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"Unlimited" Mouse Quit Wireless Smart Travel

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Abstract

With the development of science and technology, the improvement of computer hardware performance and the influence of high-performance software, high-performance and high-sensitivity mice came into being. People who like to play games have higher requirements for mouse sensitivity and hope to achieve "zero" signal delay. This poses a challenge to the original mouse technology. The old-fashioned mouse cannot keep up with the response speed of the computer, and its performance is relatively poor. With the continuous development of wireless mouse (Bluetooth connection, WIFI connection) and USB3.0 wired mouse, all kinds of high-speed and low-cost single-chip microcomputers have poured into the market. A multifunctional "infinite" mouse is the original intention of this subject. This text is based on STM32 wireless mouse system design and realization, discusses the system function analysis, the hardware system design, the Kail development environment configuration, the multifunctional wireless mouse realization.

Keywords

STM32, Wireless Mouse, Single-Chip Microcomputer.

1. Development Background of Wireless Mouse

With the development of science and technology, computers have entered almost every household. Due to the needs of work and life, people have been inseparable from the use of computers. At the same time, the mouse matched with the computer is an indispensable tool. Among them, the wireless mouse is convenient and easy to use. Has been widely used [1].

The market law of IT smart products has always been that if there are products that are smaller and more convenient than it, old products that already occupy a certain market space will be replaced in a short time. For example, the transition from wired audio to Bluetooth audio. This is also a manifestation of the improvement in the level of technological development in the IT industry. When we use a PC, we need a keyboard and a mouse. The keyboard and the mouse can only be operated when they are connected to the PC via USB. The keyboard we use for typing does not need to be moved frequently, but we need to move frequently when operating the mouse. The mouse is connected to a line, and the mouse that is implicated will affect our operation of the computer when we use it [2].

2. System Function Analysis

This system develops a mouse that can be plugged into a computer through STM32 single chip microcomputer, and its function is the same as that of a real mouse. Mainly divided into USB wired mouse, WIFI wireless mouse. Same as the actual application, the USB mouse is directly plugged into the computer to use, and the wireless mouse is divided into two parts and uses the middle wireless transmission. The mouse can mainly move the cursor up, down, left, and right, left mouse button, right mouse button, mouse scroll up, mouse scroll down and mouse wheel functions:

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When the joystick is down: control the cursor to move down; when the joystick is up: control the cursor to move up; when the joystick is to the left, control the cursor to move to the left; when the joystick is to the right, control the cursor to move to the right; press the joystick to indicate reality Press the button under the mouse wheel. Left touch button: left mouse button; right touch button: left mouse button; upper touch button: mouse wheel scroll forward; down touch button: mouse wheel scroll backward, dual-axis button rocker sensor as shown in Figure 1 Show.

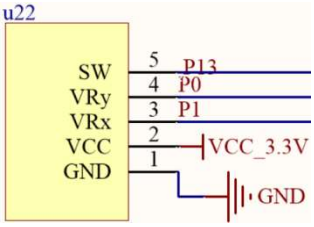

Figure 1. Two-axis key rocker sensor

Mouse wireless collection and sending: WIFI module, STM32F103C8T6 single-chip microcomputer, rocker interface circuit, light touch button. Mouse wireless receiving: USB interface circuit, STM32F103C8T6 microcontroller, WIFI module. Independent function: The mouse wireless acquisition and sending board has the function of a USB wired mouse, and it can also be used as a wireless mouse. The wireless receiving board is directly connected to the computer via USB. The wireless acquisition and sending board is plugged into the power supply, and the device is automatically connected wirelessly. After the device is automatically connected wirelessly, any joystick or button operation on the acquisition board will have the same function as the computer mouse in reality. The design uses STM32 to collect button parameters and send them wirelessly. After receiving and parsing wirelessly, the receiving board sends the corresponding mouse protocol data through the USB function.

3. Hardware System Design

3.1 STM32 MCU Main Circuit Design

STM32 series chips are a kind of 32-bit microcontrollers based on ARM and Context series produced by ST Semiconductor and can be simulated and tracked in real time. This control chip has a relatively small design, a relatively low cost, and a low-consumption product. However, it has a rich external interface to realize the design function, which is beneficial to expand the peripheral circuit to achieve more functions.

3.1.1. STM32 has the Following Advantages

Using ARM's latest Cortex-M3 core; excellent real-time performance; excellent power consumption control; integration has reached the maximum degree; the development difficulty is small, and it is beneficial to the rapid production and market investment of the product.

