

QR Code Student Attendance System

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Abstract: With the rapid development of Quick Reference Code (QR Code) technology, the scope of applications continues to expand. The QR Code function has also been widely used in the field of education. The QR Code attendance system can help lecturers quickly get student information and complete absent records. Users can also quickly manage student absence records anytime, anywhere. In some high schools, paper signing is still traditionally used; paper attendance forms require students to pass the signature, and there are many disadvantages. The attendance is easily damaged, signatures slowly take time, and the user must also manually upload the attendance information. With the rapid development of QR Code technology, the scope of applications continues to expand. The QR Code function has also been widely used in the field of education. The QR Code Student attendance system can help lecturers quickly get student information and complete absent records. Users can also quickly manage student absence records anytime, anywhere. The paper attendance system has some problems: The attendance is easily damaged. Moreover, the signature method took much time, and users also needed to upload the attendance information manually. The QR Code attendance system ensures attendance authenticity faster and more accurately. At the end of a class, the lecturer can use the QR Code to register the students who are absent from class and complete the class attendance. It can solve the complicated problem of paper attendance very well, and QR Code attendance can Upload attendance information directly to the server.

Keywords: QR Code, attendance, security, authentication, Internet

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1. Introduction

The QR Code student attendance system (QRSAS) ensures attendance authenticity faster and more accurately. For example, at the end of a class, the lecturer can use the QR Code to register the students absent from class and complete the class attendance. It can solve the complicated problem of paper attendance very well, and QR Code attendance can upload attendance information directly to the server.

The situation of multi-course courses in the same classroom and regular paper sign-in is very cumbersome, and some shortcomings interfere with students and make it easy to make confusing information. Therefore, it is meaningful to design [4] a paperless attendance system. There are many electronic sign-in systems, such as

fingerprint, face recognition, etc. Users can complete the check-in accurately, but to achieve a quick and easy check-in, they must use the QR Code check-in [5]. The QR Code has a high penetration rate, the operation is very simple [1][2], the use process is fast, and there is no additional resource requirement.

2. Background

The absence of classes seriously affects academic performance. A few students took advantage of class time to go out and have an accident. Allowing students to develop good work and standardizing students' time and attendance is one of the things most universities want to do. Therefore, the fast and effective check-in method is very popular with universities. The attendance systems must

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truly reflect the student's attendance, encourage students to attend classes, let lecturers and students know each other, give students more opportunities for classroom performance, record students' course learning process, provide the basis for usual grade evaluation, and reduce the risk of accidents for students.

The traditional sign-in method is comprised of two (1) order roll call and (2) group statistics. In the order roll call, the lecturer asked the students to use the roster for sequential roll call. The advantages of this method are that every student must answer, the lecturer can have more opportunities to meet with each classmate, and more truly reflects the student's arrival. On the other hand, the disadvantages: If the number of students is relatively large, this will waste a lot of precious time for students and lecturers, and in some cases, other students will help answer.

For the second method of group statistics, the lecturers can divide the students in the class into multiple groups. Each group selects a group leader. The group leader determines the group's attendance. After class, the group leader hands the list to the lecturer. The advantage of it is that it saves the lecturer's time and facilitates discussion and learning in groups. Nevertheless, it has disadvantages where it could be situations where the team leader shields the team members and the lecturer cannot determine the actual attendance rate of the students [3].

Unlike the traditional sign-in method, the modern method uses advanced technology like face recognition, where the student stands in front of the face recognition machine, scans their face, and signs in. The main advantage of it is that it saves the lecturer's time and has a certain degree of reliability; the student's punch card situation will be recorded in the background data, which provides a basis for the student's usual performance evaluation. On the other hand, however, it incurs high costs. Further, it could be facial recognition errors; the machine cannot recognize the students. Therefore, the record cannot be entered into the attendance list.

The modern sign-in system also uses fingerprint recognition, where each student's fingerprint is recorded into the back-end database through the fingerprint machine. The students put the finger that recorded the fingerprint on the fingerprint punch-in machine before class. The fingerprint punch-in machine matches the back-end database to find the corresponding fingerprint. The advantage of this method is that each fingerprint is unique and records the student's attendance in detail; fingerprint recognition is fast and easy to operate. However, some students' fingers are often peeled, and fingerprints are difficult to capture.

