

virtual human image synthesis technology and voice interaction interface technology, and will serve not only as a helpful tool to simplify the lives of the elderly, but also as a companion and source of guidance. It will safeguard the mental health of the elderly, provide convenient care and support for children who want to stay in touch with their aging parents, and promote the integration of modern technology into the lives of the elderly.

Based on the data analysis, we suggest that the Virtual Life Assistant should have the following functionalities:

(A) Health management: Use smart wristbands to monitor the physiological status of the elderly 24 hours a day and set reminders for medication or exercise at scheduled times [10]. Provide personalized health plans based on individual conditions and professional medical advice, recommend healthy recipes, play videos suitable for elderly fitness exercises, and encourage users to develop healthy habits. Health management should be carried out from all aspects of daily life to help the elderly establish the concept of health maintenance, improve the awareness of health maintenance, and promote the action of health maintenance.

(B) Companionship and greetings: The software can have a virtual character that provides companionship and greetings to the elderly. Send greeting messages at set times to alleviate feelings of loneliness [11]. When the elderly feel down or need someone to talk to, the virtual character can act as a listener, providing emotional support and comfort. And with the voice wake-up function, the elderly can communicate with it through voice dialog without typing, and its image and tone can also be adjusted according to the elderly's preferences.

(C) Social functions: Establish a digital platform for communication among the elderly to expand their social circle, enable smooth interactions and exchanges, share life experiences, and create a warm atmosphere within a digital community [12]. Encourage the elderly to make friends through digital communities and help the elderly to meet people with common interests.

(D) Entertainment features: Provide entertainment programs, movies, and music that are popular with the elderly, allowing them to enrich their lives in their leisure time. Offer various online courses, book resources, and learning tools to help them acquire new knowledge and skills, improve self-cultivation, and cultivate hobbies and interests. Through these contents, let them enrich their old lives, fill their spiritual world, and help them find my value.

(E) Function optimization: Increase the dialect recognition ability of the device, improve the emergency response in critical situations, and improve the software usability [13]. According to the habits of the elderly, the personalized interface is made and the instructions suitable for the elderly are made, so that the elderly can better use the smart device.

At present, most of the smart products on the market are mainly designed to meet the needs of young people. Both in appearance and function, they tend to be younger gr oups, which greatly reduces the enthusiasm of elderly people to learn and use smart p roducts. Therefore, smart products should also be modified in terms of technology, co mbined with the preferences and learning ability of the elderly to adapt to aging. We propose that virtual life assistants should also be based on the physiological and psych ological conditions of the elderly, hoping to help the elderly better face the digital divi de through virtual life assistants, and then adapt to the changes of the development of the digital information era, and lead a more convenient and comfortable life.

6. Conclusions

In conclusion, the number of elderly people using smartphones will continue to expand. It may be only a matter of time before other smart devices are gradually integrated into the lives of the elderly with economic development and ideological awareness. The improvement of smart devices for the elderly may be the general trend. The Virtual Life Assistant should prioritize health monitoring functions while complementing them with companionship, greetings, social interaction, and entertainment functions. Through continuous optimization and feature enrichment, it can provide comprehensive, convenient, and personalized services for the elderly, so that the elderly can better use intelligent products.

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