Design of the Robot car Based on Motion Controller

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Abstract: This paper presents a design of autonomous tracing and obstacle avoidance robot car, three wheeled carriage structure can make the car flexible steering, and easy to complete the tracing and obstacle avoidance action, it uses the motion controller as the core to build the motion control system, and uses infrared sensors as path and obstacle detection device, the use of digital tube can display the car driving mileage. Using the motion controller as the core of the system has the advantages of fast response speed and high control precision, and it has a certain practical significance for the development of robot autonomous tracing and obstacle avoidance car.

Keywords Robot car; Control system; Motion controller
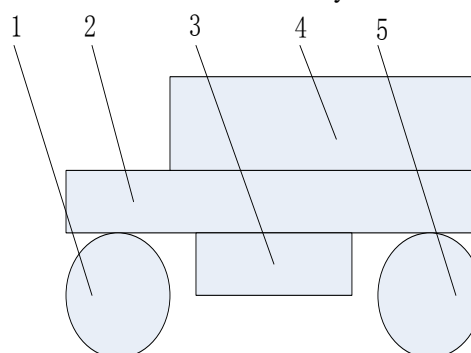
INTRODUCTION

With the development of science and technology, the robot plays an important role in all walks of life, the application of a robot can be seen in the life and production[1]. Robot technology is a comprehensive technology, it involves mechanical, electronic, information, computer, network, artificial intelligence and many other areas [2]. The robot can replace human to finish the task in the bad environment, improve labor efficiency, reduce the hidden trouble of security[3]. The promotion of robot application makes the research of robot become a hot topic. Among them, the intelligent tracing robot is one of the robot widely studied, tracing robot mainly moves in the given area along the trajectory, and completes the setting target points for each access [4]. Intelligent tracing robot is applied to the sensor technology, information processing technology, motor driver technology, it is a comprehensive platform. A tracing robot is designed using an intelligent motion controller as the core in this paper, and using the sensor to detect the moving line, automatically according to the setting track to move forward. It can also display the travel distance.

ROBOT CAR HARDWARE DESIGN

The design of mechanical parts of the robot car

Robot car is required to automatically walk in accordance with the specified route, human can not intervene. In order to make the car can flexible steer, this design of the car using three wheels scheme. As shown in Figure 1, the car's front wheel is a guide wheel, the rear wheels are driving wheel. Front guide wheel using a universal wheel, rear wheel driving wheel uses two motors to respectively drive. The sensor for tracing use is under the body, other hardware is installed on the car body.

1.Front wheel 2.Body 3.Sensors
4.Other hardware 5.Rear wheel
Figure 1.The diagram of winder

The design of control system of the robot car

When robot car autonomous traces, human cannot intervene, so the robot car must have the ability to recognize route independently, the forward direction is determined according to trolley route instructions. Fig. 2 is the design of control system of robot. Motion controller is the core of the whole control system. The infrared sensor is a detection device, in the process of movement, the detection feedback information to the motion controller by infrared sensor, the motion controller control servo motor according to setting procedures. The motion controller sends instructions to a servo driver, servo driver sends out the corresponding pulse to the servo motor, servo motor will complete the corresponding action. The car turns by the difference speed of two rear wheels. And mileage display device is on the robot car, system detects pulse number of two motor encoder, then convert it into driving mileage.
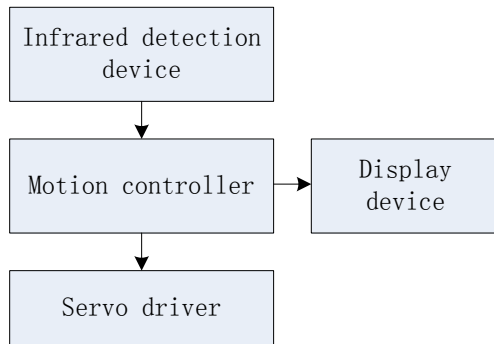
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Figure2. The design of control system

SOFTWARE DESIGN

Software overall design

Motion controller is the core of the robot car control system. Figure 3 is the overall design scheme of the software, because the motion controller does not have the program development environment, so program needs to be written using PC, motion controller and PC communicate directly using the RJ45 interface, the completed program after the preparation can be directly transmitted to the motion controller from PC, the controller has running environmental, written procedures can be run independently from PC. The movement program are all stored in the motion controller, PC is responsible for programming and debugging. Program design uses the modular design, as shown in Figure 4, it includes detection module, display module and I/O module.
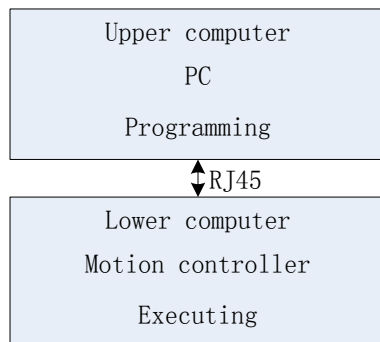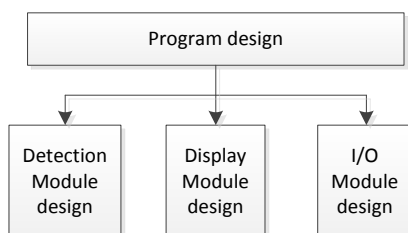

Figure3. The overall design of control system

Figure4. The modular design of program

Detection module

The detection module is mainly used to detect the position and the obstacle, complete car tracing and obstacle avoidance, corresponding hardware of detection module is infrared sensor, when infrared sensor detects the ground track variation of signal, system makes judgments, then sends out turn command, rear wheel control the car to turn. Infrared sensors detect the obstacles ahead, the system judges and issues a obstacle avoidance command , car rear wheel drive to complete the obstacle avoidance.

Display module

In the robot car moving, digital tube can display the mileage of car movement. The display module is divided into two parts, respectively, they are detecting and display part. Detecting part detects pulse number of the servo driver, and then convert into the driving mileage, the calculation formula is as follows:

$$L=（a\div A）\times\pi\times d \qquad （1）$$

Of which: L is the mileage, a is detection of pulse number, A is pulse number for wheel rotates a circle, D is the diameter of the wheels.

The display part uses digital tube, and shows the mileage out on digital tube.

I/O module

The detected signal is sent through the I/O interface from controller to the system, the relevant instructions are sent through the I/O interface of controller, the design of I/O module of the system is shown in table 1.

Table1.System I/O design

Input		Output	
IN0	Detection signal 1	OUT0	Indicated light 1
IN1	Detection signal 2	OUT1	Indicated light 2
IN2	Detection signal 3	OUT2	Indicated light 3
IN3	Detection signal 4	OUT3	Indicated light 4
IN4	Obstacle avoidance signal 1		
IN5	Obstacle avoidance signal 2		
IN6	Obstacle avoidance signal 3		
IN7	Obstacle avoidance signal 4		

CONCLUSION

In this paper, by the motion controller as the core , a kind of auto tracking and obstacle avoidance of robot car is designed, the car uses infrared sensors to detect information of the track and obstacles, then information feedback to the system, the system will give the corresponding response according to the

procedures. The use of digital tube can display mileage. The robot car integrates sensor technology , electrical and electronic technology and many other advanced motion control technology together , it can realize the automatic movement, and does not require human intervention, it has a certain significance to the development of independent tracing robot car.

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