

# The Design of Green Smart Residence for the Aged

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**Abstract:** *With the end of World War II, relatively stable international standards have emerged, the world economy and industry have prospered, medical standards have continued to rise and improve, and social aging has become a global growth trend. The ever-increasing elderly population has always been a problem of population growth, and countries around the world are mainly concerned about and committed to solving this problem. How to deal with the severe situation of an aging society and how to create an indoor and living environment suitable for the elderly are problems that need to be solved urgently. This paper conducts research on the design of green smart homes for the elderly, understands the relevant theories of green smart homes on the basis of literature, and then optimizes the design of the elderly homes, evaluates the design plan, and draws from the evaluation results, the overall design evaluation of this article is relatively good. More than 50% of the people who scored a score of 3 or more for the prospective design, and 60% or more scored for the barrier-free design.*

**Keywords:** *Population Aging, Senior Housing, Smart Housing, Housing Design*

## 1. Inductions

Population aging is an inevitable growth trend in the world [1-2]. The situation in China is that our country has a large population, fast speed, unbalanced economic growth, insufficient social system protection, insufficient experience in dealing with aging, and the problem of population aging in our country is already very serious [3-4]. China may be in the wave of the world's aging population. Its influence involves all aspects, and its success or failure is actually related to the national economy and people's lives, the rise and fall of the country, and the long-term stability of the country [5-6]. In China, studying the current situation and countermeasures of aging has become an important topic. As a young designer with a grand theme, it is very important to create a comfortable living environment for the elderly so that they can enjoy their old age, because research on housing suitable for the elderly is harmonious. A necessary and important part of society and sustainable communities, has a positive role [7-8].

Regarding the research on green smart homes for senior citizens, some researchers discussed in detail the relationship between gardening and community landscape design, and revealed the benefits of gardening in community landscapes. They found that community landscapes have medical functions in addition to visual functions. The research and reference of the related practical research results of the basic theory of horticultural nursing in Japan will be more specific and systematically integrated into the landscape design of the entire region [9]. Based on the ergonomic, psychological and physical characteristics of the elderly, the researchers proposed four types of housing suitable for the elderly: ordinary, elderly, home and medical. It also regulates the installation of indoor houses such as indoor floors, related equipment and indoor equipment, and the analysis and explanation of old security equipment [10]. In addition, some researchers are conducting research on home renovation and home care design, practice the renovation of nursing homes, and conduct inspections and acceptances related to the home after renovation, providing important practical references for subsequent home renovation practices [11]. In summary, with the advancement of the aging population, more and more designers are beginning to pay attention to the aging residential design.

This paper conducts research on the design of green smart homes for the elderly, analyzes the physical condition characteristics and housing needs of the elderly on the basis of literature data, and then uses cases to optimize the housing, and evaluates the optimized plan related conclusions.

## 2. Research on Green Smart Homes for the Elderly

### 2.1 Social Attributes of the Elderly

The aging process is an inevitable natural law, including the following characteristics:

#### (1) Body aging

These include changes in hair, skin, height, and weight. These changes vary from person to person and are closely related to factors such as personal living conditions [12]. These changes in physical condition make the elderly dissatisfied with their self-image and lower their self-esteem.

#### (2) Reduction of various normal functions

The decline of the sensory function of the elderly causes the decline of vision, hearing and taste ability, which causes great troubles for the normal survival and social activities of the elderly. At the same time, the elderly have slow neuromotor function, which reduces their mental activity and physical functional skills, makes their movements inaccurate, uncoordinated, and even clumsy, which hinders them from participating in social activities and endangers their health and psychology. At the same time, the memory of the elderly is diminished, and sometimes they are confused about what happened.

#### (3) Personality changes

The personality of the elderly changes gradually with the change of physical ability, and often act according to experience. The self-centeredness of some older people can also affect interpersonal relationships.

The change in the role of the elderly in society is reflected in their normal circumstances that determine that they can no longer participate in a society like young people. For most elderly people, how they perform in the family is very important. Due to the influence of traditional culture. In our country, the family structure is mainly based on nuclear families and extended families, especially whether the elderly between families live together. One is that there is a certain distance between the elderly and the children, making it easier to deal with emotional relationships.

