# Research on the Design of Elderly Care Facilities Based on the Concept of Intelligent Elderly Care

Tao Yang[1,2(✉)] and Yong Zhang[1,2(✉)]

[1] School of Design and Art, Shenyang Jianzhu University, Shenyang 110168, China
806009741@qq.com, 2542931073@qq.com
[2] College of Design and Art, Shenyang Jianzhu University, Shenyang, China

**Abstract.** With the development of society, China's population aging problem is becoming more and more serious, and the proportion of elderly population is increasing year by year, coping with population aging is the task proposed to us in the new era. At the same time, the development of big data, Internet of Things, artificial intelligence and other technologies, and gradually mature science and technology provide more complete care for the development of the elderly, and the elderly industry is gradually changing in the direction of intelligence and humanization. However, the research on the application of intelligent elderly care concept to the elderly care industry is mostly focused on policy and industry, and the research on the intelligent elderly care facilities has some limitations. This paper investigates the current situation of intelligent elderly care facilities and summarizes the innovative design strategies of elderly care design based on the concept of intelligent elderly care.

**Keywords:** population aging · intelligent elderly care concept · elderly care

## 1 Introduction

The 14th Five-Year Plan states that we should promote the synergistic development of the elderly and the elderly industry, improve the basic elderly service system, vigorously develop inclusive elderly services, develop age-appropriate technologies and products, and cultivate new industries such as intelligent elderly care. Intelligent elderly care service integrates intelligent sensing, identification, computing, Internet of Things and other technologies, allowing sensors to connect with computer networks to provide high-tech services for the physical and mental health of the elderly and improve their quality of life. Intelligent elderly care service plays an important role in integrating the advantageous resources from all walks of life and promoting the benign development of senior care industry.

## 2 Status of Intelligent Elderly Care

### 2.1 The Current Situation of Population Aging in the Country

Data from the 7th census released by the National Bureau of Statistics in 2021 shows that the elderly population (60 years old and above) is about 260 million, accounting for about 18.7% of the total population, and it is expected that in 2025, China's elderly


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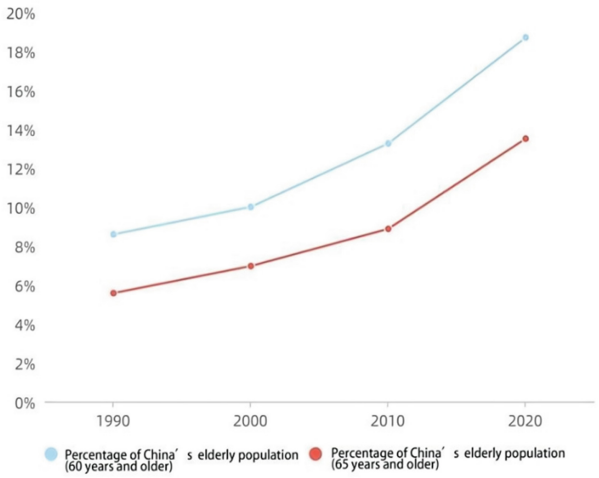


**Fig. 1.** Development trend of China's elderly population (over 60 years old)

population will exceed 300 million. China's aging is becoming increasingly serious, and aging will profoundly affect all aspects of Chinese society (Fig. 1). Meanwhile, the government is actively responding to the impact of aging, improving long-term planning for an aging society, and formulating corresponding policies and regulations. [4] The market of senior care industry is also developing with the increase of elderly population. Intelligent technologies and products are gradually applied in senior care, which enhances the happiness and security of the elderly, but also has certain limitations.

## 2.2 Concept and Classification of Intelligent Elderly Care Services

Intelligent elderly care service is the process of providing senior care service by using intelligent control technology. Intelligent elderly care service is the process of providing safe, convenient, healthy and comfortable services for the elderly based on the Internet and the Internet of Things, a collection of modern communication and information technology, computer network technology, elderly service industry technology and intelligent control technology.[1] Apply intelligent technology to the elderly care industry, provide intelligent services according to the actual needs of the elderly, let the elderly turn the elderly from passive to active, and improve the quality of life of the elderly. [2]

Care facilities for the elderly refer to nursing homes and elderly care homes that provide mainly group living and life care for the elderly, providing them with professional services such as life care, rehabilitation care, spiritual comfort and cultural entertainment. Applying the concept of intelligent elderly care to the design of elderly care facilities and organically combining intelligent technology and elderly care services is of great practical significance to actively cope with the aging of the population.

# 3 Principles of Age-Appropriate Design for Elderly Care Facilities

## 3.1 Physiological and Psychological Changes in the Elderly

During the aging process, the physiological functions of the elderly continue to deteriorate and the functions of the body systems continue to decline, making daily life more and more difficult for the elderly.