3.1.2. STM32 is the Most Suitable Development Platform

On the STM32 platform, multiple projects can be developed at the same time, and based on C language programming, STM32 is currently the most suitable. Not only does it meet the large demand for storage space and pins, but the pins, peripherals, and software are also highly compatible with all-round flexibility.

3.2 USB Port Universal Serial Bus Circuit Design

Small terminal devices using embedded system microprocessors are becoming more and more popular in society. Universal Serial Bus (USB) is widely used in the fields of instrumentation, digital equipment and computer peripherals because of its high transmission rate, easy expansion and plug-and-play advantages [3]. Compared with the parallel port and serial port of the interface between the

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early microprocessor and PC, the USB interface is not only large in size, but also low in transmission rate [4].

As the standard of the external bus, USB makes the interaction between the computer's hardware system and the software system more standardized. A USB interface can be connected to multiple hardware devices, such as keyboards and mice, etc., are all connected to the USB interface. From 1994 to 1996, companies from various countries have successfully replaced the serial port and parallel port communication interface. Now the computers that people use have USB interfaces.

What are the advantages of USB devices: users do not need to shut down when using external devices, they can be used directly by plugging in USB; USB is light and small, easy to carry; standards are unified, our common external devices can all use USB standards, making computers and peripherals The connection is no longer limited to a single direction connection as before. To The USB interface is also called a serial port. It is a commonly used PC terminal interface. It consists of two power lines and two signal lines. The signal transmission method is serial transmission, which can basically meet the low industry and low demand. For civilian needs.

The 10R resistor used is an impedance resistor. Its purpose is to ensure stable signal transmission. Therefore, a 10K resistor is used as a pull-up resistor for the USB interface. The schematic Figure 2 of the USB interface module is shown in the figure below.

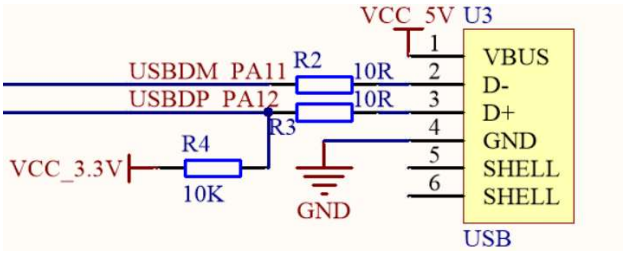

Figure 2. Schematic diagram of the USB interface module

3.3 ESP8266WIFI Module Circuit Design Circuit Design

The ESP8266 is used as the core processing module, mainly because the processor has the characteristics of fast running speed, rich development materials related to the Internet of Things, simple internal circuit structure, convenient I/O port resource configuration, and high cost performance, which can meet all of the system. Performance index requirements [5].

ESP8266 has different packages in different models, and its antenna has three interfaces: stamp hole interface, IPEX interface and onboard PCB interface; ESP8266 can be widely used in smart homes, smart grids and other fields, as well as smart industrial control applications.

ESP8266WIFI module features: There are multiple two-way data transmission communication interfaces; there are three working modes: STA/AP/STA+AP; ESP8266 has two protocol stacks: TCP/IP, and there are multiple TCP Client connections inside; low energy consumption It also supports external power supply and battery power supply; it is equipped with a 32-bit MCU that can be used as an application processor; supports remote control of Smartlink intelligent networking functions; supports DC power supply voltage; supports simultaneous transmission of multiple instructions.

ESP8266 can realize the functions: GPIO control, PWM control, serial port transparent transmission. Serial port transparent transmission: data transmission, the transmission reliability is good, the maximum transmission rate is: 460800bps; PWM control: adjust the brightness of the light, switch the light color, control the speed of the motor, etc.; GPIO control: control such as relays and switches. ESP8266WIFI module interface principle Figure 3.

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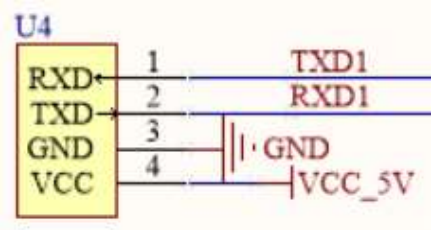

Figure 3. Schematic diagram of WIFI module interface

3.4 ESP8266 Wireless Communication

There are three working modes of ESP8266 wireless communication module:

The first AP mode: ESP8266 working in AP mode is similar to common WiFi hotspots. It can be connected to this "WiFi hotspot" through mobile terminal devices, etc., so that computers, mobile phones and other devices can build a local area network with ESP8266 for wireless Communication. The ESP8266 at this time is the server side.

The second STA mode: ESP8266 working in STA mode can be used as a receiver, it can receive the signal from the wireless router, and the weak signal from the device can be connected with the ESP8266 through the receiving signal. Connect the ESP8266 to the hardware device to remotely control the hardware device. The ESP8266 at this time is the client.

