# System Design of Intelligent Track Wheelchair

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## Abstract

This graduation design finally realizes an intelligent tracking using a wheelchair, the renowned STC89C51 as a controller, through the STC89C51 minimum system circuit, LCD1602 display circuit design of driving circuit, active buzzer circuit and DC motor, the perfect completion of the automatic wheelchair along the provisions of the route and to form uniform to safety the protection effect, through many tests, this system both in hardware and software can run smoothly, especially the code of the program, through the professional software testing found that the high efficiency of its bottom. In hardware construction, the system can be thought to the price, power consumption and system size overhead is reduced to a minimum, so all the useless and not essential modules and components are cut, not to use variables and functions of shielding in the software, the software code can accomplish large amplitude compression greatly the increase of smooth running. The design verification results of intelligent tracking wheelchair control system carried out one by one test, the testing results show that the signal, reflects the intelligent tracking wheelchair systems must have high practical value and application potential.

## Keywords

Smart Intelligent wheelchair, infrared tracking, intelligent protection, line identification.

## 1. Introduction

The smart track wheelchair system with the control chip as the main control core will take the STC89C51 minimal system as the most critical part of the hardware circuit. Around the minimal system circuit, various sensors, human-computer interaction modules, LCD and other necessary circuits are arranged[1-6]. Through the construction of C program code, the smallest track wheelchair system will take the STC89C51 minimal system as the most critical part of the hardware circuit. Efficient program execution process is used to control the efficacy of intelligent track wheelchair system. Because there are many unavoidable problems in the use of the old intelligent tracked wheelchair control system for many years, developers are actively exploring effective measures and feasible ways to solve these problems. Among them, the intelligent tracked wheelchair system using microprocessors such as controllers as controllers is the most appropriate one. A good set of measures, because the main control chip is an executive device of the program, so it works in accordance with the ideas of R&D personnel, and the earlier intelligent tracked wheelchair system uses low-tech analog technology or mechanical structure as the main structure, so it is almost impossible to optimize the system regularly. The updateable program characteristics of the controller chip completely solve this major scheme defect[7-9].

Nowadays, the world's top research and design technical data of intelligent tracked wheelchair system are only learned in a very small number of countries or enterprises, so the price of production and research of intelligent tracked wheelchair system is still not down. At present, there are more and more researchers on the design of intelligent traceable wheelchair control system at home and abroad.

In addition, many people in Colleges and universities are participating in the research and development of intelligent traceable wheelchair system. Nowadays, some of the smart track wheelchair control system products with the highest performance use 32-bit core processor as the main control system and at the same time have ultra-fast operation speed. Because its core can simultaneously calculate 32-bit binary data in unit time, it compares with the vast majority of 16 bits in the market. Kernel products are much faster. The comprehensive performance of the intelligent tracked wheelchair control system is the fundamental factor to win the relevant products in the market at present, because nowadays some intelligent tracked wheelchair control systems with 16-bit processor as the main control have lower cost than 32-bit products, so it can win more users than 32-bit products, but with 32-bit products. The cost of research and development of bit microprocessors is being continuously reduced. In the near future, 32-bit intelligent tracked wheelchair system will be more competitive.

This paper regards the intelligent tracked wheelchair system as the research goal and uses STC89C51 as the main control core part of the system. Through the design of software and hardware system, an electronic system with all expected functional indicators is realized. This type of intelligent tracked wheelchair system configurated by this topic is now on the market. With a more or less improvement of product results, this paper reflects the optimization and increase of the current research status of intelligent traceable wheelchair system everywhere from the establishment of the subject to the selection of equipment, from hardware design to software design. Through this STC89C51, this paper completes this type of intelligent tracked wheelchair system, which will be configured in this project. It calculates signals with efficient software execution process, and realizes the communication between users and the system with a better human-computer interaction experience interface. The new intelligent traceable wheelchair control system based on microprocessor solutions such as main control processor is a complete innovation of the traditional intelligent traceable wheelchair system. It integrates the new technologies such as high-speed data acquisition, high-definition liquid crystal display and intelligent sensors into the intelligent traceable wheelchair system, which is a transmission. Intelligent track-based wheelchair control system can not be completed, even if there are many errors in the operation process, there is no need to worry about the quality of the system, so it is only necessary to optimize and improve the target code and re-write, these characteristics are incomparable with traditional intelligent track-based wheelchair control system. Because the main control chip contains multi-pins and the designer can manipulate each pin flexibly through the target code, the intelligent tracked wheelchair control system with the control chip as the main control can drive a large number of sensors and necessary modules, whether in effect or function, the operation efficiency The precision of the parameters and the richness of the targets in the fruit will be greatly increased.

