Design of tracking avoidance car

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Abstract

This paper an intelligent tracking avoidance car has designed, which using STC89C52 as main control chip, cooperate with the motor and reducer tracking sensor, obstacle avoidance sensor and so on, the aim of the system is to achieve the car intelligent detection signals to identify obstacles and adjust the car driving towards, accurately completing the car along the track in real time, avoid obstacles, and other functions, and then complete the reverse in the end. This system has function of driving time display. Experiments show that this design has simple structure, to a certain extent, embodies the intelligent operation of car, it has a good practicability.

Keywords

STC89C52;Tracking sensor;Obstacle avoidance sensors; Sound sensor; Along the tracks

1. Introduction

Intelligent vehicle is a concentration of environment awareness, planning decision, multiple levels, and other functions in an integrated system, auxiliary driving is an important part of intelligent transportation system. It is an important content in the field of robotics research, and main design is an organic whole for machinery, electronics, testing technology and intelligent control. It has a broad application prospect such as military, civilian, space and other development areas, and the intelligent technology is widely used in various fields. The design of intelligent car through photoelectric detector to sense the obstacles information around the car, and the real-time feedback and transportation information has realized by LCD display module, main control system according to the feedback information to determine and adjust the car driving direction and speed, after avoiding obstacles, the car will move forward along the straight line.

2. Overall design

This system can be divided into power supply, a signal detection, control part. Signal detection part including: tracking detection module, obstacle avoidance module. Control part includes: motor driver module. Each part of the module design as follows: (1) power supply module: use battery to provide enough voltage; (2) control module: the STC89C52 single-chip microcomputer; (3) tracking detection module: using photoelectric sensor; (4) test module: the obstacle avoidance sensors; (5) motor module: using DC gear motor;(6) motor drive module: using special chip L298N as the motor driver chip; (7) the base of the car used car[1]. System overall block diagram is shown in figure 1.

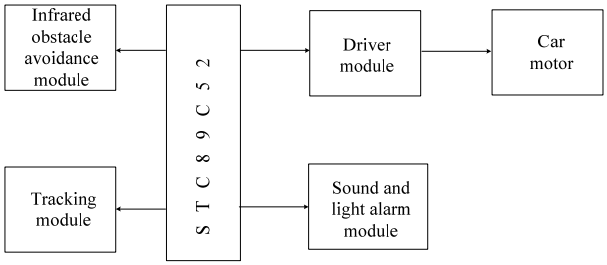

Fig.1 system composition block diagram

3. Hardware circuit design

System can be divided into the sensor detection and intelligent control. Sensing part includes infrared tracking module, obstacle avoidance module, intelligent control part includes the control device in the system according to the output of the sensor transform electrical signals to logic, to control the car's motor, completed the car straight, to detect signs of turning, to detect obstacles, avoid obstacles and other various tasks.

3.1 Control circuit design.

When the car electrical, system began to work, and timing module running. When the car driving, the photoelectric sensor is used to judge whether arrived to the turning sign. When arrived, whether turn is controlled by the car. When the small car driving to the obstacles, and then determine whether hit obstacles, to control the car to avoid obstacles. This system can completely realize the topic request and has stability functions based on 89c52 chip.This chip has cost-effective, so use it as the main control chip. Single chip microcomputer control circuit as shown in figure 2.

