

## MRSM Betong Outing System

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### Abstract

This project addresses the need for an efficient outing management system within an educational institution. Faced with challenges in manual record-keeping and coordination, the study aims to develop a comprehensive solution. Objectives include designing a user-friendly interface for students, parents, and dormitory staff, implementing a secure QR code system for tracking entry and exit times, and establishing transparent communication channels along with location tracking. The study utilizes standard software development methodologies, incorporating use case modeling. Key findings reveal enhanced efficiency, transparency, and security in outing management. The discussion emphasizes the system's positive impact and suggests future enhancements, focusing on continual improvement and user feedback integration.

## 1. Introduction

Recognizing the potential for burnout and the importance of a balanced life, MRSM acknowledges students' need to rejuvenate. Hence, on Sundays, students are free to engage in outings for various valid reasons outside of the school perimeter. This opportunity allows them to recharge, socialize and pursue personal interests, contributing to their overall well-being and ensuring they remain motivated and prepared for the demanding academic week ahead. This activity requires a lot of process and the fact that it is done manually does not make it any better[1]. Therefore, a groundbreaking initiative is proposed for MRSM Betong, which is The Outing System. This system is a web based system. This proposal aims to simplify the complex and outdated outing system currently in place at MRSM Betong.

## 2. Related Work

QR code technology serves as the linchpin, introducing a streamlined method for recording entry and exit times. Seamlessly integrated into the Outing System, this technology enhances security and efficiency. The integration of QR code technology with the MRSM Betong culture signifies a progressive step towards modernization, aligning with the institution's values. The implementation not only optimizes outing management but also reflects an adaptive embrace of technological advancements within the distinct cultural context of MRSM Betong.

### 2.1 Maktab Rendah Sains Mara (MRSM)

Maktab Rendah Sains Mara (MRSM) is a renowned network of boarding schools in Malaysia dedicated to providing quality education with a focus on science and technology outlined on the official Majlis Amanah Rakyat (MARA) website[2]. Established by Majlis Amanah Rakyat (MARA), MRSM plays a pivotal role in

nurturing academically inclined students, particularly in the sciences. The common features of MRSM include a rigorous academic curriculum, state-of-the-art facilities, and a conducive learning environment. The emphasis on science aligns with the goals of this project, which seeks to enhance the outing system for MRSM Betong. Recognizing MRSM's commitment to excellence, this project aims to integrate technological solutions that streamline and augment the safety and efficiency of student outings at MRSM Betong.

## 2.2 QR Code Technology

Quick response (QR) code technology emerges as a pivotal technological component within the framework of Maktab Rendah Sains Mara (MRSM) Betong's outing system. The implementation of QR code scanning introduces a seamless and efficient method for recording entry and exit times during student outings. Common features of this technology include real-time recording, enhanced data accuracy, and streamlined communication between stakeholders. In the context of this project, QR code scanning aligns with the institution's commitment to technological innovation and student safety.

## 2.3 Mobile Application

A mobile application, commonly known as an app, is a software program designed to run on mobile devices such as smartphones and tablets. These applications leverage the unique features and capabilities of mobile devices to provide users with a wide range of functionalities, from entertainment and productivity to communication and information retrieval. Mobile apps can be obtained through app stores or online platforms, allowing users to easily download and install them on their devices. They are developed for various operating systems, including iOS and Android, using programming languages such as Swift, Java, or Kotlin.

## 2.4 Comparison with Existing System

The V-Outing System, UMP E-Community's Hostel Checkout after 12AM and ASIS.my at MRSM Sultan Azlan Shah provides an insight to nodules and features that can be implemented in this system.

**Table 1** System comparison

Features/Systems	V-Outing	UMP E-Community [3]	ASIS.my	MRSM Betong Outing System
Login	Yes	Yes	Yes	Yes
Register	Yes	No	Yes	Yes
Online application form	Yes	Yes	Yes	Yes
Status tracking	Yes	Yes	Yes	Yes
QR code	Yes	No	Yes	Yes
Location tracking	No	No	No	Yes
Warden approval	No	Yes	No	Yes
Disciplinary record	No	No	No	Yes
Parents module	No	No	Yes	Yes
Application modification	No	Yes	No	No
Outing report	No	No	No	Yes

The MRSM Betong Outing System offers a comprehensive suite of features including location tracking, warden approval, disciplinary records, a parents module, and outing reports, setting it apart from other systems. While V-Outing, UMP E-Community, and ASIS.my also provide essential functionalities such as login, registration (except UMP E-Community), online application forms, status tracking, and QR codes (except UMP E-Community), MRSM Betong's additional capabilities ensure thorough monitoring and control. Notably, UMP E-Community includes warden approval and application modification, whereas ASIS.my features a parents module. However, MRSM Betong's extensive features make it the most robust and detailed system among the compared options.

