

Pusat Tuisyen CGT Management System in Muar

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DOI: <https://doi.org/10.30880/aitcs.2025.06.02.050>

Article Info

Received: 15 June 2025

Accepted: 20 November 2025

Available online: 30 November
2025

Keywords

Tuition, management, system,
prototyping, Web-Based System,
LMS, QR Code

Abstract

Tuition is a supplementary education service aimed at enhancing students' academic performance by providing additional guidance and learning opportunities outside regular school hours. Pusat Tuisyen Cemerlang Gemilang Terbilang (CGT) currently faces challenges due to its reliance on manual processes for managing attendance, payment records, and class schedules. These inefficiencies result in increased administrative workload, data inaccuracies, and delays, impacting the overall user experience for teachers, students, and parents. To address these issues, an online management system has been developed, aiming to enhance efficiency and streamline processes. The system follows the prototyping software process model, encompassing phases such as planning, analysis, design, implementation, and testing. The management system is specifically designed for deployment at CGT, catering to the needs of its administrators, teachers, students, and parents. The expected outcomes include automated attendance tracking via QR codes, streamlined payment handling, user-friendly class scheduling, and real-time performance monitoring. By automating key operations, the system aims to enhance CGT's overall efficiency and user satisfaction.

1.0 Introduction

Pusat Tuisyen Cemerlang, Gemilang dan Terbilang (CGT) is a tuition center located in Muar, Johor. The center is managed by their owner and accommodates a variety of teachers and students from different schools in the Muar district. CGT offers classes for both secondary and primary school students. The management of numerous teachers and students from different schools complicates the tracking of tuition fee payments, sharing of notes, and recording of student attendance.

Currently, CGT's information management is still carried out manually using physical documents. The parties involved include the owner and manager of CGT, teachers from different schools, and students from various schools. This process involves the use of forms to record fee payments, student attendance, and class schedules. All this information is stored in physical files organized by category, without the use of specialized software to manage or track data. This manual method makes it difficult to access and track information quickly and accurately, especially as the number of students and teachers grows.

The manual system implemented at Pusat Tuisyen CGT has caused several key issues that need immediate attention. First, the manual system using physical forms and documents makes it difficult to manage and track information, such as student fee payments. This process is not only time-consuming but also prone to human error and the loss of important documents. The implications of these issues include delays in information processing and

the potential loss of critical data, which can negatively affect operational efficiency and customer satisfaction.

Furthermore, the manual management of information complicates the handling of class schedules. Each subject has a limited number of students to ensure a comfortable learning environment. Tracking the number of students in a class manually becomes a challenge for both teachers and the management. This could lead to misunderstandings between different parties.

Lastly, the manual system does not provide the ability to generate reports or analyze data easily. This limits the center's ability to monitor performance, make strategic plans, and make data-driven decisions. Without an effective solution, the management will face difficulties in identifying issues that require attention, hindering improvements in service quality.

1.1 Scope

This study will cover various aspects, including the management of tuition center information, fee payments, student attendance, and class schedule management. The case study will be conducted at Pusat Tuisyen Cemerlang, Gemilang dan Terbilang in Muar, Johor. The study involves several individuals, including the tuition center manager, SPM teachers, parents and SPM students, to obtain more in-depth information. The important modules in this system shows in Table 1 below.

Table 1: *Pusat Tuisyen CGT Management System modules*

Modules	Explanation
1. User authentication module	Securing login for manager, teachers and students by having user registration, login/logout, resetting password and role-based access control between manager, teachers and students. Allows students and teachers to manage their personal information especially for teachers.
2. Fees management module	Allows parents to update the payment receipt after making payment. The manager will review and approve the payment so that the parents will be notified that their payments has been confirmed.
3. Attendance management module	Enables students to marks their attendance by using QR code scanning and allows teachers to manage attendance records.
4. Class schedule module	Allows students to manage their own class schedule with each class will have a specific teachers assigned to it. Parents can review their children schedule.
5. Teaching, learning and performance management module	Allows teachers to upload teaching materials, conduct monthly assessments, and manage student marks, while students can access materials, submit exercises, view performance feedback, and exchange documents. Parents can also review their child's performance.
6. Report and analytics module	Provides teachers and manager insights on the students' performance, attendance, fee status and rating system.

2.0 Literature Review

According to Indeed (2023), management system is the set of policies that a company implements to help it meet certain quality standards in different areas of its management [1]. This acts as a guide for management to follow, ensuring consistency and alignment across various department. It encompasses different areas of an organization's operations, such as quality assurance, risk management and performance monitoring. By implement management system for Pusat Tuisyen CGT, it will help in streamline processes and decision making.

Hashmicro (2024) argues that tuition management system (TMS) plays a crucial role in enhancing communication among stakeholders, such as manageristrators, parents, and students [2]. Features like automated

notifications and alerts help stakeholders stay updated on important matters, including payment deadlines, overdue accounts, and successful transactions. These systems often incorporate integrated messaging tools, allowing for direct communication within the platform, thereby minimizing reliance on external methods like emails or phone calls. This centralized approach promotes collaboration and ensures that all parties are informed and engaged, creating a more efficient and connected environment.

TMS provides significant advantages over the manual processes at Pusat Tuisyen CGT. While the current approach keeps records of payments and students, TMS streamlines and automates these tasks, ensuring accuracy, efficiency, and real-time access to data. Additionally, TMS enhances communication through automated notifications and offers a centralized platform for managing all tuition-related activities, reducing manageristrative workload and improving overall effectiveness. This shift to a digital solution would modernize operations and better meet the needs of all stakeholders [2].

Thus, by implementing TMS at Pusat Tuisyen CGT, it would greatly improve the operations by automating tasks, enhancing communication, and providing real-time access to data. This shift would streamline processes, reduce manageristrative workload, and create a more efficient and connected environment for all stakeholders.

2.1 Comparison with existing system

There are three (3), system that will be compared in this section, PTTI-Better Result, MC Plus and KASTURI Academy.

2.1.2 PTTI-Better Result

PTTI, a leading online tuition platform in Malaysia, offers Online Tutorial Classes (OTC) for SPM students nationwide [3]. Students can choose single subjects or package programs like Science Stream, though teachers are pre-assigned. Subscription durations range from 1 to 6 months, and payments are made via FPX or e-wallet. Post-payment, students can access schedules, teacher details, and recorded classes. This system will inspire Pusat Tuisyen CGT in program flexibility, and confirmation modules.

2.1.3 MC-PLUS

MC Plus transitioned to online tuition during the 2020 pandemic [4]. Students must register, make payments via FPX, e-wallet, or upload bank slips, and can then access schedules, teacher details, and recorded classes. Profile updates are limited, and only students and managers can use the system. Managers oversee student data, teacher details, and tuition payments. Students can access a "Notes Bank" of subject materials. Pusat Tuisyen CGT will reference MC Plus for payment uploading, a user-friendly interface, and enhanced student and class management.

2.1.3 KASTURI Academy

Founded in 1983, Kasturi Academy enables registered students to log in and customize their schedules, including choosing online or physical classes, as well as day, time, and teacher preferences [5]. Managers handle program updates, subject management, and administrative tasks for branches. Students access shared learning resources and review enrolled classes. This system's comprehensive management features will guide Pusat Tuisyen CGT in handling tuition operations efficiently.

2.1.4 Comparison of Three (3) Existing Systems

The existing systems, which are PTTI, MC Plus and KASTURI Academy and the proposed system Pusat Tuisyen CGT Management System are being examined and research to find out the similarities and differences. Table 2 illustrates the summarization of the comparison between systems.

