Research on Data Collection Design Based on Zigbee Wireless Technology Smart Home System

Yuhe Gao[1, *], Zijian Qin[2], Rui Zhang[2], Wenru Zhang[2], Yi Duan[2] and Zhenyu Li[2]

[1]Yunnan University of Finance and Economic, Kunming, China
[2]Dalian Maritime University, Dalian, China

*Corresponding author e-mail: 18845916868@163.com

Abstract. In order to decrease the shortcomings of traditional smart home control system, we take a new smart home management system by using microprocessor control technology and wireless networking technology. This system uses ARM9 processor as the core and could be used both Linux and Windows operating systems. The home networking uses ZigBee wireless technology which has cheaper, lower power and large range characteristics. The results of this research shows that this system could control home appliances, security alarm, remote monitoring and other functions. It has certain practicality and promotion value.

1. Introduction

With the development of the level of science and technology, people's living rggythm is accelerating. People want to be able to operate home appliances more conveniently and enjoy an efficient, safe, convenient home environment. So more and more people pay attention to the concept of smart home. So far, there are some certain limitations of the development of smart home, as follows:

- Expensive price;
- The control system operation is too difficult;
- The system function cannot be personalized;

There are three categories for smart home network control technology: wiring technology, power carrier technology and wireless technology.

The cabling technology has the best stability, but it needs re-wiring. It is too troublesome and costly for the home wiring technology which has been renovated; Because of the inherent pulse interference inherent in the power line, the power carrier technology can easily cause signal transmission instability; ZigBee wireless technology has many advantages such as lower complexity, lower cost, larger network capacity, and higher security. So it is suitable for home-use to build smart home systems.

At present, research on smart home network control technology mainly lies in ZigBee wireless technology research: Dai Min, Wang Yihuai, Pan Qiyong proposed a home networking solution based on ZigBee technology in 2012 by using PIC18LF4620 micro-controller and low-power wireless transceiver chip CC2420 to design the node processor module and the radio frequency module separately. Through the design of the home network communication protocol, the communication between the master node and the terminal node was realized. The article was mainly designed and carried out on the basis of the PIC18LF4620 single chip microcomputer; and Xin Hailiang, Zhong

Peisi, Zhu Shaoqi and Yu Yingjing designed a ZigBee-based total solution for the IoT smart home control system in 2013. By analyzing the characteristics and application occasions of various wireless communication technologies, the ZigBee wireless communication technology was designed with the Linux system as the core. In the article is mainly talking about how to use ZigBee's wireless communication technology under Linux to transmit signals. In this paper, we use the CPU as the ARM920T core, faster than the average micro-controller and better meet the real-time requirements of the system. It could take into account both Linux and Windows operating systems and achieve home appliances intelligent control, security alarm, remote monitoring and other functions.

2. System function analysis

Video surveillance. After the client clicks "Start", the client sends a request for acquiring a picture to the server. The camera of the server collects the picture and sends the client through the network. The client interface displays a picture and the picture is collected every 10 ms through the timer to form a picture. Click "end" on the client to stop the picture collection and the client interface displays the picture pause.

Control the corresponding electrical appliances: such as lights, fans, cameras, digital tubes and cameras, a key to open, a key off;

Develop human-computer interaction interface. Users can adjust the use of each household appliance according to their own needs to simplify the operation; click the "return" button to return to the server-side connection interface; click "exit" to close the server-side interface and shut down the system;

Real-time status can be viewed through the PC client.

3. Overall structure design

This system is mainly composed of three major components: ZigBee technology constitutes a home-internal network device through the network to achieve interoperability; the Internet allows users to control home devices within the home or real-time monitoring of family conditions; users can pass a computer to control the smart home appliances. It is shown in Figure 1.
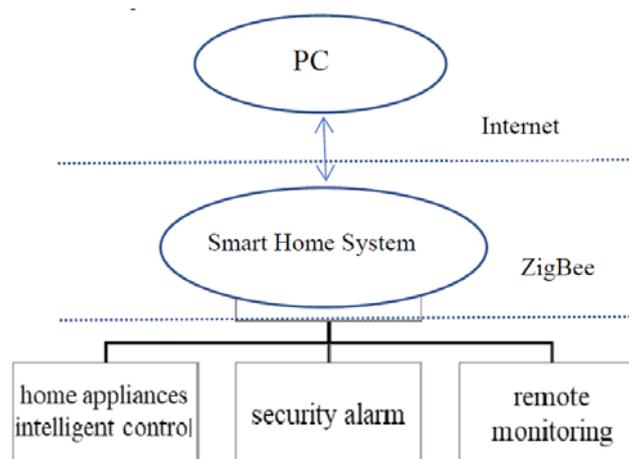

Figure 1. Three major components of smart home system

Under the above structural conditions, we achieved the following project structure of the shooting boundary. The ARM920T chip board through the serial port connect the ZigBee module indirect and the camera, lights, fans and other sensors connected to the ZigBee module through ZigBee communication is shown as follows:
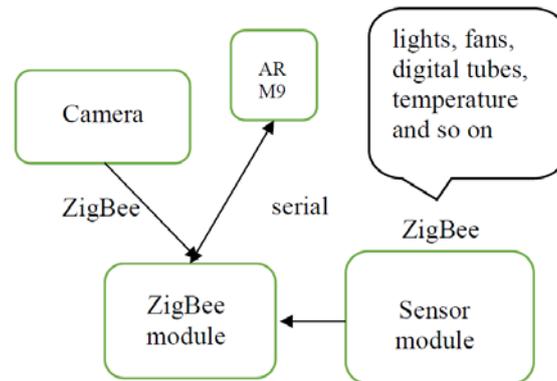
Figure 2. Project Function Structure

