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Design of Smart Phone Organizer based on OpenMV

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Abstract: *Inappropriate use of cell phones can affect the normal order of the lecture, and reasonable control of cell phone use in the classroom can improve students' learning efficiency. This project designs a cell phone smart organizer with a circumferential distribution structure. It uses a special crank slider mechanism to make the cell phone in the organizer only perform the circumferential translational movement, preventing collision damage to the cell phone. Arduino is used for control, and the servo drives the crank rotation. Based on the OpenMV module, the cell phone can be accessed through face recognition, which enhances the security and operability of the organizer. At the same time, with the LCD, the face recognition result is dynamically displayed, which is convenient for human-computer interaction.*

Keywords: *Cell phones, organizers, face recognition OpenMV*

1. Introduction

1.1. Origin of the topic

Cell phone as a popular mobile network terminal has brought great convenience to our life, but at the same time, the unreasonable use of cell phone has also brought many problems. For example, in classrooms, libraries, and other public learning places, the phenomenon of students playing with cell phones is very serious, leading to inefficient learning and even interfering with the normal teaching order. Reasonable control of cell phone use in classroom scenes can improve students' learning efficiency in the classroom, so the topic of smart phone organizers is proposed.

1.2. Research background

The improper use of cell phones by students in colleges and universities reduces the efficiency of students' classroom learning and interferes with the normal teaching order, which has drawn the attention of college administrators. In recent years, some colleges and universities have been promoting cell phone storage bags, which is a countermeasure against the phenomenon of improper use of cell phones. For example, in Nanjing Jiaotong Vocational Technology College, there are cell phone storage bags hanging in each classroom, and each bag is numbered and fixed on the wall. Before class, students set their cell phones on silent or off and put them into the bags. The unified cell phone storage management has enabled students to stay away from the temptation and influence of cell phones and concentrate on their lessons. In the past two years, cell phone storage management has been basically accepted by the students, and the phenomenon of "head-down" students in class has been basically eliminated. Moreover, students' attendance in class has improved, and classroom order has been well improved, but this move has drawn more questions from students about safety. With the increasing level of intelligence, the development of artificial intelligence technology, sensor technology, and multimodal fusion technology, technology is changing our way of life and making machines more intelligent. For example, the smartphone storage cabinet based on fingerprint recognition technology uses a fingerprint recognition module to read fingerprint information. By comparing someone's fingerprint with the pre-saved fingerprint of that person, the real identity can be verified. Compared to the storage bag, the introduction of fingerprint recognition technology improves the convenience and security of cell phone access.

Currently, face recognition and fingerprint recognition are the two main technologies of biometric identification. Compared with fingerprint recognition technology, face recognition can complete the recognition process without touching, which is extremely important in the era of pandemics and has higher security. Therefore, this project proposes a cell phone smart organizer based on face recognition technology.

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2. Program design

2.1. Structural design

The cell phone smart storage cabinet has six circumferentially distributed storage boxes, each box has a crank slider mechanism, the slider's guide is circular, the circle center of the circumferentially distributed crank does not coincide with the circle center of the circular guide, and the offset distance is equal to the length of the connecting rod. When the crank rotates, the organizer only performs the circular translational movement, preventing the internal cell phone from colliding and falling during the movement and effectively protecting the cell phone. The cell phone smart organizer adopts a high-torque servo as the power source, which is driven by a synchronous belt transmission and directly drives the crank for rotation. The organizer has only one cell phone access opening. When the camera recognizes the corresponding face information, the crank will be driven to rotate and send the organizer to the cell phone access opening, allowing the user to access the cell phone.

2.2. Hardware design

The designed cell phone smart organizer is driven by a high torque servo and controlled by Arduino. The OpenMV module realizes the face recognition, and the organizer has an LCD for easy information human-computer interaction.

2.2.1 High torque servo

Due to the high torque required to drive the cell phone smart organizer, a high-torque servo was selected through circuit knowledge to facilitate position control. The rotation angle of the high-torque motor can be easily controlled using the Servo library of Arduino to control the rotation of the specified organizer to the cell phone access port.

2.2.2 OpenMV module

As shown in Figure 1, the OpenMV camera is a small, low-power, low-cost board. It uses a standard M12 lens, which can be changed to a different focal length. Also, it comes with a MicroPython interpreter, which allows you to program in Python on the embedded (Python 3 to be precise). Python makes programming machine vision algorithms much easier.

