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

AITCS

Vol. 7 No. 1 (2026) 723-741
https://publisher.uthm.edu.my/periodicals/index.php/aitcs

VIRTU: Student Behavior Reporting App

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DOI: https://doi.org/10.30880/aitcs.2026.07.01.039

Article Info

Received: 15 June 2025
Accepted: 21 June 2026
Available online: 30 June 2026

Keywords

Student Behavior Management, QR Code Technology, Mobile Application, Educational Technology, Real-time Communication

Abstract

Student behavior management in Malaysian secondary schools currently relies on SSDM (Sistem Sahsiah Diri Murid), which requires teachers to manually login through school accounts, type student names and IC numbers for identification, leading to time-consuming processes and data entry errors. This study develops VIRTU, an enhanced digital student behavior reporting system that utilizes QR code technology to streamline the existing SSDM workflow for SMK Bangsar. The system was developed using Waterfall methodology, implemented with Flutter mobile applications, Firebase backend, and web-based administrative dashboard to replace manual student identification with automated QR code scanning. The system features role-based access control, real-time notifications, and comprehensive reporting capabilities. Expected outcomes include reduced manual workload, improved tracking accuracy, and enhanced stakeholder communication, demonstrating strong potential for upgrading existing SSDM implementations across Malaysian secondary schools.

1. Introduction

Student behavior management is critical for educational excellence in Malaysian secondary schools, directly influencing academic achievement and classroom environment. The SSDM (Sistem Sahsiah Diri Murid), introduced by the Ministry of Education Malaysia, serves as the national framework for tracking and managing student behavior in schools by recording both positive and negative behaviors to promote moral values and character development. However, the existing system relies heavily on manual data entry processes, requiring teachers to log in, search for student details, and input behavior information manually, which proves time-consuming and inefficient, particularly for educators managing large classes or operating under tight schedules.

The current manual SSDM implementation faces significant challenges including data entry errors, delayed interventions, and inconsistent record-keeping that can lead to inaccurate behavioral assessments. Research demonstrates that teachers often base their academic recommendations, including track placements, on students' behavior and attitudes, whether intentionally or unintentionally, with positive behaviors such as work habits, punctuality, and responsibility serving as key indicators of student potential [1]. Studies indicate that teachers' perceptions of student self-confidence and reliability significantly influence academic recommendations, with students exhibiting positive behaviors receiving higher evaluations [2]. Given the substantial impact of behavioral records on academic outcomes, streamlining the behavior tracking and reporting process becomes essential for educational fairness and effectiveness.

This paper presents VIRTU, a comprehensive digital behavior management system designed to modernize and enhance the current SSDM implementation at SMK Bangsar through QR code technology integration. The system assigns each student a unique QR code linked to their behavioral profile, enabling teachers to scan codes using a mobile application for real-time behavior reporting while eliminating manual data entry requirements. The research objectives include developing an efficient QR code-based student identification system, creating

mobile applications for real-time behavior tracking, and implementing a web-based administrative dashboard for comprehensive system management [3]. VIRTU aims to reduce reporting errors, improve intervention timeliness, enhance parent-teacher communication, and provide data-driven insights for evidence-based decision making in student behavior management.

This paper presents the system development methodology, implementation results, and comprehensive evaluation outcomes. Section 2 reviews related work in educational technology and behavior management systems, Section 3 details the research methodology and development approach, Section 4 discusses implementation results and user acceptance testing, and Section 5 concludes with findings and recommendations for future research.

2. Related Work

Student behavior management systems have evolved significantly with the integration of digital technologies in educational institutions. Traditional approaches often relied on manual documentation and periodic reporting, creating challenges in real-time monitoring and effective intervention strategies.

2.1 Student Management Information System

A Student Information System (SIS) is a powerful software platform designed to streamline and automate the administrative and academic functions of educational institutions. These systems manage critical information such as enrollment, grades, attendance, and communication, enabling stakeholders to access data efficiently. By integrating features like scheduling, reporting, and analytics, SIS enhances institutional efficiency while providing real-time insights to inform decision-making. Such systems support administrators by reducing manual errors and improving data management processes, ultimately fostering better student outcomes [4]. The integration of Industry 4.0 innovations into SIS represents a pivotal advancement, streamlining client interactions and fostering transparency in information management [5].

