Application and Development Trend of Smart Home in Residential Interior Design

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Abstract. Smart home is the product of artificial intelligence, which can provide people with a safe, comfortable and environmentally friendly home environment, as well asmeets people's living needs in residences in an all-round and personalized way and has a good development prospect. This paper expounded the development, classification and application of smart home in residential interior design. Taking Bill Gates' "Future Home" as an example, it analyzed that the introduction of smart home can organically combine residences, users, environment and plants to provide a better living environment for human beings.

1. Introduction on Smart Home

Smart home is a comprehensive system based on residential interior space by using automation technology, network communication technology, structured wiring and other technical meanscombined with a variety of equipment. In the interior space of the residence, it is effectively connected in series to work in a unified way. Through such means, it is tried to create a safer, more efficient, comfortable, convenient and personalized living environment for people (Figures 1 and 2).


Figure 1. Smart Home System 1	**Figure 2.** Smart Home System 2

(Figure 1 and Figure 2) Smart Home System

The predecessor of "smart home" is "home automation". Its emphasis is on the introduction of automation equipment, and there is no intelligent control system. After that[1], along with the development of electronic technology and information technology, the concept of smart home has begun to appear, and the residence with the introduction of technology, network and information elements is more controllable. This control even includes remote control. Therefore, smart home is officially appeared.

With the gradual commercial use of 5G technology, the Internet of Things will be the next historic opportunity after the Internet and mobile Internet. With the rise of the Internet of Things era, smart home (home Internet of Things) already has more mature development conditions[2]. From a global perspective, according to Statista data, the size of the world smart home market is about 33.4 billion US dollars in 2017 and is expected to rapidly increase to 78.2 billion US dollars by 2022. Smart home has become an inevitable trend (Figure 3).
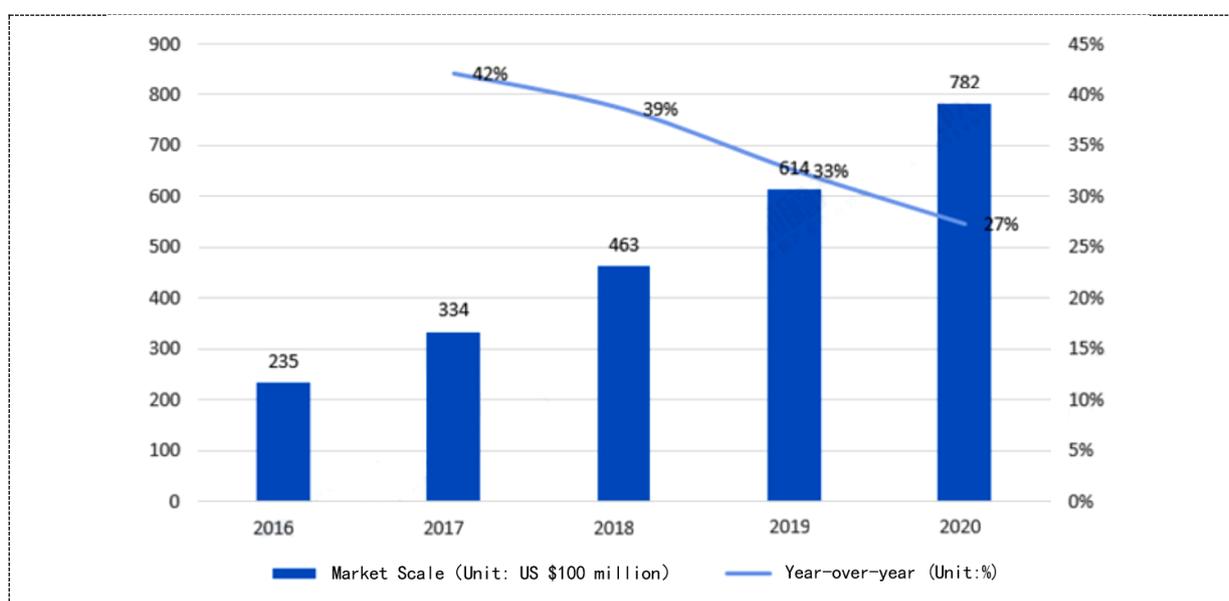
※Source: Statista Prospective Industry Research Institute

(Figure 3) World Smart Home Market Scale from 2016 to 2020 (Unit: US $100 million,%)

2. Classification of Smart Home Products

At present, there are many kinds of "smart home" products in the market, which can be roughly divided into the following four categories according to their use functions:

2.1. Improve the quality of living products

The essential function of smart home is to improve the living environment. Therefore, this kind of products naturally appeared first and there are many kinds and quantities. For example, televisions, acoustics, lights, air conditioners, curtains, sweeping robots, etc. that can be remotely controlled are commonly used. There are also some more complex products, such as systems that can automatically adjust interior temperature and humidity according to changes in the environment and purify the air[3], as well as kitchen consoles and refrigerators that can detect and measure the content of food ingredients. These products have played a great role in promoting people's healthy life.

