Research and Design of Smart Home System Based on Cloud Computing

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Abstract. With the rapid development of Internet of Things (IoT) technology and cloud computing technology, smart home received more and more attention, which focuses on integrating with the home life-related facilities and building efficient residential facilities and family affairs management system to get safe, convenient, comfortable and artistic home life. Firstly, this paper introduces some problems of traditional smart home, which analyzes the advantages of 'Internet plus' and cloud computing combining with smart home and proposes ae new kind of smart home system based on cloud computing. At last, The simulation experiment proves that the new system can solve and improve the problems existing in traditional smart home system.

Keywords: Smart home · Cloud computing · Internet plus

1 Introduction

Currently, with the 'Internet Plus' era, people increasingly dependent on the basic necessities of the Internet, at the same time, the Internet has also brought to people's lives more convenient [1]. At this point, the traditional smart home reveals a lot of problems, which can no longer meet the requirements of consumers. 'Internet Plus' combined with the smart home has become a trend.

Now, there are many smart home systems on the market, but they will more or less bring bad influence to the user experience, which has been unable to meet consumer demand [2]. In recent years, with the Internet of Things technology and the rapid development of cloud computing, they provide technical support for the development of smart home [3]. And smart home development has also made great progress.

This paper first introduces some problems of traditional intelligent home, which analyzes the advantages of 'Internet plus' and cloud computing combining with smart home and proposes a new type of smart home system based on cloud computing. Finally, The simulation experiment proves that the new system can solve and improve the problems existing in traditional smart home system.

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2 Analysis of the Present Situation of Smart Home

Smart home system is the use of a variety of advanced technology, integration of individual needs, will be related to the home life of the various subsystems, such as security, lighting control, air conditioning control and other organic combination to achieve intelligent control and management purposes [4]. A typical smart home system is shown in Fig. 1.

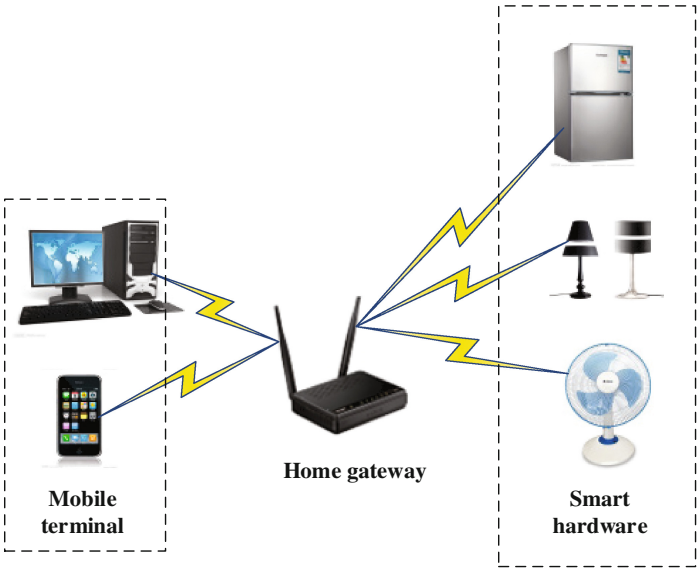

Fig. 1 Traditional smart home systems

Smart home now has entered the outbreak period. Data projections, China's smart home market will reach 180 billion yuan in 2018. However, there are data show that 87.5% of consumers are not satisfied with the smart home products. Although the smart home has great potential market, but the current sales market is limited to some high-end crowd or part of the pilot public buildings. Smart home is not universal in the market because of smart home system there are many problems [5].

- There is no business model.
  At present, including the smart home of the Internet of Things industry are exploring business models. Only by selling hardware equipment profitability can not be long, because a set of equipment sales may be used in a period of more than 10 years. If only the hardware update is not enough to support these hardware equipment manufacturers.
- Not really smart.
  Smart home users do not find the pain point, but for smart and smart. which does not give the user the opportunity to experience the real convenience and visible

economic benefits. The intelligent use is only dispensable, and users cannot rely on it. Users do not have enough economic benefits to drive, who develop long-term habits difficult to change.

