Campus Personal Health Information Reporting System under the Covid-19 Epidemic: Design and Development

Tao Li¹,ᵃ* and Zhao YE²,ᵇ

¹,²Network Research Center, South China University of Technology, Guangzhou, Guangdong, China

ᵃtli@scut.edu.cn,ᵇzhye@scut.edu.cn

*Corresponding author

Keywords: COVID-19, Personal health reporting system, ICT in education.

Abstract. In January 2020, the world witnessed the outbreak of a dangerous epidemic called COVID-19. The Chinese government has adopted strict anti-epidemic measures. To solve the problems caused by traditional manual operation, such as a missed report, false report, and late report, Campus personal health information reporting system was developed. The J2EE technology and campus sharing data center were used in this system to interface with CAS, HRS, Student Status Management System, and other systems of the university. The system mainly provides two functions: daily health information reporting and data statistical analysis. The system can greatly improve work efficiency and reduce the workload of school frontline staff which has verified in an actual environment. The design ideas and implementation methods of this system can be referenced and applied to quickly building a safe and reliable management information system in colleges and universities in responding to sudden public health incidents.

Introduction

In January 2020, the spread of new coronavirus appeared in the crowd. For this reason, Chinese governments at all levels took the lead in adopting strict epidemic management measures: on January 25th, Wuhan, China restricted the city's external traffic. In January 31st, the Guangdong Provincial Department of Education issued a notice requiring universities in the province to carry out full coverage, omission, and precise control of the distribution and health status of faculty and students in key areas of epidemic prevention and control. The central government has issued various notices and documents to guide the information work and application construction of epidemic prevention and control. In order to implement the requirements of joint prevention and control of the epidemic situation and grasp the health status of all teachers and students, Chinese universities have tried various means of information, including daily reporting by using social chat tools, using online service system of schools to transform on-line service process, and Internet free questionnaire. After comparing and analyzing all kinds of information tools, South China University of Technology chose an agile development model to rapidly develop an on-line IamOK campus personal health information filling system.

This paper describes the design and implementation of the IamOK system. The system is based on the user basic information authoritative source data provided by the school shared data center, and realizes the accurate coverage of the school's filling objects. The system provides personal health information for each day. The system provides more than 400 administrators for all 94 two-level units in the school to provide tracking and statistical services for daily tracking of the area, contact information, and health information of teachers and students. The school management layer
can get real-time information on all kinds of health information statistics and data of IamOK, which is more than 50 thousand teachers and students, through the system. It greatly relieves the workload of front-line personnel in schools.

**General Requirements for Personal Health Information Reporting System**

As the data grasper of various management work during the epidemic period, the IamOK system needs to meet the following requirements: first, in the early stage of epidemic prevention and control, the university urgently needs a working system to master the health status and location changes of teachers and students. Agile development and rapid on-line is the primary goal at the beginning of the system construction; secondly, to strictly implement the system of "daily report, zero report" and "man to man" system, the needs of IamOK reporting system are fully and accurately covered by all teachers and students, providing accurate data support for various joint defense and joint control work. Third, the IamOK system involves tens of thousands of operations per day, and user requirements are minimized in terms of user usability. Finally, the system involves the user's privacy data. Strict management systems and technical protection measures should be introduced to support data encryption, desensitization, and anti-climbing. The system needs to meet the requirements of information security grade protection level 3 or above.

**Design and Implementation of IamOK System**

The IamOK system relies on the information resources of the school and shares the data center to push the basic information of school teachers and students, including the number of workers, names, units, and identity types, to form a user basic information table. The shared data center does not push personal information such as ID cards, gender, class, and professional information, which is not related to health reporting. The IamOK system is used as the basis for controlling the scope of the reporting. The system is connected with the unified identity authentication system of the school, and the student number returned by the unified identity authentication system is the sole identification of users. The IamOk system focuses on the function of user reporting and data statistics and analysis, to ensure that the system can serve on-line quickly and safely.

**System Technology Framework Design**

The whole system adopts the J2EE technology structure. This mature technology architecture is widely applied because it can ensure the good security and expansibility of the application system. As shown in Figure 1, the system adopts the idea of hierarchical design, from the bottom up to the Dao layer, the Service layer and the Controller layer, which reduces the coupling between the various parts of the system, and improves the expansibility and maintainability of the system.

