

# Study of Smart Home System based on Zigbee Wireless Sensor System

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**ABSTRACT:** With the development of Internet of Things technology, intelligent home systems in people's lives are more and more widely. Compared with the traditional smart home system, the smart home networking technology based on internet of things reflects in the wiring flexibility, low cost, scalability and so on. This paper introduces the research background, significance and current situation at home and abroad intelligent home systems, wireless sensor networks are outlined. Several wireless communication network technology is compared, selected Zigbee technology as a smart home networking technology within the system. The paper discussed wireless sensor network applications and Zigbee technology to study the architecture of Zigbee wireless network. According to the Zigbee protocol stack layers function analyzes the protocol specification protocol stack physical layer, MAC layer, network layer and application layer and the function of each layer.

## Introduction

Things as a strategic emerging industry has been written in our government to develop a "second five" plan, a national strategy. Things not only accelerated the IFAP, enterprise information technology and government information process, but also greatly enhance the labor productivity of the whole society. Things take all the objects via RFID and wireless sensor networks to the Internet, and complete the identification and management. Things in the environment, people can at any time using any device, any way to get the desired services. Use networking technology to connect PC and other small smart devices to the network for people to obtain information service platform. Under the influence of networking technology background, smart home is becoming a hot new research and applications. Rise of the Internet of Things for the development of smart home brings a new space for development. Smart home in the home life has an important extension to give more and more users of all ages. Smart home as a new concept was proposed, which is different from traditional control networks and digital networks, has its own unique advantages. Called smart home smart homes, is a residential basis, with construction, network communications, information appliances, automation equipment, and other functions, set system, structure, service and management as one of the efficient, comfortable, safe, convenient, environmentally friendly living environment. All set inside the home of information, entertainment, communications, computing and other functions in one of the interconnected information appliances, together constitute the home network. Smart Home also has other functions, such as automatic meter reading, intelligent home software, home wiring systems, home networking, sports and health monitoring, automatic watering flowers, pet care and animal control.

## Smart Home Sensor Network

Smart home sensor network is composed of several sensor nodes distributed in the environment habitable zone composition, these sensor nodes through wireless technology constitute

self-organizing network, whose main function is the perception, the home sensing target acquisition and processing all kinds of information covered by the network such as temperature, gas, transport and node-aware information to smart home gateway, after arriving via the Internet or GPRS PC or smart phone, and through the management interface of the device is displayed. From the network perspective wireless sensor network is a complete network system, a plurality of nodes together to different nodes play different functional entities. Typical smart home sensor network usually consists of wireless sensor nodes, gateways, and intelligent home management device composed of the management device used herein refers to a PC or smartphone.

After the completion of the deployment of wireless sensor nodes constitute a network through self-organization. Target signal monitoring wireless sensor nodes after simple processing and transmission to the local smart home gateway. Users through an external network, such as GPRS or Internet, and smart home gateways can interact. Smart home gateway can publish queries and control commands to the network, receiving target information sensing node returned. From the entire network functions to analyze the sensor nodes play a dual role of routers and end nodes, which provides the following functions, first complete local information gathering, followed by temporary storage, processing and transmitting data forwarded by other nodes, the last node in common other collaborative completion of certain tasks. Wireless sensor node consists of sensors, a processor, a wireless communication module and the power of the four modules. Wherein the sensor for data acquisition and conversion, control and data processor to complete the entire node processing, wireless communication module to complete the task of wireless communication, information exchange, power supply operating voltage of the sensor nodes. User sends a command to the network through the intelligent home gateway, the sensor node configuration and management, collecting sensor nodes collect information, then the information processing and analysis, the more accurate monitoring results to the user hands. Smart Home Gateway more abundant than ordinary sensor nodes power, its data storage space is relatively large, the operation speed is relatively fast, so its data processing power, storage capacity and communication capacity is relatively strong. In addition, the bridge between the intelligent home gateway or wireless sensor network and external network is responsible for implementing the conversion between different protocols.

