

The Design of High-Efficiency and Synergetic Attendance System

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Abstract. This paper analyzes the benefits and limitations of several attendance systems that have been used in universities and describes the design of an Attendance System which combines the attendance recording and dormitory management. The system described in this paper is based on MySQL and featured by synergetic, high-efficiency and low-cost. The deployment of this attendance system could contribute to students' management and help to create a better study atmosphere in universities.

Introduction

Since some of the students pay little attention to their lectures or teachers get problems in their teaching methods, the absence of lectures in college students has been a serious problem. In order to keep the attendance rate, most teachers prefer to call the roll during the class time, and many student attendance systems have been designed to help doing this. For example, Radio Frequency Identification (RFID) technology can be used to detect if students are in their classrooms, attendance systems based on this technology could achieve high efficiency [1] [2]. Near Field Communication (NFC) [3] and Smart card [4] technology can be also applied into attendance systems. Face recognition based system works in different way: A camera is needed to capture students' image and then program will match their faces and find out who's absence, the whole process can be done without any human intervention [5] [6]. Image-based intelligent attendance logging system is another kind of system using camera. It will monitor people all the time to see if they are absence and count their working time [7]. There are also attendance systems using fingerprint verification technology, since the fingerprint is unique and hard to forge, such design can bring perfect accuracy [8] [9]. However, fingerprint is not the only way to identify a person in biometrics. Hand geometry is unique for everyone too. Capture students' hand geometry to serve as ID is another solution for building an attendance system [10].

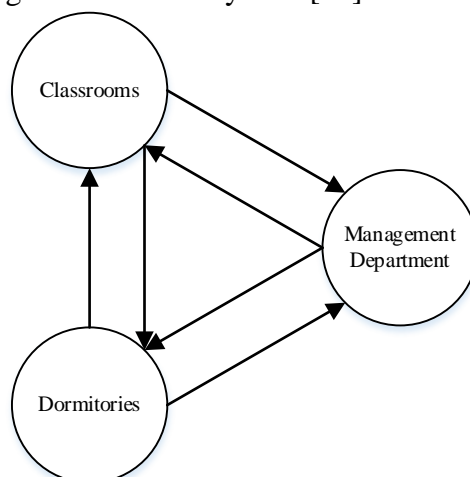


Fig.1. Synergetic system

The attendance systems mentioned before involves plenty of high-technology, featured by automation, efficiency or accuracy. Some of them have been put into use and proved to be helpful, but all of these systems ignore students' behaviors in dormitory which have a great contribution to

their performance in classes. And some of the existing attendance system can't share information with proctors who take charge in students' management. All these problems lead to low practicability. So, it's necessary to design a High-Efficiency and Synergetic Attendance System: recording not only students' attendance information in classrooms but also their behaviors in dormitories, all these information could be shared with proctors in management department as soon as they were send out, then, proctors, teachers and dorm supervisors would work together to make sure that effective measures could be taken in time to prevent things from going worse, as shown in Fig.1.

System design and implementation

System structure

The system consist of four basic modules as shown in Fig.2: classroom module used for gathering attendance information; dormitory module used for gathering comments from dorm supervisors; management module for querying data and importing module for updating database.

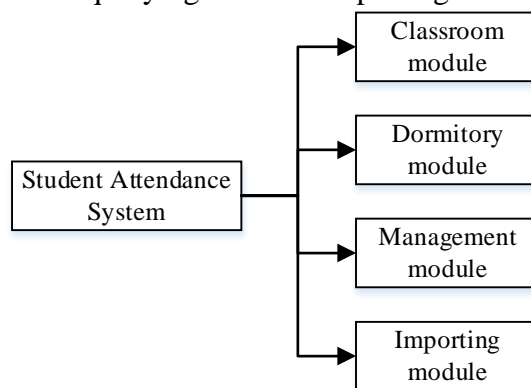


Fig.2. System structure

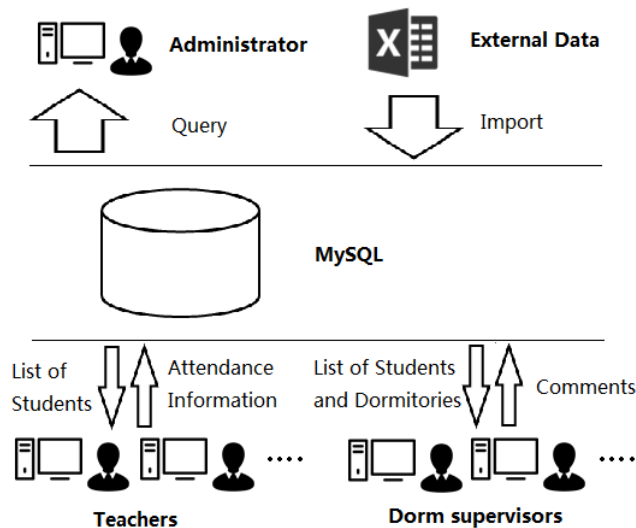


Fig.3. Attendance system's working process

To deploying the system, a server with MySQL is needed and client programs should be installed. Fig.3 shows how the system works: The administrators will get a table (an Excel file) containing all the students and courses' information at the beginning of the term, and import it into database with the help of importing module. After that, if any teacher opens the program installed on the computer in classroom, it will provide a table containing each student's name, ID and a checkbox for marking the absence. When the roll call is completed, the program will send the attendance information to server. As for dormitory module, the working process is all the same. Since the information from teachers and dorm supervisors has been sent to database, the administrators can query them and