3. Methodology of QRSAS

The waterfall approach was the first software development life cycle model used widely in software engineering to ensure project success. In "The Waterfall" approach, the whole process of software development is

divided into separate phases. In this Waterfall model, typically, the outcome of one phase acts as the input for the next phase sequentially. Figure 1 shows the phases and flow of the methodology. Generally, it consists of the following processes:

1. Plan the defined problem and prepare a proposal.
2. Analysis gather requirement in function and non-function.
3. Design the application and database.
4. Write code and implement the expected functionality to derive the complete system.

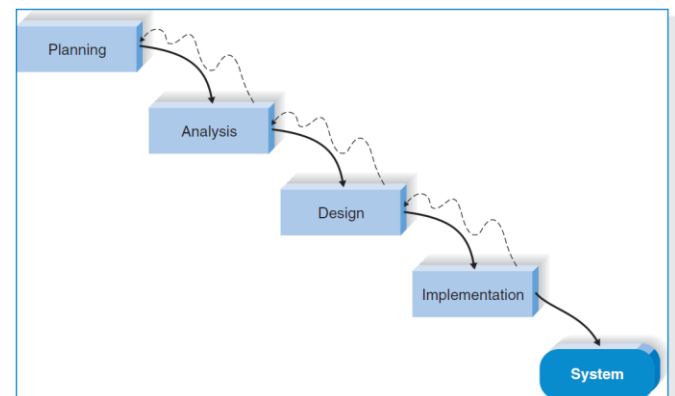


Figure 1. The phases of QRSAS

4. Design And Development of QRSAS

The QR Code attendance system ensures attendance authenticity faster and more accurately [7]. At the end of a class, the lecturer can use the QR Code to register the students who are absent from class and complete the class attendance. It can solve the complicated problem of paper attendance very well. The traditional attendance is easily damaged. Sign slowly take much time.

Moreover, users also need to upload the attendance information manually. So electronic sign-in will improve this situation. The QRSAS is working in traditional high school student have their table, and each class have around 30 students [9]. The functions of the system are:

- 1) Function 1: Admin can manage all student info and generate QR Codes for each student.
- 2) Function 2: Mobile phone software [8] realizes QR Code recognition [6].
- 3) Function 3: The database stores student information and attendance record.
- 4) Function 4: The system Can count the absence of students in time.

The user of the system comprises three entities: (1) lecturers. (2) admins, and (3) students. The lecturers are allowed to edit student attendance information and view student information. On the other hand, the admins are allowed to generate QR Codes and store student information in the database. Finally, the student can only be allowed to view the attendance list. Table 1 summarises the list of

functional requirements, while Table 2 lists the non-functional requirements. The requirements are classified based on three levels of priority, namely mandatory (M), optional (O) and desirable (D).

Table 1. List of the functional requirements

NO.	REQUIREMENT ID	REQUIREMENT DESCRIPTION	PRIORITY
	QRSAS_01	The system can provide a login interface for the lecturer to access the system on Android.	
1	QRSAS_01_01	The lecturer is able to login into the system with the user ID and password.	M
2	QRSAS_01_02	The lecturer is able to log out from the system.	M
3	QRSAS_01_03	Admin is able to login into the system with user ID and password.	M
4	QRSAS_01_04	Admin can log out from the system.	M
	QRSAS_02	The admin is able to manage Student Information in the system	
5	QRSAS_02_01	The lecturer can edit student information such as name, matric number,	M
6	QRSAS_02_02	The lecturer is able to search and view student information	M
	QRSAS_03	The system can generate QR Code	
7	QRSAS_03_01	The system allows the admin to generate a QR image containing the link.	M
	QRSAS_04	The lecturer can view their information	
8	QRSAS_04_01	The lecturer is able to view the information by scanning the QR Code.	D
	QRSAS_05	The system is able to manage the attendance list	
9	QRSAS_05_01	The lecturer is able to view the attendance list, such as student information, class name and time.	M
10	QRSAS_05_02	The lecturer is able to edit the attendance list	M
11	QRSAS_05_03	The admin is able to	M

		view attendance lists such as student information, class name and time.	
12	QRSAS_05_04	The admin is able to edit the attendance list	M