The specific technical framework adopted the current popular JPA framework, namely, Spring Boot and JPA. Spring Boot to complete the business logic processing. The Dao layer implements the mapping between the Java entity class and the database relational mapping table through JPA technology. The system uses Spring Boot embedded plug-in as a container to provide external services to the outside world. It is easy to deploy and maintain. To improve the response speed of the system and improve the scalability of the system, the system uses Redis cache technology to realize session sharing and data cache. The front-end technology adopts the progressive framework VUE and the component library element-UI based on the user interface, which can achieve the logical interaction between browser pages and back-end. In terms of system performance, the reverse proxy and load balancing are realized by Nginx.
As shown in Figure 2, the IamOK system is deployed on two cloud hosts based on H3Cloud OS E system management. The configuration is 4 core CPU, 8G running memory and 300GBSAS storage and 8 core CPU, 16G running memory, and 300GSAS storage. The school data center after the Internet export and after the unified load balancing server, the OS system is running on the Internet. Two sets of firewall servers are provided to ensure system security. According to the actual operation situation, the deployment plan of the system can meet the needs of 60000 users with 800 concurrent requests per second.
System Development and Implementation

User Client

IamOK health reporting system 100% covers more than 50 thousand teachers and students in the whole school. The system is developed by H5 technology on the client-side, supporting mobile browsers and WeChat enterprise/enterprise WeChat access. As shown in Figure 3, Daily reports include 19 information, including the location of the city, the current address, the state of health and health, whether to visit, pass through the epidemic area and the health condition of the family members. To reduce the user's reported cost, the user can complete reporting by submitting one key if the situation is unchanged the first day after the first report.

Figure 3. User interface.

System Management Terminal

To achieve the requirements of the "superior person to person" plan for the superior departments in charge of prevention and control, the system provides a more perfect system management end for more than 400 administrators. The management end includes three modules: authentication, filling, and statistics.

(1) Authentication Module

System authority is divided into two categories: teaching staff administrators and student administrators. Each class administrator is divided into a school administrator and a two-level unit administrator. The two-level unit administrator can check the filling status, statistics, and export records of the users of the unit and its subordinate units. Some retired staff and workers are unable to fill in reports due to physical reasons or other special reasons. Two-level administrators confirm their health status online. We can make use of the function of the system to provide the completion of daily filling. The school administrators have the authority of user management under the classification.

(2) Fill in Module

The system generates an independent filling record every day. The system automatically determines
whether the record has changed with the previous day. If there is any change, it will prompt the administrator in the user list. The system will report the daily report in real-time, and provide a key to remind the filling function for the unfilled personnel on that day. Administrators can use this function. Remind users to fill in the report on the day by SMS and WeChat news.

(3) Statistical Module

Epidemic prevention and control is a dynamic process that constantly changes according to the actual situation. At different stages, the data required for statistics and reporting are different. The IamOK system needs to be quickly on-line and meet changing management needs. The IamOK system adopts the demand hierarchical management solution: Aiming at the overall statistical needs such as the reporting rate of each unit, the statistics of personnel in the epidemic area, and the abnormal state of body health, the system provides an online statistical interface, aiming at the needs of temporary reporting data, multi-field conditions, query statistics, etc. The system provides a perfect data export function. Administrators at all levels can export data in their management authority in EXCEL format, and then use WPS Office, MS EXCEL, and other office management software to conduct off-line statistics.

System Safety

In terms of system security, the IamOK system adopts a variety of system security measures, including the transport layer adopts HTTPS protocol to ensure data transmission security; user authentication is connected with the unified identity authentication system of the school, avoiding the local storage of user passwords and ensuring the identity authentication security; the system constructs the Apache Shiro security framework, and realizes multi-dimensional control of user access and management authority; In order to ensure data traceability, the system uses "operation log + operation log" to record users' behaviors in detail, such as access records, submit records and edit operations, etc., so as to facilitate traceability and accountability. In data security, the system adopts a data backup mechanism with automatic backup of different machines, greatly reducing the possible losses caused by all kinds of sudden accidents such as human error operation, system failure, and hardware failure.

Operation Effect and Analysis

It took only five days to complete the development and testing of the IamOK health reporting system. The system was formally running on-line on February 5, 2020. More than 90% of teachers and students' health information has been collected in less than 24 hours. By the end of March 30, 2020, the IamOK system has tracked down 51474 people and serve 432 administrators at all levels. 2083644 student health data were reported on which abnormal health status 9312 cases in it. There are 4071 records of the health status of the faculty members. The system has been on-line for more than 50 days. The IamOk system has established a solid and smooth information link between the teachers, students and schools, and the administrators of the unit. It provides detailed data support for the various epidemic prevention works in schools and has made adequate data preparation for the "one person, one book" work of the teachers and students returning to school in batches.

Conclusion

The university management information system generally has a relatively complete demand, and
buys mature software products or uses waterfall development mode to develop. However, under the condition of a sudden outbreak, higher requirements for university management information systems are put forward in the aspects of on-line time, information security and availability, etc. IamOK campus personal health information filling system is put forward. Making full use of the authoritative data provided by the school shared data center, adopting the mature technology framework, selecting functions, focusing on optimizing the user experience, deploying the computing resources in the public construction of the school and protecting the environment to achieve the security of information system, all have been verified in the actual operation. It can be used for reference in the information planning, construction, and technology selection of universities when dealing with similar public health emergencies.

References