(1) **Physiological characteristics**

As people age, their sensory systems deteriorate, which can reduce the ability of the elderly to respond to the outside world. The reduced ability to discern things in the elderly makes them less sensitive to light and less able to recognize colors; the reduced ability to discern language makes it difficult for the elderly to communicate; the loss of brain cells slows down the functioning of the nervous system and affects the cognitive ability of the elderly. At the same time, the body functions of the elderly gradually decline and the muscles and bones age to different degrees. Muscles atrophy and cannot exercise or extract heavy objects for a long time; organic components of bones decrease and fractures occur easily; immune system decreases and changes in climate and environment cause various diseases in the elderly, which in turn accelerate the aging of the elderly, and the interaction between the two causes a series of changes in the muscles of the elderly (Fig. 2).

(2) **Psychological characteristics**

The psychological characteristics of the elderly are influenced by both physiological factors and the external social environment. The deterioration of physiological functions leads to the elderly's reduced ability to take care of themselves, their reduced ability to adapt to the environment, their weakened ability to maintain their own security, their lack of inner security, and their tendency to cause tension and anxiety. After retirement, elderly people are separated from their daily full and solid living environment, and it is

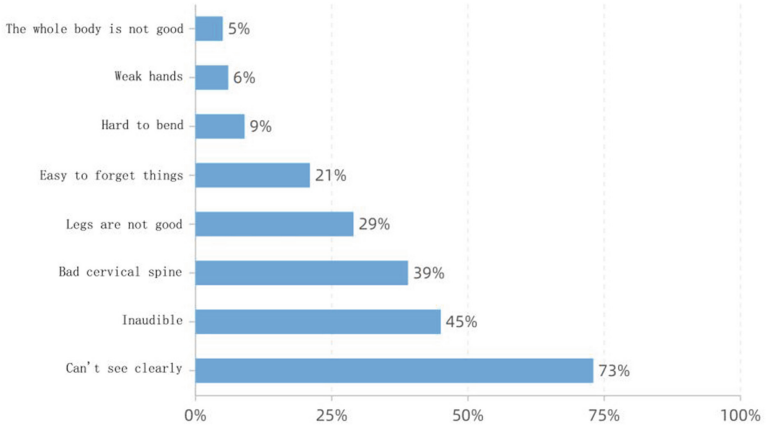


**Fig. 2.** Chart of changes in the physical condition of the elderly with age

difficult for them to adapt to a leisurely life with plenty of time, which usually causes them to have a spiritual emptiness and a sense of loss. At the same time, the circle of life becomes smaller, the opportunity to contact with the outside world is reduced, the lack of social communication, resulting in a sense of loneliness among the elderly.

### 3.2 Design Principles of Aging-Friendly Intelligent Facilities

The design of the intelligent elderly care concept is based on the special characteristics of the elderly in all aspects, and the design principles of elderly care facilities under the intelligent elderly care concept are proposed based on the practical needs of the elderly and the special characteristics of the elderly.

(1) **Ease of use and fault tolerance**

Ease of use is the most basic principle of interaction design, the elderly will inevitably make certain errors due to cognitive ability or errors, so the aging-friendly design of intelligent facilities should be as simple as possible, with as few operations and steps as possible to achieve the purpose of easy understanding and convenient operation for the elderly. At the same time, in order to let the elderly better adapt to the intelligent facilities, the operation interface icons should be recognizable, with text labeling; in the operation of the volume, color and form should cater to the elderly to adapt to the rhythm; wrong operation should be repeatedly reminded, if necessary, the intelligent facilities can be forced to stop according to the preset function.

(2) **Consistency and efficiency**

Intelligent facilities should be designed using the same set of interaction logic and visual specifications to improve the efficiency of interaction and bring clear guidance and foreknowledge to the elderly. The interaction methods, interface icons, text, and style styles in intelligent facilities need to be consistent and coherent, so that the elderly can complete the operation process in the shortest time and the quickest path. For example, voice assistants are addressed consistently throughout the intelligent facility system, with multiple voice assistants maintaining only one voice assistant feedback.

(3) **Emotional design**

With the development of the economy and society, intelligent technology has gradually developed and matured. Intelligent systems are increasingly able to understand people and realize emotional experience has become a reality. At present, relying on big data, artificial intelligence technology voice assistant, such as Apple's "Siri", Baidu's "Xiaodu", Xiaomi's "Xiaoxiaoyou", etc.;in While bringing convenience to users, they also resonate with users' emotions through interface color and copy language. [5]

## 4 Design Strategies for Elderly Care Facilities Based on the Concept of Intelligent Elderly Care

Intelligent elderly care service refers to the process of using intelligent control technology to provide senior care services, and the products and services it brings influence the form and content of elderly care facilities. Reasonable application of intelligent facilities, thus

providing a safe living environment, efficient living services and improving the quality of life and living for the elderly.

