

The Development of Tuition Centre Management System Using Laravel Framework and Ethereum Blockchain

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Abstract

Technology integration in academic management helps solve problems like manual work, poor communication, and unclear tutor qualifications. Aimi An Najjah tuition centre faces these issues. This study introduces a Tuition Centre Management System with blockchain to improve operations, automate tasks, and build trust. The objectives are to design, develop using web-based technology, and test the system through alpha and beta testing. The system includes student information management, attendance tracking, fee payment handling, timetable generation, and tutor certificate verification using blockchain. It was built using Laravel for the backend, HTML, CSS, and JavaScript for the frontend, and MySQL for data management. A prototyping model was used to match user needs. User Acceptance Testing results show that 77.4% of users are very satisfied, and the rest are satisfied. The system reduces errors, improves efficiency, and strengthens communication. Blockchain ensures tutor credentials are clear and secure. It sets a new standard for digital use in education with future mobile and scalability upgrades.

1. Introduction

The integration of technology into the academic environment has emerged as a critical solution in addressing challenges within the education system. Tuition centres play a pivotal role in supplementing formal education by providing personalized and structured learning experiences that cater to the diverse needs of students [1]. Recent developments indicate a significant rise in the number of tuition centres in Malaysia, driven by parental concerns about children's academic performance and the increasing emphasis on individualized learning. For instance, a report dated May 28, 2024, highlights the surge in tuition centre enrollments, supported by the rise of online classes post-Covid-19, which allows for greater personal attention and flexibility in learning [2]. Parents often perceive tuition centres as more effective than conventional schooling in addressing the children's unique learning challenges.

Recognizing the importance of accessible supplemental education, the Malaysian government has introduced initiatives such as free tuition programs for students preparing for the Sijil Pelajaran Malaysia (SPM), focusing on six core subjects [3]. These initiatives underscore the critical role tuition centres play in enhancing student's academic achievements. However, as the demand for supplementary education increases, tuition centre faces operational challenges, including managing large student-to-teacher ratios, manual administrative tasks [4], and communication inefficiencies with parents and students [5].

This study focuses on Aimi An Najjah, a tuition centre located in Perpat, Rengit, which provides educational services for students aged 7 to 17. The centre offers a comprehensive curriculum, including core academic subjects such as Bahasa Melayu, English, Science, Mathematics, and History, as well as religious studies like *Ibadat*, *Sirah*, *Quran*, and *Tauhid*. Aimi An Najjah also provides targeted support for major national and religious

examinations, including SPM, UPKK, and SDEA. Currently, the centre relies on manual processes for student registrations, attendance tracking, and communication, primarily using WhatsApp to interact with parents and manage administrative tasks. These practices are cumbersome, prone to errors such as delayed administrative tasks, inconsistent records, and inefficient updates and tracking while performing data retrieval, particularly as the centre expands its services. Other than that, it could lead to increased fraud and an unorganized process of verifying tutor qualifications, which can reduce overall transparency and weaken parent’s trust in the system.

To address these challenges, this study proposes the development of a tuition centre management system to streamline administrative operations, and enhance the overall management and communication within the tuition centre. The proposed system integrates key functionalities, such as student information management, fee tracking, class scheduling, and tutor qualification tracking, while leveraging blockchain technology to ensure secure and reliable data management. The three main objectives of this project are: to design a tuition centre management system using a structured approach, to develop a tuition centre management system using web technology, and to test the developed system using alpha and beta testing.

This paper is organized into five sections. Section one provides an introduction to the study, outlining its purpose, scope, and significance. Section two describes the literature review, which examines existing systems and explores the technologies relevant to the proposed system. Section three details the methodology employed to successfully develop the proposed system. Section four focuses on the results and discussion, analyzing the findings and the implications. Finally, section five concludes the study by summarizing the key outcomes and contributions.

2. Literature Review

The literature review provides an in-depth discussion of key topics and technologies essential for the successful implementation of the proposed system. It ensures the system’s development is based on established theories and advanced technologies for maximum effectiveness and reliability.

2.1 Aimi An Najjah Case Study

Aimi An Najjah is a tuition centre located at No. A-2, Lot 870, Sri Perpat, Kg. Perpat Rengit Batu Pahat, 83100 Rengit, Johor. By providing supplemental academic support to students in the age range of 7 to 17 years old. It offers not only primary school education, but also secondary school education and religious school, especially for students who are about to take the *Sijil Pelajaran Malaysia* (SPM), *Ujian Penilaian Kelas Kafa* (UPKK) and *Sijil Darjah Enam Agama* (SDEA). This tuition centre focus on providing a range of flexible learning solutions, such as group classes with a maximum of 20 students per class. Each program is designed to improve academic skills, enhance subject comprehension, and build confidence in a nurturing learning environment. Table 1 shows the categorization of the subject offered.

Table 1 Subject categorization

Type of school	Subjects
Primary school	Bahasa Melayu, English, Mathematics, Science
Secondary school	Bahasa Melayu, English, Mathematics, Science, Islamic study, History
Religious school	Quran, UPKK, SDEA

The current management system at Aimi An Najjah tuition centre relies on manual processes and WhatsApp for communication. Student registration is conducted via hardcopy forms, requiring parents to visit the centre or submit details through WhatsApp, which the manager records manually. The centre does not provide proof of tutor qualifications, which may cause parents to question the credibility of the tutors. Additionally, schedules, learning, materials, and fee payment reminders are sent individually through WhatsApp, requiring the manager to contact each parent manually. Attendance is recorded on paper and stored manually, increasing the risk of error or lost records. These processes are time-consuming, prone to inefficiencies, and divert attention from more critical tasks, make overall operation cumbersome. Figure 1 illustrates the current management workflow at Aimi An Najjah, which relies on paper forms and WhatsApp for communication.

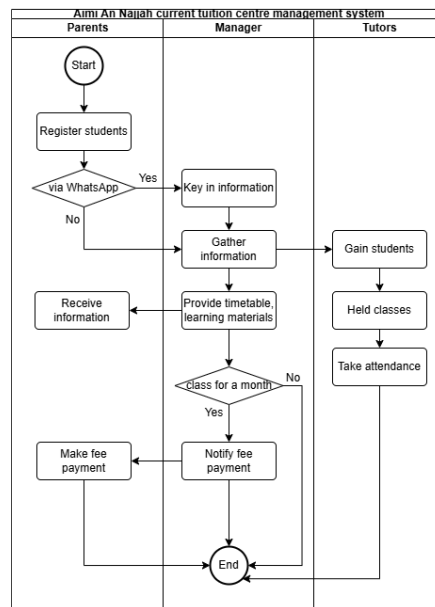


Fig. 1 Flowchart of current workflow

This approach poses risks such as delayed tasks, inconsistent records, and inefficiencies in data management. To address these issues, integrating a digital solution can streamline and automate operations. The proposed tuition centre management system will digitize daily operations using an online platform with a centralized database, improving efficiency and saving time to focus on critical performance enhancements. Additionally, using blockchain to manage tutor certificates ensures transparency, authenticity, and tamper-proof records, building trust with parents and reinforcing the centre's credibility.

2.2 Management Information System (MIS)

Management Information System (MIS) method is a technology-driven that collects, processes, stores, and disseminates information to support decision making, control and analysis of an organization [6]. The management information system will streamline administrative tasks, from student registration to attendance tracking and communication management. Its composition and the elements are quite different from different angles. By implementing the MIS into this study, it can confirm that the primary advantage of the MIS is its ability to improve productivity and decision-making by providing timely, accurate data and enabling data-driven insights [7]. MIS facilitates efficient information sharing, enhances communication, and offers real-time reporting capabilities that help in strategic planning. Above all, by using the management information system it will mainly help in replacing the manual processes of Aimi An Najjah tuition centre with digital solutions, enabling easy access to organized data, reducing human error, and facilitating quick data retrieval for both staff and tutors.

