Design of Portable Intelligent Classification Cosmetic Cabinet Based on Image Processing

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(School of Mechanical and Automotive Engineering, Shanghai University of
Engineering Science, Shanghai, 201620)

Abstract

A portable intelligent classification cosmetic cabinet based on image processing is proposed. Firstly, the structure of this intelligent classification cosmetic cabinet is designed in detail. Subsequently, the hardware and control principle are introduced. Finally, the control program is written in Python language, and the physical verification is carried out. Experimental result proves that the cosmetic cabinet can perform the expected functions, and the intelligent control of the cosmetic cabinet is realized by voice control.

Keywords: intelligent classification, image processing, mobile phone app, voice control, Python language

1 Introduction

In China, the application of diversity of makeup is obvious. Make-up is no longer limited to the scope of artistic performance and has been extended to a wide range of fields such as commercial photography, film production, image endorsement of makeup products, and personal makeup artists of stars.

Makeup artists have become an emerging, fashionable general career in the 21st century. On the one hand, in the makeup process, there are many kinds of cosmetics, the volume is generally small, and the used cosmetics are not only unfavorable for searching but also more likely to be broken or even lost. Putting the cosmetics together in a mess is easy to breed mites which can cause skin damage and affect make up effect. Therefore, it is extremely important to safely classify cosmetic. On the other hand, make-up has been more than just a job that needs to be done indoors. The figures showed [1] that commonly used cosmetics often need to be carried around for the make-up artists work with the team of the TV series. Cosmetics also need to be carried around

when the photography company takes the wedding photos for couples outside in order to timely makeup modification. Therefore, the cosmetic cabinet should be more portable. In addition, the makeup process is tedious and takes a long time, so many people must take up a certain amount of time to get up early in the morning. If the cosmetics are sorted and placed in a simple and quick way, a lot of time can be saved.

With the development of the times, commercial photography, film and television production, and private makeup have become popular, but the portable cosmetic storage cabinets are blank in the market, which brings great inconvenience to professional makeup artists. Therefore, the design of this product can solve the corresponding problem.

2 Structure design of the cosmetic cabinet

2.1 Scheme design

The main purpose of the cosmetic cabinet is to realize intelligent automatic classification and storage. Firstly, the camera automatically scans the QR code on the cosmetics, then the main board recognizes the storage area where it is located and controls the servo to rotate to the corresponding area in order to make the cosmetics fall into the correct area. The main part of the cosmetic cabinet can be disassembled and compressed, which is convenient to carry, place or carry separately as needed. At the same time, the function of remote control of the cosmetic cabinet can be realized by rotating the storage area to the corresponding area with voice control. The flow chart of the research program is as shown in Fig. 1.
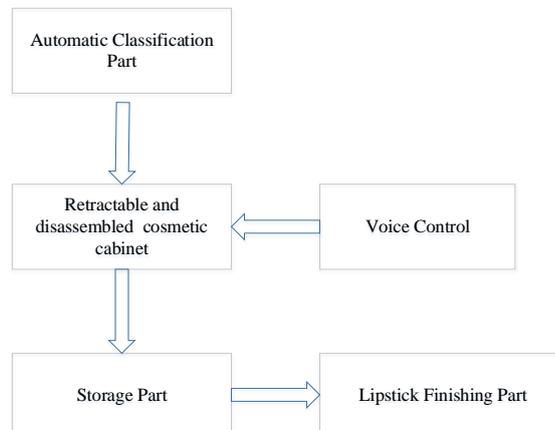
Fig.1.   Flow chart diagram

2.2 Design of the cosmetic cabinet

The cosmetic cabinet is mainly divided into five parts including main body part, storage part, automatic classification part, lipstick finishing part and voice control part.

2.2.1. Main body of Cosmetic cabinet

The main body of the cosmetic cabinet is mainly made of aluminum and acrylic materials. The size of the cosmetic cabinet is about 60*30*30 cm. Each layer can be longitudinally contracted by adjusting the elasticity of the right-angled fixture on the bracket in order to minimize the volume of the cosmetic cabinet when carrying. It allows for easy assembly, disassembly and carry by splitting into multiple cabinets[2-4]. Diagram of main body of cosmetic cabinet is as shown in Fig. 2.

