Design of intelligent trading bookcase based on new electronic control lock

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Abstract

In view of the lack of direct trading devices between students in the second-hand book market, an intelligent trading bookcase based on a new type of electronic control lock is proposed. The structure of the intelligent trading bookcase is designed in detail, and the hardware and control principle are introduced. Finally the physical system is verified with program written in C. All expected functions are working well on human-computer interaction window.

Key words： New electronic control lock, Intelligent trading, C Language, Human-computer interaction

1 Introduction

In recent years, with the price rising, teaching materials is more expensive than ever. Second-hand books are more and more popular among college students. Due to the expansion of university enrollment, the requirement of curriculum materials , especially second-hand books, is gradually increasing.

Most of old books, especially textbooks, are sold to second-hand bookstores or waste recycling malls. The second-hand bookstore is originally intended to recycle old books, but needs profits to support its shop expenses as a commercial store, so the second-hand books are bought at waste paper price, but sold out at discount of 30%-50% of the book price. At the same time, the majority part of second-hand books is teaching materials. The original books are rare. Those students can only buy more expensive new books. Thus it can be seen that the recycling rate of books in our country is low, and the original intention of saving money is slightly deviated under the background of commercialization.

In addition, this student-intermediary-student trading mechanism, makes the transaction of second-hand books blocked. Data shows that more than 50% of the new books have only been read once or twice and sent directly to the waste recycling bin, which has caused great waste of resources and environmental pollution. If there is a convenient way for students to trade send-hand books, it will greatly improve the utilization rate of second-hand books, so that the transaction of second-hand books

back to the nature of environmental welfare. Therefore, this product can provide a platform for students to trade freely and solve the related problems of second-hand book trading.

2 Structure design of trading bookcase

2.1 Scheme design

The ISBN code of second-hand book is obtained by scanning gun, and transmitted to PC end. The PC end acquires the book information through the Douban book API on internet, and displays it on screen. User controls the PC terminal to transmit commands to the Arduino development board through the human-computer interaction window of the display screen output, so to control the relay to power on/off the electromagnet and to enable the process of storing and selling books. The flow chart of the research scheme is as shown in Figure 1:

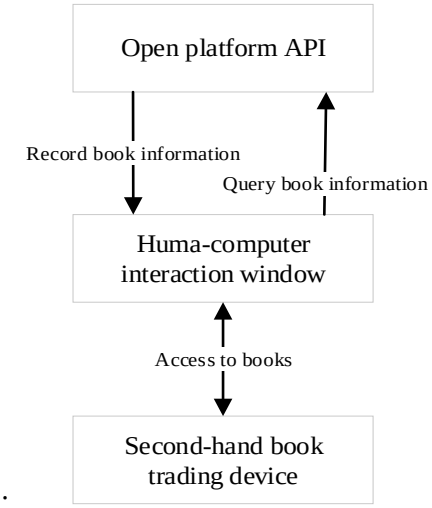

Figure 1 Flow chart of the research scheme

2.2 Structural design

The trading bookcase is mainly divided into four parts: the main device, the bookcase, the electronic control lock device and the display screen.

2.2.1. Main device

The main device is mainly divided into two parts, one is the display screen located above the trading platform, the display screen is connected with the aluminum profile bracket through the wall hanging bracket, and it is a 10-inch resistance touch display screen. Through the object-oriented programming, the books and the basic information of the books on the trading platform are intuitively reflected on the screen through the human-computer interaction window. A series of action, such as storing books and buying books, are done on this interactive interface. The second part is

divided into two plates, the front side is composed of eight separate small spaces, used for the storage of books in the bookcase, the rear side is used for the installation of relays and electromagnets and other hardware facilities, the bottom of the device is equipped with casters with brake pads to facilitate the placement of the device. After each module of the device is installed, it will be packaged and beautified with foam board on the outside of the frame structure. The overall structure of the trading bookcase is as shown in Figure 2.