2.3 Blockchain

Blockchain serves as an automatic distributed ledger which comprises all transactions and state. This system is non-stopping, accepting new transactions, creating new blocks, and always growing the states. In order to handle this complexity and the amount of growing volume of data, the blockchain architects re-used fundamental data structures known throughout the history of computer science, but combined them in new forms [8]. Blockchain technology provides a decentralized and secure platform for recording credentials, making it ideal for storing sensitive information [9].

2.4 Ethereum

Ethereum is a decentralized blockchain platform that enables developers to build and deploy smart contracts and decentralized applications, allowing secure, transparent, and tamper-resistant transactions without intermediaries. Structured around a peer-to-peer network of nodes, Ethereum relies on its native cryptocurrency, Ether (ETH), to fuel network operations and execute smart contracts. These constructs run on the Ethereum Virtual Machine (EVM), a computation engine that ensures the reliability and functionality of decentralized applications across the network [10]. Significantly, Ethereum provides various advantages that suit the problem state in this study, where the needed for parental trust in ensuring that the tutor provided at the tuition centre is an educated, certified individual. The Ethereum blockchain will be used specifically for

storing and verifying the tutor's education certificates. By using Ethereum's blockchain, each certificate issued can be timestamped and cryptographically protected, ensuring it is both secure and tamper-proof. Parents can independently verify the qualifications of tutors, which enhances credibility and trust in the education provided by the centre.

2.5 Web-based System

A web-based system is an application that operates through a web browser, allowing users to access and interact with it over the internet without the need for local installation. Structured with a client-server model, it consists of a front-end, user interface accessed via the browser and a back-end, server and database that processes data and manages functionality [11]. The web server handles incoming client requests and sends back responses. It also manages connections, sessions, and security mechanisms. Meanwhile, the storage acts as the database that stores and manages data for the web application [12]. The advantages of a web-based system include easy accessibility from any internet-connected device. It reduced the need for hardware resources, and simplified updates and maintenance, as changes are implemented on the server side. These features make web-based systems ideal for businesses and users seeking flexibility, scalability, and efficient management of digital resources.

2.6 Study of Frog VLE

Frog Virtual Learning Environment (VLE) is released under the 1BestariNet program in 2012 by the Education Ministry of Malaysia (KPM) in collaboration with YTL Communications Sdn.Bhd (YTL) [13]. This system focuses on online class and learning resource management. Next, this system allows the teachers and student to interact through exercises, quizzes, forums, polls, and the sharing and access of learning resources. It also provides an award-winning feature to support schools in making a different learning and teaching environment, where it could give motivation to the user to keep performing in their task. The feature available in Frog VLE could guide the development of the learning resources and class features for the proposed system. The study of this system provides the necessary governance and administration of the accounts of students and tutors in the proposed system. The features of accessing learning resources online should be included in the proposed system. This is to ensure that the students and tutors can easily interact in providing necessary learning materials.

2.7 Study of UTHM Student Academic System

UTHM student academic system is currently deployed as a part of electronic online system at Universiti Tun Hussein Onn Malaysia (UTHM) for their students and lecturers. This system consists of two main subsystems which are the SMAP Online [14] and UTHM Author [15]. These subsystems can only be access for active UTHM students and lecturers. SMAP Online is an academic performance reporting system that provides student the reports of their past academic performance during their year of studies in UTHM, allow students to register their subjects, view any announcement related to the release of the new timetable for upcoming semester and examination schedule, and holds student's personal information by display their biodata records submitted to the university authority, have attendance taking by using QR code and provide a features for student to pay their education fee through online payment gateway. The features available in SMAP Online can assist this study in developing the student record management, managing students' attendance and education fee payment features for the proposed system through observation of the user interfaces of these features in SMAP Online. The registration of the subject should be done by the parents of the students at Aimi An Najjah tuition centre when registering their children.

Next, UTHM Author is an online learning resource-sharing platform that allows lecturers to share their learning materials, make class announcements, conduct online quizzes and test, and post class exercises such as assignments and labs. Meanwhile, students can access all the necessary learning materials, submit tasks given, and be notified of class information from the system. UTHM Author focuses on the online class, learning resource management, and forum features. This system allows the lecturers and students to interact through exercises and access learning materials on the Internet. The features could guide the development of the learning resources and class features for the proposed system. Besides, the automation creation of classes is necessary for the proposed system as the subjects in an education standard are usually taught by the same tutor. The sharing of the learning resources should be standardized in order to avoid different versions of the same learning materials.

2.8 Google Classroom

Google Classroom is a free, cutting-edge online learning management system designed by Google to foster effective communication and collaboration between educators and students [16]. Google Classroom offers an

efficient solution for organizing classrooms and improving access to learning materials. It allows teachers to create engaging activities that enhance student participation and tailor materials to different learning styles, such as video lessons and interactive activities. The platform also includes an automated class calendar, helping teachers and students track due dates and classwork across all classes. The features available in Google Classroom could guide the development of class calendar and learning materials management considering various file format that suitable for students. The reference of this system during the development can gain a view of the features that can be implement in the proposed system where the needs of online timetable is necessary. This tool allows students to keep track and alert with their timetable.

2.9 System's Comparison

Table 2 summarizes the three chosen existing system studied and compared to the features of the proposed system. This includes the modules, language, and technology of the proposed Tuition Centre Management System.

Table 2 System's Comparison

Features/System	Frog VLE	UTHM Student Academic System	Google Classroom	Tuition Centre Management System
Programming language	HTML, CSS, JavaScript/JQuery, unknown query language	HTML, CSS, JavaScript/JQuery, unknown query language	Unknown	PHP with Laravel framework, SQL
Technology	Web-based	Web-based	Web-based, mobile application	Web-based
Web responsiveness	Yes	Yes	Yes	Yes
Target user	1. Active teachers 2. Active students 3. Parents	1. Active UTHM student 2. Active UTHM lecturers	1. Lecturers 2. Students	1. Manager 2. Tutors 3. Parents
Register and login	Yes	Yes 1. Need to login 2. Registration made by UTHM	No 1. Need to enter class code	Yes 1. Parent register student 2. Manager register tutor
Student and tutor management	No	Yes (SMAP)	No	Yes
Payment management	No	Yes (SMAP)	No	Yes
Certification management	No	No	No	Yes Blockchain tutor's education certificate
Attendance management	No	Yes (SMAP) QR code	No	Yes Checkbox
Study material management	Yes	Yes (Author)	Yes	Yes
Timetable management	No	Yes (SMAP)	Yes	Yes

To sum up, the proposed Tuition Centre Management System offers more advantages compared to existing systems. While other systems only focus on single function like registration and communication, this system combines all key features in one centralized platform. This makes it easier to use, improves data accuracy, and reduces manual work. It also includes blockchain technology to verify tutor certificates, which builds parent

trust and ensures security. By using a centralized and modern system, the tuition centre can run more effectively and transparently, helping administrator, tutors, and parents work together better.

3. Methodology

Prototype model is a system developments method in which a prototype is built, tested, and the reworked as necessary until an acceptable outcome achieved from which the complete system or product can be developed [17]. The extreme prototype model is adopted in developing the system. Figure 2 illustrates the six phases in the prototyping model. The phases start with requirement gathering, quick design, prototype building, customer evaluation, refined prototype, and final product.

