Research of Network Security Technology in Smart Home

Liangying Chen

Sichuan Vocational College of Information Technology, Guangyuan 628017, China

229993768@qq.com

Abstract. Under the background of the development of computer technology and information technology, the smart home network has been gradually improved, surpassed the previous development, and gained new progress. The realization of smart home system needs network security technology as a guarantee. Although the smart home system has made progress, while for maintaining the harmony and coordination of the families' facilities and the residential environment, there are a lot of technical problems needed to be solved at present. For example, many safety standards need to be unified. This paper, from the realization of the domestic and international research situation of smart home, an overview of the network security technology, smart home network framework, and the existing smart home network security system to study on the application and research of network security technology in smart home, and then analyzes and draws the conclusion. In a word, to achieve the security of smart home system needs network security technology continuing to progress, so it also requires long-term efforts.

Keywords: Network security technology; smart home; research.

1. Domestic Research Status of Smart Home

Research on smart home in China has just started, and the current research goal is mainly concentrated on some scattered research on the smart home system like ammeter, water meter and gas meter copy subsystem, control subsystem and medical help subsystem and so on. Although companies such as Lenovo, has done tentative researches in this aspect and constructed blueprint for domestic smart home, due to the lack of unified standards in the implementation and without specification nor interface protocol, these products are only in the experimental stage and they have not circulated in the market [1].

1.1 Concept, Goal and Function of Smart Home Network

The goal of home network is to realize the resources sharing and work coordination, and proceed exchange and communication of information. Finally, through the application of diversity to bring great convenience, security and a better life to the users [2].

(1) Information sharing function. Share information, files, Internet, applications, etc.

(2) Home entertainment function. Realize the signal transmission between the entertainment equipment, which makes it convenient to enjoy the entertainment equipment, not hindered by the equipment. It is possible to realize video conference, conference call, video on demand, and other video and audio information communication for the external.

(3) Information collection function. Collect user's water meter, electric meter and other data information, so as to provide convenience for various managements.

(4) Safety precautions. Through the fire prevention, anti-theft and other safety alarm to remind the security situation.

1.2 Research Status of Smart Home Network Security Technology

The smart home system network consists of two parts, which are the external network and the home network. The home gateway is the core controller of the smart home system, and it is also the key node of security communications of the smart home system. Smart home system network structure is shown in figure 1.

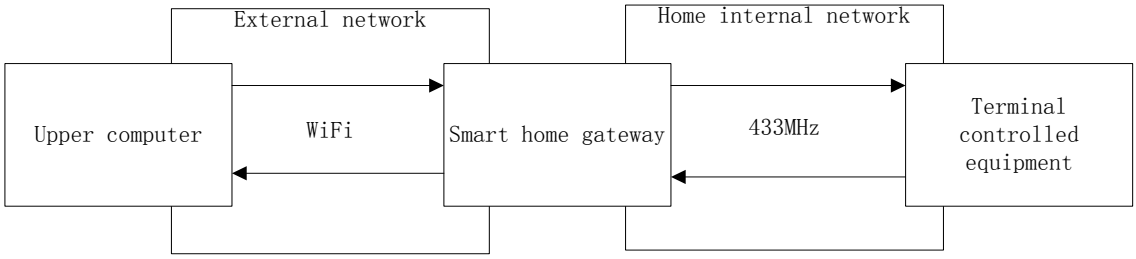

Figure 1 Network composition structure of smart home system

At present, from the practice, it is found that, for the smart home network system, the most often-appear problem lies in the tests of users' legitimacy. Now the majority uses static password to verify. If the password is lost, then the consequences are difficult to estimate. Once the server has been compromised by hackers or information leakage, it will threaten the security of the entire smart home system.

1.3 Application of Embedded System in Smart Home Network

The home network of embedded system is a real-time, multi task and network operating system based on microprocessor development. It requires a strong intelligent operating system, but also need to achieve a complex man-machine interface as well as the relevant network communication protocol. The embedded operating system has the characteristics of real-time. In smart home control network system, signal transmission rate is low and information transferred is little, but it has a high requirement on real-time and reliability of monitor and control signals (such as alarm signals). Once there is an emergency situation, the system needs to send out signals immediately.