2.2. Security products

As far as residential interior design is concerned, the first thing to consider is safety. Naturally, the primary functions of smart home products are no exception, such as remote monitoring, electronic entrance guard and automatic alarm system. However, the significance of security is not limited to this,

especially for residences with elderly, children or patients in the home, such as remote monitoring and automatic fire alarm. Intelligent systems can also play a safe role in protecting such people in the home who have no behavioral ability or lack self-care ability.

2.3. Health and welfare products
In the face of various social environmental problems and life pressures, people's physical and mental health have been greatly threatened, and they are paying more and more attention to this problem. Some residencehold medical equipment connected to the hospital system, not only can it bring convenience to patients, so that patients with mild and stable illness can transmit information to doctors without leaving their homes, which is convenient for doctors to understand the patient's state in time, but also that the patients do not need to be hospitalized[4], which also reduces the burden on patients and hospitals and leaves limited medical resources to patients who need more. For example, blood pressure meter, blood glucose meter, heart monitoring equipment and other intelligent products.

2.4. Whole residence scenario products
Looking at the development of the residencehold appliance industry, it can be divided into three stages. Initially, it is a traditional functional appliance, which must rely on manual programmed operation. The second is the intelligence of a single device to realize mobile phone APP control. The third stage is a connector with active consciousness to realize data sharing and interconnection between residencehold appliances and provide scene-based experience of the whole residence (Figures 4 and 5). For example, Viomi locates the whole residence Internet residencehold appliances, and its whole residence water purification system is implanted with a variety of water quality sensors to share and interconnect data with washing machines, dishwashers, etc. According to the washing requirements of the washing machine, take the initiative to provide it with high-quality softened water and start the soft water washing mode[5]. If it is recognized that the water purification system has removed scale when the dishwasher is working, the soft water device of the dishwasher will stop this part of the work, thus saving energy.

Figure 4. Whole Residence Scenario Product Experience 1
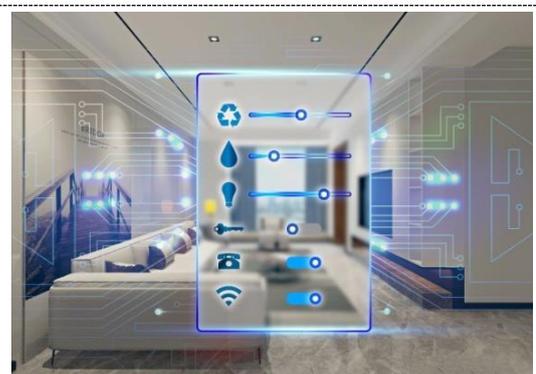
Figure 5. Whole Residence Scenario Product Experience 2

3. The Application of Smart Home in theResidential Interior Design

3.1. Provide an efficient and convenient lifestyle
At present, designers have habitually considered the introduction of various smart home devices that can be remotely controlled in residential interior design, such as lights, curtains, various residencehold appliances, etc. These smart home devices can run before people arrive, thus greatly improving the convenience of life. In addition, the smart home can also monitor a variety of indicators in the residential room in real time, such as temperature, humidity, pollution source indicators, light and other contents. Designers can customize these indicators according to the needs of residents, making

the practical functions of the residential more convenient, thus satisfying the use of residents themselves. For example, in hot summer, before arriving at the room, you can quickly cool down through remote control, reduce the time waiting interiors for cooling down, and increase people's comfort and convenience in life.

3.2. Provide security for living
In the residential interior design, safety, fire prevention, theft prevention and other issues are important aspects of design. In order to protect the personal and property safety of the residence and the residents, the smart home can carry out real-time, effective and all-round monitoring of the residence, and can know whether the residence is safe without the owner being at home. In addition, especially when there are elderly people, children or patients with low behavioral ability with mobility difficulties in the home, the real-time monitoring of smart home can also enable their families to know their dynamics at any time, and in case of danger or accident, they can find and rescue in time. In addition to these monitoring functions, smart home can also block some dangers and hidden dangers before they occur, thus further improving the safety of the whole environment, such as sensing lights, human health data monitoring system, etc.

3.3. Promote the sustainable development of residential energy consumption
Smart home has also played a great role in protecting the natural environment. For example, different families have great differences in living habits, the requirements for many conditions such as temperature, humidity and light are different. It is difficult for the traditional home environment to effectively control these indexes, However, the smart home system can do it. It can control the operation mode of various furniture products according to the data defined by the residents, reduce the waste in various cost budgets, convert and utilize resources, implement energy regeneration measures, implement resource sharing, and have the ability of sustainable development.