export them to an external file through management program, if a student is found to have too many bad records, the proctor might have a good talk with him.

Database design

Based on the system structure, seven tables are needed as described in Tab.1 and Tab.2.

Tab.1. Tables in MySQL part 1

Table	Column	Type	Note
classes	ClassID	varchar(40)	Storing basic information of lectures.
	ClassName	varchar(30)	
	TeacherName	varchar(40)	
class_info	ClassID	varchar(40)	Storing detailed information of lectures, including where and when does a lecture conduct.
	RoomID	varchar(15)	
	StartWeek	int	
	EndWeek	int	
	Class_Begin	int	
	Class_End	int	
absence_detail	StudentID	varchar(10)	Storing students' records of absence.
	ClassID	varchar(40)	
	AbsenceDate	varchar(10)	
absence	StudentID	varchar(10)	Storing Course-Choosing information and count absence times.
	ClassID	varchar(40)	
	AbsenceTimes	int	

Tab.2. Tables in MySQL Part 2

Table	Column	Type	Note
classes	ClassID	varchar(40)	Storing basic information of lectures.
	ClassName	varchar(30)	
	TeacherName	varchar(40)	
class_info	ClassID	varchar(40)	Storing detailed information of lectures, including where and when does a lecture conduct.
	RoomID	varchar(15)	
	StartWeek	int	
	EndWeek	int	
	Class_Begin	int	
	Class_End	int	
absence_detail	StudentID	varchar(10)	Storing students' records of absence.
	ClassID	varchar(40)	
	AbsenceDate	varchar(10)	
absence	StudentID	varchar(10)	Storing Course-Choosing information and count absence times.
	ClassID	varchar(40)	
	AbsenceTimes	int	

In order to improve performance, some measures were taken:

- In some create table statements which specify the layout of tables, foreign key constraints were used to keep spread-out data consistent, any invalid insert or update operation would be rejected.

- All the statements were written as stored procedures. Using stored procedures provides a consistent and secure environment and improved performance, client programs can also benefit from this.

- Since the column “AbsenceTimes” of table “absence” is related to table “absence_detail”, we set triggers associated with table “absence_detail” to perform the calculations. This design also guarantees the consistency of data.

Module implementation

All the client programs of the system were written in C#, here are some of the programs.

Classroom module

As previously mentioned, the classroom module is designed for teachers, it helps teachers to call the roll and send the attendance information to database. So the design principle of this module is to minimize the operation of teachers. Fig. 4 shows the working process of classroom module.