In general, the system architecture of the entire smart home system is shown in Figure 3: the client sends commands and requests to the server, the server controls the modules and collects data which includes image data collection and environmental factor data collection.
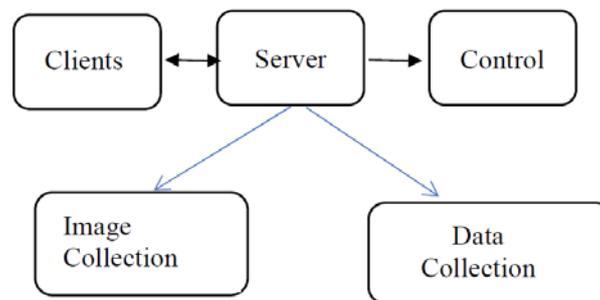
Figure 3. Smart home system system structure diagram

4. Data collection program module design and implementation code

The entire process is divided into four parts: Initializing ZigBee, ZigBee receiving messages, ZigBee sending messages, and exiting ZigBee. It is worth noting that ZigBee has different data packet formats for receiving messages and sending messages, as shown in the following figure:

The code for the above four parts is as follows:

int zigbee_init(char *devpath, int baudrate) // Initialize the zigbee and set the path and baud rate

int zigbee_get_dat(int fd)//zigbee get data from fd

Ret = serial_recv_exact_nbytes(fd, buf, sizeof(buf));//Assigned the length of the information received from the serial port, ie the information sent by reading m0 to ret

if (buf[0] == 0xBB) {//buf initial value is 0xbb to optimize the read environment information, and then stored in the global structure * /

Memset(&data,0,sizeof(struct env));//empty the data in the structure env, set 0

data.id=(int)buf[1];//data id is first in buf

If ((data.x = (int)buf[8]) > 127){// if the value of data.x is greater than 127

Data.x -= 256;//data.x is the value of data.x minus 256}

Int zigbee_exe_cmd(int fd, char *p) // instructions run by zigbee

/* match the client's command, write the control instruction to buf, then call the interface function and send it directly to M0*/

if (strstr (p, "LIGHT_ON") != NULL) {//Comparison instruction p and "LIGHT_ON" if the same, the light is on Buf[4] = 0x00;}

else if (strstr(p, "LIGHT_OFF") != NULL){//Lights off buf[4] = 0x01;}

int zigbee_exit(int fd)//exit zigbee

Table 1. ZigBee received environment packet format

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
tag	id	len														data																crc			
				tmp		hum		acc				adc								light				state											
				1	h	1	h	x	y	z		ch0				ch1								led	fan	buzz	7led								
bb	4	24	4	0	20	0	35	1	1	0	0	1f	0	0	0	23	0	0	0	70	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0

Table 2. ZigBee send command packet format

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
tag	id	len														data																crc			
				opid	ope																														
dd	4	24	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 3. Management system test results

Smart Home Management System					
Equipment Control	Parameter Settings	Security Alarms		Data Monitoring	
Appliance Control	Network Parameter	Alarm	Normal	Lighting	xxx
Appliance Control	Network Parameter	Monitoring	Normal	Lighting	xxx
Appliance Control	Mode Control Parameters	Light, Fan	Normal	Humidity	xxx
Environmental control					

5. System testing

Connect the smart home controller and test computer to the network. The IP address of the computer is 192.168.1.22 and the port number is 8080. Enter the IP address and port number on the computer-related service interface. Click the link to access the sub-page of the menu for related operating. The system interface and menu sub interface are shown in the following figure:
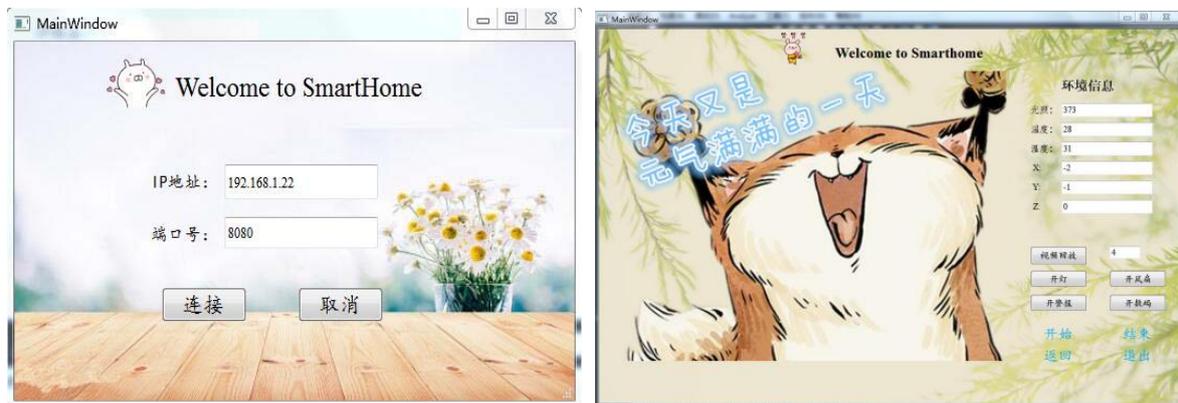
Figure 4. System interface and menu sub interface

Management system test results as shown in the table, click on the corresponding button to control different components:

6. Conclusion

This article based on ZigBee wireless networking technology, taking the ARM9 microprocessor as the core and taking into account the Linux and Windows operating system designed a new type of smart home management system. The detailed system block diagram is given in the article. We could get real-time aspects of the specific operation program from the code. And this design adopts ZigBee technology to solve the complicated wiring problem well. At the same time, it adopts local area

network to implement PC-side control of smart home which provides a direction for the future intelligent home control system.

References

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