

## Design of Patrol Vehicle and Its Image Acquisition Device

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### Abstract

The traditional security work is carried out manually, which are boring, waste of labor, low efficiency. In order to save human resources, this paper designed a patrol car and its image acquisition device. In this design, the camera can be shaken from side to side to increase the camera's camera breadth, which increase the accuracy of patrol vehicle body movement and the ability to judge obstacles. The stepping motor is used to drive the body of the car, which has the characteristics of light weight and low price. This device can be applied to the fixed track patrol in public places such as schools and hospitals.

### Keywords

Patrol car, CCD, Trail route, Car driven.

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## 1. Introduction

The patrol car is a vehicle designed and developed for security, peacekeeping. According to the way of power source, the type can be divided into electric and fuel type. The electric cars are more popular in the market. The car can take 2-8 direction of four-wheel disc electric vehicles. warning lights, horn, propaganda devices and professional electric are installed. The car is not only a popular with the public security department, but also become the such as the administrative law enforcement departments, schools, hospitals and other places of choice for routine patrol security models. The security patrol car not only makes up for the shortcomings of the development of the traditional security industry, but also brings a new development model and ideas[1, 2].

With the continuous development of science and technology, patrol car is more and more inclined to the direction of intelligence and unmanned development. Now the cars can be equipped with a CCD image capture device at the bottom of the front, thus the signal acquisition and recognition are carried out for the identified circuit on the road surface [3]. After processing the output of the corresponding driving signal drive motor, route tracking can be realized. But the existing taking device for CCD image is stationary in the course of practical use. In order to avoid the sudden situation, it is necessary to adjust the position of the camera. the camera can have a wider field of vision [4, 5]. Because the existing CCD image taking device installed in the bottom of car, the regular cleaning is needed [6].

Based on the above background. This paper presents a CCD image acquisition device for patrol security vehicle, and discusses its structure and control process.

## 2. Structure of CDD Image Ingestion Device

The structure of CCD image acquisition device for patrol security car mainly includes the body of patrol car, camera, glass shield, solenoid valve, fan, screw, motor and other devices. The overall structure diagram is shown in Fig. 1, and the side view installation diagram of camera is shown in Fig.2. Fig. 3 shows the overlooking installation structure diagram of the slider. In the diagram:

1- Patrol car body, 2- Injection port, 3- Water tank, 4- Air pump, 5- Support beam, 6- Jet nozzle, 7- Camera, 8- Glass shield, 9- Water jet, 10- Telescopic rod, 11- Heating network, 12- Fan, 13- Fixed rod, 14- Solenoid valve, 15- Motor, 16- Slider, 17- Screw, 18- Chute.

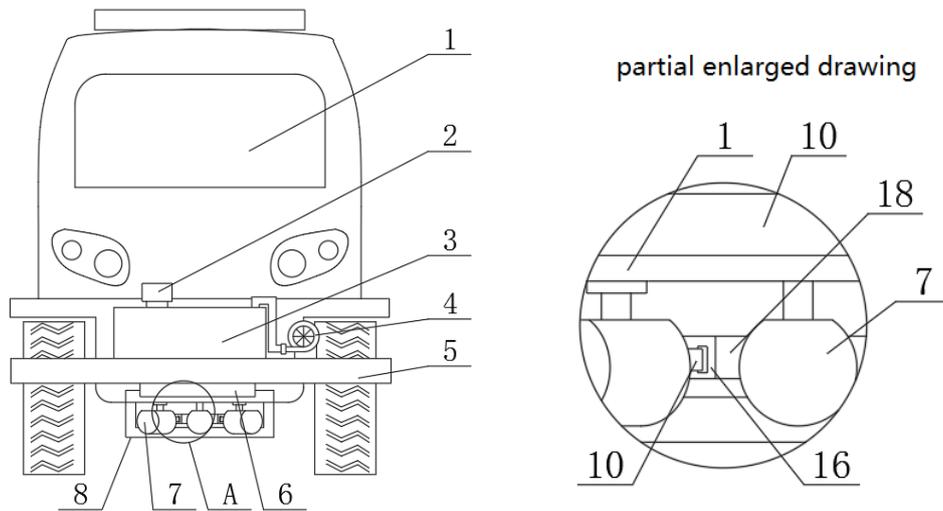


Fig. 1 Schematic diagram of the overall structure of the device

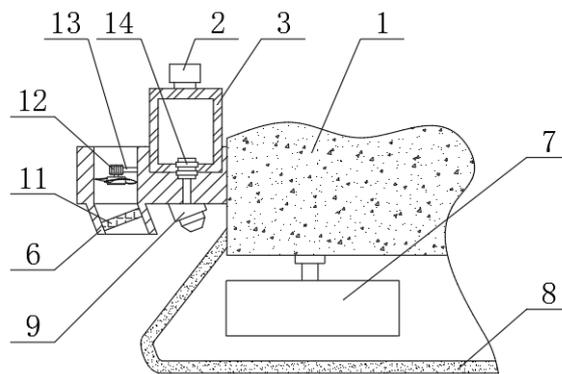


Figure 2 Side view installation structure diagram of camera

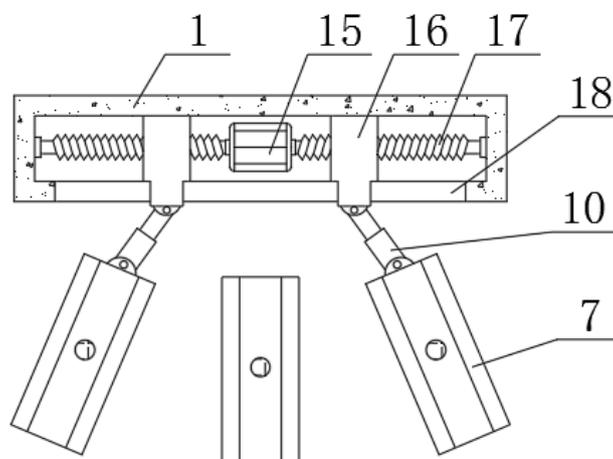


Figure 3 Schematic diagram of installation structure overlooking the slider

The bottom of the patrol car body is fixed with a glass shield. In order to ensure the protection of the camera, a glass shield is set on the outside of the camera. A motor is fixed connected inside the bottom

