

# The Current Situation and Future Challenges of Smart Home

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**Abstract:** Smart home technology has made great progress in the past few years, and it is changing our lives. In the real life it has brought a lot of convenience to some people, especially for old and disabled people, which is a great advance for society, but its development has also encountered some obstacles and challenges. Smart home is an extension of current electronic information and communication technology, but the development of the past 20 years has not achieved the expected results because of the security and the technology problems (Chan, et al., 2008). To solve the problems we need to learn about it first, a smart home refers to a convenient home setup where appliances and devices can be automatically controlled remotely from anywhere with an internet connection using a mobile or other networked device (Zhang, et al., 2015). For many years, home automation has been considered a promising field for the development of electronic technology, developing the smart home becomes the cornerstone of the development of the electronic field. The purpose of this article is to discuss the challenges and possible solutions encountered in the development of smart homes. First, an overview of the current state of the smart home will be introduced, and then the development issues and impacts will be analyzed, and finally, possible serviceable solutions and measures will be considered and evaluated.

## 1. Introduction

In the age of electronic information, the emergence and development of many electronic products has greatly improved the quality of human life, and solving the challenges meeting in the development of electronic products has become the research contents that people mainly focus on. As the core and most valuable factor of production in the era of digital economy, data is profoundly changing the way of production and life of human society, at the same time there are also many concerns about the hidden danger of consumer privacy security, and even national security. Smart home data may include sensitive or confidential information, which may endanger the privacy of residents. And the integration problem between different devices and avoiding redundant data has also become a factor hindering the development of smart homes.

## 2. Development of smart home

In 1984, when United Technologies applied the concept of informatization and construction equipment integration to the City Plaza Building in Connecticut, USA, the first smart building appeared, which started the upsurge of building smart houses around the world. The term “smart home” appeared in 1998 and is inseparable from the concept of “smart city” (Deyanov and Kharitonova, 2020). In different countries, smart homes have made different progress. In the past few years, smart homes have made great strides in family support, providing more support and assistance to residents' lives than ever before.

In addition, the development of smart homes is inseparable from the rise of the Internet of Things. Smart homes have emerged with the rapid development of the Internet of Things. It is now possible to use computers to fill sensors and control equipment in the sensors, and this method is already a mature technology in today's homes. Sensors perceive the state of the physical environment through the interaction between the environment and the instrument, and obtain services that may need to be

provided by reasoning about these states to help achieve these goals. Sensors cannot only record the value of the object, but also connect multiple devices to interact. As was suggested by Bush (2016), the Internet of Things did not happen overnight, it was a long slow process. For decades, computer scientists have been preparing for the Internet of Things to connect everything.

### **3. Application of smart home**

Through the Internet of Things, ordinary objects can become smart objects, and can interact with other devices to provide users with a comfortable and convenient living environment. As a result, the smart home industry has brought great convenience to our lives. Smart refrigerators can understand the shelf life of internal items. The smart bulb can adjust the opening time and brightness according to the sunset time at different times of the year. The smart toilet can automatically flush and detect sanitary conditions. In addition, smart homes using sensors may also save energy and achieve sustainable development goals. Smart home can provide us with a safer, more convenient, comfortable and energy-saving home environment.

Smart home is not only suitable for ordinary people, but also for people with special needs, such as the elderly and the disabled. Majumder et al. (2017) have argued that advances in medicine and public health, coupled with increased awareness of nutrition, environment, and personal hygiene, have paved the way for the dramatic increase in global life expectancy. However, the increase in average life expectancy has led to the aging of the population. Smart homes show unique advantages in this respect. High-quality smart home designs can help elderly and disabled people have a freer life, give them the ability to take care of themselves, additionally provide help without changing the normal life of residents. Smart homes would provide low-cost continuous and long-distance life monitoring to help offspring understand the situation of their parents more quickly. Smart houses can enable the elderly to live in a comfortable family environment, and can help the disabled get rid of expensive medical facilities. Consequently, the pressure of supporting the elderly may become less. Most notably, these devices can help their families and even medical staff to monitor the overall safety of the elderly in real time. Provide remote support and feedback to further reduce the risk of accidents for the elderly and the disabled. This is evident, in each case, the sensors in the smart house and various medical equipment are constantly in operation. These devices operate in a network and sometimes connect to remote data collection and processing centers. The remote center diagnoses the current situation and gives reasonable feedback. Following this, smart homes provide convenient and safe services for the disabled and the elderly.

### **4. World's efforts to develop smart home**

Countries all over the world are committed to researching smart homes. In Japan, about 15 smart houses are under development, which aim to create a smart and comfortable environment and make full use of the Internet of Things technology so that the elderly can live comfortably at home. The Ministry of International Trade of Japan has even built 13 "Welfare Technology Houses" (WTH) equipped with fully automatic medical equipment to collect data on the physiological conditions of residents and provide timely feedback to residents to help residents understand their physical conditions and make timely adjustments. Smart homes are developing rapidly in Colorado. The TV screen can be changed or paused according to the user's moving position (Amanda, 2012). Although this is the first smart home in this area, with the improvement of technology, this concept will be accepted by more people (Amanda, 2012).

