APPLIED INFORMATION TECHNOLOGY AND COMPUTER SCIENCE
e-ISSN: 2773-5141

AITCS

Vol. 6 No. 2 (2025) 813-832
https://publisher.uthm.edu.my/periodicals/index.php/aitcs

SIS: Student Information System for SMKTMI with RBAC

Nurul Nadia Abd Wahab[1], Zubaile Abdullah[1]*

[1] *Fakulti Sains Komputer dan Teknologi Maklumat,*
Universiti Tun Hussein Onn Malaysia, Parit Raja, Batu Pahat, 86400, MALAYSIA

*Corresponding Author: *zubaile@uthm.edu.my*
DOI: https://doi.org/10.30880/aitcs.2025.06.02.044

Article Info

Received: 21 October 2025
Accepted: 19 November 2025
Available online: 30 November 2025

Keywords

Student Information System, Role-Based Access Control, Agile methodology, Data accessibility, Data encryption.

Abstract

The implementation of information systems in educational institutions offers numerous benefits, including enhanced data security, improved accessibility and more efficient management of academic and administrative processes. At present, SMK Tunku Mahmood Iskandar (SMKTMI) relies on the Ministry of Education's system, which presents limitations in functionality and user access. To address these shortcomings, this project introduces a web-based Student Information System (SIS) developed specifically for SMKTMI. The system was built using the Agile Software Development Life Cycle (SDLC) methodology, enabling iterative development through sprints and continuous feedback from stakeholders. Developed with PHP, HTML, CSS and MariaDB, the system features core modules such as class scheduling, academic assessment, attendance tracking and discipline record management. It also incorporates role-based access control (RBAC) to ensure appropriate access for administrators, teachers, parents and students, along with security features including email verification, login attempt limitations and password policies.

1. Introduction

An information system collects, stores and makes information accessible when needed, helping to keep everything organized and simplify work processes. Various organizations, including banks, hospitals and businesses, use information systems to streamline data management and improve communication. The benefits of using an information system include easier data retrieval and usage, reduced errors and enhanced communication across different levels of the organization [1]. By keeping information organized, an information system supports faster and more reliable decision-making.

However, many organizations, including SMKTMI, have not fully utilized information systems. Although SMKTMI uses the Ministry of Education's system, its function is limited. This means the school misses out on the full advantages of a more advanced student information system that could improve operations and support for students and parents. Teachers find it challenging to efficiently enter or retrieve information because the system is not user-friendly. Teachers are frequently forced to use manual record-keeping or other techniques due to its lack of integration with other school management technologies. On the other hand, parent cannot access an information about their children daily attendance and discipline record within this MoE's system.

In this digital era, modernizing information management systems in schools is becoming increasingly urgent [2], thus a Student Information System (SIS) which is a digital platform is develop for SMKTMI. The system helps schools safely and efficiently organize and manage student information. It centralizes student records such as personal details, academic progress, attendance, disciplinary records and other important data. Tasks such as scheduling and report generation can be automated reducing the workload of the staff and minimizing errors.

This can lead to more efficient school operations and allow staff to focus on more important tasks such as teaching and student support.

2. Related Work

This section reviews key concepts and technologies related to information management and system security within educational environments. It begins by introducing the purpose of the study and the role of Management Information Systems (MIS) in improving data efficiency and decision-making. It then explores access control methods, followed by a focus on Role-Based Access Control (RBAC) as a structured model for permission assignment. Authentication mechanisms such as login attempt limiting and account lockout are discussed to ensure secure access to the system. The section also covers system monitoring and auditing practices, including admin activity tracking and logging. Email verification is addressed as an added security layer to prevent unauthorized or automated access. Finally, the section highlights comparisons with existing educational systems such as SAPS, SPPBS, and APDM to inform the design of the proposed system.

2.1 Management Information System (MIS)

A Management Information System (MIS) is a valuable tool that helps managers make well-informed decisions about their business operations. It works by gathering and analyzing data from various sources, such as employees, processes, and inventory, to provide useful insights that benefit both managers and their teams. For an MIS to be effective, it needs well-organized business processes, accurate and up-to-date data, and reliable hardware and software for storing and processing information. The success of an MIS also relies on the skills of the people who design, implement, and use it effectively. Although businesses may use different types of systems, they all serve the same key purpose to improve decision-making. In today's fast-moving world, having access to accurate and timely information is essential. An MIS helps managers monitor performance, identify patterns, and allocate resources wisely, ultimately leading to better results for the organization [3].

In general, an MIS consists of three fundamental components like people, hardware, software and processes. The people component includes users such as administrators, staff and decision-makers who manage and interpret data to support institutional objectives. Hardware and software refer to the technological tools used to collect, store and process information, including servers, networks and application systems. Processes involve the systematic gathering, validation, and analysis of data, which is then transformed into structured information such as reports, dashboards and visual summaries. These components interact continuously, allowing data to flow from input through to useful output. As illustrated in Fig. 1, MIS integrates these elements into a coherent cycle that supports timely, informed and data-driven decision-making, particularly in education environments where information accuracy and accessibility are critical.

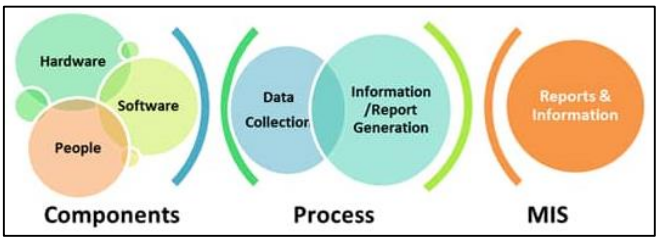

Fig.1 *Components and Process Flow of a Management Information System*

2.2 Access Control

Access control is a crucial security mechanism that regulates who can view or access specific systems and data, ensuring that only authorized individuals can use the resources. Various types of access control are commonly used in businesses today, including Discretionary Access Control (DAC), Mandatory Access Control (MAC) and Role-Based Access Control (RBAC). Administrators or designated personnel can customize access control settings to determine which employees can access specific data. Access control systems often track and log every access attempt for security monitoring. However, managing access control can be time-consuming and complex, especially in large organizations with frequent changes in personnel, such as new hires or employee departures [4]. The primary purpose of access control is to safeguard sensitive information from unauthorized individuals and protect it from potential threats like data breaches.

2.2.1 Role-Based Access Control (RBAC)

Role-Based Access Control (RBAC) is chosen for this system because it offers a secure and efficient way to manage access to sensitive student information based on the user's role within the school environment. In a Student Information System (SIS), different users such as administrators, teachers, parents, and students have different responsibilities and therefore require different levels of access. By implementing RBAC, the system ensures that each user can only access the information relevant to their role. For example, teachers can only manage attendance and grades for their assigned classes, parents can view only their child's academic records, and students can access their own data. Administrators, on the other hand, have full access to manage the entire system. This approach minimizes the risk of unauthorized access, protects student privacy, and simplifies access control by assigning permissions based on predefined roles rather than individual users. RBAC also enhances system scalability and reduces administrative workload, making it an ideal choice for educational environments where maintaining data security and user accountability is essential [4].

2.3 Login Attempt Limiting

By limiting the number of times, a person can try to log into a system in a certain time frame, login attempt restriction is a security measure intended to lower the risk of unwanted access. This method works especially well against brute-force attacks, in which the attacker repeatedly attempts different username and password combinations in an effort to obtain unauthorized access [5].

2.4 Account Lockout

In authentication systems, account lockout is a security feature that, following a certain number of unsuccessful login attempts, temporarily or permanently disables a user account to prevent unwanted access. This approach is mainly intended to protect against brute-force attacks, in which a hacker methodically attempts a large number of password combinations in an attempt to guess a user's password [8].

2.5 System Monitoring and Auditing

A strong cybersecurity strategy that protects an organization's networks, information systems, and sensitive data must include security auditing and monitoring. An organization's information systems, procedures, and policies are systematically examined as part of security auditing in order to find vulnerabilities, evaluate security controls, and make sure that specified security standards are being followed. Organizations can proactively address potential security risks and vulnerabilities with the use of this proactive strategy [9]. In contrast, security monitoring is a continuous procedure that entails the constant inspection of a company's network, systems, and applications in order to identify and address security events immediately. Monitoring seeks to quickly detect suspicious activity, illegal access, and other security risks.