## 2. Design Scheme

The efficient operation of the intelligent tracked wheelchair control system can not be separated from the implantation of high performance-cost computing core chips. For many intelligent systems, the quality of the core processor is the key to determine the success or failure of their products. The control core of the intelligent track wheelchair system is STC89C51 shown in Fig. 1. It combines clock circuit and reset circuit to form the minimum system circuit of STC89C51. The control of each circuit and sensor is completed through different input and output interfaces of microprocessor. In terms of program code storage, STC89C51 opens up a 4-k-byte programmable space to users, and the variable storage area is 256 bytes. The combination of the two determines the position of STC89C51 in small and medium-sized electronic systems. With its low price and high-performance computing effect, STC89C51 can defeat many competitors. STC89C51 uses DC5V voltage for power supply, which is compatible with most sensor modules or chip modules.

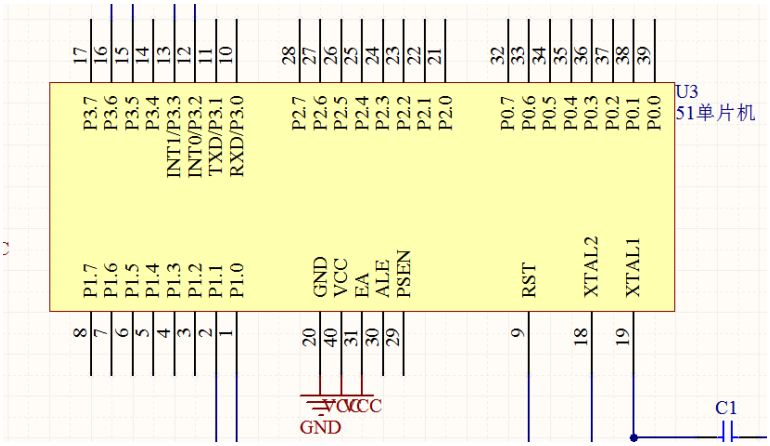


Fig. 1 STC89C51 MCU chip

The key part of the intelligent track wheelchair system is the construction of the minimal system circuit, which is the key to ensure the stability of the whole system, although it is very simple. Next, we will begin to configure the minimum system circuit of STC89C51, which has two sub-circuits: reset circuit and clock circuit. For the construction of reset circuit, three components (resistor, capacitor and key) are connected as shown in the schematic diagram of Fig. 2. Its main purpose is to output high-level signal to the RST pin of the processor chip when pressing the key, so that STC89C51 can reset immediately and realize the re-programming code.

