

# The Impact of Smart Home Technology on the Lives of Older Adults

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## ABSTRACT

The problem of global aging is becoming increasingly serious, and the issue of the elderly has become a focus of social concern. At present, the facilities and conditions of nursing homes, apartments for the elderly and community care for the elderly are not yet perfect, and it is difficult to meet the needs of the elderly in their twilight years. In order to meet this challenge, many countries have put forward the concept of "aging in place", the provision of elderly services without changing the living environment of the elderly. The Chinese Government not only advocates "aging in place" but also actively promotes "aging at home", which has become one of the most common forms of aging in China, in accordance with the actual situation in the country. With the development of modern intelligent technology, high-tech intelligent technology is gradually applied to daily life, providing a convenient and comfortable living environment for the elderly. The introduction of smart home technology not only enhances the independence of the elderly's life but also provides a new direction for the intelligent development of the future elderly model.

**Keywords:** *The elderly, Smart home, Design application.*

## 1. INTRODUCTION

The aging population has become one of the largest groups in today's society, yet they are often at risk of being marginalized in the rapidly evolving wave of technology. Currently, many elderly people still rely on traditional ways of living at home, which to a certain extent restricts them from enjoying the convenience and safety brought by modern technology. This paper aims to study the multifaceted impacts of different smart home products on the lives of the elderly through an in-depth analysis of their lifestyles, and to explore their specific effectiveness in enhancing the convenience of life, promoting health management, and improving the safety of living.

## 2. LIFESTYLE CHARACTERISTICS OF THE ELDERLY

The group of older persons concerned in this paper is aged 60 and above, and older persons at this stage are in the golden age of old age. Although their physical functions begin to decline gradually

and the characteristics of aging gradually appear, most of them still maintain a better ability to take care of themselves. At this stage, the elderly are usually able to complete most of the activities in their daily lives independently, so their dependence on smart home products is relatively low. However, this does not mean that smart home technology has no value or impact on them.

### 2.1 Physiological Characteristics of the Elderly

The physiological characteristics of the elderly reflect changes in the functioning of the organism during the aging process. These changes are mainly manifested in a number of physiological systems, including the motor system, nervous system, cardiovascular system, respiratory system, blood system and immune system. Physical aging and degeneration in the elderly are divided into two main aspects: external changes and internal changes [1].

### 2.1.1 External Changes

Extrinsic changes are those changes in physical characteristics that can be observed with the naked eye and that are usually readily noticeable by family members and caregivers. The main ones include:

- Skin aging: Skin becomes loose, dry, wrinkled and discolored.
- Hair loss: Hair becomes thin, gray, or even falls out.
- Shortening of height: Gradual shortening of height due to osteoporosis and compression of the spine.
- Weight fluctuation: Weight may increase or decrease, depending on the individual.
- Tooth loss: teeth become loose or fall out, affecting chewing function.
- Muscle flaccidity: Muscle strength decreases, and muscles become flabby, affecting mobility.

### 2.1.2 Intrinsic Changes

Intrinsic changes are those that occur within the body and are not visible to the naked eye, which have a profound impact on the health and quality of life of older adults [2]. The main ones include:

- Aging of organs: Gradual decline in the function of major organs such as the heart, liver and kidneys.
- Decrease in metabolism: A decrease in basal metabolic rate leads to a decrease in energy expenditure, which can easily lead to weight gain.
- Decline in digestive function: Gastrointestinal peristalsis slows down, and secretion of digestive juices decreases, leading to indigestion and impaired nutrient absorption.
- Slowing of the mind: The brain's reaction time slows down, and its ability to process information decreases.
- Misalignment of memory skills: reduced short-term and working memory skills and tendency to forget things.
- Changes in personality: Due to changes in brain function, changes in personality and behavior may occur, such as becoming more stubborn or emotionally unstable.

