Design of AGV Training Scheme
Yong-qiang WANG and Xue-rong LIU
Shandong Technology and Business University, Shandong Yantai 264005, China

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Abstract: This article through the design AGV practical cases, introduces the hardware design and the choose and buy mode; The main function of three kinds of control system are introduced, respectively is the ground (upper) control system, vehicle (single) control system and navigation/guidance system. This project is the coordination of the ministry of education co-operative education programs; Goal is to design a set of practical cases.

Introduction
AGV is automatic guided vehicles, is equipped with electromagnetic or optical automatic guiding device, such as can walk in accordance with the provisions of the direct route, which has the function of safety protection device and a device to run transport cars; Also called as a wheeled mobile robot.[1,2]

AGV research and development about the computer, automatic control, information communication, mechanical design and electronic technology, and other disciplines, is a set of optical, mechanical and electrical and computer in the integration of new and high technology.

Based on the development project of the AGV, make a able to independently identify the path of intelligent Vehicle, its design content covers the control, pattern recognition, sensing technology, automotive electronics, electrical, computer, machinery, energy, and other disciplines of knowledge, to student's knowledge and the ability to practice and the cultivation of good.

This project based on the example as the goal, the AGV car to subdivide instance project for mechanical system design, circuit design, the driver software system development, the realization of the intelligent dispatching and obstacle avoidance algorithm, such as the car system overall debugging more child tasks, studying the role of students in each subtask, subtasks difficult problem, how to give students the right guidance method, etc., to help students in the process of project research and development, to solve the relevant problems in the design of step by step. By complete training project, so that the students can have a comprehensive understanding of the process of mechanical and electrical system of research and development, to involve the machinery, electronics, circuit, control, detection, each link of knowledge to autonomous learning, active learning, change the past passive learning approach to learning, to cultivate applied talents of high quality, cultivate and improve the students analysis solves the question ability, practical ability, team cooperation ability and innovative thinking ability cultivation of comprehensive ability.

The System Structure
First the overall design is modular, whether it is a vehicle carrying platform, using standardized interfaces, and all kinds of sensor module regardless of electromagnetic guided, optical guide, or visual (recognition) guidance, etc can be used.[3]

Vehicle body slide platform is extensible, loading different tray, can carry different objects; Driving wheel travel mechanism adopts two rounds of differential, buy electric drive and integration power actuators, such as the iTAS servo actuator is made up of servo motor, low screw back lash planet reducer of a coupling of mechatronics device drivers. The system overall framework is shown in figure 1.
The following three preset scheme.

System scheme 1: electromagnetic guided + two rounds of differential servo motion mechanism + anti-collision system ground control system + L trajectory.

System scheme 2: optical seeker + two rounds of differential servo motion mechanism + anti-collision system ground control system + circular trajectory.

System scheme 3: visual navigation + two rounds of differential servo motion mechanism + anti-collision system ground control system + grid trajectory.

The Control System

AGV control system to implement navigation, path planning and guidance control. AGV control system is divided into the ground (upper) control system, vehicle (single) control system and navigation/guidance system, among them, the ground control system refers to the fixed equipment of AGV system, mainly responsible for task allocation, vehicle scheduling, path (line) management, traffic management, such as automatic charging function; Vehicle control system after receiving the command, the host system for AGV navigation computation, direct implementation, vehicles, loading and unloading operation, etc; Navigation/guidance system for AGV stand-alone system absolute or relative position and heading. Using industrial computer as the vehicle control system, and the upper machine communication adopts the wireless communication mode.[4]

AGV ground control system the AGV upper control system, is the core of the AGV System. Its main function is to AGV system (AGVS) of many sets of AGV standalone task allocation, traffic management, traffic management, communication management and so on.

AGV vehicle control System, the AGV single machine control System, after receiving the command, the host System for AGV stand-alone navigation, guidance, path selection, vehicle driving, loading and unloading operation, and other functions.