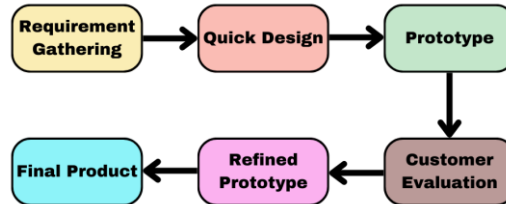


Fig. 2 Prototype Model [18]

For this study, the final product phase will be replaced with final testing, as developing a final product is not required. In addition, by building an initial working model that stakeholders can interact with, it can help in the practical foundation to identify necessary adjustments and ensure that the system’s core features align with user expectations. The use of a prototyping model, can help in building a robust and user-centred final system.

3.1 Software Requirement Specification

Table 3 shows the functional requirements that focus on specific tasks, features, and processes the system must perform to meet user needs. These include actions like data processing, system interactions, and task automation.

Table 3 Functional Requirements

Num	Module	Description
1	Registration and Login Module	1. Allow the new users to register new accounts before login. 2. Allow the existing users to log in with the ID and password. 3. Redirect the valid users to the specified dashboard based on the role when successful login.
2	Student and Tutor Management Module	1. Allow the administrator to view the student list. 2. Allow parent to register students and manage student details.
3	Payment Management Module	1. Allow the administrator to view the payment status, whether paid or unpaid. 2. Allow the parents to receive fee notification monthly. 3. Allow the parents to pay fee via online banking then view payment status.
4	Certification Management Module	1. Allow the administrator to create the tutor’s education certificate. 2. Allow the parents to view the certificate.
5	Attendance Management Module	1. Allow the tutor to create and edit student attendance via check box. 2. Allow the parents to view the attendance status.
6	Study Material Module	1. Allow the tutor to add study material on the web system. 2. Allow the parents to download the study material.
7	Timetable Management Module	1. Automatically generate timetable for each student based on registered subjects. 2. Automatically generate a timetable for a tutor based on subjects teach. 3. Allow administrator, tutors, parents to view the timetable.
8	Report Module	1. Allow administrator to generate report for student details, payment statistics, tutor details, and subject management module.

Table 4 shows the non-functional requirements that describe the system’s performance criteria and operational characteristics. Together, these requirements provide a comprehensive blueprint for system development, guiding the design, implementation, and testing phase to ensure the final product meets expectations and achieves its objectives.

Table 4 Non-functional Requirements

Num	Module	Description
1	Performance	The system should be responsive, user-friendly, and able to handle user actions smoothly.
2	Operational	The loading time required for a website is no more than 1 minute.
3	Security	The system should protect data to prevent unauthorized access, alteration, or disclosure of sensitive data.
4	Reliability	The system should operate consistently and be available at least 99% of the time.
5	Compatibility	The system should be able to work on any web browser.

3.2 System Analysis

A context diagram is a diagram that presents the overview of the interaction between the system and its user. Context diagram also shows the output to and from its user and system. Figure 3 shows the context diagram with three external entities, namely the administrator, tutors, and parents.

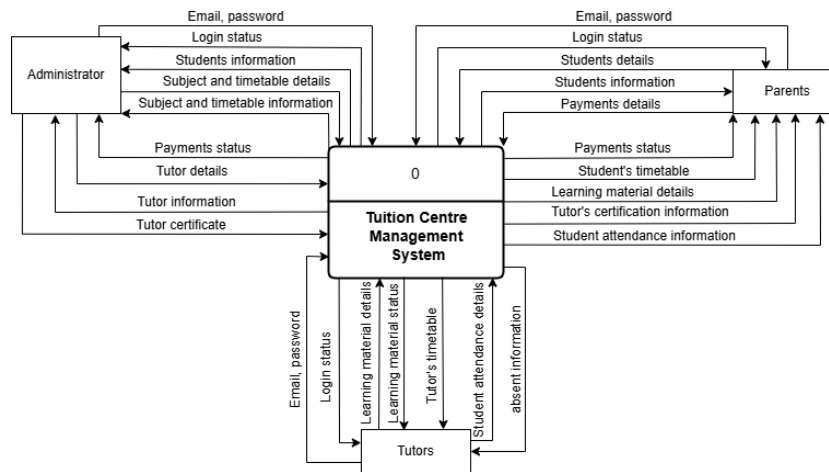


Fig. 3 Context Diagram

Based on the context diagram, the administrator oversees the system and manages various aspects such as managing student and tutor information, and monitoring fee payment status. Meanwhile, tutors are involved in accessing the tutor’s timetable, uploading learning material, and taking attendance. Lastly, parents are responsible for registering their children in the tuition system, also able to use the system to stay updated on their child’s activity, including viewing attendance and timetable details, receiving fee payment notifications and accessing learning materials uploaded.

Next, the Data Flow Diagram (DFD) Level 1 as shown in Appendix A, the Entity Relationship Diagram (ERD) in Appendix B, and the flowchart of the proposed system shown in Appendix C are provided for reference.

3.3 System Design

Design phase involves creating detailed designs for both the user interface and the database. The user interface design focuses on developing an intuitive, user-friendly layout that enhances usability and ensures seamless interaction for parents, tutors, and administrator. Figure 4 illustrates the system architecture of the proposed tuition centre management system, highlighting its key components and interactions.

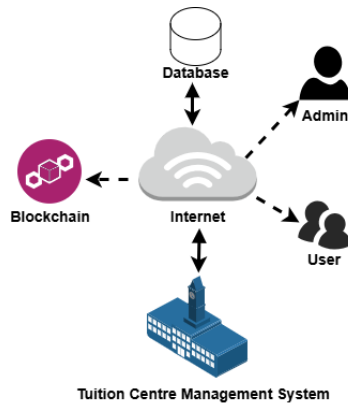


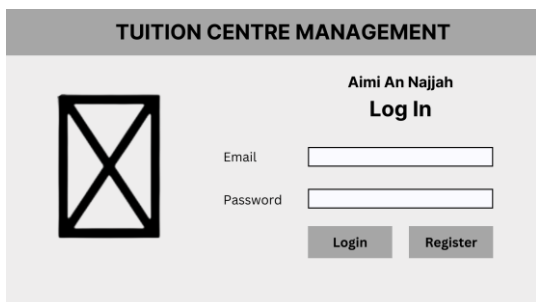
Fig. 4 System Architecture

Next, the relational schema that defines the structure of a database, outlining how data is organized into tables and the relationships between it. Table 5 list the schema tables from the database.

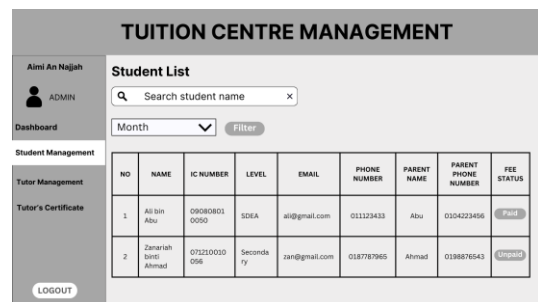
Table 5 Relational Schema

Num	Table Name	Attributes
1	Tbl users	(<u>ID</u> , email, name, password, role)
2	Tbl parent_infos	(<u>ID</u> , parent_ic, parent_phone, parent_address, parent_name, parent_email, <u>user id</u>)
3	Tbl tutors	(<u>ID</u> , tutor_ic, tutor_name, tutor_email, tutor_phone, tutor_address, <u>user id</u> , <u>subject id</u>)
4	Tbl student_lists	(<u>ID</u> , name, ic, level, phone, <u>user id</u> , <u>parent id</u>)
5	Tbl subjects	(<u>ID</u> , name, price, subject_class, level)
6	Tbl enrollments	(<u>ID</u> , <u>subject id</u> , <u>student id</u>)
7	Tbl timetables	(<u>ID</u> , day, start_time, end_time, classroom_name, <u>subject id</u>)
8	Tbl materials	(<u>ID</u> , title, description, date, file_path, <u>subject id</u> , <u>tutor id</u>)
9	Tbl fee_payments	(<u>ID</u> , amount, stripe_payment_id, status, <u>student id</u> , <u>parent id</u>)
10	Tbl attendances	(<u>ID</u> , date, <u>student id</u> , <u>tutor id</u> , <u>subject id</u>)
11	Tbl certificates	(<u>ID</u> , name, file_path)

Furthermore, the user interface focuses on streamlining the workflow, reducing manual errors, and enhancing productivity by prioritizing user needs and preferences. Figure 5 (a) shows the login page for all users. It acts as an index page of the system. Meanwhile, Figure 5 (b) shows the student list from administrator view.