### 3. Methodology

In the context of developing MRSM Betong, this model is selected for its clarity and simplicity, making it an ideal choice for a project with well-defined and stable requirements[4]. In the Waterfall Model, the development process is divided into distinct phases, each building upon the results of the previous one. This structured approach aligns with the need for a systematic and organized development process for MRSM Betong. The Waterfall Model is chosen for MRSM Betong's development due to its straightforward nature, making it easier to plan, design, implement, and test various components of the school's systems.

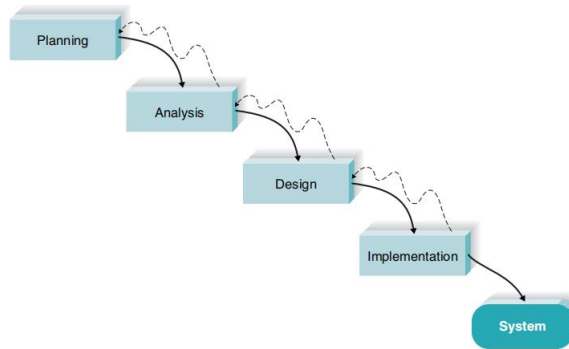


Fig. 1 Waterfall Mode[3]

#### 3.1 Development Activity

There are total of five phases from the waterfall model. Each phase has its own assignment and output that need to be produced during the entire project development. Besides that, the output had been completed within the specific days that have been given.

Table 2 Activities and Tasks

Phase	Activity	Output
Planning	● Proposed the project	● Proposal
	● Produced project schedule	● Gantt chart
Analysis	● Requirement elicitation	● Requirement document
	● Feasibility study	● Feasibility study report
	● Requirement documentation	
Design	● Architectural design	● Design specification
	● Database design	● Prototype
	● User interface design	● System design document
Implementation	● Coding	● Source code
	● Integration	● Integrated system
	● Documentation	
Testing	● Test planning	● Test report
	● Test case design	● Verified software
	● Test case execution	

### 4. Analysis and Design

Analysis involves examining requirements and breaking down a system into components. Design is the process of creating a blueprint based on analysis, specifying how components will interact to meet those requirements. Both are crucial phases in software development, guiding the systematic creation of effective and well-structured solutions.

#### 4.1 Functional Requirement

Functional requirements represent specific features, capabilities, and behaviors that a system must exhibit to meet the intended objectives and satisfy the needs of its users. These requirements outline the system's functionalities, specifying the tasks it should perform, the interactions it should support, and the data it should manage.

**Table 3** Functional Requirement

Module	Function
User registration and login	<ul style="list-style-type: none"> <li>● System allows students and dormitory warden to register themselves.</li> <li>● System allows them to login into their registered account.</li> </ul>
Outing request	<ul style="list-style-type: none"> <li>● System allows students to initiate student outing requests.</li> <li>● System allows dormitory wardens to assess outing requests considering disciplinary records.</li> </ul>
Profile	<ul style="list-style-type: none"> <li>● System allows students and dormitory wardens to edit their profile details.</li> </ul>
Parents	<ul style="list-style-type: none"> <li>● System allows parents to access the system .</li> <li>● System allows parents to receive notification on their child's outing activities.</li> </ul>
Dormitory warden	<ul style="list-style-type: none"> <li>● System allows dormitory warden to manage student's outing records.</li> </ul>
Disciplinary record	<ul style="list-style-type: none"> <li>● System allows head of dormitory warden to modify a student's eligibility for outings by updating their disciplinary records.</li> <li>● System allows hed of domritory warden to track the location of student.</li> </ul>
QR code	<ul style="list-style-type: none"> <li>● System allows student to produce a QR code.</li> <li>● System allows head pf dormitory warden to scan and record entry and exit times form.</li> </ul>
Notification	<ul style="list-style-type: none"> <li>● System allows students to receive notification on outing request status.</li> </ul>
Report and statistic	<ul style="list-style-type: none"> <li>● System allows head of dormitory warden to generate reports.</li> </ul>

## 4.2 Non-Functional Requirement

Non-functional requirements describe the non-behavioral aspects of a system, capturing the properties and constraints under which a system must operate[5]. These requirements are crucial for ensuring the overall effectiveness, reliability, and usability of a system.

**Table 4** Non-Functional Requirement

Module	Description
Performance	Specifies how the system should respond to different levels of workload, including aspects such as response time, throughput, and scalability.
Reliability	Describes the system's ability to perform consistently and reliably under various conditions, including its uptime, availability, and fault tolerance.
Security	Outlines the measures the system must implement to protect against unauthorized access, data breaches, and other security threats.
Usability	Defines the user experience and interface design considerations, ensuring the system is user-friendly, accessible, and meets the needs of its intended users.