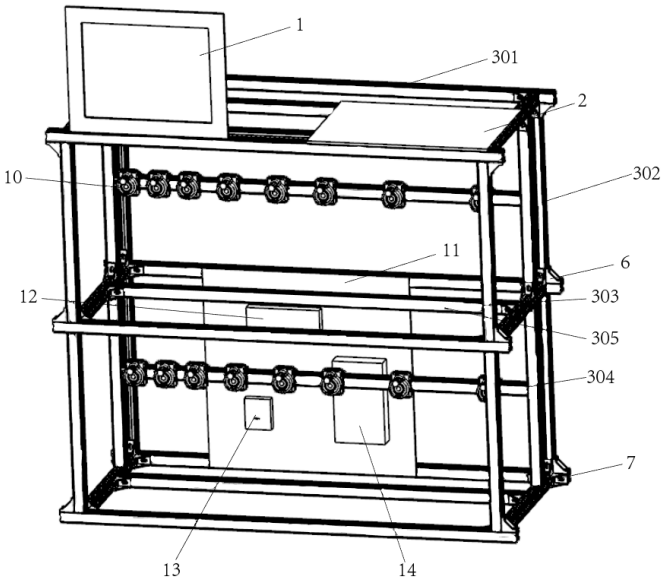

Figure 2 Diagram of the overall structure

2.2.2 Bookcase

A single bookcase consists of three parts: the inner bookcase, the outer book frame, and the upper and lower slide tracks.

The inner bookcase, which is used to store books in the shape of a hollow cuboid, is wrapped in an outer book frame, with an opening on one side, and the other five faces are surrounded by transparent plastic sheets. the specific parameters are as follows: 316 × 250 × 43 (unit: mm). The back of the inner bookcase is equipped with stainless steel iron sheet, and then the inner bookcase can be adsorbed by electromagnet. The outer side plate of the inner bookcase is smooth and flat, and the transparency is high. Books can be placed in from the side without transparent plastic sheets. The outer book frame is surrounded by four transparent plastic panels, showing a hollow cuboid, which is used to modularize the bookcase, once a single bookcase got malfunction, it is easy to replace and maintain; at the same time, it limits the movement of the inner bookcase in the direction of two degrees of freedom. The upper and lower slide tracks are fixed on the outside of the inner bookcase and on the inside of the outer bookcase, which reduce the elastic force required by the back bouncing out of the inner bookcase, and then reduces the running power of the

electromagnet and reduces the cost of use. The schematic diagram of the bookcase is as shown in Figure 3.