(a)



(b)

Fig. 5 (a) Login Page (b) Student Management Page

Figure 6 (a) shows the timetable for students where student and parents can print the timetable. Next, Figure 6 (b) shows the attendance list, ticked by tutors.

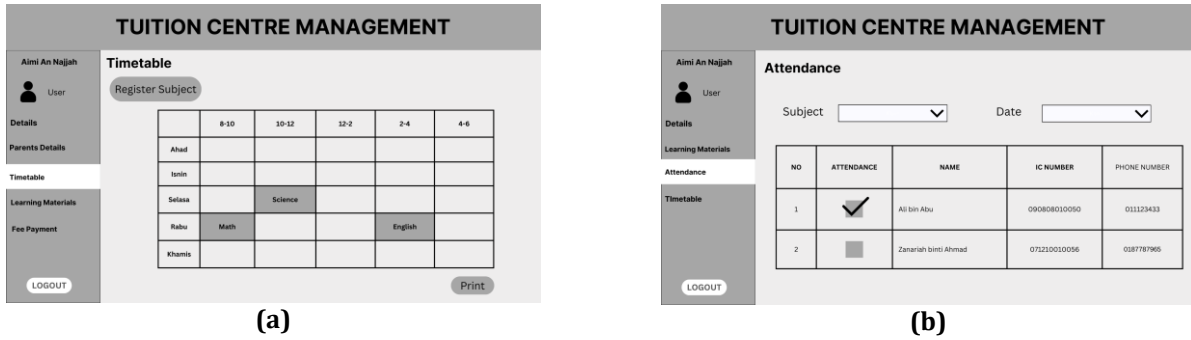


Fig. 6 (a) Timetable Page (b) Attendance Page

4. Implementation and Testing

The section covers the implementation and testing of the Tuition Centre Management System, ensuring security and usability. A test with an administrator was conducted to ensure the system meets the stakeholder requirements. Additionally, multiple parents and tutors tested the system to verify its reliability and functionality.

4.1 Security Implementation

This section emphasizes the importance of ensuring secure access to the system in protecting both user data and the overall integrity of the Tuition Centre Management System. By implementing strong authentication methods, the system not only safeguards user privacy but also builds trust among its users.

4.1.1 Bcrypt hash

Bcrypt hashing improves security by generating a unique salt for each password, making it difficult for attackers to crack password using precomputed hash tables. In this study, bcrypt is used to hash the user password to ensure privacy and protection. Figures 7 and 8 shows the bcrypt hash in the system.

```
'password' => ['required', 'confirmed', Rules\Password::defaults()],
```

Fig. 7 The Bcrypt hash implementation

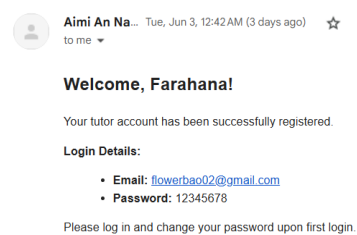
```
password
$2y$12$rgz6Pv57r29fTY1ZIWIFhOw2RAvMx3D...
$2y$12$hwiqbl7sJTFhXL8bszhVcOqrrmGOjzY5...
$2y$12$2ejnaFcfFW/7fnt1yZGNO/TnFm0Yx86...
```

Fig. 8 The hash value stored in table database

4.1.2 Email Account Activation

Email account activation adds an extra layer of security by verifying the user’s identity and ensuring that only valid email addresses are used to access the system. Figure 9 shows the email activation in the system.

```
Mail::to($request->tutor_email)->send(
    new TutorRegisteredMail($request->tutor_name,
        $request->tutor_email, $request->password)
);
```



(a) (b)

Fig. 9 (a) The email verification process (b) Email received

4.2 Module Implementation

This section shows the implementation of various modules in the Tuition Centre Management System. The system is divided into multiple modules to simplify the development, testing, and maintenance.

4.2.1 Register and Login

This module serves as the entry point for users, allowing parents, tutors, and administrator to securely create accounts and log in. It includes important security features like password encryption and email verification, ensuring that only authorized users can access the system. Figure 10 (a) shows the register page, and Figure 10 (b) shows the login page.

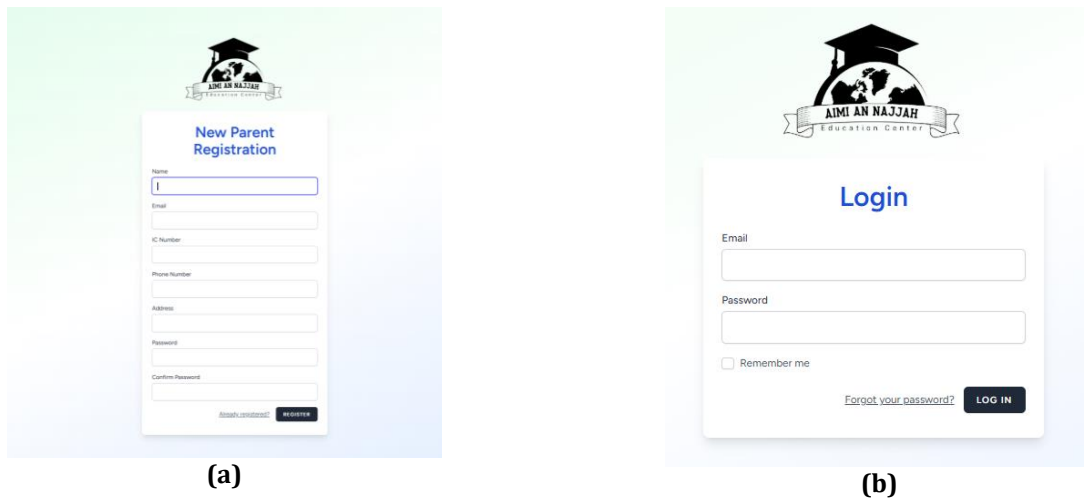


Fig. 10 (a) The register page (b) The login page

4.2.2 Tutor and Student Management

This module helps administrator and parents manage tutor and student information efficiently. Tutors can be added and linked to specific subjects, while student details are tracked along with their enrollments and assigned tutors. Figure 11 (a) shows the student management page, and Figure 11 (b) shows the tutor management page.