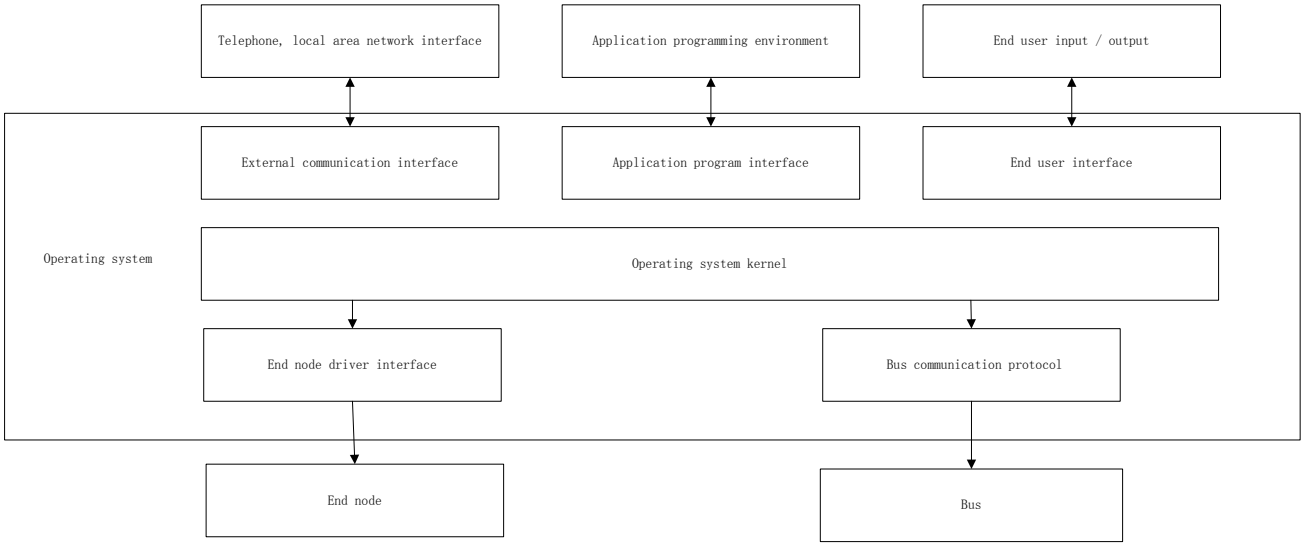

Figure 2 Structure of embedded operating system

In order to realize the remote monitoring and the communication with the external network, because of the technical limitation, the domestic mainly rely on the embedded operating system introduced from foreign countries. It not only has a very good value for the technological use, but also the main goal of achieving information appliances.

2. Network security technology overview

2.1 Concept of Network Security and Its Level Structure

Network information security mainly includes physical security (physical media level), security control (network information system) and security services (application program level).

Physical security refers to the security protection of the network information stored and transmitted in the physical media level.

Safety control refers to, in network information system, control and manage the operation and process of information storage and transmission, mainly including security control of the operating

system, security control of network interface module, and security control of network interconnection equipment [3]. It just provides simple preliminary information security and protection.

The security service is the method of guarding against all kinds of security threats and resisting a variety of attacks. It needs to protect the confidentiality and integrity of network information in the application program level, and identify sources of information and content authenticity, so as to ensure to provide users with security.

2.2 Network Security Model and Basic Security Technology

(1)Network Security Model

Communication subjects form a communication channel by the trusted third party negotiation communication protocol. In the process of information exchange, it will be threatening by various security, facing communication interception, a sudden interruption, secret eavesdropping, information being tampered with and so on [4]. In all kinds of security attacks, the communication subjects must take measures to prevent infringements and attacks. Network security model as shown in figure 3.

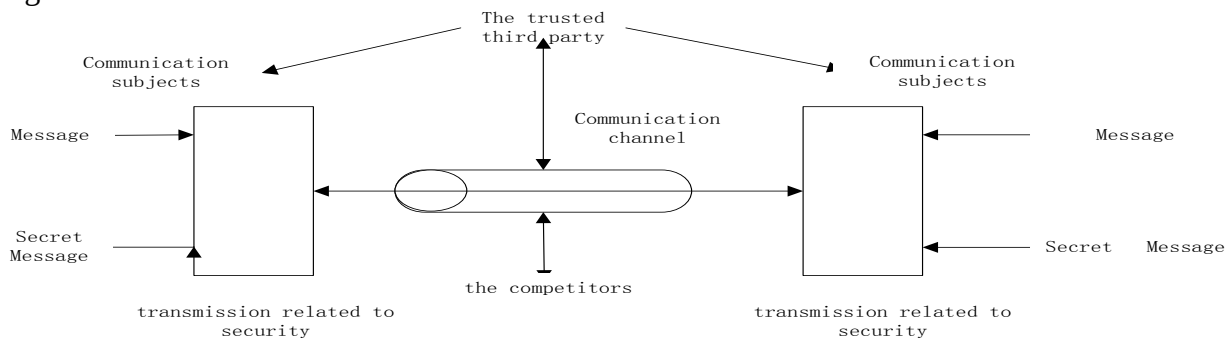

Figure 3 Network security model

(2)Basic Security Technology

Regardless of what form of network security services are adopted, it is not enough to ensure their safety, and it will cause information risks. Even if for a simple e-mail and file, it is necessary to pay attention to the safety of information transmission, to prevent criminals to steal confidential documents and information privacy.

