Application and Management of College Epidemic Prevention and Control Information Platform Based on Face Recognition and Temperature Measurement Technology

Xiuru Jian[1,a,*], Xiutong Jian[2], Yanjiao Wei[2], Ziyue Liu[1], Xiaolong Wang[3]

[1]*Beijing Polytechnic, Beijing, 100176, China*
[2]*Beijing University of Posts and Telecommunications, Beijing, 100876, China*
[3]*Zitiao Network Technology Co., Ltd, Beijing, 100089, China*
[a]*jzm7897@163.com*
[*]*Corresponding author*

Abstract: With the development of science and technology, computer science is becoming more and more mature and plays an important role in social life and economic development. Based on this background, an epidemic prevention and control information platform for universities based on face recognition technology and temperature technology has been created. The system can realize real-time monitoring of students' identity verification, ID card numbers and internal school item files, it can also effectively detect the body temperature of teachers and students, and make timely early warning suggestions to relevant departments based on the detection results, which provides effective data support as well as technical guarantee in public security work. At the same time, it uses embedded computer technology to realize the interaction of data between each link in the epidemic prevention work and the database, which is convenient for the staff to grasp the relevant data information and dynamic changes in a timely manner, thus providing effective guarantee measures for the management of universities. This paper introduces the information platform of university epidemic prevention and control based on face recognition and temperature recognition technology, and designs and implements the study of the system.

Keywords: Face recognition, Temperature measurement technology, Information platform for epidemic prevention and control in colleges and universities

1. Introduction

With the development of science and technology, the global economy is becoming more and more closely connected, and the demand for information is increasing. Many new technologies have been created to meet the trend of the times and to meet the needs of human production and life [1]. Among them, face recognition as a method of identification has been widely applied to various fields and has achieved good results. At present, the epidemic prevention and control work in colleges and universities mainly realizes real-time monitoring of virus by means of epidemic intelligence collection and image processing, and combines with image recognition technology to realize dynamic tracking of epidemic information, so as to realize effective prevention and control of epidemic, which provides effective guarantee for epidemic prevention and control work in colleges and universities [2,3].

Face recognition technology is a new type of information security technology, and its main role in the prevention and control of epidemic in colleges and universities is to transform the collected picture information into image information with multimedia characteristics such as video and audio through image processing, feature extraction and classification, and then transmit it to the back-end processors to achieve effective monitoring and management of the epidemic. Temperature measurement technology is a kind of technology to collect the temperature of students in school through temperature measurement equipment [4]. The working principle of temperature measurement equipment is to measure the human body temperature by using infrared forehead thermometer, infrared thermal camera and body temperature remote sensing technology according to different environment and temperature. The application of these two technologies to the information platform of university epidemic prevention and control can improve the level and efficiency of epidemic prevention and control to a

great extent, which effectively solves the drawbacks brought by traditional manual management [5].

2. Open CV-based Face Recognition Technology

2.1. Face Recognition Process

The face recognition process is to analyze and process the image and transform it into the corresponding text, and finally output it to the user. In this system, a matching algorithm based approach is used to realize the recognition. A model is built based on parameters such as image feature points and information required for the corresponding target object, and then a template is used to learn some data to determine whether the relationship between all elements in the target area is correct, and also to interact with the computer through face recognition technology, so as to obtain an effective and accurate amount of data, and finally the The results can be returned to the user or the system to prevent and control the outbreak [6]. The face recognition method is shown in Figure 1.
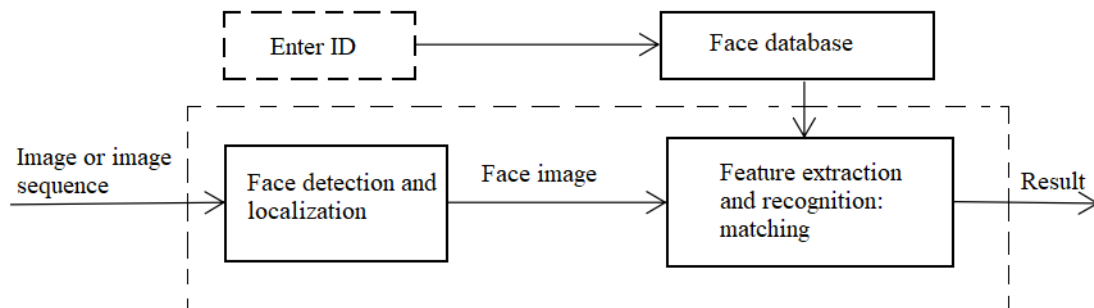

