

Research on Intelligent Perception Method of "Healthy Home" for the Optimization of Urban Living Environment in an Aging Society

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ABSTRACT

In response to the trend of population aging in China, optimizing living environments is crucial for improving the quality of life and happiness index of the elderly. This paper focuses on urban living environments in an aging society. By studying existing technologies in smart cities, smart healthcare, and smart homes, it analyzes the current research status of intelligent perception methods for "healthy home" in urban environments for the elderly. It also proposes suggestions for integrating smart cities, smart homes, and healthy aging to develop intelligent perception methods for "healthy living." The aim is to meet both the common and individual needs of the elderly, providing new ideas for the field of smart aging.

Keywords: Aging society; Urban living environment; Healthy home; Intelligent perception

I. Current Status of Home Care for the Elderly in Cities

According to the "2023 Annual Bulletin on the Development of the National Aging Cause" jointly released by the Ministry of Civil Affairs and the National Aging Office in 2023, by the end of 2023, the population aged 60 and over in China reached 296.97 million, accounting for 21.1% of the total population; those aged 65 and over reached 216.76 million, accounting for 15.4% of the total population. With the increasingly severe trend of population aging, urban living environments are facing new challenges. How to use technical means to improve the living conditions of the elderly in cities and enhance their quality of life and happiness has become an urgent issue to address.

The Central Committee of the Communist Party of China released the guiding document "Opinions of the State Council on Deepening the Reform and Development of Elderly Care Services" in 2024, emphasizing that

"deepening the reform and development of elderly care services is an urgent requirement for implementing the national strategy to actively respond to population aging and an important task to ensure and improve people's livelihoods. It concerns the well-being of hundreds of millions of people and social harmony and stability. The government must play a leading role in the development of elderly care services."

However, the government is facing increasing financial pressure in promoting the development of elderly care services, and the acceptance capacity of social pension institutions and the capacity of nursing services are limited. Therefore, urban home elderly care services, as an effective way to alleviate the financial burden of the government, show broad development prospects. This kind of pension not only helps the elderly maintain a high quality of life at a lower cost but also can bring socialized elderly care services into every family.

In recent years, the field of smart elderly care

has made significant progress in multiple aspects. For example, the construction of smart cities has leveraged innovations in technologies such as the Internet of Things and big data to provide new approaches for creating elderly-oriented living environments; smart medical technology offers convenient medical services for the elderly through remote healthcare and intelligent monitoring devices; smart home technology achieves intelligent control of home environments via the Internet of Things and artificial intelligence. However, these technologies still face numerous challenges in practical applications. For instance, according to a sample survey report from two districts and four communities in Nanchang City, Jiangxi Province, in 2024, the acceptance of smart healthcare among the elderly is influenced by both information literacy and educational levels, leading to issues of "limited cognition and difficulty in application"; educational level affects the elderly's ability to accept smart healthcare, causing some to develop resistance towards it; the age-friendliness of smart home devices is relatively low, and there is room for improvement in the specialized design of smart home systems targeting the five major senses of the elderly.

Therefore, it is urgent for us to explore the construction of an intelligent system integrating space perception, health monitoring, and emergency response.

II. Problems with Urban Home Care in the Context of Digitalization

1. Supply and Demand Barriers

In terms of demand, influenced by traditional concepts, the elderly often have a fear of novel and strange things and their understanding and recognition of intelligent pension informatization is insufficient. They show certain resistance to the use of modern intelligent products. Through a comprehensive analysis of domestic and international literature on smart elderly care and quantitative questionnaire surveys, the study found that urban seniors have a higher demand for smart medical care and smart living services than for emotional comfort. Specifically, there is a high demand for electronic medical monitoring, one-touch emergency call positioning

services, and smart living services, including dining services, convenience repairs, and daily care. In addition, considering the differences in family conditions, physical conditions, and economic conditions of the elderly, the needs of individuals in home care are also diverse.

