

Design of Automated Logistics System Based on PLC

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Abstract: With the rapid development of social science and technology nowadays, the requirements for the design of automated logistics system are becoming higher and higher in the production line of all kinds of material transportation. According to the operation characteristics and control requirements of logistics production line, this paper designs the design and control scheme of automatic logistics system based on PLC. On this basis, the control system of the shuttle truck is designed, and the program solution under the automatic operation mode is given. Automated warehouse is a combination of automation technology and logistics and warehousing. The design of the interface connection with the roller conveyor of the robot and the stacker is completed, and the specific principle description of the system operation is given, aiming at improving the reliability and self-control precision of the device, thereby improving the working efficiency of the whole system. The practical application shows that the PLC control system is safe, reliable, stable and efficient.

1. Introduction

The conveying system must be highly reliable. In a stereoscopic warehouse, there is usually only one conveying system, once a failure occurs, the whole warehouse work will be affected [1]. Therefore, the equipment in each link of the conveying system is required to be reliable, durable and easy to maintain. Set up manual control to backup the conveying system. With the rapid development of logistics, as an important part of the logistics system, manual retrieval of single-storey warehouse inventory can no longer meet the requirements of reality. At this time, the concept of three-dimensional warehouse was put forward [2]. It connects not only the three-dimensional warehouse, but also the small pallet roller conveyor line, which is the core content of the whole outbound packaging system design. The purpose of production logistics management is to reduce production costs, which is achieved by coordinating and speeding up the logistics of enterprises [3]. Reducing the production logistics time of the company can reduce the production cycle of the whole product. After the whole production process is automated and standardized, the quality of the product can be optimized to optimize the space of the production workshop, which can improve the utilization rate of the equipment, so that the time can be achieved spatially. Balance [4-5].

In the production activities of enterprises, from raw materials to finished products, the time when materials are actually processed and inspected only accounts for 7% to 13% of the production cycle, while the remaining 93% to 98% of the time is in storage, handling, transportation and processing. State [6]. In the manufacturing industry, 25% to 55% of the total operating expenses are material handling fees [7]. This paper takes the production of automated packaging line out of the shuttle bus as an example, introduces the structure and characteristics of the shuttle shuttle, the working principle, and analyzes and discusses its design points [8]. Generally speaking, the automated three-dimensional warehouse mainly consists of the following parts: two-dimensional shelf, track roadway stacker, pallet conveyor system, size detection bar code system, communication system, automatic control system, etc. With the continuous development of computer technology, artificial intelligence technology, especially expert system, is a computer program with intelligent characteristics. Its intellectualization is mainly manifested in the ability to imitate human expert

thinking in a specific field to solve complex problems. There are more and more applications in logistics system design [9].

2. Methodology

Logistics system design includes overall layout, scheduling control, material handling, transportation, storage and the selection of corresponding equipment. To meet the requirements of manufacturing system economically, effectively and flexibly is the goal of logistics system design. The main task of facility layout is to study the whole process of product processing from raw materials to finished products, to design all kinds of materials and facilities in space in the most reasonable and effective way, to make the efficiency, management, cost, safety and other indicators reach the best state, and to ensure the unimpeded flow of manpower, logistics and information [10]. In the automatic mode, the outbound shuttle arrives at the designated station by judging the state of the large tray on the chain machine; in the manual mode, the outbound shuttle is stepped by the workstation through the touch screen or the manual switch on the vehicle body; In the dynamic mode, the car body can be moved forward and backward manually to any reachable range. The code reader on the car body reads the large pallet code taken each time, and saves it when it arrives at the outbound station.

In order to calculate the appropriate input of the system and solve the QP, built-in function blocks (FBS) and organization blocks (OBS) were written. Organization blocks are built-in functions that are called by hardware interrupts. A function block is a user-defined function whose corresponding data is stored in a data block (DB) with the same number. Figure 1 depicts the sequence in which these blocks are called.