Figure 1: Face recognition method

2.2. Face Recognition Technology Based on Open CV

OpenCV technology is a computer-based face recognition software, the system can be used to detect various epidemics in colleges and universities, for example:through video, pictures and other ways to obtain images. In this process, some high-tech means need to be used, such as using cell phones or computers with cameras installed on them to collect data, or placing cameras directly in the human radiation area to collect intelligence information and analyze and process it, and then transmit it back to the monitoring host [7]. Or GPS positioning technology is used to obtain information related to personnel inside the university as well as documents and image data uploaded with external communication platforms, which can make it easier to manage the epidemic in the university [8].

For Open CV-based face recognition, first set the sample mean of class i as shown in Equation (1).

$$u_i = \frac{1}{ni} \sum_{x \in classi} x \tag{1}$$

The overall sample mean is shown in Equation (2).

$$u = \frac{1}{m} \sum_{i=1} x_i \tag{2}$$

Based on the inter-class dispersion matrix and intra-class dispersion matrix, the calculation is shown in equations (3) and (4).

$$S_b = \sum_{i=1}^{c} n_i (u_i - u)(u_i - u) \tag{3}$$

$$S_w = \sum_{i=1}^{c} \sum_{x \in classi}^{c} (u_i - x_k)(u_i - x_k) \tag{4}$$

In addition, there is another expression of inter-class dispersion matrix and intra-class dispersion

matrix, such as Equation (5) and Equation (6).

$$S_b = \sum_{i=I}^{c} p(i)(u_i - u)(u_i - u)^T \tag{5}$$

$$S_w = \sum_{i=1}^{c} \frac{p(i)}{n_i} \sum_{x \in classi}^{c} (u_i - x_k)(u_i - x_k)^T$$

$$= \sum_{i=1}^{c} p(i)E\{(u_i - x)(u_i - x_k)^T \mid x \in classi\} \tag{6}$$

According to the above description, the calculation of dispersion matrix and intra-class dispersion matrix can get the information of face recognition. Using this technology, the monitoring of epidemic in universities can be carried out from a systematic perspective, which improves the management efficiency and provides an important reference value for public sectors such as schools and governments.

3. Temperature Technology

3.1. Infrared Forehead Thermometer

Infrared forehead thermometer is one of the most commonly used temperature measuring instruments and one of the most used detectors at present. It works by comparing the temperature of the target with the characteristics shown on the image to determine whether the target object has been identified. The infrared detection technology is based on the system's internal setting of a specific area, and then all objects in the area are scanned one by one and their location is recorded roughly. The advantage of infrared forehead thermometer is simple operation, easy to carry, and it will not occur in the detection process of basic miscarriage of justice, it can be more accurate identification of different objects [9]. However, the disadvantage of the instrument is that it can only detect the temperature of the human epidermis, and the temperature of the human epidermis will receive the influence of various external factors, and can only detect the target object within a certain distance, if more than this distance will not be able to test the temperature of the target object, in addition, the instrument can only be a target person's temperature test, so the use of the instrument test time is longer.