### 4.1 ISM Model Building of Intelligent Elderly Care Services

The Interpreted Structural Modeling (ISM) technique is built to study the internal logical relationship of the intelligent elderly care system, analyze the elements that make up the senior care system, study the structural levels within the intelligent elderly care system, and clarify the logical relationship between senior care services and senior care facilities, which works as shown in the Fig. [2].

The intelligent services provided by elderly care facilities should meet both the product needs of the elderly and the service attribute needs of intelligent elderly care services. Product-attributed elderly care facilities require reasonable functions and various forms, and provide the elderly with a warm and comfortable physical environment with a beautiful visual enjoyment of the environment. Service attribute elderly care facilities provide the elderly with various services such as management, catering, cultural entertainment and life care. The intelligent elderly care system can only meet the increasingly updated service demands to carry more quality services for the elderly.

### 4.2 Design Strategies for Elderly Care Facilities

The intelligent facility plan is established according to the typical floor plan example of single living room by Prof. Zhou Yanmin [3], and the intelligent design of elderly care facilities is carried out in four aspects: management service, life care service, health service and cultural service (Fig. 3, 4).

(1) **Management Services**

Intelligent management services applied to elderly care facilities mainly focus on two aspects of security system and automation control, providing the most basic security for the elderly. The security system consists of various detection devices and home alarm devices, with an intelligent lock at the entrance, which will trigger the corresponding detection device when someone illegally invades, alerting the security personnel and automatically alerting the police. The elderly can cut off the power of certain high-powered appliances, such as kettles, irons, induction cookers and other dangerous electrical devices, with one key in the intelligent system. The smoke and coal detection device set in the kitchen, when the elderly forget to turn off the gas and power supply, senses the alarm and quickly uploads to the backstage and is handled by the backstage personnel. Meanwhile, some indoor facilities can be controlled automatically according to the situation, such as turning off the power supply and gas valve.

(2) **Life Care Services**

The intelligent life care service mainly focuses on the arrangement of indoor intelligent system, which provides services for the elderly through intelligent control of indoor care facilities. Its operations include light switches, brightness adjustment, curtain switches, electrical switches, etc. The intelligent system recognizes the movements

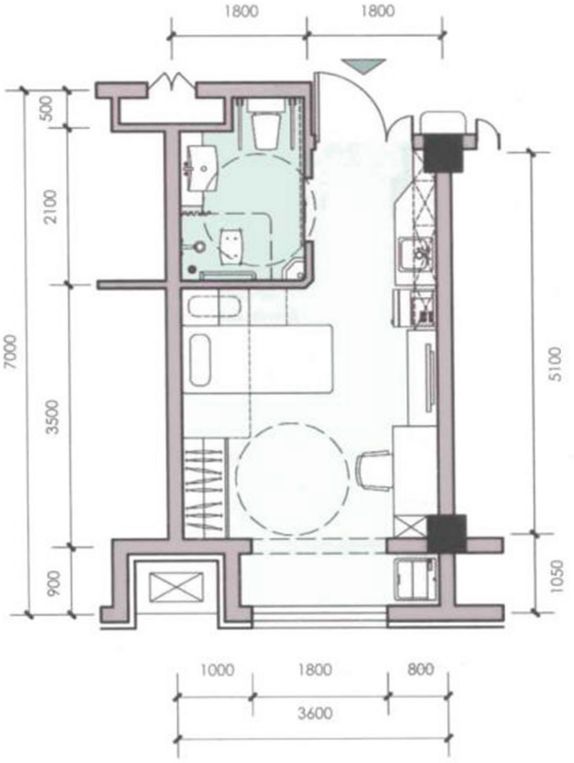


**Fig. 3.** Typical case of single living room

and voices of the elderly to perform relevant operations. Intelligent monitoring device detects the elderly resting, automatically dimming the lights and cutting off the power; when the elderly enter the bathroom, the intelligent system slowly opens the lamps and lanterns, and the intelligent toilet is automatically heated; the pull-string emergency call device is located at the bedside, bathroom, and three sensitive locations in the walkway, with a height of 1.2m and a pull-string length of 0.9m to ensure that the elderly can be alerted in time after a fall; the infrared detection device is set indoors If the elderly are found to be in an abnormal state for a long time, the emergency call will be made to the service personnel in the elderly care facility.

