

The Design of the Powr Strip Lock Screw Intelligent Control System based on PLC

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Abstract

The control system of Powr Strip lock Screw based on PLC is designed and applied to practical production. The system consists of screw feeder, electric screwdriver module, XYZ motor module, hand-held teaching pendant and Panasonic fpxh c60t PLC as the controller. The back-to-back system scheme is designed by analyzing the pain points, working principle and control scheme in the process of Powr Strip Screw. The system is compatible with the application of two different screws on the same product. Through the configured front and rear electric screwdriver, the product can be fixed at one time without manually switching the product. The equipment operates stably, and the efficiency is greatly improved.

Keywords

PLC; HMI; Powr Strip; Lock Screw.

1. Introduction

At present, the automatic screw locking machine is still the main automatic locking tool, and it is still in the stage of automation transition, but many small and medium-sized enterprises still use the traditional locking method. Automatic screw locking machine is to gradually solve and alleviate the pressure of manual production. Improve production efficiency and speed of locking screws by simulating manual locking screws.

The fully automatic screw locking machine developed in this project is used to replace the traditional manual screw locking process, greatly simplify the boring manual operation and mobilize the enthusiasm of workers. According to the urgent needs of enterprises, there is no corresponding equipment on the market. According to the needs of enterprises, the intelligent equipment of screw locking is developed according to the needs of enterprises, and finally the equipment can be put into use in the market.

2. System Scheme Design

The project adopts a multi axis locking screw platform. Aiming at the application of enterprise Powr Strip Screw. Customized and developed a set of intelligent locking and payment equipment to realize the intelligent locking and payment function of rear cover screws. The equipment has a number of innovations and solves several major pain points faced by enterprises in the production process

Pain point 1: a wide range of products.

Solutions: 1) system can store hundreds of product models

2) Make universal fixture, compatible with all products

Pain point 2: two different specifications of screws in individual products.

Solutions: 1) adopt the back-to-back scheme

2) Intelligent switch screw for locking

Pain point 3: operators generally have low education.

Solution: the operation interface is simple and can be used quickly.

pain point 4: the locking effect is uncontrollable.

Solution: adopt KILEWS Screwdriver to realize accurate torque control.

The equipment uses PLC and HMI as the main control core to provide strong system stability and customizable maintenance. The air blowing screw feeding mechanism is used to automatically send screws. After teaching programming, after saving the screw points, just press the start button to complete the function of automatic locking, which is convenient and intelligent. As shown in Figure 1, 2.

(1) Stop button: press this button to stop the equipment.

(2) Reset button: a button to restore the equipment to the startup state

(3) Emergency stop button: the emergency stop button of the equipment. The emergency stop button is to quickly press this button in case of emergency to achieve safety protection measures.

(4) Start button: press this button, the equipment can start to enter the working state.

(5) Multifunctional Clamp: it is used to fix processing workpieces.

(6) Screw feeder: automatic screw feeding.

(7) Touch screen: control and observe the running state of the equipment.