2.6 Email Verification

The process of confirming an email address is legitimate and increasing the probability that it belongs to a real person is known as email verification. Ensuring that a legitimate individual with a working email address will receive and respond to the sent email is the main goal of email verification [10].

2.7 Similar System Analysis

This section compares the current Sistem Analisis Peperiksaan Sekolah (SAPS), Sistem Pengurusan Pentaksiran Berasaskan Sekolah (SPPBS) and Login Kehadiran & Aplikasi Pangkalan Data Murid KPM (APDM). The study of related system aims to make relevant comparisons and identify best practices that could carry out in SIS: Student Information System for SMKTMI with RBAC.

2.7.1 *Sistem Analisis Peperiksaan Sekolah* (SAPS)

SAPS designed to function as a collection centre, storing and analyzing internal examination data from each school across Malaysia as shown in Fig. 2. This system only functions online that can be accessed by certain parties such as Kementerian Pelajaran Malaysia (KPM), Jabatan Pendidikan Negeri (JPN), Pejabat Pendidikan Daerah (PPD) and schools. The provision of a centralized data centre this centralized system provides convenience and can be used by the KPM, JPN and PPD to make comparisons, analysis or identifying existing weaknesses to improved. This system is also designed to reduce issues in request school examination data. SAPS can also use as a benchmark for management through analysis of TOV (Take of Value), ETR (Expected Target Result) and AR (Actual Result). The class teacher plays a role by access the system to input and update class information, subject information and student data for the class he/she supervises. The subject teacher will then enter the exam scores for each student according to the information provided earlier by the teacher class [12].

Fig.2 *Main Page SAPS*

2.7.2 *Sistem Pengurusan Pentaksiran Berasaskan Sekolah* (SPPBS)

This SPPBS system is developed online and used among Malaysian teachers to facilitate the process updating and entering student performance data based on implementation of Pentaksiran Berasaskan Sekolah (PBS) under Standard Primary School Curriculum (KSSR) as shown in Fig. 3. PBS is a form of assessment that is holistic in nature, evaluating aspects cognitive (intellectual), affective (emotional and spiritual), psychomotor (physical) and social in line with the National Education Philosophy National. This PBS is an assessment that is formative and summative, which practices the concept of assessment for learning and assessment of learning which evaluates the field academic and non-academic fields. This PBS is implemented by the school in an organized manner according to the procedures set by set by the Malaysian Examination Board (LPM). The SPPBS component for teachers consists of two categories, namely academic and non-academic. Academic categories consist from School Assessment (SA) and Central Assessment (PP). Non-academic categories consist of Assessment Psychometric (PPsi) and Assessment of Physical Activities, Sports and Co-curriculum (PAJSK)[13]

Fig. 3 *Main Page SPPBS*

2.7.3 *Aplikasi Pangkalan Data Murid* (APDM)

Aplikasi Pangkalan Data Murid (APDM) is a system created by the Kementerian Pelajaran Malaysia (KPM) to make managing student data easier across schools in Malaysia. It acts as the central database, storing essential information about each student, such as personal details, attendance, academic performance, and other related data as shown in Fig. 4. The system is designed to make student data management more efficient and accurate on a national scale. Schools can now organize and store information systematically, including basic details like names, identification numbers, addresses and guardian information. It also tracks attendance and academic results, helping schools analyze data and create detailed reports. One of APDM's main features is the ability to monitor student attendance. Teachers can quickly log daily attendance, and the data is accessible to school administrators and KPM to track attendance patterns nationwide. This feature is vital for spotting attendance issues and taking necessary actions. Additionally, APDM provides up-to-date and accurate data to help schools and KPM make better decisions. For instance, information about attendance and academic performance can pinpoint students who may

need additional support or intervention. The system also aids in the planning of more effective educational programs and policies [14].

Fig. 4 *Main Page APDM*

2.7.4 Comparison with the Existing Systems

Table 1 shows the comparison between *Sistem Analisis Peperiksaan Sekolah* (SAPS), *Sistem Pengurusan Pentaksiran Berasaskan Sekolah* (SPPBS) and *Aplikasi Pangkalan Data Murid KPM* (APDM) focusing on their data collection, system access and performance monitoring features.

Table1 *Comparison Between Related System and Proposed System*

System Features	SAPS	PBS	APDM	SIS: Student Information System (SMKTMI)
Role-based Access Control	Yes	No	Yes	Yes
Administrator Access	Yes	Yes	Yes	Yes
Access to Student Data	Yes	Yes	Yes	Yes
Parent-Child Relationship Tracking	No	No	Yes	Yes
Analytics and Reporting	Yes	Yes	No	Yes
PIBG Payment Tracking	No	No	No	Yes
Assessment Statistics & Analytics	Yes	Yes	Yes	Yes
Comprehensive Audit Logging	No	No	Yes	Yes
Account Lockout Protection	No	No	No	Yes
Data Access Controls	No	Yes	No	Yes
User Activity Tracking	No	No	Yes	Yes

3. Methodology

This section describes how the Student Information System (SIS) for SMKTMI was developed. Because of its flexibility and ability to facilitate development in stages, the Agile approach was selected. Working closely with stakeholders to make sure the system satisfies their demands is the main goal of agile. Agile divides the work into smaller components called sprints rather than constructing the entire system all at once. A particular component of the system is completed at each sprint, tested and shared for user input. This methodical approach facilitates adjustment and guarantees that the finished system is of excellent quality and meets the needs of the school.

3.1 Software Development Life Cycle (SDLC) Agile

The development of the Student Information System SIS follows the System Development Life Cycle SDLC model integrated with the Agile methodology. This hybrid approach includes seven essential phases Plan Design Development Test Deploy Review and Launch. Agile was chosen due to its iterative process flexibility and emphasis on continuous improvement. This approach allows regular feedback from stakeholders such as school

administrators teachers parents and students ensuring the system evolves based on real user needs. Each development sprint includes design testing and refinement promoting steady progress and alignment with expectations.

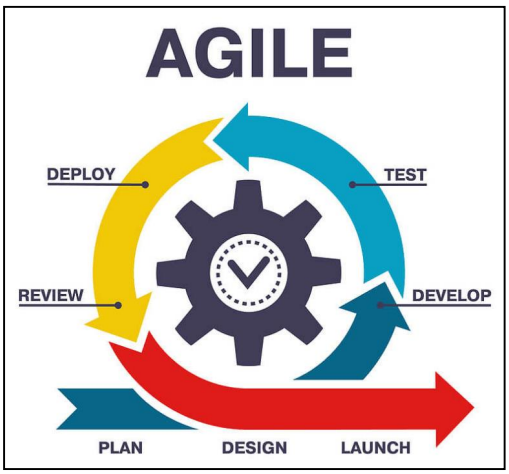

Fig.5 *Lifecycle of Agile Methodology [15]*

3.1.1 Phase 1: Plan

In this phase, the process began by gathering important information to define the scope and features of the proposed Student Information System (SIS). An interview was held with Puan Siti Fauziah – YDP PIBG SMKTMI of the school, to understand the specific needs of the school and its users. During the interview, key requirements were discussed including identifying who would be using the system and what challenges the school was facing with its current system. It was revealed that accessing up-to-date student data and improving communication between parents and the school were major concerns. The system needed to provide easy access to student information, offer real-time updates, and ensure secure communication between teachers, parents, and administrators. To meet user expectations, detailed requirements were gathered: parents need to view attendance, performance, and announcements through a clear interface; teachers need tools for grading, attendance, and remarks to reduce administrative work and support student progress; students need access to exam results, attendance, and notifications; administrators need secure logins, role-based access, and usage tracking. These needs guided the system's practical, efficient, and user-focused design.

3.1.2 Phase 2: Design

With clear requirements in place, the project moved into the design phase. The system architecture was drafted to illustrate the relationship between the database, server, and client interface. Wireframes and interface mockups were created using Figma to visualize the layout and user flow. At the same time, the database structure was designed using MySQL Workbench. Tables were created to organize data related to students, users, attendance, assessments, schedules, and discipline records. Attention was given to relational integrity and role-based access to ensure data was stored securely and efficiently.

3.1.3 Phase 3: Development

The development phase involved writing the actual code for the system using PHP for the backend and HTML with CSS for the frontend. MariaDB was used as the database engine. Development was carried out in a local environment using XAMPP, which provided the necessary support for Apache, PHP, and MySQL. The development process followed the Agile sprint format, with each sprint focusing on building specific features such as user registration, login, role-based access, attendance tracking, grading, and communication tools. Access control logic was implemented based on user roles, and GitHub was used for version control and backup management throughout the process.