### **Smart Home System Design**

Former Zigbee technology is widely used in PC peripherals, consumer electronics, intelligent home control, medical technology and industrial automation and other fields, since Zigbee networks are self-organizing wireless network, its high flexibility, it can be applied to Zigbee technology internal network smart home system, through smart home-related technology and user needs analysis, combined with the thesis put forward the following model of smart home system design requirements: 1) wireless network using Zigbee technology to build intelligent home network, to achieve a from wired to wireless home network changes, and complete control of the sensor nodes. 2) local control, in a residential user can smart home system on-site monitoring by the home gateway. 3) remote monitoring, remote from anywhere in the house, users can quickly access the network via a PC or smart phone, so as to realize the smart home system for remote monitoring. 4) reduce power consumption, full use sleep mode to extend the life of the sensor, to avoid frequent battery replacement.

The chip embedded Zigbee-based wireless network transceiver modules to a variety of devices in the home, to build wireless home control network. Users can choose according to the different needs of the access or removal of the different functions of the terminal device. Each sensor node in

the network will be collected information is sent to the full-function coordinator, then the coordinator through a specific interface to send information to a smart home gateway, followed by the development of man-machine interface display, the other via a PC or smart phone can realize the device control and query the status of the overall system architecture shown in Figure 1.

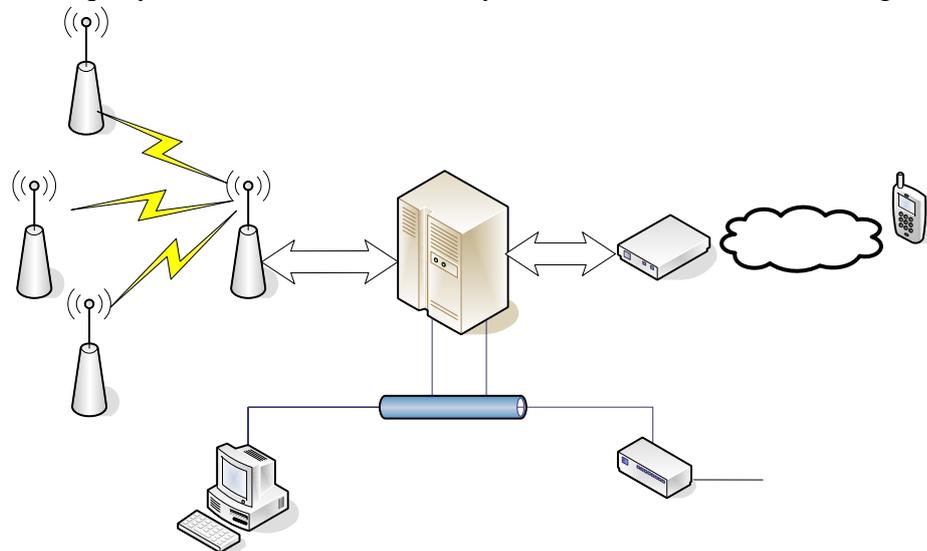


Fig. 1 Zigbee Smart Home System

### Hardware Design of Smart Home System

Because smart home system is limited space, cost and real-time conditions, where the choice of embedded technology to design intelligent home gateway, to improve resource utilization. Smart Home Gateway hardware design of the structure shown in Figure 4.1, the hardware architecture of intelligent home gateway based on embedded processor-based chip, configure the power and reset circuit, Zigbee wireless communication module, a wired network interface, a wireless network module, input and output devices, serial and other necessary peripherals, communication interfaces and provides a platform for running software. Each module smart home gateways have different roles to play, run the home gateway which is inseparable from power support; Zigbee wireless network of the internal network of the home, inside the home is responsible for collecting environmental information; GPRS module smart home remote monitoring; LCD display for user management interface, RS232 serial port coordinator through the gateway host controller.