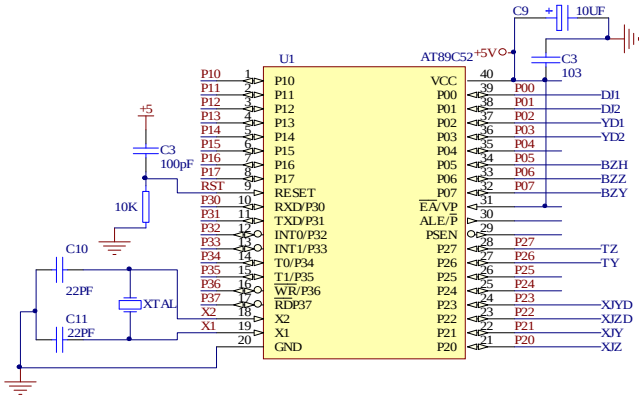

Fig.2 Control circuit based on MCU

3.2 Tracking detection circuit.

The car tracking is the use of infrared detection method, namely using infrared ray on the surface of the physical that different colors have different reflection properties characteristics.TheTCRT5000 photoelectric tube is used in this paper, when in the process of the car driving, it launch infrared light to the ground constantly. When the infrared diffuse emission occurs when white ground, reflected light comes on car receiving tube. If there are any black line, the infrared light is absorbed, the car can't get a signal. The received signal is convert to high and low electrical signal through the LM393 as a comparator, so as to realize the detection of signal [2]. Using photoelectric sensor to control the car when driving ensure it don't turn off the runway and turning control the car. Tracking detection circuit diagram is shown in figure 3.

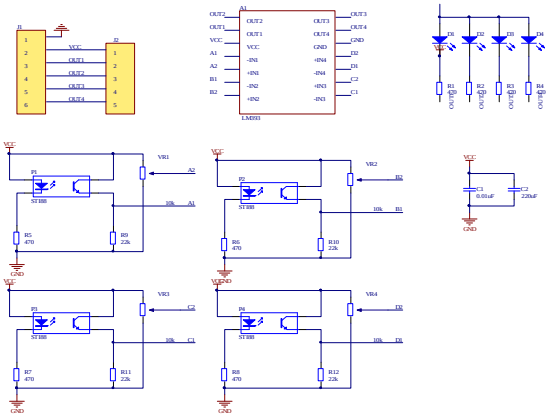

Fig.3 Tracking circuit diagram

3.3 Obstacle avoidance circuit

Obstacle avoidance as the core content of intelligent car movement control, is one of the most important modules of the whole system, the stand or fall of obstacle avoidance scheme, the merits of the system is directly related to the final performance. Smart car to obstacle avoidance function must be able to sense the presence of obstacles, in order to achieve better avoid obstacles function, design, JY043W reflex infrared electric sensor as the test components[3].If car encountered obstacles, infrared transmitting tube gives the same intensity, and the intensity of infrared receiving tube side receives is different, so the voltage of the output value is different also, through the LM393 comparator, comparing with the external input signal, the I/O ports detected high level 1 said signal (obstacles), 0 for no signal (no obstacles).When driving, if have any obstacle detection in front of the car, the microcontroller sends a signal to control the car accordingly turning, backward operation, and control of the car by restoring area around obstructions and security. The circuit diagram is shown in figure 4.

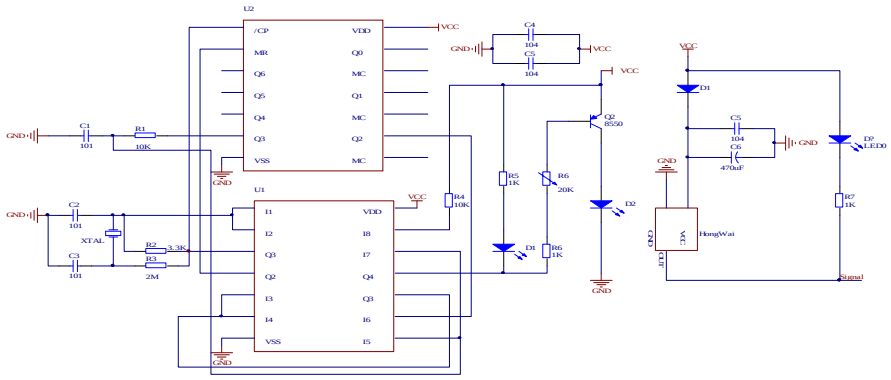

Fig.4 Obstacle avoidance circuit

3.4 Motor drive circuit

L298N can drive two motors, OUT1, 0 ut2 and OUT3, OUT4 between two motor respectively, 5, 7, 10, 12 foot is used to control input level, the forward and inversion of control motor, ENA and ENB is used to control the motor start and end. Microcontroller STC89C52 output PWM wave in both groups, each group of PWM wave is used to control a speed of a motor, the other two I/O port can control forward and inversion of the motor. P10, P11 control the direction of the first motor, PWM1 control input of the first motor speed: P12, P13 control the direction of the motor, the second input PWM2 second motor speed control. Control method and control circuit is simple. Motor drive circuit principle diagram as shown in figure 5.