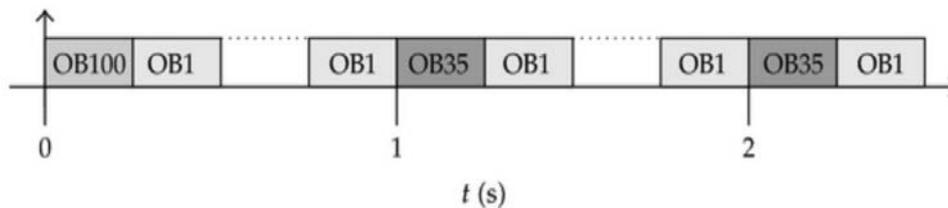


Fig.1. Schematic diagram of different organization blocks in PLC

The warehousing system is the link between the stacker system and the conveyor system. When the machine is out of the warehouse, the stacker takes out the goods and sends them to the delivery system. The delivery system transports the goods to the conveyor system, and the goods are distributed and transported by the conveyor system. When the goods are put into the warehouse, the goods entering and leaving the warehouse system are connected to the goods sent by the conveyor system. Send it to the stacker, which will deliver the goods to the set location in a working manner to complete the operation. The automatic warehousing system completes the storage management of inventory items in and out through the upper computer database management system. The operator only needs to select the required items on the software operation interface, and the access tray is a fully automatic process. Logistics area divides the whole workshop into two parts. The area on the left side of the logistics area is called West Two Spans and West Three Spans. The control system in this paper is divided into two-span control system and three-span control system. The logistics connection between them is carried out by manual means. The area on the right is called the second and third west spans.

The programmable controller is a special industrial control computer, which is usually placed and operated directly in the industrial field and connected directly with the controlled device and equipment. Moreover, its working voltage is very low and its working frequency is high, so all kinds of interference on the industrial site will have a great impact on it, and even cause serious accidents due to misoperation. The maximum length of the cable depends on the transmission rate. The transmission rate and distance are shown in Table 1.

Table 1 Transmission rate and distance relationship Table

Baud Rate (Kbit/s)	9.7	23.7
Distance (m)	1300	1500

There are two kinds of operation modes in the warehouse entry and exit system, automatic and manual. In the case of automation, the warehouse entry and exit system can operate automatically according to the availability of goods or not. When goods are available, it will automatically run to the entry-exit position and the initial position when no goods are available. In the case of manual operation, the access system is in the form of point movement to facilitate the needs of special circumstances. In order to achieve the goal of speed regulation and stop accuracy, a satisfactory control mode is obtained by transforming the operation area and counties of the frequency converter. The speed control of stacker generally adopts semi-closed loop control and frequency converter, and the displacement adopts open-loop control. After the robot has finished the yarn on the large tray, the outbound shuttle conveys the empty pallet to the empty pallet temporary storage chain machine, and then transports it to the elevator and sends it to the second floor, so that one is completed. Library loop. The material transporter is used to transport the welded casing to the designated welding station, and the finished material transporter is used to transport the welded casing to the unloading station. The two transport vehicles should work together and there should be no conflicting actions. When a station is using a transport vehicle, other stations are temporarily unable to control the vehicle.

3. Result Analysis and Discussion

The electronic control system of this solution is responsible for accepting commands from the host computer or the touch screen console, collecting external sensor data, judging its own state, and communicating control of the inverter through the USS protocol to drive the motor to realize the movement of the mechanism, and during operation. Monitor system status. In the manual mode, pressing the manual control button, the cargo station in manual operation will perform the button control action until the end of the movement or the button is raised. The difficulty of stacker control lies in the uncertainty of start and stop position and the discreteness of the operation. Different distances correspond to different acceleration and deceleration curves. Because of the inertia of the stacker itself and the cargo, multi-stage speed control is adopted to ensure the smooth lifting and running. The selection switch can be selected through the interface of the outgoing shuttle car on the touch screen. When the manual button is clicked, the manual operation of the shuttle truck can be realized. When the automatic button is clicked, the shuttle truck can run automatically. Easy to reorganize and expand. Equipment development is developing in the direction of flexibility, intellectualization and integration.

