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Design of Intelligent Remote Control Car Based on MCU

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***Abstract*—With the development of economy and society, intelligence has become more and more popular, and intelligent remote control car plays an increasingly important role in all walks of life. In order to promote the application of intelligent car and improve the automation level of unmanned transportation, this paper designs an intelligent remote control car based on STC89C52 micro-controller, which is composed of remote control module and car module. There are two selection modes in the remote control module: body mode (the purpose of controlling the movement of the car is achieved by tilting the remote control from front to back, left to right by the user) and remote sensing module (the purpose of controlling the movement of the car is achieved by the user by operating the two axis key rocker sensor on the remote control), which enables the car to make left turns, right turns, forward turns, backward turns, accelerates and decelerates according to the user's requirements. Based on the technology of wireless communication and radio remote control, this paper focuses on the practical application design of wireless communication in life. Its design idea can be applied in transportation,production and other fields, and has a high market application value.**

Keywords- Remote control based on Body feeling; Six-axis gyroscope; Bluetooth communication; LCD 12864B; Ultrasonic distance measurement

I. INTRODUCTION

With the rapid development and progress of artificial intelligence (AI) professional technology, automatic intelligent control management professional technology, and advanced computer professional technology, AI cloud operation control will have a broader space for development and progress[1,2]. At the same time, with the rapid development and progress of science and technology, the secondary industry of electronic processing and manufacturing is also developing rapidly. Artificial intelligence is widely used in a variety of industries. Artificial intelligence cars are not only used in the secondary industry, but also used in the artificial intelligence cloud home[3].

The analysis, research, development and operation of China's wireless remote control car began in the late 1970s[4]. Supported by the core points of the "863", "Ninth Five Year Plan" and other high professional technology development and progress plans, it has achieved significant scale development and progress. Since the 1980s, the whole country has already started to carry out the analysis and research on the remote control car in a large range. Through more than 20 years of development and progress, the country has made great progress in its application research. The wireless remote control car has a broad application and development prospect in the military, anti nuclear and other poor environmental conditions, making it a very critical research focus.The wireless remote control car in foreign countries started earlier than China[5,6].

In the early 1970s, the United States, Britain and other countries took the lead to start large-scale related research. At that time, the lunar lander and other projects were one of the outstanding products.Wireless remote control car, due to its small effective volume, low operating costs, strong survival and development level, has attracted much attention. As a new invention in the contemporary era, the artificial intelligence car can be used for scientific exploration, rescue and relief, road cleaning, etc[7-9].

The intelligent remote control car integrates a variety of high-tech, such as microcomputer principle, integrated circuit, remote control and intelligent control, which makes the intelligent car have the ability of self-regulation and decision-making, and is a combination of high-tech. Smart cars are particularly suitable for working in environments that humans cannot adapt to, such as alpine plateau, hypoxia underwater, fire scene, etc. They can complete tasks perfectly and efficiently without giving the same protection as the car people. It also plays an indelible role in military affairs, playing a prominent role in earthquake relief, anti-terrorism, terrain exploration, etc., reducing unnecessary human resource needs[10]. Of course, due to the outstanding advantages of smart cars, they are also widely used in material transportation, traffic facilitation, efficient production and other aspects in production and life, making smart cars low power consumption, high efficiency, and high reliability, becoming another research hotspot. In this paper, an intelligent body sense remote control car based on single-chip microcomputer is designed. Through the rocker sensor and six axis gyroscope loaded on the remote control, users can change the position state of the remote control after controlling the rocker or cutting in the body sense mode on the remote control, that is, moving back and forth, left and right, and swinging. The car movement can be adjusted accordingly to achieve remote operation of the car and improve the user's operating experience. The design idea of this paper can be extended to the rescue and security

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operations of military communications and strategic robots, and has high market research and promotion value[11,12].

II. Overall Scheme Design of The System

Intelligent motion sensing remote control car is mainly composed of two parts, respectively remote control part and car part. The system block diagram of the remote control part is shown in Fig.1, and the system block diagram of the car part is shown in Fig.2. The remote control part is composed of STC89C52 control core, MPU6050 six-axis gyroscope, Bluetooth module, LCD1602, two-axis keystroke rocker, voltage regulator module and power module. The car module is composed of STC89C52 main control chip, Bluetooth module, TB6612FNG motor driver, LCD12864, ultrasonic module, steering gear module, buzzer module, voltage regulator module and power module.

