Analysis of guiding Mode of AGV car

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Abstract

Automatic guided vehicle is an automatic material handling equipment. It has many advantages, such as high degree of automation, flexible application, safety and reliability, unmanned operation, simple construction and convenient maintenance. AGV is the key equipment of modern logistics system. It is of great significance to improve the degree of production automation and improve production efficiency. The guiding mode of AGV vehicle is the core technology of control, which not only determines the flexibility of the application system, At the same time, it also affects the reliability and configuration cost of the system. Understanding the advantages and disadvantages of different navigation technology is very important for the development and selection of AG. The guiding mode of V car is explained in detail and its advantages and disadvantages are analyzed. It is convenient for enterprises and laboratories to select and judge the guiding mode of AGV trolley.

Keywords

AGV car, guide mode,Electromagnetic navigation.

1. Introduction

After entering the new century, the development of enterprises has entered a new stage. The demand for industrial robots and automatic production lines is increasing. If enterprises cannot keep up with the development of the times, they cannot improve the working efficiency of the corresponding production workshops according to their needs. It will be difficult in the era of industry 4.0 and the Internet of things. So the development of intelligent automation equipment has become the only way to the development of large manufacturing enterprises. In particular, in the development of automatic production line, AGV car is an indispensable intermediate hub, AGV car is also called AGV car. As an automatic guide vehicle, it is a large transport robot that walks along a fixed track. It is a kind of wheeled robot. As shown in figure, it is one of the most widely used towed automatic guidance vehicles. The appearance of automatic guidance vehicle has brought great development to the transportation of manufacturing industry, and the operation efficiency of enterprises has been greatly improved.

2. Fixed path navigation

Fixed path navigation refers to a kind of navigation mode which can not be changed after the path has been pre-embedded. It mainly includes electromagnetic induction navigation, optical band induction navigation and magnetic induction navigation, etc. Due to the relatively low cost, the fixed path navigation is relatively stable in operation, and so on. It is one of the most widely used navigation methods at present.

2.1 Electromagnetic navigation

In general, a metal wire with a specific frequency is laid on the path of an automatic guided vehicle, and a corresponding electromagnetic inductor is installed on the vehicle. Generally, one is installed on each side of the automatic guide vehicle. In this way, when the automatic guide vehicle is travelling on a predetermined track, the induction coil of the electromagnetic inductor can sense the signal of the metal wire laid, and through the comparison of the two signals, the orientation of the car in the

predetermined track can be obtained. The signal is strong or weak. The vehicle can be adjusted by using the controller to adjust the speed of the two wheels. When the signal intensity is the same on both sides, it is indicated that the automatic guide vehicle is on the scheduled track In the process of safe driving, because of the continuous dynamic closed-loop control, the control accuracy is high and the stable tracking navigation can be realized. To ensure the safety, reliability and smoothness of AGV navigation control. There are two kinds of electromagnetic navigation modes: single frequency navigation and multi frequency navigation. Single frequency system provides single frequency oscillating electromagnetic signal on the whole line. By connecting or disconnecting the feed current of each section of the line to specify the running line and guide the vehicle to operate. This navigation mode requires a centralized control station, And the on-off interface of sensing signs such as magnets and branch segments is installed at the crossing and branches of the lines. The multi-frequency system is a circuit. Each loop or branch line in the vehicle sets its own line frequency, fed by a different frequency oscillator, and each vehicle sets its operating frequency as required. Only when the set frequency of the vehicle is the same as the frequency of a certain segment, The vehicle can be guided along the line.

