ISSN: 2414-1895 DOI: 10.6919/ICJE.202111_7(11).0018

Robotic intelligent stereo library design

Lingjiao Dong

Wenzhou Polytechnic, Wenzhou 325035, China

Abstract

The stereo library system plays a more and more important role in modern warehousing industry. It uses the cooperation between automatic storage equipment and computer management system to realize the high-level rationalization, access automation and operation simplicity of stereo library. This paper studies the application and management of automatic stereo library.

Keywords

Stereo library, automation, management.

1. Overview of Automated Stereo Library

Automated stereo library, also known as elevated warehouse, generally refers to a warehouse that uses multi-layer or more than ten layers of shelves to store unit goods, and uses roadway stacker and other warehouse in and out equipment for goods ex warehouse and warehousing. This kind of warehouse makes full use of storage space, so it is also called stereo library. Traditional warehouse has many disadvantages, such as large floor area, low access efficiency, high labor intensity and so on. The automatic stereo library adopts computer control to maximize the function of the warehouse, and can provide a complete set of logistics transportation schemes such as warehousing, automatic transportation and product distribution for enterprises.

2. Basic Composition of Automatic Stereo Library

2.1 Chassis

Three section splicing structure is adopted to facilitate assembly and transportation. Each section is connected by 40 * 80 aluminum profile. The form of profile is convenient to connect with adjacent modules. Heavy load adjusting foot cup is installed at the bottom to ensure the level of underframe. The up and down running rails of the stacker are made of GB / T 11264-2012 [hot rolled light rail 18kg / M], with high metal plasticity and low deformation resistance, which greatly reduces the energy consumption of metal deformation, and the stacker can operate stably on the rails.

2.2 Goods Shelves

It adopts the form of combined shelf, which is convenient for transportation at the same time. The columns and beams are formed by continuous rolling of cold-rolled steel plates, and the surface is painted. Each column is connected with the underframe with a stainless steel base to improve the overall stability. Because the material is transported by pallet, the three-dimensional warehouse adopts pallet access mode and corbel cargo structure. The tray fixing is guided and positioned by the taper pin on the tray frame. The tray frame adopts the way of sheet metal integrated forming to ensure the flatness and strength of the installation surface of the guide pin.

2.3 Location

The X / y plan of storage location is shown in Figure 1. There are 8 + 6 = 14 single-layer storage locations, and 2 temporary storage locations are set for outbound and inbound respectively, which reduces the inbound and outbound waiting time of the ground rail robot docking module and improves

ISSN: 2414-1895 DOI: 10.6919/ICJE.202111_7(11).0018

the overall efficiency. The column is set as a row of warehouse location positioning holes, which can freely adjust the height and number of layers of the warehouse location. The profile underframe is installed and fixed in a long groove. The warehouse location setting is very flexible. There are 3 layers of warehouse locations, a total of 42 storage locations.

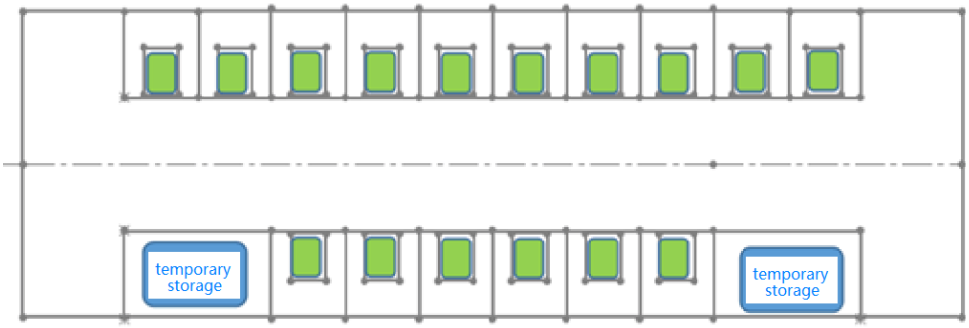

Figure 1. x / y plan of warehouse location

2.4 Tunnel stacker

The structure of roadway conveyor is shown in Figure 2. The main body is a frame structure formed by splicing four reinforced aluminum profiles, which is convenient for disassembly and assembly, and can realize the linkage in X, y and Z directions to complete the function of goods access. The three directions are driven and controlled by servo motor. The servo motor realizes the closed-loop control of position, speed and torque. It has the advantages of good high-speed performance, strong anti overload ability, stable low-speed operation, short dynamic response time of motor acceleration and deceleration, etc. x. The Z direction is also equipped with bar code positioning and laser ranging system, which can more accurately locate and display the positions in both directions. The y-direction fork runs on the linear slide rail, which can run stably in both directions to realize accurate positioning and transportation of the warehouse locations on both sides.

