

Talking About the Smart Home Ecosystem

Qi Wang, Ziheng Zhang

Xiamen University Tan Kah Kee College, Zhangzhou, Fujian, 363000, China

Abstract: Smart home ecosystem research involves the connectivity and ecosystem of various technologies, products and services in the smart home field. The study of smart home ecosystem can help to understand the development trend of the field, the ecological pattern of the industry, the direction of technological innovation, as well as market opportunities and challenges.

Keywords: Smart home, Ecological chain, Outlook.

1. Introduction

The smart home industry has gone through continuous exploration and practice from the conception to the vigorous development, and the smart home technology and products have developed rapidly under the impetus of the new generation of information technology. In this paper, we will analyse and study the development history of the smart home industry, overview of the smart home concept, industry chain, current market situation, related policies, current challenges and opportunities, and the case of Xiaomi Company.

2. Overview of Smart Home Concept

Smart home is a contemporary innovative concept centred on housing, integrating automatic control technology, computer technology and Internet of Things (IoT) technology. Its core concept lies in the organic combination of home appliance control, environmental monitoring, information management and audio-visual entertainment, etc. By centralising the management of various devices in the home and realising functions such as remote control, interconnection and independent learning, it creates a more convenient, comfortable, safe and energy-efficient intelligent home living environment for users. Smart home does not mean a single product, but a collection of systematic products. According to the characteristics and functions of smart home products on the market, we can roughly divide them into six categories: smart home appliances, smart small appliances, smart security devices, smart connectivity controllers, smart light sensing devices and smart home energy management systems.

3. The Development History of Smart Home Industry

The development of smart home has gone through several stages. Early smart home concepts can be traced back to the 1980s and early 1990s, when computer networks and the Internet were just emerging, and scientists began to think about how to connect home devices to the Internet for remote monitoring, control, and data collection. However, due to technological limitations and high costs, the application of early smart home products and systems suffered many challenges. Entering the 21st century, with the development of wireless communication technology and embedded systems, smart home has ushered in a new stage of development. The emergence of wireless sensor networks

(WSNs) has made large-scale device connectivity more convenient and practical. At the same time, the development of cloud computing and big data technology provides powerful support for smart homes, allowing massive device data to be collected, stored and analysed, and enabling precise control and decision-making. At this stage, smart home mainly focuses on the intelligence of single devices, such as smart TV, smart audio, smart lights and curtains. With the advancement of technology and the promotion of market demand, the smart home has begun to develop towards integration and holistic development. The application of Internet of Things (IoT) technology enables a variety of home devices and systems to connect with each other and work together. The central control system becomes the core of the smart home, and users can monitor and control remotely through mobile devices such as mobile phones and tablet PCs. At this stage, the smart home system is able to automatically adjust the status of home equipment according to the user's needs and habits, improving the quality and convenience of life. In modern smart homes, the application of artificial intelligence (AI) and voice assistant technology further promotes the development of smart homes. Users can control devices, access information, and perform various tasks through voice commands. In addition, the application of AI technology enables smart home systems to learn and adapt according to the user's behaviour and preferences to achieve personalised and intelligent management.

In China, the development of smart home has also gone through several stages. In 1994, smart home was introduced into China, and has experienced a budding period, a pioneering period, a wandering period and a convergence and evolution period. In the budding period, the whole industry is still in a concept familiar, product awareness stage; in the pioneering period, the domestic has set up a number of smart home R&D and production enterprises, marketing, technical training system gradually improved. At present, China's smart home market has become an important part of the global Internet of Things, and presents a vigorous momentum of development.

4. Policy Analysis of Smart Home

As one of the representative industries in the Internet of Things era, smart home has received active support and policy support from governments at all levels [1]. With the promotion of smart city construction, the rapid development of artificial intelligence industry and the continuous upgrading of the consumer market, the smart home industry has ushered in a

historic development opportunity. Therefore, the powerful impact and influence brought by the smart home industry can be felt in all fields, and all forces are actively contributing to the development and growth of the smart home industry.

As a new industry integrating the traditional home industry with artificial intelligence, audio and video, Internet of Things and other technologies, smart home's complex industrial chain requires the participation and cooperation of many parties. In order to better adapt to the needs of this diversified industry chain, relevant enterprises, industry institutions, top universities and research institutes have met to establish research organisations for smart home-related industries.

These research organisations aim to gather professionals and experts in the industry to work together on cutting-edge technology research and innovation in the smart home field. Through cross-border cooperation and knowledge sharing, these organisations are committed to promoting cooperation and development upstream and downstream of the industry chain, and facilitating the continuous progress of smart home technology. This mode of cross-border cooperation and co-construction will help the smart home industry better respond to market challenges and drive the industry in the direction of greater intelligence and innovation. At the same time, these research-based organisations also provide a platform for related enterprises to communicate and learn, promote the sustainable development of the smart home industry chain, and provide users with a smarter, more convenient and safer home life experience.

5. Smart Home Industry Analysis

At present, the smart home has a complete industrial chain. The upstream of China's smart home industry chain includes solutions, industrial design, chips, sensors, PCBs, MCUs, communication modules, voice control and interaction technology, intelligent controllers, etc.; the middle reaches of the smart home terminal products are smart door locks, smart curtains, smart lighting, smart speakers, smart air purifiers, sweeping robots, smart air conditioners, smart televisions, smart washing machines, etc.; the downstream is smart home terminals. TV, smart washing machine, etc.; downstream through online and offline sales channels to end consumers.

6. Smart Home Market Analysis

With the continuous progress of science and technology,

consumers are no longer strangers to smart home products. The smart home industry market is rich in product types, but the ecological chain is not perfect, the number of service providers of family integrated smart home solutions is small, and the connectivity of the products between different brands is poor, most of the home products on the market need to have a separate APP belonging to the product, which makes the smart home in the popularity of the efficiency of the extremely low[2].

7. Challenges and Opportunities

In the Internet era, technology is constantly updated and market competition is increasingly fierce, which poses a higher challenge to emerging smart home enterprises. Relying only on their own independent ecological chain may be difficult to cope with the changing market demand and competitive pressure. Therefore, it has become crucial to cross the boundaries of corporate organisations to cooperate and co-innovate with other enterprises, entrepreneurs and technology providers. Such cross-border co-operation not only helps to share resources, technologies and market channels, but also promotes innovation, reduces costs, expands business scope, and enhances a firm's position and competitiveness in the industry. By working closely with other ecosystems, emerging smart home companies can better grasp market opportunities, address challenges, and achieve sustainable growth.

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