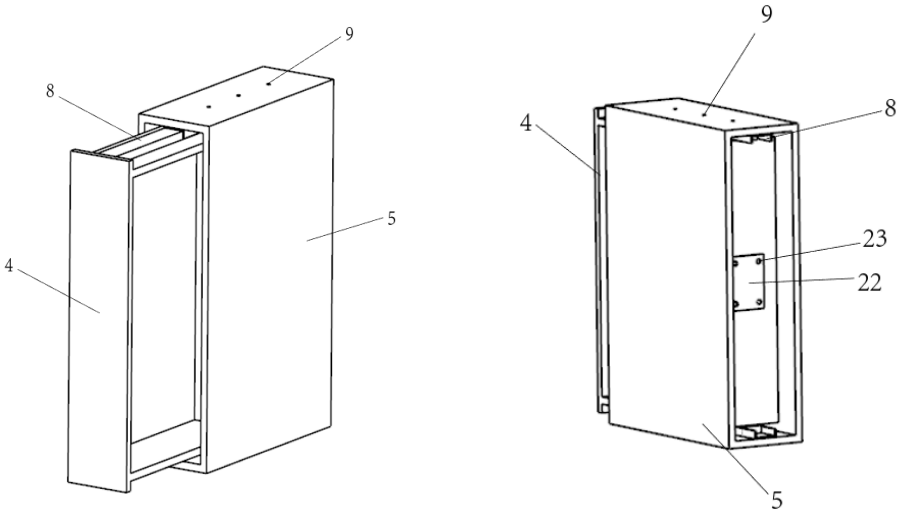

Figure 3 Schematic diagram of bookcase

2.2.3 Ejection adsorption device

The eject adsorption device includes an electromagnet, a spring and an electromagnet bracket. The electromagnet is placed through the main hole position of the electromagnet support, as shown in Fig. 4, and the electromagnet lead is drawn from the center hole below the electromagnet bracket. The spring is placed in the hole above the electromagnet. There is an empty cylindrical support inside the hole, and the inner part of the support can be inserted into the spring path guide rod. After the spring path guide rod passes through the electromagnet support, there is a part of semicircular groove, which can be matched with the clamping slot to limit the spring path guide rod to be ejected by spring elastic force. After the pop-up adsorption device is installed in each inner bookcase, the electromagnet will adsorb the stainless steel iron sheet on the back of the inner bookcase when the book is stored. When the transaction is completed, the corresponding bookcase will pop up under the action of spring, so as to obtain the books purchased.

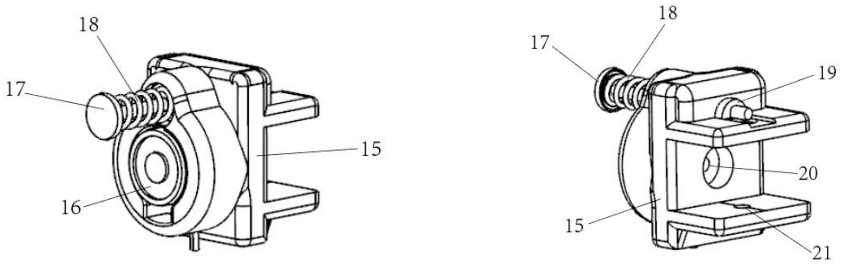

Figure 4 Diagram of new electronic control lock

3 Hardware and control principle

The hardware structure of the intelligent trading bookcase is shown in figure 2. Mainly includes: Arduino development board, relay, 12v switching power supply, PC terminal (not marked), display screen.

The PC terminal is used as the central control device, and the control program is composed in C language to control the switch of each electronic control lock.

The specific process is as follows: the user controls the form interface through the device, chooses to sell the book, the display form pop-up the book selling interface, the user scans the ISBN code behind the selling book through the scanner, the PC end queries the corresponding coding book by entering the bean flap API interface, invokes the book basic information, displays to the human-computer interaction window, after the user confirms the sale and sends the open bookcase electric signal to the Arduino development board through the human-computer interaction window, The relay module interrupts the power supply to the corresponding electromagnet, the inner bookcase rear iron sheet loses the attraction to its attraction is spring bounces open, at the same time the book information will be stored in the corresponding catalogue form interface, after completing the above operation, it will prompt to close the bookcase door and control the relay module's power supply license to the corresponding electromagnet through the internal program, at this time, the user is required to manually push the bookcase in until the electromagnet is in contact with the iron sheet, then the storage of book is done.

4 Experimental results

Trading bookcase can be easily disassembled, compressed and assembled.

When scanning the QR code behind the book with the scanning gun, the information of the book will be displayed in the human-computer interaction window. After the relevant instructions are given in the human-computer interaction window, the book can be saved and bought.In the test process of intelligent trading bookcase, each part works normally.

5 Conclusion

In this paper, the structure and control principle of the intelligent trading bookcase based on the new electronic control lock are introduced in detail. Through experiments, it is proved that books can be bought and sold in the way we designed. And it shows the intelligence of the trading bookcase through the human-computer interaction window, and shows the characteristics of stability, intelligence and efficiency in the testing process.

At present, there is a lack of way to trade between students and students in the second-hand book market. With the continuous growth of the number of college students, the demand for second-hand books is also gradually increasing, a better way of trading is extremely important. This intelligent trading bookcase has a wide range of application, valuable for research prospect. And it has good market value because of its low cost.

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