Table 2. List of the functional requirements

NO.	REQUIREMENT ID	REQUIREMENT DESCRIPTION	PRIORITY
	QRSAS_06	Operational	
13	QRSAS_05_01	The system can be accessed via the Internet.	M
14	QRSAS_06_02	The system can be used in the Android system	M
	QRSAS_07	Performance	
15	QRSAS_07_01	The system can be accessed within 24 hours per day and 365 days per year.	M
16	QRSAS_07_02	The QR image can be scanned within 24 hours per day and 365 days per year.	M
17	QRSAS_07_03	The system is able to respond to user requests in 45 seconds.	D
	QRSAS_08	Security	
	QRSAS_08_01	The system can only access by username and password.	M

The use case diagram is detailed to show the system's dynamic behaviour. Hence, the operations involved in using the mobile app for creating student information and managing attendance in an activity diagram in Figure 2 are self-explanatory. The class diagram in Figure 3 shows the attributes and operations of the app. In this work, four main classes were students information, lecturer, admin, and SQL. The interactions between the classes are illustrated clearly in the diagram.

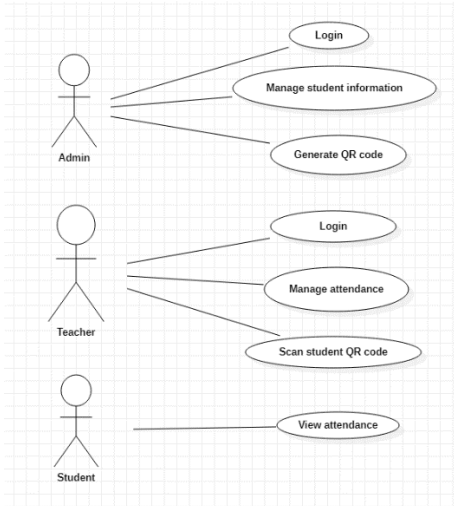


Figure 2. The use case diagram of QRSAS

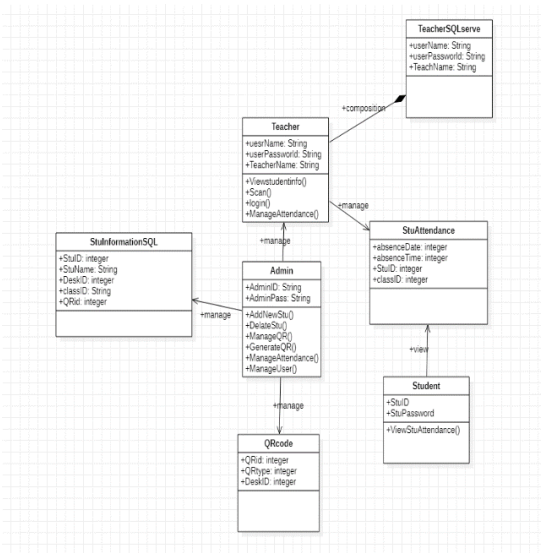


Figure 3. The class diagram of QRSAS

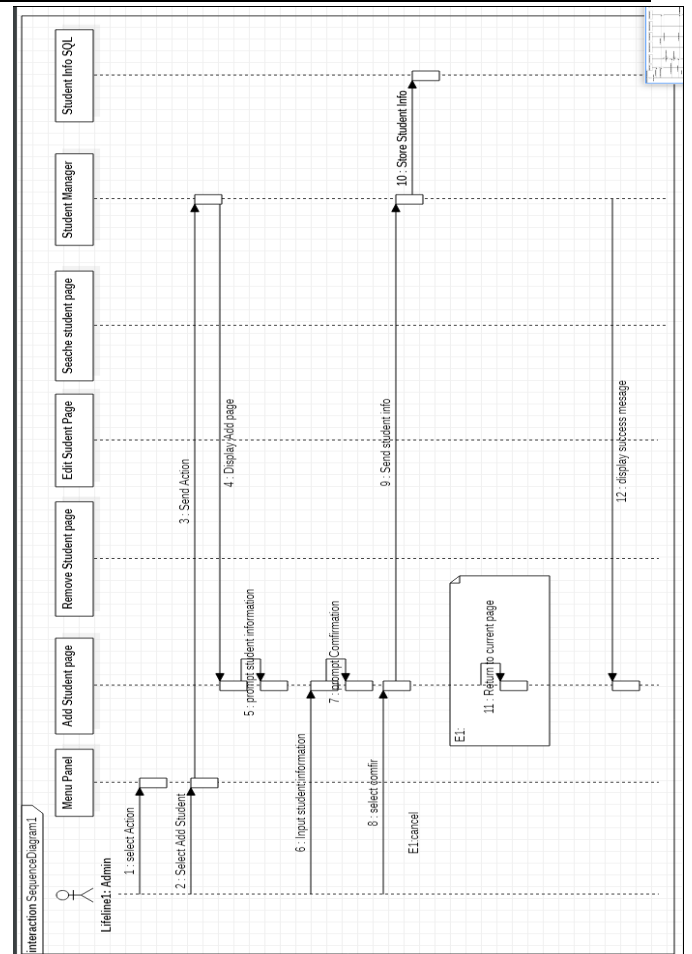


Figure 4. The sequence diagram of Add function

Figures 4, 5, and 6 show the sequence diagrams for Add function, generate QR code and identify QR code.

