Research on the Design of Intelligent Home Security Monitoring System Based on Internet of Things

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Abstract: Aiming at the problem of uneven distribution of energy consumption and high false alarm rate in traditional home security monitoring system, a smart home security monitoring system based on Internet of Things is proposed and designed. The system is divided into three parts: sensing module, safety control module and equipment monitoring module. The hardware and software are designed according to the structure of the system. The hardware is mainly analyzed according to the two modules of image recognition and speech recognition. The software part is to use pyroelectric infrared and vibration sensors to sense anti-theft information and improve anti-theft monitoring. Combined with toxic gases, temperature and smoke, fire monitoring and alarms are completed to realize the design of smart home security monitoring system. According to practice, the network has a long life cycle, the average network delay is reduced by 16.2 seconds, and the average false alarm rate is 16% lower than the traditional system. The security monitoring performance of this system is relatively high. This article will explore the design of this security monitoring.

With the development of Internet of Things (IOT) technology and big data, people have put forward higher standards for security issues in family environment. Because the housing safety problems mainly include household appliances, gas operation accidents and abnormal room operation. Therefore, it is necessary to keep abreast of the situation at home when you go out. Traditional safety measures can no longer be handled. With the help of Internet +, sensors, IoT and big data technology. Home security information can be sent to the user's mobile phone or network in time so that the homeowner can control it in real time. The ability to intelligently monitor it is the subject of modern home security research. This article will explore this topic.

1. Design background of smart home security monitoring

With the improvement of living standards, new requirements have been put forward to the living environment. The safety device with a single alarm function no longer meets the needs of people. Home security monitoring system smart home should complete home security monitoring and alarm, it is based on the Internet of Things smart home security monitoring system architecture. Smart home security monitoring system includes sensor module, safety control module and equipment monitoring module, the main purpose is to achieve family security. The detection module mainly uses the home Internet sensor to detect the home environment information, and sends the detection data to the back-end database of the unified command of the controller. The security processing module mainly monitors the access control system and is responsible for timely alarm processing. Monitor electrical appliances such as air conditioners, refrigerators, microwave ovens and intelligent control devices via wireless networks.

2. Composition and Structure of Monitoring System

According to the structure of smart home security monitoring system, the system hardware is designed. The hardware module mainly includes image recognition module, gateway processor,

speech recognition module, sensor and single chip computer. Among them, the gateway processor installed in the system is an optimized external memory interface based on ARM1176 architecture. The image recognition module is mainly used for access control, including camera, sensor and recognition device. Network junction and processing chip, mainly identifies fingerprints and face images [1]. The image recognition function structure can prevent the interference of the sensing channel and compare the processing result with the template information to obtain the recognition result. The camera and sensor collect facial and fingerprint images, and the collected information is sent to the image processing chip through the network interface. The chip automatically analyzes and responds to the image information, and finally the recognition result is displayed by the device. The image processing chip has built-in AE/AWB function and can convert various data formats. A feature recognition unit and an image information extraction unit are built in the chip, and have excellent image recognition functions.

The voice recognition function is also one of the important functions of the security monitoring of the smart home, and the voice signal is collected by the sound collector. The A/D is converted into a digital signal, the encoder is used to encode and decode the digital signal, and the Codec result is input to the buffer. Storage If voice recognition is interrupted or voice needs to be played, the system will wake up the interrupt server and automatically determine whether to play or reconfirm. If voice is required, the coded data is converted to D/A and sent to the playback terminal.

3. Hardware Design of Monitoring System

As a 32-bit processor monitoring system, STM32F103 is chosen as CPU. The system has a maximum operating frequency of 72 MHz, fast data processing and huge information resources. External interrupt source handles multiple interrupts at the same time, improves the utilization of processor resources, provides three channels of I2C, SPI and other multi-channel communication interfaces, and extends Flash and SDRAM for Nor. The microprocessor is connected to expand the storage data space and has high data transmission for the DAM channel [2]. The STM32 chip exchanges data with the wireless communication module and other sensor unit modules through the interface. High performance, low cost and low power consumption compared to other microcontrollers.

The data transmission of the system is realized by the wireless bridge, and the data collected by the home is transmitted to the user mobile terminal via the wireless network, thereby improving the efficiency and coordination of the communication. The main research in circuit configuration is the data exchange between the STM32 microcontroller and the W5500, as well as the data reception, processing and transmission between the wireless sensor module and the sensor. The main controller establishes network connection with W5500 module and communicates with the main controller chip through SPI serial external interface. Send the data to the Internet of Things platform, and finally exchange information with the user terminal. The NRF2410 module of 2.4 GHz radio transceiver is connected to various sensors to collect the changes of sensor data in real time and send the data to the main controller.