3.1.4 Phase 4: Test

Once development reached a stable point, testing was carried out on each individual module. Unit tests were performed to confirm that functions like login, form validation, and data entry worked correctly. The email verification system was tested to ensure users could receive registration confirmation and reset links. Test scenarios were created to simulate user behavior, such as entering incorrect credentials, submitting incomplete

forms, or navigating across roles. Any issues such as incorrect redirects or data display errors were logged and resolved. The system was also tested on multiple devices and browsers to ensure responsiveness and usability.

3.1.5 Phase 5: Deploy

After successful testing, the system was deployed to a live hosting environment using a free hosting provider. All files and databases were migrated from the local development environment to the live server. A subdomain was created to provide access for testing purposes. During deployment, database access was secured, session control was configured, and role-based restrictions were revalidated. Test user accounts for each role were created to simulate full interaction with the system in a real-world scenario.

3.1.6 Phase 6: Review

The review phase involved collecting feedback from actual users. A group consisting of administrators, teachers, parents, and students was invited to access the system using the test accounts provided. Users were asked to complete typical tasks such as recording attendance, viewing student results, submitting discipline reports, or reading announcements. Feedback was gathered through online forms and informal interviews. Most users found the system intuitive and functional, although some suggested improving font size and spacing for better readability on mobile devices. Minor improvements were made based on this feedback.

3.1.7 Phase 7: Launch

With all core features developed and validated, the system was officially launched. Short training sessions and user guides were prepared to support the onboarding process. Each user group was provided with access instructions and documentation to help them navigate the system independently. Monitoring tools were activated to track usage and capture any errors in real time. With the system now integrated into the school's operational workflow, it began supporting administrative tasks and improving communication between stakeholders in a meaningful way.

3.2 System Development Workflow

This section refers to the step-by-step process used to plan, create, test, and launch a system or software. It ensures that the system is built in an organized and efficient way, meeting the users' needs and solving real problems in Table 2.

Table 2 *System* Development Workflow of SIS: Student Information System

Phase	Description	Outcome
Plan	• Collected system needs through an interview with YDP PIBG • Identified user groups (parents, teachers, students, admin) • Listed features each group needs	Clear understanding of system requirements and user expectations
Design	• Designed system architecture (server, database, UI) • Created wireframes and UI mockups • Designed database tables for student, parent, and academic data	System structure and interface ready for development.
Development	• Started coding based on design • Created login, registration, RBAC, and core features (grades, attendance, messaging) • Used sprints for better testing	Working system modules developed and tested incrementally
Test	• Checked all features for functionality • Performed technical and user testing • Collected feedback and fixed bugs	Stable and user-friendly system with minimal issues
Deploy	• Installed system on a live server • Configured database and access controls • Made system available to users	System is live and ready for real-world use

Table 2 *(Cont.)*

Phase	Description	Outcome
Review	• Gathered user feedback (teachers, parents, students) • Identified and fixed small bugs • Improved design and functionality	System improved based on real usage feedback
Launch	• Officially launched the system • Provided user training and guides • Monitored system performance	Fully implemented system integrated into school operations

4. System Analysis and Design

This section provides a comprehensive analysis and design for the Student Information System (SIS). The system makes sure that information is managed effectively, securely and easily in order to meet the demands of the admins, teachers, parents and students of SMK Tunku Mahmood Iskandar (SMKTMI).

4.1.1 Functional Requirement

A functional requirement specifies what the system must perform by outlining the necessary activities, tasks or actions to be carried out. It describes the processes that convert inputs into the desired outputs for users in Table 3.

Table 3 *Functional Requirements of SIS: Student Information System*

Functionality	Requirement	Description
User Login	• Secure login for all user roles.	Ensures only authorized users (admin, teacher, parent, student) can access the system.
Grade Management	• Teachers enter student grades and comments.	Helps teachers record marks and feedback for student performance tracking.
Attendance Tracking	• Teachers take and view attendance records.	Allows daily student attendance to be recorded and checked.
Parent Access	• Parents view student info and announcements.	Parents can monitor their child's education and stay updated.
Student Dashboard	• Students view results, attendance, and messages.	Central place for students to check their academic updates.
Admin Control	• Admins manage users and monitor activity.	Admin can control access, create accounts, and track usage logs.
Assessment Result	• Students and parents view exam results.	Allows exam and test results to be published for review by students and parents.
Schedule Timetable	• View class and exam schedules.	Teachers and students can check daily classes and upcoming exams.
Discipline Record	• Track and view student disciplinary actions.	Records student behavior and any disciplinary actions taken.
Security Module	• Manage access controls and system protection.	Provides role-based access, secure login, and protects data integrity and privacy.

4.1.2 Non-Functional Requirement

Table 4 shows Non-functional requirements define the criteria for assessing a system's operation, emphasizing quality attributes rather than specific actions. These requirements ensure the system's usability, reliability and performance.

Table 4 *Non-Functional Requirements of SIS: Student Information System*

Functionality	Requirement	Description
Security	• Data protection and role-based access.	Ensures user data is safe and only accessible to the correct users.
Usability	• Simple and user-friendly interface.	Easy for users to learn and operate the system.
Availability	• Accessible most of the time.	System should work with minimal downtime.
Performance	• Fast loading and responsive features.	System should not lag or delay during use.
Maintainability	• Easy to update and fix bugs.	Developers can fix or improve the system without affecting daily usage.

4.1.3 Context Diagram

The context diagram provides a high-level overview of the Student Information System (SIS). It represents the entire system as a single process and shows the interaction between external entities and the system through data flows shown in Fig. 6.

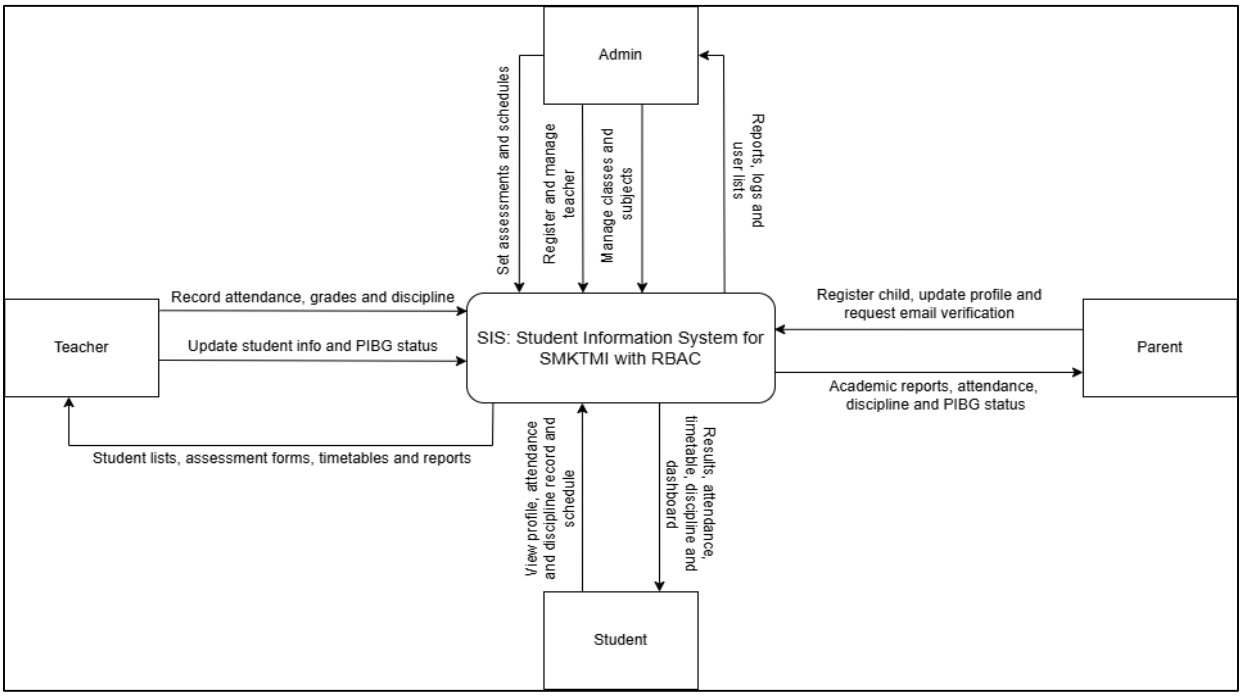

Fig. 6 *Context Diagram For SIS*

4.1.4 Data Flow Diagram Level 1

The Data Flow Diagram (DFD) Level 1 in Fig. 7 shown breaks down the SIS into its main processes while still maintaining an overview of the entire system. It illustrates how data flows between external entities, internal processes, and data stores. Key processes include user login and authentication, parent registration, student management, assessment management, attendance and schedule handling, and discipline record tracking. These processes interact with various internal data stores such as the user database, student records, attendance logs, assessment results, and discipline reports. This level gives a clearer structure of the system by highlighting how each major function contributes to the overall operation.