### 2.2 Design Requirements for Adaptability Based on the Characteristics of Physiological Perception Systems

#### (1) Simple spatial recognition

The eyesight of the elderly is reduced, the discrimination ability is reduced, the size and distance of the object are not clearly recognized, and the complicated space cannot be effectively recognized, resulting in loss and errors. Therefore, attention should be paid to reducing traffic space, public space, and open space.

#### (2) Appropriate lighting

The amount of light that 60-year-old eyes can receive is one-third of the 20-year-old level, and 80-year-old eyes are 12% of the 20-year-old level, so the requirements for brightness are higher, because the elderly are less sensitive to light than the young. The adaptation to light and shade is slower, and the temperature and softness of the color light source need to be selected.

#### (3) Easy-to-identify signs

The elderly are not too sensitive to colors and will not be able to accurately see signs and license plates that point to the space. Special signs must be set up for indoor traffic signs, elevation differences, and uphill points to serve as reminders and warnings.

#### (4) Quiet rest environment

For the elderly to get adequate rest and good sleep, a necessary condition is to have a quiet resting environment. Relevant studies have shown that sleep deprivation and other disorders are common in the elderly, and noise is one of the main causes of sleep deprivation in the elderly. Long-term lack of high-quality sleep, coupled with the influence of noise, can make the elderly feel depressed, depressed, and anxious, and trigger various negative emotions. Therefore, when designing acoustic adaptability, we must first eliminate the influence of noise and give the elderly a quiet resting environment.

#### (5) Timely and accurate voice information

Due to the wear and tear of the hearing organs, the elderly often suffer from hearing loss and behind the ears. Therefore, it is necessary to ensure that the safety equipment in the room can send accurate, timely and complete audio information. When the nursing staff receives an emergency call from the elderly, if the elderly does not hear clearly, problems will arise.

(6) Good touch experience

The furniture and equipment that the elderly touch daily should pay attention to the comfort. A good touch can give the elderly the most direct sense of space. The quality of touch also indirectly affects the mood of the elderly. The choice of materials must be natural and soft in order to give the elderly a pleasant feeling.

(7) Comfortable natural environment

In the living space of the elderly, attention should be paid to proper light, temperature, humidity and ventilation to create a comfortable natural environment for the elderly. Regarding sunlight, there is evidence that proper sunlight can effectively promote the body to secrete melatonin and solve sleep and mental health problems. Sunlight is also an important condition for improving the quality of life of the elderly. Sunlight can play a positive role in the physiology and psychology of the elderly. Regarding temperature and dryness, elderly people are very sensitive to temperature and dryness because they are weak. Therefore, it is necessary to avoid the temperature difference between indoor and outdoor as much as possible, and adjust the temperature and humidity flexibly according to the physical condition of the elderly. In terms of ventilation, the respiratory system of the elderly is fragile, and it is necessary to introduce natural wind into the room as much as possible to breathe fresh air.

### **3. Design of Green Smart Home for the Elderly**

#### ***3.1 Room Type Introduction***

The house was built around 1998. A small room of 50 square meters is used to care for the elderly. The house is on an old street, near the fruit market. There are a total of 6 floors. The roof is a public roof. The house I bought is on the second floor. It is an old house with 2 bedrooms and 1 living room, which is convenient for the elderly to move up and down.

#### ***3.2 Future Design***

Given the age of the elderly, the installation of cabinets and sheets hides a very practical and frosted railing system throughout the house. First, avoid creating such an intuitive railing and replace it with None, the barrier design is shaped like furniture. All furniture cabinets have hand-pushable extensions and slopes around the furniture as invisible handrails. The design of retirement homes must not only ensure the safety and comfort of the living environment, but also maintain human equality and self-esteem. As they grow older, they slowly and naturally need something to support.

