

Design of Vehicle Communication System Based on Single Chip Microcomputer Bluetooth Technology

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Abstract

This topic is based on the Bluetooth telematics system with STC15 single-chip microcomputer as the core. This paper designs a navigation information from Beidou navigation to Beidou navigation information processing, and then transmits the processed data information to Android mobile phone via Bluetooth. The positioning information of the car is displayed on the mobile phone to conveniently monitor and locate the position information of the car. For the information reception, the Beidou active antenna is used, and the accepted signal is converted into the NMEA0138 data format by the chip UM200. Through the STC15F60S2 microcontroller, the data is grouped and its latitude and longitude information is obtained. Connect the Bluetooth chip HC05 to the MCU, open the AT command of the Bluetooth chip, so that Bluetooth can send the location information. The Android smartphone turns on the Bluetooth function, and after pairing with the chip successfully, it can receive and display the Bluetooth information.

Keywords

Bluetooth Technology, Vehicle System, STC15F60S2 Microcontroller.

1. Introduction

China's auto industry is currently moving toward a strong, but also facing the corresponding challenges, such as technological innovation to keep up with the development of the car, the development of the car keeps up with the needs of the majority of users. At present, there are a large number of talents in machinery and vehicles, and some automation equipment such as robots that can improve work efficiency have contributed to the rapid development of the Chinese automotive industry. It is estimated that after more than a decade, the annual growth rate of China's autos will reach 10.1%. In the world, China's auto sales can reach more than 50%. Through the national car sales in the first half of 2016, we can see that the impact of Chinese cars in the world is very large. There are 6 models in China on the sales list, and through the statistics and analysis, the sales of cars in China are certain. The extent of the impact on the country's car sales changes. Among them, the communication method between the car and the mobile phone basically uses Bluetooth, and only a few North American series models can use wifi communication, but it is also a minority. Through the analysis of practicability and applicability, the interaction between wifi and car and mobile phone is not mature enough, and there are many drawbacks.

From the beginning of the twentieth century, China's self-produced Bluetooth technology, which is a communication device, was put into the market and started to be sold. Subsequently, the third, fifth, and eighth series of cars all installed and used Bluetooth as a device for in-vehicle communication, and are still in use until now. At present, domestically produced big brand cars such as Geely, Chery, and Great Wall have also used Bluetooth as a communication method for in-vehicle information.

2. Subject content and requirements

The main research content of this subject is: using low-cost equipment to achieve and complete real-time monitoring of vehicle position[1].

The technical problems that need to be solved in this topic are as follows:

The selection of components during the reception of the Beidou navigation signal. And the data signal transmission format after the initial processing of the signal. The selection of components for reprocessing the initially processed data, while writing the code to transfer the data to the Bluetooth chip, and controlling the Bluetooth to send data to the Android smartphone.

The selection of components for reprocessing the initially processed data, while writing the code to transfer the data to the Bluetooth chip, and controlling the Bluetooth to send data to the Android smartphone[2].

Using an Android smartphone app, you can receive the Bluetooth information sent in and display the received latitude and longitude information.

3. System design block diagram

The system mainly includes the Beidou signal acquisition circuit part, the Beidou signal processing part, the Bluetooth signal transmission part, the Bluetooth signal reception and the mobile phone display information part. The sending and receiving portions of the Bluetooth signal are the core of this article. The Beidou active antenna transmits the signal to the MCU through the RF processing chip after receiving the Beidou signal, and the MCU further processes the data (using C language), and the processed data information is transmitted to the Bluetooth chip HC05, and the Bluetooth chip sends a signal to the Android mobile phone. The Android phone app receives Bluetooth information[3]. The overall framework of the system is shown in Fig.1. Through the overall framework of the system we can know the general flow of the signal.

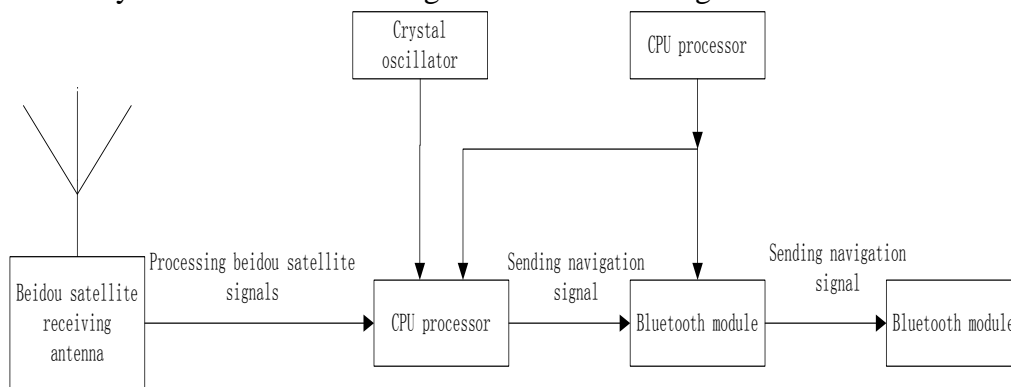


Fig.1 Overall system diagram of the system

In terms of software design, the MCU sends the signal to the Bluetooth chip, and the Bluetooth chip sends the information to the mobile phone.

