# Design of smart home system based on ZigBee

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**Abstract:** The ZigBee-based smart home system is a new solution for the requirements of highly automated and intelligent home. Mainly use ZigBee handheld controller to wirelessly collect indoor environmental parameters, remotely control various household electrical appliances, and realize complete automation and intelligentization of home control and parameter detection. The device uses the C8051F020 microcontroller as the control core unit to detect humidity and is responsible for driving the motor, processing and transmitting data. The high-precision sensor is used as the humidity detecting device, the DC motor is the actuator, the environmental parameter detection is completed, and the control functions of the curtain, the AC electric appliance, and the like are completed. The indoor wireless communication is realized by the handheld device through the IP-LINK1270 module serial port, which can receive humidity data and control simple home. This system has good development and application prospects.

## 1. Introduction

Due to the improvement of the quality of life, the high degree of automation and intelligence of various household electrical appliances has become a consumer demand, and the rapid development of science and technology has made this demand no longer far away. The new ZigBee protocol has good prospects in wireless sensor networks and various wireless terminal control, and proposes new solutions for sensor networks and control devices. The ZigBee-based network control system can realize the control and adjustment of various household electrical appliances. It only needs to modify the old household appliances (home), or add the necessary driving circuit to realize the control of small signals to the AC electrical appliances. Indoor temperature, humidity and other environmental parameters directly affect the quality of life. The ZigBee controller can also be used to collect indoor temperature and humidity detection equipment at a long distance, and then adjust the home appliance (home) according to individual wishes.We have modified the practical low-power electric fan, and installed DC motor and fixed pulley on the curtain. The ZigBee controller can send commands to the MCU to control and adjust the switch degree of the fan and the curtain. In terms of indoor parameter detection, humidity detection equipment has been developed to effectively feedback real-time data.

## 2. The system structure and various parts of the function

The whole system design scheme, the C8051F020 is the core, as the data processor and device controller, the whole device can also be used as the industrial field device, and belongs to the ZigBee core controller.

(1) Humidity sensor module: The sensor signal is filtered and sent to the analog channel of the MCU.

(2) L6203 motor drive module: When the signal provided by the MCU meets the condition, the output voltage drives the motor to rotate forward or reverse.

(3) Thyristor fan control module: The single-chip microcomputer selects and drives different thyristors to realize the control of AC electric appliances such as electric fans.

(4) Free-standing button: For the combination of four buttons, set the upper and lower limits of the humidity alarm; operate the control fan and curtain.

(5) Sound and light alarm module: When the humidity value exceeds the artificially set alarm limit, it will automatically alarm.(6) Digital tube display: The three digital tubes display the relative percentage of humidity, which is accurate to one decimal place.

## 3. The main module design and implementation principle

(1) sensor data acquisition module In this system, we selected the humidity sensor produced by Beijing Baolima Co., Ltd., which has a good linear relationship and outputs an analog signal of 0.9V~3.8V, which can be directly input into the single chip microcomputer. As shown in the figure, after the sensor output signal is filtered by capacitor to reduce the fluctuation and interference error, the MCU C8051F020 is input for A/D conversion, and the analog channel can be selected by the selection switch.
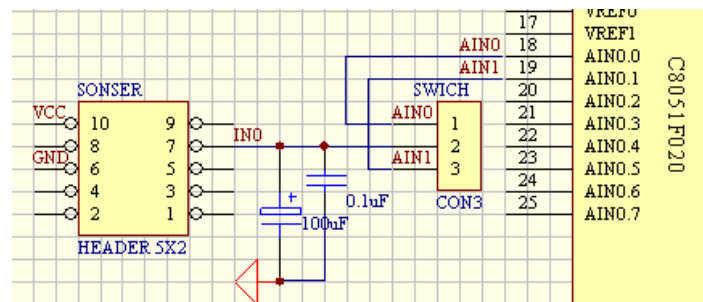