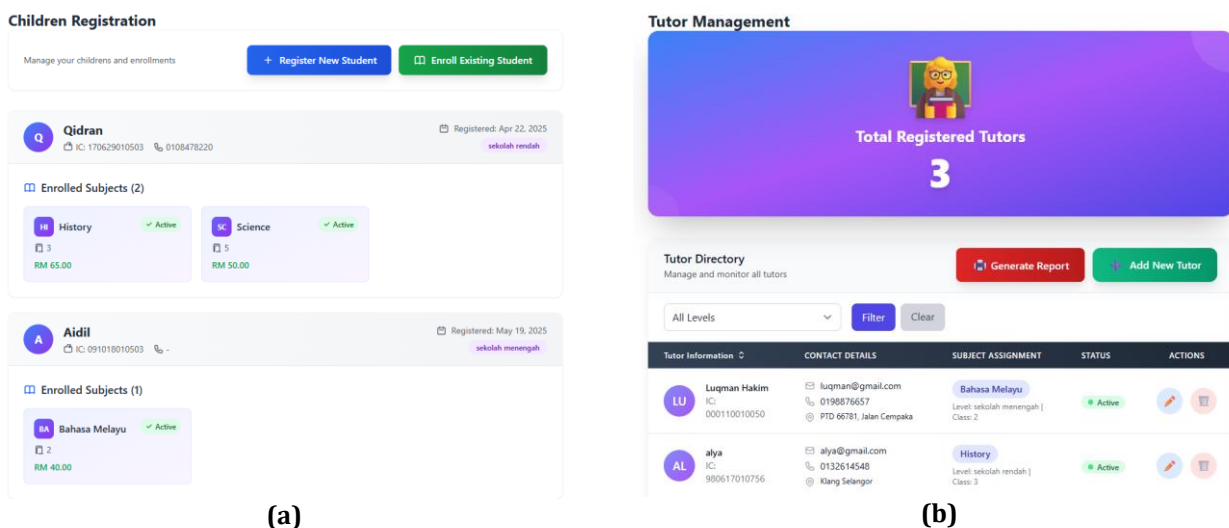


Fig. 11 (a) Student Management Page (b) Tutor Management Page

4.2.3 Blockchain Tutor Certificate

This module is to promote transparency and trust to securely store and verify tutor certification. Once the tutor's certificate is issued and uploaded, it will be stored on the blockchain. The parents can view the tutor's qualifications. Figure 12 (a) shows the list of registered tutors' certificates, and Figure 12 (b) shows the tutor's

certificate upload page.

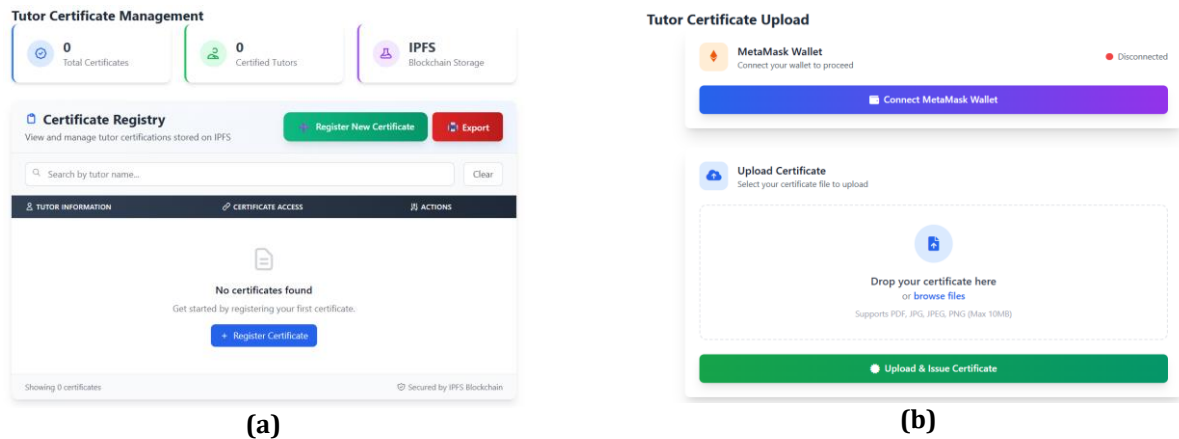


Fig. 12 (a) Tutor Certificate Management Page (b) Tutor Certificate Registration Page

4.2.4 Fee Payment Management

This module allows parents to view and complete tuition fee payments online. It tracks payment statuses, generates receipts, and ensures transparency in financial transactions. By offering online payment services using Stripe and automated status updates, it makes the fee process simpler, faster, and more reliable. Figure 13 (a) shows the fee payment page viewed by administrator, and Figure 13 (b) shows the fee payment page viewed by parents.

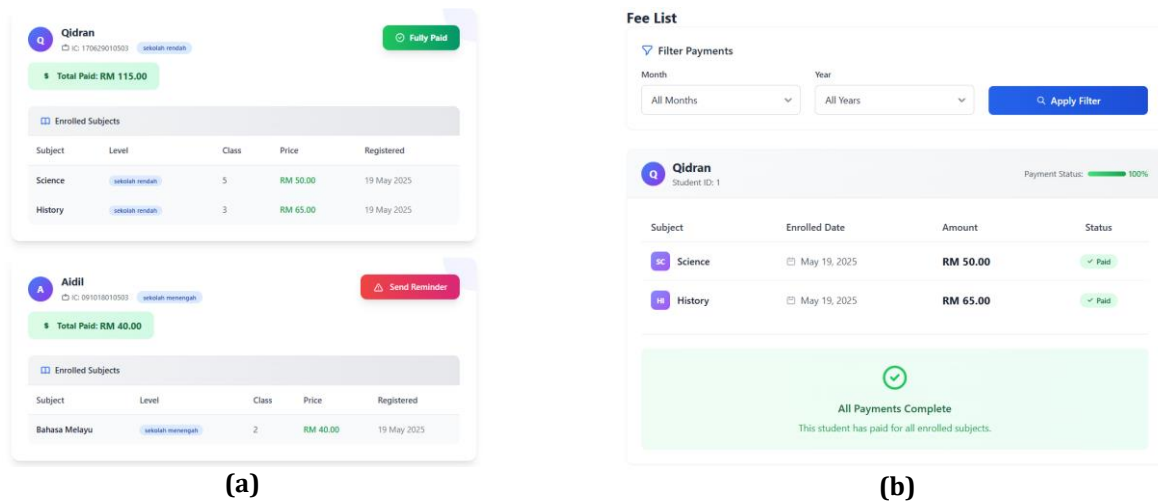


Fig. 13 (a) Administrator Fee Payment Page (b) Parents Fee Payment Page

4.2.5 Attendance Management

Tutors can easily record daily attendance through this module, which keep track of student presence in each class. It ensures accountability and helps identify patterns in student participation. This makes it easier to manage student engagement in classes. Figure 14 (a) shows the attendance report, and Figure 14 (b) shows the form of the attendance.

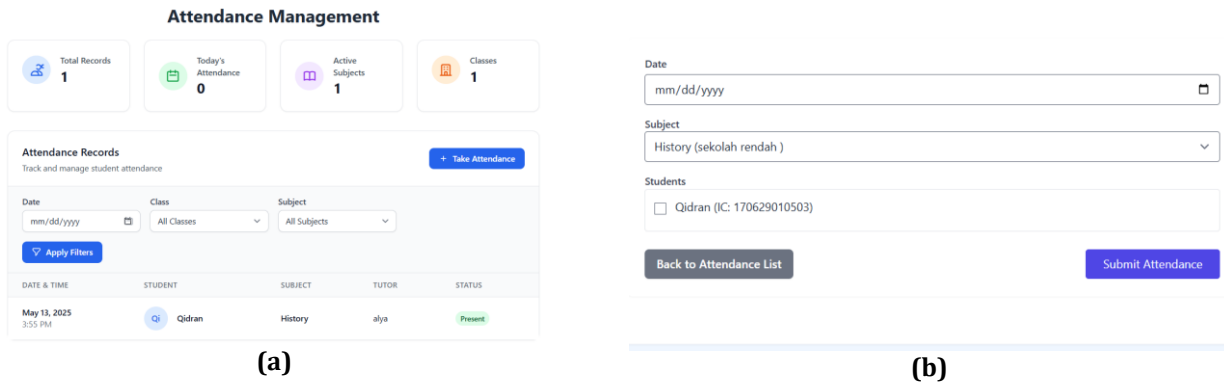


Fig. 14 (a) Attendance Report (b) Form of Attendance

4.2.6 Learning Material Management

This module allows tutors to upload and share learning materials with parents and students. Here, everything is stored in one accessible place. Parents can access and download the learning materials. This is to ensure that students always have the resources required. Figure 15 shows the accessible learning materials by tutors and parents.