3.2. Thermal Imaging Camera

Infrared thermography is a sensor that can be used to measure radiation intensity and temperature field, which can accurately digitize different objects in the image and display the data information through a computer. The instrument can reflect the temperature of the measured object in various parts of the body in real time and realize the real-time change of temperature through computer technology, thus ensuring the accuracy of medical research. With the continuous improvement and development of science and technology and people's higher and higher requirements for quality of life, infrared thermal imaging camera as a new high-tech electronic product is widely used in daily life, and its main role is to detect the value of facial features and transform the data information into images. At the same time, face recognition technology is used to achieve the monitoring of human body temperature, while converting image information into digital data for processing [10]. The advantage of this instrument is that it can achieve group temperature measurement and responsiveness, can monitor the human body temperature, and can also convert the image information into digital data, which is convenient for later analysis and processing. However, the instrument is subject to interference from external factors such as distance and clothing due to non-contact temperature measurement, and its measurement accuracy is not as good as that of a frontal thermometer, so it is recommended to be used only for group testing or primary screening in low-risk areas.

3.3. Body Temperature Remote Sensing Technology

Body temperature remote sensing technology is a measurement technology based on the change of human body temperature, which is mainly used to monitor and control medical-related diseases through face recognition, image processing and feature extraction. The technology is to fix the temperature

sensor on the body part of the subject and transmit the body temperature information to the receiver by wired or wireless conduction, so that it can collect the body temperature information in real time and process the data by computer to achieve the temperature control and detection and diagnosis of the human body. The biggest advantage of body temperature telemetry technology is that it can obtain dynamic body temperature changes, so as to grasp the temperature of medical personnel in a timely manner, which is of great help to doctors in diagnosis and treatment [11].

4. Design of Information Platform for Epidemic Prevention and Control in Higher Education

4.1. Platform System Architecture

The platform architecture includes basic hardware support layer, data layer, application support layer and application service layer, among which the basic hardware support layer mainly includes image processing system, computer and communication network, etc. The data is stored in the database for easy retrieval. In this paper, we will use embedded computing technology to collect the occurrence of epidemic situation. By designing a set of college epidemic management platform to achieve reasonable and effective use and monitoring of Internet resources, so as to keep abreast of deceptive events and dynamic information change status of related personnel during students' schooling, this can provide the latest educational intelligence reference advice to school leaders at the first time, and then achieve the purpose of preventing virus transmission and quickly dealing with public health emergencies on campus. At the same time, this also improves the efficiency of the government's work on the maintenance and updating of security and safety of this system [12]. The platform architecture is shown in Figure 2.
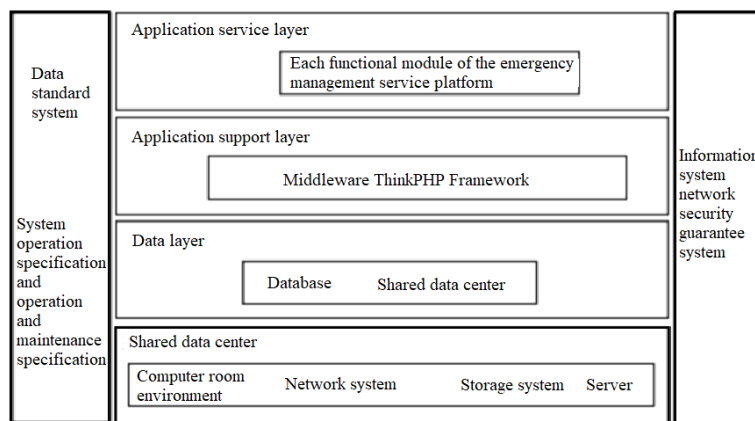

Figure 2: Platform system architecture

4.2. Platform Function Design

The system is mainly realized by face recognition and image processing technology.

Firstly, the face detection method is used to classify the epidemic in colleges and universities and extract the feature values on their feature information that meet the standards and requirements of school epidemic work and can also effectively prevent sudden illness of students. Secondly, the data are collected in different colors or brightnesses according to different areas, and the collected data are classified and labeled with different color and brightness values corresponding to the images of each area. Finally, the collected images are converted into digital graphics by PCR image processing technology. Using face recognition and image processing system for face detection of epidemic, this can effectively improve the work efficiency of epidemic prevention and control, and enable remote monitoring of relevant personnel, thus providing a more convenient and scientific means for university management and control [13].

