



A NEW INTELLIGENT SHOE CABINET

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ABSTRACT

In order to solve the problem that traditional shoe cabinets require manual access, disorderly placement and untimely collation, an intelligent shoe cabinet is designed that can automatically put shoes in place and is also equipped with automatic shoe covers and automatic shoe polish functions. The shoe cabinet is mainly composed of

automatic shoe cover machine, shoe entry device, automatic shoe picking and placing device and automatic shoe polish device, and all the functions in the shoe cabinet can be realized by touch screen. Using SolidWorks software for 3D modeling and motion simulation, followed by Keyshot software for realistic rendering and animation production demonstration, the results show that the shoe cabinet can achieve automatic access to shoes.

KEYWORDS: An intelligent shoe cabinet; Automatically put shoes in place; Automatic shoe covers; Automatic shoe polish

0 INTRODUCTION

With the development of modern technology, people have higher and higher requirements for smart home and more and more prefer smart home products that are beneficial to body and mind.^[1] As a widely used furniture in daily life, shoe cabinets are mainly used for storing shoes, improving indoor hygiene and decorating home environment.^[2] Before that, Wang Chunyan and Duan Yiliang designed a smart shoe cabinet based on temperature sensors to achieve the care of people's shoes and increased attention to foot health.^[3] Wang Yilin, Wu Yufei, and Lv Li designed and researched an intelligent home shoe cabinet, which mainly addresses the problems of poor ventilation, humidity, large floor space, poor hygienic environmental conditions, and ambiguous shoe classification in shoe cabinets.^[4] Xue

Xinghu, Wang Fangyan and others designed a plug-in smart shoe cabinet based on low space utilization and low deodorization efficiency.^[5] Li Chanxia, Yin Xiaoli and others designed an intelligent shoe cabinet that can realize automatic identification drying and automatic transmission using electronic information technology as well as adaptive control technology.^[6] Bu Xuhui, Li Zhigang and others designed an intelligent shoe cabinet based on the rapid development of Internet of Things technology using ozone deodorization, drying dehumidification and anti-mold, and automatic shoe placement and retrieval.^[7] However, most of the smart shoe cabinets currently on the market are based on sterilization and disinfection functions. In this paper, we propose an intelligent shoe cabinet that can automatically put shoes in place and has the functions of automatic shoe cover and shoe polish. SolidWorks is used for 3D modeling and motion simulation, and then Keyshot is used for realistic rendering and animation production demonstration. The results show that the smart shoe cabinet can meet the needs of smart home products and has broad market prospects.

1 Structural Composition

1.1 General Design

The overall size of this intelligent shoe cabinet is (1520×500×1200) mm, mainly composed of touch screen, automatic shoe cover machine, shoe entry device, automatic shoe picking and placing device and shoe polish machine. The shoe entry device of the shoe cabinet, the outreach of the shoe polisher and the movement of the automatic shoe picking and putting device are realized by the stepping motor driving the screw drive mechanism; the automatic shoe cover machine is realized by the forward and reverse rotation of the stepping motor driving the slider movement to reach in and out. The overall and interior of the smart shoe cabinet is shown in Figure 1.



Figure 1: Overall and internal diagram.

1.2 Touch Screen

All the functions of the shoe cabinet can be manipulated through the touch screen to achieve, the touch screen mainly has four modules of shoe cover, sterilization and deodorization, automatic shoe picking and putting and shoe polishing, each module will have the corresponding function selection respectively, the user can operate according to the demand. When it is necessary to cover shoes, put shoes or polish shoes, click the corresponding module, and the automatic shoe cover machine, shoe entry device or shoe polish device will be extended by the stepping motor driving the screw drive mechanism. When you need to pick up shoes, click on the shoe pickup module, the interface will display the photos of existing shoes in the shoe cabinet, click on the corresponding photos of the shoes you need, and take them out for the user. The touch screen is shown in Figure 2.

