

Application of Wireless Sensor Network in Smart Home Security

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Abstract—In this paper, the organic combination of security systems and wireless sensor network technology, design and implements a smart home security system based on ZigBee technology. The interior data acquisition part of the system is composed of temperature, smoke, gas sensors, real-time monitoring of indoor data. And by using the infrared detection technology to test the illegal invasion, set up a complete data collection platform. Based on ZigBee communication protocol to form a wireless network, the collected data sent to the base station. Base station receives the sensor data and communicate with PC, PC is to accept data and process analysis, real-time monitoring data, the or illegal invasion of abnormal situation such as fire detection and alarm.

Index Terms—Wireless Sensor Networks; Security System; ZigBee; CC2530

I. INTRODUCTION

At present most of the family of grating anti-theft measures, first of all, it affect beautiful and expensive, second in the event of a fire cases such as the window is the final escape, grating affected residents in case of an emergency escape. Some upscale community and businesses alarm system due to the expensive and not be received by the masses of users, such as user and security departments, the user sends alarm, security department to respond quickly, but the cost is higher, it more difficult for the widespread promotion. Mechanical operation is applied at the same time, the traditional home security system there are many inconvenience in practical application, far cannot satisfy people's needs.

Now based on sensor alarm system has entered the view of the public, for example by temperature sensor, door magnetic sensor, infrared alarm system composed of sensors, including infrared sensor can effectively detect the illegal invasion. But the existing security systems are based on the traditional cable technology, in practice there are complex wiring, beautiful degree is low, the high cost, low reliability, maintenance man, extensibility and small faults, also hard to get on a large

scale applications. To sum up, research a new type of wireless communication security system, to achieve real-time monitoring of the household, the fire alarm function, human invasion, and so on and so forth, have very significant meaning.

Social and public safety applications, with rapid deployment, self-organization and fault tolerance of sensor network is a very promising sensing technology system, can be applied to monitor, control, communications, computing, and other fields. Compared with traditional security technology has obvious advantages. This paper aims to design a home security system based on wireless sensor network (WSN), the system does not need complex wiring, sensor nodes can be random arrangement in furniture, high flexibility and scalability. And damage to a node does not affect the normal operation of the whole system and good fault tolerance. Home security system based on wireless sensor network from the aspects of cost, reliability and so on has incomparable advantage, has a great application prospect.

II. HARDWARE DESIGN

Design USES TI company ZigBee2007 based protocol is the second generation of ZigBee CC2530F256 SOC chip of TI. Refer to the TI company's advice on design, such as filter circuit, power supply decoupling, form a complete set of impedance, structure to meet the requirements of input and output impedance of RF. At the same time in order to reduce the volume of a module, used the SMA antenna design, big gain, high sensitivity, long distance communication. Crystals of external circuit has two, 32 MHZ system clock and 32.768 kHz, real-time clock when CC2530 run in low power sleep mode using 32.768 kHz crystal oscillator. On the basis of time leads to the CC2530 I/O port, convenient connection, to maximize the use of resources, and also can avoid to RF interference. Rf module circuit diagram is shown in figure 1.

