# Design of Intelligent Logistics AGV Car Terminal System

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**Abstract:** AGV is the abbreviation of Automated Guided Vehicle. It refers to the equipment of electromagnetic or optical automatic guidance device, which can follow the prescribed driving path and has the function of safety protection. This design mainly explains the development history, types, structure design and technical parameters of the AGV guided car, and puts forward the research content of the AGV guided car design; then explains the overall design of the AGV guided car, and describes the selection of sensors and specifications in detail; in the mechanical design part of the AGV guided car, the wheel axle is described. This is also the main part of this design. Then starting from the structure of the car, Pro/E is used to build the three-dimensional model of the car. The selection of servo drive motor, gear design and selection, as well as the choice of driving mode and wheel are described in detail. Finally, the layout of the sensor is explained.

## 1. Introduction

AGV (Automatic Guided Vehicle), Automatic guided AGV car. The automatic guided car can not only be used for material transportation, but also has the function of loading goods. It can also be moved to another place automatically to unload the loaded goods by itself. Autopilot cars usually use batteries as their power providers, but now some manufacturers use non-contact energy transmission systems as the power source of AGV cars. The motion characteristics of AGV are the same as those of other vehicles. Compared with other vehicles which are not characterized by wheel motion (crawling or walking robots), AGV has outstanding advantages in speed, efficiency and structure, and its control and operation are relatively simple, and its safety is particularly reliable. AGV car also has a good advantage that if there are other transport equipment on its path, these equipment do not need to lay additional tracks or other devices, and the width of the car to the site, the use of roads and space are relatively low. Therefore, in some systems of automated logistics in enterprises, the performance of the auto-guided car is very good, and it shows the high level of automation of its unmanned operation. Some of the automated actions of the AGV are commands, and the path it travels in the course of its work is controlled by the computer. Some cars use electromagnetic track as their traveling path. In the current system of automated transportation logistics process, handling and unloading is a key node, because it uses the most times in the process of logistics transportation, and also accounts for a larger proportion of logistics costs. It is precisely because the automation of the automatic guided car is relatively high, it can not only recharge, but also its appearance is exquisite and concise, so it can be enterprises. The profile image of the industry has been elevated to another level. In summary, the AGV is a tool that can be used in various occasions. Its development momentum is very good, so the development speed of AGV is very fast.

## 2. History and Trend of AGV Development at Home and Abroad

The types of automatic guided cars are trackless and trackless.

The mechanical guided track on the ground or in a certain space is called the automatic guided trolley. The structure of the trackless automatic guided car is relatively reliable, its carrying capacity is relatively large, and its cost is not high. Especially the trackless technology is relatively mature and reliable, and its positioning accuracy is high. It is often used in the two-way logistics system of straight line or loop line. The car that automatically works along the pre-set path of the computer is

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called the trackless automatic guided car.

Auto-guided cars originated in the United States, then developed in Europe, then in Japan, and finally came to China. In 1913, for the first time, the company used the Ford guided car in the United States to track, which was the early development of the AGV automatic guided vehicle. After Ford Motor Company in the United States, AGV car has been rapidly improved in the United Kingdom. The electromagnetic guided automatic guided car was first developed in the United Kingdom. The original AGV car needs to lay tracks, and the use of electromagnetic guidance makes AGV car get rid of these shortcomings, so the use of AGV becomes more simple. In the early 1960s, with the promotion of the European economy, the AGV was better popularized and applied. In the 1980s, Japan carried out further research on this aspect. Thus, the AGV with magnetic navigation technology was introduced, which greatly improved the stability of the AGV, and the AGV was also widely used in the automobile lead. Domain, and with the in-depth exchanges between Chinese and Japanese enterprises, many domestic enterprises also feel that the automatic guided car can not only save manpower for enterprises, but also save unnecessary costs, and improve the efficiency of work has a very good effect, so in recent years, the automatic guided car has also been developed rapidly in China. From all technical aspects of the AGV, the most critical and important technology of AGV is AGV. Magnetic induction guidance has been widely used. Now some enterprises mainly use laser guidance, and visual guidance has also attracted great attention. Now inertial guidance, ultrasonic guidance and magnetic screw-gyro guidance have also attracted great interest and attention.

## 3. Structure of AGV

The principle of guiding AGV car is to program the path of the car in advance by the computer. When the car is running, when the voltage is detected by the position of the digital encoder and the pre-programmed track, the controller adjusts the speed of the motor according to the detected deviation signal, and then the deviation will be corrected, so that the AGV car can be set according to the pre-set. Fixed path motion. Therefore, in the course of driving, the digital encoder needs continuous detection to adjust the speed of the motor and avoid deviation in order to control the whole system well.