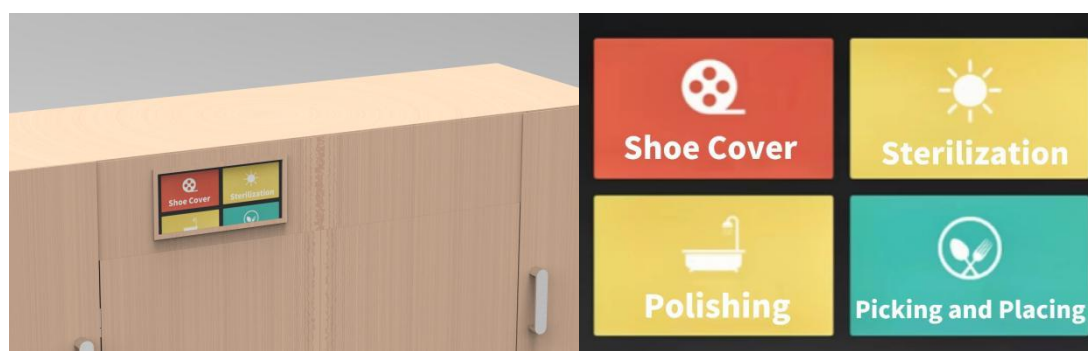


Figure 2: Touch Screen.

1.3 Automatic Shoe Covering Machine

The touch screen will control the shoe cover machine to extend, put your foot into the groove of the shoe cover machine, step down, and the shoe cover machine will put on the shoe cover for the user. The extension of the shoe cover machine is mainly achieved by the forward and reverse rotation of the stepper motor driving the slider movement. The automatic shoe cover machine is shown in Figure 3.



Figure 3: Automatic shoe cover machine.

1.4 Shoe Entry Device

The shoe entry device is used to load and unload the user's shoes. Through the touch screen to select the shoe release function module, control the stepping motor connected to the storage device rotate, drive the screw drive mechanism to make the device extend, when the infrared device detects the placed shoes, feedback to the control panel, start the motor, complete the storage. The shoe entry device is shown in Figure 4.

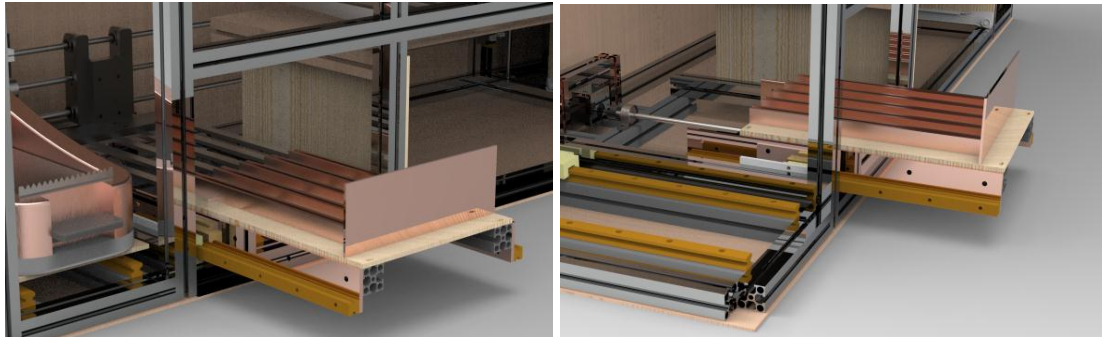


Figure 4: Shoe entry device.

1.5 Automatic Shoe Picking and Placing Device

The shoe plate and shoe tray of the automatic shoe picking and placing device are in the form of a tooth comb, which can cross fit and facilitate shoe picking and placing. The linear guide sliding table composed of light bar, screw and guide rail is driven by the motor to lift and move the shoe plate from side to side. The automatic shoe picking and placing device is shown in Figure 5.

