Labview-Based Intelligent Stereoscopic Warehouse System Design

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Abstract

The intelligent stereoscopic warehouse control system includes manual and automatic two parts. When manually running, you can specify forward rotation or reverse rotation of the motor through the labview front panel. In automatic operation, the front panel handle is used to select the storage or delivery, and then specify the position that need to be stored or shipped out. The system will automatically realize the storage or withdrawal of the goods. Firstly, design the mechanical structure of the warehouse. Secondly, write microcontroller program and complete the design of labview front panel and program block diagram, and focus on achieving serial communication between labview and the microcontroller. Finally, the intelligent stereoscopic warehouse control system designed with labview as the upper computer software is completed.

Keywords

Stereoscopic warehouse, labview, serial communication, front panel.

1. Introduction

Labview is a program development environment. The obvious difference between labview and other computer languages is that other computer languages use a text-based language to generate code, while labview uses a graphical editing language to write programs. The resulting program is in the form of a block diagram[1,2]. Traditional warehouse operation management relies on experience to place goods in the nearest position. After the warehouse has been running for a period of time, the allocation of the space is likely to become unreasonable. There are problems such as low warehouse operation efficiency, high operating costs, and unstable shelves[3,4]. Automated warehouse is an important part of logistics. It is a high-tech product of the development of modern industrial society. It is of great significance for increasing productivity and reducing costs. It has the advantages of small footprint, large storage, and fast turnover[5]. The intelligent warehouse system design is a miniature model for simulating the warehousing process in the automated production process. It is divided into manual and automatic control modes, which realizes the mechanization and automation of warehouse operations. The information processing is rapid and accurate, and the goods are automatically extracted and stored. The high-level shelves are used for storage, and the space utilization rate can reach 2 to 5 times that of ordinary warehouses.

2. Stereoscopic Warehouse Mechanical Design

Stereoscopic warehouse mechanical part consists of a stepping motor, a fork, a three-dimensional frame, a three-dimensional motion forklift, two DC motors, a microcontroller module, a stepping motor driver, a 24V switching power supply, limit switches, slotted sensor modules, pulley structures, chain drive structures and other components.

The three-dimensional frame is used for storing goods and has an incoming and outgoing buffer. The three-dimensional motion forklift is driven by a stepping motor in the horizontal direction, driven by the DC motor in the vertical direction and in the direction of the cargo in and out. It can automatically complete the inventory from the buffer to the location and automatically retrieve the goods from the location to the buffer. Column positioning tabs are installed on the side of the forklift's running track,

one for each column. The positioning of the column when the forklift is running is realized by the slotted sensor module detecting the rising edge of the column positioning piece. When the three-dimensional motion forklift moves vertically through the layer positioning plate, the slotted sensor sends a position signal. Each layer positioning plate has two light-shielding plates, the upper shade plate and the lower shade plate respectively. If you want to discharge, rise to the upper shade and then enter the position, run to the position of the limit switch, then drop to the lower shade, and then remove the goods. If you want to take the material, first rise to the lower shade and then enter the position, run up to the position of the limit switch, then rise to the upper shade, and then remove the goods. Through the serial port communication of microcontroller module and the host computer, the data sent by the host computer is analyzed to realize control of the three motors. The sensor of the limit switch and the slotted sensor can be detected in real time and sent to the host computer for accurate position control. The horizontal direction and the direction of the goods in and out rely on the belt pulley structure transmission, and the vertical direction depends on the chain transmission structure transmission. Microcontroller module is shown in Figure 1, the overall structure of stereoscopic warehouse is shown in Figure 2.

