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Design of Ultrasonic Rangefinder for Structural Strength Test based on Single Chip Microcomputer

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Abstract

In order to be able to use the knowledge we have learned in this design, first of all, a preliminary understanding of the structural strength test. The strain effect of strain gauge can measure the deformation of aircraft wing structure. We need to use ultrasonic range finder, the design of the initial position range of airplane wings, the airplane wings after for the structure strength distortion test, again with the ultrasonic range finder to measure the location of the ground, airplane wings generated after the initial position and measure the position of the gap to achieve with ultrasonic range finder test of aircraft wing structure strength test.

Keywords

Ultrasonic Ranging; Ultrasonic Sensor; STC89C52.

1. Introduction

Fig. 1 shows we are conducting the structural strength test of the aircraft to test the structural strength of the aircraft. If we need to make more subtle changes, we use strain gauges to stick on the fuselage and observe the changes of strain gauges for thousands of times. To complete this work, we need a lot of experimental data to make experimental measurements of aircraft structural strength, which is a bit difficult for us. We can carry out the falling motion of the part of the aircraft that needs to be detected from the high sky, repeatedly to detect the structural strength of the aircraft, and to detect the structure of the aircraft from the degree of distortion of the aircraft shape.

Fig. 1 Structural strength test of airfoil

2. Properties

2.1 STC89C52 module

STC89C52 is a common FLASH memory with 4K bytes. It has low voltage and high performance [1]. CMOS8-bit processor, commonly known as microcontroller. In this microcontroller, there are CPU, RAM, ROM, counter and I/O port with multiple functions [2].

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2.2 Master control minimum system module

The main control minimum system is mainly composed of power supply module, reset circuit, oscillation circuit and expansion part. The power supply of the power supply module can be supplied by plugging in the USB port, and can also be supplied with an external stable 5V power supply voltage. The reset circuit of MCU can use key reset and power-on reset. The oscillating circuit is used to provide the required clock frequency for the main control to provide stability and keep the main control in normal operation.

2.3 Ultrasonic ranging module

Ultrasonic test module test method: send high level above 10us to Trig port, can wait for high level output at Echo end, when the high level output starts timer. When the Echo interface becomes low power, We can read the value of the timer, at this time that the value of the timer is the time to calculate the distance.

2.4 Design of clock circuit

The design of the clock circuit is based on the internal clock oscillator method by two capacitors, and crystal oscillator connected in the SINGLE chip XTAL1 port and XTAL2 port also need to ground. The capacitance is 20PF and the crystal oscillator is 12MHZ.

2.5 Design of sound alarm circuit

This design a sound alarm, with a buzzer and audion, resistance connection design also need grounding and also connected to the MCU (STC89C52) P13 pin, constitute a sound alarm circuit [3].

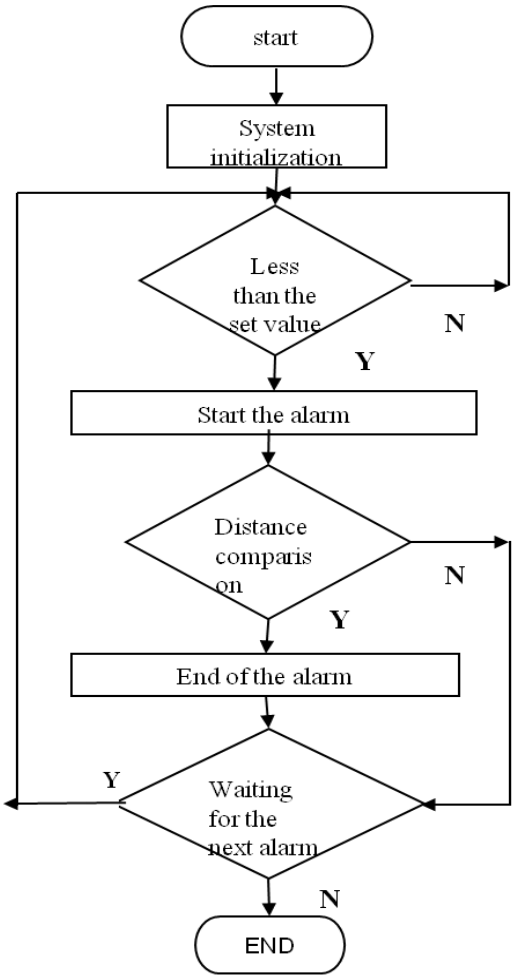

Fig. 2 Main program flow chart

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2.6 Display module

The digital tube is connected to the P1 port of the single chip microcomputer, and the external pull-up resistor is connected to ensure that the digital tube displays an accurate distance value [4].