Modern Student Information Systems have evolved to incorporate mobile technologies and real-time communication features, enabling seamless integration between administrative functions and stakeholder engagement [6]. These systems now support mobile applications for data entry, automated notifications for parent-teacher communication, and web-based dashboards for comprehensive reporting [7]. The shift towards mobile-first approaches in educational technology demonstrates the growing importance of accessibility and user-friendly interfaces in academic administration [8].

2.2 QR Code Integration in Educational System

The adoption of cross-platform development frameworks has gained momentum in educational applications due to their efficiency and cost-effectiveness. Bhagat et al. [9] conducted a comprehensive review emphasizing Flutter's benefits for cross-platform development in educational contexts, highlighting reduced development time and improved maintenance efficiency across multiple platforms. QR code integration has emerged as an effective solution for streamlining administrative processes in educational institutions. Benesa et al. [10] implemented a QR code-based attendance tracking system at Abas National High School, demonstrating that QR technology significantly reduces processing time while virtually eliminating human error in record-keeping. Their findings showed that QR code technology promotes accountability while reducing the administrative burden on educators, enabling them to allocate more time to instructional activities rather than manual documentation processes.

2.3 Comparison

Based on comprehensive analysis of existing solutions, several limitations have been identified that VIRTU aims to address. The comparison of system features is presented in Table 1.

Table 1 *System's Comparison*

Features/System	SSDM	ClassDojo	SWIS	Virtu
User Authentication	✓	✓	✓	✓
Manage Teacher Information	✗	✗	✓	✓
Manage Student Information	✓	✗	✗	✓

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Table 1 *Continued*

Manage Parent Information	✗	✓	✗	✓
Manage Behavior Categories	✓	✗	✓	✓
Manage Behavior Records	✓	✓	✓	✓
Generate Behavior Reports	✓	✗	✓	✓
QR Code Integration	✗	✗	✗	✓
Real-time Notification Module	✗	✓	✗	✓

The analysis reveals that while existing systems address specific aspects of behavior management, none provides a comprehensive solution that combines QR code efficiency, real-time communication, and robust analytics capabilities. SSDM, currently used in Malaysian schools, lacks the automated identification and mobile accessibility features that VIRTU provides, demonstrating the significant enhancement potential for existing educational technology infrastructure.

3. Methodology/Framework

The development of VIRTU follows a systematic approach to ensure reliable and efficient system delivery. The Waterfall methodology was selected due to its structured nature and clear phase dependencies, which align well with the defined requirements and timeline constraints of this educational technology project.

3.1 Waterfall Model

The Waterfall model provides a linear sequential approach where each development phase must be completed before proceeding to the next stage [9]. This methodology is particularly suitable for VIRTU development as the system requirements are well-defined, and the scope is clearly established. The sequential nature ensures thorough documentation and testing at each phase, reducing the risk of system failures during implementation.