AGV navigation and guidance technology, can be used for AGV navigation/guidance technology mainly include electromagnetic guide, optical guidance, laser navigation and inertial navigation, visual navigation, GPS positioning system navigation, and other technology; More mature and reliable is the first two,

Electromagnetic guided, electromagnetic Guidance is one of the more traditional way of Guidance, is embedded in the motion of the AGV path Wire, and Wire guided by loading frequency, through the recognition of direct frequency to achieve AGV Guidance. Its main advantage is hidden, lead pollution and not easily broken, the guiding principle is simple and reliable, easy to control and communications, to light without interference, low manufacturing cost. Defect is difficult to change the extension path, the limitations of the complicated path.

Optical Guidance, paint or paste in the motion of the AGV path ribbon, through to the cameras.
gather into the ribbon image signal is a simple process and implementation Guidance, its flexibility is good, the ground line setup is simple, but is sensitive to pollution of ribbon and mechanical wear, high requirements on the environment.

**Principle of Motion Control**

Motion control servo system working principle is simple, as made by motion control module control signals (such as pulse signal and the pulse frequency, pulse direction or analog voltage, etc.) to the servo drive unit, servo motor servo drive unit receives the converted to drive signal, the driving signal output into angular displacement or angular velocity can adjust the torque of the motor shall be carried out in accordance with the predetermined control drag mechanical movement. But there is error motor sports, especially in the simulation of speed control mode, in order to improve the positioning precision of the motion control, there must be a motor servo system of the actual movement result feedback signal feedback to motion control module by the feedback device, make the motion control module can according to the actual movement situation makes the corresponding compensation to eliminate the accumulated error. The servo motor control system is composed of a closed-loop control system. Figure 2 for motion control servo system schematic diagram.

![Motion control servo system schematic diagram.](image)

**The Wireless Communication and Working Principle**

The AGV wireless communications are mainly used in the wireless LAN and wireless data transmission module in two ways. In industrial automation, a large number of field devices adopt RS232 or RS485 communication, selection of wireless data transmission module implements AGV wireless communication with the master machine.

When wireless data transmission module receives the upper confidential data, first is going to send the data to send buffer, and at the same time the state of the module by receiving state into launching state, state transition after the completion of the start sending packaging process. Send the packaged application function is to convert the data in the buffer to suitable for wireless transmission of data packets, and some control signaling dynamically inserted into the packet. Then put the packet of data sent to the module data modulation in the mouth.

When the wireless data transmission module receives the PC after the data you need, it in accordance with the provisions, the serial port of the frame format and transmitted to the PC serial port rate. Wireless data transmission module typically provide standard RS - 232, RS - 485 and UART (TTL level), three kinds of interface modes with the computer, the user equipment, the RS - 485 single chip microcomputer or other direct connection using UART device. Wireless data transmission module application schematic diagram is shown in figure 3.
The Safety Device

AGV is very important for the safety measures, must ensure that the AGV in the process of running their own safety, and field personnel and the safety of all kinds of equipment. In general, AGV adopt multilevel security monitoring measures of hardware and software. Such as in AGV front against touch sensors and contact with non-contact touch sensors, AGV top mounted with eye-catching light and sound alarm device, around to remind operator. To need two-way operation or lateral movement before and after the AGV, crash-proof sensor need in all installation of AGV. In the event of failure, AGV, automatically acousto-optic alarm, at the same time notify the AGV control system adopts the wireless communication way.[5,6]

Summary

As AGV performance continuously perfect, greatly extend its application range, not only in industry, agriculture, national defense, health, services, and other industries widely used, but also in the zone, raids, rescue, radiation and space applications harmful and dangerous situations such as well, almost suitable for warehousing, manufacturing, and the post office, library, ports, airports, tobacco, medicine, food, chemical industry, for the dangerous sites and special industry and so on various occasions.[7,8]

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References