2.3 Data Encryption Technology

(1)Public Key Mechanism

The public key mechanism is the concept based on the one-way function of the trap gate. Public key mechanism can be used for secure communication (both sides of the communication do not need to exchange key to realize the secure communication), digital signature (be able to realize a user encrypts the data and the multiple users interpret), key exchange (both sides of encryption communication connect the information transferred) [5].

(2)Private Key Mechanism

Private Key mechanism is different from public key mechanism. It is a kind of traditional cryptography. In the private key encryption, the method of encryption key is the same as the formation, and the same way is used to decryption and encryption. In consequence, it is also called cryptographic system. The parties must trust each other and believe that the other party will not deliberately leak the private key, and only in this way can achieve data encryption and ensure its integrity.

3. Framework of Smart Home Network

3.1 Overall Structure of Smart Home Network

Smart home system is a kind of home network system with many kinds of standards and norms. It has the following characteristics: the use of distributed system control method, high strength against damage and failure, and provide alarm to the owner and the security part of risks. For communication method, radio frequency and infrared communication mode are used, which avoids the complex wiring work. The universal model controller is adopted, which is simple and convenient; the bus structure is used, which makes the system more flexible; the fuzzy neural network technology is used

to make the system more intelligent [6]. According to the characteristics of changes of the environment and the host's different requirements to proceed intelligent control, the overall framework of the smart home system is shown in Figure 4.

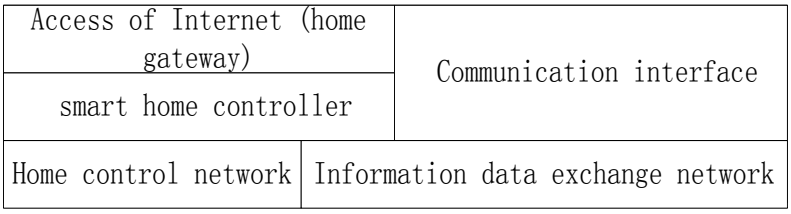

Figure 4 Overall framework of smart home system

At present, the smart home network system mainly consists of hardware platform, software module, network structure, home gateway and so on. The overall framework of the system is shown in Figure 5.