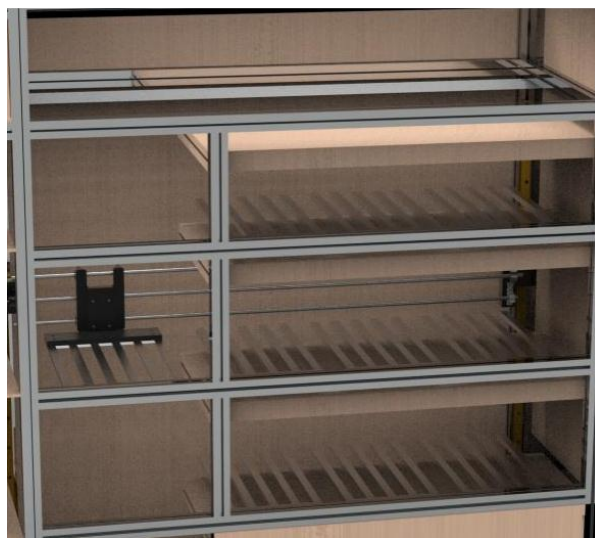


Figure 5: The automatic shoe picking and placing device.

1.6 Automatic Shoe Polish Device

The shoe polish device has a non-slip fixed panel inside, and consists of two cylindrical rollers in vertical direction and cylindrical rollers in horizontal direction to form the shoe polish device components. The shoe polish device as a whole is driven by a motor to reach out the screw. The automatic shoe polish device is shown in Figure 6.

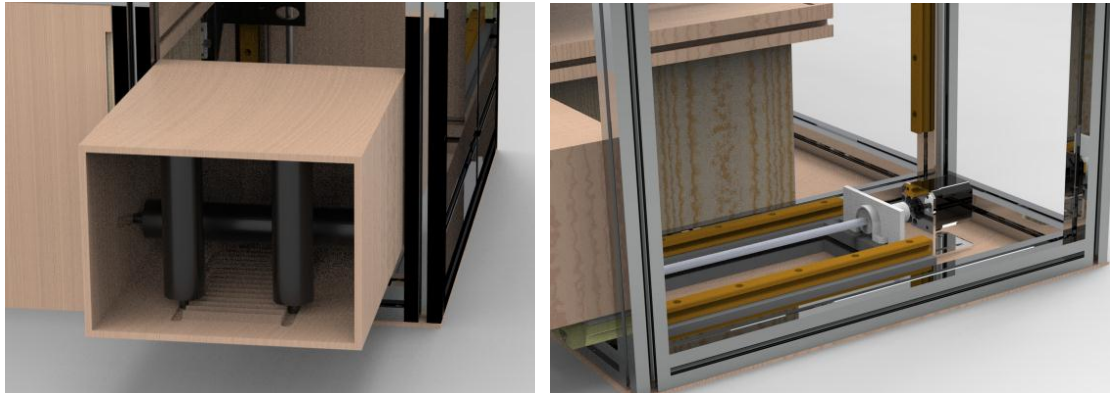


Figure 6: Automatic shoe polisher.

2 Function

Realize the automatic return of shoes to their place and free human hands. Select the shoe placement function module through the touch screen, control the rotation of the motor connected to the entry device, make the device extend, the infrared device detects the placed shoes, feedback to the control panel, manipulate the motor and complete the entry. After the sensing device on the shoe board detects that the shoe has been entered, it will find the vacant shoe position through the infrared device, transmit the position information to the controller, control the corresponding motor, and manipulate the linear guide sliding table composed of light bar, screw and guide rail to realize the up and down and horizontal movement of the shoe board of the tooth comb style to complete the shoe placement. When picking up shoes, the photo of shoes already in the shoe cabinet is displayed in the shoe pickup module on the touch screen, click on the shoe you need to wear, and the controller will send a signal to the motor to take out the shoe in the corresponding position. You can control the shoe cover machine through the touch screen, put your foot into the groove of the shoe cover machine, step down, and the shoe cover machine will put on the shoe cover for the guest.

3 CONCLUSION

The intelligent shoe cabinet designed in this paper is manipulated by the shoe module on the touch screen to drive the linear guide sliding table composed of light bar, screw and guide rail

to realize the up and down and horizontal movement of the shoe plate in the style of tooth comb, and finally complete the automatic return of shoes. When taking shoes, click on the corresponding photo of the desired shoe on the touch screen, and the shoe cabinet is automatically positioned inside and taken out through the linear guide sliding table. In addition, the automatic shoe cover machine and the automatic shoe polisher can reduce the time spent on shoe cover and polish in daily life. The intelligent shoe cabinet is designed to achieve the purpose of freeing hands and meet the needs of smart home, with a broad market prospect.

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