### **5. Problems faced by smart home**

However, there are still many drawbacks to smart homes. The rapid development of electronic information technology and communication technology and the decline in costs have made smart home projects feasible and cost-effective, bringing more opportunities to create value. Despite this,

Information security and device integration issues have arisen, which limit the development of smart homes. Although smart home brings great convenience to people's daily life, it must be mentioned that, like other electronic devices, the privacy leakage brought by smart home is also very serious. It is even easier to leak information than mobile phones. Traditional encryption methods can no longer meet the needs of privacy protection in smart home applications, and the possibility of hacker attacks is high, which makes them a huge threat. In 2019, Amazon's Echo made global headlines, and thousands of employees reportedly recorded and heard consumers' opinions and conversation. This has led many users to resist smart homes, refuse to use smart homes, and prevent criminals from monitoring and using your data, posing a threat to the property and safety of the occupants. The potential impact of smart homes on privacy and security may cause the stagnation of the smart home.

Another outstanding problem is that due to the chaos in the early stage of smart home development, most devices rely on or specify a special platform or technology, and the platforms cannot be connected to each other, which will lead to challenges in application development. In addition, users cannot easily use different types of smart homes. Following this the market acceptance of smart homes is also decline. The communication network used by each device is very different. The lighting control system uses hard connections, while other control connections can be wireless, using Bluetooth. Each type of communication depends on an industrial protocol or an academic equivalent protocol. The most important criteria in smart home applications are ease of use, cost and bandpass. Although various communication systems have been proposed, there are still interoperability challenges between different systems making the entire market unable to unify. The heterogeneity between smart homes can be unified through standard access methods. The integration and interoperability of device heterogeneity in the smart home system have become the main challenges for the deployment of this project.

## **6. New models for alleviating the problems**

However, there are many ways to deal with these challenges. There are numerous ways to address the problems linked to smart homes. In order to solve the privacy and security issues of smart homes, some manufacturers have adopted new models to deal with information leakage, and improve privacy protection through a high degree of self-learning of devices. The SDASL model has the advantages of strong adaptability, low latency and low power consumption, and is undoubtedly a better solution for smart home applications (He, et al., 2017). Although this model still leads to a certain degree of information leakage, the privacy is better protected. In the future, the technology can continue to improve privacy protection capabilities by controlling access permissions, reduce the use of irrelevant information as much as possible, and at the same time can better resist hacker attacks and protect our privacy (He, et al., 2017). In addition to developers, according to Maiti (2019), consumers should also choose devices that come with smart home hubs instead of smart homes that are directly connected to other devices.

There are also effective solutions for smart home integrated control. According to Liao (2017), the concept and application of Mashup are valued by more and more people, because this concept can help them solve the problem of interoperability of smart homes. Mashup is a service that connects multiple devices and interoperates by standardizing technologies between different groups. This service can have a good integration effect on the development of smart homes (Liao, 2017). For example, using the same method to write the operating modes of different devices can enhance the interoperability between different devices and also improve the production efficiency of smart homes. This experiment confirmed that it is feasible to complete the convenient transplantation function on the MIB device, which is largely due to the inclusiveness and structural complexity of the wireless network. Embedded systems and WOT concepts are becoming more and more popular, and good results have been achieved in the smart home called ROSE. In addition, the team is also developing web-based tools to facilitate the integration of resources in ROSE (Liao 2017). Laximinarayan and Istepannian (2000) believe the technological innovation of the next generation of wireless and Internet

will solve many incompatibility problems between smart home devices, so that smart devices have a unified operating platform, which is convenient for users to learn and use.

## 7. Conclusion

In conclusion, from the deep research on the smart home, the situation and future challenges of smart home is clear. It is worth noting that the field of "smart home" has broad prospects. At present, the smart home market and companies already have a certain scale, which makes the current challenges easier to solve. It only needs developers to be aware of the challenges of smart homes to be well solved. At the same time, it needs to be emphasized that the current smart home system cannot integrate all components to update operations in a unified manner, and most smart homes are expensive and not suitable for all families. However, due to the development of effective solutions and healthy competition among manufacturers, the development of the smart home industry will be accelerated. With the emergence of cost-control smart home systems and the improvement of the unification of integrated control between multiple devices, in the future, smart homes will be as common as today's mobile phones, and will bring more substantial help to the elderly and the disabled. In future work, developers should continue to improve the functions of smart homes to build a system that can not only ensure home safety, but also achieve energy efficiency and home comfort.

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