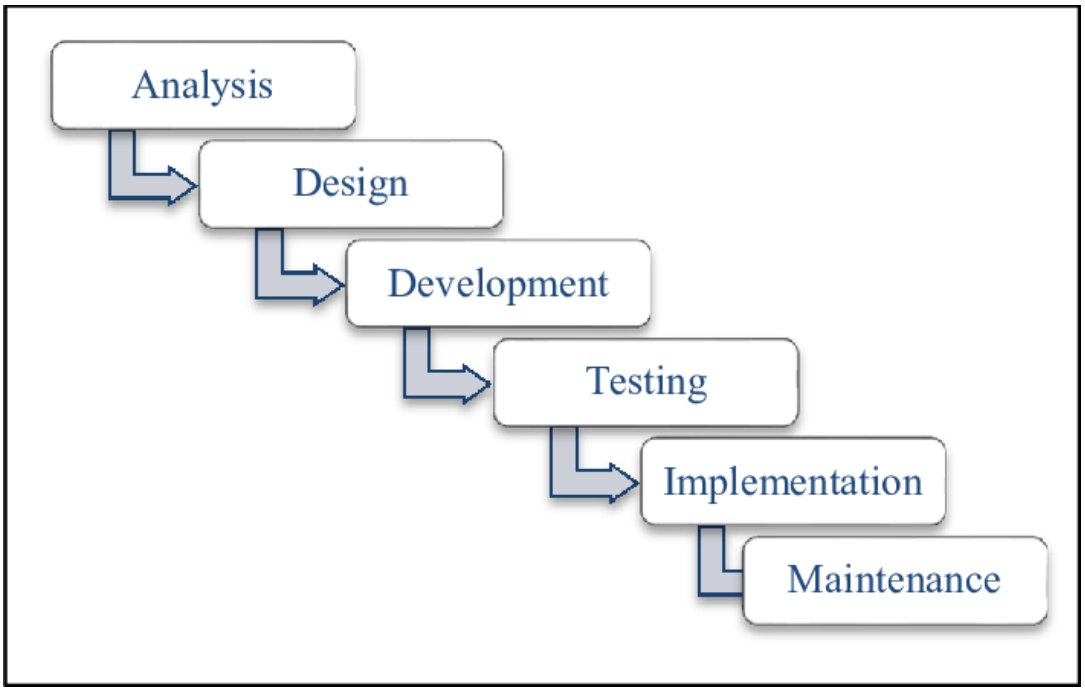

Fig. 1 *Waterfall Model [11]*

3.2 Analysis Phase

The analysis phase involves comprehensive stakeholder analysis and requirement gathering for SMK Bangsar's behavior management needs. Data collection methods include structured interviews with school administrators, focus group discussions with teachers, and questionnaire surveys distributed to parents. The requirements are categorized into functional and non-functional specifications, ensuring complete coverage of system capabilities and performance expectations.

Stakeholder analysis identified three primary user groups, administrators requiring comprehensive oversight capabilities, teachers needing efficient behavior recording tools, and parents seeking real-time communication access. Each group's specific requirements were documented and prioritized based on impact and feasibility assessments.

3.3 Design Phase

The design phase translates gathered requirements into technical specifications and architectural blueprints. System architecture follows a three-tier approach: presentation layer (mobile and web interfaces), business logic layer (Firebase Cloud Functions), and data layer (Firestore database). This architecture ensures scalability, maintainability, and secure data management. User interface design prioritizes usability and accessibility, incorporating Material Design principles for consistency across platforms. Database schema design emphasizes data integrity and efficient query performance, with careful consideration of real-time synchronization requirements between multiple user interfaces.

3.4 Development Phase

Development is structured into parallel tracks to optimize time efficiency. Mobile application development utilizes Flutter framework with Dart programming language, ensuring compatibility for Android devices. Web-based administrative dashboard employs Flutter Web with Dart programming language, providing consistent user experience and code reusability across mobile and web platforms. Backend implementation leverages Firebase ecosystem for authentication, real-time database operations, and cloud storage. QR code generation and scanning functionality integrates with native device capabilities while maintaining consistent user experience across different platforms.

3.5 Testing Phase

System integration focuses on seamless communication between mobile applications, web dashboard, and backend services. API testing ensures reliable data exchange and proper error handling mechanisms. User acceptance testing involves controlled pilot implementation with selected teachers and administrators from SMK Bangsar. Testing protocols include functionality verification, performance benchmarking, security assessment, and usability evaluation. Each module undergoes individual testing before integration testing validates inter-module communication and data consistency.

3.6 Implementation Phase

Implementation strategy includes staged rollout to minimize disruption to school operations. Initial deployment targets administrative users for system familiarization, followed by teacher onboarding with comprehensive training sessions. Parent access is enabled after teacher comfort level is established and initial behavior data is populated. Technical deployment involves cloud infrastructure setup, security configuration, and monitoring system implementation. Backup and recovery procedures are established to ensure data protection and system availability.

3.7 Maintenance Phase

Ongoing maintenance includes regular system updates, performance monitoring, and user support services. Feedback collection mechanisms enable continuous improvement and feature enhancement based on actual usage patterns and user suggestions.

4. Results and Discussion

This section presents the comprehensive development outcomes and analysis of the VIRTU Student Behavior Reporting System. The discussion covers system requirements analysis, architectural design, implementation details, and testing results that validate the effectiveness of the proposed solution.

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4.1 System Requirements Analysis

This section outlines the analysis and design process for developing the VIRTU Student Behavior Reporting System. It provides an overview of the system development workflow, details the functional requirements that shown in Table 2 and non-functional requirements shown in Table 3. This section also elaborates on the system analysis and system design.

