Design and Production of Bluetooth Remote Control Smart Car

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Abstract: This article uses Arduino microcontroller as the development and application platform, and builds an intelligent car with ATmega2560 chip as the control core, and can use Bluetooth technology to control the movement direction. The car has been tested to achieve real-time and accurate display of time, speed, mileage, steerable, automatic tracking and obstacle avoidance functions. The system is easy to implement, low in cost, flexible in applicability, and good in application and development.

1. Introduction

At the beginning of the 21st century, with the continuous update of electronic technology and the rapid development of artificial intelligence, the technology and functions of smart cars are constantly being optimized, which can replace humans to complete more complex, difficult and dangerous tasks. Smart cars have been widely used in our field of life, so their research work is of great significance[1].

Bluetooth is a wireless transmission technology that supports short-range communication between devices. It can exchange wireless information between many devices. Using Bluetooth technology can effectively simplify the communication between mobile communication terminal devices, and it can also successfully simplify the device and the Internet. Communication between them, thus making data transmission more rapid and efficient, supporting point-to-point and point-to-multiple communication, working in the global 2.4GHz ISM frequency band, its data frequency transmission is 1 megabyte, using time division duplex transmission scheme Duplex transmission[2]. Its most significant advantage is the standard and low power consumption, low cost, convenient use and high security of data transmission, which has become the current wireless communication technology enthusiastic for the Internet of Things.

This article mainly designs a remote control smart car based on Bluetooth communication. The car can realize the real-time and accurate display of time, speed, mileage, steerable, automatic tracking and obstacle avoidance functions.

2. Design of system project

The remote control intelligent car is mainly composed of a single-chip microcomputer system, peripheral circuits, and multiple high-speed data processing. These modules collect external information in real time and feedback external conditions to the single-chip microcomputer, and analyze the control of the remote sensing smart car by the sensors of the environmental perception system. The ultrasonic wave is used to survey the obstacles on the road. The tracing module tracks the trajectory designed on the road surface, processes the feedback signal through a single chip computer, and finally inputs various data to control and display the car. Through the data fusion analysis of multiple sensors, the movement status of the car is finally obtained. The transmission principle of the photoelectric gate is used to measure the number of turns of the wheel to achieve the measurement of the vehicle speed. In order to realize the above functions, it is necessary to use a mobile phone to send instructions to the microprocessor through Bluetooth mode, and send the signals to the corresponding modules for operation. In addition, the system requires a power module

to provide energy. According to the basic processing flow of the remote intelligent car, a reasonable overall system scheme is designed, as shown in Figure 1.

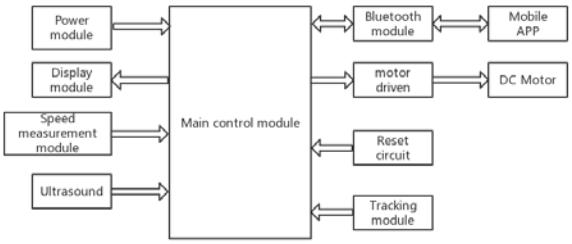

Figure 1. Overall design of the system.

3. Hardware circuit design

According to the previous overall design plan, select the appropriate hardware device and design the hardware circuit part. This system mainly adopts ATmega2560 single-chip microcomputer, Bluetooth serial port module with backplane JDY-30, HC-SR04 ultrasonic sensor, TCRT5000 infrared reflection sensor, coding disc and cooperating photoelectric gate pair tube, L298N motor driving chip, OLED color screen display, Universal wheel, lithium battery pack and other devices. The following is a detailed introduction to several key unit circuit designs.

3.1 Minimum System of Single Chip Microcomputer

The single-chip microcomputer ATmega2560 is an ultra-large-scale integrated circuit with many I / O interfaces, and it is an enhanced Arduino controller. The minimum system is relatively simple and suitable for beginners. It uses ATmega2560 as the core processor to form a small and complete microcomputer system on a chip. It has a central processor, a flash program memory, a random access memory SRAM space of 8Kb, and an erasable memory EEPROM space of 4Kb. There are also functional circuits such as interrupt systems, timers / counters, and AD converters [3]. Its biggest feature is that it has up to 54 digital inputs / outputs, while the analog input has 16 other functions. The chip in ATmega2560 is connected to the oscillation circuit and reset circuit to form the minimum system, as shown in Fig.2 below. This circuit can select USB for downloading programs or download external USB special conversion module through DuPont line. The USB is responsible for serial communication with the computer.

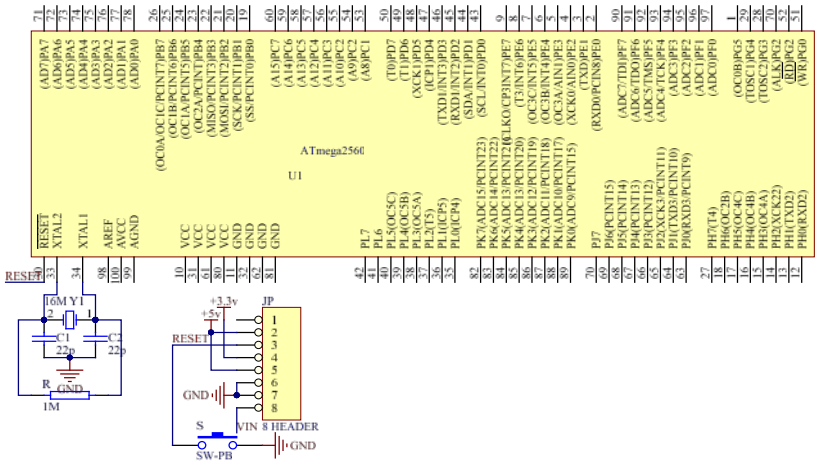

Figure 2. Minimum system of single chip design.