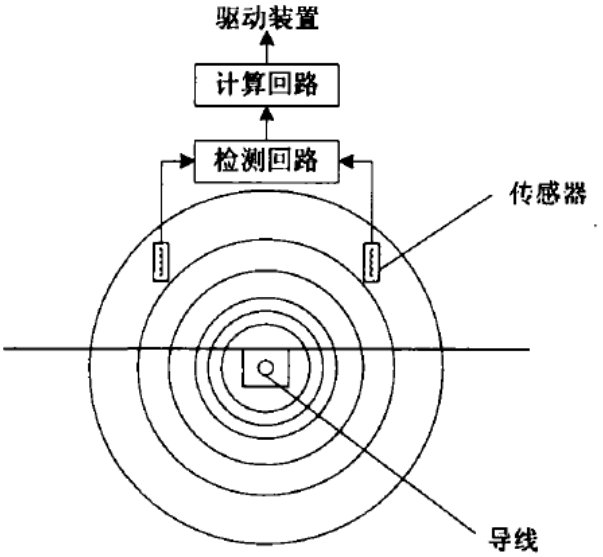

Figure 1-1 principle diagram of electromagnetic navigation

This method is the most mature and widely used navigation method at present. It has the advantages of high accuracy, metal wire laying under the ground, easy wear and tear, no influence on the site, no interference with other normal uses of the site, and better performance. For a long time to maintain magnetic signals, high reliability, simple principle, economic and practical, the disadvantage is that due to the laying of the surface, it is difficult to supplement or change the path, Cannot realize the more complex path navigation. Therefore, the electromagnetic navigation should not use in the path needs to change frequently. Moreover, if the electromagnetic path appears the breakdown also is not easy to maintain. Therefore chooses the electromagnetic navigation time to need to consider the automatic navigation vehicle concrete use Environment, for low-cost manufacturers with fixed routes, electromagnetic navigation is a very good choice.

2.2 Tape navigation

The tape guide was regarded as a model of automatic guided vehicle is representative of traditional application, guided method was originally used, because of its ease of use, change the path of flexible, by a large wide welcome home, currently on the market Chinese in Japan and Southeast Asia and other regions share fairly. Taking magnetic guide and electromagnetic induction guide mode similarly, the difference is that this way is laying surface magnetic stripe in running routes, by the magnetic guide sensor tracing surface magnetic induction magnetic signal. A miniature Holzer sensor magnetic guide on the sensor corresponding to a detection point, through the detection of multiple point detection results can be determined in real time the current AGV car The center axis deviates from

the relative position of the magnetic strip, and the AGV steering is controlled according to the deviation correction to make the AGV travel along the predetermined route. Generally, in the magnetic tape navigation, the magnetic strip is laid on the ground of the working area. The automatic guide vehicle detects the magnetic stripe signal through the magnetic navigation sensor, and controls the automatic guide vehicle to walk on the predetermined track by judging the number of the magnetic strip signal. In the navigation system, the landmark sensor and the magnetic navigation sensor cooperate each other skillfully. Detect magnetic stripe signals through landmarks to control the corresponding movement of the AGV car. For example, when an automatic navigation vehicle needs to turn, I lay a landmark sensor with a specific symbol. When the vehicle detects this particular symbol, the car takes a turn. There are also many work stations, such as stop, automatic charging, discharging, and bifurcation walking, and so on.

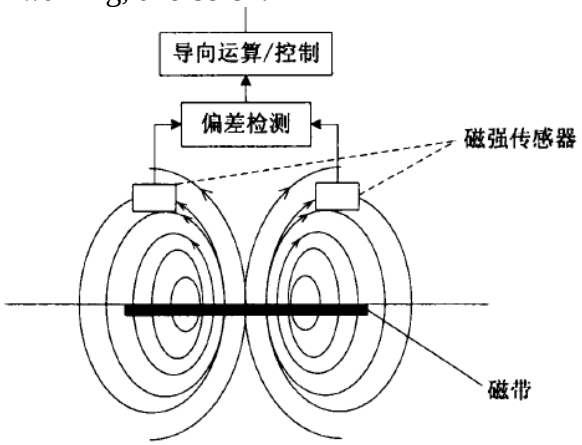

Fig. 1-2 magnetic tape guiding schematic diagram

The advantage of this navigation mode is that it can adjust the path flexibly, is not easily affected by light change, has low cost and long service life. The disadvantage is that the magnetic tape is guided, laid on the surface, easily destroyed, polluted and interfered by other external factors. It is possible to affect the normal driving of the automatic navigation vehicle, so in enterprises with high precision requirements, factories with high risk factors are abandoned. Their stability is greatly affected by environmental factors. Therefore, it is more suitable for indoor environment, and magnetic stripes are easily disturbed by other metal objects and require higher ground environment, so they are less and less favorable in the market competition in the future.