On the supply side, the state has issued a series of policies for smart elderly care. Meanwhile, some major cities are actively exploring the development model of "smart healthcare + smart communities + smart elderly care." To date, several issues have emerged in the field of smart home elderly care services: First, although national-level smart elderly care policies have been introduced, local governments have not further refined their own smart elderly care policies, and government oversight is insufficient, with inadequate financial support as well; Second, the concept of smart home elderly care has not been fully popularized among families, especially among the elderly population, who need to improve their understanding and acceptance of it; Third, current urban planning fails to integrate "elderly-oriented design" with smart residential construction, resulting in a lack of corresponding elderly-oriented facilities in residential areas; Fourth, community medical services are slow to respond, smart medical devices are complex to operate, and there is a shortage of specialized healthcare professionals, with insufficient training, making it difficult to meet the health needs of the elderly; Finally, smart home systems are still incomplete, lacking elderly-oriented designs in smart home products, which makes them inconvenient to use.

2. Interaction Barriers

Currently, in smart cities, a community-level IoT monitoring network has been established, but the usage rate among the elderly is low; in smart homes, the penetration rate of voice interaction devices for smart products has increased, but the accuracy of dialect recognition is insufficient. The elderly face significant challenges in both product use and adaptability to smart products, leading to obstacles in their interaction with smart products.

The demand-oriented approach has been hindered, as government departments, hospitals, wellness centers,

communities, elderly care families, and service enterprises have not yet accurately understood the relationship between demand orientation and technological means. They also lack a unified platform and ecosystem connection, leading to obstructed information exchange among various stakeholders. This situation is a key factor contributing to the current digital elderly care software's single functionality, poor interactive operability, and lack of overall and systematic design.

3. Emergency Response Delay Barriers

In the field of smart medical devices, current wearable technology already enables monitoring of basic vital signs, but false alarms occur frequently. There is a significant delay in emergency response between medical monitoring products and elderly users; in the realm of smart home products, development often centers on technology, lacking in-depth research into the actual needs and urgent safety issues of elderly users, leading to similar delays in emergency response between smart products and elderly users; in urban smart home elderly care services, effective collaboration mechanisms have not been established among multiple parties including the government, medical institutions, community health centers, seniors, family members, and businesses, resulting in low efficiency in collecting and applying intelligent perception data for "healthy home" for the elderly, making it difficult to provide precise services, and causing delays in emergency response between smart home elderly care services and elderly users.

In view of the above, the current intelligent perception system for "healthy home" of urban elderly people is not perfect, and there are certain limitations in the field of intelligent perception between smart medical care and smart home systems, which cannot realize real-time monitoring of the health status of the elderly.

4. Emotional Disorders

In the process of promoting home elderly care services, more attention should be paid to the importance of humanistic care. While ensuring that the elderly can obtain basic medical care, daily care, daily services, and social activities, we should also pay more attention to the psychological needs of the elderly. Given that older

adults have fewer opportunities to participate in social activities and physical exercise, as well as the potential loneliness of living alone, their emotional needs are often not adequately met. This can affect their physical health and may even lead to a decline in cognitive function. As they age, with the gradual deterioration of bodily functions, physiological health issues in older adults may also adversely impact their mental health.

In the context of the big data era, we have not fully leveraged advanced technologies to develop specific policies and measures for the mental health of the elderly, and have not effectively integrated smart medical services to provide online psychological counseling and consultation. Currently, there is a limited number of smart entertainment products designed for seniors on the market, and they often lack adequate consideration in emotional design, making it difficult to meet their daily psychological needs. Therefore, how to genuinely improve the living environment and quality of life for the elderly and achieve comprehensive care for those living at home has become a critical issue that urgently needs to be addressed in the development of urban smart elderly care services.

III. Suggestions on Intelligent Perception Countermeasures for "Healthy Home" Elderly Care in Cities

The smart home elderly care service system is a comprehensive project that covers multiple aspects of the elderly's living environment, physical and mental health, as well as spiritual and cultural life. Compared to foreign countries, urban areas in China still fall short in terms of home elderly care facilities, characterized by insufficient socialized and professional provision of such services, and a significant gap between service quality and actual needs. China should draw on international development experiences, recognize the critical role of the government in formulating policies and providing public services, increase investment in hardware facilities for home elderly care, to comprehensively improve the home elderly care environment. At the same time, based on the mature experiences of countries like Germany, the

United States, and Japan in smart elderly care technology service systems, and considering the specific conditions of Chinese cities, we should explore a "health care for the elderly" path that fits the characteristics of socialism with Chinese characteristics, thereby building a distinctive "healthy home, smart home" elderly care model.