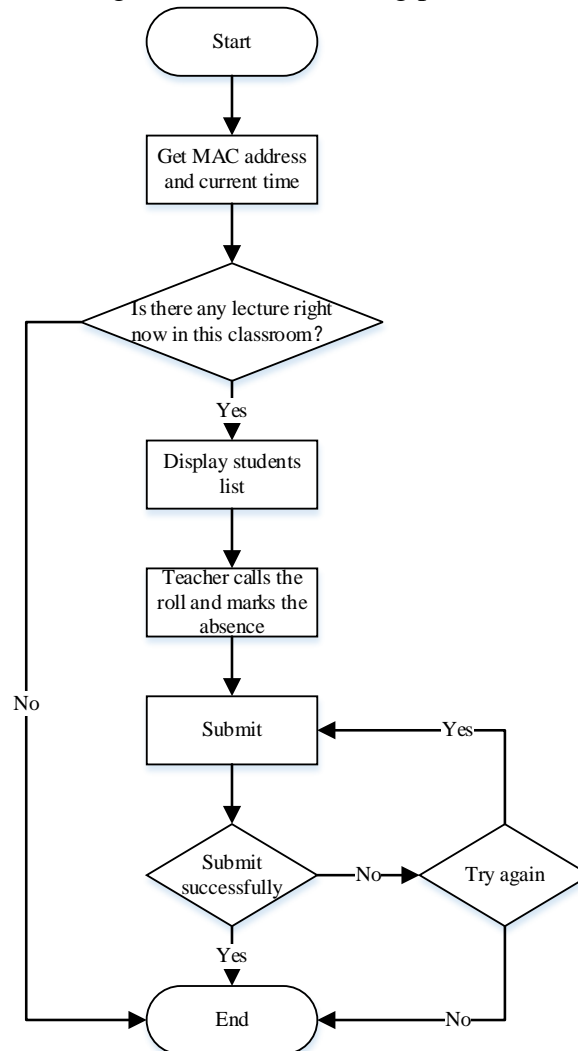


Fig.4. Working process of classroom module

The program will judge which lecture is conducting right now by reading MAC address and current time. Once a teacher opens the program, the students list of the lecture would be displayed automatically. All the teacher needs to do is calling the roll and marking the absence. If the program fails to send the information to server, it will retry several times automatically, after that, if it still fails, a MessageBox will be displayed to inform the teacher that submitting has failed and the teacher will decide whether to try again.

The students are ordered by student ID by default, but teachers can reorder students by the times that they have been absence. Besides, a teacher may calling the roll for several times during the lecture time, but even if a student is marked more than once, the student won't get more than one record in database, all the repeat information would be rejected.

Dormitory module

This module is used for gathering comments of dormitories. Dorm supervisors select the dormitory that they want to comment and click "Send" button when they finish entering the text, then the administrators receive the comment. Considering that most comments won't be long, the

words that one can enter are limited to 100.

Management module

This module is used for querying and exporting data. Clicking “query” button the user would get all the absence records and dormitory comments. The absence records are ordered by absence times, so it would be easy to find the students who always been absence. Double click a cell in datagridviews the data would be narrowed down. For example, if someone double clicks a cell in column “Name”, the program will list all the records related to the name that have been clicked, but the original table would remain and tables could be switched by clicking buttons in toolbar. This design is useful for searching information that users concern especially when there are too many records. If it’s still difficult to find the specific records, searching with the key words that have been entered is also supported. After searching, users may want to export the result to an external field, just clicking the “export” button and the excel field will be created automatically.

System testing result

The system described in this paper has been deployed and tested for months in our own college. Fig. 5 and Fig. 6 shows the data gained during these days.

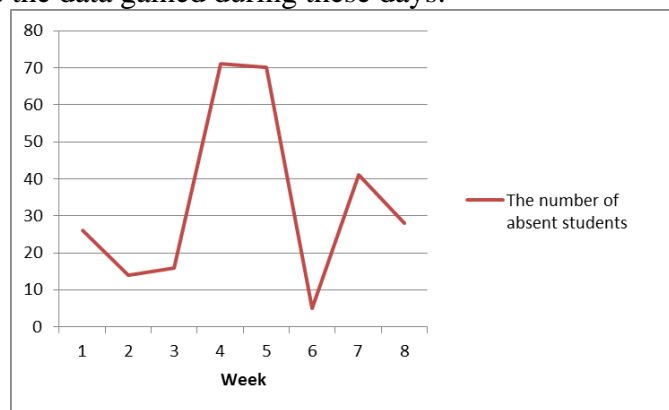


Fig.5. The number of absent students changes over weeks

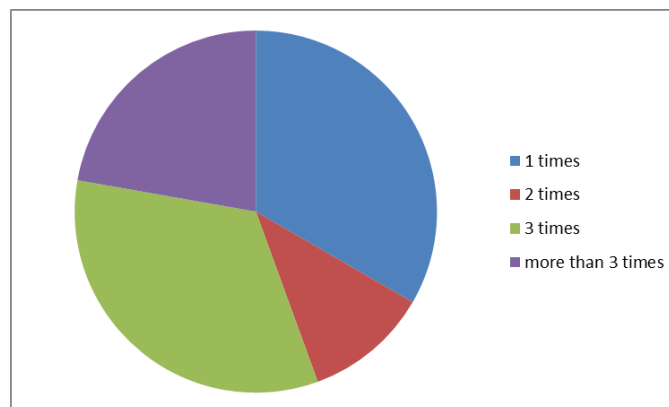


Fig.6. The proportion of using times among teachers

After the deployment of the system, some design flaws and bugs showed up and teachers complained they had problems using it. To solve all these problems, an important update was done few days later. Since the stability and performance of the system have been improved, more teachers began to use it, and the database received much more data in the next few weeks. As the test conducting, some teachers made very helpful suggestions to us, and the system were modified for several times to meet teachers’ demands better. Now, more colleges are going to be invited to take part in the test and next term the whole university could use the system.

Conclusion

The design and implementation of the attendance system in this paper have been described minutely. The developers have worked on the programs to make them quite easy to use. By sharing information timely, proctors, teachers and dorm supervisors now could work together to make sure that effective measures could be taken in time to prevent things from going worse. So, the system has achieved high-efficiency and synergetic. Since the system doesn't have too much hardware requirements, the cost of the system is extremely low. However, the performance of the system still need to be improved, and some teachers have given valuable suggestions, dealing with all these problems and expanding the using of the system are the focus of next step.

Acknowledgment

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