The steering function is guaranteed by differential speed. The universal wheel is two front wheels. Its function is not only steering, but also supporting and balancing. This is the form of four-wheel structure. The autopilot car mainly includes six parts: body, frame, wheel, load transfer device, driving device and power system. Following is the introduction of each part:

(1) Car body

The whole body is composed of chassis, frame, shell, control room and corresponding mechanical and electrical structure, which is the basic part of AGV. Structural features are similar to those of some electric vehicles, and can operate automatically without some requirements of driving a car. Steel members are commonly used for frame welding, but if the car's center of gravity is relatively low, then the car's anti-dumping ability is relatively high.

(2) Frame

The frame is the bracket of the whole automatic guided car. Wheels, light sensors, servo motors and speed reducers are installed on the frame. The basic requirement of frame design is that its strength and hardness should be relatively large, so the material of frame is usually cast aluminium alloy, which is considered to be of high quality and good performance in welding.

(3) Wheels

Solid rubber tyres are usually used as the wheels of an automatic guided car.

(4) Load transfer device

The load transfer device of the automatic guided car is a flat plate structure, which can transport the box-shaped things to the designated location, and also can transport materials, etc.

(5) Driving device

The driving device is the driving system of the auto-guided car, which can control the speed and braking of the car. Driving motor, reducer, motor, control and driver are all included in the driving

device. It is generally closed-loop and open-loop mode, with AC servo motor as the main closed-loop mode, and stepper motor as the main open-loop mode.

(6) Power system

Now the battery is the source of driving energy of the power system of the auto-guided car. The battery energy is converted into mechanical energy to drive the car and the ancillary equipment of the car according to the pre-set trajectory. According to the different types of vehicles, as well as the operation and load of different models, there will be different power battery assemblies, the general AC voltage is 12V, 24V, 48V and 72V.

## 4. Design of AGV Mechanical Structure

In the overall planning of mechanical design, the appearance of the automatic guided car is particularly important according to different application occasions. If the shape of the car is perfect and atmospheric, it will give busy people a good affinity and a certain sense of security in the workplace, alleviating people's nervous state of mind may help. Therefore, in the design of mechanical structure of trolley, attention should be paid to its appearance.

The whole frame of the AGV is the main support bracket for assembling parts, and it is also an important device in the running process of the car. It is mainly divided into two parts: the first part is the main frame structure, which is a vertical installation frame for various control and communication equipment, that is, the three-dimensional frame structure. The second part is the sub-frame structure, the driving motor and various sensors, and the wheels of the car are installed on the sub-frame. For the convenience of maintenance and disassembly, the connection between the main frame structure and the secondary frame structure is disassemblable. The main part of the frame car of the AGV has a great influence on the accuracy of the whole car.

(1) When traveling in a straight line

Linear path is generally a car in a relatively long straight line on the fast track, straight line walking can save time, when the detection of bends will end.

(2) Special Path

For the slow progress of special paths, such as in the course of a car's walking, because of the bending of the navigation white line, the front sensor loses the white line, and the car slows down. After the white line is detected by the middle sensor, it is determined according to the length of time that the car turns to which middle sensor to detect the white line, until the two front sensors return to the white line, and the current sensor is placed on the white line. Detection of white lines will end this process. Its characteristic is that when two pre-sensors are on-line and off-line at the same time, the car automatically rotates back to the straight line.

(3) When turning left

For turning left, when the car needs to turn left in the course of moving, the middle sensor on the left side of the car detects the white line, which will make the car turn left until the two front sensors return to the white line, and the white line detected by the front sensor will end the whole process.

(4) When turning right

For turning right, when the car needs to turn right in the course of moving, the middle sensor on the right side of the car detects the white line, which will make the car turn right until the two front sensors return to the white line. The white line detected by the front sensor will end the whole process.

(5) Parking time

Used for parking, and finally finished.

## 5. Conclusion

This paper makes a preliminary determination of each component of the AGV, and carries out theoretical calculation and verification. Pro/E has many problems in its three-dimensional modeling. There is no detailed description of the differential steering of the car. Because it is not familiar with

the car control unit and the implementation measures, this part has not been added, nor discussed, for the car. The whole performance analysis is still not in place. Finally, through the design of the AGV, the control unit and implementation measures of the car can be further studied. Finally, a convenient, safe and fast automatic car is designed, which can make the car more intelligent, meet the needs of AGV car in people's lives, and make it more widely used in all aspects.

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