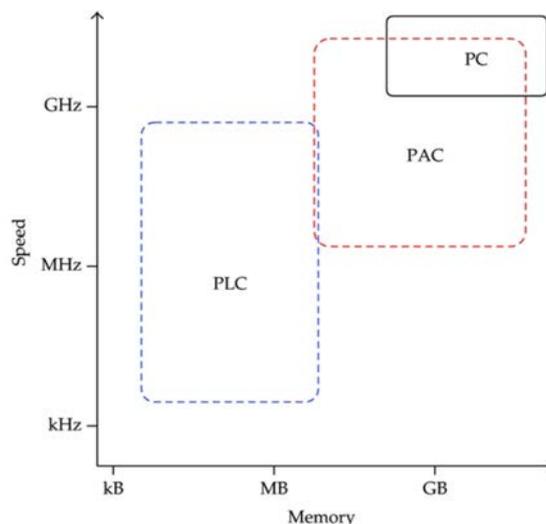


Fig.2. Compare PLC, PAC, and PC locations from a speed and memory perspective

Compared with standard PC, embedded controller is usually implemented on devices with much less computing power and memory. Figure 2 shows a variety of devices. In industry, programmable logic controllers (PLCs) are often developed for control tasks even in harsh conditions, because they have strong robustness.

With the rapid development of electronic components and the application of more and more advanced technologies in the field of industrial control, the control methods of industrial automation control systems have also become diverse. We can choose the control method according to the actual situation of the system. By using the USS protocol, this solution reduces the requirements for hardware devices and reduces wiring between devices; the control function can be changed without rewiring; the parameters of the transmission can be set or changed through the serial interface; shielded twisted pairs are used. The communication speed is high, and the speed and reliability are high. Under the automatic operation mode, when the fork leaves the cargo counter, the system starts to time. When the time arrives and there is no cargo in the car, it starts to retreat until it reaches the end point and stops automatically. Compared with the forward procedure of the warehouse, the backward control only replaces the goods positioning condition with the non-goods condition. Under this working mode, the shuttle truck communicates with the master computer, receives various task instructions issued by the master computer, completes the corresponding tasks, and timely feedback the information and status of the large pallet.

The existing logistics system research is often partial, and the systematic and integrated research work is rare. Logistics system serves the whole manufacturing system and is also an integral part of PLC. The coordination of various equipment in the system is the prerequisite for the normal operation of PLC. Therefore, when designing logistics system, we should make clear the requirements of logistics system and coordinate processing equipment from the perspective of the whole manufacturing system. Transport trolley is made of profiled steel. Its structure is strong and durable. In order to protect the processed work piece, a layer of shock absorber is installed on the horn bracket and the part where the work piece contacts. In order to ensure the stability of parking, the transmission mechanism of the transport trolley is equipped with a reducer. Both the travel motor and the current collector are mounted on the transport trolley, and the motor-driven trolley forward or reverse collector is connected to the slide line of the track to obtain the power and control signals of the transport trolley. At the same time, support for the current inventory details, access to the library records and other information reports for inspection and printing, can help analyze the consumption of inventory, adjust inventory, rationally develop the purchase plan, provide a basis for assessing production costs, thereby improving the management level of the factory, Improve work efficiency.

4. Conclusions

Based on the analysis of the operation characteristics and process flow of the production line, the overall design of the production line was carried out according to the control content and control objectives of the production line control system. Including the choice of control mode, the determination of the control plan, the structural design of the transport trolley, the drive scheme design of the transport trolley and the design of the work console. Based on the PLC design of the control system of the outbound shuttle, the system has been successfully applied to the automated three-dimensional warehouse logistics packaging line, the automation degree is greatly improved, the operation is convenient, the work is more reliable, and the control requirements are fully met. It has become the trend of production logistics construction and development. The automated warehouse is connected with the processing process and can form a flexible processing system. As the core of production logistics system, automated warehouse is the key to realize logistics rationalization of production logistics system. With the development of technology, the practicability and reliability of automated warehouse will be higher and higher, and the control will be more and more perfect.

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