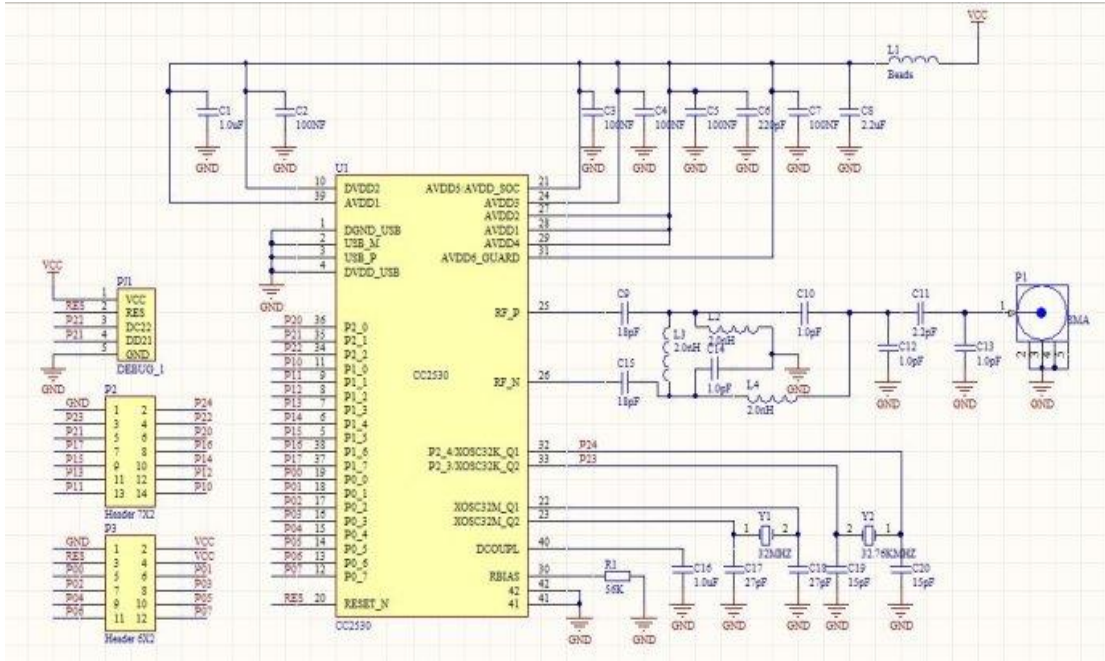


Figure 1. CC2530 rf module circuit diagram

III. SOFTWARE DESIGN

According to the division of the whole system structure, software design is divided into sensor node software and network coordinator node software of two parts.

A. The overall process and networking

Sensor node USES the events of the round robin system. To initialization of system hardware and software, including wireless transceiver chip initialization, IO port initialization, ZigBee initialization and start the interrupt, etc. Then sends a signal to the wireless network coordinator to request to join the wireless network. To join the ZigBee network after the success, received the coordinator assigns a 16-bit network address, at the same time send the coordinator node code contains information frame, system

immediately into low power mode. Wake up the system application events (such as illegal invasion, leaking gas anomalies) and timing awoken (e.g., collect the temperature information) the mode of combining the power consumption of the system is reduced greatly. Network coordinator node functions include rf transceiver software module and protocol stack software module. The coordinator to form a complete ZigBee network, network maintenance, node address allocation, and then communicate with PC and sensor nodes. Coordinator will send corresponding to sensor nodes by order of the upper machine of command, control sensor node relevant action. At the same time, the coordinator node collection to the collected data, each sensor node and sends it to the PC monitoring center. Specific software flow chart is shown in figure 2.

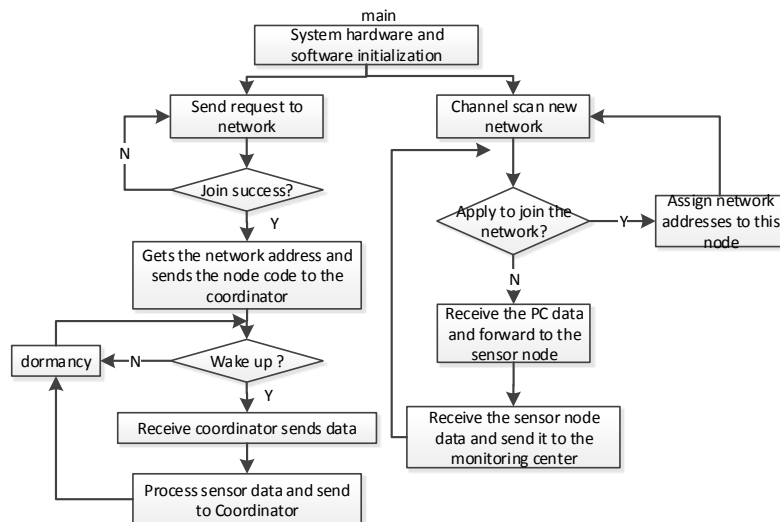


Figure 2. wireless sensor network (WSN) software flow chart

Wireless sensor network design is mainly composed of home network, the node join and quit, emergency response time, low power consumption and other parts. In this security system, the key point of design lies in the network of star networks. In short, the process of network is a network of neighbor discovery process.

B. infrared correlation software design flow chart

Infrared correlation sensor is responsible for the detection of external illegal invasion, detect anomalies

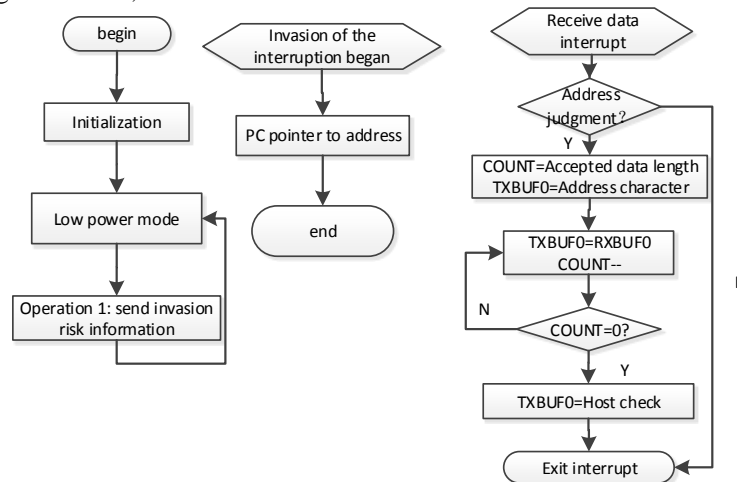


Figure 3. infrared correlation procedure flow charts of sensor nodes

C. Indoor sensor node software flow chart

Indoor sensor node is composed of temperature sensor, gas sensor, smoke sensor. Its main function is testing indoor environment is the key information, when the abnormal situation is detected, light LED alarm, and immediately send alarm information to CC2530 module, CC2530 module sends the data to the base station. The main program timer interrupt a 3 second, interrupt call each sensor module of the program.