3.2 Bluetooth Module Design

In this paper, the Bluetooth module JDY-30 is used to complete simple communication with the mobile phone, collect information, and control the direction of the car through the keys on the

mobile phone's touch screen. This module is based on the Bluetooth 3.0 protocol standard, and has the characteristics of stable performance, fast data transmission rate of more than 8K per second, and strong signal. To communicate through the serial port and the Bluetooth chip, two signal lines, Tx and Rx, are mainly used. The AT command can only be performed when the module is not connected. When the command is issued, it must be carriage return and line feed. Once the Bluetooth module is connected to the device, the Bluetooth module enters the data transparent transmission mode. Fig.3 is a circuit diagram of the JDY-30 Bluetooth module circuit.

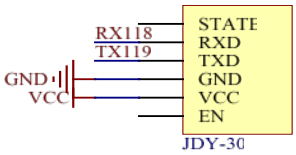

Figure 3. (Left) JDY-30 Bluetooth module circuit connection diagram.

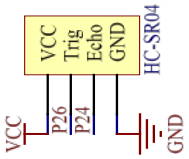

Figure 4. (Right) Obstacle avoidance module circuit connection diagram.

3.3 Obstacle Avoidance Module Design

In this design, we used the HC-SR04 ultrasonic sensor to detect obstacles on the road. The main purpose is to use the echo principle of the ultrasonic wave to reflect the signal pulses sent to the medium to collect information. When the ultrasonic transmitter emits in any direction, it will immediately return to the probe when an obstacle is detected on the way. After confirming the exact position of the obstacle, it will send the information to the left and right wheels of the car to coordinate it to avoid the obstacle. . The ultrasonic sensor is installed on the front of the trolley, which can better monitor a wide range of angles. Fig.4 is a circuit connection diagram of the obstacle avoidance module.

3.4 Tracking Module Design

This time the tracking function of the smart car is designed to rotate according to a pre-designed route, so two TCRT5000 infrared reflection sensors are adopted to complete the tracking function of the smart car. Among them, U1 is a right tracking infrared sensor, and U2 is a left tracking infrared sensor. The infrared emitting diode of the sensor emits infrared rays to the ground in real time to identify objects of different colors, so as to determine whether the cart deviates. Once the car deviates, the two wheels will produce a differential speed, which will cause the car to rectify the work, so that the car will be brought back onto the track and continue to drive on the predetermined route. Fig.5 is a circuit diagram of the tracking module. The output A0 is a low reference potential and is generally not connected to external data.

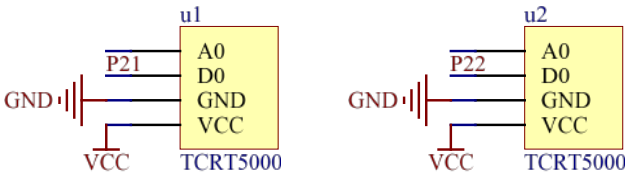

Figure 5. Tracking module circuit diagram.

3.5 Speed Measurement Module Design

Speed measurement has high precision and flexible speed sensor. This system uses a coding disc that can be moved on the side of the output shaft of the motor and a pair of photoelectric gate-to-pipe devices to achieve the speed measurement of the wheels. Fig.6 is a circuit diagram of the speed measurement module. The speed of the trolley needs to be adjusted accordingly according to the operating conditions and road conditions. The smart car speed measurement module uses slot-type optoelectronics, which can trigger the output of 5V TTL level through the slot in non-transparent objects [4]. So as to provide a single-chip computer for processing, calculate the real-time speed of the car. When the encoder disc rotates with the wheel, the adjacent edge is detected as a low level,

and the gap is detected as a high level on the side of the car through the encoder disc groove. The encoder disc is rotated synchronously with the small wheel, and the photoelectric through-type infrared sensor. You can measure a continuous pulse signal generated by light through the gap in the encoder disk. In this way, the speed of the trolley can be measured.

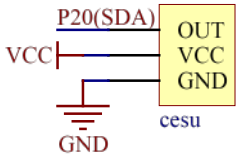

Figure 6. Speed measurement circuit diagram.

4. System software design

The selection of each module and the combination of design and practice are coordinated and integrated. Integration requires not only the rational design of the entire system, but also whether the modules can work normally. Software design is an important link for detecting that the program enters the system to run reasonably. First, the data is initialized, and the movement of the trolley is controlled by the mobile phone Bluetooth. At the same time, the signal sent by the sensor passes the detection and returns the data to the single-chip microcomputer. The motor is controlled to rotate according to the mode selection result. Then, system functions are implemented.

5. Summary

The system connects to the mobile phone Bluetooth to see if the running status of the car is running as expected, and whether the MCU receives data normally. The main parts of the debugging are motor drive module, ultrasonic module, Bluetooth module, encoder module, and tracking module.

After debugging and testing, the system finally realized the Bluetooth remote control, automatically obstructing obstacles and tracking, and can display the established functions such as time, speed and mileage on the OLED color screen display. The Bluetooth remote control smart car has good stability, good anti-interference ability, good dynamic stability, and has certain practical value.

Acknowledgment

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