### 4.3 User Requirement

It is important to establish and document the user requirements so that they lead into the process of designing the system itself. User requirements will include summary descriptions of the tasks that the system will support and the functions that will be provided to support them [6]. User requirements analysis is a crucial phase in the software development process that involves understanding, documenting, and analyzing the needs and expectations of the end users.

**Table 4** Non-Functional Requirement

No.	User Requirement
1	Students, parents and head of dormitory warden and dormitory wardens shall be able to register and login.
2	Students shall be able to initiate outing requests. Dormitory wardens shall be able to assess outing requests.
3	Students, parents, head of dormitory warden, and dormitory wardens shall be able to edit their profile.
4	Parents shall be able to receive real-time notification on their child's outing activities.
5	Dormitory wardens shall be able to handle student's outing records.
6	Head of dormitory warden shall be able to modify a student's eligibility for outings by updating their disciplinary records.
7	Head of dormitory warden shall be able to scan a QR code that head of dormitory warden need to scan to record entry and exit times.
8	Students shall be able to receive notification on outing request's status.
9	Head of dormitory warden shall be able to generate outing reports.

### 4.4 Use Case Diagram

This section explain the use case diagram for this project. Refer Appendix A.

### 4.5 Activity Diagram and Sequence Diagram

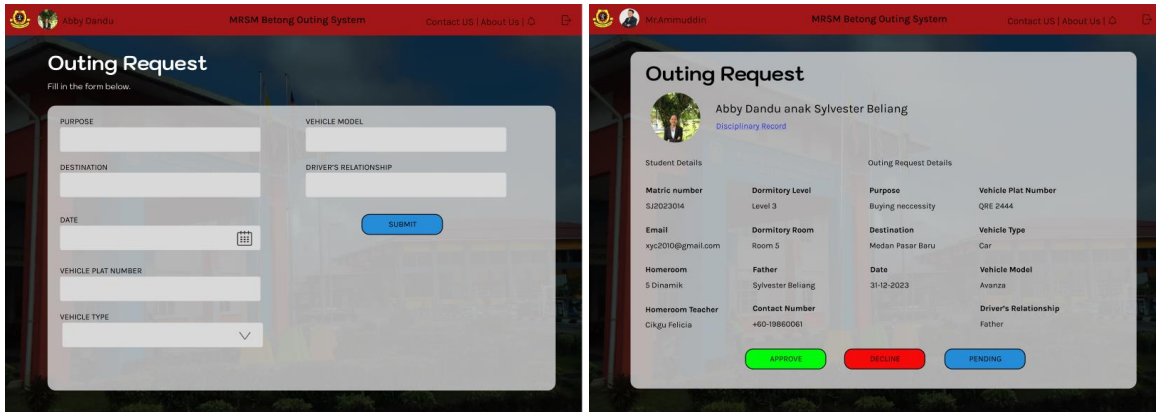
Activity diagram and sequence diagram for each use cases from 4.4. Refer Appendix B.

### 4.6 Class Diagram

Class diagram is designed based on activity diagram and sequence diagram. Refer Appendix C.

### 4.7 Design

Student can submit their outing request by fulfilling the form. Student need to enter purpose, destination, date, vehicle plate number, vehicle type, vehicle model and driver's relationship. After successfully submit outing request, dormitory warden will be able to view and assess it. Dormitory warden can review the request along with student disciplinary record. After done reviewing, dormitory warden can click one of the three button which are approve button, decline button and pending button.

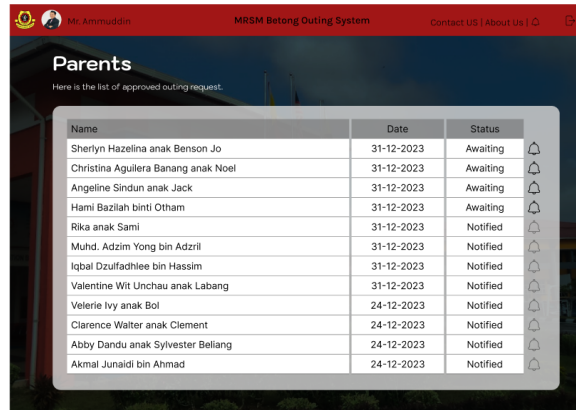


(a)

(b)

**Fig. 2** Manage Outing Request Interface (a) Submit Outing Request; (b) Assess Outing Request

In this process, dormitory warden can click one bell button to notify parents about their child’s outing activity as shown in Figure 4.8. The status will change from “Awaiting” to “Notified”. This process will only be available all type of outing request either it is approved, declined or pending.



**Fig. 3** Outing Assessment Interface

Head of dormitory warden can add and delete student’s disciplinary record. They can click “+” icon to add new disciplinary violation. After done fulfilling this disciplinary misconduct, head of dormitory warden can click submit button. To delete user can click bin icon to delete disciplinary violation.