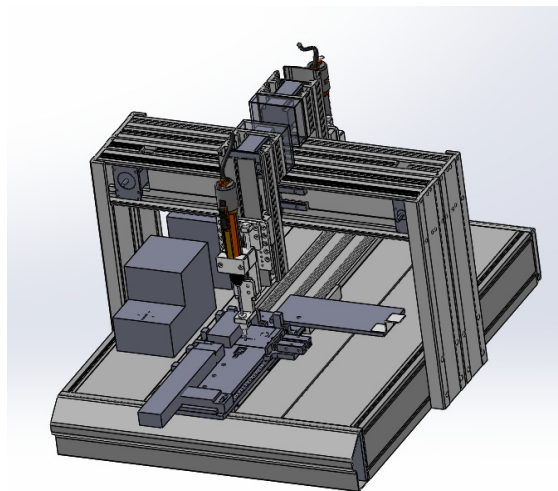


Figure 1. Overall system design

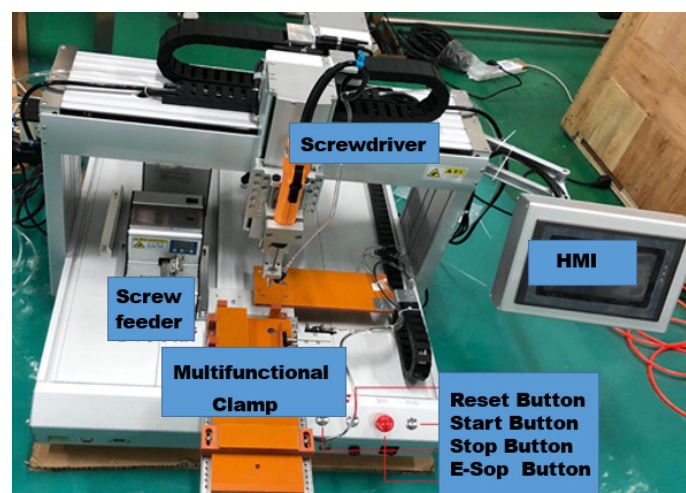


Figure 2. Actual prototype

3. Control System Design

3.1. Hardware Design of Control System

Panasonic fpxh c60t PLC is used for system control. This type of PLC is transistor output and can control 6 axes. This project is a 5-axis control application, and the touch screen adopts Samkoon AK series touch screen. According to the task requirements, the following table is the IO configuration table of the system. Table 1 shows the IO allocation table of the equipment.

Table 1. PLC program I/O Distribution

FP-XH-C60T			
Input-32 Point		Output-28Point	
X0	PB-Jog X Left	Y0	Y -P Pulse
X1	Jog X Right	Y1	Y -D Direction
X2	Jog Y Forward	Y2	X1-P Pulse
X3	Jog Y Backward	Y3	X1-D Direction
X4	Jog Z Up	Y4	Z1-P Pulse
X5	Jog Z Down	Y5	Z1-D Direction
X6	Fast/slow select	Y6	X2-P Pulse
X7	Save Screw Pos.	Y7	X2-D Direction
X8	Reset	Y8	Z2-P Pulse
X9	E-stop	Y9	Z2-D Direction
XA	Start	YA	
XB	Stop	YB	
XC	Front-Sensor	YC	
XD		YD	
XE	Induction Start	Y10	Front- Inhale
XF	Screw Again	Y11	Front - Blow
X10		Y12	Front -Screwdriver
X11		Y13	Front -Press
X12	Back-Sensor	Y14	Back- Inhale
X13		Y15	Back - Blow
X14	Front-X Origin	Y16	Back - Screwdriver
X15	-Y Origin	Y17	Back - Press
X16	Front-Z Origin	Y18	Buzzer
X17	Back-X Origin	Y19	
X18		Y1A	
X19	Back-Z Origin	Y1B	

3.2. PLC Programming

Program design is the core part of the whole PLC control system[1-3]. According to the working process and process requirements of automatic locking of row and plug back cover, the control mode and control parameters of the system are determined. In order to improve the stability and reliability of the system, necessary protection, interlocking and interlocking functions need to be added.

The control system adopts modular programming [4-5], and the work flow is shown in Figure 3. The process analysis is as follows:

This design is to replace the work of one or more employees. Only one key is needed in the operation (when each point is designed in the touch screen and the workpiece is placed

manually), the machine will automatically complete the screws on the product to be locked according to the pre prepared program. Employees only need to put the semi-finished products into the fixture and press the start button. Moreover, the equipment has accurate positioning and simple operation. Before starting, they only need to determine the required screw hole position according to the process. The device can also record the process of locking screws and automatically complete all actions of locking screws. From the initial reclaiming to screw locking, except the operation of placing the workpiece, the rest is completed by the equipment. The screws will not cause secondary pollution to the products due to the stains generated during hand taking, and the phenomenon of different degrees of manual force is avoided. The machine will lock the screws according to the set torque and downward pressure. The products have strong consistency and versatility. If the difference between the types of screws used is too large, it is OK to replace the screwdriver corresponding to the screws and the corresponding screw feeding system, It improves the production efficiency of the equipment.