3.4. Meet personalized needs
Residential interior design will generally be based on the residents' physical conditions, aesthetic needs, personality preferences to maximize overall planning. The use of smart home can make interior space more flexible and aesthetic. During construction, it is not affected by slotting and wiring or through walls and other processes. It is directly laid out in the overall space and pays attention to the coordination between space and people. It can create the effect of artistic lamination in terms of functional layout, color matching and hierarchical relationship.

For example, the traditional residential interior design has certain defects in lighting. If designers do not carry out systematic research on the lighting of interiorspace, it will lead to the overall lighting design of interior space.Although it looks aesthetic on the surface, it has poor practicability, high cost and significant resource waste ratio, and the application of smart home can just solve this problem. The effective use of smart home can enable designers to effectively control the lighting degree of the lighting system according to the needs of users, which can not only create a warm interior environment, but also implement light brightness adjustment and color conversion according to the needs of residents, so as to meet the personalized needs of owners for interior space.

4. Bill Gates' "Future Home"
Bill Gates is famous all over the world for founding Microsoft, a world-renowned technology company. His mansion is located in Seattle. The outside world calls it a "future life prediction" technology mansion. In other words, his home guides the direction of intelligent life. In the book "The Road Ahead" published in 1995, he gave a detailed description of his smart home[6]. As we all know, Microsoft is famous both inside and outside the industry for all kinds of high-tech technologies. Its rich experience in electronic equipment development and manufacturing and software system research and development has laid a good foundation for Microsoft to enter the "smart home" industry. In "Future Home" (Figures 6 and 7), "Smart Home" is designed and applied to all aspects of the

residence, not only for Bill Gates himself, the owner of the residence, but also for the guests who will come here, and even the plants inside the residence are considered.

| **Figure 6.** Interiorof "Future Residence" 1 | **Figure 7.** Interiorof "Future Residence"2 |

4.1. Meet the needs of the host
For the owner of the residence, a large number of intelligent equipment in the residence provide it with extremely comfortable and convenient living environment. These devices include not only devices that can remotely control all parts of the residence, such as room lights, room temperature, room background music, floor temperature, bathtub water temperature, even equipment capable of detecting human health indicators in the toilet has been added to carry out a real-time detection of the user's physical health and protect the safety of the user.

4.2. Meet the needs of guests
Due to the small number of visitors to the "Future Home", the design of "Future Home" has also added personalized intelligent services to these guests. Every visitor who is allowed to enter the "Future Home" will receive an electronic brooch. In this electronic brooch, it will record a large amount of data about the visitor's temperature and humidity, light requirements, music preferences and even the diet he is accustomed to. From the moment the visitor steps into the "Future Home", many intelligent devices in the "Future Home" will also make corresponding adjustments according to the data recorded in the electronic brooch in the electronic brooch carried by the visitor, so as to meet the personalized needs of different people.

4.3. Meet the needs of plants
Not only for people, for the other creatures in this residence, such as plants, "Future Home" will give relevant countermeasures. The most prominent is the monitoring of whether plants are short of water. This system will synthesize the condition of the plant itself and the current and local environmental conditions to judge whether the plant needs to replenish water. The function of this system is not only to ensure the healthy growth state of the plants themselves, but also to individually supervise each plant and decide whether to irrigate or not according to its different states. As a result, it is not necessary to irrigate at the same time, but to distribute according to needs, thus greatly saving natural resources. At the same time, automatic triggering of irrigation equipment can also save manpower and improve efficiency.

Bill Gates' "Future Home" truly reproduces the intelligent scenes of American blockbusters andthe power of science and technology that can change life. It seems to indicate to people that everything is possible in the future. Although it has always been referred to as a game for the rich, on the other hand, "Future Home" reflects the development direction of home residence: Home intelligence. With the development of social and economic level, people are increasingly pursuing a personalized, automatic,

fast-paced and fun-filled lifestyle. Humanization and intelligence in life and home are no longer the exclusive property of rich giants. The application of intelligent electronic technology, computer network and communication technology is bringing a brand-new feeling to people's home life. The introduction of intelligent home in residence has become a trend.

5. Conclusion

The emergence of smart home will set off a new wave in the field of residential interior design. Let designers begin to try to look at the living environment from another perspective, so that smart home can not only bring convenience to residents, but also satisfy residents' pursuit of beauty.

The development trend of smart home in the future must be coordinated development from economic support, social affirmation, government support and residents' needs. In particular, the advantages of smart home fully combine people's personalized needs with science and technology, enhance residents' subjective initiative, and conform to the lifestyle and aesthetic trend of the current era. In addition, energy reuse and resource sharing in smart home are consistent with the concept of green energy conservation upheld by today's social environment. Therefore, all levels will definitely increase the proportion of investment in the future of smart home, and more innovation and exploration are also needed. It is also thanks to these intelligent devices that the high-tech family life dreams in science fiction have entered our lives.

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