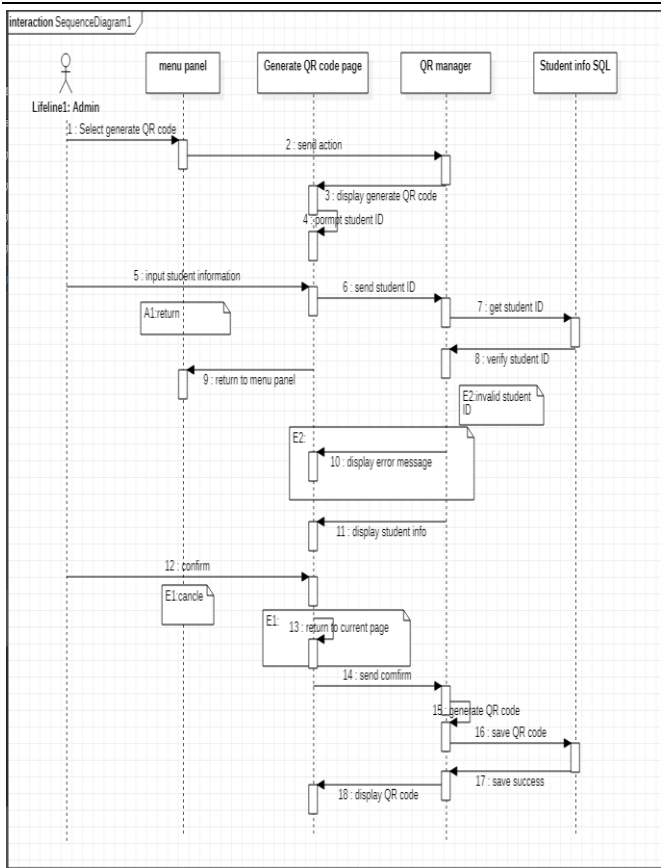


Figure 5. The sequence diagram of Generate QR Code

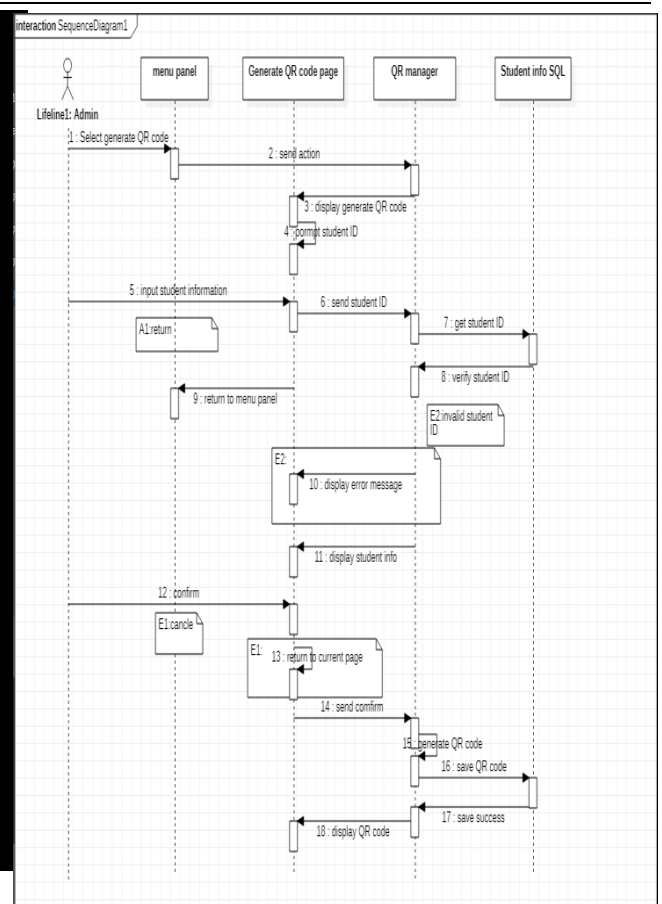


Figure 6. The sequence diagram of Identify QR Code

5. QRSAS Prototype Development

A prototype for QRSAS was developed, combining the web version for displaying the QR code and viewing the attendance records and the mobile application for scanning the QR code. Figure 7 displays the main interface of the system. Figures 8-14 show the user interfaces developed for the prototype.