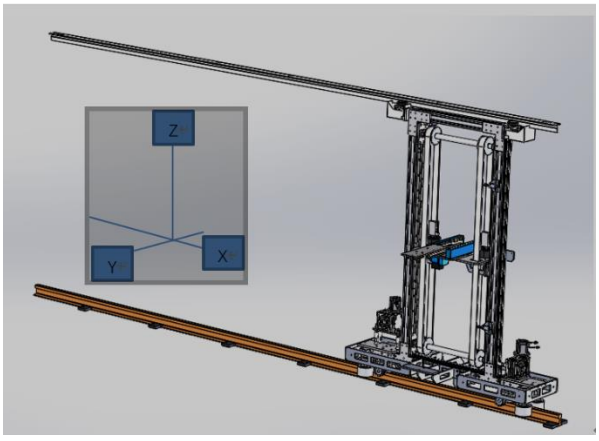

Figure 2. The structure of roadway conveyor

3. Intelligent Design

3.1 Smart Logistics Control Platform

The project adopts SCM (Supply Chain Management) and WMS (warehouse management) platforms, uses AGV and intelligent three-dimensional warehouse system to carry out intelligent handling and storage of goods, and completes the management of supplier delivery, in plant turnover, goods storage and customer delivery. SCM uses big data processing technology for real-time data collection to complete multi link logistics process control of suppliers, factories and customers; The AGV trolley is used to realize the processes of unmanned material collection, automatic turnover of semi-finished products and automatic warehousing of finished products; WMS is used to realize the control of purchase management, delivery management, warehouse management, system management and

ISSN: 2414-1895 DOI: 10.6919/ICJE.202111_7(11).0018

other functions through the intelligent storage operation system; Improve the accuracy and timeliness of data flow through the use of barcode, PDA and other equipment; Build one-to-one correspondence of warehouse locations by importing the basic data of storage locations, so as to keep the actual logistics consistent with the data flow and realize the lean management of the warehouse.

application of production management system

3.2 Application of Production Management System

MES system makes full use of digital, networked, automatic and intelligent technologies, optimizes process design and production process, organizes various production and manufacturing equipment to form a whole equipment that can realize automatic production, and finally realizes real-time communication and control between production equipment and management system and between various production equipment. It can not only effectively make up for the gap between the upper management software of the factory and the production information control system, but also contribute to the tracking management of the factory production plan and production process. It can also realize the integrated management of factory information resources, make better use of information resources, so as to achieve the goal of resource sharing, which is of great help to the economic construction of the factory and the decision-making of managers. MES system covers the basic management functions of production plan management, inventory management, process management, monitoring management and quality management, so as to provide the basis for the efficient automation of production processes such as production arrangement, instruction execution, product manufacturing, product quality inspection and instruction execution result feedback, so as to achieve the goal of "information reduction and automatic replacement".

The project adopts MES system to realize the management of human, machine, material and other related production resources in the manufacturing process. Through the monitoring and analysis of indicators such as the automatic generation of BOM, the collection of raw materials and auxiliary materials, the management of semi-finished products and line side warehouses, and the input-output of finished products, we can ensure that manufacturing resources are in place in time, efficiently transferred, reduced loss and reengineered, etc. Through the comprehensive application of various identification technologies such as configuring bar codes on parts, installing bar code labels at key parts of the production line and setting identification codes in products, the project realizes the real-time tracking of products in the production process, and online production of products of various specifications at the same time, which can not only meet the needs of mass production, but also insert small batch orders at any time, It also provides technical support for the full life cycle traceability of product quality. Through the real-time monitoring of the implementation process of the production plan and the management decision of the implementation results, the MES system of the project can let the managers at all levels know the production dynamics at any time, including attendance, planned production progress, planned completion rate and efficiency, so as to realize the online analysis and closed-loop follow-up of production abnormalities, optimize the data extraction and analysis mode, reduce the burden and enable management in advance.