The third STA+AP mode: the first two modes coexist. In this mode, the ESP8266 can be connected to the Internet through a router, or other devices can be connected as a WiFi hotspot. The two modes can be combined to realize a wide area network. Free conversion with local area network. Therefore, in order for the mouse to switch freely, select this mode.

3.5 WX Wireless Adapter Board Module

When designing a circuit, in order to pursue hardware compatibility, the standardization of the circuit interface is generally selected. However, although the WiFi module, Bluetooth module, ZIGBEE module, and infrared module interface are all serial ports, the line sequence is different, and the adapter board module is generally selected. If the wire sequence is unified, in this design, the WiFi serial port module, infrared serial port module and ZIGBEE module are all converted into the same wire sequence as the wireless serial port module, so that a circuit board can inherit WIFI without changing the hardware interface , Bluetooth, infrared or ZIGBEE wireless function, without the need to re-customize the system circuit board.

3.6 Touch Button Circuit Design

Touch the button as a switch, which can be related to the force of connecting and disconnecting the metal internal shrapnel. The initial state of the touch button is turned off, and the touch button will be turned on when the touch button is pressed by hand. Information input through the touch of a button is one of the keys to human-computer interaction. The output pin of the STM32 single-chip microcomputer is high by default. The circuit design button is connected to the high level, and the pin of the STM32 connected to the button is controlled by the program to output a low level. When the button is pressed, the low-level signal is received, and the single-chip The key signal change realizes the manual input of system information. The principle of the touch button is shown in Figure 4.

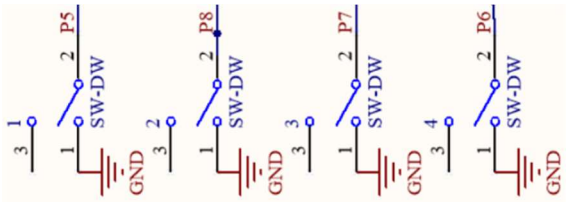

Figure 4. Touch the button

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4. Multifunctional Mouse Implementation

4.1 C Language Development

Due to the high complexity of the entire wireless smart mouse program, based on the fact that the team members are all good at C language programming, in order to facilitate the development, we use the C language program to write.

Compared with the development of assembly language, C language development has the following advantages: no need to understand the memory structure and a large number of processor instruction sets; no need to consider details such as data types and memory addresses in the process of programming; use in programming The keywords and operating functions of, can be more familiar with human thinking; the development and debugging time of C language programs can be effectively shortened; STM32 developed in C language provides reference routines, and its library function files are also easy to understand; C language programs are written Modularized writing, high portability.

All in all, C language has great advantages in structure, function, portability, readability, and maintainability. Compared with assembly language, C language reduces the difficulty of development and is easy to learn, easy to use, and easy to master. . Using C language programming as shown in Figure 5.

