

Advancements in Smart Home Technologies: Enhancing Living Environments through Integrated Systems

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Abstract:

With the continuous advancement of information technology, the smart home sector has experienced rapid development and is poised to become a significant trend in the future. An intelligent home system enhances the living environment by leveraging the house as a platform, integrating it with a sophisticated control system. This integration employs advanced technologies such as integrated wiring, network communication, automatic control, and audio-visual systems, enabling users to manage home hardware effortlessly through a single intelligent control system accessible via mobile phones. The smart home system facilitates an easy and convenient lifestyle, allowing users to remotely control their home systems using telephones and computers. This paper focuses on the "Smart Home System" project, incorporating mobile Internet technology to design mobile phone software for real-time control of smart home hardware. The primary components of this design are mobile Internet technology and the Android mobile phone system. This smart home application emphasizes the comfort, convenience, security, and stability of the smart home control system, made possible by the mature environment of mobile Internet technology. It ensures that users can manage their homes in real-time, enhancing their daily living experience. system in people's daily life under the mature environment of mobile Internet technology. Real-time.

Keywords:

Smart community, network communication, Android, database, automatic control.

1. Introduction

With the continuous development of information technology, embedded technology and wireless communication network technology have developed rapidly. People's life is gradually approaching to intellectualization. Smart home system is a modern home management assistant system based on computer technology, radio communication technology and sensor technology. It uses all kinds of household appliances and communication equipment in the user's home.

Intelligent supervision is realized through integration. Users can realize remote control of various household appliances by SMS. Smart home system is based on home environment. The embedded processor is used as the brain of the system to realize the home control network. The home network mainly includes the household appliances and wireless communication equipment. The main control module of the smart home system is to control and monitor all kinds of appliances and sensors. Smart home system has the following characteristics:

Strong convenience. The most obvious feature of smart home system is its convenience. Smart home system is mainly to complete the intelligent control of various household appliances, replacing the original complex operation of household appliances with one-click control form, which not only reflects the automation of smart home system, but also more humanized[1]. On the way home, users can complete the operation of household appliances through intelligent control system, including turning on water heater, air conditioning and so on. This will bring users a better intelligent experience.

Intelligent home system monitoring, in which residential safety monitoring and anti-theft smart home is the main function, smart home system can be located in all corners of the home sensors can obtain relevant information detection and control, including home smoke monitoring, temperature

monitoring and so on. Smart home system has strong environmental protection characteristics. Because the smart home system obtains the environmental data in the house through temperature, humidity, light and other sensors, so as to ensure that the home electric energy can achieve energy saving and environmental protection. For example, intelligent household appliances system can detect the light in the home in real time, so as to open a reasonable lighting system, which will save electricity.

2. Research meaning

This topic is based on Android system design a smart home system, mainly including device control function, video surveillance function, data query and information service function, to achieve the basic needs of users.

The development significance of smart home system is as follows:

Smart home system has high use value. This smart home system based on Android system can run on different Android smartphones. Users can control household appliances, see real-time pictures and information management in mobile applications. Such an intelligent operating system not only makes user operation more simple and fast, but also makes people's life full of a sense of technology.

Smart home system has reusable value. The smart home system developed in this paper is a combination of user function and Android system. Its main purpose is to provide relevant services for users. The intermediate module in system development is based on high cohesion and low coupling, which is easy to reuse. System developer usually redevelops the system. Its main purpose is to better realize other functions of the system [2] .

2.1 Introduction to Android

Android is an open source operating system developed in Linux environment. Android system is mainly used in smartphones and some functional machines. With the constant updating and optimization of Android system, its expansibility and compatibility are strong. At present, Android system has been used in tablets, wearable smart devices and smart home. According to statistics from relevant departments, Android has surpassed Apple's IOS system in smartphone users worldwide and become the most widely used smart operating system.

2.2 Android system architecture

Android system architecture is based on the Android operating system environment, this system architecture can ensure that developers achieve real-time programming. Android system architecture consists of five parts: application program, application framework, Android operation, system library and Linux kernel.