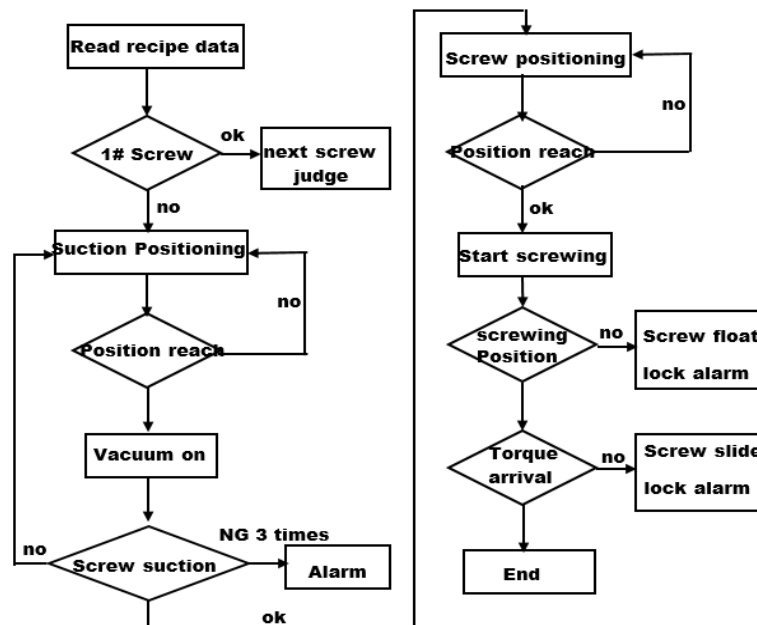


Figure 3. System PLC control schematic diagram

3.3. HMI Programming

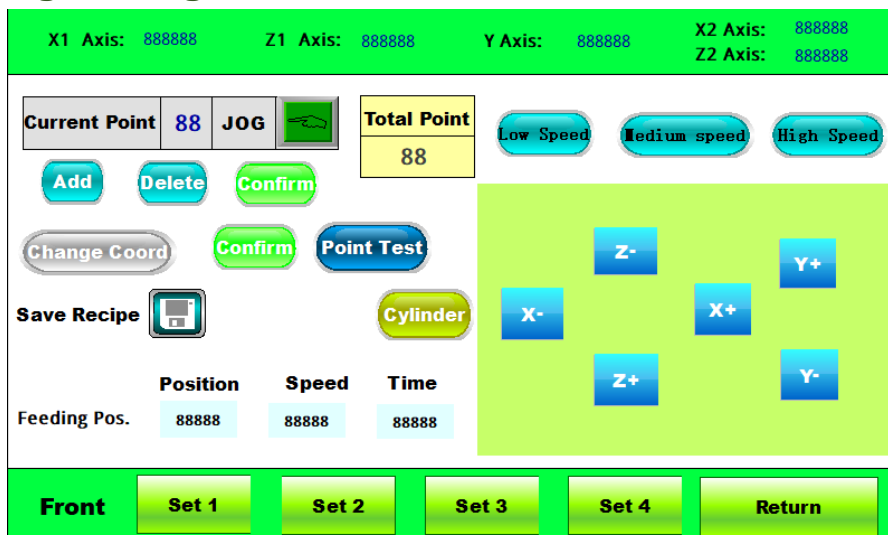


Figure 4. Advanced design set 1 interface

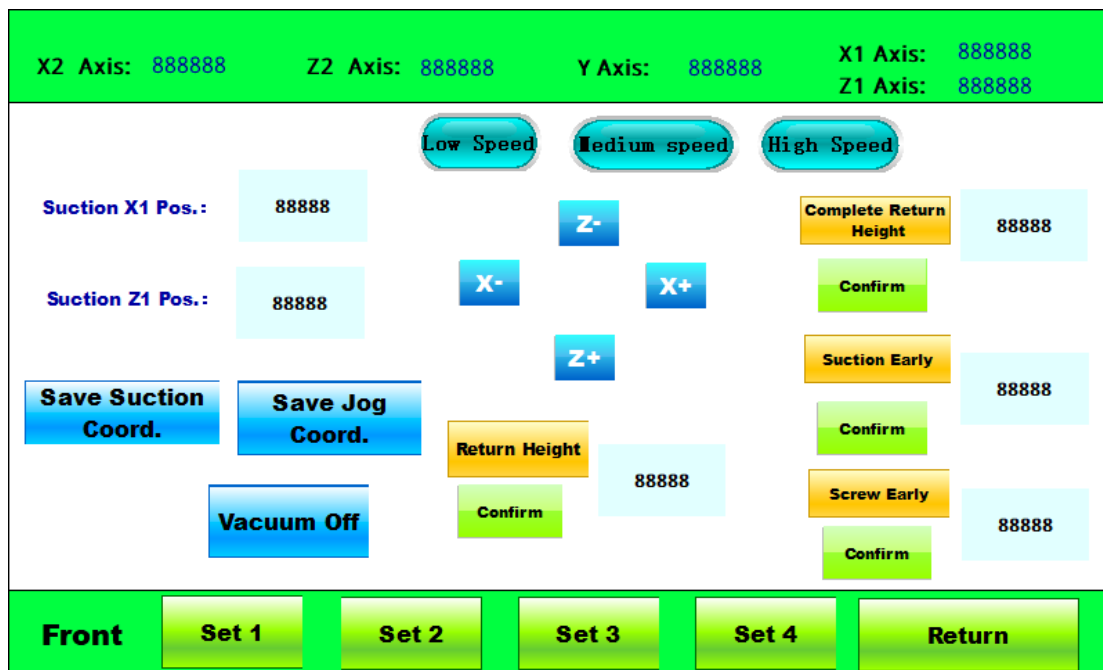


Figure 5. Advanced design set3 interface

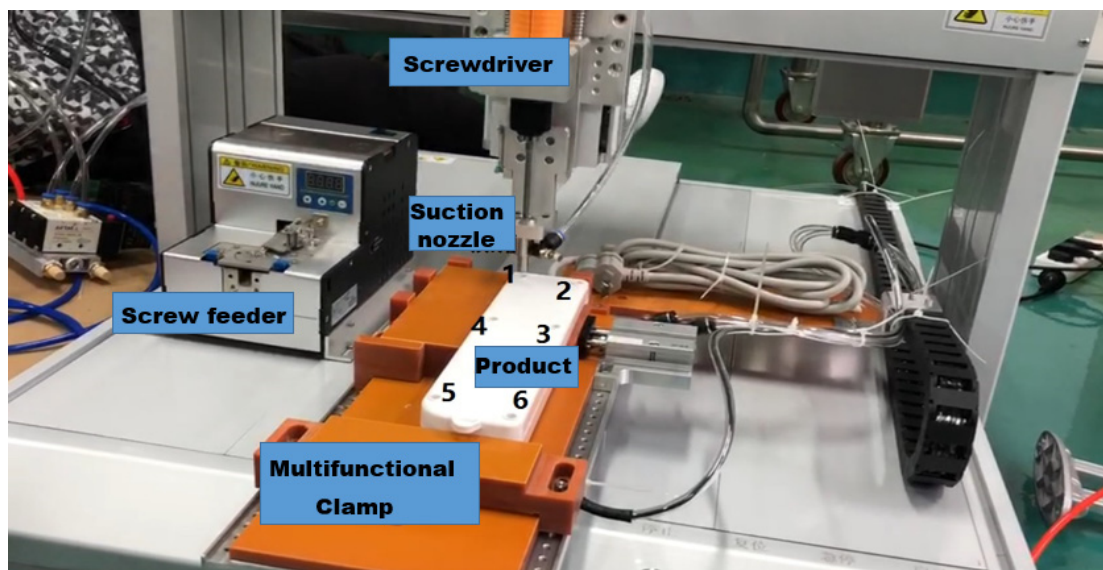


Figure 6. Equipment operation process

Taking the workpiece in the multi-functional fixture in Figure 6 as an example, we can first find that the workpiece has a total of six screw hole positions, so we need to add six screw hole points in the touch screen. The operation steps of adding screw hole points are completed in the interfaces in Figure 4.

As shown in Figure 5, after setting the point, we also need to add the return height. The return height is to return to the original height after each screw hole is punched, remove the screw, and then move horizontally to the next screw hole point for operation. In this way, a formula is completed. Test the formula. First return the equipment to the initial position, press the reset button, and then press the start button, and the equipment will start working. The coordinates of six points shall prevail. After moving to one point, it will return to the return height and continue the next operation.

