Design and Application of Integrated Circuit of Sensor Based on Single Chip Computer

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Abstract. At present, sensors are used in all aspects of people's life and work, and the demand for sensors will continue to grow in the future. More and more people want to improve their understanding of sensors. It is of great significance to study the design and application of integrated circuit of sensors based on single chip computer.

Nowadays, with the invention of various machines and the need of electricity, sensors are becoming more and more important. Sensors are equivalent to human sensory organs, which can help machines to obtain environmental information from the outside world. At present, sensors and single chip computers are widely used in intelligent industrial production. Sensors play a monitoring function to ensure the safety of production links. The data collected by sensors are processed by single chip computers to control the operation of machines to realize industrialized intelligent production and improve production efficiency. Therefore, it is of great practical significance to study the design and application of integrated circuit of sensor based on single chip computer.

1. Background of Circuit Design

At present, more and more colleges and universities are aware of the importance of sensors and have offered sensor courses accordingly. However, the traditional teaching mode is mostly adopted, that is, the types, materials and principles of sensors are simply discussed. It is difficult for students to learn something useful about sensors in practical application. This paper studies the design and application of integrated circuit of sensor based on single chip computer, so that students can design and make the sensor course independently, deeply understand the application of each module of the sensor, improve the efficiency of the sensor course, and improve the design level of the integrated circuit of the single chip sensor.

2. Selection and Brief Introduction of Main Devices of Sensors based on Single Chip Computer

2.1 Single Chip Computer

The choice of the model of single chip computer is extremely important. This design selects the single chip computer produced by STC. The K-byte flash memory has good compatibility and can be compatible with various types of single chip computers in the instruction system and pins. For example, the 51 series single chip computers produced in China can be fully compatible. The working state is mainly static work, and the working range is wide, and it can work in the range of 0Hz~24MHz [1~2]. The single chip computer uses three levels of program memory for encryption, and also supports writing programs through the serial port. The development equipment investment is lower than other models of single chip computers, and the development time is also short. It has a 32-bit bidirectional input and output line, has two 16-bit timers, together with five interrupt sources, and has two levels of interrupt priority. It has a very wide voltage, is not afraid of power supply jitter under working conditions, can withstand 2KV/4KV pulse interference, has a wide temperature range, and can operate in the -40 ° C ~ 85 ° C environment.

2.2 Design of Ultrasonic Module

This study designs the super-wave module of the single chip sensor, and selects the US-100 model super-wave module [3]. The ultrasonic module has powerful functions. It has not only

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automatic temperature correction, but also two output modes--- level and serial port, which improves its detection range. The theoretical value ranges from 2cm to 450cm. At the same time, it has a wide voltage range, which can work normally between 2.4V=5.5V. When it is static, it consumes very little power with only 2Ma, which is very suitable for the single-chip sensor studied in this study. The output mode of the ultrasonic module is designed on the back of the ultrasonic module. The output mode is selected mainly by jumper. When the jumper cap is plugged in, the ultrasonic wave adopts the serial port mode for output; and when the jumper is pulled out, the square mode of the ultrasonic module is adopted.

2.3 Design of Temperature Sensor Module

In this study, the temperature sensor module of single chip microprocessor sensor is designed, and 18B20 model temperature sensor module is selected. The temperature sensor is manufactured in the United States, and its measurement accuracy is very accurate. At present, it can measure the accuracy of 9-12 digits The whole temperature control adopts a bus to transmit signal data to meet the temperature control requirements. The temperature sensor belongs to the digital type and can be well compatible with the single chip computer. But in the process of communication, they must follow certain rules to complete the communication. Communication design is divided into three parts. The first part is the initial part, which prompts the temperature sensor to prepare for work; the second part is the ROM command part, which mainly identifies the internal transmission signal of the ROM, and then reflects to the next part of the work; the third part is the functional command part, which receives the transmission from the second part, select the corresponding function of the signal, and work according to the code.

2.4 Design of Infrared Sensor Module

In this study, the infrared sensor of single chip microprocessor sensor is designed, and the general type of infrared sensor is selected. The sensor transmits and feeds back the signal mainly through infrared ray, and transmits infrared ray through infrared device. After encountering obstacles in the transmission process, the infrared ray will reflect along the opposite direction of transmission, and eventually be received by infrared receiving device, triggering the corresponding function, and playing the role of alarm [4]. In the design of the infrared sensor module, the focus is on the distance design, so that the infrared sensor module can adjust the distance accordingly, in order to meet its use in the range of 1 ~ 65cm. At the same time, the price of the infrared sensor is very reasonable, and it can be widely used in life or industrial production. The power supply of the infrared sensor is rated at 5V voltage, rated current is 100mA, and signal transmission display speed is 2ms. It can test a variety of obstacles, including transparent obstacles.