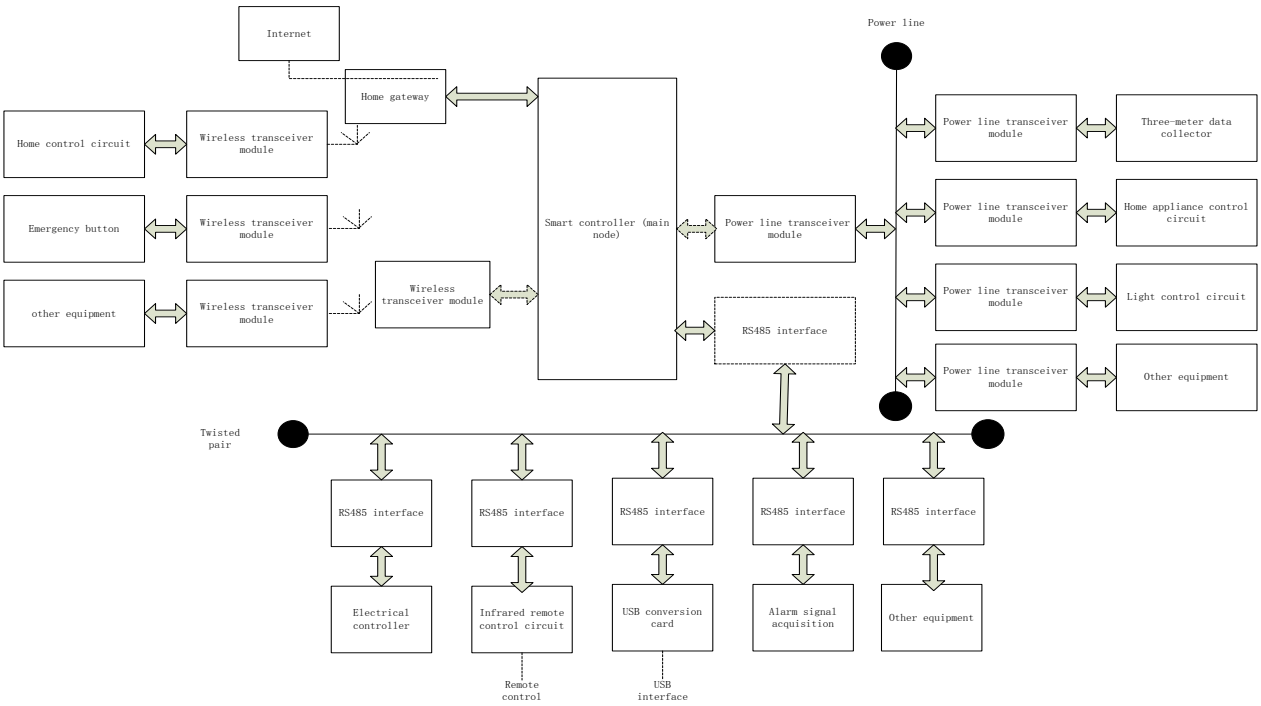

Figure 5 General design of home network

As the core node of the home network, the intelligent controller is connected by the three communication media interfaces with three sub networks. In the meanwhile, the intelligent controller is connected through the the RS232 interface with home-used PC machine and connected with the home gateway through the parallel interface, so as to realize the home network Internet access.

3.2 Hardware Platform of Smart Home Network

The hardware platform of the system mainly consists of each network node and the communication media, and the hardware part of each network node is mainly composed of the independent processor and the communication interface. Intelligent controller is the core node of the entire home network, and it is also the key to design, which assumes the tasks of information collection, security guard, state monitoring and so on, and achieves a variety of control methods.

3.3 Software Platform of Smart Home Network

The software platform of the whole home network consists of four parts: the software system of intelligent controller, the application software of each network node, the software system of home gateway and the network management system of PC.

Intelligent controller software platform can be used in two ways: the purchase of general operating system software; reduce the development based on the principle of the operating system. It mainly consists of the following three parts: appliance monitoring module is mainly used in the monitoring of traditional home appliances, such as air conditioning; the other kind is the general development control of household appliances, such as lighting. Three-meter copied module is mainly used for

home consumption list automatic copy and solve the problem of household's meter artificial reading error [7]. Security alarm module is mainly used for home security, including anti-theft alarm, fire alarm, gas leak, emergency call and other disaster alarms.

4. Conclusion

Based in the principle of taking real life practical problems as a study, embarks from the reality, according to the research results at home and abroad, this paper explores the current situation of smart home system and comparing with foreign advanced research theory, proposes the realization methods and ways for China's smart home network security system. In allusion to the field of researching on smart home system where the theory and reality are little, this paper presents a series of solutions to the problem of security communication in the smart home system [8]. The innovation of this paper is to do integrate and comparative research on the identity authentication system and data encryption system, and finally comes up with efficient solutions, which makes the whole proposed solution to the problem more complete and efficient.

References

[1]. Kumar S. Ubiquitous smart home system using android application [J]. arXiv preprint arXiv:1402.2114, 2014.

[2]. Fensel A, Tomic S, Kumar V, et al. Sesame-s: Semantic smart home system for energy efficiency [J]. Informatik-Spektrum, 2013, 36(1): 46-57.

[3]. Huiyong W, Jingyang W, Min H. Building a smart home system with WSN and service robot[C]//2013 Fifth International Conference on Measuring Technology and Mechatronics Automation. IEEE, 2013: 353-356.

[4]. Jie Y, Pei J Y, Jun L, et al. Smart home system based on IOT technologies[C]//Computational and Information Sciences (ICCIS), 2013 Fifth International Conference on. IEEE, 2013: 1789-1791.

[5]. Han J, Choi C S, Park W K, et al. Smart home energy management system including renewable energy based on ZigBee and PLC [J]. IEEE Transactions on Consumer Electronics, 2014, 60(2): 198-202.

[6]. Kumar S, Lee S R. Android based smart home system with control via Bluetooth and internet connectivity[C]//The 18th IEEE International Symposium on Consumer Electronics (ISCE 2014). IEEE, 2014: 1-2.

[7]. Stallings W. Cryptography and Network Security: Principles and Practice, International Edition: Principles and Practice [M]. Pearson Higher Ed, 2014.

[8]. Manshaei M H, Zhu Q, Alpcan T, et al. Game theory meets network security and privacy [J]. ACM Computing Surveys (CSUR), 2013, 45(3): 25.