3. Application program

System developers can use Java language to replace related applications. Compared with other mobile operating software, this is mainly to solidify the system software in the system, which is a relatively simple and flexible way of program development.

3.1 Application Framework

In the Android application development process, the most important thing is to complete the development of the entire application based on the Android application framework. In this process, system developers mainly complete the application development based on ten basic components[3]. Firstly, application developers build applications based on these components. In addition, they can also complete personalized development and development of APP programs based on various mechanisms.

3.2 Android_Runtime

Usually, when Android system works in practice, Android system mainly consists of two parts, which are core library and Dalvik virtual machine, as shown in Figure 1.

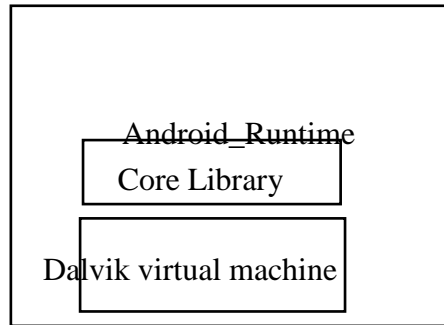


Figure 1 Android_Runtime

Core libraries in the system: The core libraries of the system provide many Java APIs and Android APIs on the Android system development platform, that is, when executing multiple applications on the Android platform, they are not based on a Dalvik virtual machine. The implementation is mainly based on the corresponding Dalvik virtual machine set up between each application. There's still a big difference between this and Java programs.

Dalvik Virtual Machine: This virtual machine is a kind of virtual machine that can cache data in mobile devices. The development of Dalvik virtual machine is mainly based on Java virtual machine. However, when the Dalvik virtual machine works, the code part involved in it is not Java bytecode, but converted to DEX format in Dalvik by Java bytecode. When the Java virtual machine works in practice, it works in the form of Dalvik virtual register. This virtual machine in registers implements storage in storage variables[4]. The running data stored in the system will be reduced, and the running speed of the system will be increased at this time, and then all the functions of the virtual machine will be realized based on the hardware level.

4. System Library

The main function of the system database is to complete the overall development of various application frameworks. The system library mainly forms a data exchange channel between the Linux kernel and the application framework. The system library can also form a C++ database between class libraries and components in Android platform, which makes the functions of Android platform rich and stable.

4.1 Linux Kernel

The Linux kernel is an open operating platform based on Android platform. Linux kernel is an information communication channel based on the system software layer and hardware layer. This information channel can complete the differentiation of the underlying hardware, which can reduce the workload of system developers. Usually, the major mobile phone manufacturers will first implement the operation driver based on the performance of the mobile phone hardware. After adding Linux content to the mobile phone hardware, Android system can be guaranteed to run in the corresponding mobile phone. The Linux kernel in Android platform can provide data protection in related applications. The structure of the Linux kernel is shown in Figure 2.

4.2 Message Push Technology

When the system realizes the function of message push, it needs a certain technical standard or network protocol to realize the push. Firstly, the user's information is transmitted over time based on the Internet, which not only reduces the overload of information data [5]. In other words, the message push function in the system is to send messages from the server, and only to receive messages from the client. In this process, a new technology of data pull-out will be formed, which is mainly based on the data request of the client. Information search and mass data storage are implemented among message pushing, information and suppliers to ensure that users get more data value. When the mobile

phone client is not working, if the server sends relevant information, the client will still receive this information, which can save power for the client mobile phone.

4.3 Basic Principles of Speech Recognition

There are two forms of language recognition technology in the system, one is learning stage and the other is recognition stage. In the learning stage, an acoustic model is formed based on the recognition unit. In speech recognition, the system uses target speech as the basic click model base for comparison, and achieves language recognition.