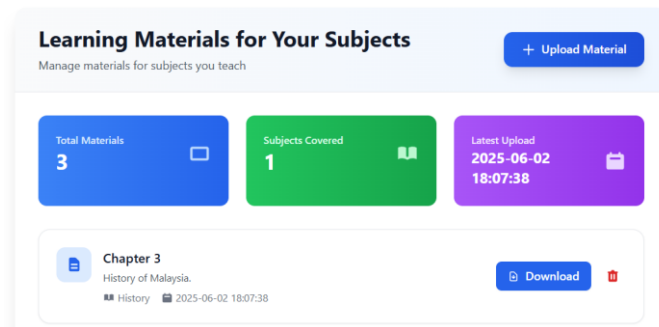


Fig. 15 The Learning Material Page

4.2.7 Subject and Timetable Management

This module allows administrator to manage subject and class schedules with a hassle-free. Administrator can assign subject, set timetables and update timetable in real time. Parents and tutors can view personal timetables, that help to stay organized and prepared. Figure 16 shows the timetable page.



Fig. 16 The Timetable Page

4.2.8 Report Management

This module generates useful reports for administrator, such as student enrollment, fee payment statistics, and tutor information. It turns raw data into clear insights, helping improve the overall efficiency and effectiveness of the tuition centre. Figure 17 shows the payment statistics report in the system.

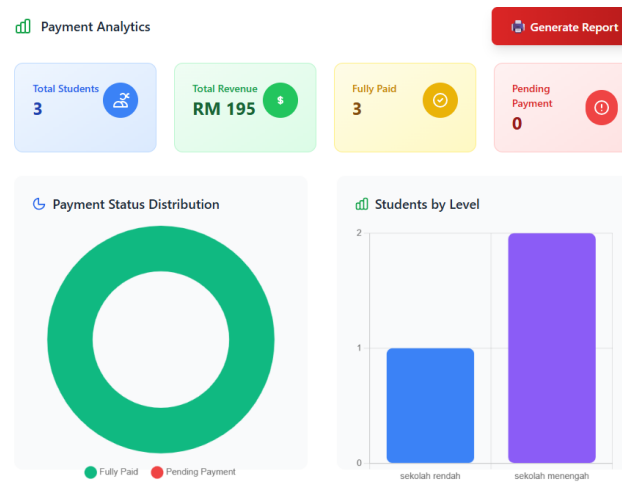


Fig. 17 The Payment Statistic Report

4.3 Testing

Functional testing, security testing, and user testing are integral components of ensuring the effectiveness of the developed system. In this study, these three types of testing are done. The functional testing verifies that all system components align with the stakeholder requirements. The security testing focuses on role verification and security of the user information, while user testing, conducted via Google Forms, with one administrator, two tutor, and twenty-eight parents. This is to evaluate both the system's interface and functionality. Table 6 shows the functional testing results by module for each user role.

Table 6 Functional Testing

Administrator Module	Test Description	Status
Login	Admin able to login and logout from the system.	Pass
Manage tutors' details	Admin able to create, view, update, and delete tutor details.	Pass
View students' details	Admin able to view student details and fee payment status.	Pass
Send reminder to parents	Admin able to send reminder through email to parents regarding late fee payment.	Pass
Manage subject and timetable	Admin able to create, view, update, and delete subject and timetable details.	Pass
Manage tutor certificate	Admin able to create tutor certificate while connected to MetaMask wallet.	Pass
Generate report	Admin able to view graph and export report for each module.	Pass
Tutor Module	Test Description	Status
Login	Tutor able to login and logout from the system.	Pass
Manage learning materials	Tutor able to create, view, update, and delete learning materials.	Pass
Manage attendance	Tutor able to create and view student attendance.	Pass
View timetable	Tutor able to view personal timetable.	Pass
Parent Module	Test Description	Status
Login and register	Parent able to register, login and logout from the system.	Pass
Manage student details	Parent able to create, view, update student details.	Pass
View timetable	Parent able to view personal children's timetable.	Pass
View learning materials	Parent able to view and download learning materials.	Pass
Manage fee payment	Parent able to make fee payment and view status.	Pass
View tutor's certificate	Parent able to view blockchain tutor's certificate.	Pass

4.3.1 User Acceptance Test

User acceptance testing is a crucial phase in the development of the Tuition Centre Management System, aimed at validating the system from the end user's perspective. The goal is to confirm that the system is user-friendly, reliable, and fully functional. Through hands-on testing, users were able to provide valuable feedback, which helped further improve its usability and overall performance. Figure 18 shows the results from the user feedback form show a high level of satisfaction. An impressive 77.4% of participants selected "strongly agree", indicating that the majority found the system highly functional and fulfilled requirements. Meanwhile, the user testing feedback for each module is shown in Appendix D.

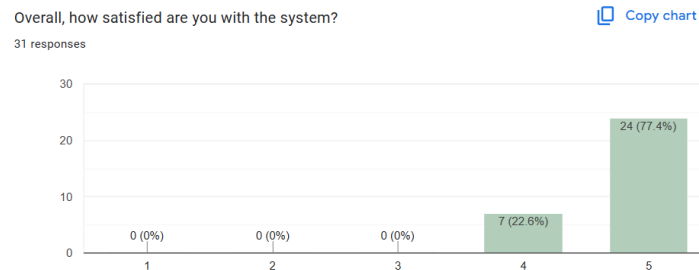


Fig. 18 The User Acceptance Test

5. Conclusion

The development of the tuition centre management system with blockchain has demonstrated significant potential in addressing the challenges faced by Aimi An Najjah tuition centre. The system streamlines administrative tasks, automates scheduling, tracks attendance, and enhances communication between parents, administrator, and tutors. The integration of blockchain technology ensures secure and tamper-proof verification of tutor qualification, fostering trust and transparency with parents. This outcome highlights the system's ability to improve operational efficiency while enhancing the quality of educational services.

The system's key strengths lie in its user-friendly design, centralized database for real-time information access, and blockchain integration for secure data management. These features reduce manual errors, save time, and build credibility, ultimately improving the tuition centre's overall performance and reputation. The implementation provides a scalable and efficient framework for managing daily operations, enabling stakeholders to focus more on educational outcomes. The implications of this system extend beyond Aimi An Najjah, as it sets a precedent for incorporating technology and blockchain in education management. It highlights the importance of adopting digital solutions to address inefficiencies and improve user experiences in similar contexts.

Future research should explore integrating advanced analytics and artificial intelligence to personalize learning experiences and provide insights into student performance trends. Additionally, expanding the system to support multi-centre operations or integrating mobile applications could further enhance accessibility and functionality. These advancements can ensure that the system continues to evolve and meet the dynamic needs of education management.

