Design of the Smart-home Security System based on Cloud Computing

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Abstract. In order to realize the real-time monitoring and remote control, alarm, large capacity storage and information sharing in the home, a variety of wireless sensors are connected by ZigBee technology to form a linked system to obtain a complete perception of the security situation at home which takes the cloud computing as its technological platform and adopts intelligent wireless connection. The data can be uploaded to the cloud computing platform through the network automatically, and can be stored, calculated and analyzed on the cloud platform. With the help of such intelligent terminals as mobile phone, pad, etc., users can set a variety of scenarios, organize a defense and remove a defense, read the real time dynamic data and information detected by the sensors, and conduct remote monitoring, control, alarming and data sharing on the cloud computing platform. Therefore, a real smart-home security cloud is established.

Introduction

With the development and application of the Internet, cloud computing, Internet of Things and big data as well as the increasing demand for security products, home security has been changed from the traditional mode that is an early monitoring, post survey reference model, to the mode of real-time monitoring, comprehensive perception, and personalized sets. It is changing towards the direction of digitization, networking, intelligence. Cloud computing takes a strategic position among the emerging industries in the country. The development of cloud computing makes the computing architecture of the Internet change from "server + client" to "cloud service platform + client". At the same time, the perfect combination of Internet of things and cloud computing technology has promoted the technological innovation of smart home security technology. The integrated technology combined various new techniques has a good technological prospectiveness, which makes the combination of cloud computing and security technology have an epoch-making significance.

The security awareness of people is enhancing. Whether people is in home, working or travelling, self-controlling requirements in life safety and property safety are also getting higher and higher, and the demand is more and more urgent. So people pay more and more attention to the smart home security system of real-time monitoring and remote control platform.

Cloud computing provides a platform for smart home security system. The platform provides cloud storage, cloud monitoring, cloud sharing, remote monitoring, etc. Smart home security system can use various types of wireless sensors, wireless smart cameras and other devices to detect the security information and transmit the information simultaneously and dynamically to the cloud computing platform in 7*24 hours uninterruptedly. Cloud computing platform has the extraordinary ability of computing and super storage capacity. It can store, analyze and compare the massive data. It can deeply analyze the relationship of different categories of information. It can query, alarm, and control
remotely. Smart home security system is linked with cloud computing platform seamlessly, which not only give full play to the detection function of the security system but also realize such functions of the platform as real-time storage, management and timely perception. Then a real-time controllable smart-home security is realized.

**Key technology and technological innovation**

2.1 Key technology

1） cloud computing

2） Cloud computing can provide convenient, on-demand network services. You can obtain the required resources in a reconfigurable computing resource pool.

3） Cloud computing includes three levels of service: infrastructure as a service (IaaS), a platform for services (PaaS) and software as a service (SaaS)

4） The features of cloud computing are listed as follows:

5） (1) super-large scale (2) Virtualization (3) high reliability (4) general purpose

6） (5) high scalability (6) on-demand service (7) extremely cheap (8) potential risk

7） 2） ZigBee

8） ZigBee is a low power local area network protocol based on IEEE802.15.4 standard. It is a kind of wireless communication technology with short distance and low power consumption.

9） Features: ad hoc network, low power consumption, low cost, low data rate, high reliability, large network capacity, high security.

10） 2.2 The technical innovations are listed as follows:

11） 1) security perception terminal and cloud platform collaborative interaction technology;

12） 2) wireless ad hoc networks, adaptive technology;

13） 3) highly stability, high security technology;

14） 4) extending the security awareness interface technology.

**Design scheme of smart home security system based on Cloud Computing**

3.1 design of Smart Home Security Cloud

The overall architecture of the smart home security cloud is showed in figure 1. The Internet of Things makes all sensors be connected to form a large scale of network. All the data can be upload to the cloud by the Internet to ensure that all the information can be real-time updated, downloaded and dynamically stored. Through the Internet and communication networks, people can see every room at any time by the terminals, and timely control the terminals and alarm, etc.
3.2 Hardware design

The hardware system function diagram of the smart home security cloud is shown in Figure 2, which is a CC2530 system solution based on the ZigBee protocol. The system function includes three modules: wireless sensor network module based on ZigBee technology, wireless intelligent gateway module, terminal control module.