Table 2: *Table of systems comparison*

Features/ Systems	PTTI	MC Plus	KASTURI Academy	Pusat Tuisyen CGT

				Management System
Login	YES	YES	YES	YES
Sign Up	YES	YES	NO	YES
Fees	YES	YES	NO	YES
Attendance Recording	NO	NO	NO	YES
Class Schedule	YES	YES	YES	YES
Profile	YES	YES	NO	YES
Teaching and learning modules	YES	YES	NO	YES
Students' Performance	NO	NO	NO	YES
Generate Report	NO	NO	NO	YES

3.0 Methodology

In this project, the prototyping model is selected as the software process model to guide and manage the activities throughout the entire development process. A prototype serves as a preliminary representation of certain aspects of a concept or the final design [6].

The prototyping model is chosen due to its notable advantages, one of which is the early involvement of users in the product's development. This is evident in the model's workflow, where a prototype is created early in the design phase and presented to users to gather feedback and refine requirements. This user engagement in the initial stages ensures the development of a system that aligns closely with the users' expectations. Additionally, the prototyping model is effective in identifying missing functionalities and errors early on. By allowing users to interact with a tangible prototype, potential issues can be detected and resolved promptly, enhancing the overall reliability and quality of the final product.

There are various types of prototyping, including throwaway prototyping, evolutionary prototyping, incremental prototyping, and extreme prototyping. In this project, the evolutionary prototyping approach is used. This method focuses on continuously improving the prototype based on iterative feedback from users until it evolves into the final system. This iterative refinement ensures that the final product is well-aligned with user needs and expectations [7].

There are total of seven phases from the prototype model. As shown in Table 3, each phase has its own assignment and output that need to produce during the entire project development. Besides that, the output had been completed within the specific days that have been given.

Table 3: Software development activities and task

Phase	Activities	Output
Planning	<ul style="list-style-type: none"> - Develop project plan - Interview stakeholder - Gather requirement from stakeholder - Identify users 	<ul style="list-style-type: none"> - Initial requirements documentation - Project plan - Project proposal
Prototype 1		
Analysis	<ul style="list-style-type: none"> - Analyzed interview session - Analyzed system needs - Create use case - Analyzed existing document 	<ul style="list-style-type: none"> - Detailed required documentation
Design	<ul style="list-style-type: none"> - System architecture design - Design database 	<ul style="list-style-type: none"> - System architecture diagrams - Interface design - Schema table
Table 3: continued		
Implementation	<ul style="list-style-type: none"> - Develop basic version prototype of Pusat Tuisyen CGT - Present prototype to stakeholder 	<ul style="list-style-type: none"> - Working prototype - Functional prototype for stakeholder review

	<ul style="list-style-type: none"> - Collect feedback - Repeat analysis, design and implementation 	
Prototype 2		
Analysis	<ul style="list-style-type: none"> - Analyzing feedback and comments from stakeholders - Identifying improvements needed from the previous prototype 	<ul style="list-style-type: none"> - Outcome of stakeholder feedback analysis - Enhancements from Prototype 1
Design	<ul style="list-style-type: none"> - Improving the system interface 	<ul style="list-style-type: none"> - System interface design
Implementation	<ul style="list-style-type: none"> - Improve first prototype for second prototype - Testing each module - Fixing errors 	<ul style="list-style-type: none"> - Validating the final prototype with stakeholders - Pusat Tuisyen CGT management system fully develop - Testing plan
End of iteration		
Testing	<ul style="list-style-type: none"> - Conduct User Acceptance Testing - Perform system testing 	<ul style="list-style-type: none"> - System testing result - User Acceptance Result
Documentation	<ul style="list-style-type: none"> - Update documentation 	<ul style="list-style-type: none"> - Updates system documentation

4.0 Analysis and Design

This section will detail more about the analysis and design for Pusat Tuisyen CGT Management System in Muar.

4.1 System Requirement Analysis

System requirements analysis is the process of identifying all user needs proposed for system development. This involves gathering information related to functional and non-functional requirements, software and hardware specifications, as well as user needs. The collected information is thoroughly analyzed and validated to ensure it meets user expectations, ultimately guaranteeing that the developed system achieves high-quality standards in every module created. Functional requirements refer to the specific functions that the system must perform, as determined by stakeholders. Meanwhile, non-functional requirements outline the quality attributes necessary for system development. Table 4 details the system's functional requirements, while Table 5 explains the system's non-functional requirements.

Table 4: *Functional Requirement*

No.	System Module	Function
1.	User authentication module	<ul style="list-style-type: none"> - System allows users to choose their roles - System allows students and parents to choose whether they want to register (for first time user) or login (for existing user) - System allows teachers to request access for approval from manager. - System allows teachers to check their approval status. - System allows user to login to the system with email and password. - System shows error message if email or password is wrong - System allows user to logout. - System allows students, parents and teachers to manage their personal information. - System shows error message when profile is not complete. - System allows students, parents and teachers to change password.
2.	Class schedule module	<ul style="list-style-type: none"> - System allows students to choose and view the subject and time for class.
Table 4: <i>continued</i>		
		<ul style="list-style-type: none"> - System allows manager to update subject and time with specific teachers. - System allows manager to add subject.

		- System allows teacher to view their class subject and time.
3.	Fees management module	<ul style="list-style-type: none"> - System allows parents to update the payment receipt. - System allows manager to approved payment. - System shows parents the approval status. - System block attendance for students if parents not update payment receipt every start of month.
4.	Attendance management module	<ul style="list-style-type: none"> - System allows teachers to generate attendance QR code by choosing subject name. - System allows students to scan QR code for attendance. - System will be block for students if parents not update payment receipt and approve by manager. - System allows teacher to mark students' attendance manually.
5.	Manage teaching and learning module	<ul style="list-style-type: none"> - System allows teachers to upload learning materials. - System allows teachers to create quiz and exercises for students performance. - System allows teachers to view and grade students submission of quiz and exercises. - System allows students to access learning materials, download and upload documents.
6.	Generate report module	- System allows parents and manager to view report.

Table 5 shows the list of non- functional requirements for every module.

Table 5: *Non-functional Requirement*

No.	Non-functional requirement	Explanation
1.	Performance	<ul style="list-style-type: none"> - Authentication and profile update actions should not exceed 5 seconds for response time. - QR code generation in the attendance module take less than 10 seconds. - Monthly reports in the report and analytics module must be generated within 10 seconds.
2.	Compatibility	- All file uploads (e.g., learning materials and exercises) must support common formats like PDF, DOCX, and JPEG/PNG.
3.	Usability	<ul style="list-style-type: none"> - All error messages provide clear and actionable instructions, such as correcting login credentials or completing profile details. - The user interface are intuitive, ensuring that first-time users can navigate key features (e.g., login, class schedule, and learning materials) without additional help.
4.	Security	<ul style="list-style-type: none"> - User passwords must be at least 8 characters long, including uppercase letters, lowercase letters, and numbers. - Manager actions, such as approving payments and updating schedules, must be logged for accountability.

User requirements refer to the detailed needs and expectations of users for utilizing the system. These requirements are crucial to analyze beforehand to ensure the system can meet user satisfaction. In other words, they provide an understanding of the features and functionalities the system should offer. Table 6 outlines the specific user requirements in the system development process.