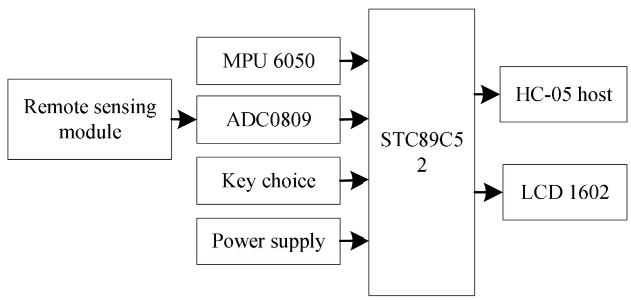

Figure 1. System block diagram of the remote control part.

The MPU6050 six-axis gyroscope sensor is mainly used for real-time monitoring and collecting data from the balance state of the remote control. After the data is transmitted to the single chip microcomputer in the remote control part, the single chip microcomputer can make relevant adjustments to the car through Bluetooth module instruction.

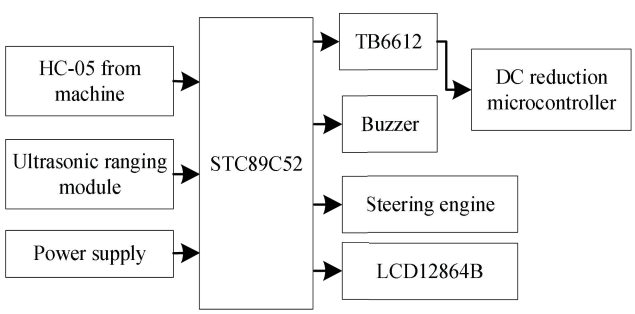

Figure 2. System block diagram of trolley part.

After selecting the mode on the mode selection interface of the remote control, you can switch from somatosensory mode to remote sensing mode, and the dual-axis keystroke-stick sensor sends analog signals to the ADC0809 ANALOG-to-digital conversion module to convert analog signals into digital signals, and the Bluetooth of the car receives the data from the remote control. The main control core of the car module is STC89C52 single chip microcomputer, which can be used to process the data information transmitted by MPU6050 six-axis gyroscope and ADC0809, so as to adjust the speed and direction of the motor accordingly, so that the car can make corresponding actions according to the requirements of users.

III. Design of Each Module of Intelligent Remote Control car

The power module in this paper uses two lm2596s voltage stabilizing modules. The power supply of the remote controller selects two 9V lithium batteries in parallel. After being connected to the voltage stabilizing module, the output 5V voltage is adjusted to supply power to the microcontroller and the peripheral equipment of the remote controller. The trolley module selects three 3.7V 18650 lithium batteries in series, and directly outputs all the voltages 11.98V (measured by the multimeter) to supply power to the VM driving the TB6612 and the voltage stabilizing module, and the voltage stabilizing output 5V to supply power to the STC89C52 minimum system and the trolley.

The system selects the MPU6050 six axis gyroscope sensor, and the SCL and SDA of this module control the MPU6050 wiring port through IIC protocol. TB6612 is a classic drive module that can drive two motors. In this paper, to achieve differential turning, two wheels on the left and two wheels on the right of the trolley form a group, which are controlled by TB6612 respectively.

HC05 is a master-slave Bluetooth serial port module. In the intelligent remote control car designed in this paper, the input voltage is 5V, the baud rate range is 4800 ～ 1382400, the communication baud rate selected by the two parts is 9600, the Bluetooth on the remote controller is the main mode for sending data, and the module on the car is the slave mode for receiving data. It adopts 8-bit data bit, 1-bit stop bit and no parity communication. When pairing the master and slave, press and hold the key after powering off, and then power on the Bluetooth module to enter the AT mode to set parameters and query information, and switch between the master and slave modes.