end of the patrol car, and a screw is fixed connected to the spindle end of both sides of the motor. In this design, the camera can be shaken from side to side to increase the camera's camera breadth, which increase the accuracy of patrol vehicle body movement and the ability to judge obstacles. When the motor is in positive rotation, the motor drives the screw to rotate. Because the threads on both sides of the motor are in opposite directions, this setting causes the slider on both sides of the motor to move in opposite directions. The screw will drive the slider on the outside of the motor to move. The slider will drive one end of the camera to move through the telescopic rod, and the other end of the camera will move in the opposite direction. When the motor is reversed, the camera rotates in the opposite direction. This setting can increase the range of the camera by turning the camera left and right. It also increase the accuracy of the patrol vehicle when it moves and the ability to judge obstacles, which has good practicability. The top of the supporting beam is fixed connected with the water tank and the air pump, and the bottom of the water tank is connected with the solenoid valve. The bottom end of the supporting beam is fixed connected with the water jet, and the top end of the water jet is connected with the bottom end of the solenoid valve. The glass shield can be cleaned regularly. When cleaning, the solenoid valve will be opened, and the pressurized water inside the tank will be sprayed to the end face of the glass shield through the spray head, so as to realize the erosion of soil stains. At the end of the scour, the wind machine rotates to blow the end face of the glass shield. The heating network will heat the passing air, and the air with higher temperature will blow to the end face of the glass shield, so as to realize the rapid evaporation of water, ensure the end face of the glass shield is clean, ensure the image quality of the camera, and ensure the normal operation of the car, which has good practicability.

The camera is arranged on the inner side of the glass guard, the supporting beam is arranged on the upper side of the camera, and the top of the camera in the middle position is fixed to the bottom end of the patrol car body. The top of the camera on both sides is rotated with the bottom end of the patrol car body through the rotating shaft, and the other end of the screw is rotated to the inner side of the bottom end of the patrol car body. The outer spiral of the screw is connected with a slider. The bottom end of the patrol car body is provided with a chute, and the outer side of the slider is slid with the inner side of the chute. The front end of the slider is connected with a telescopic rod by hinge rotation. The front end of the telescopic rod is connected with the back end of the camera located on one side by hinge rotation. The top of the tank is connected with a water injection port. The top of the tank is connected to the output end of the inflatable pump through the pipe. Clean water on the inside of the tank can be added through the water injection port. The inflatable pump can supplement the pressure in the water tank and ensure that there is a certain scour effect when the clean water is ejected, which has good practicability. The inner side of the supporting beam is fixed with a fixed rod, and one end of the fixed rod is fixed with a fan. The fan is arranged on the inside of the front end of the supporting beam. The front and lower side of the supporting beam is connected with a jet nozzle, which is arranged on the front side of the jet head. The inner side of the jet nozzle is fixed with a heating net, which is arranged on the lower side of the fan.

### **3. Control Flow**

#### **3.1 Automatic Tracking Function of the Car**

It is controlled by the external controller and the wireless signal module built in the patrol car body when used, and is powered by the battery built in the patrol car body. The camera can capture the image of the road, so as to collect and identify the signal of the identification line on the road. After processing by the processor, the corresponding driving signal is output to drive the motor, so as to realize the car tracking according to the predetermined route.

#### **3.2 Realization of Speed and Steering Control of the Car**

The car body requires light weight, so the driving source is stepping motor. We can select the driver used with the stepper motor, and use the subdivision function of the driver to achieve a small step angle, so as to improve the control accuracy of the stepper motor.

The front wheel of the car is a driving wheel, which is driven and controlled by a stepping motor. The rear wheel is a universal wheel, which can follow the movement of the front wheel. The single chip microcomputer control system can control the speed of the left and right front wheels of the car by controlling the speed of the stepping motor, and then realize the functions of the left turn, right turn, acceleration and brake of the car. The following motion control schemes are adopted in the running process of the car: controlling the speed of the right front wheel is greater than that of the left front wheel to realize the left turning of the car; the speed of the left front wheel is greater than that of the right front wheel to realize the right turning of the car; the acceleration and braking functions are realized by controlling the speed of the driving wheel.

#### 4. Conclusion

This design uses CCD image capture device, including patrol car body and camera. Through the slider, motor, screw and telescopic rod and other components, the camera can be shaken to the left and right, so as to increase the camera's scope, increase the accuracy of the patrol car body when moving and the ability to judge obstacles.

In addition, the design uses the stepper motor control, through the chassis frame, universal wheel, support plate, stepper motor, driver, protective cover and drive wheel, this setting does not need a series of connectors such as differential, and directly realizes the functions of turning, accelerating and braking through the rotation speed of the stepper motor on both sides which is a very simple process.

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