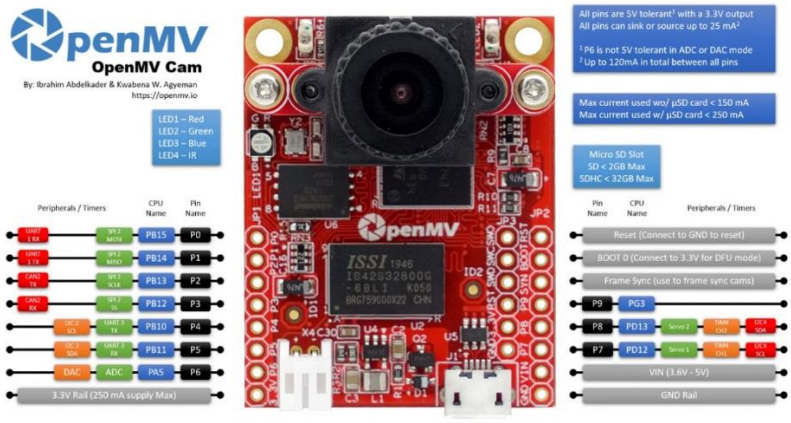

Figure 1: OpenMV module

Face detection works by using the Haar Cascade feature detector on the image. Haar cascade is a series of simple region comparison checks. For the built-in front surface detector, there are 25 stages of inspection, with hundreds of inspection pieces per stage. Face recognition is performed with LBP features, and the files are in PGM format and can be easily viewed using the "xv" program.

2.2.3 LCD display

As shown in Figure 5, the LCD display uses a 1.8-inch 128×160 16-bpp (RGB565) TFT LCD display module with a controllable backlight, which can be controlled using the OpenMV firmware's built-in LCD library.

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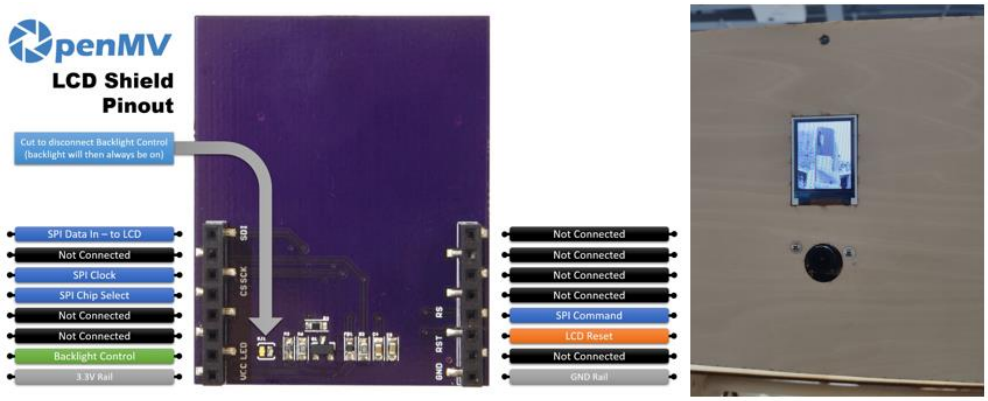

Figure 2: LCD display

In the mobile smart access locker application, the LCD display can mark the recognition to a human face in addition to displaying the image taken by the OpenMV camera.

2.3. Software design

The software design mainly includes the following functions:

(1) Real-time face detection, detecting whether a human face appears in the image taken from the camera

(2) Identify the face. When the face is detected, distinguish the different faces.

(3) Send the recognized face serial number to Arduino and drive the servo to the specified position to finish accessing the phone.

(4) Reset. When the phone is accessed, reset the phone smart storage cabinet, and wait for the next phone access