Zigbee communication circuit is a family internal network hardware design of the most complex parts. Paper home internal network that is Zigbee wireless communication network including the main chip inside the sensor node and coordinator, coordinator and sensor nodes are CC2530, CC2530 chip contains RF transceiver, the communication between the coordinator and the sensor are by CC2530 chip is done, transfer data between them are wireless. And the communication between the coordinator and home gateway is wired, S3C2440 pins P02, P03, and CC2530 are pin P0\_2, P0\_3 connection, the coordinator through the serial port for data communication with the home gateway.

Coordination is the key to Zigbee network, which consists of a functioning sensor node to act as FFD, function relatively streamlined sensor node can act as a terminal device. Coordinator There are many tasks to be completed, not only responsible for the formation of the network, but also to receive and process collected data terminal node, and home gateway serial communication, but also to gather data transmission parameters to the terminal node based on the user's operating instructions Wait. Coordinator of the master controller is also a selection of CC2530 chip (already

introduced, not repeat them here). This article chosen MAX3232 serial circuit chip to complete the level conversion RS-232 serial data, the connection with the home gateway, data acquisition transmission

## **Smart Home System Software**

Smart home gateway mainly the following functions: internal communications between home each sensor node, and control nodes; interact information internal and external network, in the face of more communication and networking tasks, you need to select the right embedded operating system to debug and run, thereby improving overall system efficiency. Paper chooses Win CE operating system, complete embedded home *gateway*.

Establish a network in the actual process of building a network, each coordinator can set up a network, if you have an existing network coordinator can request to join the network, if not on their own to build their own networks. Before the establishment of a network coordinator must set some important parameters, including networking channels, whether using a beacon mode. Specific network setup procedure is to call the MAC layer primitives has the ability to scan and the main scan.

If only a node joins the network coordinator is meaningless, more nodes in a network to join the network, the coordinator can play a greater role. The following will detail how to join the network node, the node is added includes two aspects, one is how to find a new node is already present in the network and to join, the second is how the existing network nodes allow other nodes to join. There are many ways to join the network nodes, connected by a network to join, rejoin the network, isolated nodes way to join networks.

Temperature sensor nodes are used in the design of components DS18B20, is a very simple hardware components from the preceding content we know it generally only three pins, so the hardware is connected, just to the right of the three pins connected CC2530 corresponding to three pins on it, a complete temperature sensor nodes to build success. Next is the temperature sensor node software design, software design, including the initialization function of each module, interrupt handling, and read the DS18B20 temperature detection program. It includes a system initialization procedure to set the master clock source, analog to digital conversion initialization, serial port initialization, the clock mode initialization, the Advanced Encryption Standard initialization, RF initialization, interrupt initialization and DS18B20 initialization. Note that, if placed inside the home of the plurality of temperature sensors nodes, then a single point temperature measurement becomes a multi-point temperature measurements. Since the plurality of nodes connected to a temperature sensor on a bus, if not marked, the user will not know which has the temperature information from the sensor nodes. Therefore, to identify different nodes, before the system is installed, the gateway should be home by one connection to the temperature sensor, and set the serial number. Concrete action is intelligent gateway give the temperature sensor sends a reset pulse, temperature sensor reply after reply pulses, home gateway then sends ROM command, and sends a pulse 2us so, followed by a temperature sensor to read the serial number and the same We read every serial number.

## **Summary**

In this paper, TQ2440 development board as a platform, set of networking technology, Zigbee technology, embedded technology integrates research and development of intelligent home systems, intelligent home system model was constructed. Focus on the embedded home gateway software

and hardware design, including intelligent gateway selection and design of each module. In Zigbee wireless communication system, based on the coordination and the sensor terminal equipment hardware and software design, Zigbee wireless network in-depth study, including protocol stack, network addresses, network security communications, the selection of network topology and the like.

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