Design and Implementation of Face Recognition Access Control System for University Laboratory Based on Artificial Intelligence Technology

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Abstract

Artificial intelligence is a branch of computer science. In recent years, artificial intelligence technology has developed rapidly and has become an independent discipline. The education industry is constantly updated with the development of the times, and artificial intelligence is an important technology for innovation in the education industry. Nowadays, image processing technology is gradually mature, and face recognition access control has also become a technology often used in people's lives. Combining artificial intelligence technology, face recognition technology, and laboratory access control system to obtain students' face information from the university student database, upload them to data control in batches, and let students use smart devices to reserve the laboratory, swipe their faces to enter the door, and send The attendance record is entered into the educational administration system. In this paper, an artificial intelligence-based face recognition access control system for university laboratories is constructed to realize the intelligent management of university laboratories.

Keywords-Artificial intelligence; laboratory; face recognition; system design

1. INTRODUCTION

Experimental teaching is an important part of teaching in colleges and universities. Through experiments, students can strengthen their understanding of theoretical knowledge and improve their practical ability. In colleges and universities, the planning of experimental teaching has always been an important issue. The limitation of objective conditions such as insufficient number of laboratories in colleges and universities, limited experimental equipment, and imperfect laboratory management make it difficult to guarantee the duration of students' experiments. Even though some colleges and universities have sufficient objective conditions and can be freely opened to students, laboratory management is still very difficult. The management work is cumbersome and error-prone, which results in a large loss of laboratory equipment and cannot guarantee the safety of equipment in the laboratory and the experimental efficiency of students. . With the increase of university funds, the national government has higher requirements for students' experimental ability. Open laboratories are the future development trend of universities. Therefore, the development of laboratory management in the direction of intelligence is inevitable. Compared with access control methods such as fingerprint recognition and password management, the use of face recognition to manage the laboratory is safer and more hygienic. The face recognition system has low hardware requirements. The traditional recognition system needs to rely on professional physical equipment, while the face recognition system only needs a camera to obtain the face image, and the face recognition process can be done in a computer professional system. Finish. Nowadays, face recognition technology has become a common recognition technology in people's lives.

2. ARTIFICIAL INTELLIGENCE

With the development of modern society, information technology is becoming more and more popular. From various international conferences, to all aspects of our lives, artificial intelligence technology has participated. Since the 1950s, the emergence of artificial intelligence has aroused great repercussions [1]. Up to now, artificial intelligence has developed for more than 60 years. During these years, artificial intelligence

has achieved many achievements and brought huge contribute [2]. The scientific community today generally defines artificial intelligence as a system that can correctly interpret external data, learn from this data, and use this learning to improve the ability to achieve specific goals and tasks through flexible adaptation. The biggest difference between artificial intelligence systems and ordinary systems is that artificial intelligence systems can continuously improve through learning [3]. In an artificial intelligence system, developers will reinforce learning through programming, and artificial intelligence can be continuously updated in logical reasoning.

3. SENSOR TECHNOLOGY AND FACE RECOGNITION

A sensor is a detection device that can sense the relevant information of the detected object, convert the detected information into electrical signals, and transmit them to the system [4]. Electrical signals can transmit, process, store and control information. According to the principle of the sensor, the sensor can be divided into physical sensor and chemical sensor [5]. Commonly used physical sensors include thermal sensors, light sensors, acoustic sensors, electrical sensors, ray sensors, magnetic sensors and so on. Commonly used chemical sensors include ion sensors, humidity sensors, gas sensors, biosensors and so on [6]. The technical indicators of the sensor are divided into static characteristics and dynamic characteristics. The static feature refers to the corresponding relationship between the input signal and the output when the measured object is in a steady state, excluding time variables. Static characteristics can be represented by an agenda without time variables or a two-dimensional characteristic curve. The dynamic characteristic is that the signal corresponding to the sensor input will change with time [7].

Face recognition technology is also a kind of sensor. It is a kind of biometric recognition technology based on human facial feature information. Although it is biometric technology, in fact, face recognition is not a chemical sensor, but a physical sensor [8]. Face recognition uses cameras or cameras to collect images or video streams containing faces, and automatically detects and tracks faces in the images, and then performs face recognition on the detected faces [9]. The recognition process of face recognition technology is to first store the user's face information as a comparison sample into the system. When the user performs face recognition, the photos generally have noise, the brightness of the image may be uneven or the edges are not clear, so To preprocess the image. The improved image clarity after preprocessing can improve the accuracy of face recognition [10]. After image preprocessing, grayscale the image, analyze the pixels

of the image, capture the basic structure of the user's face in the image, and then use the facial feature point estimation algorithm to find 68 feature points on the face, and compare these feature points with the face samples. corresponding.
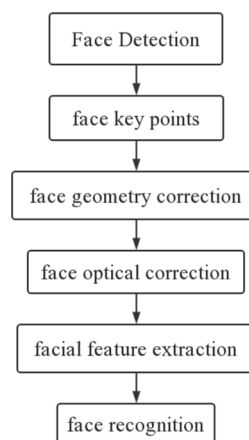