2.4. Finished product display

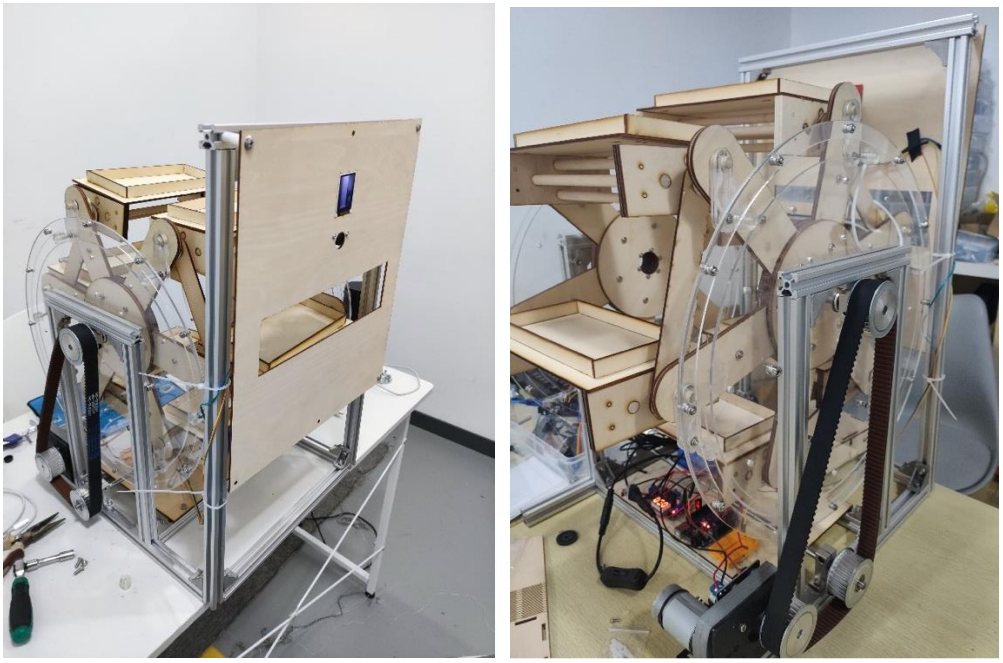

Figure 3: Mobile phone intelligent access cabinet overall appearance

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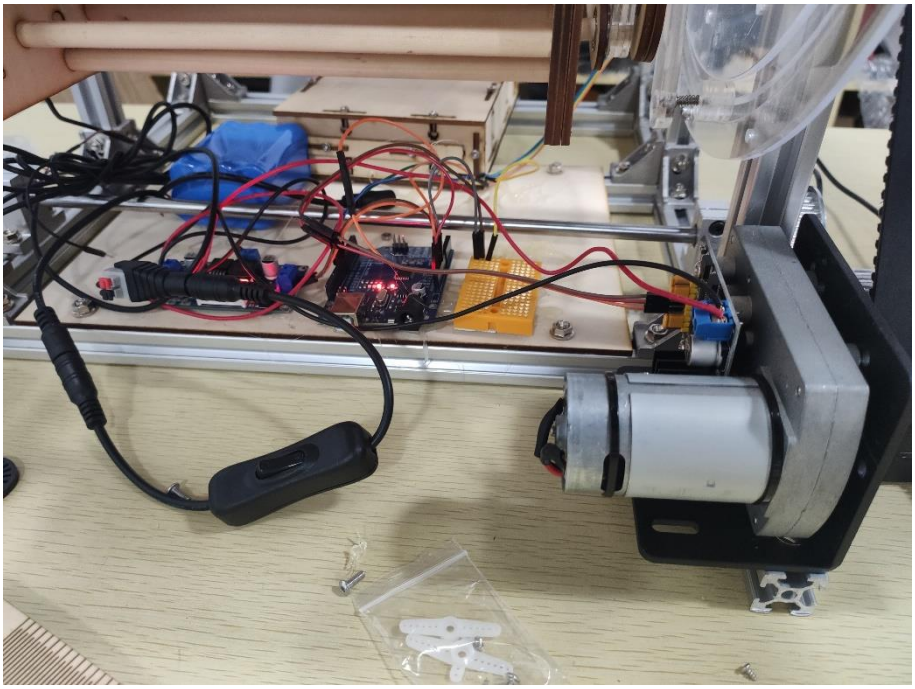

Figure 4: Power supply, Arduino control board, high torque servo installation

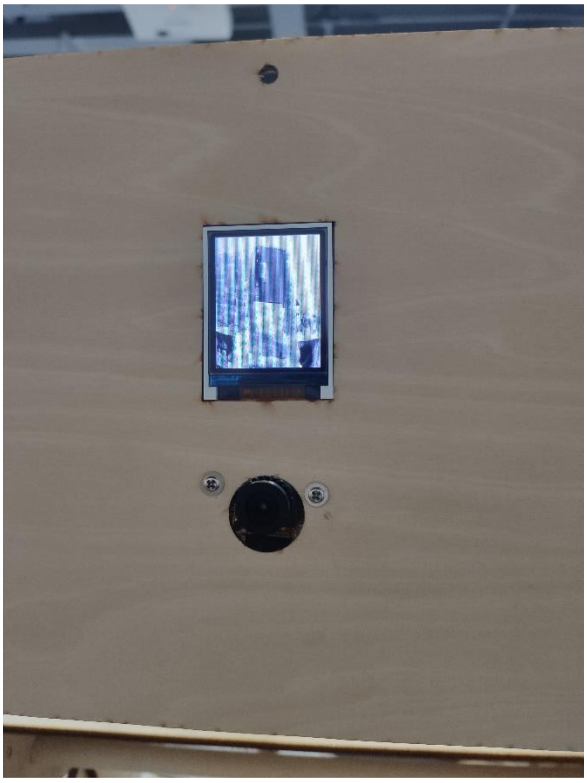

Figure 5: LCD screen display

3. Conclusion

A cell phone smart organizer based on face recognition technology is completed. Compared with existing cell phone storage methods, the cell phone organizer has easy operability and high security and can be applied to classroom student cell phone control.

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4. Creative expression

(1) Design a special crank slider mechanism, which makes the cell phone organizer always keep level during the crank rotation, avoiding the collision damage of the cell phone.

(2) Compared with the traditional organizer with a single phone access port, it can avoid theft of cell phones and improve security.

(3) Compared with the organizer based on fingerprint recognition technology, the face recognition can complete the recognition process without touching, which has higher security and convenience.

5. Deficiencies and prospects in the design

(1) The accuracy rate of face recognition is not high, and the accuracy of the face category will be improved by applying a new face recognition algorithm in the future.

(2) The number of storing cell phones is limited, and the future can increase the capacity of cell phone storage by increasing the number of crank slider mechanisms.

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