

The Future of Smart Housekeeping in Multiple Scenarios

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Abstract: With the development of the social economy and the improvement of material living standards, multi-scenario intelligent housekeeper brings convenience and security to people's lives, improve the quality of the human living environment, and enable us to save more time and have higher efficiency. In this article, we introduce some background of smart home, there are also categories of smart homes on the market, but now in the market under the multi-scene intelligent butler is not very perfect, so in this work, we need to focus on the problems that have emerged, Including improper operation, execution of wrong commands, lack of compatibility, smart furniture privacy is not enough, expensive and other problems. We also studied the development trend of smart home products, including some functional development and future development of the research content. For example, voice recognition and voice response system, Bluetooth system, infrared temperature measurement module, monitoring, automatic sleep and other functions and some simple analysis of these functions are carried out. In my opinion, the future development of smart home in multiple scenarios is a process full of opportunities and challenges, and we need to continue to explore and innovate. Only in this way can we ensure the sustainable development and social acceptance of smart homes.

Keywords: Multi-scenario, intelligent housekeeper, Internet of Things.

1. Introduction

With the development of the social economy and the improvement of material living standards, the smart home system has been gradually popularized in many families, especially in North America and Europe, there are already many families who have implemented smart home devices. Smart home to achieve the automated control of home facilities and equipment, people only need to go through the terminal equipment or voice input, you can remote control the home, even if the distance is meters away, or even thousands of kilometers away, and can be realized on the home equipment of the long-distance control[1]. If it is a traditional smart home, the smart housekeeper can turn on the lights for us manually after we return home from a tiring day; if it is a multi-scenario smart home based on the Internet of Things (IoT) technology, the smart housekeeper can put the hot bath in advance when we need it; it can also receive our instructions when we get up and open the curtains and prepare coffee for us; it can monitor the house for us when we are not at home; and it can control the house for us when we are not at home. When we are not at home, we can monitor the situation inside and outside the house and reflect it to our cell phone in time; when we go out, the sweeping robot will start working automatically; we can call and ask questions to the smart housekeeper as we use the voice assistant and so on. Smart homes bring convenience and safety to people's lives, improve the quality of the living environment, allow us to save time, have higher efficiency, and also provide mobility for the elderly to maximize the convenience of the home. However, the current scene is still relatively single, therefore, in the future, if you can design a multi-scene smart home system, users will also be more convenient, more advanced, and more intelligent.

2. Background of Smart Home

2.1. Smart Home in a Nutshell

A new generation of advanced information technology along with the rapid development of artificial intelligence has quietly into our lives, this huge progress has been detected by each country, the smart home is the use of integrated wiring technology, network communication technology, security technology, automatic control technology, audio and video technology and other technologies, the home life of the product integration of residential management system[2]. It can realize the functions of remote control equipment, the interconnection between equipment, self-learning of equipment, etc. with the help of Internet of Things (IoT) technology, collaborative hardware, software, and cloud platforms to build intelligent home life scenes [3].

2.2. Classification of Smart Home

2.2.1. Classification of Smart Home Products

At this stage, the mainstream smart home systems on sale in the market include home automation: covering intelligent upgrades from single products to the whole house, such as washing machines, dryers, air-conditioning systems, lighting control devices, TVs, and stereos, etc.; kitchen appliances: including smart refrigerators, microwave ovens and ovens, etc.; living room and entertainment: including smart TVs, audio systems, projectors, etc.; bedroom and sleep: including smart beds, smart light adjustment etc.; Bathroom and Hygiene: including smart toilet, smart shower device, etc.

2.2.2. Classification of controls for smart homes

Smart home control mainly has centralized control and distributed control, early centralized control due to the smartphone not yet being popularized, need to configure the smart home gateway, and with the continuous development of science and technology, distributed smart home control system to multi-function can be configured to control, node

for the unit, each unit can be controlled independently can also be networked control, can be controlled by keypad can be controlled by the cell phone can be realized in combination with multi-scene Smart Home[4]. However, most of the existing smart home systems are in centralized control mode, which affects the operation of the smart home to a certain extent and cannot provide the best service to people[5]. Therefore, we need to research a multi-scene and multi-function smart home system.