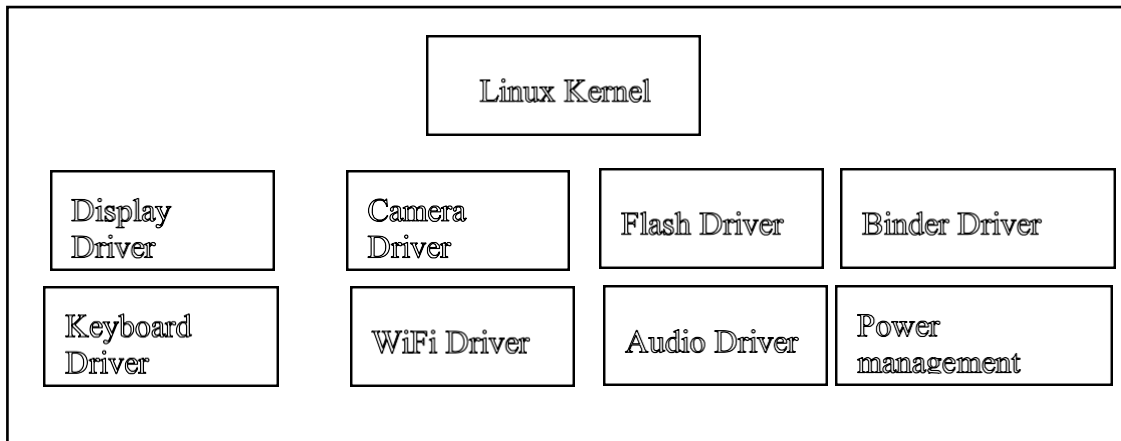


Figure 2 Android Linux Kernel

4.4. System Requirement Analysis and Network Communication Module Design

In this smart home system, the connection between household appliances and sensors is mainly in the form of power carrier or WiFi, which will form a local area network in the home. The local area communication network covering the family can collect the basic operation and demand services of all kinds of electrical appliances in the home in real time, which will form a kind of intelligent home system with strong automation. In smart home system, not only is the communication network formed by itself to realize information exchange and monitoring, but also users can realize information transmission in smart home based on wireless communication in the home, including Bluetooth devices, GSM network, Internet network and other ways can be realized. Information transmission of home intelligent system. According to the development situation of information network technology, smart home system is gradually moving towards a better development of humanization and convenience.

4.5 The Importance of Network Communication Security

Network communication technology usually refers to the collection, storage, processing, transmission and interaction of text or graphics, audio and video data through terminal equipment such as computers and network communication equipment, so as to realize the sharing of information and data resources. With the use of network communication, people can realize the exchange and transmission of information, thus effectively improving the convenience of communication between people. In the process of promoting the construction of digital society and information society, network communication plays a very important role. At the same time, it can create a good environment for social stability and economic development. However, in the current network communication, network security problems often occur, which poses a great threat to people's privacy and information. Therefore, in order to give full play to the role of network communication, we must strengthen the maintenance of network communication security, and use advanced technology to improve the security of network communication information.

5. Conclusion

The development of this system will be based on the Android platform, focusing on the creation of a smart home application (APP), thereby establishing a foundation for the future evolution of smart home technologies. The intelligent system application developed in this paper aims to meet specific user needs, comprising several key components.

From an overarching perspective, the paper first discusses and analyzes the background and significance of smart home systems, elaborating on the research purpose and importance of these systems. The requirement analysis for the smart home system is conducted based on software engineering principles. This involves an in-depth investigation and analysis encompassing two primary steps:

1. **Composition and Structure Analysis:** The initial step is to examine the overall composition and architecture of the smart home system. This includes identifying the various components that make up the system and understanding their interactions.
2. **Functional and Non-Functional Requirements Analysis:** The next step is to assess the actual functional and non-functional requirements of smart home applications based on user needs. Functional requirements specify what the system should do, such as controlling lighting, security, and temperature, while non-functional requirements address how the system performs these tasks, including aspects like reliability, usability, and performance.

By following these steps, the paper aims to develop a comprehensive and user-centric smart home application, leveraging Android system capabilities and software engineering methodologies to ensure the APP meets the evolving needs of smart home users.

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