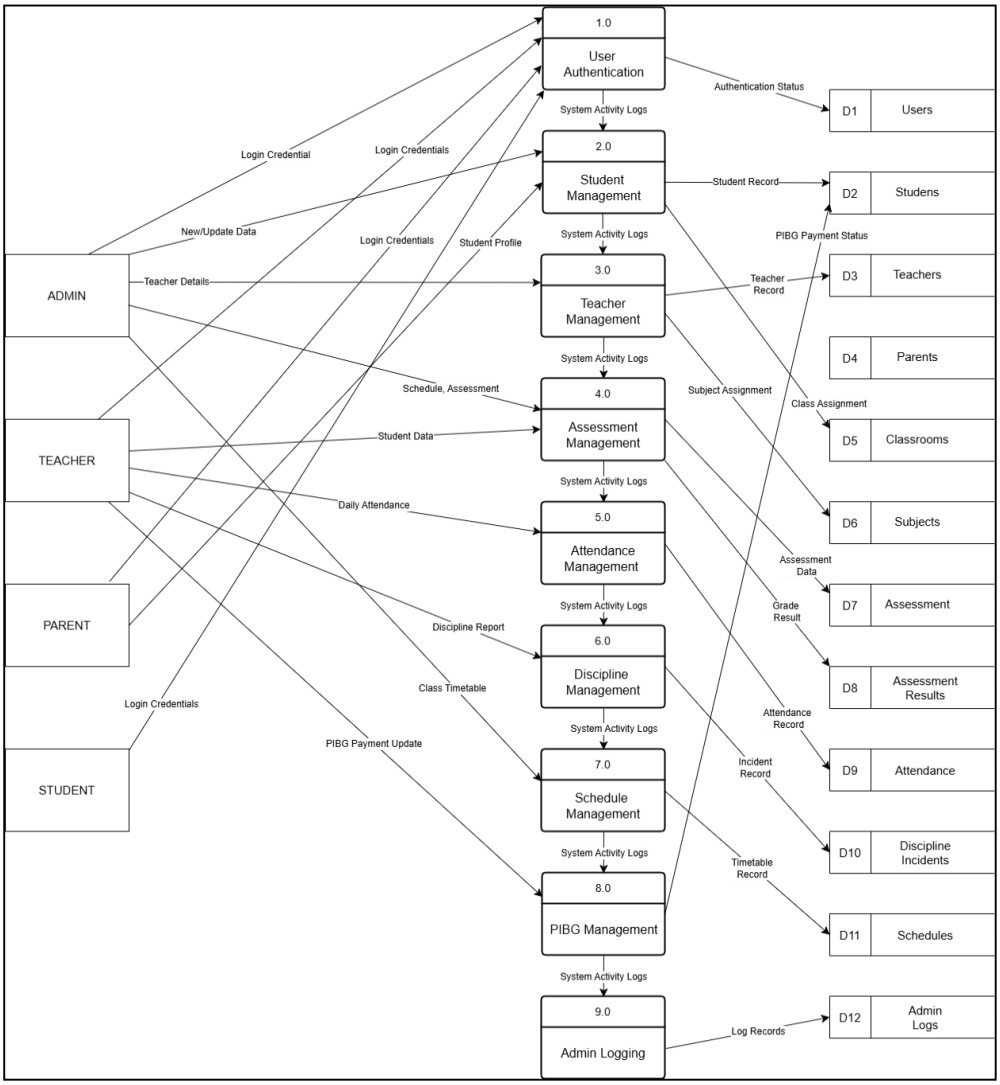

Fig. 7 *Data Flow Diagram Level 1 for SIS*

4.2 Entity Relationship Diagram

This section explains what an ERD (Entity-Relationship Diagram) is a visual representation of the data model for a system. It shows the entities (similar to tables in a database), their attributes (fields or columns) and the relationships between them as shown in Fig. 8 (Apendix A).

4.3 Flowchart

This part presents the visual representation of critical processes within the Student Information System (SIS). Flowcharts are used to illustrate the logic flow, decision points, and actions taken during user interaction with the system. This helps developers, stakeholders, and evaluators better understand the system's design and ensure a secure and user-friendly experience shown in Fig. 9, Fig. 10 and Fig. 11 in Appendix B.

4.4 Interface Design

The interface design of the SMKTMI School Management System focuses on simplicity, clarity, and ease of use for all user roles. The system uses a consistent layout and color theme that reflects the school's identity, with a clean blue interface that enhances readability. Navigation is streamlined using a sidebar menu that remains consistent across all pages, allowing users to quickly access the features they need. Each user role such as admin, teacher, student, and parent have a personalized dashboard that displays only the relevant functions and information. This helps reduce clutter and confusion. The design is responsive and works well on both desktop and mobile devices. Buttons, forms, and tables are arranged in a logical way, and font sizes are chosen carefully to ensure the content is easy to read. Overall, the interface is designed to be intuitive and user friendly, enabling

users to interact with the system smoothly without needing any technical background shown Fig. 12, Fig. 13, Fig. 14 and Fig. 15 in Appendix C.

5. Implementation and Testing

The results and discussion section presents data and analysis of the study. This section can be organized based on the stated objectives, the chronological timeline, different case groupings, different experimental configurations, or any logical order as deemed appropriate. Results from the user acceptance test must be reported in this section.

5.1 Implementation of Security Features

The SMKTMI School Management System integrates multiple layers of security to protect user accounts, system integrity, and sensitive student data. Key features include login attempt control, account lockout, real-time system monitoring, and email verification.

5.1.1 Login Attempt Limiting

To mitigate brute force attacks and unauthorized access, a login attempt limiting mechanism is enforced. This feature helps detect suspicious login behavior and responds with preventive action. The system allows a maximum of 5 consecutive failed login attempts. Each failed attempt is logged with the username, timestamp, and IP address to support traceability. Once the threshold is exceeded, the user's account is temporarily locked for 30 minutes. If violations continue, the system enforces a progressive lockout duration. All login attempts, whether successful or failed, are stored in the security logs to support ongoing analysis and auditing in Fig. 16.

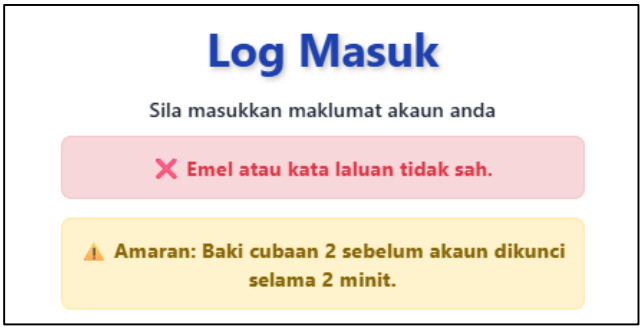

Fig.16 *Login Page with Attempt Limiting*

5.1.2 Account Lockout

Working alongside the login limit, the account lockout system automatically restricts access after detecting potential unauthorized login attempts. Accounts are automatically locked once the defined threshold of failed login attempts is reached. The system stores the lockout status and duration in the database. Administrators are granted the ability to manually unlock user accounts if a lockout is deemed to be legitimate. Users are notified through email when their accounts are locked, and a self-service unlock feature becomes available after the lockout duration has expired. All account lock and unlock events are documented within the security audit logs for transparency in Fig.17.

Fig.17 *Login Page with Account Lockout Duration*

5.1.3 System Monitoring and Auditing

The system generates logs for all actions performed within the system, categorized into general activity logs and security-related event logs. Each log entry contains essential information such as user ID, IP address, timestamp, and the action performed. Logs are classified based on severity level, including INFO, WARNING, ERROR, and SECURITY. Administrators can view and analyze these logs through a dedicated dashboard. Additionally, the system is configured to trigger automated alerts for critical or abnormal security events. All logging practices follow retention policies that align with educational data protection regulations shown in Fig. 18.

