# Design of Greenhouse Temperature Control System Based on ZigBee Wireless

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**Keywords:** ZigBee, Greenhouse, Wireless communication technology.

**Abstract.** The ZigBee technology in the greenhouse is introduced in this paper. STC89C52 microcontroller, DS18B20 temperature sensor, and CC2430 radio frequency components are choosed, and the control of environment parameter acquisition inside the greenhouse, wireless transmission and reliability of real-time is implemented. After the debugging and running indicates, the system has reached the expected design goal.

## 1. Introduction

The greenhouse combines digital sensor technology, wireless communication technology, computer technology and other advanced technologies to achieve intelligent control of greenhouse. This method can artificially change the growing environment of crops, change the environmental parameters in the greenhouse according to the conditions needed for the growth of crops, so that crops can completely get rid of the restrictions of natural climate. In this way, crops can be grown in the most favorable environment for their growth all the year round, so as to realize the off-season output of crops and the high quality and high efficiency of industrialization, thus greatly improving the grain yield and quality.

## 2. ZigBee Technology

ZigBee wireless technology is a new short range wireless communication technology with low rate, low complexity, low power consumption and low cost. It can satisfy the wireless networking between some devices with relatively large distribution range and low cost. ZigBee routers can work for a long time on the premise of battery power supply. Therefore, it is suitable to collect and control all kinds of environmental parameters in greenhouse, which is beneficial to fine management in agricultural production, and to improve the efficiency and economic benefit of production.

The intelligent control system of greenhouse based on wireless technology is mainly composed of single chip microcomputer, sensor, actuator, wireless transceiver module and central control software. The whole block diagram of the data acquisition system in greenhouse is shown in Fig. 1.

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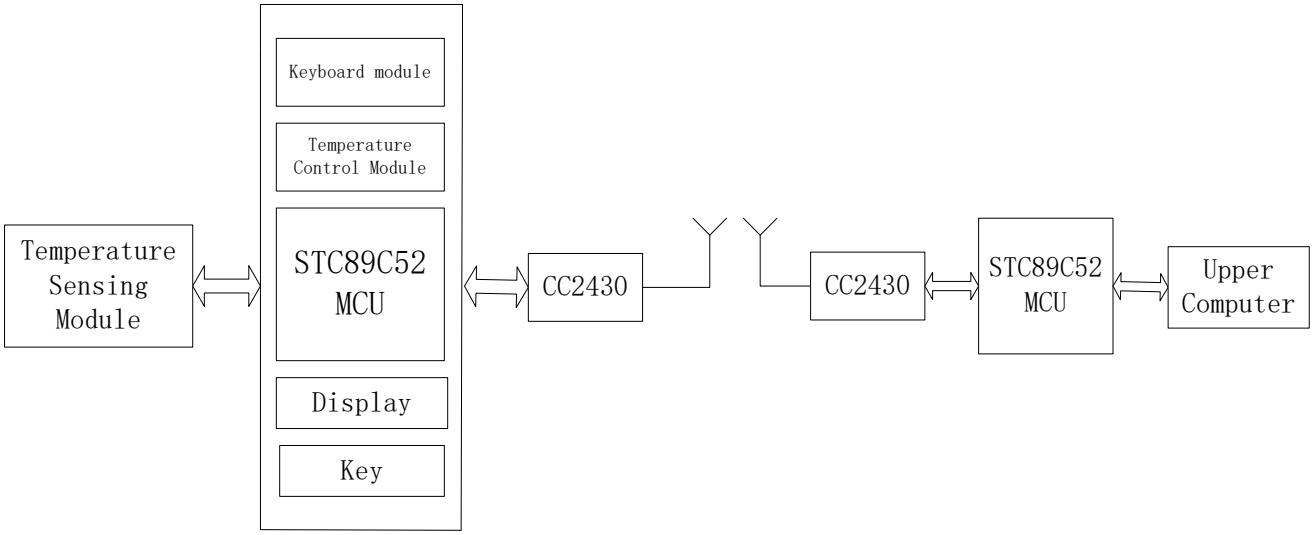


Fig. 1. Integral block diagram of data acquisition system in greenhouse

## 3. Hardware Selectiong and Circuit Design

### 3.1 Power Circuit Design

The operating voltage of LCD and other components is 5 V, while that of CC2430 is 3.3 V. Therefore, to meet the normal operation of the system, two voltage levels are required. The design of the power circuit is shown in Fig. 2.