4. Software Design of Monitoring System

The intelligent community security system based on Internet of Things technology should be designed scientifically and reasonably according to the principles of accuracy, stability, timeliness and easy interaction [3]. It is the lowest layer of the system, that is, sensor node layer. It uses WIFI access network to collect, sense and transmit environmental information around and inside the community. Then, the network layer is responsible for receiving and sending information, and is the communication layer linking to the underlying devices. This is followed by the business layer. This layer decompresses the data packet using the protocol conversion module and uses the data processing module to preprocess and display the data information. Finally, the application layer [4]. This layer provides real-time visual management of intelligent community security monitoring data, reflecting the characteristics of intuitive and convenient.

As the core component of the monitoring system software design, when designing the central controller and the network information transmission module, the wireless transmission module is a relay station for data transmission and is connected to the Internet of Things platform. The W5500 has an 80MHz SPI interface, supports 9 Socket connections, supports protocols such as ICMP, and supports high-speed serial external device interfaces. The access speed of W5500 can fully meet the maximum SPI rate of STM32. The initialization code of W5500 STM32 central controller of Ethernet is connected through SPI interface to send data to the IoT platform in real time.

In the smart home environment, it is usually necessary to control smart home device nodes through the Internet, and also need communication between home devices to achieve mutual control. There may be multiple hardware devices in the home, and the intelligent home gateway needs to establish connections with these devices through different interfaces. Through general I/O port control equipment, such as display screen and sensor, through various industrial bus standards (RS232, I2C) access, main memory and network card equipment through high-speed bus control external equipment access [5]. In addition, the gateway processor can also establish a connection with an intelligent node such as an MCU, and the MCU controls other devices in the home through the gateway. Make it possible. A network card chip such as the AX88180 allows the gateway to access the Internet, and the user can remotely access the gateway through a network server, thereby enabling remote control of the home appliance.

The gateway application mainly includes four modules. Transmission control, protocol parsing, security verification and functional logic units. The transmission control module is mainly used to receive data of the home appliance, and can control the home appliance according to an instruction from the host application.

The security monitoring function module collects the dynamic information of the intelligent cell in real time through the sensing device, and performs the operation of the control command issued by the upper layer. Its main features are: The first is the intelligent community border defense. The module's border defense subsystem protects against intrusions, detects and monitors intrusions, and reports and distributes alerts through alerts, reboots, and hibernation. The second is the safety of residential buildings. This subsystem is an important part of the access control subsystem. Active control can prevent people from forcibly entering the home, mainly detecting, identifying, opening and unauthorized access, and will issue a warning signal [6]. The third is the home security subsystem. This subsystem is mainly used to ensure the safety of residents' homes, report fire accidents and emergency assistance of residents, and better protect the lives and property of residents.

5. Performance Test of Monitoring System

The design of the home intelligence monitoring system consists of the following main interfaces: user login, home environment monitoring, home equipment operation and operation status monitoring, various electrical control modules, alarm processing, system maintenance settings and user management [7]. The user authenticates his identity using the user login module and verifies his personal login. The indoor environment monitoring module is used to monitor indoor temperature, humidity, brightness and gas detection. The user can observe the indoor environment of the home according to the software module [8]. The health monitoring module of household appliances is mainly used to monitor the current health status of each household appliances. Users can monitor whether the household appliances are powered off by software. Electrical control module is designed as the core part of the whole control system, allowing users to easily switch and adjust electronic equipment. When there are special situations that cannot be handled at home, the alarm processing module is used to send emergency information to users, providing accurate current emergency reminders for users [9]. The system maintenance module is a group of software modules, which can make the software more sound and make the user get a better experience. Users use the user management system module to add new rights account and new family monitoring and control subsystem to make the software more adaptable [10].

6. Conclusion

In a word, the intelligent community security system applies the Internet of Things technology and uses the main technology to build the system network architecture and hardware platform. Design security monitoring, alarm response, intelligent community security system alarm management module to improve security level. In this paper, we design an intelligent home monitoring system based on the Internet platform by introducing various sensor units and wireless communication functions. It can accomplish data acquisition, transmission and processing purposes. Through many simulation tests, the system is stable and can detect and monitor the equipment in the home. This can greatly improve home safety. The system uses STM32 as the central controller to achieve low power consumption and high efficiency. The data processing of the Internet of Things is the connected object, as an extended intelligent network of big data Internet. It is a typical application of the Internet and Internet + home mode, the core of the entire system is innovative applications, its main purpose data collection. This is a design and implementation of a remote monitoring platform that implements a terminal network and an Android-based environment. It is also a basic network deployment, hardware platform, programming and debugging of the entire system, control testing and change of system stability. The focus of this paper is on designing and acquiring mobile terminal applications to control terminal nodes.

System compatibility, easy to expand development, easy to implement, good experience, high commercial promotion and practical features it has value. I hope that based on the above research, I will provide better design suggestions for the future construction of smart home prevention and control.

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