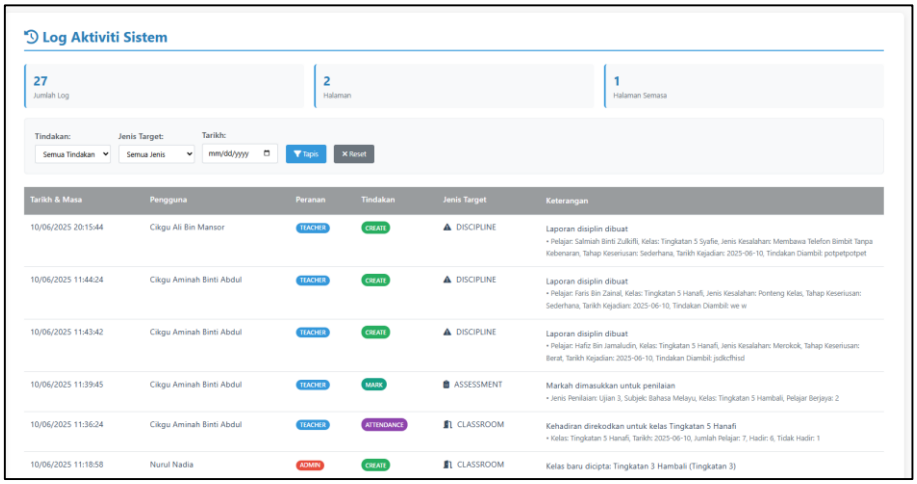

Fig.18 *System Monitoring and Auditing*

5.1.4 Email Verification

To verify user identity and ensure the authenticity of accounts, the system enforces an email verification process during registration and email changes. The system uses cryptographically secure tokens to generate verification links. These tokens are valid for 24 hours, encouraging timely user verification. Each email contains clear instructions along with the verification link to guide the user through the process. Verification status is recorded in the user database, and users are restricted from full access until the email is successfully verified. If a user changes their email address, a re-verification is required. All verification-related actions are tracked and stored in the security logs to maintain accountability shown in Fig. 19.

Fig.19 *Email Verification*

5.2 Implementation of System Module

The SMKTMI system comprises dedicated modules for each user role. These modules are tailored to support the specific responsibilities and needs of administrators, teachers, parents, and students. Each module implements strict role-based access control to ensure data confidentiality and system integrity.

5.2.1 PIBG Payment Tracking for Teacher and Parent

This section allows teachers to record and monitor PIBG contributions, while parents can track their payment history in a secure and transparent manner. It reduces manual errors, prevents confusion, and ensures accurate financial record-keeping between the school and parents system shown in Fig. 20.

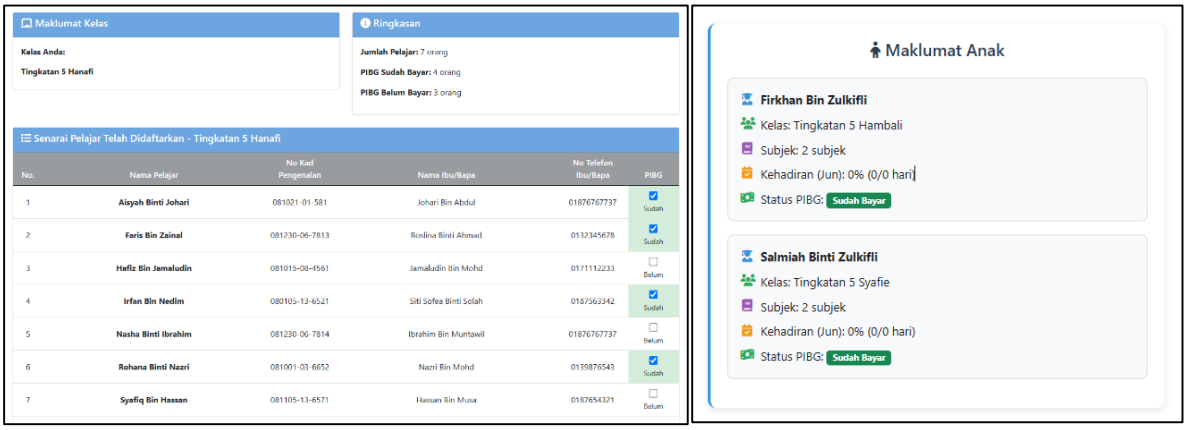

Fig.20 *PIBG Payment Tracking*

5.2.2 Discipline Management

This section allows teachers to create and submit discipline records based on the severity of student behavior. Admins can view these reports to monitor cases, follow up with necessary actions, and ensure proper resolution. The system also supports status updates and action tracking, providing a clear workflow for managing student discipline shown in Fig. 21.

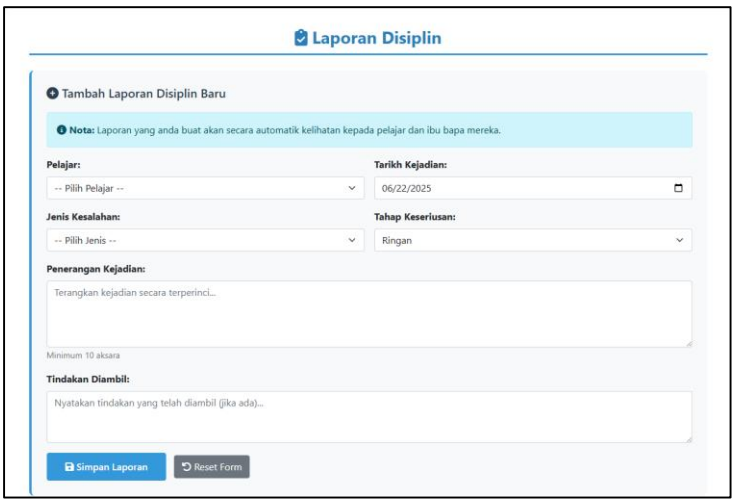

Fig.21 *Discipline Record*

5.2.3 Attendance Tracking

This feature allows teachers to record daily attendance and classify absences accurately shown in Fig. 22. The system supports report generation and calendar-based tracking through an easy-to-use interface. Parents and students also can view the attendance records.

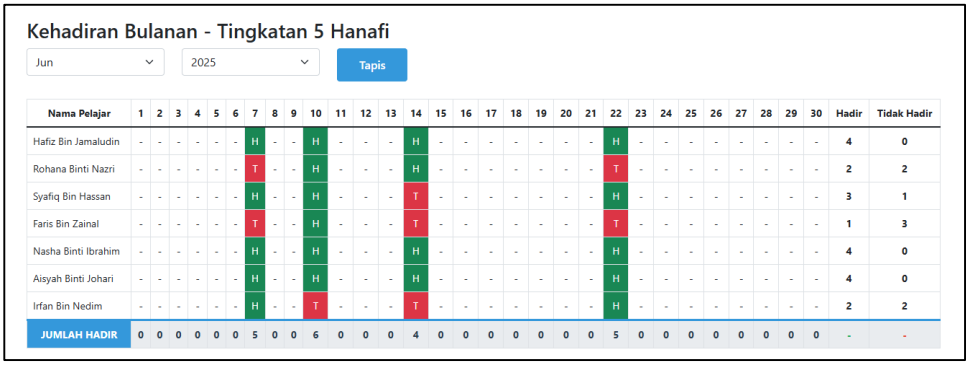

Fig.22 *Attendance Record*

5.3 User Acceptance Test

User Acceptance Testing (UAT) was conducted to evaluate the performance, usability and functionality of the Student Information System developed for SMKTMI. A total of eleven users participated in the testing, comprising two administrators, three teachers, three parents and three students. Each participant was provided with a role-specific login credential and was instructed to perform tasks according to their user type. The system was hosted on a live web server and accessed using desktop to reflect realistic usage conditions. The testing focused on several key aspects, including login security, email verification, account lockout after failed attempts, and the enforcement of role-based access control (RBAC). Each module was tested independently, with users exploring their dashboards and interacting with core features such as attendance, grading, discipline records and PIBG payment tracking.