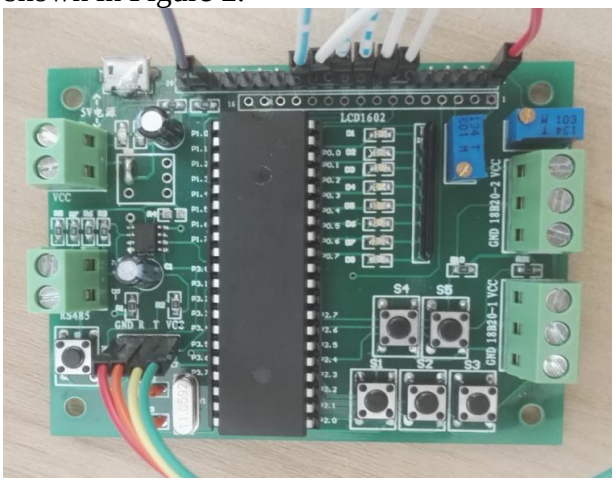

Fig 1. Microcontroller module

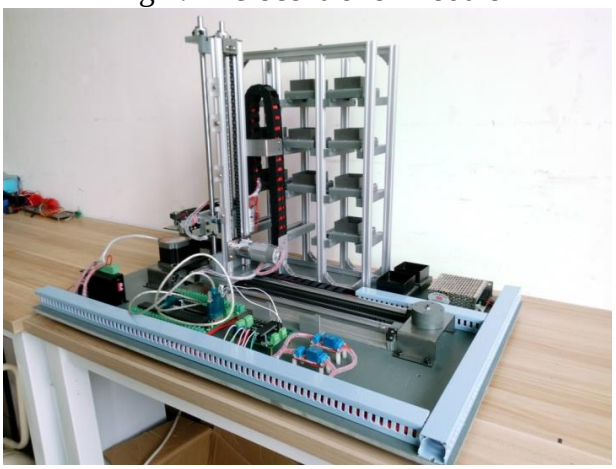

Fig 2. Stereoscopic warehouse

3. Labview Programming

When designing the labview program, you should design the labview front panel first, then design the labview program block diagram. The front panel includes a jog handle for selecting automatic or manual, a jog handle for selecting the storage or delivery, a serial port selection control for selecting serial communication with the microcontroller, 6 switch controls that control motor rotation, 12 selection buttons and 1 emergency stop button. The emergency stop switch is used to stop the rotation of all motors in an emergency and avoid damage to the motor and warehouse structure. The front panel is shown in Figure 3.