LCD12864 is a Chinese character library, which can display 8 characters × 4 lines 16 × 16 dot matrix display screen of Chinese characters. Serial communication is used in the car. PSB pin is a serial communication port, BLA is connected to 5V, BLK is grounded, and V0 is directly grounded to adjust the contrast pin to maximize the contrast. LCD1602 display module is generally used to display letters, numbers and symbols, and control data transmission through the P0-P7 port of the microcontroller.

IV. Software Design

A. *Circuits Remote control part*

The microcontroller of the remote control will first initialize the serial port, the six-axis gyroscope MPU6050, LCD and ADC0809. After the user selects motion mode and remote sensing mode by pressing the button in the remote control selection interface, the LCD1602 displays the selection interface. STC89C52 converts the data read by MPU6050 and ADC0809 into 8-bit data and sends it to Bluetooth. The Bluetooth of the host sends 8-bit data to the Bluetooth of the car's slave. The main program flow chart of the remote control is shown in Fig.3.

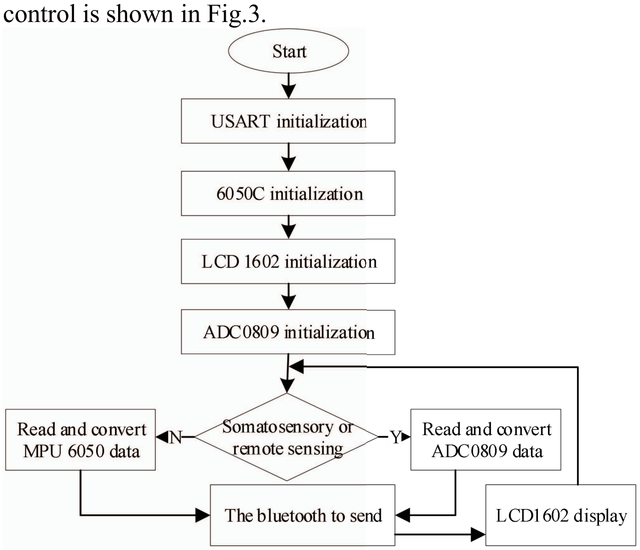

Figure 3. Flow chart of main program of remote control.

B. The Car Parts

After the serial port initialization, LCD12864B initialization and timer initialization of STC89C52 on the car, two subroutine programs are carried out at the same time. One is after receiving the data from the bluetooth of the host computer, and after decoding by the single chip computer, the 8-bit binary number received is successively converted into forward and backward signals, left and right wheel speed. Turn the steering gear from 0 to 180 degrees. Another subprogram for ultrasonic ranging, LCD12864B display obstruction and car distance. When the distance between the car and the obstacle is less than 20 cm, the buzzer will alarm. The program flow chart of small car owner is shown in Fig.4.

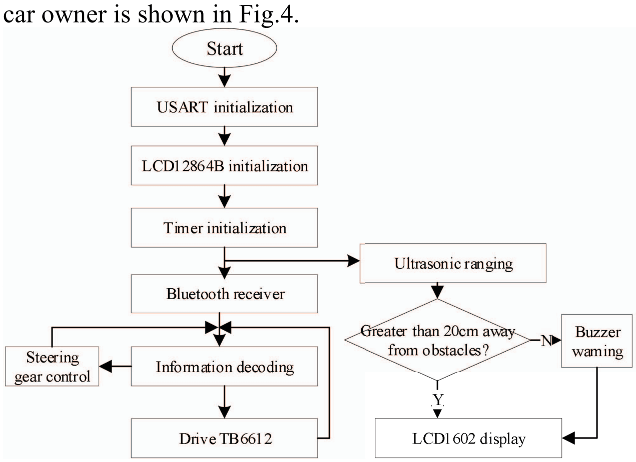

Figure 4. Flowchart of small car owner program.

V. System Testing

The physical picture of the remote control is shown in Fig.5 and the physical picture of the car is shown in Fig.6. The system test includes two parts. The ultrasonic ranging data is shown in Tab.1, and the speed test data is shown in Tab.2.