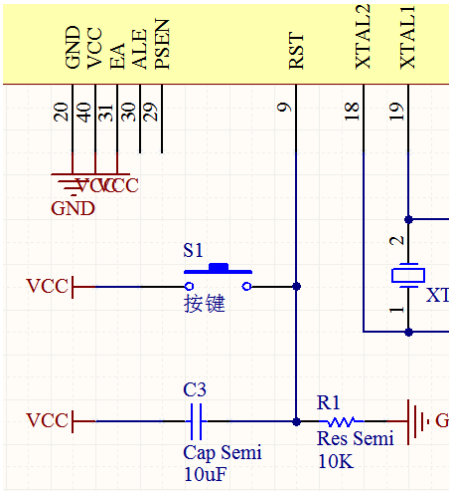


Fig. 2 Reset circuit

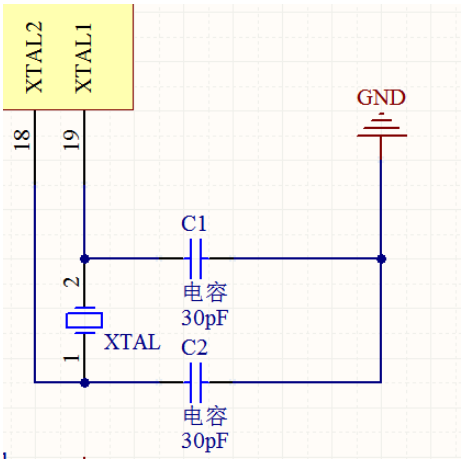


Fig. 3 clock circuit

As shown in Fig. 3, for the configuration of the clock circuit, three electronic components (two capacitors and a 12M crystal oscillator) are connected according to the circuit diagram structure shown in the following pictures. Its main function is to provide a frequency selective network for the oscillator synthesized in the controller so that the 12M clock signal can be continuously supplied to the control. The device works.

In order to achieve high-efficiency infrared emission and reception, so as to realize the obstacle detection in the course of the track wheelchair moving forward, the infrared tube-to-tube sensor shown in Fig. 4 is selected in this subject. It realizes the fast transmission and reception of 950 nm infrared ray. The intelligent track wheelchair system realizes the function of detecting obstacles, so this is achieved. These devices are especially suitable for the intelligent tracked wheelchair control system. Its power supply voltage is 5V DC. It can greatly reduce the power consumption parameters of the system by configuring the device in the intelligent tracked wheelchair system, which is especially conducive to improving the comprehensive index.

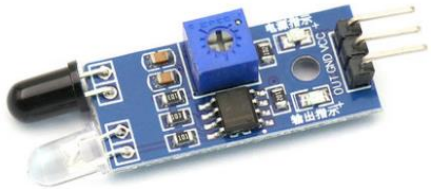

Fig. 4 Infrared coupler sensor module

As shown in Fig. 5, two identical infrared tube modules are installed on the left and right sides of the tracked wheelchair to detect the black guide under the wheelchair. The schematic diagram shown below is the design of obstacle detection circuit, in which the left infrared tube module is connected with the PC 3.3 pin of the single chip computer, and the right infrared tube is connected with the right one. Connected with the P3.2 pin of MCU, the two infrared tube sensors are powered by + 5V DC voltage.

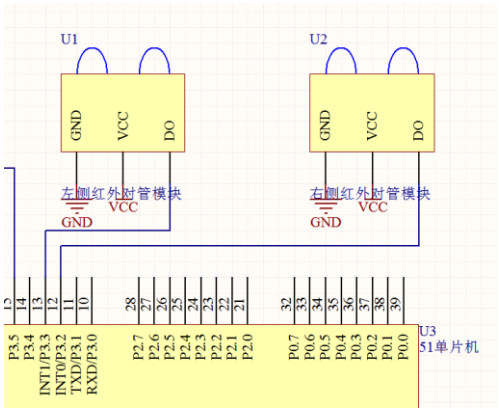


Fig. 5 Circuit Diagram of Infrared Counter-Tube Sensor

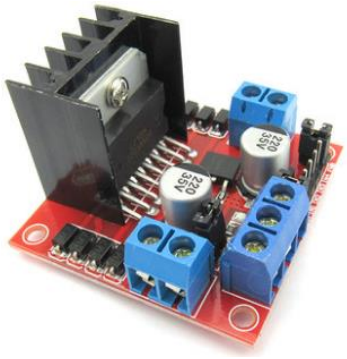

Fig.6 L298N DC motor drive module

In order to realize the powerful rotation of the driving motors of the left and right wheelchairs, as shown in Figure 6, the system will use L298N DC motor driving module to amplify the power of the PWM wave output by the single chip computer. This module can realize the power amplification of two PWM waves at the same time, which is just suitable for the left and right of the system. The power supply voltage of the wheel motor is 6-24V.