Table 6: *User Requirements*

No.	User Requirements
1.	Manager, students, teachers and parents must be able to register as first-time users or log in as existing users.
2.	Manager must be able to approve teachers request access.
3.	The system should validate login credentials (email and password) and display error messages for incorrect inputs.
4.	Students, parents and teachers must be able to update their profile.
<i>Table 6: Continued</i>	
5.	Parents must be able to update payment receipts in the system.
6.	Manager should have the ability to approve payment receipts.

7. Parents should receive email notifications once the payment is confirmed.
8. Teachers should be able to generate attendance QR codes by entering subject name.
9. Students must be able to scan QR codes to mark their attendance.
10. Students should be able to select and view their desired subjects and class timings.
11. Manager should be able to update the subject, class time, and assign specific teachers.
12. Teachers should be able to view their assigned subjects and class schedules.
13. Students and teachers must be able to manage and update their personal information.
14. Teachers should be able to upload learning materials, conduct assessments (quiz and exercises).
15. Students should be able to access uploaded learning materials, view performance and download and upload documents.
16. Parents should have the ability to view their child's assessment performance.
17. Parents and manager must be able to view monthly performance reports.

4.2 UML Specification

According to Dennis et al. (2019), UML diagrams are used in object-oriented programming methods to visualize and model any system development project from analysis to design [8]. Several UML diagrams are utilized in this project, including use case diagrams, use case specifications, activity diagrams, sequence diagrams, and class diagrams. Each diagram represents different aspects of the system to explain each module based on user requirements.

A use case diagram represents the interactions between users and use cases within a system. It helps identify the system's functional requirements in an organized manner and models the interaction between the system and its users. In this system, the users include students, teachers, parents and manager. The diagram highlights six (6) use cases, as depicted in Figure 1: user authentication including manage profile, manage class schedule, manage fees, manage attendance, manage profile, manage and learning, and lastly, generate report.

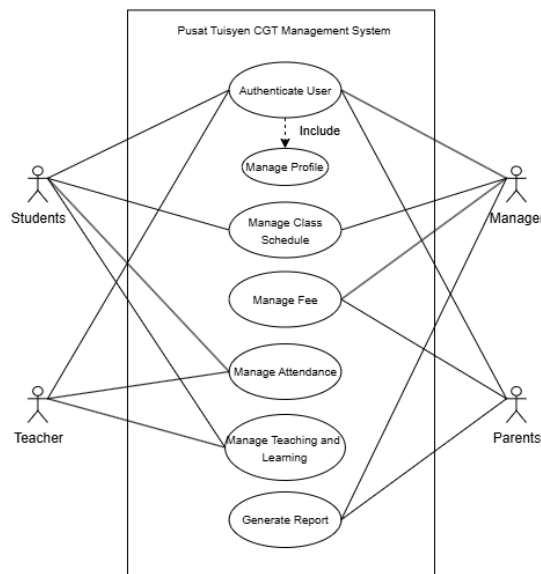


Fig. 1: Use Case Diagram

User need to authenticate first by choosing whether their roles are manager, students, teachers or parents. If they are students and parents, they can login-for existing user, or register-for first time user- to the system. Meanwhile manager and teachers only need to login, as manager have the credentials while teachers need to be approved first by manager before allowing them to teach in Pusat Tuisyen CGT. Additionally, students, parents and teachers can update and manage their personal information. The system also allows parents to choose their children name, so that they can view their children schedule. Students can view and choose subjects along with their class schedules, with manager manage class schedules and assigning teachers. Teachers generate QR codes for attendance, and students mark their attendance by scanning them. Students' attendance will be blocked, if the parents not pay the fees yet. Parents can update payment receipts, which need manager approval. Teachers can upload learning materials, conduct assessments via online in the system, and manage student performance, while students access materials, submit assignments, and view their assessments marks. Parents can view their child's performance, and both parents and manager can generate and review performance reports.

Figure 2 shows three main modules that are highlighted in Pusat Tuisyen CGT Management System in activity diagram.

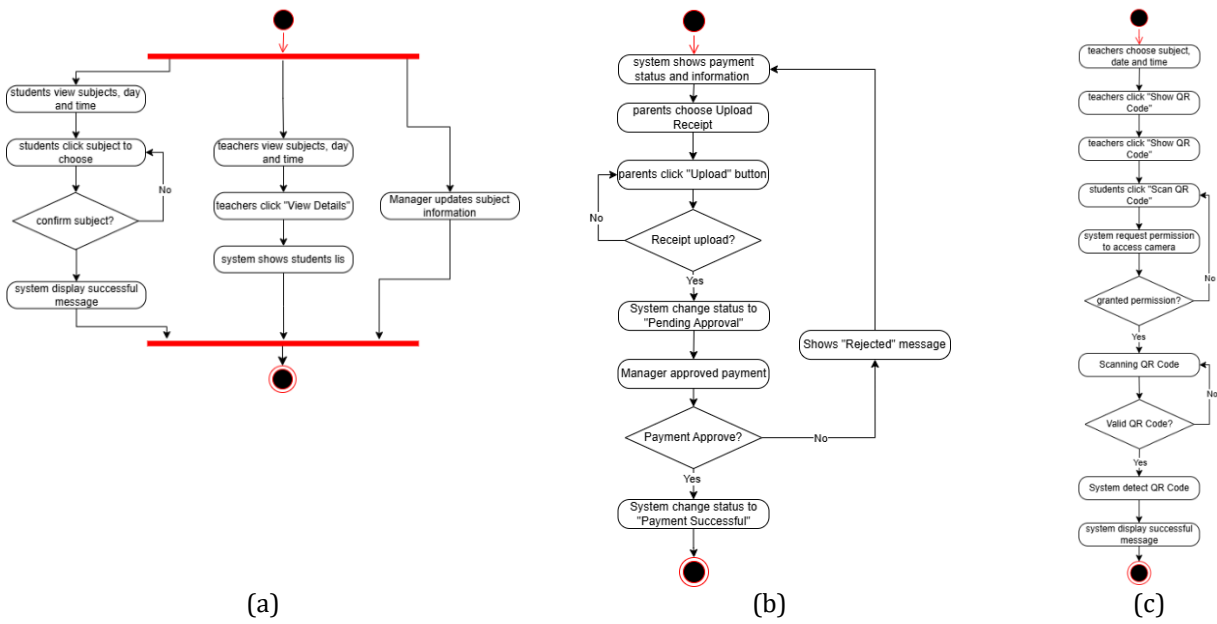
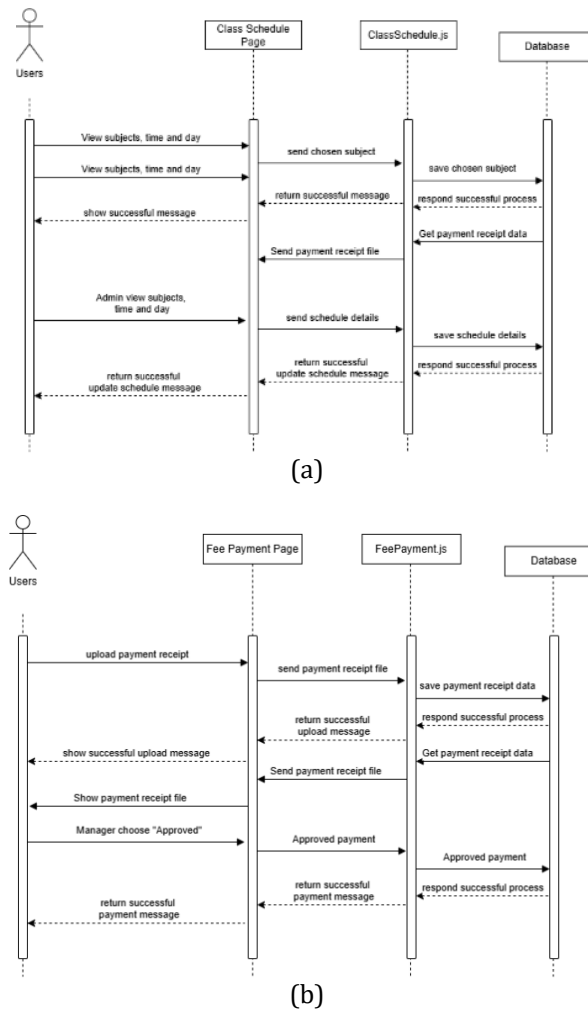


Fig 2: (a) Manage Class Schedule Module (b) Fees Management Module (c) Attendance Management Module

Figure 3 shows three main modules that are highlighted in Pusat Tuisyen CGT Management System in sequence diagram.