**Fig. 4** Outing Assessment Interface

Head of dormitory warden can generate QR code on the day of outing. System will shows a successful message on top of the QR code generated. User can click print or download button. After successfully generating the QR code, the student can scan it prior to exit and enter the school premise. In student interface, the system will have

access to camera. The student then point the camera towards QR code. This code will lead student to a form where they need to enter exit and entry time.

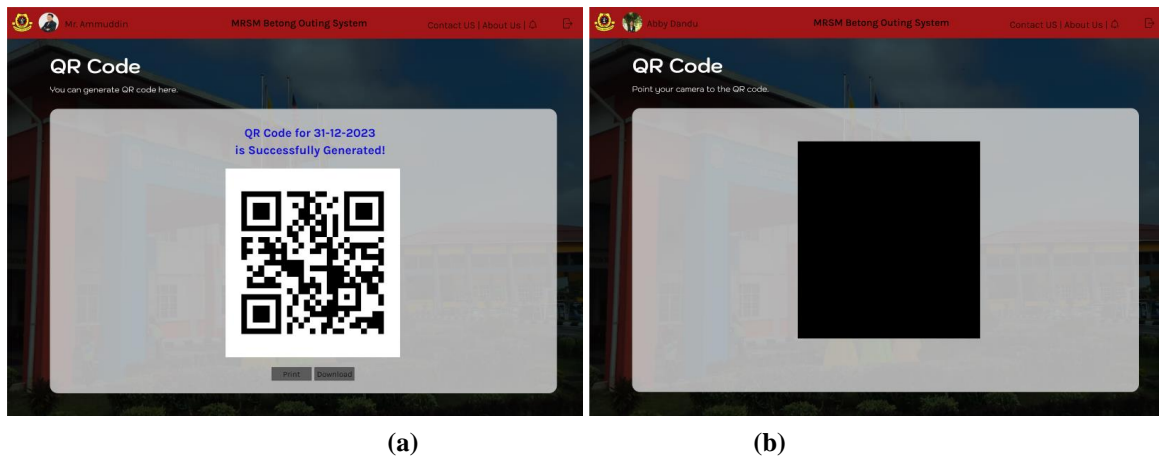


Fig. 5 Generate and Scan QR Code Interface (a) Head of Dormitory Warden; (b) Student

## 5. Result and Discussion

This section provides an overview of the processes involved in the test plan, test design, and execution of test cases. It includes a comprehensive table listing all test cases. Additionally, the outcomes of the user acceptance testing are presented. The test plan process outlines the strategies and criteria for testing, ensuring coverage and quality. The design phase focuses on creating detailed test cases that align with the specified requirements. During execution, these test cases are run to identify any defects or issues. The results are meticulously analyzed to ensure the product meets user expectations and requirements. Finally, user acceptance testing results are shared, highlighting the feedback and approval from end-users, which is crucial for the product's success and deployment readiness.

### 5.1 Test Case

The testing of the MRSM Betong Outing System was conducted for each module, with a primary focus on the system's functionality. Table 5 presents the comprehensive list of test cases used in this process. Each test case was designed to verify specific functionalities within the system, ensuring they operate correctly and meet the required specifications. This thorough approach allowed for the identification and resolution of any defects or issues, ensuring the system's overall reliability and effectiveness.

Table 5 List of Test Cases

Test Case	Description	Expected Outcome	Status
<b>TEST_100 Register and Login</b>			
TEST_100_001	User register with valid details.	The user would be registered, and a confirmation message would be displayed.	Pass
TEST_100_002	User register with invalid details.	The system would reject the registration attempt and display an appropriate error message.	Pass
TEST_100_003	User login with valid details	The user would be able to log in successfully, with the system granting access and displaying a welcome message.	Pass
TEST_100_004	User login with invalid details.	The system would deny access and display an error message.	Pass
<b>TEST_200 Manage Outing Request</b>			
TEST_200_001	Student submit outing request with valid details.	There will be confirmation message and the recording of the request in the system.	Pass
TEST_200_002	Student submit outing request with	The system's response to invalid outing requests, expecting a rejection and an error	Pass