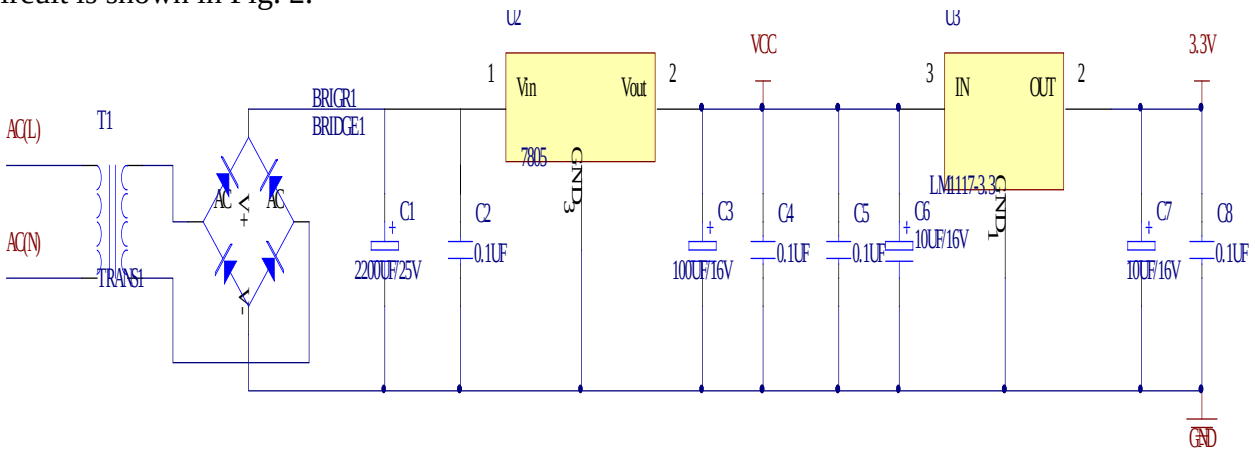


Fig. 2. Power supply circuit design

### 3.2 Circuit Design of Main Control Chip

In this paper, STC89C52 is used as the main control chip, which is the core component of the hardware circuit, including an oscillating circuit and a reset circuit. The sequence of control signals sent out by the control CPU in time and the reset function in case of circuit problemms are realized [3]. The minimum system of the main control chip circuit is shown in Fig. 3.

