Design of Bluetooth anti-lost Device Based on 51 Series Single Chip Microcomputer

Xue Lu1*, Li Sha2, and Junbo Luo3
1Guangdong Science and Technology Basic Condition Platform Center, Guangzhou, Guangdong, China
2Guangdong Science and Technology Basic Condition Platform Center, Guangzhou, Guangdong, China
3Guangdong Science and Technology Basic Condition Platform Center, Guangzhou, Guangdong, China
*Corresponding author’s e-mail: 1158722742@qq.com

Abstract: In order to solve the problems like the difficulty of people to retrieve the lost valuables in daily life and rampant theft in crowded areas, a practical Bluetooth anti-loss device based on 51 series single-chip microcomputer is proposed in this paper. It can effectively avoid the risk of users' valuables being stolen or left behind, which has a very good market prospect. Based on the Bluetooth communication technology, this paper introduces the working principle of the Bluetooth tracker, and designs its hardware system circuit, including power module, crystal oscillator module, button module, alarm circuit, core controller, Bluetooth module and so on. The master and slave uses the same program design, by constantly sending handshake information to each other and using a timer to detect whether the other one is disconnected or not, achieves the anti-loss and anti-theft function. The Bluetooth anti-loss device designed has the advantages of high reliability, strong functionality, and high performance-to-price ratio.

1. Introduction
Limited by energy, people often leave small valuables in a corner in their daily life. How to quickly retrieve the accidentally dropped items has become a pain point for many people. In crowded places, thieves and pickpockets can not be prevented, and theft prevention has become the demand of people. At present, the mainstream anti loss devices in the market generally have the problems of false alarm and disconnection. At present, the mainstream anti loss devices in the market generally have the problems of false alarm and disconnection, such as the high price, low alarm sound, non replaceable battery and so on, which are difficult to be widely used in life. In view of this, according to the point-to-point Bluetooth data communication technology, using STC89C52 as the core controller, this paper designs a Bluetooth anti lost device which can realize the functions of searching and anti losing.

2. Working principle of Bluetooth anti loss device

2.1 Bluetooth communication principle
Bluetooth technology is a short distance wireless communication technology standard jointly formulated by Ericsson, IBM, Intel, Nokia and Toshiba in May 1998. It uses short distance, low-cost
wireless connection instead of cable and wire connection, which can easily establish wireless connection, strong portability and wide applicability. In addition, Bluetooth equipment also has the advantages of low power consumption and low cost[1-2].

Bluetooth devices work in the global 2.4GHz band[3], the data rate is about 1MB/s, the time division duplex transmission mechanism is used to realize full duplex transmission. In order to prevent other interference sources in the same frequency band from interfering with Bluetooth transmission, Bluetooth adopts fast confirmation and frequency hopping [4] to ensure the stability of the connection.

2.2 Principle of anti loss device

In this design, the master-slave has the same hardware design and program design. The hardware module of the Bluetooth anti loss device includes power module, crystal oscillator module, key module, alarm circuit, core controller and Bluetooth module. The hardware system structure diagram is shown in Figure 1.

Fig. 1 Structure block diagram of Bluetooth tracker hardware system

(1) The power module uses 5V external power supply to supply power for the 52 MCU. The 5V power supply obtains 3.3V voltage through the voltage stabilizing circuit to supply the Bluetooth module hc06. The USB interface attached to the power supply module enables the Bluetooth anti loss device to use the mobile power bank to supply power for it, which is convenient to carry.

(2) The crystal oscillator module uses 12 MHz crystal oscillator to provide system clock for 52 MCU.

(3) The key module uses two independent buttons, one of which is the "alarm" button, which can send the alarm information to the connected anti loss device and make it sound an alarm; the other independent button is the "close" key, which can be pressed to close the alarm module of the machine.

(4) The alarm circuit uses the buzzer as the alarm device. When receiving the alarm information from the other party or not receiving the handshake information of the other party after timeout, the buzzer will ring to remind the user.

(5) The core controller uses STC89C52 single-chip microcomputer, as 51 series single-chip microcomputer, 52 single-chip microcomputer has complete input and output, control port and internal program storage space, and has the advantages of simple structure, powerful function, wide application and low price. The single chip microcomputer 52 can be connected with Bluetooth module for information receiving and sending control and alarm control.