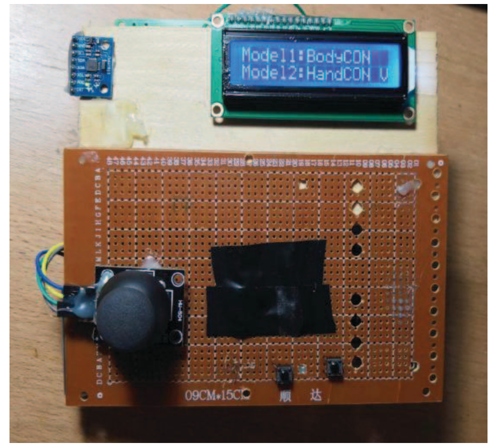

Figure 5. Physical picture of remote control.

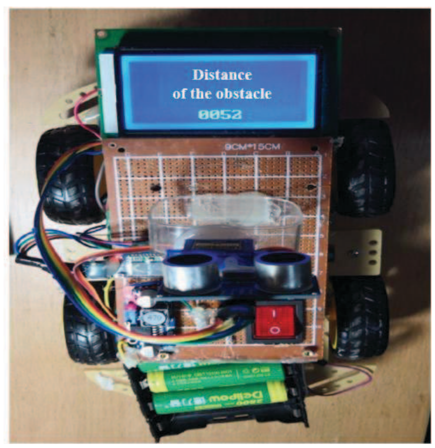

Figure 6. Physical picture of the trolley.

The system is built by combining sensor technology and Internet of things technology with existing mature technology, and the technical difficulty is not enough, so it has a good feasibility. The system integrates the collection, uploading, analysis and diagnosis of diagnosis and treatment data, and realizes real-time and effective online communication between doctors and patients.

VI. Data Testing and Analysis

After completing the creation and debugging of the software and hardware systems, and confirming that the web pages on the doctor's side and the patient's side can be used and transmit data properly, the ECG signal simulation outputter and the human body are tested separately to calculate the pulse signal output from the person being tested and the instrument, and restore the real-time fluctuation graph of the pulse beat. After confirming that the pulse output signal is not distorted, the pulse recovery section is calculated to see if the heart rate beat frequency recovered by the pump is the same as the measured frequency[10]. The test results are shown in Tab.1 below.

TABLE I. ULTRASONIC RANGING DATA

Number of times	1	2	3	4	5	6	7	8	9
Measured distance(cm)	2	10	16	25	50	70	120	150	250
Physical distance(cm)	2.0	10.2	16.3	25.4	50.3	70.3	120.6	150.5	250.6

TABLE II. DATA SPEED TEST DATA

Number of times	1	2	3	4	5	6	7	8	9
First gear speed m/s	0.21	0.19	0.21	0.21	0.20	0.21	0.17	0.20	0.21
Second gear speed m/s	0.32	0.32	0.31	0.32	0.32	0.32	0.32	0.32	0.32
Third gear speed m/s	0.52	0.56	0.56	0.56	0.55	0.55	0.55	0.55	0.55
Fourth gear speed m/s	0.71	0.74	0.73	0.70	0.73	0.73	0.73	0.74	0.75

From the data of ultrasonic ranging, the average error of ultrasonic ranging is 0.35cm. There are two reasons for the error. The first one is that the car is real-time ranging rather than in-situ ranging, and the car is not at the origin when the signal returns, which leads to the ranging error. Motor drive and other modules take away most of the current resulting in the ultrasonic ranging module required relatively little current, from leading to ranging instability. The expected values (m/s) of first, second, third and fourth speed are 0.22, 0.32, 0.55 and 0.73 respectively. From the speed test, the average error (m/s) of the real-time speed of the first, second, third and fourth speed is 0.02, 0.003, 0.005 and 0.02. The reasons for the error are two points. The first point is that the ground impedance will affect the speed, and the second is that manual measurement will produce errors when the timer is pressed. But overall the error is within acceptable limits.

VII. CONCLUSION

This design through the corresponding software and hardware design, basically realized, according to the user specified requirements with motion sensing and remote sensing two modes to control the car forward and backward left turn right turn acceleration and deceleration of the ultimate goal. And in the case of adding the right amount of interference, ultrasonic ranging is also very accurate. But because some of the algorithms still need some improvement and improvement, so the next will be on this basis to further in-depth research, the future of intelligent motion sensing remote control car will also receive more attention.

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