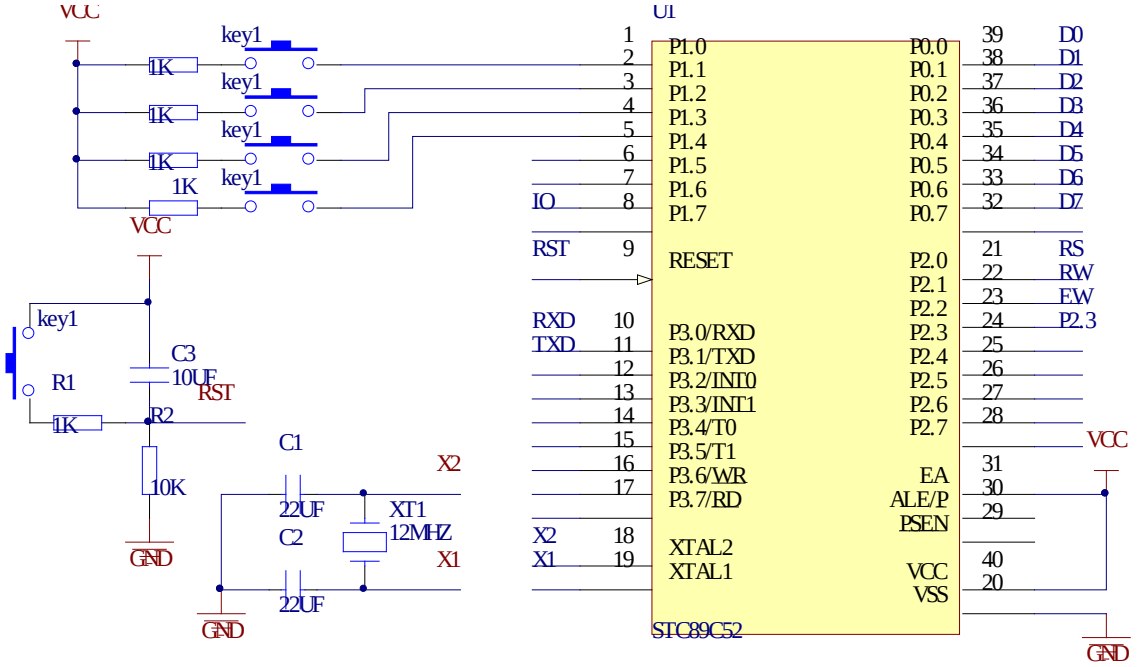


Fig. 3. Minimum system of main control chip circuit

### 3.3 Sensor Circuit Design

The sensor module uses DS18B20 to obtain the temperature data of the surrounding environment. Because DS18B20 is a port line communication, so the central microprocessor and DS18B20 only one port line connection[4]. The sensor circuit diagram is shown in Fig. 4.

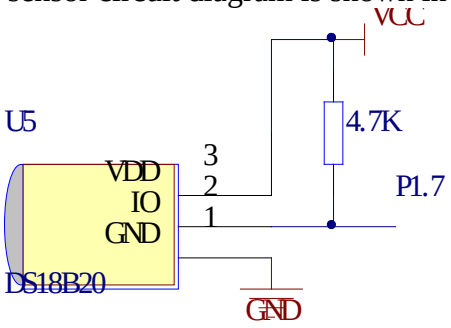


Fig. 4. Sensor circuit diagram

### 3.4 Design of radio frequency circuit

The RF circuit module is responsible for the driving of the sensor and the transmission of data. A large number of internal circuits have been integrated, and only a small number of peripheral circuits can be implemented. The schematic diagram is shown in Fig. 5.

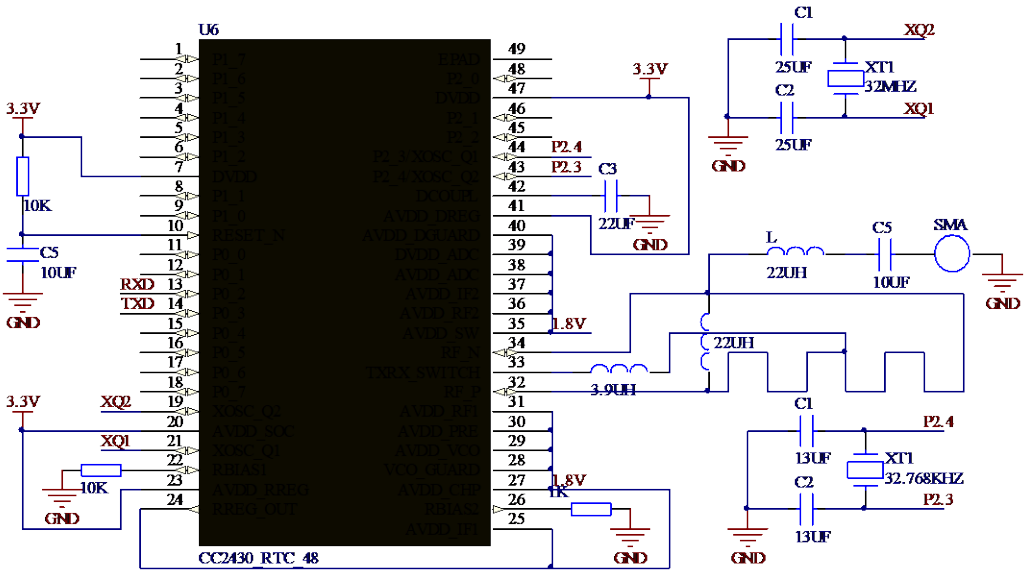


Fig. 5. Circuit diagram of radio frequency module

## 4. Upper Computer Software Design

### 4.1 Software Function Design

The monitoring software of the upper computer mainly provides the data display screen of the real-time environment parameters in the shed to the user. In addition, some supporting functions such as data alarm, historical trends and so on need to be provided.

### 4.2 Monitoring Interface

After opening the development system page, click on the "library", open the library manager, drag the switch, temperature meter and alarm clock directly into the development page, and then use the toolbox to do the "start" and "stop" buttons, as well as the temperature display, and set the screen, alarm window and other buttons. The main interface is shown in Fig. 6.