	invalid details.	message.	
TEST_200_003	Student submit multiple outing requests for the same date.	The system reject the additional requests and notify the student	Pass
TEST_200_004	Domritory warden approve or decline the outing request.	Corresponding outing status will be displayed to students.	Pass
<b>TEST_300 Edit Profile</b>			
TEST_300_001	User can edit their profile.	The profile successfully updates and a confirmation message shown.	Pass
TEST_300_002	User fail to edit profile.	Rejection of invalid updates and an error message.	Pass
TEST_300_003	User cancel to edit their profile.	Cancel the editing process without making changes	Pass
TEST_300_004	User change their profile photo.	The system change user profile photo and updated in the database.	Fail
<b>TEST_400 Notify Student's Activity</b>			
TEST_400_001	Head of dormitory warden register parents.	The warden successfully registrate of parents by the dormitory warden.	Pass
TEST_400_002	Head of dormitory warden view parents details.	The warden to view parents details successfully.	Pass
TEST_400_003	Head of dormitory warden notify student and parents.	The system to send notifications to parents and student successfully.	Fail
<b>TEST_500 Manage Disciplinary Record</b>			
TEST_500_001	Head of domritory warden submit valid disciplinary record.	Successful submission of a valid disciplinary record bye the head of dormitory warden.	Pass
TEST_500_002	Head of dormitory warden submit invalid disciplinary record.	Rejection of invalid records and an error message.	Pass
TEST_500_003	System ban respective student from accessing outing request function.	The system ban students with active disciplinary records from submitting outing requests.	Pass
<b>TEST_600 Generate and Scan QR Code</b>			
TEST_600_001	System generate QR Code for an approved outing request.	Successful QR code generation upon warden approval of outing request	Pass
TEST_600_002	Student activate location tracking.	Students could activate location tracking, with the expected outcome being successful activation.	Pass
TEST_600_003	Head of dormitory warden scan QR code.	Successful scanning of the QR code by the warden.	Pass
TEST_600_004	System record exit and entry time.	The system to record accurate exit and entry times.	Pass
TEST_600_005	Student deactivate location tracking.	Students could deactivate location tracking successfully.	Pass
<b>TEST_700 Viewing Outing Status</b>			

TEST_700_001	Student view outing request overview with status.	Students could view their outing request overview with statuses.	Pass
TEST_700_002	System update the status.	The system to update the status of outing requests accurately.	Pass
<b>TEST_800 Report</b>			
TEST_800_001	Head of dormitory warden view outing report.	The warden could view outing reports successfully.	Pass
TEST_800_002	Head of dormitory warden download outing report.	The system to allow the warden to download reports successfully.	Pass
TEST_800_003	Head of dormitory warden print outing report.	the warden could print outing reports successfully.	Pass

### 5.2 Overall Result of Test Cases

In total, 28 test cases were executed across various modules. Out of these, 26 tests passed, accounting for approximately 93% of the total tests. The remaining 7% consists of the 2 failed tests. The ratio of passed to failed tests is 13:1, indicating a predominantly successful testing outcome. This high success rate reflects positively on the system's reliability and functionality, as most functionalities were validated successfully. Figure 6 shows the pie chart of overall result.

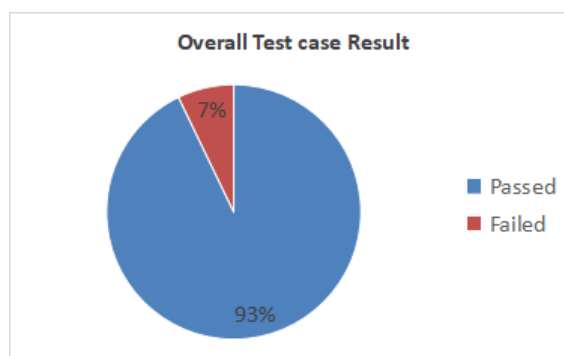


Fig 16 Overall result of test cases

### 5.3 User Acceptance

User acceptance testing (UAT) was conducted to ensure that the MRSM Betong Outing System meets the needs and expectations of all stakeholders. This involved stakeholders completing a Google Form divided into three parts: design, functionality, and user experience with a linear scale 1-5 from very poor to very good. A total of 10 respondents participated, including 1 head of dormitory warden, 2 dormitory wardens, and 7 students. Table 6 presents the comprehensive feedback from all users collected via the Google Form.

Table 6 Google Form Feedback

Question	Answered 1-3	Answered 4-5
<b>Design</b>		
Interface layout and organization of info	2 respondents (20%)	8 respondents (80%)
Does the element include enhance your understanding of the system	1 respondent (10%)	9 respondents (90%)
How easy was it to navigate through different features	1 respondent (10%)	9 respondents (90%)

<b>Functionality</b>		
The features in the system work as expected	2 respondents (20%)	8 respondents (80%)
How was the performance of every features	0 respondent (0%)	10 respondent (100%)
How confident are you in the system's security to protect sensitive data	0 respondent (0%)	10 respondents (100%)
How accurate and reliable did you find the data presented by the system	0 respondent (0%)	10 respondents (100%)
How satisfied are you with the system	0 respondent (0%)	10 respondents (100%)
<b>User Experience</b>		
Overall user experience of the system	0 respondent (0%)	10 respondents (100%)
Will additional training be helpful to fully utilize the system	3 respondent (30%)	7 respondents (70%)

## 6. Conclusion

During the implementation phase, the MRSM Betong Outing System was deployed to assess its functionality and performance, yielding notable findings. The system demonstrated high reliability and robust stability due to well-considered design decisions. Users provided positive feedback, appreciating the user-friendly interface and efficient navigation. Despite a few minor usability issues that were quickly resolved, the system proved scalable, effectively handling increased user loads. Stress testing confirmed its capacity for managing numerous concurrent users, and integration with existing infrastructure ensured seamless data exchange and platform compatibility.