3.4. Equipment Operation

The commissioning operation of the equipment is shown in Figure 7. Figure 8 A handheld mobile controller is developed for the application to facilitate point teaching control, and a multi-functional fixture is developed according to the customer's product type, which can be compatible with most product sizes. The control system is easy to operate and can save multiple groups of formula data for easy switching. The speed of the equipment can reach 1pcs / s. It is also compatible with the application of two different screws on the same product. Through the configured front and rear electric screwdriver, the product can be fixed at one time without manually switching the row and insertion position. At the same time, the locking is completed, the equipment operates stably, and the efficiency is greatly improved.

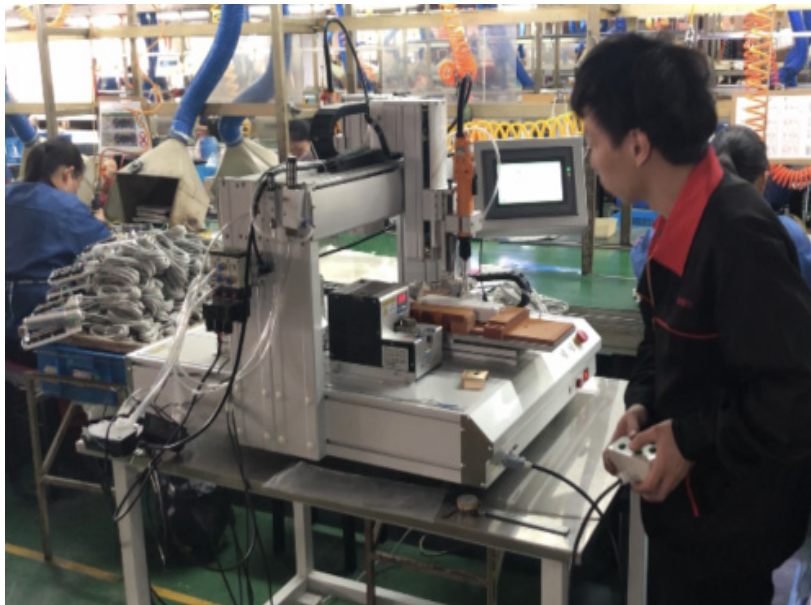


Figure 7. Field operation

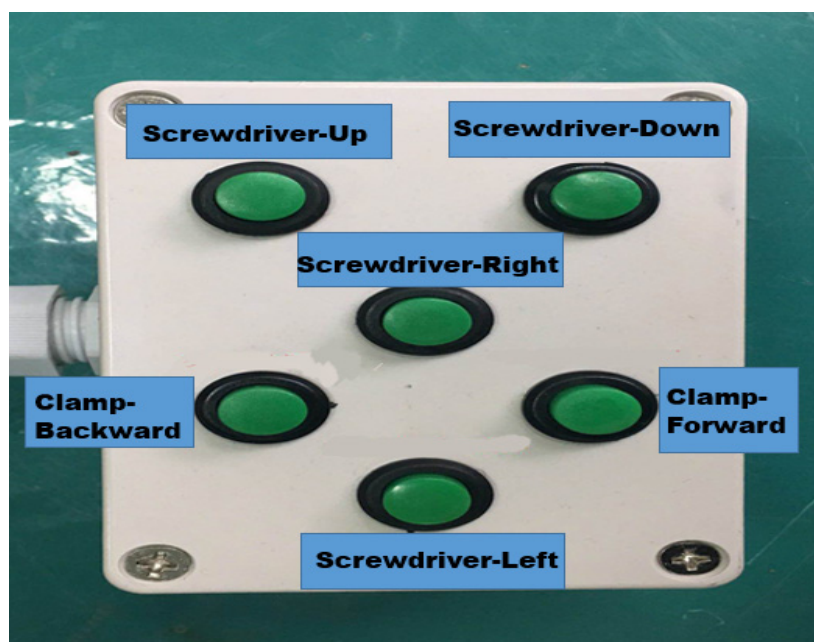


Figure 8. Hand held teaching pendant

4. Conclusion

The system adopts Panasonic fpxh-c60t PLC as the core of the control system to coordinate the action of the moving axis of each module. Combined with motor control technology and sensor technology, it realizes the control of the intelligent locking of Powr Strip Screw. The actual operation of the system shows that it can be widely used in the field of row, insertion and locking, and greatly improves the production efficiency.

Acknowledgments

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