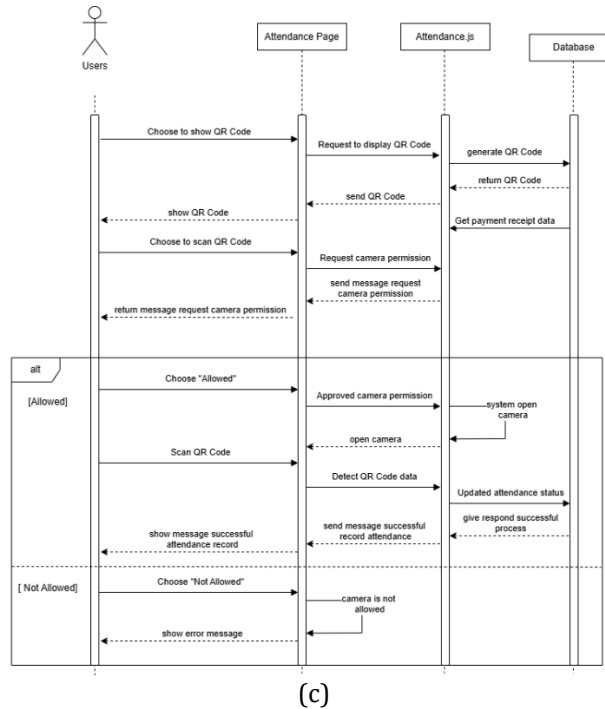


Fig 3: (a) Manage Class Schedule Module (b) Fees Management Module (c) Attendance Management Module

The class diagram illustrates in Figure 4 are the structure of the CGT Management System using Unified Modeling Language (UML), encompassing eighteen (18) classes: Manager, Parent, Student, Teacher, Subject, ParentStudent, ClassSchedule, TLP (Teaching, Learning, and Performance), MaterialMessages, Attendance, Invoice, Assessment, AssessmentQuestion, AssessmentOption, AssessmentResponse, AssessmentAnswer, ExerciseSubmissions, and StudentEnrollment.

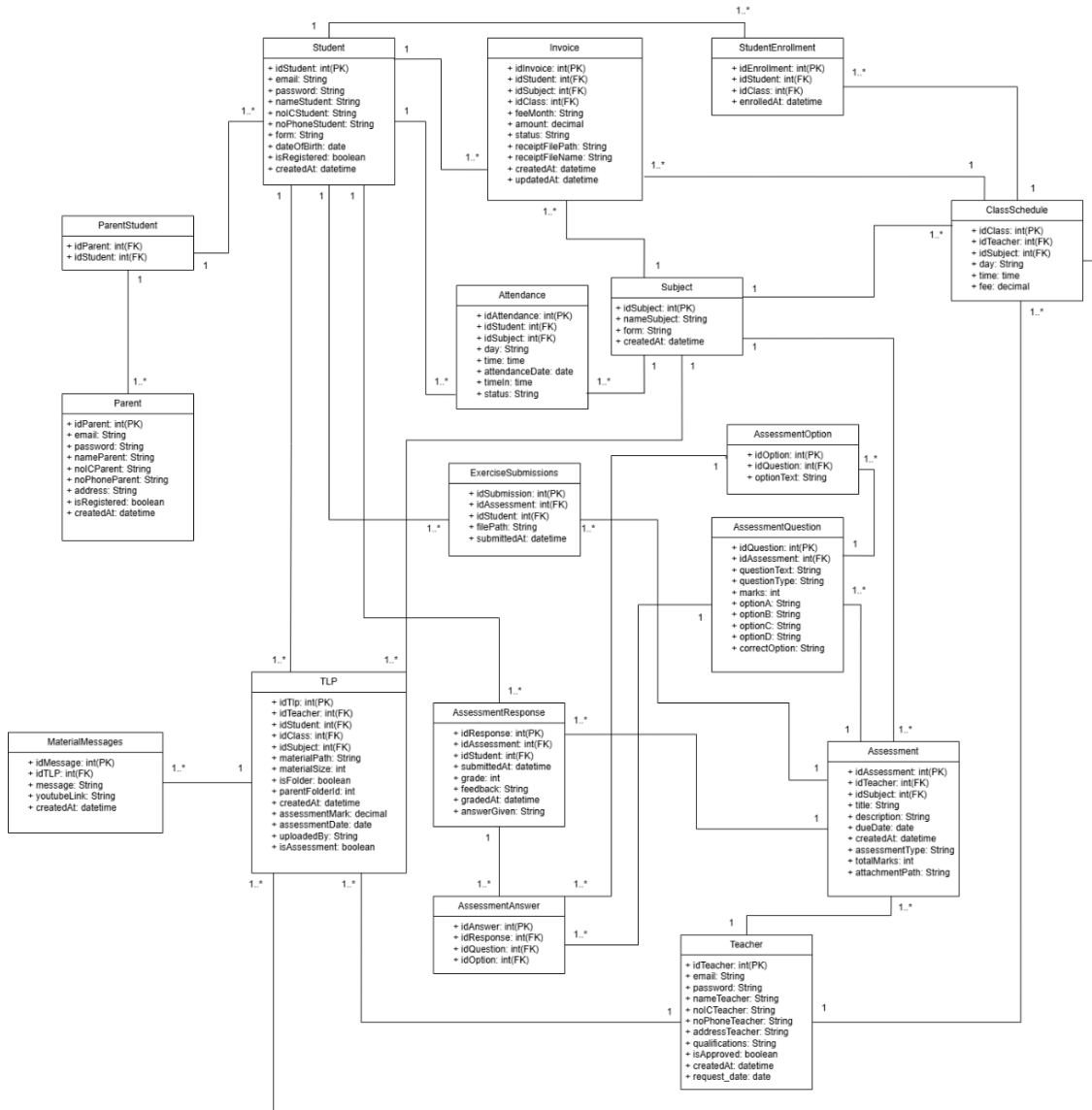


Fig 4: Class Diagram

User login and profile information are integrated within the Manager, Parent, Student, and Teacher classes, each representing a specific system role. The ParentStudent class establishes a many-to-one relationship between students and their parents. The Student class is central to the system, linking to Attendance, Invoice, TLP, AssessmentResponse, ExerciseSubmissions, and StudentEnrollment for managing academic records, financial data, and learning progress. The Teacher class connects to ClassSchedule, TLP, and Assessment, enabling instructors to manage classes and monitor student performance. ClassSchedule contains scheduling details such as assigned teachers, subjects, times, and fees. TLP serves as the hub for learning materials and assessment tracking, connected to Teacher, Student, Subject, and ClassSchedule, while MaterialMessages stores shared session resources. Attendance records daily student presence by subject and schedule, and Invoice handles student payments. The assessment module consists of interconnected classes—Assessment, AssessmentQuestion, AssessmentOption, AssessmentResponse, AssessmentAnswer, and ExerciseSubmissions—facilitating question creation, response collection, grading, and file submissions. Lastly, StudentEnrollment manages which students are linked to which schedules, enabling controlled access to content and tracking tools. This comprehensive class diagram supports efficient academic and administrative management across the CGT platform. Below is the list of database schema used in Pusat Tuisyen CGT Management System in Muar:

- i. Manager (idManager (PK), email, password).
- ii. Parent (idParent (PK), email, password, nameParent, noICParent, noPhoneParent, address, isRegistered, createdAt).
- iii. Student (idStudent (PK), email, password, nameStudent, noICStudent, noPhoneStudent, form, dateOfBirth, isRegistered, createdAt).
- iv. ParentStudent (idParent (FK), idStudent (FK)) //bridge for parent and student, relationship many-to-many

- v. Teacher (idTeacher (PK), email, password, nameTeacher, noICTeacher, noPhoneTeacher, addressTeacher, qualifications, isApproved, createdAt, request_date).
- vi. Subject (idSubject (PK), nameSubject, form, createdAt) //table for subject
- vii. ClassSchedule (idClass (PK), idTeacher (FK), idSubject (FK), day, time, fee) //table for set class schedule
- viii. TLP (idTlp (PK), idTeacher (FK), idStudent (FK), idClass (FK), idSubject (FK), materialPath, materialSize, isFolder, parentFolderId, createdAt, assessmentMark, assessmentDate, uploadedBy, isAssessment) //table for teaching learning performance
- ix. MaterialMessages (idMessage (PK), idTLP (FK), message, youtubeLink, createdAt)
- x. Attendance (idAttendance (PK), idStudent (FK), idSubject (FK), day, time, attendanceDate, timeIn, status)
- xi. Invoice (idInvoice (PK), idStudent (FK), idSubject (FK), idClass (FK), feeMonth, amount, status, receiptFilePath, receiptFileName, createdAt, updatedAt)
- xii. Assessment (idAssessment (PK), idTeacher (FK), idSubject (FK), title, description, dueDate, createdAt, assessmentType, totalMarks, attachmentPath)
- xiii. AssessmentOption (idOption (PK), idQuestion (FK), optionText)
- xiv. AssessmentQuestion (idQuestion (PK), idAssessment (FK), questionText, questionType, marks, optionA, optionB, optionC, optionD, correctOption)
- xv. AssessmentResponse (idResponse (PK), idAssessment (FK), idStudent (FK), submittedAt, grade, feedback, gradedAt, answerGiven)
- xvi. AssessmentAnswer (idAnswer (PK), idResponse (FK), idQuestion (FK), idOption (FK))
- xvii. ExerciseSubmissions (idSubmission (PK), idAssessment (FK), idStudent (FK), filePath, submittedAt)
- xviii. StudentEnrollment (idEnrollment (PK), idStudent (FK), idClass (FK), enrolledAt)

4.3 User Interface

Figure 5 shows three main modules that are highlighted in Pusat Tuisyen CGT Management System in system interface, which are, the class schedule interface, where students can choose their desire subject and they also can view the teachers name. Next is, manage fees where parents need to upload the bank receipt with their child's name and subject they take in what month. Moreover, the attendance management module shows on how teachers will generate the QR Code for attendance. They need to enter subject name, date and time.

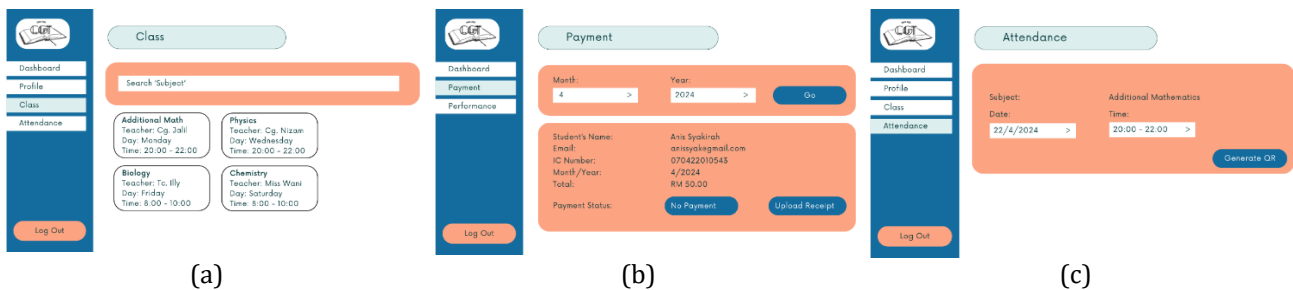


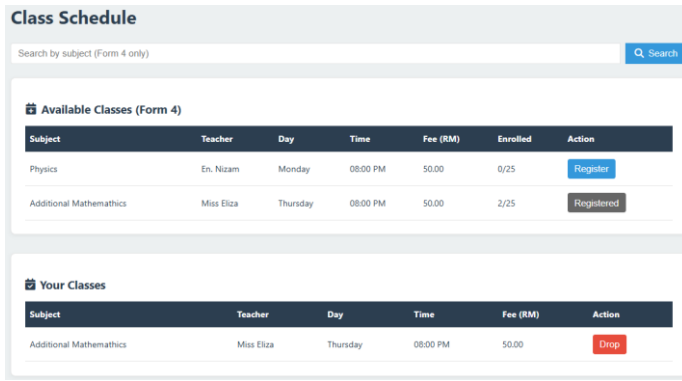
Fig 5: (a) Manage Class Schedule Module (b) Fees Management Module (c) Attendance Management Module

5.0 Implementation and Testing

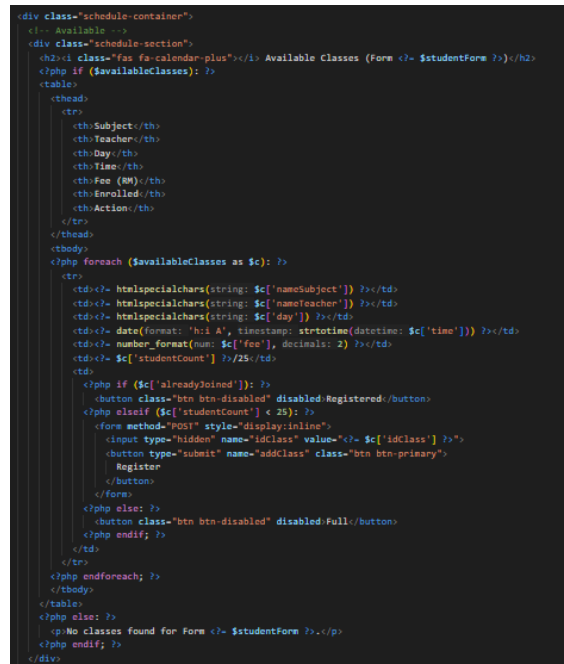
This section will detail more about the analysis and design for Pusat Tuisyen CGT Management System in Muar.

5.1 Implementation

Figure 6 shows the student's view: an interface where enrolled classes appear in time slots, along with teacher names and subject codes and was filtered based on students' form. The source code demonstrates the controller code: validating that the student is enrolled, querying the pivot table for student.