Acknowledgement

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Conflict of Interest

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

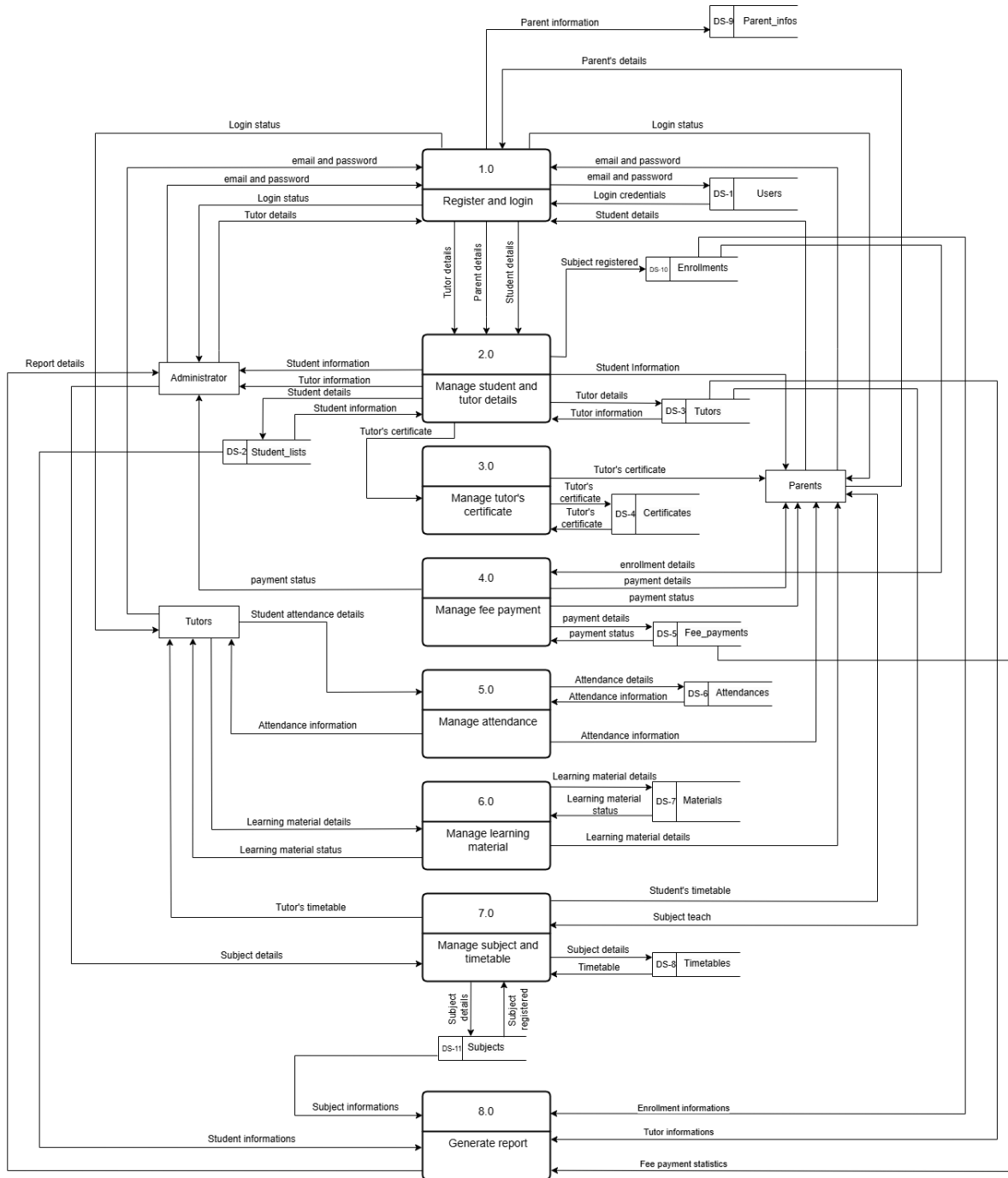
Author Contribution

The author confirm contribution to the paper as follows: **study conception and design:** Fatin Nadia Zainudin, Nur Ariffin Mohd Zin; **data collection:** Fatin Nadia Zainudin; **analysis and interpretation of results:** Fatin Nadia Zainudin, Nur Ariffin Mohd Zin. All authors reviewed the results and approved the final version of the manuscript.

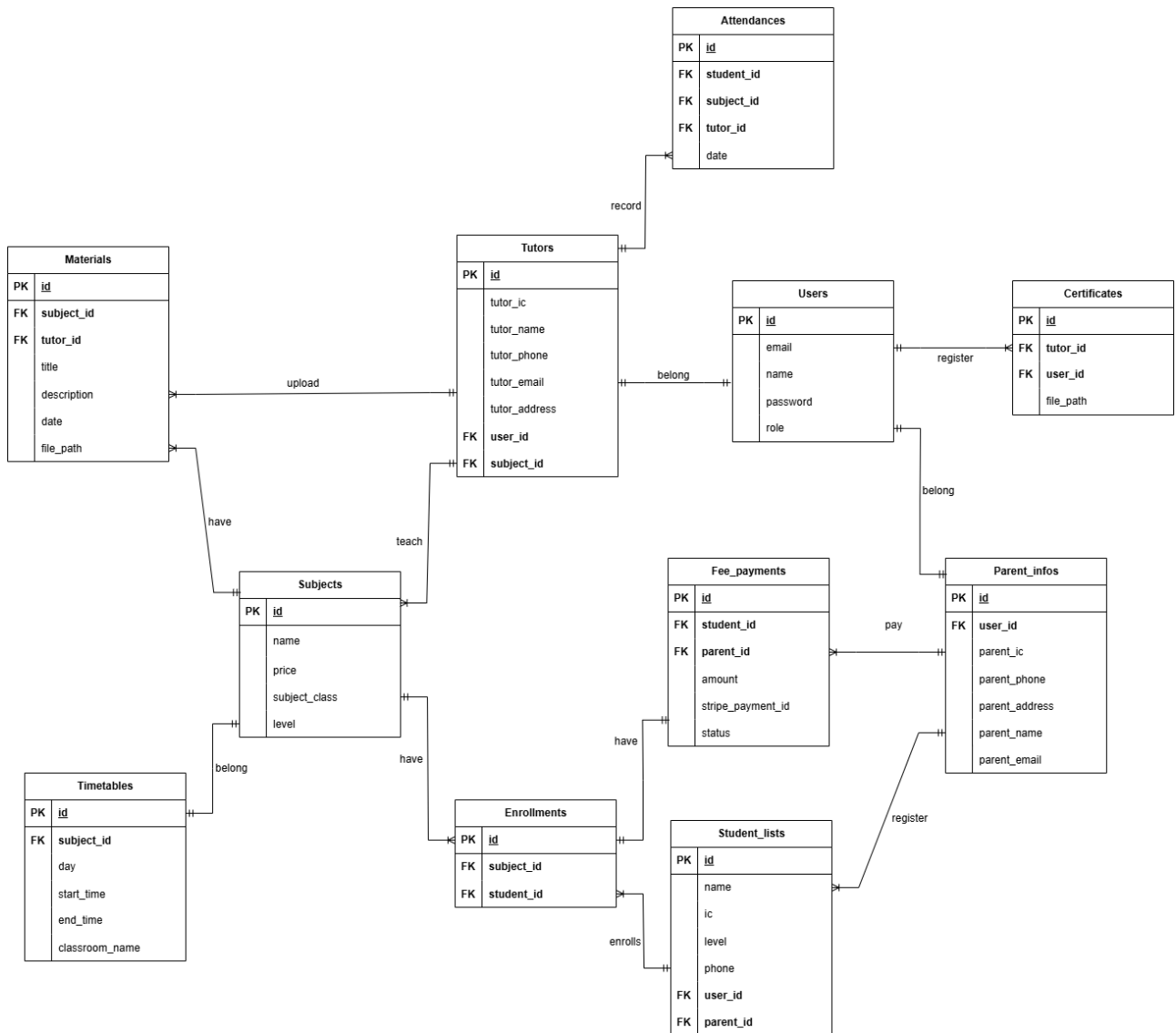
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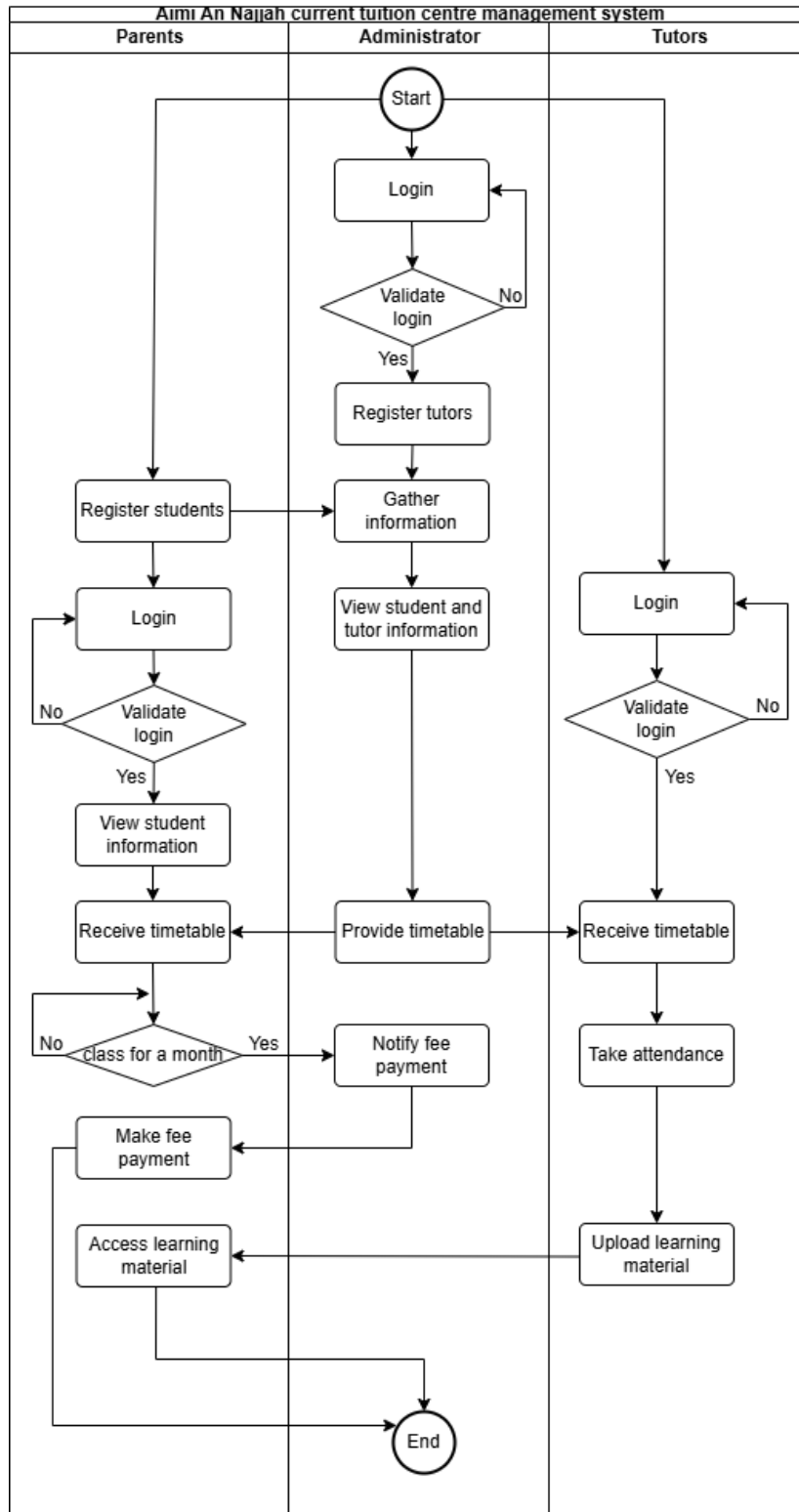
Appendix A: Data Flow Diagram Level 1