4. Intelligent Function of the System

4.1 Production Plan Management

In the production process of the factory, production plan management is one of the important factors affecting production efficiency and production capacity. Therefore, in the production plan management, it is necessary to effectively improve the efficiency and accuracy of production plan management, eliminate the conflict of production plan arrangement, and affect product order delivery or product quality. After the factory receives the product order, the MES system can automatically schedule the product order reasonably according to the specific conditions of finished products in inventory, current actual production status, material preparation status, equipment load status, order delivery priority, etc. MES system realizes the one-stop transmission function of products from order signing to finished product delivery, without personnel participation, so as to ensure the accuracy and

ISSN: 2414-1895 DOI: 10.6919/ICJE.202111_7(11).0018

timeliness of order information. At the same time, in the production task management of MES system, the receipt and progress display of order production tasks can be realized, and the completion status of various historical production tasks can be queried, which is convenient for factory managers to understand the actual and transparent production situation.

4.2 Production Inventory Management

Production inventory management needs to manage all material inventory in the factory, including raw materials, parts, self-made parts, purchased and outsourced parts, finished products and equipment spare parts. In the MES system, it can realize the functions of material inventory query and retrieval, parts first in first out, etc. at the same time, it can view the material inventory status and query the historical use record. In addition, it also has the functions of warehouse allocation and inventory counting. When the material inventory is insufficient, it will send out a low inventory alarm to prevent the shortage of materials or equipment spare parts from affecting product production or quality assurance. For example, the MES system records that a part is an imported material with a long replenishment cycle. The system can set an inventory material warning line according to the historical use experience of the part and the factory management personnel. When the inventory of this material is less than this warning line, the system will automatically send an instruction to the factory purchase system to complete replenishment.

4.3 Production Process Management

In order to effectively improve the production beat and capacity of the factory, MES system can realize the closed-loop visual control of the production process and monitor the production efficiency in real time. Based on the measurement of production beat and combined with the actual production problems, the operation units are divided to facilitate the factory process personnel to analyze the bottleneck process, strive to eliminate all kinds of waiting waste, reduce the accumulation of WIP, ensure the balance of equipment and manpower load, realize balanced production, improve the overall efficiency of the production line, and achieve the purpose of improving production capacity and efficiency.

4.4 Production Monitoring Management

Sufficient production resources in the factory are the basic conditions to ensure the smooth completion of the production process. Therefore, during the management of factory production, it is necessary to do a good job in the monitoring and management of relevant elements such as human, machine, material, method, environment and measurement, and provide relevant information such as the actual status and historical monitoring records of these production resources to ensure the smooth progress of production activities. MES system can monitor and manage the implementation of production plan, equipment operation status and production environment. In addition, it can also monitor and manage the alarms caused by personnel, equipment, quality and other reasons, so as to find problems in time, deal with them quickly, and report the treatment results at the first time after the treatment, so as to ensure the smooth progress of its production process under strict monitoring. In the process of realizing the monitoring function, distributed digital control technology is adopted to collect system data and manufacturing terminal data, and monitor the operation status of production equipment in real time to promote the improvement of equipment utilization.

4.5 Production Quality Management

As the production plant of vehicle passive safety products, product quality is very important, which is related to the life safety of end customers. In the process of product production, its quality management needs to be realized through strict process inspection, and realize the quality traceability of the whole product life cycle, including incoming material inspection, production process control, finished product inspection and so on. Through the quality management function of MES system, the incoming material inspection, production process control and finished product inspection are linked, so as to realize the quality traceability management of the whole product life cycle.

ISSN: 2414-1895 DOI: 10.6919/ICJE.202111_7(11).0018

Acknowledgments

This paper was supported by Yalong Intelligent Equipment Group Co., Ltd. (H2018103) and by National vocational education teacher teaching Innovation team research project（SJ2020010102）.

References

[1] Yuan Peipei. Research and application of key technologies of intelligent warehousing [D]. Shanghai: Donghua University, 2016.

[2] Xia Li. Research on picking scheduling and monitoring system of stacker in automated three-dimensional warehouse [D]. Taiyuan: Zhongbei University, 2016.

[3] Gu Ping. Research on Optimization of automated three-dimensional warehouse [J]. Science and technology outlook, 2017 (6): 141.

[4] Sheng Xiaohe, Zhang Junyu, Zou Wen, et al. Analysis and application of queuing theory in automated logistics system [J]. Logistics technology and application, 2017 (6): 162-163.

[5] Jiao Hongshuo, Lu Jianxia. Overview of research status of intelligent factory and its key technologies [J]. Electromechanical engineering, 2018, 35 (12): 7-16.

[6] Five reasons for enterprises to implement MES system [J]. Smart factory, 2018 (01): 38-39.

[7] Liu Hui, sun Jiayu. Implementation path of enterprise MES system under intelligent manufacturing [J]. China Electromechanical industry, 2016 (12): 96-97.