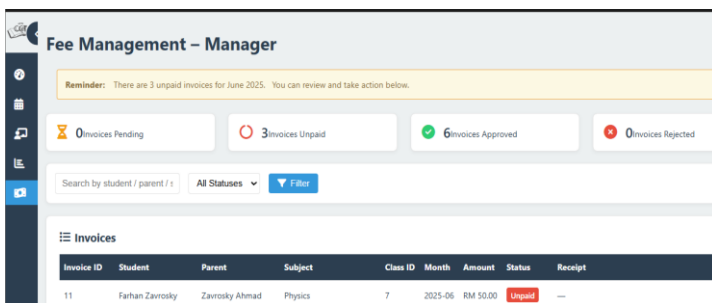
(a)



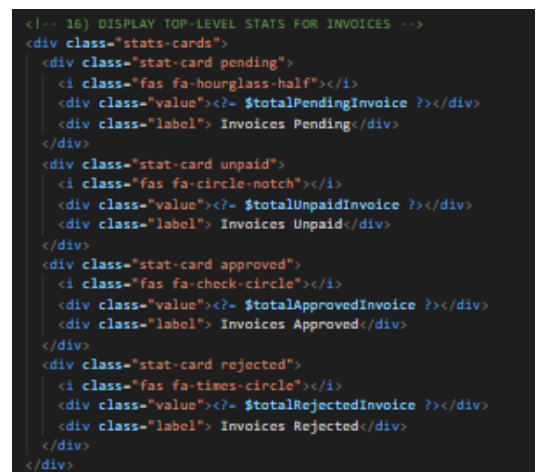
(b)

Fig 6: (a) Class Schedule Page (b) Source Code for Class Schedule

Figure 7 displays the fee management page for manager: pending receipts are listed with student names, dates, amounts, and a thumbnail of the uploaded proof. Approve/reject buttons let manager process payments. Manager can download the payment receipt before make approval. The source code contains the backend logic: it validates status changes, updates the receipt record, update the status to parents, and recalculates monthly revenue summaries.



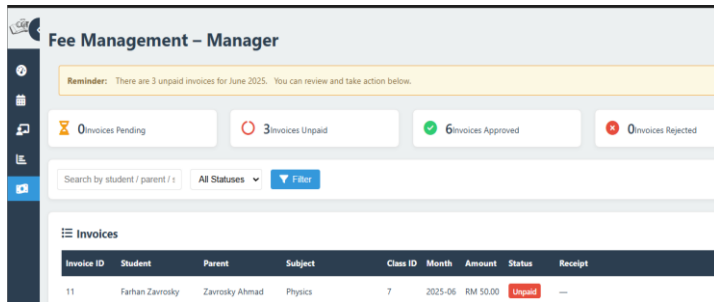
(a)



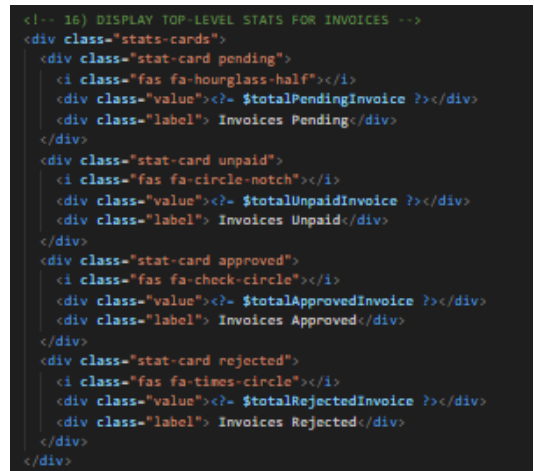
(b)

Fig 7: (a) Fees Management Page (b) Source Code for Fees Management

Figure 8 illustrates the teacher’s attendance module: a dropdown to select a subject, date picker, and a “Generate QR” button that outputs a QR code image representing that session. The source code shows the code that generates a unique token tied to the class ID and timestamp, creates the QR graphic, stores the token in the attendance table, and returns the image for display or printing. Error handling ensures duplicate codes cannot be generated for the same session.



(a)



(b)

Fig 8: (a) Fees Management Page (b) Source Code for Fees Management

5.2 Testing

Functional testing is a testing that been done on the system function. The system should be able to perform the functions that meet the functional requirements which has been discussed in the previous chapter. The test cases are derived based on the functional requirements defined in chapter 4. Table 7 shows the requirements traceability matrix (RTM). It traces the system requirements and specifications. This assists in testing to make sure that all the requirements from the system are being tested properly.

Table 7: List of Test Cases

Software Requirement Specification	Test Case ID	Test Case Description	Test Result (Pass/Fail)
REQ_100	TC_100	User Authentication Module	
FR01-01	TC_100_01	The system allows users to select their roles: Manager, Student, Parent, or Teacher.	PASS
FR01-02	TC_100_02	The system allows users to register or login.	PASS
FR01-03	TC_100_03	The system allows Students and Parents to enter their name, date of birth, identification card number, email, phone number, home address and grade level.	PASS
FR01-04	TC_100_04	The system allows Teachers to request access and be approve by manager.	PASS
FR01-05	TC_100_05	The system allows Teachers to check their request approval using IC number.	PASS
FR01-06	TC_100_06	The system validates the registration and login form.	PASS
FR01-07	TC_100_07	The system displays a registration and login success message upon successful credentials.	PASS
FR01-08	TC_100_08	The system displays an error message if credentials are invalid.	PASS
REQ_200	TC_200	Manage Schedule Modul	
FR02-01	TC_200_01	The system allows users to access the class schedule page.	PASS
FR02-02	TC_200_02	The system shows a list of subjects according to the students' form.	PASS
FR02-03	TC_200_03	The system saved data after the manager updated the class schedule information.	PASS
FR02-04	TC_200_04	The system displays messages successfully updating the subject.	PASS
FR02-05	TC_200_05	The system displays students' lists according to the subject they take.	PASS

Table 7: *Continued*

FR02-06	TC_200_06	The system shows students registered classes.	PASS
FR02-07	TC_200_07	The system does not allow students to enroll in the same class they enroll in.	PASS
REQ_300	TC_300	Fees Management Module	
FR03-01	TC_300_01	The system allows user access to the fee payment page.	PASS
FR03-02	TC_300_02	Parents must upload files in .pdf, .jpeg, .jpg, or .png format only.	PASS
FR03-03	TC_300_03	The system stores the bank receipt and sends it to the manager.	PASS
FR03-04	TC_300_04	The system changes the payment status to "Pending" after uploading the bank receipt.	PASS
FR03-05	TC_300_05	Bank receipt payment details are displayed on the manager page for approval.	PASS
FR03-06	TC_300_06	The manager can approve or reject the bank receipt payment.	PASS
FR03-07	TC_300_07	The system changes the payment status to "Approved" after the bank receipt is verified by the manager.	PASS
REQ_400	TC_400	Attendance Management Module	
FR04-01	TC_400_01	The system allows users to access the attendance page.	PASS
FR04-02	TC_400_02	Teachers can select the subject name to display the attendance QR code.	PASS
FR04-03	TC_400_03	The system generates the QR code automatically.	PASS
FR04-04	TC_400_04	Students can scan the QR code using the camera to mark their attendance.	PASS
FR04-05	TC_400_05	The system detects the scanned QR code.	PASS
FR04-06	TC_400_06	The system displays a success message after the student successfully scans the QR code.	PASS
FR04-07	TC_400_07	Students are marked as present if they successfully scan the QR code.	PASS
FR04-08	TC_400_08	The system block the students' attendance page if their parent not pay the fee of the month.	PASS
FR04-09	TC_400_09	Teachers are able to mark students' attendance manually.	PASS
REQ_500	TC_500	Manage Teaching and Learning Module	
FR05-01	TC_500_01	The system allows users to access teaching and learning page.	PASS
FR05-02	TC_500_02	The system allows teachers to upload various types of learning materials.	PASS
FR05-03	TC_500_03	Teachers and students must upload files in .pdf, .jpeg, .jpg, or .png format only	PASS
FR05-04	TC_500_04	The system must enable teachers to conduct and manage monthly assessments.	PASS
FR05-05	TC_500_05	Teachers able to download students submitted work.	PASS
FR05-06	TC_500_06	Students able to upload and download files through the system.	PASS
FR05-07	TC_500_07	The system displays message upon successful uploaded files.	PASS
FR05-08	TC_500_08	The system allows teachers to create assessments (quiz and exercises).	PASS
FR05-09	TC_500_09	The system allows students to answer the assessments.	PASS
FR05-10	TC_500_10	The system automatically calculates the students mark for their assessments.	PASS
REQ_600	TC_600	Generate Report Module	
FR06-01	TC_600_01	The system allows users to access report page.	PASS