The project successfully achieved its overall objectives, resulting in a robust outing management system for MRSM Betong. An object-oriented design facilitated a modular and flexible structure, enhancing maintainability and extensibility. The web-based platform increased accessibility and ease of use for students and staff. Extensive testing, including alpha and beta phases, demonstrated the system met most user requirements. While user satisfaction was high, further enhancement is needed for features like real-time notification integration. The project advanced knowledge in outing management systems through an effective object-oriented approach and waterfall development model.

The MRSM Betong Outing System offers significant advantages, such as streamlining outing requests and approvals, enhancing monitoring and safety with location tracking, reducing errors, and facilitating easy editing of outing details. It also generates valuable data for better decision-making. However, the system has limitations, including reliance on internet connectivity, potential navigation difficulties for less tech-savvy users, increased administrative responsibilities during the transition, and exposure to cybersecurity risks. Recommendations for future enhancements include developing a mobile app, implementing an automated assessment tool, incorporating multi-factor authentication, and enhancing the parent module for better communication and involvement.

## Acknowledgement

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### Appendix A: Use Case Diagram

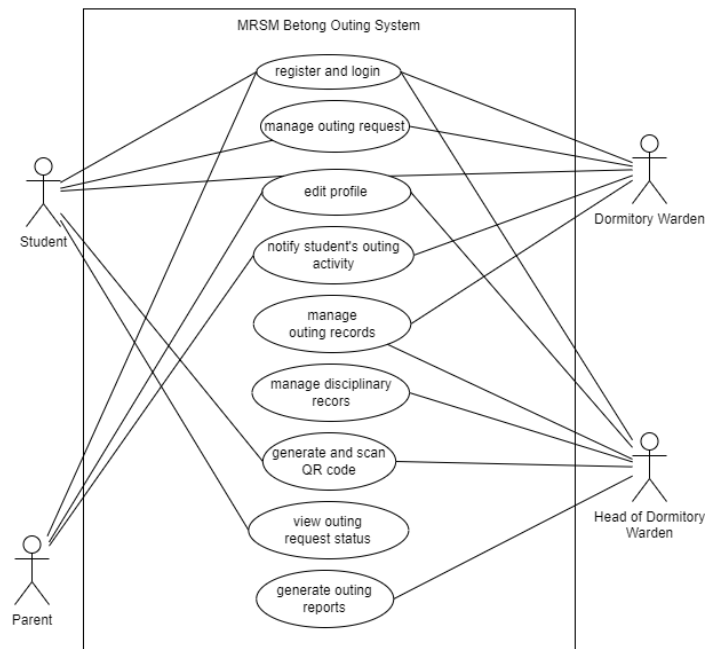
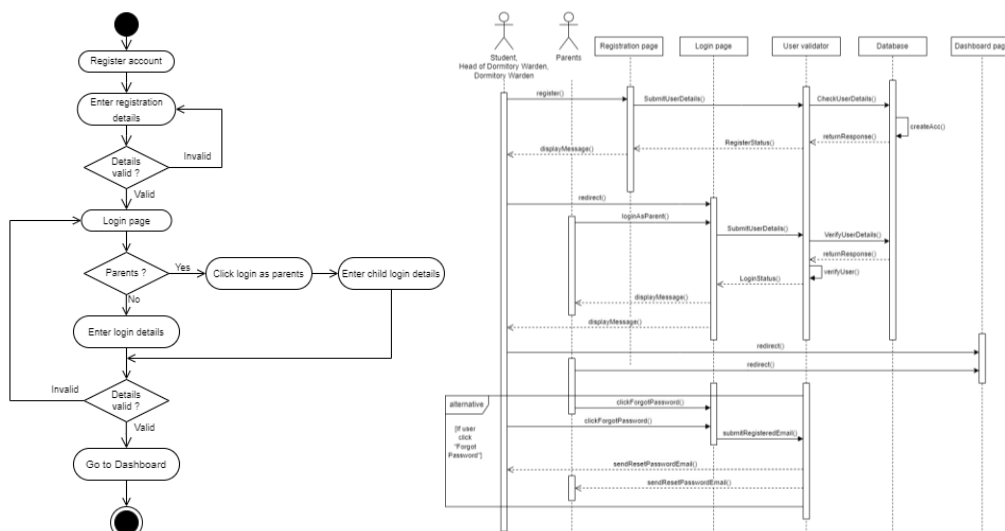