Feedback was gathered through a structured online form and brief follow-up discussions. Overall, participants responded positively, highlighting the system's ease of use, logical navigation and alignment with user expectations. The role-based restrictions were effective and no unauthorized access was reported. Security functions operated as intended, and all tested modules responded without errors. Suggestions for improvement were minor and mostly related to interface presentation, such as improving font readability and mobile layout spacing. Based on the results of the UAT, the system is deemed ready for deployment, with only small adjustments recommended to enhance the user experience further.

6. Conclusion and Future Works

In conclusion, the development of the SMKTMI School Management System has successfully delivered a centralized platform for managing academic, administrative, and communication processes in a school setting. Key modules such as the Admin, Teacher, Parent, and Student Dashboards were implemented with role-based access controls to ensure security and ease of use. Security features like login attempt limiting, account lockout, and email verification have been integrated to protect user data and maintain system integrity.

Although the system has achieved its core objectives, there is still room for future improvement. Upcoming versions of the system may include features such as mobile app support, integration with financial systems for fee payments, real-time messaging, and analytics dashboards powered by AI to track student performance trends. Continuous user feedback will guide the enhancement of the system to better serve the needs of SMKTMI and potentially be adapted for other schools in the future.

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:*** *N. N. Abd Wahab, Z. Abdullah;* ***data collection:*** *N. N. Abd Wahab, Z. Abdullah;* ***analysis and interpretation of results:*** *N. N. Abd Wahab, Z. Abdullah;* ***draft manuscript preparation:*** *N. N. Abd Wahab, Z. Abdullah. All authors reviewed the results and approved the final version of the manuscript.*

References

[1] "What is Information System? Definition, Examples, & Facts." Accessed: Jun. 11, 2025. [Online]. Available: https://emeritus.org/in/learn/information-system/
[2] Frida, "Innovative Solutions for High School Inventory Management: An Information System Approach," Journal of Computer Science Application and Engineering (JOSAPEN), vol. 2, no. 2, pp. 39–42, Aug. 2024, doi: 10.70356/JOSAPEN.V2I2.35.
[3] "(PDF) Information Management." Accessed: Jun. 11, 2025. [Online]. Available: https://www.researchgate.net/publication/389813963_Information_Management
[4] V. C. Hu, D. F. Ferraiolo, and D. R. Kuhn, "Assessment of Access Control Systems", doi: 10.6028/NIST.IR.7316.
[5] "Limit Login Attempts - Really Simple Security." Accessed: Jun. 11, 2025. [Online]. Available: https://really-simple-ssl.com/instructions/limit-login-attempts/
[6] "Security and Privacy in Communication Networks: 15th EAI International ... - Google Books." Accessed: Jun. 11, 2025. [Online]. Available: https://books.google.com.my/books?hl=en&lr=&id=a2vDDwAAQBAJ&oi=fnd&pg=PA26&dq=account+lockout&ots=L3cQllS83T&sig=-
[7] "(PDF) Security Auditing and Monitoring: Incident response and management." Accessed: Jun. 11, 2025. [Online]. Available: https://www.researchgate.net/publication/389587035_Security_Auditing_and_Monitoring_Incident_response_and_management\
[8] "How Email Verification Works | An easy explanation to the general process." Accessed: Jun. 11, 2025. [Online]. Available: https://mailfloss.com/how-email-verification-works/
[9] "SAPS Ibu Bapa 2025 Login / Semak Keputusan Peperiksaan Pelajar." Accessed: Jun. 11, 2025. [Online]. Available: https://portalinfo.com.my/saps-ibu-bapa/
[10] "Sistem Pentaksiran Berasaskan Sekolah (Pbs): Sistem Pengurusan Pentaksiran Berasaskan Sekolah (SPPBS)." Accessed: Jun. 11, 2025. [Online]. Available: https://pbs-pentaksiranberasaskansekolahpbs.blogspot.com/2013/06/sistem-pengurusan-pentaksiran.html
[11] "Pangkalan Data Murid." Accessed: Jun. 11, 2025. [Online]. Available: https://apdm.moe.gov.my/
[12] "Agile Software development life cycle: Is it Right for Your Project?" Accessed: Jun. 12, 2025. [Online]. Available: https://yuktisolutions.com/blog/agile-sdlc-for-your-project

Appendix A: Entity Relationship Diagram

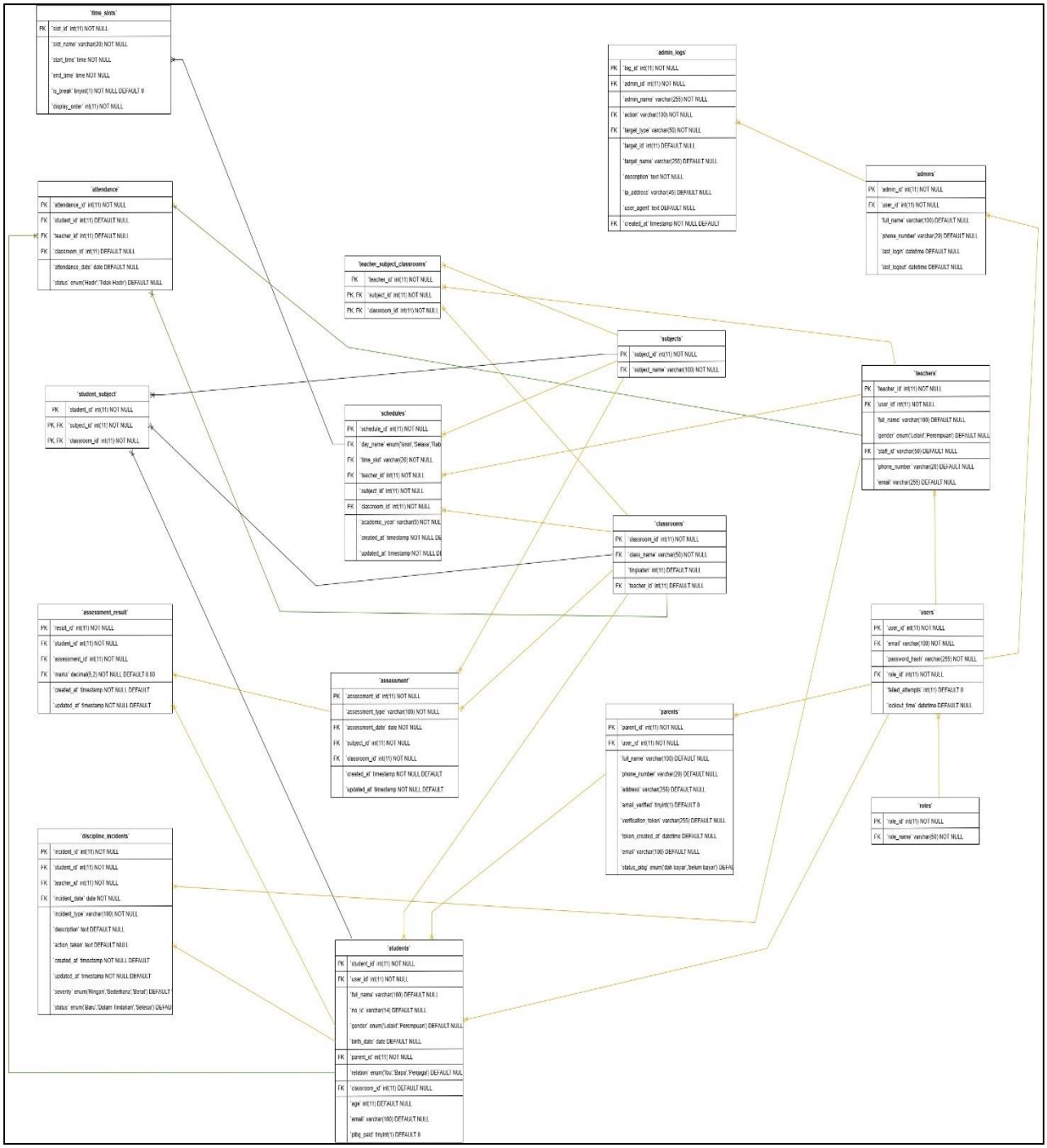

Fig.8 *Entity Relationship Diagram*

Applied Information Technology and Computer Science Vol. 6 No. 2 (2025) p. 813-832