3.2.1 Wireless sensor network module

Wireless sensor network module is built on the ZigBee platform. TI CC2530 and various sensors are integrated which has the characteristics of self-organization, dynamic and high reliability. It can form sensor networks automatically. It can upload the data detected to the cloud computing center. The cloud has a large capacity of storage, and can provide terminals with some intelligent computing data and various information benefitting to form the super computing power of the cloud computing center. This way breaks the geographical and time constraints, and be easy to upload and download. Through Internet and GSM, the smart-home security system can be monitored remotely and a complete perception and control toward home can be realized.
1) Anti-theft system

The wireless cloud intelligent lock, wireless sensor, magnetometer sensor wireless magnetic window, cloud infrared intrusion detectors, etc..

Wireless cloud smart lock includes password input, fingerprint input, and face recognition can be added to it. In the event of forgetting keys, the door can be opened by inputting a set password, or by scanning the fingerprint stored, or by face recognizing.

Those are more safe and fast. At the same time, the state of open and close can be transmitted by the wireless intelligent gateway to the cloud. Mobile phone or computer terminal will give a prompt or alarm that make family members can get the state of the house whenever and wherever.

The clearance window magnetic and magnetometer sensor can alarm in time through a wireless network. When others break in, the cloud infrared intrusion detectors can detect and give timely warning.

2) Fire prevention, Combustible gas leakage system

This system includes Wireless smoke detector, combustible gas detector, and temperature and humidity sensor. You can timely know whether there are signs of fire or a combustible gas and toxic gas leak in the home by these detectors. In order to protect the safety of family members, you can remotely control the corresponding valve or mechanical hand to open the window or close the valve.

3) Video surveillance system

The cloud camera is a device which can monitor and dynamically upload the captured image to the cloud. It can shot in a multi angle. The family can view or download the video record no matter now or in the past.

4) Alarm system

Wireless emergency button, wireless sound and light alarm. The state of the wireless emergency button is connected to the receiving terminal of the family through the network, or is set to connect to 110 or the property management office. When there is an emergency, a call for police help can be made by pressing a button, which can notify the family or the relevant departments to carry out the
rescue in the fastest speed. Wireless sound and light alarm can alarm with a bright flashing light and sharp sound when the detector sounds. At that time the family can receive the alarm information.

3.2.2 wireless intelligent gateway module

1) basic functions

Wireless intelligent gateway is the control center of the whole system. It also is an important wireless router. It can uploaded the information collected by a variety of sensors to the cloud in real time. It can interact with the intelligent terminal which can remote control and alarm.

3.2.3 Intelligent interactive terminal module

Smart phones (Figure 5), computers, tablet computers and other control terminal. Control terminal can set up a variety of scene mode, Such as out of home mode, home mode, sleeping mode, and drawing mode. It also can organize or remove a defense at any time. It can meet the personalized needs. Intelligent terminal can not only monitor the situation in real time, but also can remotely control the door lock, alarm device, valve, mechanical hand and other equipment. People can download the data from the cloud computing platform at any time to view the data. Even in the distant horizon, every corner of the home can be monitored and controlled

![Figure 5. mobile terminal control system interface.](image1.png)  ![Figure 6. system function physical map.](image2.png)

3.2.4 system function in kind

Figure 6 is a physical diagram of system function, from left to right in turn is : temperature and humidity sensors, infrared cloud intrusion detector, smoke sensor. A wireless intelligent gateway system is at the top right of the graph.
3.3 software design

![System function flow chart]

After the system is initialized, each sensor node will send the request to the network coordinator. After the coordinator allows, each sensor node will join the network and prepare to detect. If there is something abnormal in the detection process, related data will be transmitted to intelligent terminal (smart phone or computer) and stored in the cloud computing center at the same time. And the intelligent terminal can remotely control valve or mechanical hand. When the operation is completed and the alarm is released, the sensor restarts to detect. Data has been stored in the cloud and can be downloaded whenever and wherever possible.

Summary

This paper constructs a complete smart home security system with a variety of technologies (such as cloud computing technology, ZigBee technology, Internet of things technology, etc.). People can fully be aware of the various situations of the home in real-time, conduct the remote monitor and control, and master the security situation at any time. Data and information can be stored in the cloud computing center, which can promote the security model changing from the passive defense into a smart active defense. It can solve the worries of people from home.

References