These physiological changes not only affect the daily lives of older people but may also increase

their health risks. Therefore, understanding and paying attention to the physiological characteristics of the elderly is crucial to developing lifestyle and health management programs that suit them. Smart home products can play an important role in this process by providing convenient, safe and personalized services to help older people better cope with physiological changes and improve their quality of life [3].

## 2.2 Characteristics of the Behavioral Model

Behavioral patterns of older adults change significantly as they move into old age, and these changes are reflected in the range of activities, social behaviors, and seasonal activity characteristics.

### 2.2.1 Changes in the Scope of Activities

As we age, the range of activities of the elderly shrinks in the following ways:

- Bradykinesia: Slower movement and reduced range of motion in older adults due to decreased muscle strength and joint flexibility.
- Family-centered: After retirement, the daily activities of the elderly are shifted from the workplace to the family, where daily activities are centered on the family.
- Reduced social scope: The social circle is significantly reduced as the social circle shifts from colleagues in the workplace to family members and nearby neighbors.

### 2.2.2 Changes in Social Behavior

The social behavior of older adults also changes with age:

- Shift in the social object: The main social object has shifted from colleagues in the workplace to family members and neighbors, and social activities are more centered around the family.
- Reduced long-distance socialization: Due to physical aging and limited mobility, older adults reduce long-distance socialization and prefer to socialize closer to home.
- Reduced frequency of socialization: As physical function declines and the range of activities shrinks, older people socialize less frequently.

### 2.2.3 Seasonal Activity Characteristics

The activity patterns of the elderly are also affected by seasonal changes, and the different seasons are characterized as follows:

- Winter and rainy seasons: During the winter and rainy seasons, older persons spend less time outdoors and more time at home due to cold and slippery weather. Mobility is limited during these seasons and older people prefer to spend time at home for leisure and recreational activities.
- SPRING AND SUMMER: During the spring and summer months, when the weather is warm, seniors increase their outdoor activities. They prefer to walk, exercise or participate in community activities outdoors.

### 2.2.4 Increase in Time Spent at Home

Older people spend significantly more time at home, especially during the winter and rainy seasons. This characteristic has important implications for the lifestyle and health management of older persons:

- Family activities: Older people spend more time at home doing family activities such as watching TV, reading, and doing housework.
- Health management: Increased time spent at home makes it easier for older people to conduct self-health monitoring and management, such as regular measurement of blood pressure and blood glucose.

These characteristics of older people's behavioral patterns need to be taken into account when designing smart home products and services to meet their needs better and improve their quality of life. Smart home technologies can help older adults better adapt to these changes in behavioral patterns by providing convenient, safe and personalized services.

## 3. SMART HOME STATUS

Intelligent home refers to connecting various equipment and systems in the family through computers, network, communication and automatic control technology to form a unified intelligent system. The traditional concept of the home includes home appliances, decoration, furniture and other supplies related to the family room, while the home furnishing industry mainly covers the following eight aspects: home decoration, home

appliances, home textiles, home furnishings, lamps and lanterns, kitchen and bathroom.

The smart home adds intelligent technology on this basis, uploading diversified information to the cloud through the network platform, realizing the connection between things, and allowing users to control various supplies at home according to their own needs through cell phones, voice control and other means.

### 3.1 Characteristics of Smart Home

Key features of a smart home include:

- Internet of Things technology: smart home is a product of the Internet of Things under the premise of the Internet, connecting various devices in the home through the network to realize the interoperability and sharing of information.
- Human-computer interaction: The smart home will give control to the user; people can control the supplies at home according to their needs through cell phones, voice control and other means.
- Convenience and Comfort: Smart Home provides users with a more convenient, comfortable and safe living experience and is a way to improve the quality of life with less investment rapidly.

### 3.2 Development History of Smart Home

The concept of a smart home was first proposed by Pomidor W in his paper "Lifeline and Smart Home: Technology Comes to the Home," published in 1988. The earliest article on smart homes in China, "What kind of smart home", was published in 1998; it explored the form of smart homes and how users use them. These early studies laid the foundation for the development of the smart home.