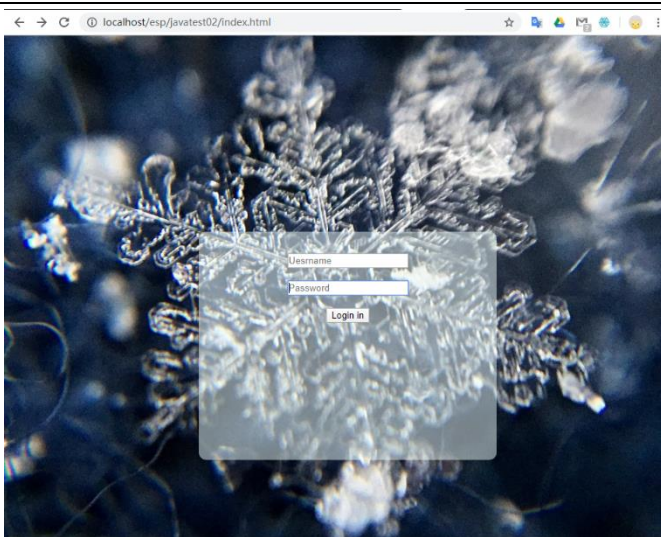


Figure 7. The login page of QRSAS admin part

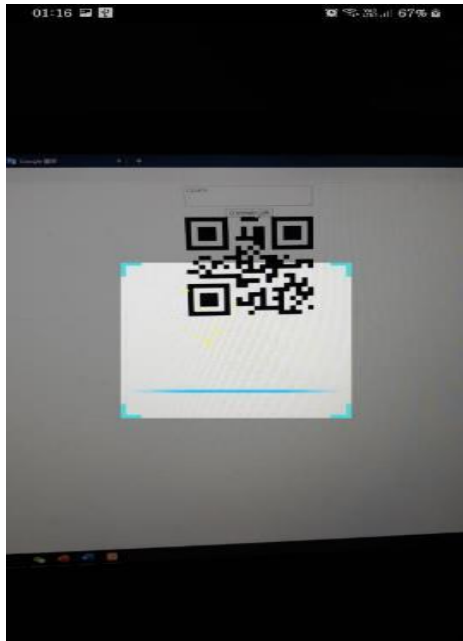


Figure 8. The scan function of QRSAS

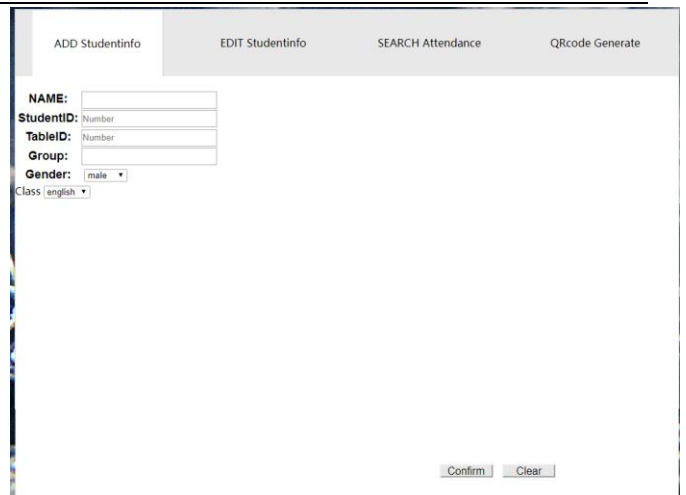


Figure 8. The add function of QRSAS

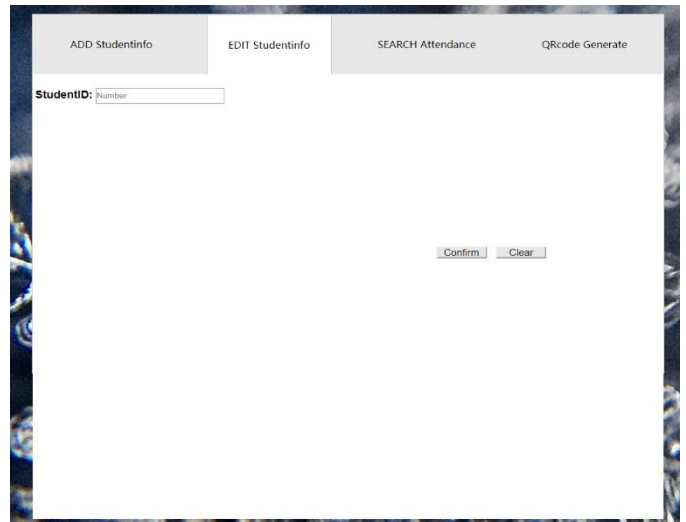


Figure 9. The edit function of QRSAS

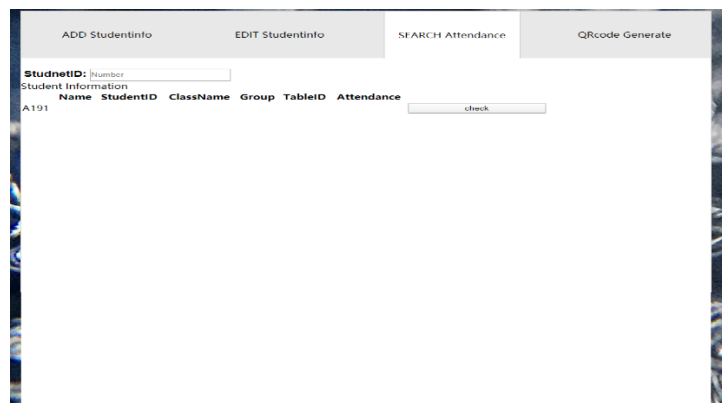


Figure 10. The search function of QRSAS



Figure 11. The QR Code generate of QRSAS

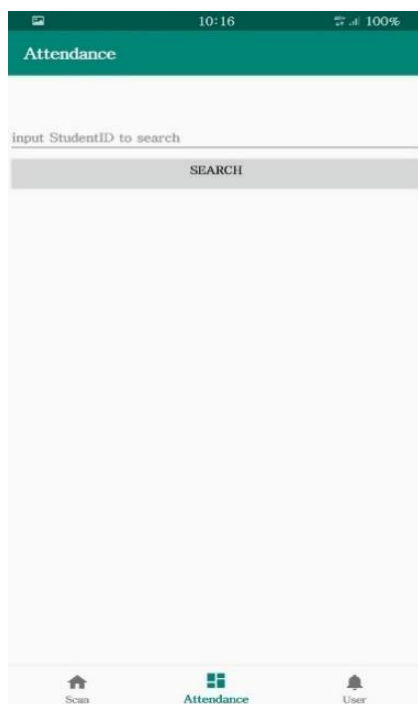


Figure 13. The search function of QRSAS



Figure 12. The Login page of QRSAS

The interfaces for the prototype of a mobile app and website for creating and managing students' information and attendance are described above. It represents the requirements explained in the previous subsection. Software prototyping is a standard way of demonstrating the software requirements so that further comments and suggestions can be obtained from the users based on their experience in interacting with the prototype. The Android Studio was used as the main integrated development environment (IDE) tool [10].

