Application Research of Internet of Things Smart-home System Based on MCU Micro Control

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Abstract. As a controller, the functions that need to be realized are very limited, and there is no need for large-scale calculation, a very simple single-chip microcomputer can be competent. However, it is necessary to make the single-chip microcomputer exquisite and powerful, that is, integrate one or more cores of RFID, ZigBee and PLC in the chip, so as to reduce the volume of the control system and realize embedded system.

1. Introduction
Smart home, as the realization of family informatization, has become an important part of social informatization development. Due to its huge application prospect, the Internet of things will be a realistic breakthrough in the development of smart home industry, which is of great significance to the development of smart home industry. Based on the design concept of easy implementation, convenient operation and close to use, this paper adopts one or more core MCU integrating RFID, ZigBee and PLC in the chip as the control terminal, and uses multiple control sources including infrared remote control, keys and web interface to control household appliances. The second to fourth chapters of this paper describe the specific implementation of the software and hardware of the whole design. The fifth chapter builds a specific environment example according to the designed functions. Function analysis of smart home control system the main functions of smart home control system include automatic control of home equipment and home security. Automatic monitoring of household equipment includes centralized, remote control, remote monitoring, control and data acquisition of electrical equipment [1] Monitoring and control of household appliances: monitor and control household appliances such as water heater, microwave oven, video and audio according to the requirements of preset procedures[2]. Data acquisition, measurement and transmission of heat meter, gas meter, water meter and watt hour meter. According to the data acquisition program set according to the requirements of community property management, the consumption of heat meter, gas meter, water meter and watt hour meter is automatically collected and measured through sensors, and the acquisition results are remotely transmitted to the community property management system[3]. The air conditioner shall be monitored, adjusted and controlled according to the preset procedures and parameters such as time, temperature and humidity[4]. The monitoring, adjustment and control of lighting equipment respectively controls the opening and closing of lighting equipment in each room according to the preset time program, and can automatically adjust the illuminance of each room[5]. Curtain control, control the opening / closing of the curtain according to the preset time program[1].
2. Research related concepts
So what is the relationship between embedded system and MCU and Internet of things. Starting with embedded system, embedded hardware and software can be reduced, mainly professional computer technology with strict requirements on cost, volume and power consumption. It may be more abstract to say that the ATM machine of a bank is an embedded system, but its operating system is an XPE embedded version. This XPE embedded system is obtained by reducing the XP system, and the hardware is also specially applied to the ATM machine, which can be understood as a kind of hardware reducible. This is an embedded system. Since you have the word "system" in your question, you can understand it as an MCU running Linux or Android system, and they are used in specific devices as a core function processing system. Most of them are used in gateway devices and need human-computer interaction devices, which can run many programs.

Single chip microcomputer can be understood as a simplified version of computer CPU. With low power consumption and can add external circuits (i.e. can increase or decrease hardware), for software, you can use whatever you need. From this point of view, single chip microcomputer system is also an embedded system It can be understood as MCU with limited computing power, memory and peripherals, such as 51 single chip microcomputer and STM32 single chip microcomputer first contacted in the University. The developed products basically have relatively simple functions and only run one program. First, confirm that you have the correct template for your paper size. This template has been tailored for output on the US-letter paper size. If you are using A4-sized paper, please close this file and download the file for “MSW_A4_format”[2]. The Internet of things, hence its name, means that everything can be connected to the Internet. Reasonably speaking, as long as the communication equipment is OK, but the problem of power supply is difficult to solve, so low power consumption is required, so MCU is a good scheme.

Therefore, the relationship between the three is that the Internet of things needs a low-power system such as MCU. MCU is an embedded system.

Entry level MCU can not represent the core competitiveness. It can only realize some simple problems. It can only say that you know too little, single chip microcomputer has several difficulties: high frequency wiring. High frequency mainly refers to chips with processing speed of more than 100MHz (not entirely the category of single chip microcomputer, such as DSP and embedded or cortex, but these are based on single chip microcomputer, which is also the commercial application field of single chip microcomputer in the market)[3]. At this speed, the transmission of signals on wires has a complex impact, For example, a group 8 is caused by the uneven arrival of data transmitted on wires of different lengths. Low frequency or this error is not a distance divided by speed (if the distance is certain, the time error is less if the speed is slow), but the high-frequency signal is too fast, and this error cannot be ignored (affecting the timing). The signal interference between the wires is becoming more and more prominent. Impedance matching should also be considered. There is no excellent theoretical and practical basis. The PCB board you draw for your schematic diagram is also a waste board. The second is the theoretical algorithm, which is the software part. Have you heard of feedback? Many control microcontrollers need to compile various algorithms to control. If there is a slight error, the results are thousands of miles away, but there is no deep enough automation theory. You can only stop at the onlooking stage. It can be said that the single-chip machine is an engineering field that needs to constantly learn new knowledge.