2.3 Optical navigation mode

Optical navigation is to replace the magnetic strip in the magnetic navigation with paint or ribbon, the magnetic navigation sensor is replaced by the optical sensor, and the working principle is to collect the information of the color path. Then the navigation is realized by computer to recognize and analyze the color signal of the image. There are two kinds of optical navigation system: identification and reflection. Figure 1 is the principle diagram of optical band reflection mode. Special lacquer tape with stable reflectivity. Guided vehicle equipped with infrared light source with transmitting and receiving functions, It is used to illuminate lacquer tape, at the same time, it is equipped with photoelectric sensor to receive reflected light. It is distributed evenly on the lacquer tape and on both sides, and detected by the sensor. The light signals are compared and calculated, and the moving direction of the car is adjusted to achieve the purpose of guiding operation.

This method has the advantages of low cost, convenient and flexible, easy to change. The drawback is that the control and communication lines need to be laid separately, it is very sensitive to mechanical damage, and it is greatly affected by the ground conditions, and the color of the ribbon should be kept bright. Otherwise, the weak signal detected by optical sensor will lead to poor reliability and low accuracy of navigation, so it is necessary to deepen the color of lacquer tape.

3. Ranging and positioning navigation

Location navigation refers to the method of determining the position by measuring the distance of a road sign or a specific marker. It mainly includes laser ranging navigation and ultrasonic ranging navigation, etc. After setting the route of ranging and positioning navigation, it can be changed according to the demand. The line setting is flexible and changeable, so it is a relatively high-end navigation mode.

3.1 Laser Navigation

Laser navigation does not require an advanced navigation method to deal with the ground in advance, but requires the installation of a device to emit and receive lasers on the AGV trolley and through a highly reflective reflector mounted around the operating area. As a positioning sign, a laser scanner is installed on the AGV car, which scans the surrounding environment in real time. When the scanner scans three or more reflectors in different positions, the car can feedback the corresponding coordinate values according to the reflector. The normal line of each reflector and the angle of the longitudinal axis are calculated directly from the controller to calculate the current position of the AGV car in the global coordinate system. Marking, driving direction and driving angle to achieve the accurate positioning of the vehicle and guide the vehicle along the planned path.