Fig. 2. Diagram of main body of cosmetic cabinet

2.2.2 Storage part

The storage part is divided into three layers, each of which is a disc of three-quarters of a height of 10 cm and a radius of 5 cm. The cushioning material is used in the storage area.

The disc is evenly divided into three areas, which are used to place items to realize the classification function; the remaining part gives space for the falling of the items and taking the items. There is a certain slope at the bottom to prevent the cosmetics from accumulating in the falling area.

The movement of the external servo is transmitted to the rotating shaft at the center of the disc through the gear structure. The disc can complete the rotation of the fixed angle. The structure is as shown in Figure 3.
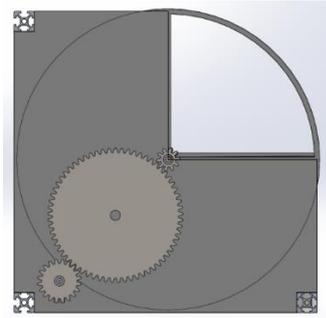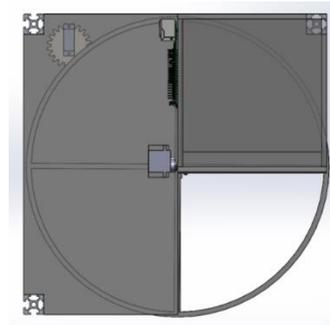
Fig.3. Storage part structure   Fig.4. Automatic

classification part structure

2.2.3 Automatic classification part

The automatic classification part of the cosmetic cabinet is about 10*15*15cm in size. A baffle is provided to control the falling speed of the item with a slope. It can give enough time to scan the QR code with the camera and the analysis of the QR code image by the main board [5,6]. Then the main board controls the disc to rotate the corresponding angle to open the baffle, so that the cosmetics can fall to the corresponding area, to achieve automatic classification. The structure of automatic classification part is as shown in Fig. 4.

2.2.4 Lipstick finishing part

One layer of the storage part is subdivided into multiple classification areas to realize the function of lipstick finishing according to the general color number or the brand. It can be realized by reducing the rotating angle of the servo so that the lipstick is placed neatly, which reduces the time looking for the lipstick of the desired brand or color in the mess drawer.

2.2.5 Voice control part

The voice control part is connected with the mobile phone through the blue tooth module. The voice control is performed by touching the virtual button in the mobile phone app or by directly speaking the command. For instance，By speaking the number of the cabinet required to be opened, the disk can be remotely controlled to rotate a certain angle to open the cabinet, so that we can access the item in advance.

3 Hardware and control principle

The hardware structure diagram is as shown in Fig. 5. It mainly includes:

Raspberry Pi 3b+, connecting rod, servo, detection box, baffle, bottom plate, turntable, gear and COMS camera.
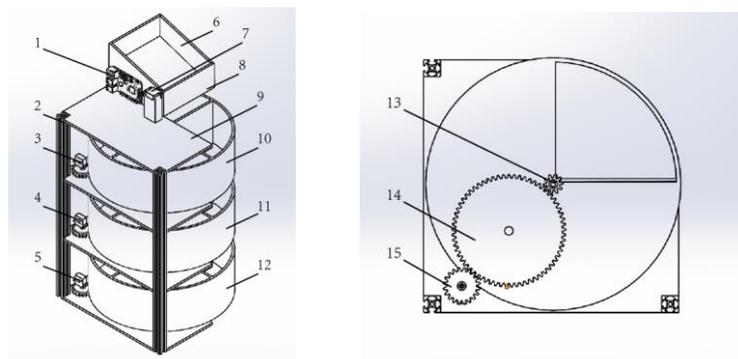
1- Raspberry Pi 3b+; 2-Connecting rod; 3-Servo 1; 4- Servo 2; 5-Servo 3; 6-Detection box; 7-Servo 4; 8-Baffle; 9-Support plate; 10-Storage plate 1; 11-Storage plate 2;12-Turntable 3; 13-Pinion; 14-Large gear; 15-Middle gear.