Fig. 6 Outing Assessment Interface

### Appendix B: Activity Diagram and Sequence Diagram





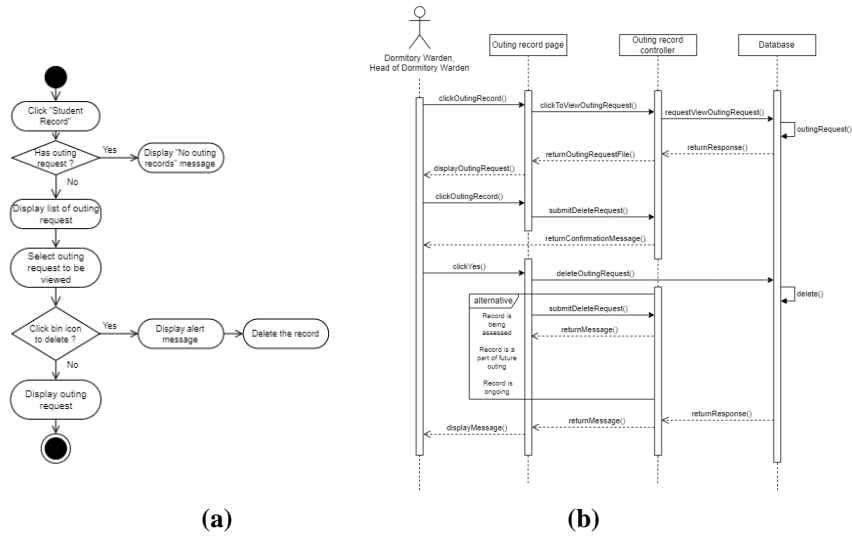


Fig. 10 Manage Outing Record (a) Activity Diagram; (b) Sequence Diagram

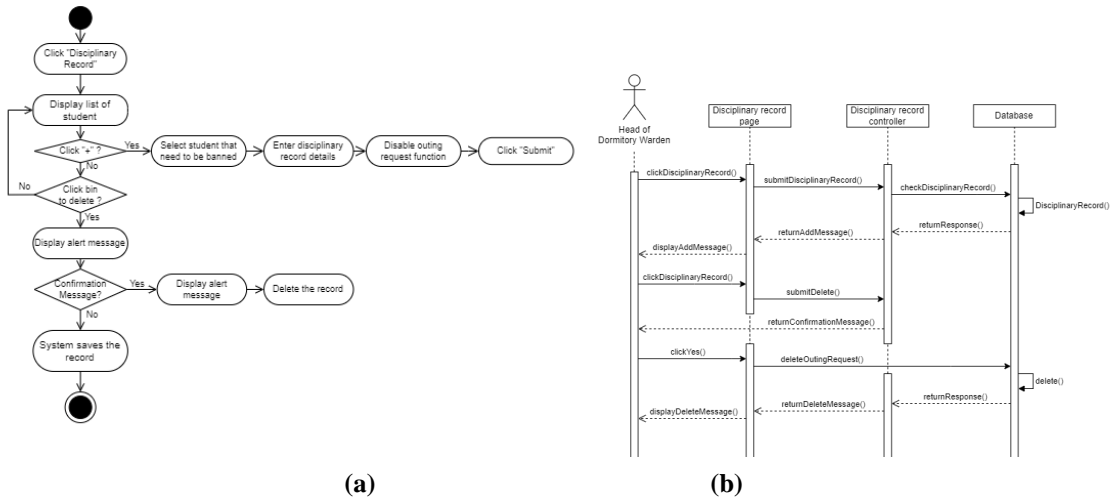


Fig. 11 Manage Outing Eligibility (a) Activity Diagram; (b) Sequence Diagram

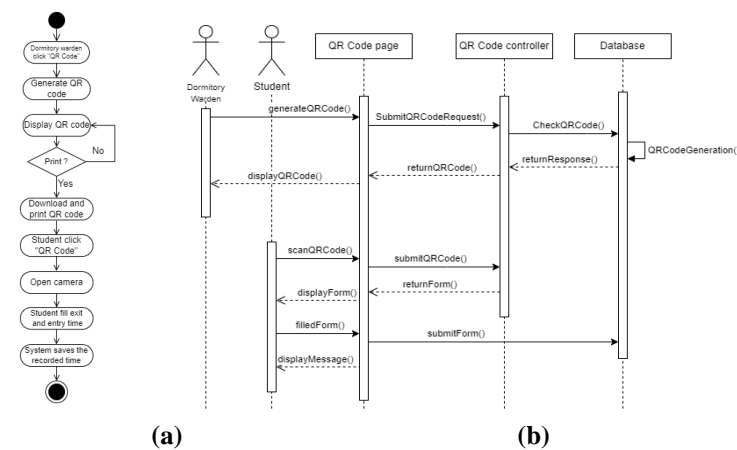