3. The Internet of things
The Internet of things is a branch of smart home application, which is also a kind of smart-home application technology. Smart home uses mobile phones as the remote control of household appliances to control TV and air conditioning. We know that the remote-control controls appliances through infrared. What medium should mobile phones use? Yes, it is the network. The network is divided into wired, wireless, broadband, GPRS, LAN, Internet and so on. The mobile phone can remotely control the infrared terminal at home through the wireless Internet. The infrared terminal
receives the network signal and then converts it into infrared to control the switch of air conditioner and TV. This infrared terminal is an application of embedded system.

3.1. Remote control
Remote control has two steps. Smart-home devices upload data or commands to a master computer (router or other name) through ZigBee or Bluetooth. The master computer can be connected to the Internet through wifi or Ethernet. The mobile app can remotely send commands to smart-home devices through the network to realize the control function. If some large smart-home devices automatically bring wifi modules or network cards, step 1 is omitted.

3.2. The rise of the Internet of things market
The rise of the Internet of things market can be said to provide a new space for the development of embedded software and hardware, which is mainly related to networking. It is mainly reflected in three levels:

3.2.1. New sensing equipment. Because this industrial trend needs not only to perceive, but also to turn the perceived signal into data for further application. Therefore, the biggest feature of the new generation of sensor devices is networking, which is mainly composed of various wireless networks, but wired networks actually have a solid foundation. It depends on the needs of application scenarios.

![Figure 1. Intelligent furniture internet of things application.](image-url)

3.2.2. Gateway. In general, the short-range network on site will not adopt the same protocol as the remote network. Considering the security factor, there must be a gateway device. At the same time, the gateway has the function of local data sorting. This device may also integrate the control function of the Internet of things and become the central node of the field network. Whether it is industrial scenario or smart home, it is basically such an architecture at present. Smart home contains a gateway, similar to the host, through which other devices can be connected and controlled. Including: lighting control, electrical control, security, background music and others. Lighting control also includes
switches, sockets, lamps and so on. Electrical control is to combine the supported electrical appliances into the smart home network, especially for the electrical appliances operated by the remote controller. There are more security devices, including door and window magnetic induction, infrared intrusion detector, audible and visual alarm, high-definition camera, virtual password lock and so on. Needless to say, the background music includes the corresponding speakers and other hardware, such as smoke detector, combustible gas leakage detector and so on.

Figure 2. 3G network user terminal.

3.2.3. Intelligent traditional equipment. In fact, it can be regarded as the integration of 1 and 2 in traditional equipment. In this way, traditional equipment, whether rice cooker, refrigerator or excavator, has become an intelligent device because it integrates more sensing devices and gateways, and can accept remote control and wider range of linkage. Research on the embedded system of Internet of things has its distinctive characteristics. (1) There should be a data transmission path. (2) With certain storage function. (3) With CPU. (4) Operating system. (5) There should be special application programs. (6) Follow the communication protocol of the Internet of things. (7) There is a unique number that can be identified in the world network[4].

3.3. Internet of Things WiFi Module
At present, most mature smart home solutions in the market are based on wireless connection modules. For example, LED color control technology based on BLE Bluetooth SKB360, online audio transmission solution based on WiFi AP, webcam solution based on WiFi AP and long-distance video transmission solution based on WiFi protocol are all built-in wireless connection modules, Bluetooth module and WiFi module to realize the control of intelligent terminal equipment. The future of MCU is in smart home.

The advantage of single chip microcomputer is small and cheap. It lies in the bottom control and detection. It is very suitable for smart home.

For example, someone want to turn off the light, but the bed is a little far from the lamp holder. He was playing the mobile phone on the bed and too lazy to move, so he could write a control circuit with a single chip microcomputer, which is integrated with the old switch. The single chip
microcomputer is connected to WiFi or ZigBee, and then transmitted to the cloud. There can be an app on the mobile phone. Click the light off and the light on. What’s more, fans, air conditioners, televisions, water heaters, and even to the shower head for watering flowers. Someone knocked at the door. The single chip microcomputer realized the camera to take pictures - cloud - client. The express receiver came. Click with your finger and the door opened. Yes, this is my understanding of smart home in the Internet age. All tools in the mechanical age will become our terminals and finally integrated into your mobile phone. The single chip microcomputer will be composed of neurons of these terminals.

4. Smart-home system design
Smart home system is safe and effective. It integrates the facilities related to home life with other technologies, constructs an efficient management system of residential facilities and family schedule affairs, improves the safety, convenience, comfort and artistry of home, and realizes an environmental protection and energy-saving living environment. It involves three aspects.