Table 7: *Continued*

FR06-02	TC_600_02	The system displays students' performance reports to parents.	PASS
FR06-03	TC_600_03	Manager can print report.	PASS
FR06-04	TC_600_04	The system displays statistical reports for students, teachers' performance, assessments' performance and payment status.	PASS
FR06-05	TC_600_05	Users able to download report.	PASS

The overall test results for the functionality testing is shown in Table 8. The total test cases for each module and the number of passes test result are concluded in the table.

Table 8: *Overall Test Results*

Test Case	Total Test Case	Total Success	Total Failed
TC_100	8	8	0
TC_200	7	7	0
TC_300	7	7	0
TC_400	9	9	0
TC_500	10	10	0
TC_600	5	5	0
Total	46	46	0

Based on Table 5.2, all the total cases for this test are 46 test cases and all the test cases are being approved. This indicates that the system is able to perform all the functionalities that meet functional requirements of the system.

5.3 User Acceptance Testing

Figure 9 until 14 shows the User Acceptance Testing that was carried out with six (6) participants, comprising the manager, teachers, parents, and Students (Form 4 and Form 5).

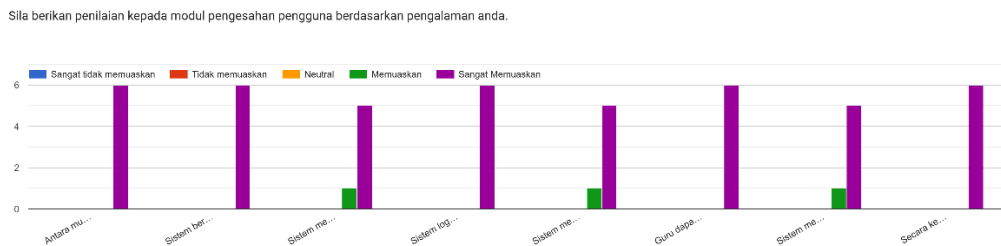


Fig 9: User Authentication Module

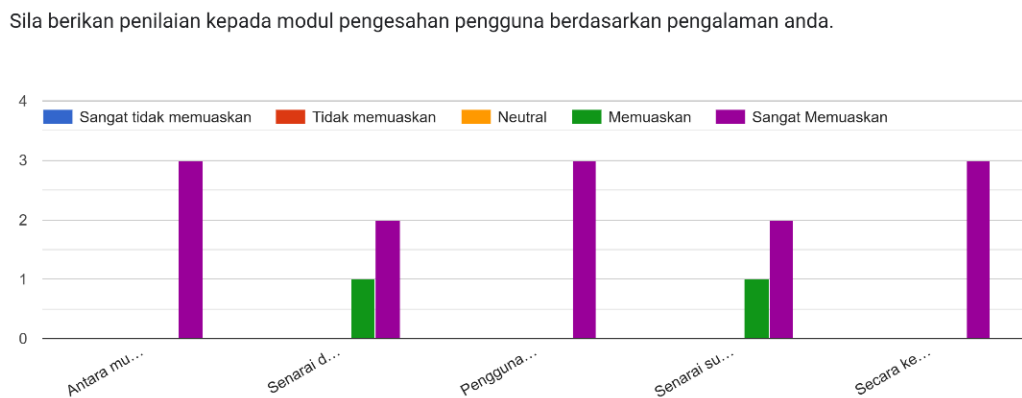


Fig 10: Manage Class Schedule Module

Sila berikan penilaian kepada modul pengesahan pengguna berdasarkan pengalaman anda.

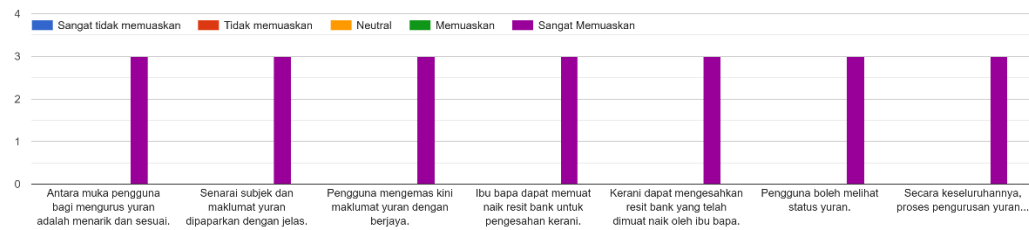


Fig 11: Fees Management Module

Sila berikan penilaian kepada modul pengesahan pengguna berdasarkan pengalaman anda.

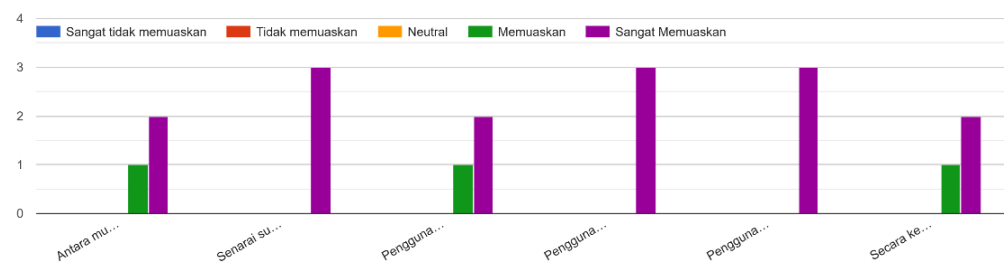


Fig 12: Attendance Management Module

Sila berikan penilaian kepada modul pengesahan pengguna berdasarkan pengalaman anda.

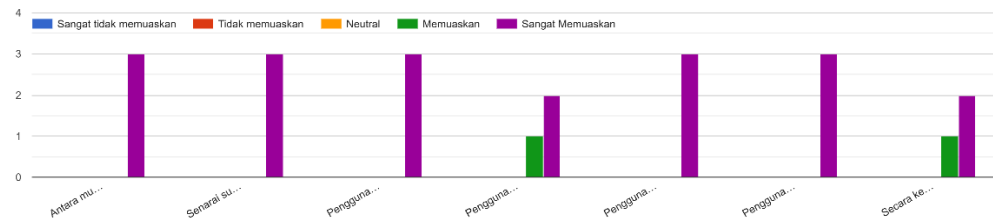


Fig 13: Manage Teaching and Learning Module

Sila berikan penilaian kepada modul pengesahan pengguna berdasarkan pengalaman anda.