(6) The Bluetooth module uses hc06 components, as shown in Figure 2. Hc06 works in 2.4GHz frequency band and can establish effective connection within 10 meters. After the two hc06 are connected, they can continuously send handshake information to detect whether the distance between the two anti loss devices is too far.
3. Programming

The core controller of Bluetooth anti loss device is STC89C52, and the main program flow chart is shown in Figure 3. Check whether Bluetooth connection is successful. The tmmod of MCU\(^6\) is set as tmmod = 0x21 = 00100001. Timer T1 works in mode 2, i.e. automatic overload 8-bit timer mode, and timer T0 mode 1 is 16 bit timer mode.

Because Bluetooth communication needs timer as baud rate generator, the host can synchronize with slave in communication process. The high register of timer T1 is set as Th1 = 0xfd, that is, the baud occurrence rate is set to 9600bps, and the error rate is 0%. When scon = 0x50 is set in the control register, the serial port works in mode 1, i.e. 10 bit uart mode, so that the controller can send data through Bluetooth. The Bluetooth anti loss device needs to use the timer T0 to keep timing to judge whether the other party is out of the connection range, so Th0 = 0x3c, tlo = 0xb0, timer T0 timing 50ms.

First of all, the anti loss device detects whether the Bluetooth connection is successful. If not, continue to wait. Otherwise, turn on the timer to start timing, and send handshake information to the connected object every 0.25 seconds. If the time-out does not receive the response from the other party, it is considered that the distance between the anti loss device a and B exceeds the threshold value, and the buzzer will alarm. At the same time, the anti loss device detects whether the local key is pressed and executes the corresponding key command. After the handshake information of the other party, the timer is refreshed again. If the handshake information is alarm information, the buzzer will give an alarm.

In order to realize the anti false alarm function of Bluetooth, this design has a confirmation mechanism before starting the alarm circuit. When receiving the alarm information, the program will reconfirm that the other party is disconnected or receives the alarm message again before triggering the alarm device. The Bluetooth anti loss device designed in this paper is shown in Figure 4.
Fig.3 Flow chart of main program
4. Conclusion

Based on the Bluetooth transmission technology, this paper designs a practical Bluetooth anti loss device with the advantages of anti false alarm, anti loss and anti-theft. The actual performance test shows that the Bluetooth anti loss device can realize the functions of one key search and alarm within 10m, which has the advantages of high reliability, strong functionality and high cost performance.

The design of Bluetooth anti loss device can effectively avoid the risk of valuables stolen in crowded places, and its one button search is also greatly convenient for people's life. Therefore, this design has certain practical value. With the introduction of low-power Bluetooth 4.0 [7], the power consumption of the anti loss device based on Bluetooth is greatly reduced. With its low-power consumption and low-cost characteristics, it will be widely used in people's life [8].

References

[1] Qian Zhihong. (2006). Principle, development and application of Bluetooth technology. Beijing: Beijing University of Aeronautics and Astronautics Press, 4-11.
[2] Huang Zhiwe. (2005). Bluetooth hardware circuit. Beijing: Beijing University of Aeronautics and Astronautics Press, 2005: 359-366.
[3] Zhang Lulin. Bluetooth protocol and its implementation. (2001). People's Posts and Telecommunications Press, 255-258.
[4] Zhang Qun, Yang Xu, Zhang Zhengyan, et al. (2012). Design and implementation of Bluetooth module serial communication. Laboratory research and exploration, 31 (3): 79-82.
[5] Liu Mige, Wang Lu. (2010). Design and implementation of multifunctional electronic anti dropping device. Journal of Xi'an University of Arts and Sciences, 13 (1): 41-43.
[6] Yan Jie. (2010). Principle and interface technology of single chip microcompute. China Machine Press, 75-81.
[7] Xu jingo. (2012). Principle and implementation of low energy Bluetooth 4.0 protocol. Microcomputer applications, 2012, 28(10): 16—19
[8] Wang Lei. (2013) Research and design of anti loss device based on Bluetooth 4.0 technology [D]. Taiyuan University of technology, 22-28.