(3) **Intelligent Health Services**

Intelligent health services provide health management, care, rehabilitation and nursing services for the elderly through remote collection, processing, storage and query of medical information, and can also provide technical support to medical staff in senior care facilities remotely. According to the health management system and intelligent monitoring equipment, a personal health file is established for each senior citizen, and personalized health services are customized to regulate all aspects from diet to exercise.

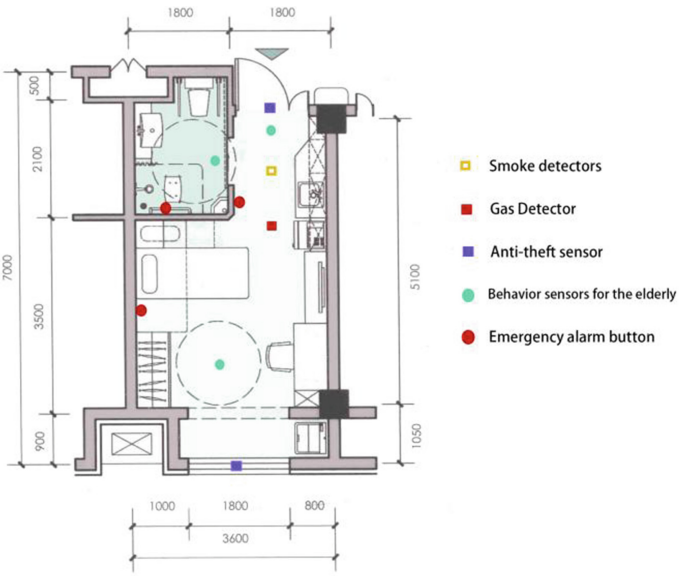


**Fig. 4.** Intelligent induction device layout

For example, we can provide daily weather information on a regular basis to inform the temperature, air quality and appropriate clothing, and remind the elderly to wear masks and disinfection when they go out and deliver government policies at a time when the epidemic is spreading; we can remind the elderly to take their medication on time and even provide home delivery service based on their personal profile information; we can provide telemedicine service by adding video and projection devices in the treatment room to facilitate telemedicine; we can provide physical We provide monitoring and evaluation of health indicators and special checkups based on personal information to provide continuous and effective protection for the health of the elderly (Fig. 5).

(4) **Intelligent Cultural Services.**

Intelligent cultural services help the elderly establish communication and contact with people around them through interest collection and telematics interaction, and provide a communication platform for learning and sharing. According to the interests of the elderly, we recommend movies, music, chess and cards that meet their interests; the elderly can take photos and record videos and upload them to the cultural service platform to share their lives; we provide an online communication platform, hold lectures for the elderly to teach courses on health, painting, chess and cards, musical instruments, etc., advocate the elderly to tell their work and life experiences and continuously integrate into society; we recommend various interest societies and clubs We also recommend various interest groups and clubs to establish a community for the elderly and provide online and offline activities, so that they can enjoy their lives to the fullest.

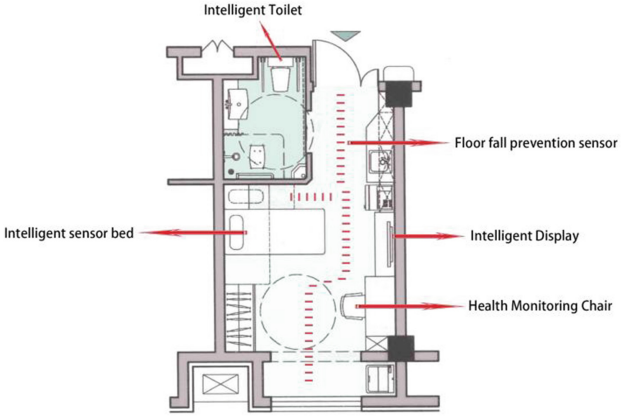


**Fig. 5.** Indoor intelligent facilities distribution diagram

## 5 Conclusion

At present, the design and application of aging-appropriate intelligent elderly care facilities in China are still in the initial stage, and the development of intelligent elderly care facilities cannot fully adapt to the changes in the development of the times and meet the aging-appropriate needs. The application of intelligent elderly care facilities lacks system specification and cannot meet the physiological and psychological needs of the elderly in terms of function and form. This paper summarizes the aging-friendly design principles and innovative design strategies of intelligent elderly care facilities through the research on the design of elderly care facilities with the concept of intelligent elderly care. The design in terms of function, form and operation is as refined as possible to continuously adapt to the physiological and psychological changes of the elderly, help the elderly embrace a higher quality of senior living, and create a positive aging physical and mental environment for the elderly.

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