- There are security risks.
  Manufacturers ignore the safety of smart home. Related reports show that a lot of people's lives and intelligent equipment is only an increase of network control functions, but to the hacker's attack has brought convenience, which making the traditional smart home systems exist security risks.
- Cannot handle large amounts of data.
  As the number of devices in the smart home system increases, the data generated during the operation of these intelligent devices grow exponentially. For the massive data generated, the traditional smart home system hardware conditions simply cannot meet such requirements. Massive data cannot be stored and calculated to limit the development of smart home.

Traditional smart home these problems seriously hindered its position in the market, it is necessary to propose a new intelligent home system to solve or improve these problems.

3 Design of Smart Home System Based on Cloud Computing

Cloud computing is a product of distributed computing, parallel computing, utility computing, network storage technologies, virtualization, load balancing, high available and other traditional computer technologies and network technologies [6]. Cloud computing is rapidly deployed in the Internet industry with its ultra-large scale, high scalability, virtualization, high reliability, on-demand services, fast services and extremely low cost. It has three service models including SaaS, PaaS and IaaS [7], as shown in Fig 2.

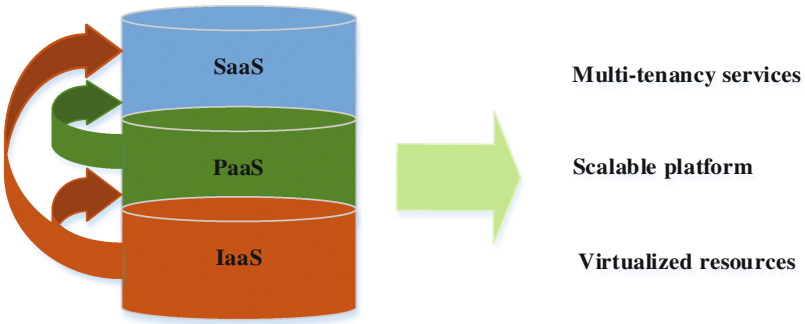

Fig. 2 Three service modes of cloud computing

In this paper, the design of smart home system is based on B/S architecture development, the system uses the IaaS cloud computing model. We will build on the basis of IaaS PaaS smart home system. We directly rented Aliyun's ECS (Elastic

Compute Service) and deployed it, including firewalls, load balancers, web servers, database servers, backup servers, and file servers. Specific cloud deployment architecture shown in Fig. 3.

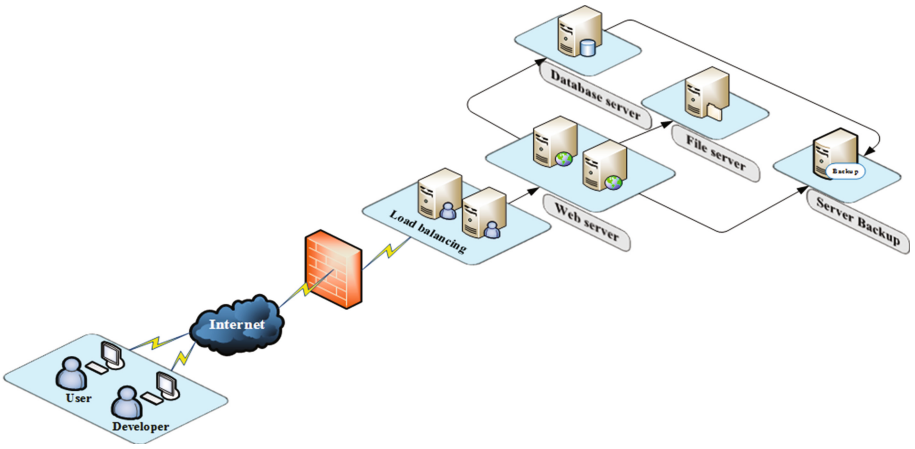

Fig. 3 Cloud deployment architecture

The application of cloud computing technology in the smart home system makes the design of the home gateway becomes very simple. ECS and home gateway use TCP/IP protocol for communication. In the course of communication, we adopt algorithm encryption to encrypt the data in order to enhance the security of the system. As long as the family of smart home devices connect home gateway by the lwIP, ZigBee, wifi and other wireless communication protocols, which can communicate with the cloud, so that the system to achieve online control and real-time detection purposes. The architecture of a complete cloud-based smart home system is shown in Fig. 4.