### 3.3 Current Status of Smart Home

At present, the smart home has entered a period of rapid development, and more and more smart home products have entered thousands of households. The main application scenes of the smart home include:

- Intelligent Lighting: Remote control and automatic adjustment of lighting through smart bulbs and control systems.
- Smart Security: Providing home security through smart cameras, door locks and alarm systems [4].

- Smart home appliances: Smart refrigerators, washing machines, air conditioners and other home appliances can be remotely controlled and status monitored via mobile apps.
- Intelligent environment control: automatic adjustment of the indoor environment through the intelligent thermostat, air purifier and other devices.

The popularization of smart homes has made people's lives more convenient and efficient, as well as improved the quality of life. With the continuous progress of technology, smart homes will continue to develop and push the boundaries to bring more innovations and applications.

## **4. SMART HOME TECHNOLOGY OVERVIEW**

### ***4.1 Definition of Smart Home Technology***

*Smart home technology* is a technology system that integrates advanced information technology, communication technology and automation control technology to interconnect various types of equipment, facilities and systems within the home, thereby realizing home management, equipment control, energy management and security monitoring functions, and aiming to improve the quality and convenience of life. This technology system is based on the integrated application of various technologies such as the Internet of Things, artificial intelligence and sensor technology.

### ***4.2 Technology Key for Smart Home***

The smart home system is dedicated to building an efficient, interactive and adaptive home environment by integrating and coordinating multiple advanced technologies. The system combines technologies such as artificial intelligence, the Internet of Things, automation, cloud computing and big data analytics to bring significant convenience to the daily lives of middle-aged and older adults. The application of AI in smart homes includes data analysis, pattern recognition and predictive maintenance. By learning users' behaviors and preferences, AI is able to automatically optimize the home environment and enhance users' living experience. IoT, as the foundation of smart homes, provides the necessary infrastructure for smart homes by connecting various types of home devices and sensors to the Internet and realizing communication and coordination between devices.

## **5. THE IMPACT OF SMART HOME TECHNOLOGY ON OLDER ADULTS**

Smart home technology can improve the convenience of life for the elderly and promote their healthy body management.

### ***5.1 Improving the Ease of Living***

Smart home technologies have significantly improved the convenience and safety of older people's lives. Through intelligent management and control, these technologies make everyday life easier and safer for seniors. Smart home systems typically include a variety of smart devices and sensors, such as smart lighting, temperature control, security monitoring and emergency response systems, which play a key role in enhancing the quality of life for older adults.

Intelligent lighting and temperature control systems can automatically adjust the home environment and improve living comfort. For example, intelligent lighting systems can automatically adjust the brightness according to changes in indoor light, reducing the need for the elderly to adjust the lighting manually; intelligent temperature control systems can automatically adjust the indoor temperature according to the difference between indoor and outdoor temperatures, providing a constant and comfortable living environment for the elderly.

Smart security monitoring and emergency response systems provide a higher level of safety for seniors [5]. Smart cameras and motion sensors installed in the home can monitor unusual activity in the home in real-time to detect potential safety issues, while emergency response systems can quickly contact medical services or family members when seniors need help, such as with falls or sudden health problems.

In addition, smart home systems simplify daily tasks for the elderly through voice control and automation programs. The elderly can control home appliances through voice commands, such as turning on the TV or adjusting the temperature of the air conditioner, reducing the need for physical operation; automation programs, such as timed closing of curtains or preset operation modes of home appliances, also greatly reduce the daily management burden of the elderly.

## **5.2 Promoting Health Management**

Smart home technologies play a crucial role in monitoring and managing the health of older persons, especially in the context of the increasingly sophisticated use of telemedicine and personalized health services. These technologies facilitate health management and enhance the quality of life of older persons in a variety of ways.