In addition to invisible handrails, the design of the living room and bathroom is also very flexible. This means that the elderly can wear barrier-free equipment as they age, and the living room is designed with a hidden shoe cabinet. The installation interface usually has a built-in wall decoration, which can be installed freely when needed in the future.

#### ***3.3 Barrier-free Design***

As a living place for the elderly, it is necessary to fully consider the issue of barrier-free access. First, the doors and walkways need to be widened. Due to changes in the physical condition of the elderly, the width of the wheelchair in the future will be about 0.5 to 0.6 meters, so the total width of the room should be at least about 0.8 meters. Each space must be wheelchair accessible, and the circular area H with a diameter of 1.5 meters needs to be reserved. Not only the width of the door is exquisite, but the ground must also be strictly level to prevent the elderly from tripping. When the elderly suffer from Parkinson's disease, their balance system will have problems, muscle coordination will be impaired, and they are now more prone to problems.

The second is the design of the bathroom. Indoor drainage should be unblocked, and sufficient space should be reserved for future equipment. The bathroom has an increased area of 0.76m x 1.5m, which is enough for the elderly to take a bath, and a strip-shaped floor drainage channel is installed to

ensure the separation of dry and wet. The use of bathroom curtains for heat preservation also considers this space to be more flexible. The height of the bathroom window sill is 1.5 meters. The elderly can put things, and some shelves are installed on the wall next to the windows. The height is stepped. It can not only be fixed, but also act as an invisible handrail. The flexible interface allows the elderly to freely choose to install barrier-free facilities. The toilet space is abundant, which is convenient for the installation of railings in the future, and can also meet the needs of the elderly in wheelchairs and family caregivers.

**3.5 Distribution of Smart Devices**

The activities of the elderly at home are mainly concentrated in the living room, bedroom, kitchen and bathroom. Therefore, smart devices are mainly placed in the above four spaces. Since the elderly in the house are mainly between the above four spaces, the main node is equipped with an anti-drop sensor on the floor of the equipment. The bedroom and the living room are the places with the largest space and the most complete functions, as well as the places where the elderly live long-term. Therefore, many smart electrical appliances and unstable health monitoring equipment (electronic blood pressure monitors, electronic clinical thermometers, etc) should be placed where elderly people can use them. The one-click help button is installed in the place where the elderly are most likely to encounter danger, such as the elderly’s bed or toilet. Other equipment can be ordered, depending on the nature of the space. For example, a smart refrigerator is installed in the kitchen, a smart mattress is installed in the bedroom, and a smart toilet is installed in the bathroom. The location of the infrared camera is restricted by the type of house. After the camera is installed, the location of the elderly at home can be observed without obstacles.

**3.6 Smart Terminal Design**

The smart terminal for the elderly is not only the only terminal system that directly interacts with the elderly, but also a tool for understanding the elderly and calling for long-term care. Due to the particularity of the device group, the device should be visually designed in terms of button size, color, and button logo. App device interface must be visually designed

The elderly mobile phone APP system is closely related to the community service platform system. Its functional modules include four parts: information transmission, service orders, service files, and personal center (Figure 1).

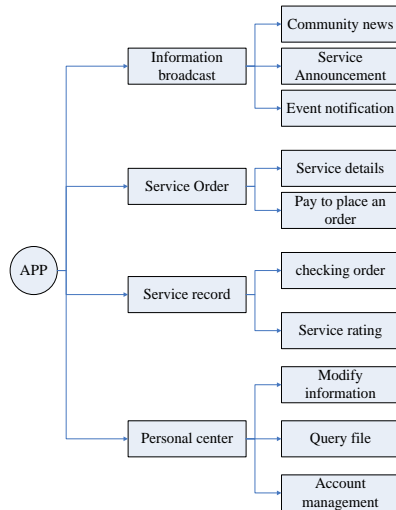


Figure 1: Schematic diagram of the APP system module for the elderly

**4. Residential Design Evaluation**

The formula for determining the sample size, the accuracy of the expected survey results (a), the confidence level of the expected survey results (b), and the specific data of the overall standard deviation estimate  $\sigma$ , the number of overall units N.