2.3. Problems with the current smart home

2.3.1. Improper operation, execution of wrong commands

Problems with the device itself: smart home devices may have hardware malfunctions or software defects, which can directly affect their normal operation. For example, sensor input signals out of the meter's measurement range, unresponsive devices, or poor wireless connectivity can lead to the execution of erroneous commands. In addition, logic errors in the device can be caused by component failures (e.g., electrolytic capacitors, diodes with the wrong polarity) or assembly errors (e.g., integration blocks mounted in the wrong direction).

Communication problems: smart home devices usually rely on wireless signals for communication, and signal interference or blocking can cause the device to fail to receive the correct commands, which can lead to errors. For example, unstable Wi-Fi connections or configuration issues can affect the proper functioning of the device.

Software design and debugging problems: The software design and debugging process of the smart home system may be flawed. For example, the error handling code in the software may fail to effectively deal with input-dependent and input-independent errors, resulting in the device failing to execute commands correctly under certain circumstances. In addition, failure to adequately consider various potential problems during the debugging process of the system program may also lead to errors in the actual use of the device.

2.3.2. Inadequate compatibility

Incompatible technical systems: Smart home devices of different brands and models often use different communication protocols and technical standards, such as Bluetooth, WiFi, Zigbee, etc., which makes it difficult to realize effective communication and interaction between them. This technical heterogeneity makes interoperability between devices complex and difficult.

Inconsistent standards: the current market lacks a unified smart home standard, and each manufacturer develops corresponding standards and interfaces based on their own needs, which further exacerbates the compatibility problem between devices. For example, some devices may only support a specific brand's APP or gateway, and users need to download multiple apps to manage all the devices.

Conflict of commercial interests: As different vendors hold their own views in market competition, they are often unwilling to share or open up their core technologies, making it difficult to realize cross-brand interoperability of devices. This competitive relationship makes even vendors who are willing to solve compatibility problems face greater challenges.

Software Upgrade and Maintenance: Different vendors use different operating systems and applications for their equipment, resulting in equipment upgrades or the release of new features that may not be compatible with the old equipment, causing problems for users.

Intelligent housekeepers face multi-brand, multi-model smart home appliances, due to the different models and specifications, there will be no command link, not be able to give timely feedback to the user!

2.3.3. Insufficient privacy in the smart home

Data Collection and Privacy Leakage: Smart home devices collect users' daily life information, including behavioral patterns, habits, and even personal privacy, through hardware such as sensors and cameras. These data, if improperly used or leaked, will seriously threaten users' privacy and security.

Vulnerabilities arising from device interconnections: smart home systems rely on IoT technology, and this type of connectivity can easily lead to vulnerabilities between devices, making it easy for hackers to break in and gain access to user data.

Lack of unified security standards and regulations: The smart home industry currently lacks unified security standards and regulations, and many manufacturers ignore security issues during the design and production process, resulting in a large number of devices with serious security vulnerabilities. In addition, existing minimum laws contain ambiguous provisions that complicate data protection issues.

Third-party misuse and unauthorized monitoring: data from smart home devices is often stored on external servers on platforms such as Apple Homekit, Google Assistant, or Amazon Alexa, making it possible for third parties to misuse this data for unauthorized monitoring.

Lack of user control: Smart home devices are usually controlled by manufacturers, and users lack sufficient knowledge and control over the use and management of their own data, which further exacerbates privacy risks.

Device Hijacking and Malicious Code Attacks: smart home devices are susceptible to a variety of threats such as eavesdropping, replay attacks, message notifications, denial of service, malicious code, and impersonation attacks, all of which can be used to invade a user's privacy.