4.1. Hardware Design
The main processor adopts ARM13. The network section makes use of the existing WiFi at home. GRPS Module adopts SiRFStar III/GSC3F/LP.7979. It is captured with 144dBm.I/fVGA interface: Integrated 256M memory and LCD display, which can play HD video. 4 USB interfaces, which can realize the function of platform expansion; Support full speed (12Mbps) transmission. 10 / 100M Ethernet network interface is used, 5 megapixel camera and one can bus are installed on the backplane, and CAN2.0A or CAN2.0B protocol is supported[5].

4.2. Software Design
The operating system can be Windows CE version; Considering the use cost, the network interface is driven in 10M / 100M adaptive mode.

4.3. System Process Design
Relevant parameters can be set in the system, such as data acquisition time interval, so as to effectively prevent the failure of the system function in case of failure of individual monitoring points, so as to ensure the normal operation of the system.

Smart-home automation and Internet of things are attracting extensive attention in the information industry. With the emergence of more and more smart homes and networked devices, people's daily life has become simpler, better and more comfortable. Smart home has changed people's way of life. For example, how to turn on the air conditioner before entering the house? When preparing dinner in the kitchen, open Alexa and play people's favorite music. How to get the weather forecast? Smart home automation can do more. It has become the future of our life. The global smart home market is expected to reach about US $40 billion. Now, the ease of use and convenience of these smart home devices, from smart kettle, refrigerator and dryer to air conditioner and a series of safety and security devices, such as alarm system and circuit safety camera, make the smart home system very attractive. Through their interconnection, it is easier to manage more operations. With the help of smart home devices of the Internet of things, you can easily reduce energy consumption and cost while saving time. One of the main problems people face when applying the Internet of things smart home is the high cost. Compared with unconnected devices, they are very high, so they are always hesitant when choosing devices that support the Internet of things. There is no doubt that although IOT devices are expensive at the beginning, they will save cost and energy in the future. This is an important factor to consider. For convenience, people share their digital footprints. When using smart home technology, we began to share physical footprints. However, if the equipment is damaged, the consequences will be fatal. Getting their digital footprint
may even be worse than divulging social security numbers. Security and privacy will play a key role in shaping this industry. Integration will have a positive or negative impact on smart home technology. There will be no misunderstanding about AI driven devices in the future. Smart home should be able to know when the owner turns off the lights when he leaves the room, unlock the lock through facial recognition, etc. In 2019 and beyond, there will be more integration to support smart home owners. Security cameras are being used more and more, and people are using them to monitor their property[6]. Through the appropriate integration of artificial intelligence, the threat alarm can be automatically obtained. If there is an emergency, it will actively remind people to control the situation. This has a great impact on remote video surveillance. From the perspective of owners, they will be happy to adopt new methods to monitor family property. Nowadays, the monitoring of houses and property has become very important. Operating electrical equipment is also a good thing, because now more and more people use electrical equipment to do most of the housework. Internet of things smart-home solutions will change people's lifestyle. Some important ways to do this are to save time. Most smart-home products are designed to free people from trivial things. By getting rid of monotonous daily work, people will have more time to focus on other important activities. Save money: using the Internet of things can save house operating costs. People can use smart grid integration to monitor the devices with the most power consumption, so as to save energy. You can even control lighting and heating. Improve the quality of life: by using the smart home automation solution supported by the Internet of things, you can make your home a place with less pressure and lower cost. Conclusion is not every home user has made progress in adopting the Internet of things. Many people still need to upgrade technology at the most basic level. Regardless of the development of these new technologies, smart-home automation involves not only entertainment, but also other important aspects related to our daily life. It is possible to change people's lives from different angles, and the meaning is not exactly the same.

For ordinary people, the smart home system can be connected to our daily digital devices, such as computers, especially mobile phones, so that we can know the temperature and humidity at home at any time, so as to control our home, intelligentize our life and improve our sense of happiness. From the perspective of Internet of things practitioners or expert research, smart home is to connect cloud servers, constantly collect daily data and finally integrate industry big data, so as to provide industry support for improving smart home system, improving user experience and improving users' intelligent life in the future.

The satisfaction of Chinese Internet users with the use of smart home in 2020 show that 67.6% are quite satisfied. It can be seen that the system research on intelligent furniture will be further upgraded and evolved.

5. Conclusion
This design expounds the concept and application prospect of smart home, and introduces and analyzes the embedded system, MCU, Internet of things market and hardware system. In the design, the hardware and software resources of the system are fully utilized, the coordinated control of each module is realized, and the reliability and universality of the system are improved. Through this design, the basic functions of smart home monitoring system are realized. On this basis, different modules can be added to expand different functions with the same working principle. The system has the characteristics of less investment, low cost and high reliability. It also has good scalability and practical value, which is in line with the intelligent and networked development direction of home appliances in the future.

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