The platform includes the front-end application function module and the back-end management function module. The front-end function module mainly includes notice, emergency news, emergency knowledge, data filling, abnormality report, back to school application, psychological counseling and question and answer modules. The back-end management function module mainly includes data statistics, back-to-school approval and system management modules, as shown in Figure 3. In addition, the most important tables in the background database design are shown in Tables 1 and 2.
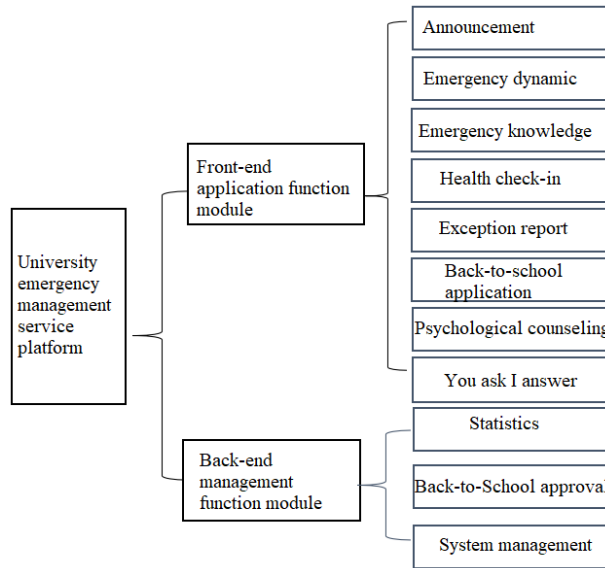
Figure 3: System functional design

Table 1: Information on the rights of various roles of the platform

Is primary key	Field name	Field description	Data type	Length	Can be empty	Default value	Remarks
Yes	JSLBBH	Role Category Number	VARCHAR(60)	60	No		
Yes	JSMC	Role Name	VARCHAR(60)	60	No		
Yes	QXBM	Permission Code	VARCHAR(60)	60	No		
Yes	QXMC	Permission Name	VARCHAR(60)	60	No		

Table 2: Health information

Is primary key	Field Name	Field Description	Data Type	Length	Empty	Default value	Remarks
Yes	JGH	Faculty Member Number	VARCHAR(20)	20	No		
Yes	XM	Name	VARCHAR(60)	60	No		
Yes	XB	Gender	VARCHAR(60)	60	No		
Yes	BMMC	Department name	VARCHAR(60)	60	No		
Yes	JG	Place of origin	VARCHAR(60)	60	No		
Yes	YQD_14D	Have you been to the focus of the epidemic in the past 14 days near	VARCHAR(60)	60	No		
Yes	JCBL_14D	14 days whether contact with the case	VARCHAR(60)	60	No		
Yes	FRQK	whether fever	VARCHAR(60)	60	No		
Yes	KSQK	whether cough	VARCHAR(60)	60	No		
Yes	QCQK	whether shortness of breath	VARCHAR(60)	60	No		

5. Application and Management of Epidemic Prevention and Control Information Platform Implementation in High Schools

5.1. PHP Framework Technology

PHP framework technology is an MVC and object-oriented technology that focuses on the encapsulation and transformation of objects so that they can be graphically presented to the user. At the time of application, the target object can be identified by its properties and mapped to a specific environment. The framework technology has strong real-time, controllability and stability, and it can monitor the target object in real time, which can effectively solve the problems of public security departments in epidemic prevention and control [14].