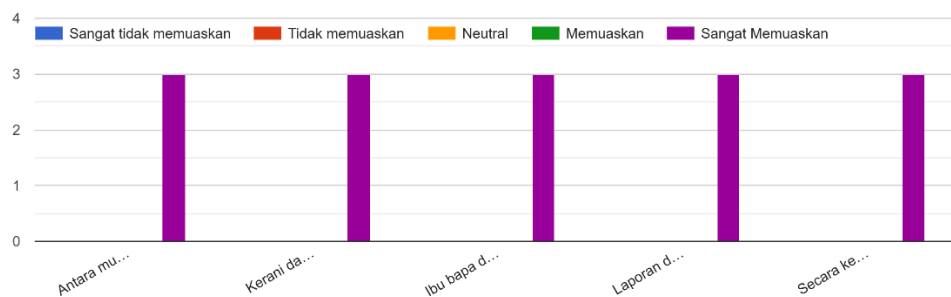


Fig 14: Generate Report Module

The User Acceptance Testing (UAT) results demonstrate an exceptionally high level of user satisfaction across all key modules. Both Fee Management and Report Generation achieved a perfect 100% “Very Satisfactory” rating, underscoring their seamless workflows and clear outputs. Every other module scored above 80% in “Very Satisfactory,” with User Authentication at 93.8%, Teaching & Learning at 90.5%, Subject Management at 86.7%, and Attendance Management at 83.3%. These consistently strong scores indicate that the system effectively meets user needs with only minor opportunities for fine-tuning—particularly around the attendance workflow—to push every module toward unanimous “Very Satisfactory” approval.

6.0 Achievement of the Overall Objectives

The primary objectives of this project were to design, develop, and test Pusat Tuisyen CGT Management System using object-oriented and web-based approaches. These objectives were successfully achieved.

Firstly, the system was designed using principles of object-oriented programming (OOP), ensuring modularity, scalability, and maintainability. Key design elements included class diagrams, use case diagrams, and sequence diagrams, which effectively mapped out the interactions and functionalities of the system components. Various modules such as User Authentication Module, Fees Management Module, Attendance Management Module, Class Schedule Module, Teaching and Learning Management Module and Generate Report Module. were designed to meet the specific requirements of Pusat Tuisyen CGT, ensuring comprehensive coverage of the procurement process.

Secondly, the system was developed as a web-based application, allowing accessibility from any location with internet connectivity. This addressed the limitations of the previous manual system, which required physical presence for management activities. Technologies such as MySQL for database management, Visual Studio Code for programming, and secure communication protocols were employed to create a robust and efficient system. The web-based nature of the system facilitated real-time updates and streamlined the management workflow, significantly reducing processing times.

Thirdly, extensive testing phases were conducted, including unit testing, system testing, and user acceptance testing (UAT). These tests ensured that each component functioned correctly and met the user requirements. Feedback from the UAT was incorporated to refine and enhance the system, ensuring that it not only met technical specifications but also aligned with the practical needs and expectations of the end-users. The testing phase validated the system's reliability, security, and performance, confirming that the online management system was ready for deployment in a real-world environment.

Overall, the successful achievement of these objectives resulted in the creation of an efficient, user-friendly, and secure Pusat Tuisyen CGT Management System. This system streamlined the management process, reduced administrative overhead, and provided a scalable solution adaptable to future needs.

6.1 System Advantages

The advantages of PUSAT TUISYEN CGT MANAGEMENT SYSTEM are stated as follows:

- i. The system makes the operations faster as it automates attendance, fee processing, and scheduling, significantly reducing manual paperwork and processing time.
- ii. The system provides transparent tracking like real-time dashboards let manager, teachers and parents monitor attendance rates, fee statuses, and student performance at a glance.
- iii. The system centralized document management, making all receipts, reports, and teaching materials securely in one location, simplifying file retrieval and audit trails.

6.2 System Disadvantages

The disadvantages and limitations of the system for PUSAT TUISYEN CGT MANAGEMENT SYSTEM are as follows:

- i. There is no feature of forgot password on the login page. This makes it difficult for users—especially students, parents or teachers—to access the system if they forget their password.
- ii. The system does not send email notifications, so users must log in manually to discover pending approvals or upcoming submission deadlines. This often leads to overlooked tasks, delayed approvals, and increased support requests.
- iii. Lack of integrated payment gateway, which in the system, parents must upload bank-transfer receipts for manual approval. There's no real-time payment processing, which can slow fee collection and introduce verification delays.

6.3 Recommendation

Despite the good reviews from the user in the user acceptance testing that had been done in chapter 5, there are few recommendations that can be implemented to improve the system and make the system better than before:

- i. Add a "Forgot Password?" link on the login page that sends a time-limited reset token to the user's registered email address. Upon clicking the emailed link, users should be guided through a secure password-reset form. This self-service flow reduces support overhead and prevents lockouts.

- ii. Integrate a transactional email service (e.g., SendGrid, Mailgun, or a local provider) via SMTP or API, and build event hooks in your application so that key actions—like approval requests, new submissions, and upcoming deadlines—automatically enqueue emails for asynchronous delivery.
- iii. Implement a reliable gateway (e.g., Stripe or ToyyibPay) to enable in-app payments via credit/debit cards or online banking. It will automatically reconcile transactions and update fee statuses in real time and retain the receipt-upload option as a backup, but prioritize seamless, automated processing to accelerate fee collection and reduce manual approval tasks.

Conclusion

In the end, an online management system for Pusat Tuisyen CGT has been researched and successfully developed. The system begins with the design phase, which uses object-oriented programming. This approach ensured the system's modularity, scalability, and maintainability. Key design elements included class diagrams, use case diagrams, and sequence diagrams, which effectively mapped out the interactions and functionalities of the system components.

The system was created as a web-based application after the design stage. The old manual approach necessitated physical presence for management operation; this solution addressed those limits by enabling access from any place with internet connectivity. To build a reliable and effective system, technologies including secure communication protocols, Visual Studio Code for programming, and MySQL for database administration were used. Because the system was web-based, real-time changes were made possible, and the management procedure was improved, which resulted in much shorter processing times.

User acceptability testing (UAT), system testing, and rigorous unit testing were all part of the testing phase. These tests made sure every part fulfilled user criteria and operated as intended. To make sure the system not only complied with technical requirements but also matched end users' expectations and practical needs, feedback from the UAT was included into the system's improvement process. Through testing, the online management system's performance, security, and dependability were verified, indicating that it was prepared for implementation in a real-world setting.

In summary, the project's goals of creating, testing, and developing an online management system for Pusat Tuisyen CGT were accomplished. The management process is now much more effective and efficient thanks to the new system, which supports the tuition's modernization and digital transformation objectives. The method showed a thorough and iterative approach to developing a solution that satisfies the present and future needs of Pusat Tuisyen CGT, from original concept through development and testing.

Acknowledgement

The authors would like to thank the Faculty of Computer Science and Information Technology, Universiti Tun Hussein Onn Malaysia for its support.

Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

This journal requires that all authors take public responsibility for the content of the work submitted for review. The contributions of all authors must be described in the following manner:

*The authors confirm contribution to the paper as follows: **study conception and design:** Nabiha Aishah Kamaruzzaman, Norhanim Selamat; **data collection:** Norhanim Selamat; **analysis and interpretation of results:** Nabiha Aishah Kamaruzzaman, Norhanim Selamat; **draft manuscript preparation:** Norhanim Selamat. All authors reviewed the results and approved the final version of the manuscript.*

An author name can appear multiple times, and each author name must appear at least once. For single authors, use the following wording:

The author confirms sole responsibility for the following: study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

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