Fig.1 sensor interface circuit

(2) Communication module the wireless communication function in the entire control network system is realized by serial communication between the IP-LINK1270 module and the C8051F020. The IP-LINK1270 module is a 2.4GHz wireless transceiver module that is fully compliant with the IEEE802.15.4 standard and the ZigBee specification. It requires 3.3V working power and logic level, just to ensure smooth communication with C8051F020, its reset end is connected with the reset end of the MCU, and the IP-LINK1270 module is also reset when the MCU is powered on. Before using this module, you need to configure its network number, node number, channel and frequency, etc., in order to accurately send data or commands to the device.
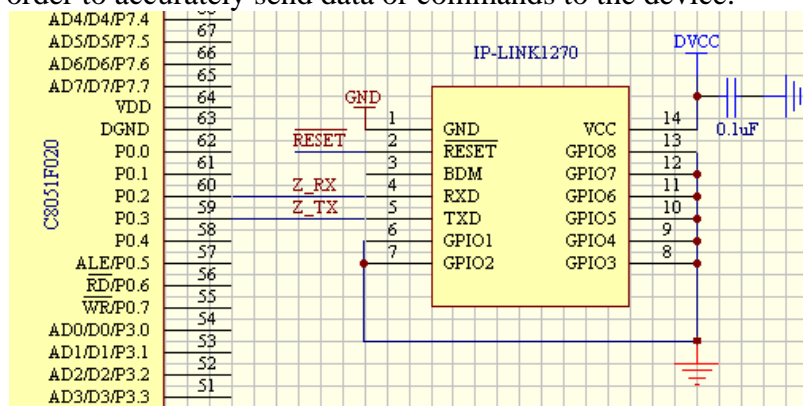


Fig.2 communication interface circuit

(3) Motor drive and thyristor switch module the chip L6203 is used as the core drive of the motor, and one signal is output from the I/O port of the single chip as the enable signal of the L6203, and the on/off of the chip is controlled. Then, the MCU provides two signals. When the two signals are high and low, the motor can be driven. The order of the high and low is different, and the rotation direction of the motor is different.
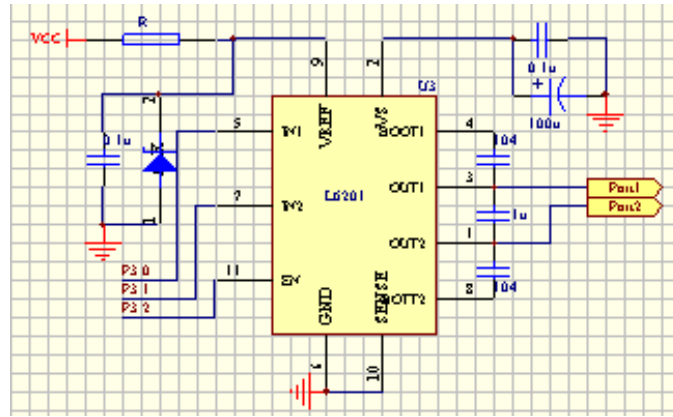
Fig.3 Execution of the motor drive circuit

(4) Other commonly used modules The commonly used modules used in this system mainly include a separate button circuit, an audible and visual alarm circuit and a three-digit digital tube display circuit.
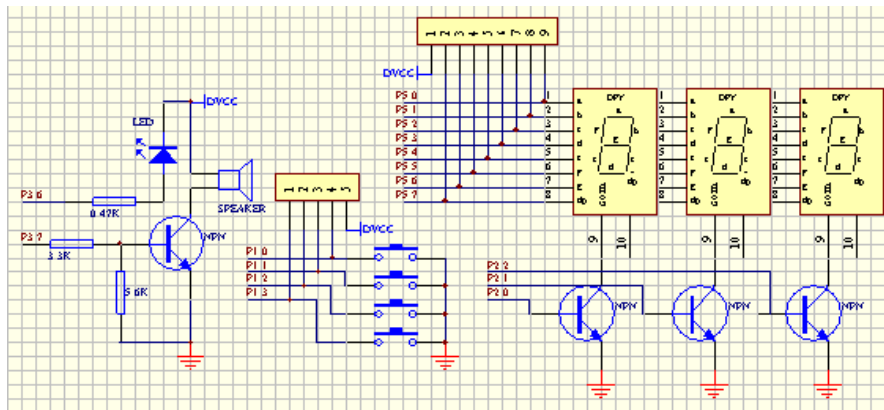

Fig.4 alarm, button, display circuit

The independent button is connected to the MCU by pull-up. When no button is pressed, the I/O input pulls the high level provided by the power supply, and when the button is pressed, the pull-up resistor is grounded at one end, and the input valid signal is high. Level. Due to the single sound or lighting, the expected alarm effect is not necessarily achieved at the industrial site. We use the light alarm method to control the buzzer and the LED to be turned on and off through the triode. The three digital tubes use the dynamic display mode to save I/O resources, and also realize the chip selection of the digital tube by controlling the on/off of the triode. As long as the scanning frequency is high enough, the visual will not feel flicker.

## 4. Summary

ZigBee-based furniture intelligent system has the advantages of strong communication function and low power consumption. The effective distance of wireless communication in home applications is moderate and has a good application prospect. Currently. Our development is only in the laboratory stage, and the basic objectives expected are achieved through the modification and commissioning of some simple equipment. It can control simple equipment such as curtains, AC electric fans, and wireless detection of environmental parameters such as humidity and temperature. The system can be further extended to comprehensive collection of multiple environmental data of all households, network control of various home appliances, and a highly intelligent, intelligent and networked smart home system.

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