1.A Digital Healthy Home Elderly Care Service System Coordinated by Government, Medical Institutions, Communities, Families, and Enterprises

Strengthen government policy supervision, accelerate the construction of medical information databases for elderly people in cities, improve community elderly care service systems and their quality standards, implement tiered management to meet the diverse home elderly care needs of different cities. Utilize internet technology to create a new model of digital health and home elderly care services that integrates resources from "government, medical institutions, communities, families and seniors, and enterprises." Build a family-style home elderly care information cloud platform so that children can monitor and care for their parents online, fulfilling their psychological need for round-the-clock companionship. Establish a daily medical monitoring service platform for the elderly, enabling hospital doctors to remotely monitor the health status of seniors and upload real-time monitoring data. Develop an intelligent home management platform for the elderly, innovating smart home systems and their ecosystems to meet specific needs, such as enhancing the dialect recognition capability of smart home products, thus greatly facilitating the daily lives of the elderly. Establish a home elderly care service platform to meet the needs of seniors in terms of diet, supervision, maintenance, and other aspects of daily life. The construction of these platforms primarily draws on mature experiences in smart elderly care from countries like Germany, the United States, and Japan, with a focus on remote monitoring and online medical services, advanced technologies such as medical rescue and smart home, combined with the actual situation of Chinese cities, integrate government, medical institutions, communities, families, enterprises and other elderly care resources to provide more comprehensive

and professional elderly care services for the elderly.

When categorizing urban home elderly care models, it is essential to collect detailed information about family members. This includes basic household information, the number of children, the income status and health conditions of the elderly, as well as their medical history and required care services. At the same time, while ensuring privacy protection, some suitable data should be shared with community health centers, local medical institutions, and service providers. This will enable more precise, efficient, and rapid provision of customized services for the elderly population.

2. Elderly-oriented Design

In the process of urban residential construction planning, emphasis should be placed on adding elderly-oriented facilities and creating living scenarios suitable for the elderly, to create a safer, more convenient, and more comfortable living environment. At the same time, actively develop and promote smart home devices suitable for the elderly, by simplifying operation procedures and reducing usage difficulty, thereby significantly enhancing their experience and satisfaction when using these devices. Additionally, to further improve service quality, efforts should be made to strengthen the functions of smart home products in intelligent perception and data collection, ensuring that they can accurately capture the actual needs of the elderly and provide personalized services accordingly. Through the implementation of these comprehensive measures, the ultimate goal is to effectively enhance the overall quality of life and inner happiness of the elderly, allowing them to feel more care and warmth in their later years.

3. Health Management and Emergency Services for the Elderly

Under government leadership, efforts should be focused on cultivating and developing skilled home caregivers, strictly establishing service standards for care, and enhancing supervision of caregivers to improve the quality of care services, thereby meeting the diverse needs of elderly individuals. Leveraging smart healthcare technology, local medical institutions provide remote medical services and health monitoring for the elderly.

Smart medical devices transmit daily physiological data of the elderly to service platforms while also meeting the surveillance needs of family members. For minor physical discomforts, doctors can offer remote guidance for self-treatment. Additionally, through IoT and AI technologies, the usage process of medical equipment is simplified, its intelligent sensing capabilities are enhanced, real-time health status monitoring of the elderly is conducted, and emergency call functions are added to respond to emergencies. "In emergency service models, it is essential to set monitoring thresholds and use IoT technology to monitor indoor information so that community workers can promptly identify abnormalities and make appropriate decisions."

4. Care Services for the Elderly

Pay attention to and deeply understand the psychological needs of the elderly, and propose emotional design solutions for smart home products. For example, we can draw inspiration from the SenseRobot chess-playing robot developed by SenseTime, which is not only technologically advanced but also capable of emotional interaction with seniors, greatly enriching their spiritual lives. On this basis, more efforts should be made to develop intelligent entertainment products suitable for the elderly, to meet their diverse and personalized needs during urban home elderly care.

IV. Conclusion

This study proposes an intelligent perception solution for "healthy home" to optimize urban living environments in aging societies. By integrating smart city, smart healthcare, and smart home technologies, it not only meets the general and specific needs of elderly people in urban home elderly care but also improves data collection and processing procedures. It enhances the elderly-oriented and emotionally engaging design of home products and highlights the intelligent perception functions of home elderly care products. This research enriches the theoretical framework of smart aging care and provides new ideas and methods for its development.

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