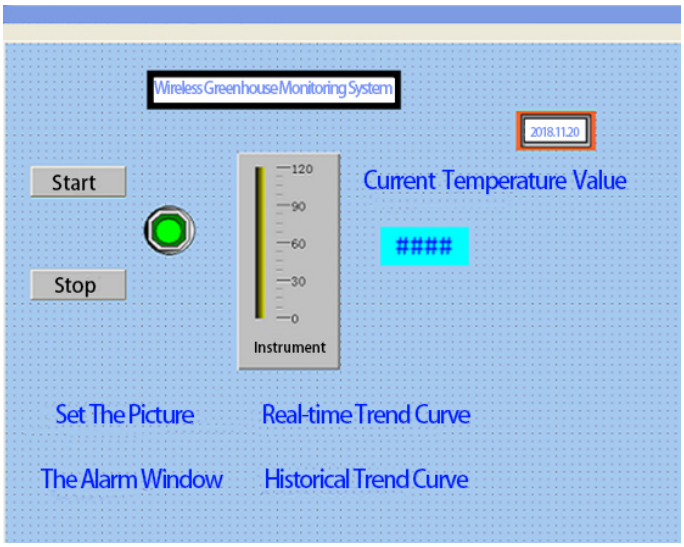


Fig. 6. Main interface

After opening the development system page, click on the "real-time trend curve" in the toolbox to put the real-time trend curve into the development page, and then double-click the curve screen to set the curve. The real-time trend curve interface is shown in Fig. 7.

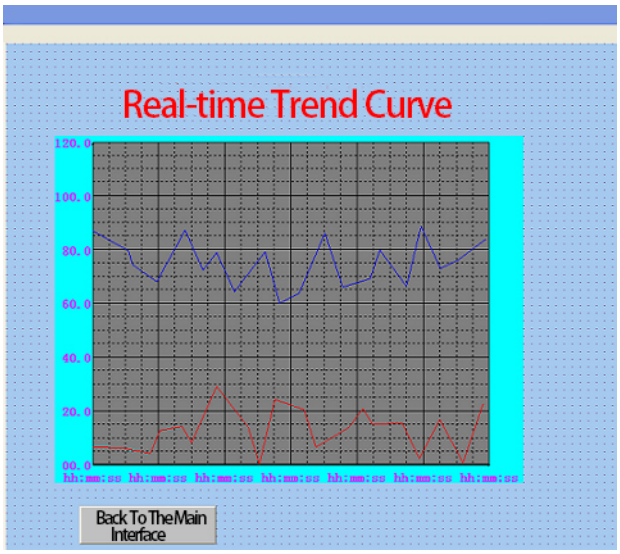


Fig. 7. Real-time trend curve interface

After opening the development system page, click on the "Library", open the Library Manager, double-click "History Curve" to put it into the development page, and then double-click the historical trend curve screen to set the curve. The interface of the historical trend curve is shown in Fig. 8.

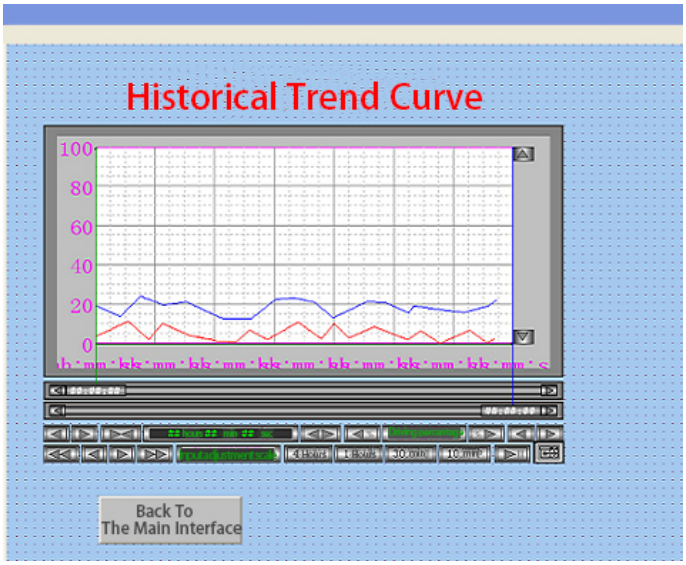


Fig. 8. Historical trend curve interface

## 5. Conclusion

Based on the research of ZigBee wireless communication technology, a temperature acquisition and control system based on ZigBee network is designed and implemented in this paper. One of the obvious advantages of this system is that it eliminates the intricate wiring in the traditional temperature measurement and control system and improves the flexibility of the temperature collection terminal. And it is the use of Kingview Kingview 6.55 to design a greenhouse monitoring system software. The design requirements are met.

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