Fig. 12 Generate and Scan QR Code (a) Activity Diagram; (b) Sequence Diagram

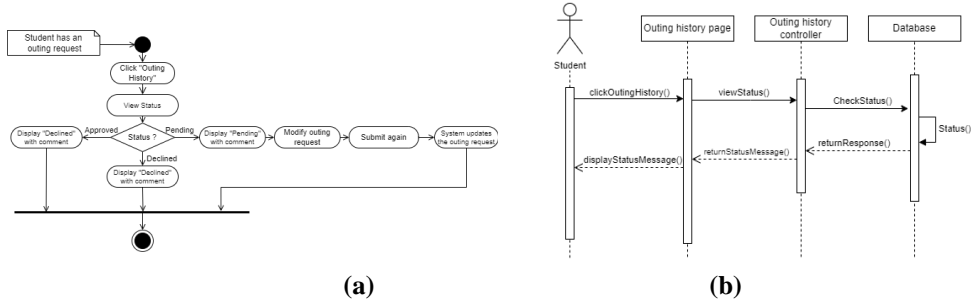


Fig. 13 View Outing Status (a) Activity Diagram; (b) Sequence Diagram

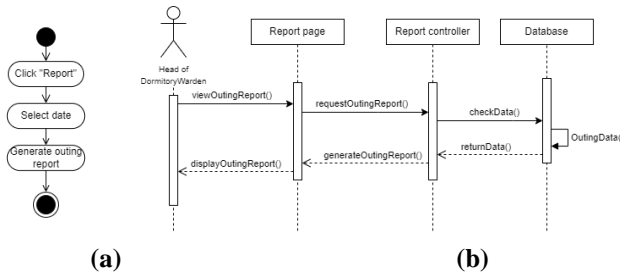


Fig. 14 Generate Outing Report (a) Activity Diagram; (b) Sequence Diagram

Appendix C: Class Diagram

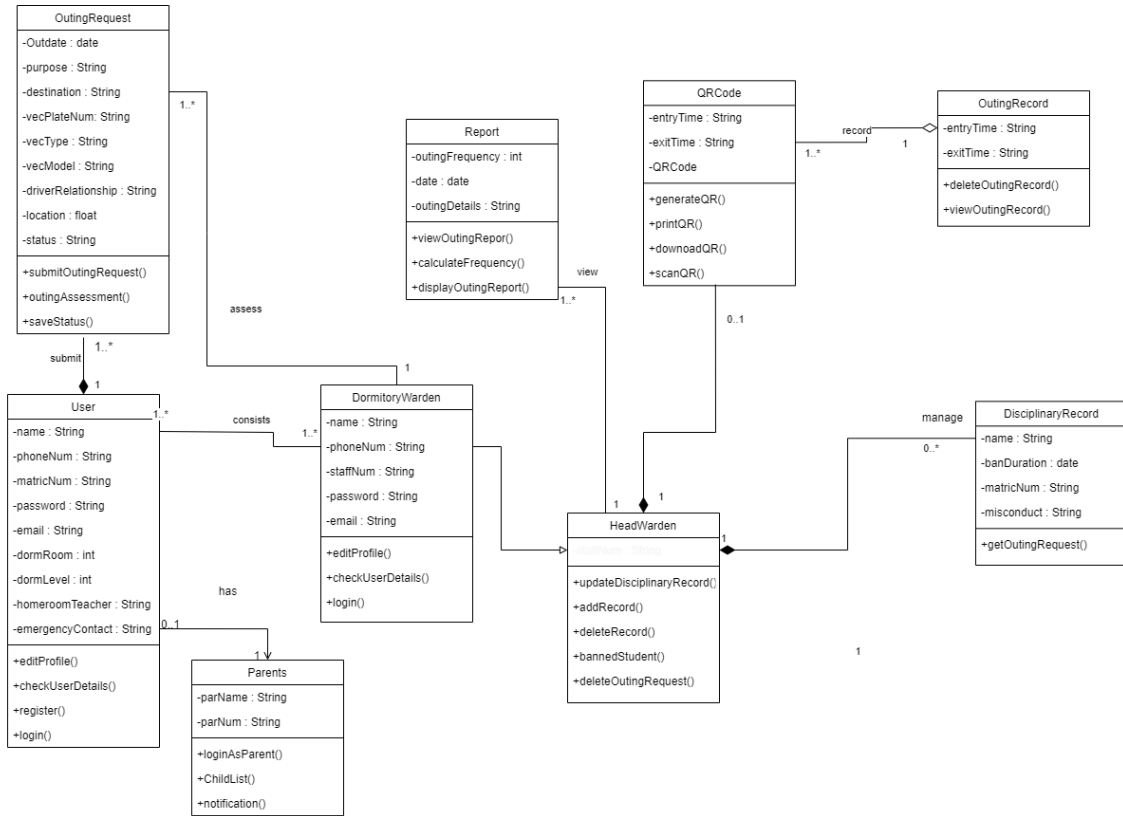


Fig. 15 Class Diagram