APPENDIX B: FLOWCHART

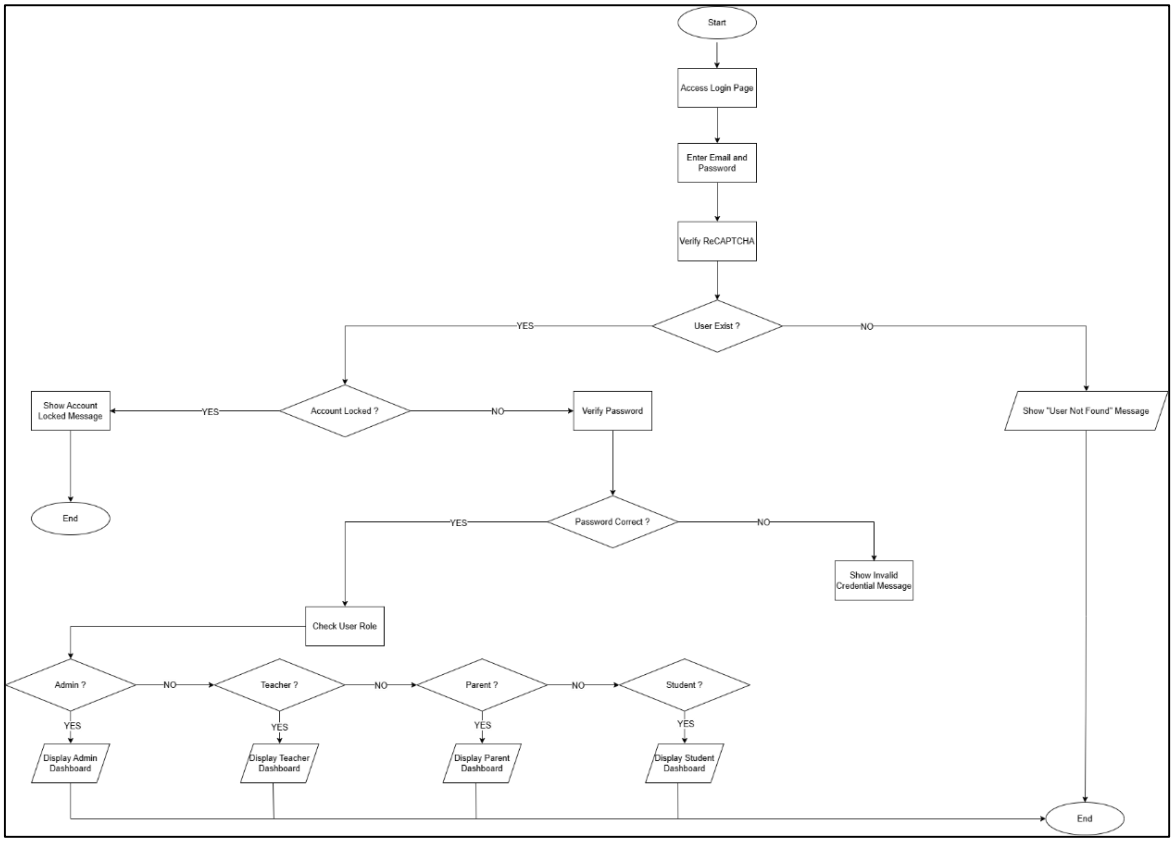

Fig.9 *Login Authentication Flow*

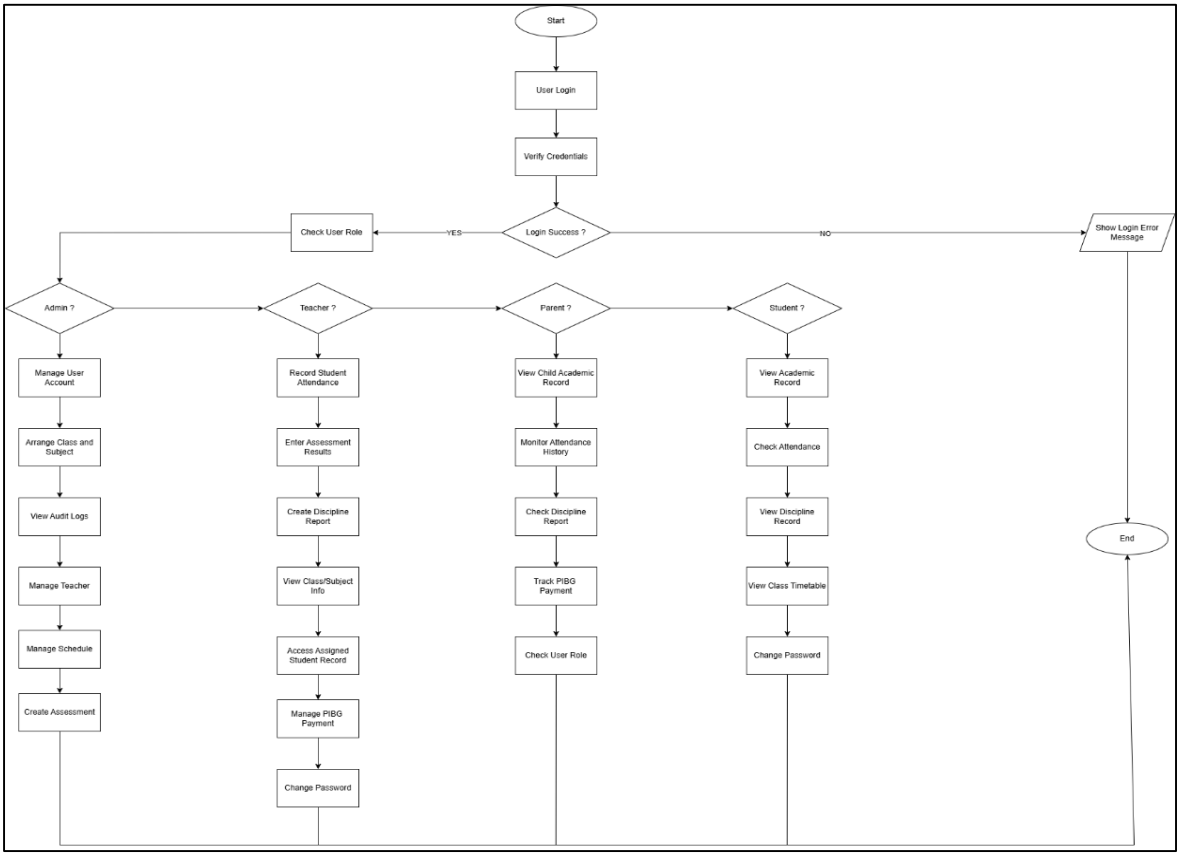

Fig.10 *Role-Based User Interaction Flow*

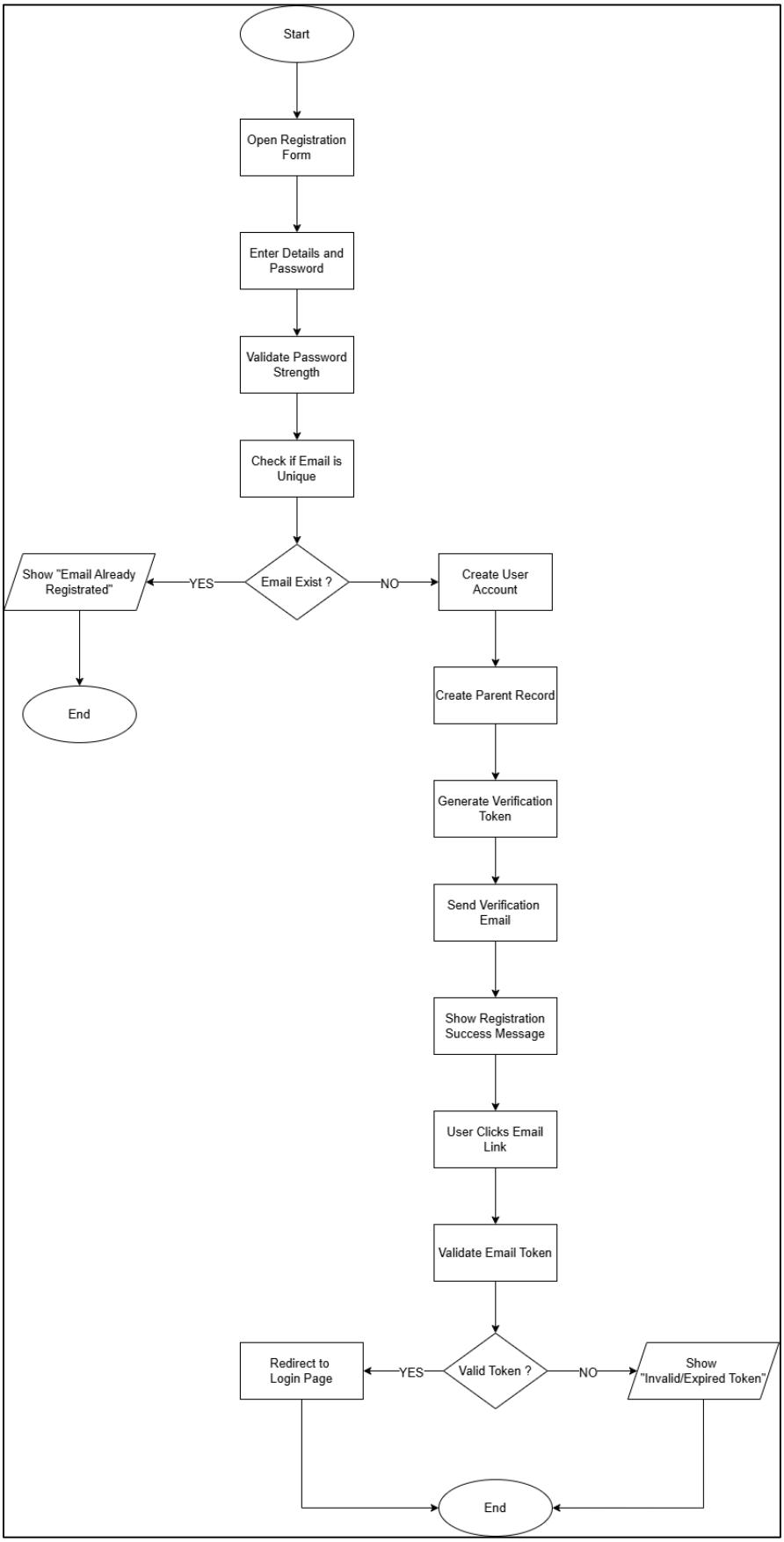

Fig.11 *User Registration Flow*

Applied Information Technology and Computer Science Vol. 6 No. 2 (2025) p. 813-832