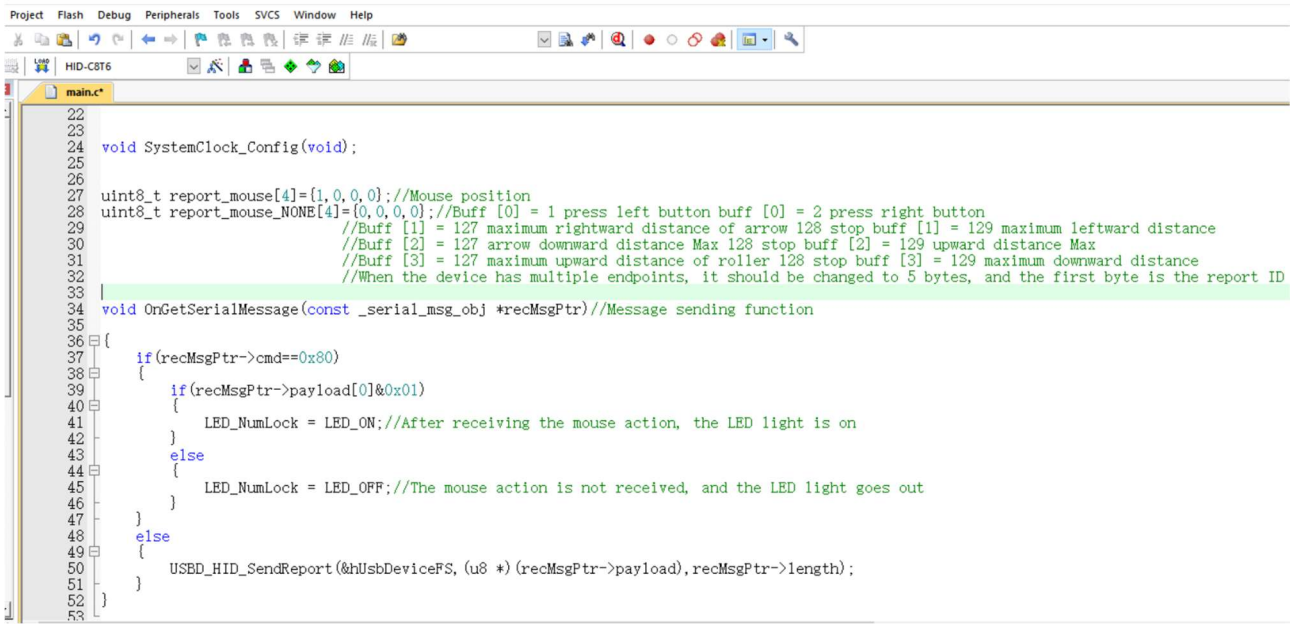

Figure 5. Mouse development environment program code

4.2 Keil Program Development Environment and Compilation Implementation

The software used in the compilation and debugging environment of the MCU program code in this work is Keil5. The Keil5 software is usually suitable for the development of 51, 12, 15 series of MCUs and the development of STM series of MCU systems. Among them, Keil has the following characteristics: Keil software supports multiple operating systems at the same time, and can write and burn single-chip microcomputers of various chip models. Its library contains many low-level functions, which are directly called when used, which is convenient and fast. The writing and burning of the program code of the single-chip microcomputer in this work uses keil5, which is a free and open integrated environment for 51 single-chip microcomputers and embedded development [6], which can be compiled and simulated online and has a visualized operation interface [7]. Unlike Keil MDK4 and previous versions, Keil MDK5 is divided into two parts: MDK Core and Software Packs. MDK Core mainly includes uVision5 IDE integrated development environment and ARM Compiler5. Software Packs can separately manage (download, update, remove) device support packages and middleware update packages without replacing the MDK Core. Create a new STM32 engineering

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project, and create three new folders CORE, OBJ and STM32F10x_FWLib under the project. CORE is used to store core files and startup files, OBJ is used to store compilation process files and hex files, and the STM32F10x_FWLib folder stores library function source code files. The Listings and Objects folders are automatically generated folders for storing intermediate files generated during the compilation process. Install the corresponding device library, select the STM32 model, add the designed components, write the main function file main.c, add the startup code, add the function code, and finally compile and burn. The realization of the multifunctional mouse is shown in Figure 6.

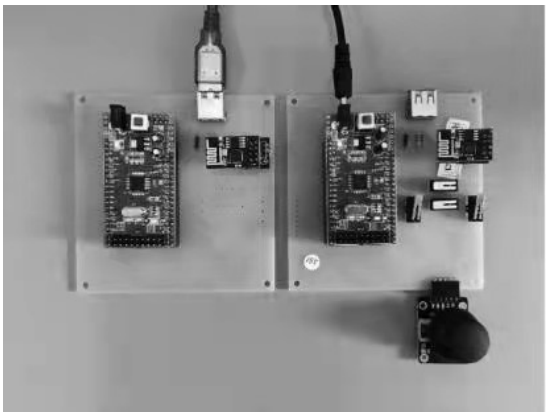

Figure 6. Simulation experiment diagram

5. Conclusion

This article is based on the design and implementation of STM32 single-chip microcomputer "infinite" smart mouse, from the hardware composition, circuit design to software programming, the whole composition is explained in detail. This design has almost realized all the functions of a wired mouse. In the design of this subject, the team members have a clear division of labor, cooperate with each other, and completed the mouse hardware and software research and design content within the corresponding time. In the design process, the realization of each module is still difficult. When confused, team members actively report and communicate with the mentor, learn from the mentor's guidance in all aspects, and improve the design ideas. At the same time, I would like to thank the instructor for his patient guidance and the revision of the thesis, which allowed the preliminary conception of this design, as well as the design realization and the editing of the thesis to be improved.

The main interfaces used in this design are the serial port communication of the single-chip microcomputer and the communication of the wireless transceiver module. The actual application of the product is relatively easy to understand, less difficult to get started, and easy to be held by the public. There is another outstanding feature in this design, that is, it is simple to implement and the hardware cost is low. There is no significant delay in the use of the mouse. Due to limited resources, there is no professional test of the operating code and the system in terms of processing speed and signal anti-interference to obtain data. In subsequent improvements and upgrades, the data frame format can be simplified and the data can be filtered to further improve the stability.

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