3. Hardware Design of Integrated Circuit Of Sensor based on Single Chip Computer

3.1 Design of Power Supply

The single-chip sensor integrated circuit belongs to a small-sized circuit. At the same time, for the purpose of life and production requirements, the design is biased towards a convenient design, and the designed rated voltage is 5V. This design is to solve the power supply problem of the single chip sensor. The power supply mode is specially designed. One is to use the rechargeable battery for power supply, and the other is to use usb for power supply. For the design of the rechargeable battery, the battery box is selected as the fifth battery, and the four-cell battery is connected in series, which can ensure that the single chip computer can maintain the normal voltage range, satisfy the voltage requirements of the module, such as, the temperature sensor module, the super-wave sensor module. The other is the design of the Usb power supply, which is the simplest way to supply power. It only needs to install an ucb interface on the circuit. It can supply 5V voltage to the sensor to meet the system's voltage requirements.

At the same time, it is necessary to design the minimum system circuit of the single chip computer to meet the needs of the single chip operation. The design of the minimum system circuit includes a power supply circuit, a crystal oscillator circuit, and a reset circuit [5]. The power supply circuit is the simplest in design, but attention should be paid to the connection problem of the positive and negative poles of the power supply. The positive pole is two interfaces, and the

negative pole is an interface. This ensures that the internal and external storage of the microcontroller is more convenient and not easy to appear error. For the design of the reset circuit, a capacitor charging and discharging circuit is used to make the reset circuit of the single chip computer. A capacitor of 10 mF is installed on the positive pole of single chip computer power supply, and a resistor is connected in series, which can control the charging time of single chip computer very well. For the design of the crystal oscillator circuit, combining two chip capacitors and one crystal oscillator to control the beat frequency of the crystal oscillator, the operating speed of the single chip microcomputer can be controlled. When designing the crystal oscillator circuit, attention should be paid to keeping the capacitor close to the crystal oscillator as much as possible, and the crystal oscillator is close to the microcontroller. It makes the circuit more concise and saves fewer flyers on the circuit board. In the whole smallest system, the single chip microcomputer and the crystal oscillator component are placed in the positive part of the circuit board, and all other original components are placed in the north, which can effectively reduce the minimum system internal space and make the single chip microcomputer operation more stable.

3.2 Circuit Design of Ranging and Blind Guide Instrument

As for the circuit design of range finder and blind guide instrument, the service and ultrasonic sensor module are the main parts. In this design, the buzzer is installed on the blind guide and range finder, which adds sound hints to the single chip computer. In this way, the operator can control the data of the single chip computer. In the design, the placement of the position is very important. First of all, the circuit board and the ultrasonic module must be close to each other, and preferably is in the edge position [6]. The ultrasonic probe is calculated from the edge of the circuit board to ensure that both of them are maintained on a reference line and the accuracy of measurement data is guaranteed. The buzzer chooses 5V generator, which meets the voltage requirement of single chip computer. When the single chip computer is powered, the buzzer will emit buzzing sound; while the current disappears, it will show silence. At the same time, the PCB board is specially designed to use one-sided wiring, which can avoid the production of flying lines.

3.3 Circuit Design of Infrared Alarm

The structure of the infrared alarm circuit is very simple. Two infrared reflective sensors are inside the infrared sensor module. The reflected infrared signal is connected to the pin of the single chip computer, which causes the change of the corresponding function. The selection of the infrared sensor module has great advantages. On the one hand, the effective transmission distance of the sensor is very long, so the problem of transmission distance need not be concerned, and it can be adjusted automatically in the range of 3 `80cm. On the other hand, the connection between the infrared sensor and the single chip computer is very simple. The whole infrared sensor only uses three wires to connect, which effectively releases the space inside the circuit board and ensures the stability of the single chip computer.

3.4 Circuit Design and Fabrication of Overall Hardware

The integrated circuit design of the single chip sensor will be carried out on a single sided copper plate. The selected copper plates are with the length of 15cm and the width of 6.7cm. The single panel has great advantages, because the integrated circuit design in this study has more sensor modules, which increases the complexity of the circuit design. The double-sided circuit is easy to cause errors, and the single-sided circuit is adopted to facilitate the connection of the line. Secondly, the single-sided circuit is easier to plate than the double-sided circuit, and the positioning of each module is easy. Moreover, the single-sided circuit plate making is cheaper than the double-sided circuit plate making, which can effectively reduce the cost of the overall circuit design.

4. Conclusion

In short, the sensor is currently deeply involved in various fields of people's lives, and has a positive impact on people's lives. The research on the design and application of integrated circuit of sensor based on single chip computer has practical significance. Through the analysis of the main device selection and introduction of the single chip sensor, the understanding of the single chip computer is deepened. This research is designed for single chip computer, ultrasonic module, temperature sensor

module, and infrared sensor module, to help people understand the design and application of integrated circuit of sensor based on single chip computer.

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