As shown in Fig. 7, this paper decides to use JGB38 DC motor to provide power conversion for the tracked wheelchair system. Its main feature is that it can convert electrical energy into mechanical energy. The manufacturer of this device is Qiaotian, a famous motor company, which can easily find DC motor in many industrial control fields. Use. It shows excellent performance such as 12 number of devices, and its shortcomings are mainly excessive weight. In terms of cost, the price of the device in the market is close to 2.5 RMB yuan or so. In addition, the network has all kinds of design information of the device. The normal working power supply voltage of the device is 5V DC power supply. Then the device is designed with wide voltage input characteristics, which can work normally in the range of + 3 to 12V, and in the stabilization work. Its current state is about 3 amperes (maximum load), which shows that its power consumption reaches about 15 watts (maximum load). In the packaging of electronic components, the device chooses a circular module to encapsulate the appearance, and its internal structure is more clear. It covers the circuit modules such as magnet, rotor, iron core, stator and wire package. The device is designed into the tracked wheelchair control system, which can be flexibly controlled by a single chip computer.

Fig. 7 DC motor

Fig. 8 is the schematic diagram of JGB38 DC motor. Because of the high integration of this type of JGB38 DC motor, the parts of rotor, stator, wire package, magnet and iron core have already been integrated inside before leaving the factory. The performance of voltage stabilization module will be realized by stabilizing the input level VCC so as to stabilize the coil and so on. Important part provides stable power supply. Through the module diagram in the picture, we can see that the module leads out positive and negative pins. When configuring the circuit, it is not necessary to connect the pins of its internal chip. It is only necessary to construct the data communication circuit between STC89C51 MCU and STC89C51 MCU controller. By imitating the reference given by DataSheet module, the following module circuits are configured. In this traceable wheelchair control system, The small DC motor module is connected according to the following relations. The speed control circuit of the DC motor needs to be realized by the output of PWM wave by the single chip computer. However, there is no module circuit for the output of PWM wave in the single chip computer. By consulting the data, the left and right two DC motors are connected with L298N DC motor driver chip, and the left wheel is one of them. The motor is driven by OUT1 and OUT2 pins of L298N chip. The PWM wave output from P3.5 pin of single chip computer enters L298N chip and will be amplified and sent to the left wheel motor for use from OUT1 pin. The right-wheel motor is driven by OUT3 and OUT4 pins of L298N chip. The PWM wave output from the P3.6 pin of single chip computer enters the L298N chip and will be amplified and sent to the right-wheel motor for use from the OUT3 pin.