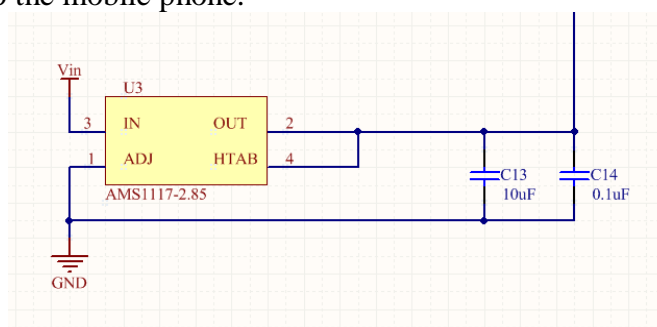


Fig.2 ASM 1117 peripheral circuit diagram

4. Circuit Design

4.1 PowerCircuit Design

In the car's in-vehicle system, the navigation power supply is 12V, and the selected chip and antenna supply voltage[4] are both 3.3V. So the Bluetooth communication system designed requires a chip that can regulate 12V to 3.3V. According to the needs and performance analysis, the chip used in the power circuit used in this system is ASM1117. The peripheral circuit of the chip ASM1117 is shown in Fig.2.

4.2 Design Of Beidou Signal Receiving Module

This design is based on the Bluetooth technology of the vehicle communication system. Since the function of the single chip microcomputer is to process the data information transmitted by the UM220 chip, each time the car moves one position, there will be a position data signal transmitted, and the MCU needs to perform arithmetic processing on it. Transfer Beidou navigation information to the Bluetooth chip. This process requires that the operating speed of the microcontroller must be fast. If the running speed of the MCU can't keep up with the data transmitted by the UM220 chip, it will cause the system to be disordered and the desired result will not be obtained. In terms of energy consumption, the MCU must be of a low-power type, and saving energy is everyone's obligation. In addition, the size of the MCU should be as small as possible. In the limited space of the car, in order to give people more comfortable driving and living environment, the equipment inside the car should be as small as possible under the condition of ensuring the function. Because the data transmitted by UM220 is transmitted in serial form, there is also serial communication when the MCU wants to transmit information by the Bluetooth chip, so the MCU receives data with serial communication function[5]. Secondly, the information received by the single-chip microcomputer is continuous, and the data processed by the single-chip microcomputer is also quite large. Therefore, the capacity requirement for the selection of the single-chip microcomputer is also indispensable, in order to ensure that the single-chip microcomputer can be used normally and Some new functions can be extended, and the capacity of the microcontroller is appropriately selected. After screening, I decided to use the STC15 series of single-chip microcomputers, which have low power consumption, large capacity, serial communication and fast operation.

4.3 BluetoothCommunication Module Design

The Bluetooth module is the main research part of this design. The Bluetooth module in this design is mainly responsible for transmitting the baseband signal received by the MCU. In the process of receiving Bluetooth information on the Android smartphone, it is mainly determined whether the KEY button of the Bluetooth chip is pressed and whether the Bluetooth now belongs to the master mode or the slave mode.

HC05 is a Bluetooth serial port module with master mode and slave mode. Most people use it to communicate with Beidou navigation. HC05 Bluetooth chip can be automatically paired with Bluetooth-enabled devices on the market, such as smart phones and tapes. Bluetooth-enabled personal computers and other smart Bluetooth devices. The HC05 is very small in size and only one piece of rubber. The power supply voltage of the Bluetooth module is 3.3V. It can directly receive the data on the ATM 32 MCU without any external equipment. The HC05 Bluetooth chip supports baud rates ranging from 4800 to 1382400, which is why HC05 is popular in navigation. Its compactness and lightness are also very popular among developers and users.

The pin diagram of the HC05 Bluetooth chip is shown in Fig.3.