Fig.5. Hardware structure of the cosmetic cabinet

The Raspberry Pi 3B+ [7] is used as a central control device to write control programs in Python language to control the rotation of the servos at each layer.

The specific process is as follows: the cosmetics to be detected are placed in the automatic classification part 6, the cosmetics are slid, and the COMS camera collects the QR code information attached to the cosmetics, and the main control board converts the voltage value into a pixel value through one ADC [8,9]. The QR code image is subjected to simple filtering and binarization processing, then the image is linearly scaled to obtain a QR code bit stream. The obtained bit stream is decoded according to the QR code encoding standard. The main control board recognizes the storage position where the cosmetic is located according to the information obtained by the decoding, and the program controls the servo of the corresponding layer to rotate at a certain angle. The corresponding storage position is rotated to the right-angled gap by the cooperation between the large gear, the middle gear and the pinion. At the same time, the upper layer of the corresponding layer is rotated to the gap position if it is not located at the right-angled gap position to ensure the smooth sliding of the cosmetic. The baffle which is originally in the closed state passes through the servo. After being rotated, it is turned into an open state, and the cosmetics slide out from the automatic classification part and fall in the rotated storage position.

The voice is input through the mobile phone blue tooth transmission or the cabinet voice control module. When the mobile phone app or the voice control part recognizes the corresponding instruction, the signal is sent to the main board. After the main board processes the information, the corresponding layer servo is controlled to rotate the corresponding storage position to the right-angled gap.

4 Experimental results

The cosmetic cabinet can be easily disassembled, compressed and assembled.

Put the prepared cosmetics on different types of QR codes, then put them into the automatic classification part. After the camera finishes recognizing, the servos work to control the baffle automatically open and the cosmetics fall into the corresponding storage area. Speak the corresponding command or click the corresponding position virtual button, the storage part is automatically rotated to the corresponding position.

During the testing, all parts of the portable intelligent cosmetic cabinet are worked normally.

5 Conclusion

In this paper, the structure and control principle of the intelligent classification cosmetic cabinet based on image processing are introduced in detail. The experiment can demonstrate that it can accurately and efficiently store cosmetics and can realize the intelligence of the cosmetic cabinet through voice control. It has been characterized by stability, intelligence and efficiency during the testing process.

At present, the intelligent classification cosmetic cabinet on the market belongs to the blank field. The intelligent classification function of the cabinet can be more than just for makeup but other fields. It has broad application, research prospects and market value.

References

1. Liu Li. Research on the cultivation of professional talents in art colleges and universities [D], Shandong: Shandong Normal University, 2017.

2. Qinghua Liang, Huijun Zou, Jinqiu Mo. Interesting Institutions [M]. Beijing: Mechanical Industry Press, 2013

3. Lianggui Yan, Guoding Chen, Liyan Wu. Mechanical Design (9th Edition) [M], Beijing: Higher Education Press, 2013.

4. Lin Wei, Xiaohong Li. Mechanical Structure Analysis and Design [M]. Beijing: Beijing Institute of Technology Press, 2009.

5. Chuan Liu. Research on QR code recognition algorithm based on mobile phone camera scanning [D]. Chongqing: Chongqing University, 2014.

6. Qingqing Long. Research on Android smartphone guide system based on QR code recognition[D]. Zhejiang：China Jiliang University, 2013.

7. Dandan Zhou, Jing Yang, Nan Ren. Acquisition of QR code information based on Raspberry Pi [J]. Electronic Technology & Software Engineering, 2017(8): 213-214.

8. Jichang Huang, Baoping Cheng, Zhuqing Zhang, et al. 210 Cases of Sensor Detection and Control IC Applications [M], 2012.

9. Zhengyi Wang, Wei Wang, Yanqi Wu. Principles and Applications of Electromechanical Systems Control [M]. Beijing: Beijing Institute of Technology Press, 2012.