4.1.1 Functional Requirements

Table 2 *Functional Requirements*

No	Module	Description
1	Authentication	The system shall allow administrators, teachers, and parents to register accounts and log in using valid credentials. The system shall verify email and password combinations and redirect users to their respective dashboards based on role-based access control.
2	Manage Teacher Information	The system shall enable administrators to create, edit, delete, and manage teacher accounts. The system shall support role assignment (Classroom Teacher or Subject Teacher) and enable profile management capabilities for teacher information updates.
3	Manage Student Information	The system shall allow administrators to add, edit, delete, and organize student information in the registration system. The system shall automatically generate unique QR codes for each student to streamline behavior tracking and identification processes.
4	Manage Parent Information	The system shall allow administrators to create parent accounts and establish parent-child relationships. The system shall enable linking of multiple children to parent accounts and provide communication preferences for notification management.
5	Manage Behavior Categories	The system shall allow administrators to classify and categorize student behaviors as either good or bad. The system shall enable creation, modification, and deletion of behavior categories to provide flexible behavior management interface for teachers during behavior recording.
6	Manage Behavior Records	The system shall allow teachers to scan student QR codes for quick identification and behavior recording. The system shall enable selection of behavior categories, addition of notes and categorization, and store behavior records with timestamp and teacher information for audit purposes.
7	Generate Behavior Records	The system shall allow administrators and teachers to generate comprehensive behavior reports based on various filters. The system shall enable parents to view their children's behavior reports through the parent portal and provide PDF export functionality for behavior reports and academic documentation.

4.1.2 Non Functional Requirements

Table 3 *Non-functional Requirements*

No	Requirement	Description
1	Security	The system shall implement robust authentication mechanisms and role-based access control to ensure only authorized users can access appropriate system functions and student data.
2	Performance	The system shall provide responsive user interfaces with loading times under 3 seconds for standard operations and support concurrent access by multiple users without performance degradation.

Table 3 *Continued*

3	Usability	The system shall provide intuitive user interfaces that require minimal training for teachers and parents, with clear navigation and consistent design patterns across all platforms.
4	Reliability	The system shall maintain 99.5% uptime during school operating hours and implement automated backup mechanisms to prevent data loss and ensure system availability.
5	Scalability	The system shall accommodate growth in user base and data volume, supporting up to 1000 concurrent users and storage for multiple academic years of behavior data.

4.2 Use Case Diagram

The use case diagram illustrates the interactions between different user roles which is admin, teacher and parent, and the system functionalities. The diagram demonstrates how each actor interacts with specific modules based on their authorized access levels and responsibilities within the behavior management workflow.