Figure 1. Face recognition process

4. USER MANAGEMENT OF FACE RECOGNITION LABORATORY MANAGEMENT SYSTEM

In the laboratory management system, teachers and students should be provided with different user roles, and the functions they can use are different [11]. At the same time, the administrator user should be added. The administrator can transfer the images of the students to the database, and manage and modify the personal information of the students. Student users can manage personal information in the system, log in and modify passwords, inquire about laboratory usage, obtain experimental data, reserve experiments, and view reservation records.
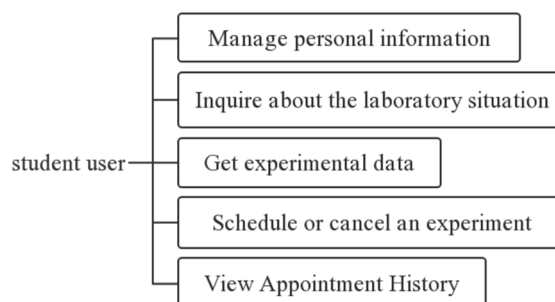

Figure 2. Example of student user

Teacher users can modify personal information and passwords, manage experimental materials, view and modify experimental reservation records, reserve laboratories, and view laboratory videos.
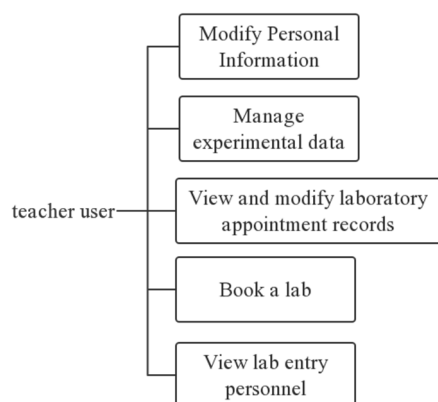
Figure 3. Teacher user example diagram

5. IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE-BASED FACE RECOGNITION LABORATORY ACCESS CONTROL SYSTEM

The system uses the face recognition algorithms of DotNet and SQLserver, which are widely used today [12]. This algorithm can capture student images through the camera and transmit the image data to the database for corresponding recognition. The administrator transfers the images of the students in the educational administration system into the face recognition database through the educational administration system to provide comparative samples for face recognition. Due to the large number of students in colleges and universities, the student ID should be used as the student's unique ID, the student ID should be mapped to the student's image, and the student ID should be set as the primary key in the face database, so that the image name has a certain data structure.

After the student's face feature information is saved to the face recognition database, the system will use the camera device to take real-time photos of the students standing at the door, obtain the student's face image, and search the image information with the feature data in the database to find the similarity tallest face.

When searching the face information of students, key parameters can be selected for searching. The system obtains faces with a similarity of more than 90% in the comparison results, and records the corresponding user name and the time of entering the laboratory into the access control system. After searching for the corresponding face, the system will show that it has passed the authentication.

In the process of face recognition, there will be recognition errors. When the system finds that the image is not good, it will discard the image, and generate a form, send the form to the administrator, and prompt the administrator to re-collect the student's face image. , and manually transfer the student image to the face database. After the administrator uploads it multiple times, the artificial intelligence technology will make improvements based on the points that often make mistakes in image recognition, significantly improving the efficiency of recognition and shortening the time of recognition.
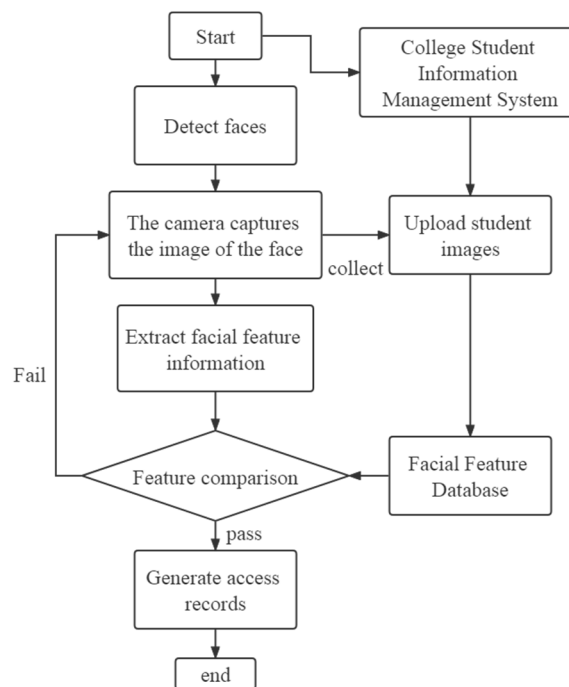

Figure 4. System flow chart

6. SYSTEM TEST EXPERIMENT

This research uses the face recognition system to conduct 10 sets of experiments. Each set of experiments will change the tester's face posture, such as changing expressions, face angles, lighting effects, etc. make a judgment. The system judges faces with a face matching degree of more than 90% as reliable.

TABLE I.   COMMON FACTOR VARIANCE

Experiment number	face match	Number of misidentifications	pass
1	71.5%	0	
2	93.2%	1	✓
3	98.1%	0	✓
4	94.6%	0	✓
5	63.1%	1	
6	91.3%	0	✓
7	59.3%	1	
8	71.2%	0	
9	94.0%	1	✓
10	47.8%	0	

There are still some deficiencies in the practical application of this system. In the process of identification, there are still identification errors, which need to be further improved and adjusted.

7. CONCLUSION

This paper attempts to build a laboratory access control system through the application of face recognition technology and artificial intelligence technology. The face recognition method used in this system has strong practicability, convenient recognition, and relatively mature technology, which simplifies the management process of the laboratory and improves the efficiency of the laboratory. Next, the system should be further improved until it can be applied to actual use.

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