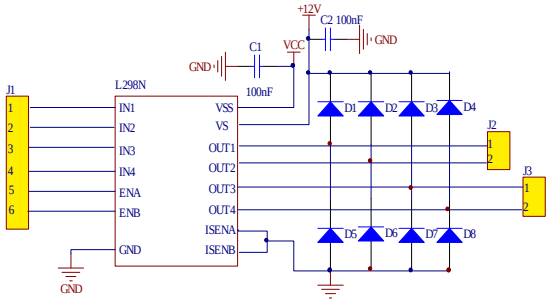

Fig.5 Motor driver circuit diagram

4. System software design

4.1 Design of control process

System software is including the main program , motor driver subroutine, avoid barrier of program, voice prompt, interrupt subroutine timing sub-processes, display subroutine, etc[4]. Programs is completed under Keil platform, using C language to write and debug, with the modular programming ideas when is designed. Main function is to be responsible for sensor signal acquisition and control, the motor forward and backward, turn left turn and right speed regulation, and realize the flexible

robot obstacle avoidance based on the system requirements, the smart car overall flow chart and the obstacle avoidance process as shown in figure 6 and figure 7.

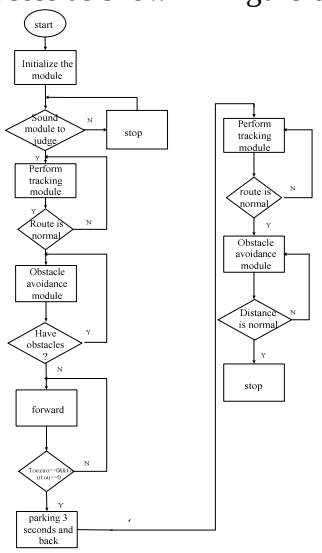

Fig.6 Overall flow chart

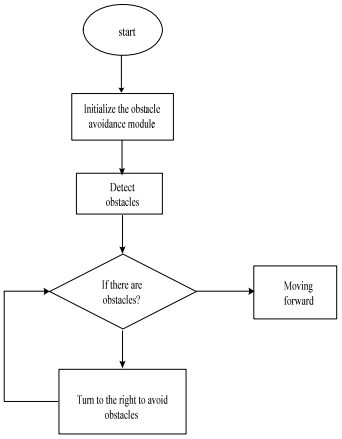

Fig.7 Obstacle avoidance process

4.2 Intelligent algorithm design

In order to make the car have the function of intelligent avoid obstacles and tracking, intelligent algorithm mainly includes tracking algorithm, the algorithm of obstacle avoidance, speed algorithm, etc[5]. Tracking control algorithm process as shown in Fig.8.

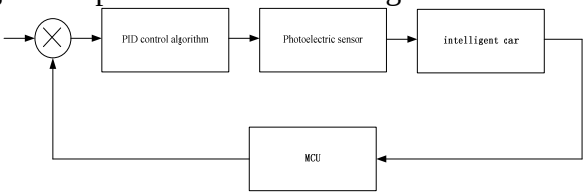

Fig.8 Tracking control algorithm

According to the layout of the sensors, sensor position using digital markers, if detected black line, ' 0 ' is used, but, there is no detected, that white line is detected with the number '1'. In the process of actual driving, because, the orbit has a lot of acute angle, pure angle, the turn angle for the car needed is high. To prevent large swing angle in the process of turning, lead to the car rushed out of the orbit and can't return, let the car back and perform to turn. Practice shows that this algorithm can realize the car turn sensitive. Considering the speed of the car and the distance for detect obstacle, in order to avoid the car turning into obstacles, making the car after it detects obstacles, then turn left, again to detect obstacles, continue to adjust, until around obstructions in design.

5. Summary

The design in hardware, fully using the infrared sensors and photoelectric tracking sensor of obstacle avoidance, make the car can accurately according to the designed route to forward so as to achieve the predetermined destination. L298N is used to drive DC motor can solve the problem of the speed of the car. As can be seen from the test results, the smart car to realize the rapid response to guide state, and can making accurately error analysis. It has high performance, meet the design requirements.

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