APPENDIX C: INTERFACE DESIGN

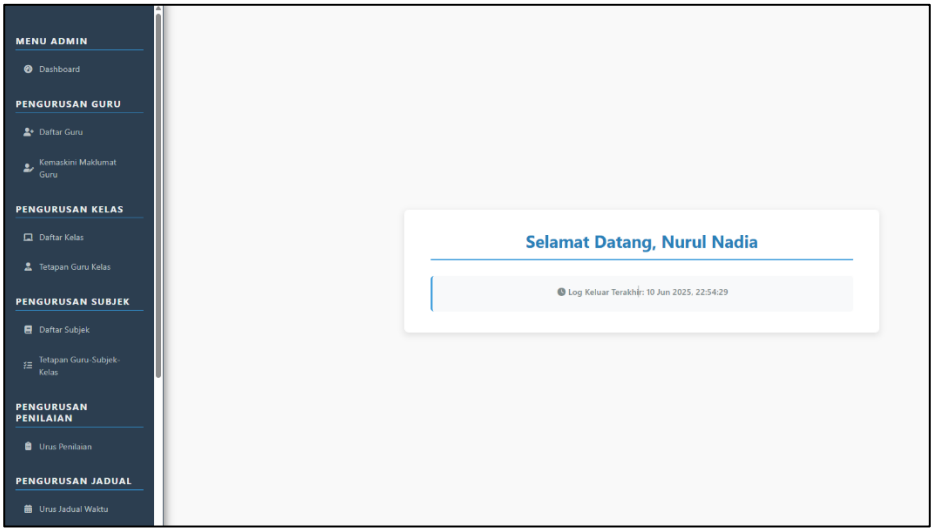

Fig.12 *Admin Dashboard*

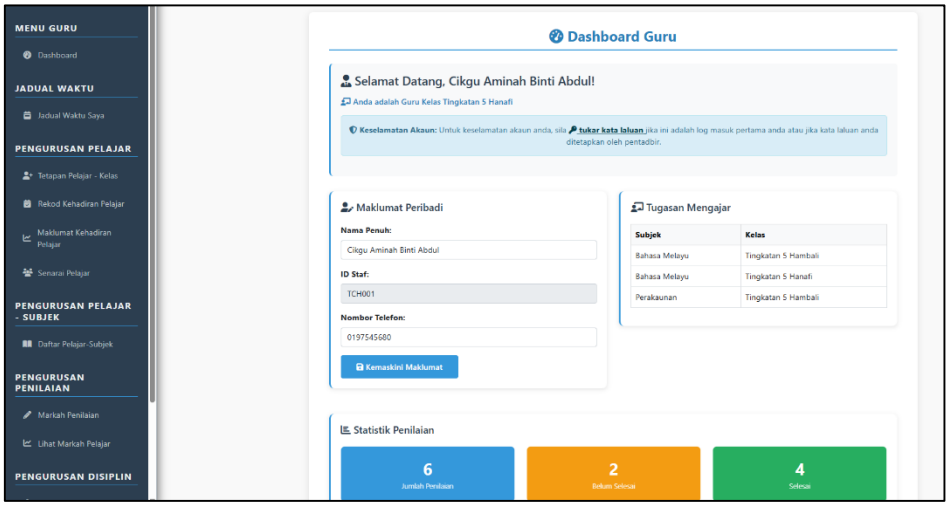

Fig.13 *Teacher Dashboard*

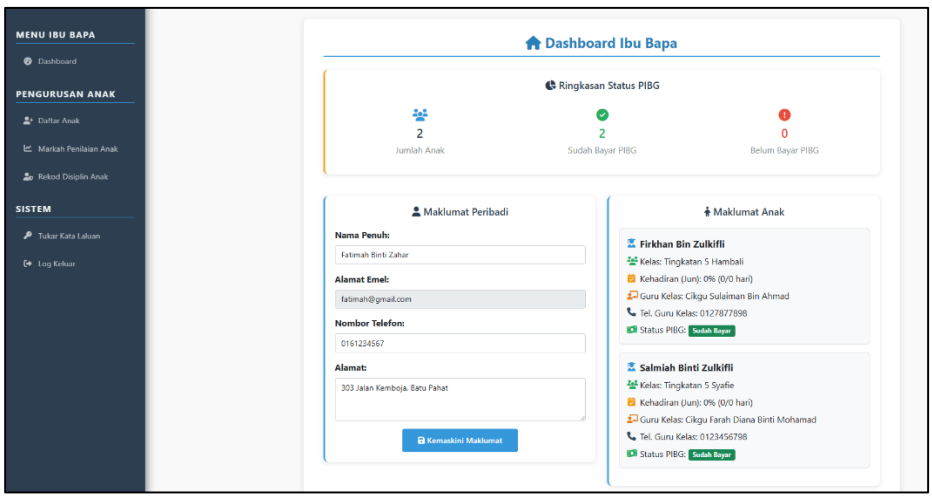

Fig.14 *Parent Dashboard*

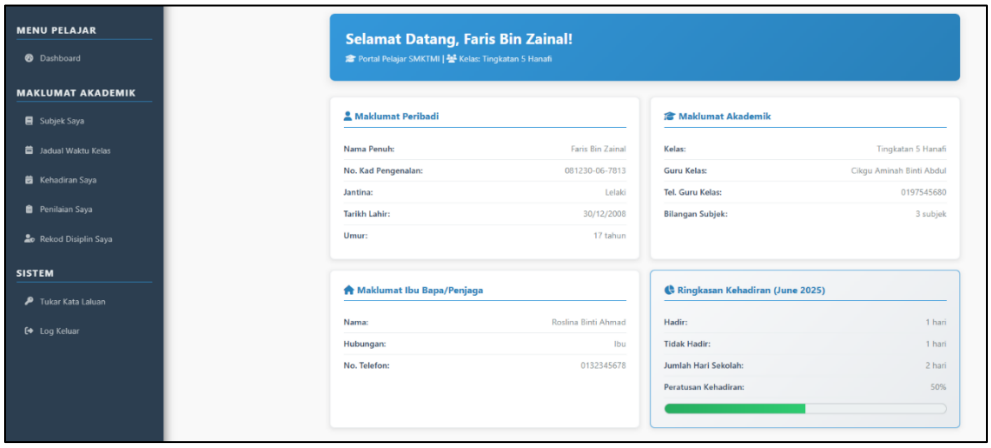

Fig.15 *Student Dashboard*