The construction of intelligent elderly apartments is one of the typical applications. By utilizing modern technology and implanting chips in furniture, floors and other environments, the daily life of the elderly can be monitored in real time. For example, smart floors can sense the trajectory of the elderly's activities and send out immediate alerts to notify family members or healthcare providers when abnormal behaviors, such as falls, are detected. Robotic nurses used in community hospitals and homes also play an important role in health management. These robots are able to monitor the health data of the elderly and send the data to community doctors to provide healthcare counseling and advice to the elderly.

For example, Amazon's Alexa Together service helps seniors manage their health through integration with smart home devices. Alexa Together collects real-time data on home health (e.g., steps, sleep, blood pressure, blood glucose, etc.) and provides health reminders and emergency response capabilities. Additionally, Alexa devices support voice interaction to help seniors make initial health diagnoses and assist with doctor appointments or ambulance calls when necessary.

These applications demonstrate the great potential of smart home technology in health management for the elderly, which not only improves the accuracy and real-time health monitoring, but also enhances the accessibility and personalization of healthcare services. As technology continues to advance and innovate, it is expected that these applications will play an even greater role in the future, further enhancing the quality of life and health management of the elderly.

## **5.3 Enhanced Security**

Smart home technology utilizes advanced information technology, sensing technology, communication technology and control technology to closely integrate the home environment with the Internet to achieve intelligent management and control of the home environment, thus providing

middle-aged and older adults with a safer, more convenient and comfortable living experience. Sensor technology in smart home systems plays a key role in ensuring the safety of middle-aged and older adults.

For example, motion sensors are able to detect activity in the home, and when an emergency such as a fall occurs in an older adult, the system is able to send out an alarm and notify family members or contact emergency services in a timely manner. In addition, smoke sensors and gas leakage sensors can also respond immediately in the event of a fire or gas leakage in the home to ensure safe living.

The remote monitoring system in the smart home likewise provides extra security for the safety of the middle-aged and elderly. Family members can remotely view the real-time situation at home through smartphones or other devices to keep abreast of the elderly's health condition. For example, smart cameras can not only perform daily monitoring but also automatically send alerts when abnormalities are detected.

The automation control technology in smart home systems also greatly enhances the safety of the home environment. For example, the intelligent lighting system can automatically adjust the brightness according to the ambient light to prevent the middle-aged and the elderly from falling when they wake up at night due to insufficient light. Intelligent temperature control systems can keep the indoor temperature stable, preventing health problems caused by excessive temperature differences.

In addition, smart door locks and door/window sensors provide an important safeguard for home security. These devices can detect the opening and closing status of doors and windows and sound an alarm when abnormalities are detected, preventing break-ins. Meanwhile, smart door locks can be unlocked by fingerprints, passwords or mobile apps, reducing the risk of middle-aged and older adults being locked out of their homes because they forget their keys.

For example, LIFX's smart lighting system not only automatically adjusts the brightness according to the ambient light but also provides light environments suitable for different activities through preset scene modes, further enhancing the safety and comfort of living, while Ecobee's smart thermostat learns the user's temperature adjustment habits and automatically adjusts the indoor

temperature to maintain a comfortable living environment and save energy at the same time.

The application of these smart home technologies not only improves the home security of middle-aged and older adults but also provides them with more convenient and comfortable living experience. With the continuous progress of technology, smart home systems will bring more security and convenience to the lives of middle-aged and older adults in the future.

## 6. CONCLUSION

The rapid development of smart home technology has created a new path to improve the quality of life of the elderly. This study thoroughly analyzes the positive impact of smart home technology on the quality of life of the elderly from multiple perspectives [6]. Smart home technology significantly improves the living environment of the elderly by enhancing the convenience of life, supporting health management, and enhancing safety and security.

Looking ahead, the development of smart home technology will pay more attention to user experience, especially the special needs of the elderly. With continued technological advancement and innovation, smart homes will provide more personalized and interactive services to enhance further the living comfort and quality of life of the elderly and better integrate them into their daily lives.

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