2.3.4. Expensive

Intelligent housekeepers R & D and production costs are high, which may lead to the selling price being on the high side, the high selling price may cause some users of the intelligent housekeeper deterred by a major factor

3. The development trend of smart home products

3.1. Multi-scene intelligent housekeeping:

Designed to multi-scene intelligent housekeeper-based smart home system, to bring convenience and security to people's lives, to enhance the quality of the human living environment, but also to give the mobility of the elderly to maximize the convenience of home. Due to the different living and resting conditions of each family, we can customize the intelligent housekeeper according to the living habits of the owner of the house, so that the intelligent housekeeper can form its own management habits.

3.2. Functional development

Through the system requirement analysis, the functional requirements include voice recognition and voice reply system, Bluetooth system, infrared temperature measurement module, monitoring, automatic hibernation, wireless data transmission, voice wake-up, intelligent human-machine dialogue system with multimodal fusion, etc.

Speech recognition and voice reply systems consist of a microcontroller, voice recognition module, and voice reply module. Speech recognition is the basic function of the system, and voice recognition can improve the convenience of home life.

Bluetooth system sends the data processed by the system to the cell phone via Bluetooth and then controls other smart homes in the home via Bluetooth module or voice control module.

The infrared temperature measurement module consists of an infrared temperature measurement probe and a display module[6].

Surveillance features high-definition digital surveillance and cameras with infrared capabilities to ensure proper monitoring at night[7].

The auto-sleep feature saves electricity and reduces power consumption[8].

Wireless data transmission enables data transfer and is able to link the various system modules.

The Wake on Voice function can work after detecting the input of voice to be able to exit the hibernation mode automatically[9].

Intelligent human-machine dialog systems with multimodal fusion can enable machines to have self-learning capabilities.

3.3. Future development of research content

3.3.1. System Architecture Design

Design the overall architecture of the smart housekeeping system, including the physical layer, data layer, and application layer. Determine the communication protocols and data exchange methods between the layers to ensure system stability and scalability.

3.3.2. Equipment selection and testing

Understand the mainstream smart home devices on the market, including smart switches, smart refrigerators, smart TVs, and smart beds.

Select equipment on the market that meets the system requirements, has stable performance, is easy to integrate, and is tested in practice.

Study the interconnection technology between the selected devices to ensure that there is no problem with the interconnection of the devices.

3.3.3. Algorithmic studies

Design control algorithms applicable to intelligent housekeeping systems in multiple scenarios, including advanced technologies such as machine learning and deep learning. Develop intelligent control modules to realize automated control and intelligent regulation of home equipment. The effectiveness and reliability of the control algorithm will also be verified through experiments.

3.3.4. User Interaction Interface Design

Study the design principles and methods of user interaction interface to ensure that the interface is easy to understand and operate. Design and realize a variety of interaction methods, such as mobile apps and voice assistants, to meet the different

needs of users. Followed by user research and testing, listening to user suggestions, and continuously optimizing the design of the interactive interface.

3.3.5. Study on safety and security mechanisms

Study the security vulnerabilities and hidden dangers of the smart home system and develop corresponding security measures. Develop security modules, such as security authentication and data encryption, to ensure the security of user data and privacy, and to prevent monitoring and privacy leakage by third parties; and finally, conduct security testing and evaluation to ensure the security and stability of the system before it can be used.

4. Concluding Remarks

The rapid development of science and technology has promoted the updating of smart homes, which has greatly improved people's living experience and quality of life. However, the development of smart homes in the current market is still imperfect, not only the degree of intelligence is low, but also the coordination between each smart home is poor, and the connection is relatively single. Therefore, the future development of smart homes in multiple scenarios will be a process full of opportunities and challenges. We need to continue to explore and innovate, combining advanced technology with humanized design to bring users a more intelligent, convenient, and comfortable home life experience. At the same time, we also need to pay attention to issues such as user privacy and data security to ensure the sustainable development and social acceptance of smart homes.

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