The calculation formula is:

$$n = \sigma^2 / (a^2 / z^2 + \sigma^2 / N) \tag{1}$$

Under special circumstances, if it is a very large population, the calculation formula becomes:

$$n = z^2 \cdot \sigma^2 / a^2 \tag{2}$$

For this design, evaluate the forward-looking design, barrier-free design, and the distribution of smart devices. The scorers are teachers from the design institute. The results are shown in Table 1:

Table 1: Residential design evaluation results

	Forward-looking design	Accessible Design	Distribution of smart devices
1	12%	11%	13%
2	21%	21%	22%
3	33%	35%	32%
4	44%	43%	43%

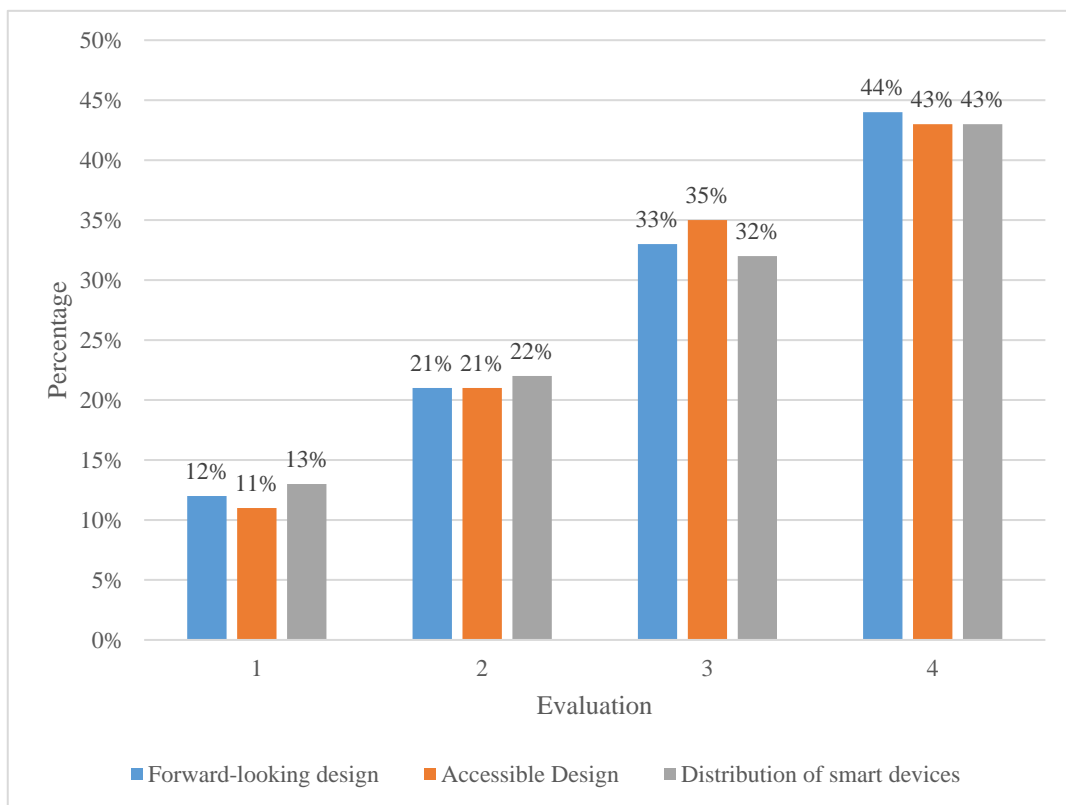


Figure 2: Residential design evaluation results

It can be seen from Figure 2 that the overall design evaluation of this article is relatively good. More than 50% of the people who scored more than 3 points for the forward-looking design, and more than 60% of the people who scored more than 3 points for the barrier-free design.

**5. Conclusions**

This paper studies the design of green smart homes for the elderly. After analyzing the relevant knowledge, optimizes the design of the elderly homes, and scores the optimized schemes. From the scoring results, it can be seen that the overall evaluation of the optimized schemes in this paper Good, more than 50% of the number of people with a score of 3 or more in the evaluation of forward-looking design.

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