MVC architecture pattern is a common architecture, the core concept of the pattern is to decompose the system architecture, and then the entire data structure, algorithms and database information unified. This approach allows all the work to be assigned to different parts so that the whole can work together. The MVC architecture pattern includes model, view and controller, where the model is mainly responsible for business logic and data encapsulation, and return and format-independent data, the core idea of the model is to connect the various components of the system, through which the overall functionality can be achieved. The view is used to present the connection between the model, data and database, and its core idea is to connect the various parts of the system, through which the whole function can be realized. The controller is responsible for coordinating the model and the view, including receiving requests and calls to the relevant model, returning it to the data, and then performing the corresponding operations.

5.2. Implementation Process

This platform is developed using ThinkPHP+ HTML5+CSS3 technology and mobile B/S architecture mode to monitor the epidemic situation in colleges and universities. The latest face recognition technology is applied on the mobile terminal, and gistiasql statements are used to complete information interaction. Firstly, two modules, front-end (user-side) and back-end management side, are built separately under Thinkphp framework, and the java programming language is used to realize the acquisition, processing and storage of data on the user-side, and MySQL is used in the back-end management module for logic checking to ensure the overall operation of the system; Secondly, we define the configuration information of the module, establish the database table, and realize the management of the user-side database by querying, updating and retrieving the database; again, we divide the controller into database controller and template controller, use the gistiasql function to operate the database, and establish the relationship between the database table and the user-side entity in the system; Finally, after inserting the After inserting the data, the controller receives the data from the view via post, creates the corresponding data table in the database, and establishes a link with the database to complete the update and maintenance of the data.

5.3. Platform Application

In the daily teaching and research activities of universities, all kinds of information related to the schools are involved, such as students' study situation and teachers' working status. These data need to be collected, but after acquiring these data, corresponding processing is needed, such as converting the collected images into numbers, and then realizing the identification of them through face recognition technology. Based on this requirement, a face recognition and monitoring system is designed. This system mainly adopts face recognition technology, which extracts the information in the image through face recognition system and realizes the result of data processing according to the corresponding algorithm. At the same time, the user name and password functions and corresponding permission settings are set in this system. When someone enters the background, they can choose to add, modify or delete related information and other operations, so that the database data can be backed up.

5.4. Daily Management and Maintenance

In daily management, we need to carry out corresponding maintenance work according to the characteristics of the epidemic. For example, we should take preventive and disposal measures against viruses and hackers in universities, and use computer systems for real-time monitoring and management of epidemics to classify and manage epidemics so as to prevent emergencies.

In order to facilitate students and teachers to use the Internet for information query and browsing, and to keep abreast of the dynamic information of various network resources on the school website, which requires all the advantages of strong data sharing, good timeliness and high security, this requires us to pay attention to the following points in the daily maintenance:

(1) Regular inspections should be made for the protection and management of viruses in colleges and universities, and regular inspections should be made for the prevention and prevention of viruses in colleges and universities. In terms of network security management, a special campus network can be established to strengthen the school website, Weibo and other social platforms and students. information exchange between them. At the same time, it is also necessary to pay attention to maintaining the relationship between teachers and students in the daily teaching process, and to do a good job in information communication within the university.

(2) The use of Internet of Things (IoT) technology to realize the sharing of epidemic prevention and control data, that is, the use of IoT technology to collect various information into the database and then unified integration and analysis to achieve real-time monitoring of the epidemic situation. By uploading the documents and information released by various departments in the university to the cloud, the dynamic monitoring of the epidemic can be realized, thus improving the sharing of information resources between the government authorities for the university and the society, which can provide scientific and effective decision-making basis for the school and hospital.

(3) The virus protection management should be checked regularly, and the network security maintenance work in colleges and universities should also be managed well. Strengthen the connection and communication between teachers and students in daily teaching activities. At the same time, strengthen the website construction, establish and improve the campus network system and information platform to ensure the healthy development and normal operation of the school's internal network environment; For student users, it can provide timely and accurate retrieval of effective data resources and use them quickly, efficiently and conveniently to obtain relevant information; For government departments, it is necessary to improve management efficiency, reduce administrative costs, reduce unnecessary expenses and improve service quality.