Appendix B: Entity Relationship Diagram



Appendix C: Flowchart of Proposed System



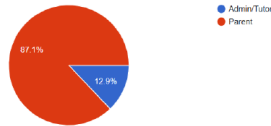
Appendix D: User Testing Feedback

Tuition Centre Management System - User Testing Feedback

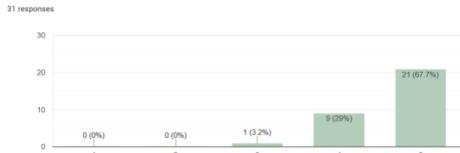
This form is designed to collect your feedback on the system's performance, usability, and overall experience. Your responses will help us improve the features and ensure the system meets the needs of all users, including admin, tutors, and parents.

Please answer each question honestly based on your experience. This will only take a few minutes to complete. Thank you for taking the time to test the Tuition Centre Management System.

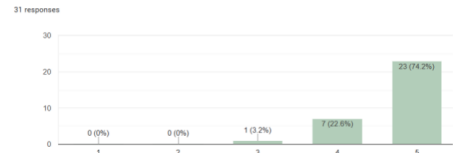
Role
31 responses



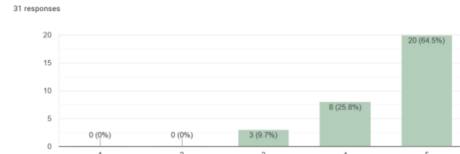
The registration and login process is smooth and without any major problems. [Copy chart](#)



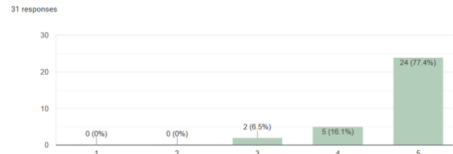
The system correctly identifies user roles after login. [Copy chart](#)



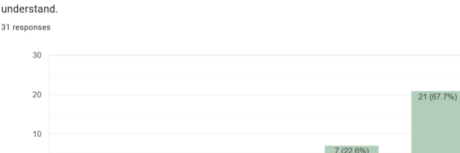
The student details is easy to manage and provide correct output. [Copy chart](#)



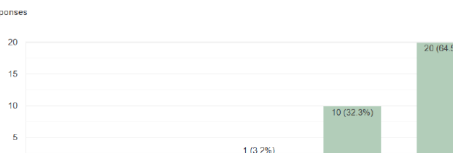
The tutor details is easy to manage and provide correct output. [Copy chart](#)



The certificate upload and verification process works well and is easy to understand. [Copy chart](#)



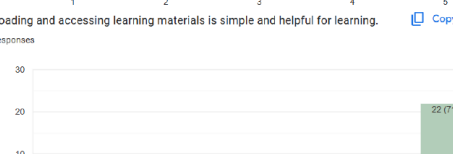
The fee payment section clearly shows payment status and is easy to use. [Copy chart](#)



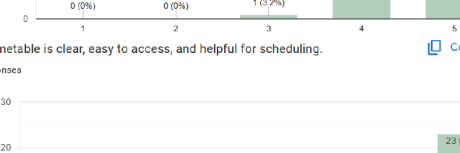
The attendance is easy to view and mark records without problems. [Copy chart](#)



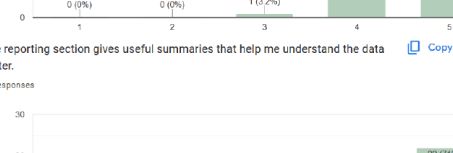
Uploading and accessing learning materials is simple and helpful for learning. [Copy chart](#)



The timetable is clear, easy to access, and helpful for scheduling. [Copy chart](#)



The reporting section gives useful summaries that help me understand the data better. [Copy chart](#)



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PUK MAMEN AL FATEH
REKENCING BATU PABAT JOHOR