First DS18B20 temperature acquisition program by I/O configured, I/O send temperature measuring command, collecting temperature values, and then determine whether the temperature more than 50 degrees Celsius, if the temperature is more than 50 degrees Celsius, immediately send warning information to the CC2430 module through the wireless sending form to the base station. The flow chart shown in figure 4.

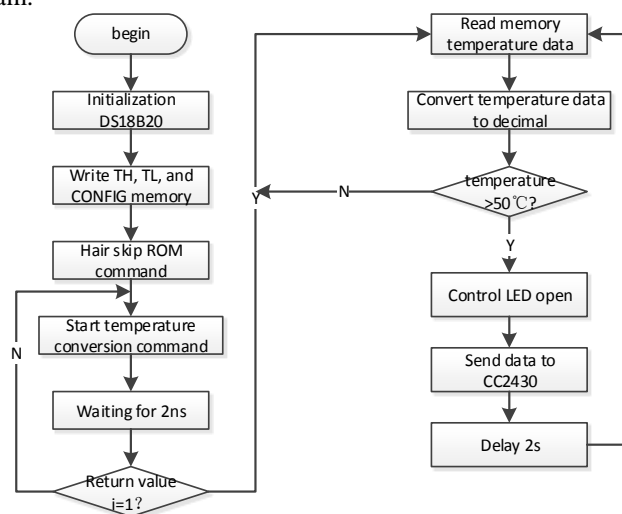


Figure 4. temperature gathering flow chart

Broadly similar smoke and gas sensor detection principle, can be directly IO port voltage judgment, if the gas or smoke concentration exceeds the preset value, the

IO mouth high level, and then the LED lights up, immediately send alarm information to the CC2430, base

station to respond accordingly. The program flow chart are shown in the figure 5 as follow.

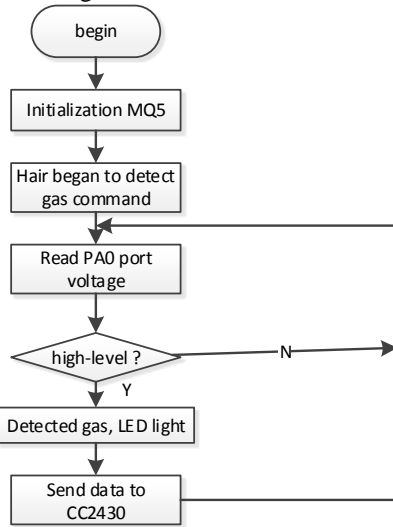


Figure 5. the gas flow chart of detection

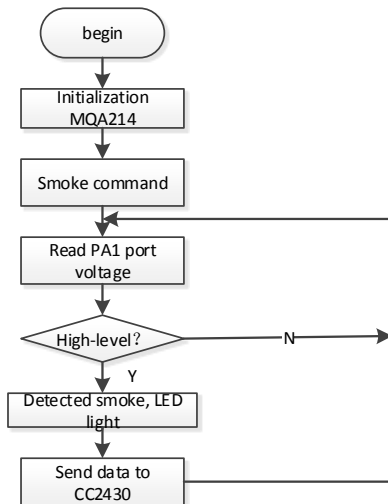


Figure 6. smoke test flow chart

IV. SUMMARY

Widespread use of intelligent terminals, mobile Internet rates declining, WIFI network cover large area, accelerating the development of the intelligent terminal APP. In addition to entertainment games application, intelligent terminal security applications also gradually entered People's Daily life. In this paper, design of low power consumption based on wireless sensor network security alarm system, the system adopts the infrared correlation sensor, temperature sensor, gas sensor, smoke sensor for indoor and outdoor environment information collecting, based on ZigBee communication protocol to form a wireless communication network, the data collected by the wireless signal is sent to the base station, station receives the sensor data and communicate with PC, PC is to accept data and process analysis, real-time monitoring data, the or illegal invasion of abnormal situation such as fire detection and alarm. The system adopts CC2530 ZigBee module.

REFERENCES

- [1] OuYangRuiZhang. Security industry is booming vitality. China's public security (all), 2012.15:50-52
- [2] Huang Ju pay, Huang Yunwei, Wang Yixue, Wu Zhenxiang, XiaoXiao. Close to the people's consumption security: security in the future development trend of common agent "consumption security" in the development of our country. China's security, 2013 01:79-85
- [3] Gong Yuanpeng. Intelligent household security system design based on JESS. Modern electronic technology, 2012.03:134-136
- [4] Jianying Cao. Remote intelligent greenhouse multimedia data acquisition system based on Web design. Computer and digital engineering, 2011, 77:77-78
- [5] He Youbin. Under the Internet of things of intelligent campus safety analysis. Journal of telecommunication network technology, the 2012 01:41-44