6. Conclusion

In summary, under the epidemic prevention and control, the combination of face precision recognition technology and infrared temperature measurement technology combines the monitoring, surveillance and management of the epidemic, which improves the security of educational resources and students' living environment in colleges and universities. By applying the detection system to the school, each person entering the school can monitor the change of students' body temperature and health condition in real time and upload the monitoring data to the computer system, thus realizing the real-time monitoring of the whole school students. Once the abnormal situation occurs, the system can immediately take corresponding measures to ensure the health and personal safety of students. In conclusion, various products based on face precision recognition technology and temperature measurement technology have made significant contributions to the prevention and control of epidemics. Nowadays, it is still of great value and social significance to make more accurate, easy and low-cost products for epidemic prevention and control.

Acknowledgement

References

[1] Aierya Kuamari. Opportunities and Challenges Faced by Transgender Groups During the Epidemic Prevention and Control Period [J]. Journal of Social Science and Humanities,2021(10):3-8.
[2] Tianfang Liu. Research on Improving Community Epidemic Prevention and Control Ability from the Perspective of Governance--Take Nanchang City of Jiangxi Province as an Example [J]. Journal of Sociology and Ethnology,2021(2):13-17.

[3] Gargi Mishra, Virendra P. Vishwakarma, Apoorva Aggarwal. Constrained L 1 -optimal sparse representation technique for face recognition [J]. Optics and Laser Technology,2020(C):129-131.

[4] Xinyue Xu. Countermeasures and Suggestions on Overall Promotion of Epidemic Prevention and Control and Poverty Alleviation in Ethnic Areas [J]. Journal of Social Science and Humanities, 2021(6):-19-21.

[5] Li Pengwu, Liu Ronghai. X-ray Image Recognition Method for Crimping Defects of Strain Clamp Based on OpenCV [J]. Journal of Physics: Conference Series,2021:16-22.

[6] Rana Md. Milon, Akter Tithy Tajkuruna, Hasan Md. Mehedi. Vehicle Detection and Count in the Captured Stream Video Using Opencv in Machine Learning [J]. Computer Science & Engineering: An International Journal,2022(3):12-15.

[7] Deng Yujie, Liu Junyu, You Haonan. Three fixture synchronizations of crane based on OpenCV [J]. Journal of Physics: Conference Series,2022(1):33-35.

[8] Guofeng Zou, Guixia Fu, Mingliang Gao, Jinfeng Pan, Zheng Liu. A new approach for small sample face recognition with pose variation by fusing Gabor encoding features and deep features [J]. Multimedia Tools and Applications,2020:20-23.

[9] Wang Botao, Niu Yanxiong, Qin Xudong, et al. Review of high temperature measurement technology based on sapphire optical fiber[J]. Measurement,2021,184-188.

[10] Hisao Suzuki, Jiro Ohno. Recent Trends in Temperature Measurement Technology in Iron and Steel Industry [J]. Transactions of the Iron and Steel Institute of Japan,2019(7):19-23.

[11] T. Kamimoto, Y. Deguchi, Y. Kiyota. High temperature field application of two dimensional temperature measurement technology using CT tunable diode laser absorption spectroscopy [J]. Flow Measurement and Instrumentation,2015:46-50.

[12] Liu XinJun, Wang ShuJuan, Liu Cheng, Fan LiRu, Fu CuiQing, Qi Kun, Su WenKang. [Characteristics, Ozone Formation Potential, and Source Apportionment of VOCs During the COVID-19 Epidemic in Xiong'an. [J]. Huan jing ke xue= Huanjing kexue, 2022(3):43-44.

[13] Fan Yanyan, Wang Zhuoxin, Deng Shanshan, et al. The function and quality of individual epidemic prevention and control apps during the COVID-19 pandemic: A systematic review of Chinese apps [J]. International Journal of Medical Informatics,2022,160-166.

[14] Jiahui Lin. Relationship between epidemic prevention and control and economic development in China [J]. Academic Journal of Humanities & Social Sciences,2022:23-27.