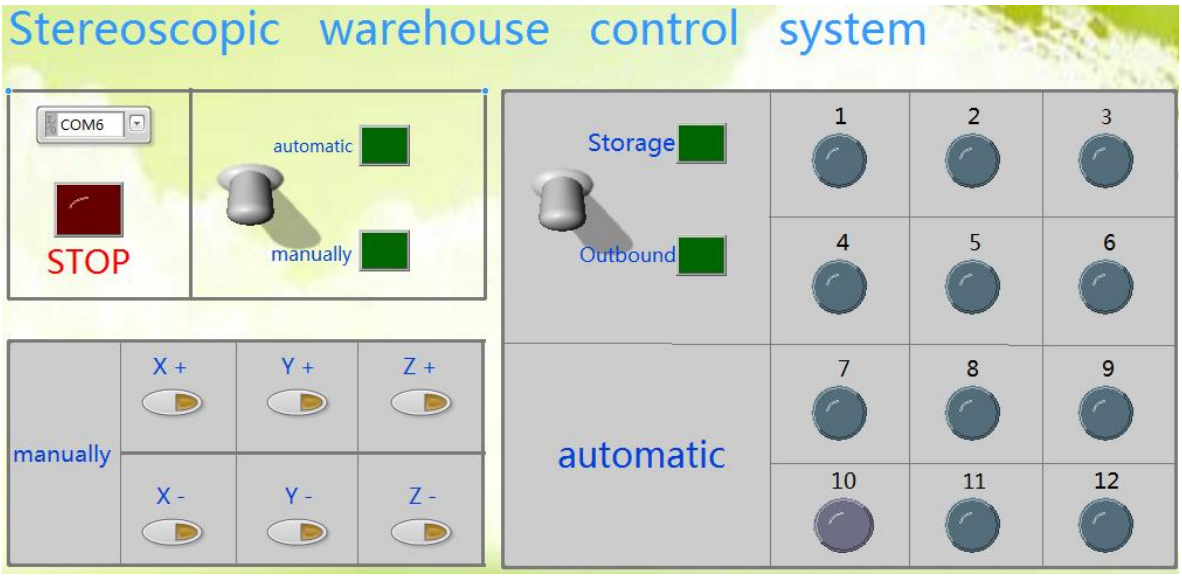

Fig 3. The front panel of the stereoscopic warehouse control system

Accurate warehousing and outbound need to obtain the position information of the motion forklift in time and accurately, so the location of the positioning piece is very critical, and its position directly determines the row and column information corresponding to each position. If the location of the positioning plate is inaccurate, there is a tendency that the goods cannot be removed or cannot be placed. The quality of the slotted sensor plays a crucial role in the normal operation of the system. According to the signal detected by the slotted sensor, labview controls the rotation of each motor. If the slotted sensor does not work properly, the subsequent control will be confusing and it will not be able to accurately locate the specified position. The control system must focus on realizing the serial communication between labview and microcontroller module, and enable the microcontroller module to receive the instructions sent by the upper computer and send the signals to the upper computer. Serial communication as shown in Figure 4.

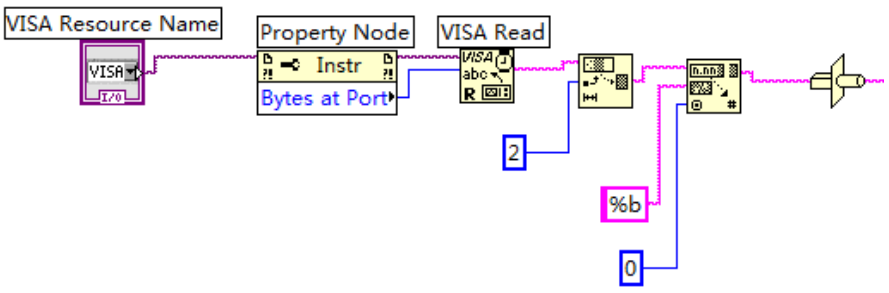

Fig 4. Serial communication

During manual operation, the upper computer sends the motion command to the microcontroller through the labview to control the rotation of the three motors. Firstly, when the front panel specifies the position of the product to be taken out, move the motion forklift horizontally to the column where the goods are located, and then move in the vertical direction to the row where the goods are located. Since the columns and rows are determined, so we can determine the specific location of the goods. Then enter in the direction of the goods entering and exiting, it will rise in the vertical direction after detecting the limit switch signal, hold the goods up to a certain height and stop, and then exit along the direction of the goods entering and exiting to the limit switch position, and then it is retracted to the specified position in the vertical direction, and finally it is returned to the origin of the buffer area in the horizontal direction, put the goods back into the buffer area and return to the starting point, thus completing the entire process of item shipment. When the item is in storage, after the front panel specifies the position for placing the goods, the upper computer sends an action instruction to the microcontroller through labview, so that the forklift picks up the goods from the buffer area, and then

move horizontally to the corresponding column, move it vertically to the corresponding row. After confirming the position of the specific position, the goods are put in the direction of the goods entering and exiting, then descend to the designated position in the vertical direction and exit to the position of the limit switch in the direction of the goods entering and exiting. Finally, the forklift returns to the origin of the buffer zone.

4. Conclusion

Designed and implemented the design of the mechanical parts of the stereoscopic warehouse, and developed a host computer control system based on labview. The position information was determined by the slotted sensor and the positioning pieces. The manual operation and the automatic operation are achieved through the serial communication of the microcontroller and the labview, fully embodying the convenience of the stereoscopic warehouse in the warehousing, and providing a complete solution for the development of an industrial practical stereoscopic warehouse control system.

References

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