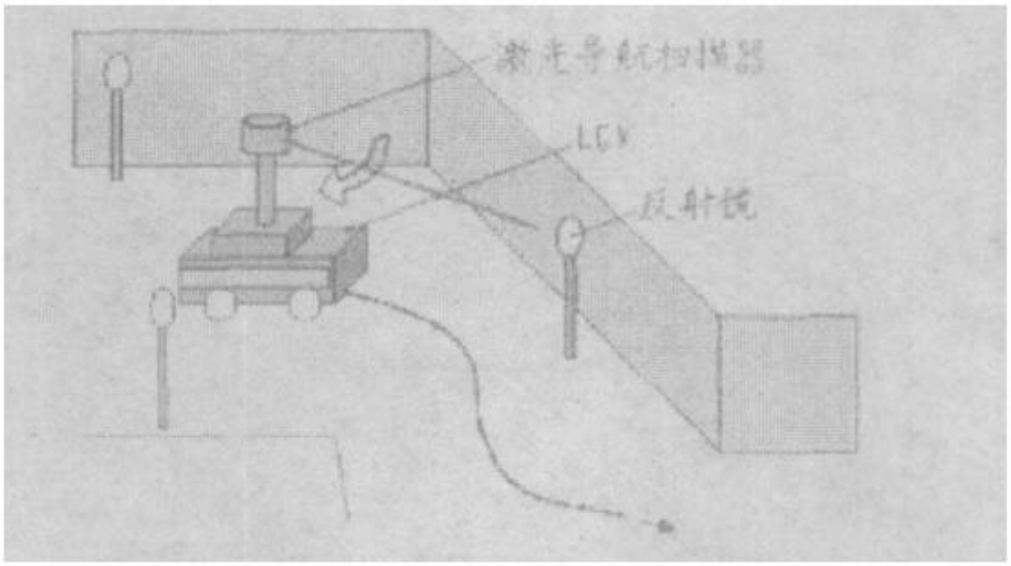

Figure 1-3 principle diagram of laser navigation

In the subsequent development, laser navigation technology has been constantly innovating, especially the laser navigation without reflector developed by Eagway, which is favored by customers. But if the laser emitted is changed to other ways and means such as infrared ray, It also has the advantage of accurate location and the same guiding principle. It can choose whether to use infrared navigation or laser navigation according to the specific environment.

The advantage of laser navigation is that after providing enough reflective mirror and wide scanning space, the navigation and positioning accuracy is very high, the ground does not need other auxiliary positioning, and the path is flexible, which is suitable for many environments. The equipment such as reflector is complicated to install, and the calculation is very complicated.

3.2 Ultrasonic navigation mode

This method is similar to the method of laser infrared measurement. The difference is that it does not need a special reflective mirror, but it can be guided by a common wall or similar object. Therefore, a more flexible and low-cost solution is provided in a specific environment. However, due to its large reflectance, it is often difficult to apply in a manufacturing workshop environment.

4. Visual navigation

Visual navigation has the characteristics of good guiding flexibility, reliable work and high level of intelligence. It has become a developing trend of advanced technology and superior performance. In general, the camera is used to take pictures of the automatic guided vehicle, and most of the cameras use the CCD model. Then the automatic navigation vehicle is analyzed and positioned by computer vision processing software. This method, which is based on the principle of image processing, is called visual navigation. When the camera is installed in the front part of the automatic navigation vehicle, The car can follow the predetermined track formed by the fixed icon laid in front of it. Usually, it can be reached by using visible visual colors such as black or white as icons To the purpose of fixed path, if the guiding mark is replaced by the object of visual system with certain characteristics, it can be analyzed and processed by computer vision software, and the navigation of free path can be realized by means of feature navigation.

The advantage of visual navigation is that it can satisfy many kinds of even very special environments, it can easily identify multi-branch paths and all kinds of road signs, and it has better flexibility and flexibility of navigation, and it can be used as an unfixed track way. It can also be used as a fixed track mode. The shortcoming of visual navigation is that the computing image recognition technology is more complex and the reliability needs to be improved. Because of the high cost and immature technology, most of this technology is used in the navigation system at present. Unmanned helicopter landing system has not been used in civil AGV system.

5. Other navigation methods

5.1 Inertial navigation

Inertial navigation is a revolution in navigation technology, because its use of gyroscopes elevates the positioning accuracy of automatic navigation vehicles to a higher level. Inertial navigation refers to the installation of gyroscopes on AGV vehicles. Before running, the car will set a reference position in advance, and then measure the acceleration of the AGV car by relying on the gyroscope, and convert the measured acceleration value and coordinate value into the current coordinate and direction of the AGV car. When the AGV car deviates from the predetermined route, a vector difference will be formed between the measured acceleration value and the specified value, and the vector difference will be obtained by the quadratic integration of the vector difference. The deviation value can be obtained and used as the data to correct the driving direction of the car.

The advantage of this technology is that it can be used in a wide range of applications and high accuracy, so it is used in a large number of high-precision enterprises in large quantities, but the disadvantage is that the corresponding cost will be very high.

5.2 GPS (Global Positioning system) navigation

GPS navigation refers to tracking and guiding AGV vehicles in unfixed road surface control system through satellite positioning system. This technology is not very mature and is still in the developing stage. This type of navigation is more suitable for outdoor long-range tracking and navigation, and the precision of navigation is limited by the level of the satellite in the air and the surrounding environment factors.

6. Summary

In the face of the industrial revolution today, the development of AGV trolley is developing rapidly. The guiding mode of AGV car is also developing continuously. This paper only summarizes and analyzes the existing universal guiding mode and provides these suggestions to all of us.

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