6. Evaluation of QRSAS

This project aims to test the usability of the QR Code Student Attendance System, to test the level of user friendly and the presentation of the contents. The project also aims to test the functionality of the application regarding the functions of the application. The QR Code attendance system ensures attendance authenticity faster and more accurately. The evaluation aims to discover whether the system functions as expected and those details that can be improved. The following table simply shows the satisfaction of evaluators with the QRSA System. Most evaluators expressed satisfaction, but some problems still affect the system's use and experience.

A usability evaluation is an evaluation that was conducted to measure the effectiveness of the QR Code Student Attendance System. Respondents evaluate the system by usefulness, ease of use, satisfaction and security

of QR Code Student Attendance System. The respondents of field testing were thirty people comprised of ten lecturers and twenty students. A Google Form was created to be used during the evaluation. The respondents received the invitation by sent to them through online media such as WhatsApp and WeChat. There is guidance in the form to guide the respondents to perform the task of evaluation of QRSAS. The researcher also guided the respondents and responded to them if they were still having a problem. There are two main execute tasks for the respondents to evaluate the function that available can work.

For executing the task of the admin users, the procedures of the evaluation follow the process below:

1. Login
2. Add student information
3. Edit student information
4. Search attendance
5. Generate QR Code

On the other hand, the users performed the following process sequence for executing tasks for the students.

1. Login
2. Scan QR Code
3. Search Attendance
4. Logout

The evaluation was made by twenty students and ten lecturers, comprising ten females and ten males. The age of the students was between eleven to nineteen, while the age of the lecturers was above twenty years. 70% of the respondents had heard about QR codes. On the other hand, 16% of the respondents did not know about QR codes, while the rest were unsure. On average, the respondents had two classes in a day. Regarding the number of students in the class, 33% had classes less than ten. The evaluation results indicate that QRSAS is useful and easy to use. In addition, respondents expressed satisfaction with the application's functionality, which helps them create and manage attendee lists. The analysis of the feedback of respondents on the specific functions provided by QRSAS shows that most respondents agree to add student information, generate QR Codes, and search and identify QR Codes, which is both simple and useful. They also believe that QRSAS can help them create and manage attendee lists in a more efficient manner and satisfy the way they create and manage attendee lists. In terms of the user interface, interviewees said that QRSAS is easy to use and does not require written instructions. Therefore, they can easily remember how to use the mobile application. In addition, the interviewees are satisfied with the appearance of the mobile application and intend to recommend it to other applications. Figure 15 shows the summary of the evaluation results.

	strongly disagree	disagree	neutral	agree	strongly agree	average
QRSAS is easy to use.	0	0	12	15	3	3.7
QRSAS is user friendly	0	1	6	18	5	3.9
QRSAS is flexible.	0	2	7	14	7	3.67
QRSAS requires fewer steps to complete the check-in	0	0	7	16	7	4
QRSAS is easy to learn how to use it.	0	1	6	18	5	3.9
I can use QRSAS without written instructions.	0	0	8	16	6	3.93
I can easily remember how to use it.	0	0	11	13	6	3.83
I don't notice any inconsistencies as I use QR code attendance system	0	0	11	15	4	3.77
I can recover from mistakes quickly and easily when using QR code attendance system.	0	0	4	20	6	4.07
I can use QR code attendance system successfully every time.	0	1	11	15	3	3.67
I am satisfied with QR code attendance system.	0	1	6	15	8	4
I would recommend QR code attendance system to my friend.	0	1	6	19	4	3.87
Traditional Login works the way I want it to work.	0	1	10	12	7	3.63
I feel I need to have QR code attendance system.	0	1	7	19	3	3.8
QR code attendance system is wonderful and pleasant to use.	0	0	4	17	9	4.17

Figure 135. The evaluation results of QRSAS

7. Conclusion And Future Works

This paper described the design and development of a mobile app for creating and managing high school attendance lists. An efficient attendance system is necessary to support the education system [11,12, 13,14]. There are many aspects of attendance lists that can be studied. In the future, we plan to complete the functionality of QRSAS by providing support for creating and managing attendance lists. According to test feedback, the system needs a complete database and a more beautiful and simpler interface design. In the future, the scope of system users can also be expanded, such as using QR Code identification in school sports facilities to rent sports equipment and student registration. This function can effectively reduce the workload of sports equipment storage work and be accurate and fast.

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