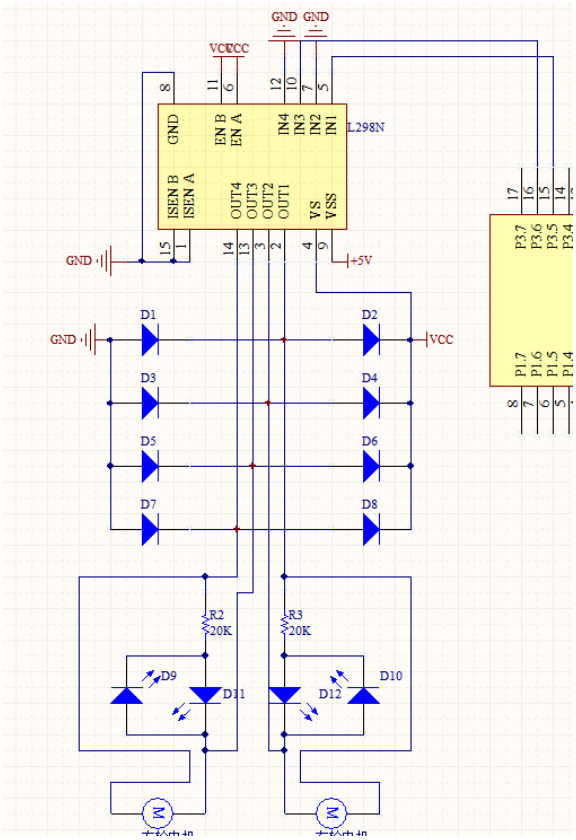


Fig.8 Design of Driving Circuit for Two-wheel Motor

After the detailed design of the hardware of the intelligent tracked wheelchair control system, this part will begin to design software program driver code for the hardware of these systems. After the initialization is completed, the system will enter the formal working stage. After the wheelchair is started, the system will start to pair with the left and right infrared tube modules. In this process, the single chip computer will continuously read the output level of the infrared tube sensor on both sides. When the infrared tube on the left side outputs high level and the low level on the right side outputs, it means that the left infrared tube on the left side detects that the wheelchair is on the right side of the black guide line as a whole, in order to achieve follow-up. For the effect of the guide line, it is necessary to adjust the forward direction of the wheelchair to the left slightly. The duty cycle of PWM wave of the DC motor driving the left wheel will be reduced by the single chip computer, thus the speed of the left motor will be reduced and the wheelchair will turn left. When the output level of the left and right infrared tube module is all low, the black guide line is on the left of the wheelchair. Between the right wheelchairs, the wheelchair is in good condition, and there is no need to adjust the motor speed; when the left infrared tube output low level and the right side output high level, it means that the right infrared tube detected that the wheelchair is on the left side of the black guide line as a whole. In order to achieve the effect of following the guide line, it is necessary to move the wheelchair forward slightly. Left adjustment, MCU will reduce the duty cycle of PWM wave driving the right wheel DC motor, thereby reducing the speed of the right motor and realizing the right turn of the wheelchair. Through this process, MCU will always control the wheelchair to achieve a touch-free forward.

In order to verify the results of hardware circuit and software code design, this part will begin to test each functional link by making physical objects. For this purpose, the following drawings are made. Through the physical appearance drawings in the drawings, it can be found that the system uses a car template as the framework and matches with a single chip. The main control board of the computer forms the overall appearance of the system. When the power supply is applied to the object, the system starts to work. The Fig.9 shows that it is moving along the black guide line. The system can

detect the direction of the black guide through the infrared tube sensor, and adjust the direction of the car according to the direction of the guide line.

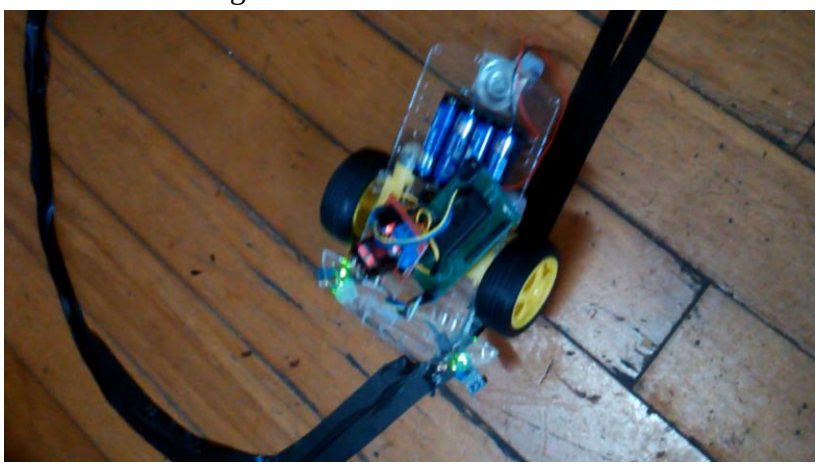

Fig.9 Design of Driving Circuit for Two-wheel Motor

## 3. Conclusion

After introducing the parameters of components, the construction of hardware circuit, the design of software system and the installation and debugging process, the intelligent track wheelchair system of this type has been completed, which has complete functions. After testing and comparing the measurement results with the reference results, it can be found that the performance of the system is complete and has all the characteristics of a complete system. At the same time, through environmental experiments and other tests, it is found that the intelligent tracked wheelchair control system can maintain stable work in a wide range of temperature and humidity. This is particularly important for widening the use of this design. Of course, it is also related to the selection criteria of components. The electronic components used in the system have very high stability.

## Acknowledgements

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