3. The software design

3.1 Main program workflow flow chart

The main program as the main part of the system program, according to the design of the preset function of the orderly call each subroutine, to achieve the ultrasonic rangefinder ranging function. (as shown in Fig .2)

3.2 Flow chart of ultrasonic detection program

The ultrasonic detection program mainly detects the level of ECHO port of ultrasonic module through timer 1. ECHO port is high level start timer 1, ECHO port is detected again, low level off timer 1.(as shown in Fig.3)

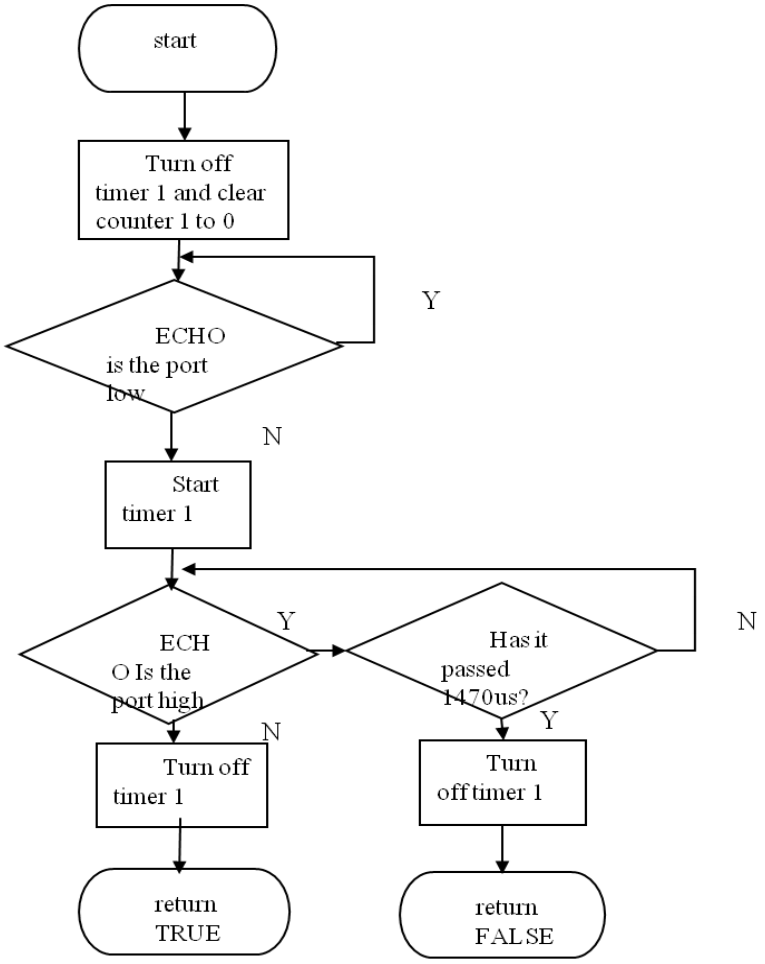

Fig. 3 Flow chart of ultrasonic detection program

4. Conclusion

We need to know what are pairing aircraft structure strength test, we don't adopt strain gauge strips, the design for the strain effects caused by strain gauge is small changes, the use of this we adopt single-chip computer in order to complete the range finder measured from the height of the airplane wings, ultrasonic ranging, this design is in order to be able to achieve the goal of range finder to measure distance. Mainly learn the characteristics of ultrasonic sensors, and the basic ranging principle. Ultrasonic is widely used in life, ultrasonic ranging is just one of them. To complete the

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design also need to understand the microcontroller (STC9C52), its various port functions, the reasonable application of special ports. In the redesign of the circuit, we should try to build the circuit in PROTEL software, and finally improve the circuit we designed, so as to facilitate our later welding debugging work.

Acknowledgments

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