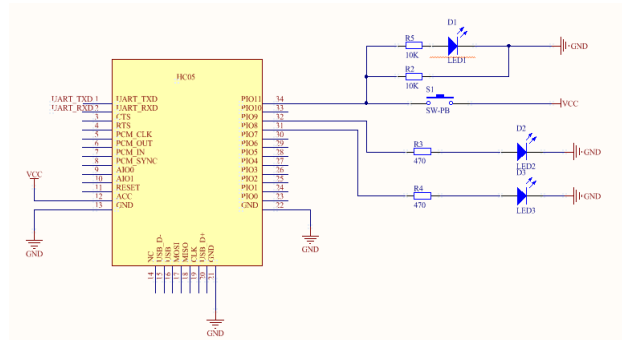


Fig.3 Peripheral pin diagram of the HC05 chip

The HC05 Bluetooth chip UART_RXD and UART_TXD are connected to the PA9 and PA10 pins of the STM32 microcontroller, respectively. The 12th pin of the Bluetooth chip is connected to a 3.3V high level, and the 3.3V voltage is supplied by the power supply circuit. The GND pins PIN 12, PIN 21, and PIN 22 of the chip are grounded. The S1 switch is used to control the Bluetooth chip to enter the AT command. When Bluetooth enters the AT command, LED D1 illuminates and R2 acts as a protection circuit. After PIO9 and PIO10 are connected to a resistor, they are connected to the LED and then grounded to indicate the current state of Bluetooth. When the LED D2 is lit, the Bluetooth chip starts to work, and the LED D3 flashes to indicate that Bluetooth is transmitting the location information.

5. System Programming

5.1 Bluetooth Program Design Ideas

The general flow chart of this Bluetooth communication system is shown in Fig.4.

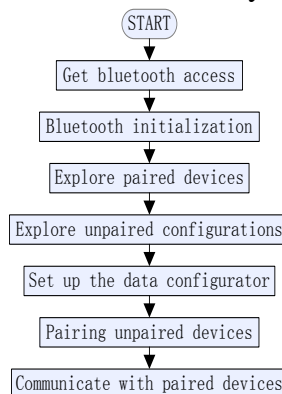


Fig.4 Main flow chart of Bluetooth communication

5.2 Single-chip Serial Port Program Design Ideas

The flow chart of the main program of the serial port of the single chip microcomputer[5] is shown in Fig .5.

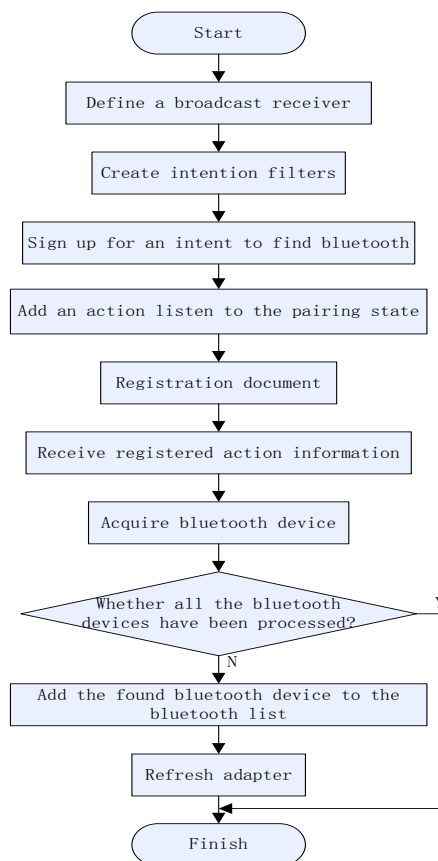


Fig.5 Serial port main block diagram

5.3 Conclusion

Through the hardware circuit and the software design of the single-chip microcomputer, the process of receiving and processing the Beidou navigation signal and then displaying the location information to the mobile APP is completed. It realizes the function of establishing communication between the car and the mobile phone using Bluetooth technology. The design can be used in various aspects, such as monitoring the position of the car. As long as the driver downloads the software in the mobile phone, the mobile phone opens the APP to receive the location information in the car navigation, and sends the location information to the control center that needs to monitor the location of the car. In this way, the car can be positioned and tracked in real time to ensure that the vehicle will not be lost or damaged.

In the future research and design, the latitude and longitude information received by the APP is connected with the Baidu map, then the location information of the car can be displayed on the mobile phone as a map display, and the positioning function of the Baidu map can also be utilized. The navigation function can also be navigated by operation, in a nutshell similar to a simple navigator. It is good for small family cars or agricultural vehicles that do not require additional functions for positioning. This requires only a few chips and an antenna to use the mobile phone as a navigator, which also solves the problems of large size, heavy weight, high price, and inconvenient use.

References

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