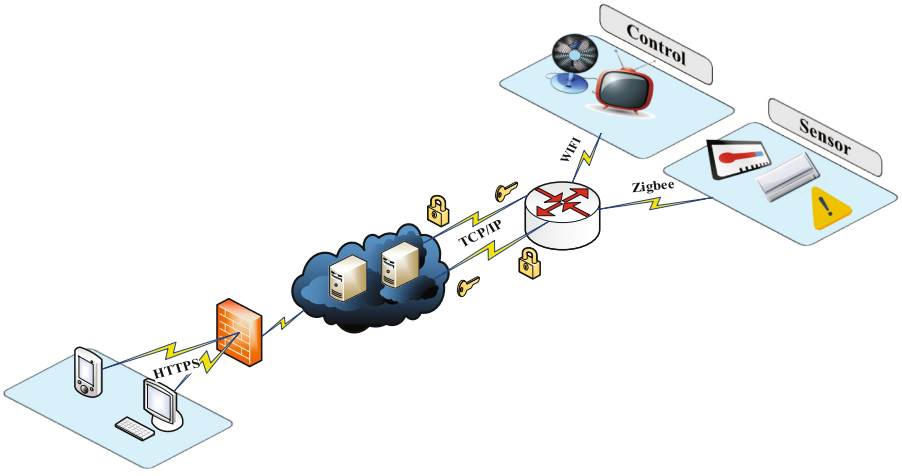

Fig. 4 The architecture of smart home based on cloud computing

4 Results and Discussion

After the system was built, we designed the software part of each function module by the asp.net technology. After the programming was completed, the target circuit board through the network cable to access the home gateway, the core board IP address was set to ECS IP address. Then entered the ECS IP address (https://118.178.230.195) on the client (pc, phone or pad), and entered the correct user name and password in the corresponding interface, we can log into the system's main control interface.

Then the client can control the target board by the simulation of household appliances, the system successfully completed the Web page and the underlying hardware interaction. So far this paper has completed the complete design of intelligent home control system. The complete smart home system is shown in the Fig. 5.

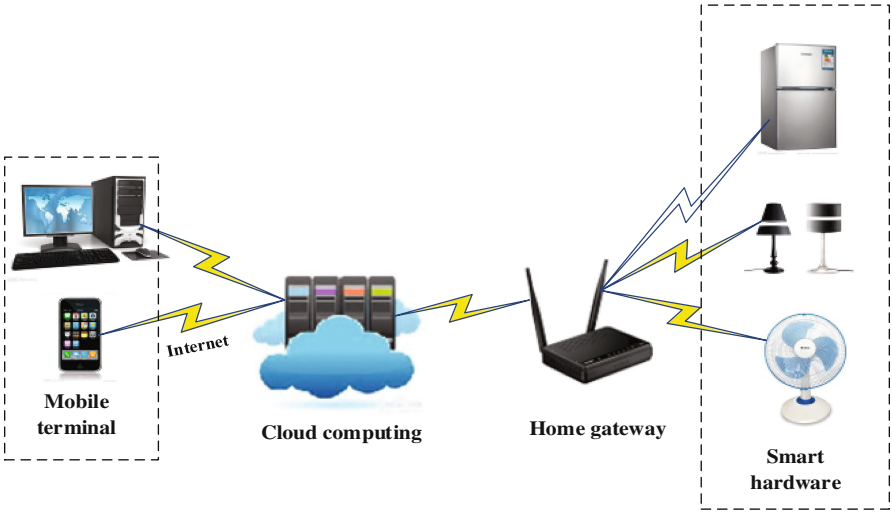

Fig. 5 Ideal reference image and two blurred images

The experimental results show that the system has the following advantages:

- The B/S architecture model developed by the system compatibility is very good, and closely integrated with the Internet.
- The system focused on the cloud, reducing and clarifying the task of the gateway, making the system standardization and generalization.
- The system can realize the dynamic access of massive intelligent devices.
- Cloud computing provides a basis for the storage and calculation of big data.
- The communication process by adding encryption algorithm to enhance the security of the system.

5 Conclusions

This paper describes the traditional intelligent home the shortcomings of existence, revealing the so-called smart home tepid status quo reasons. And a smart home based on cloud computing system is proposed by the study of cloud computing technology, the advantages of cloud computing and integration of 'Internet plus' new economic model. Finally, the experimental results show that the system is practical. Compared with the traditional intelligent home system, the system improves the flexibility and real-time of the user access, reduces the cost, and solves and improves some problems existing in the traditional smart home.

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