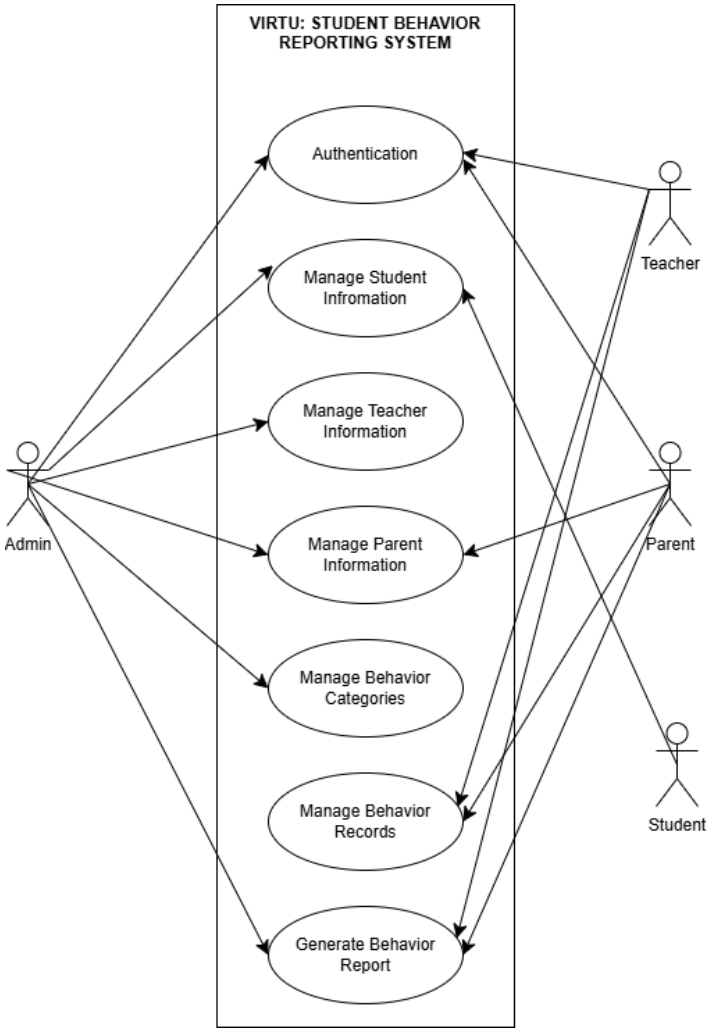

Fig. 2 *Use Case Diagram*

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4.3 System Architecture

VIRTU: Student Behavior QR Code Reporting Application uses a centralized Firebase Cloud Firestore Database to manage data and supports three main user roles: administrators, teachers, and parents. Each user accesses role-specific interfaces through mobile applications and web dashboard. Administrators manage the system through a web-based admin panel with comprehensive user management, student registration, and system configuration capabilities. Teachers use mobile applications with QR code scanning functionality to record student behavior incidents in real-time. Parents access child behavior reports through a dedicated mobile portal with communication features. The system integrates WhatsApp API for parent-teacher communication, automated QR code generation for students, and PDF report generation. All user interactions are secured through Firebase Authentication, and real-time data synchronization ensures immediate updates across all platforms. VIRTU's system architecture is designed for scalability and seamless cross-platform operation.

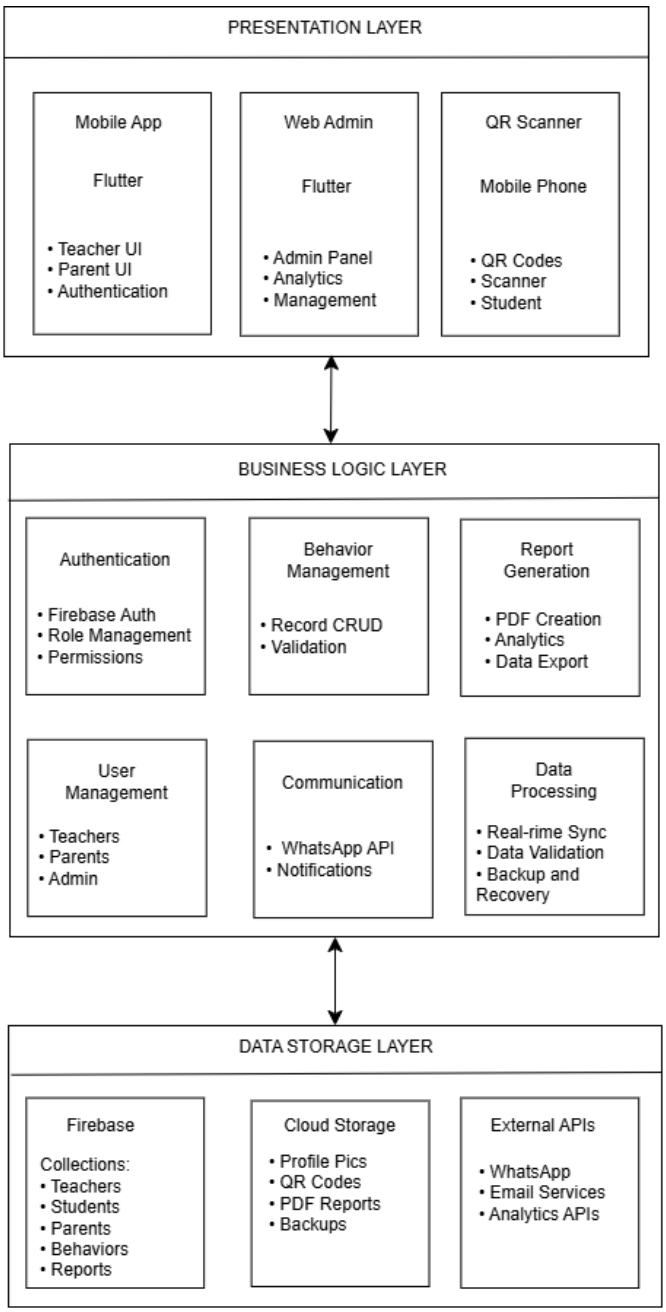

Fig. 3 *System Architecture*

4.4 Class Diagram

The class diagram represents the object-oriented structure of VIRTU system, showing the relationships between major entities including User, Teacher, Parent, Student, BehaviorRecord, BehaviorCategory, and Report classes. The diagram illustrates inheritance relationships, associations, and multiplicities that define the system's data model and object interactions.

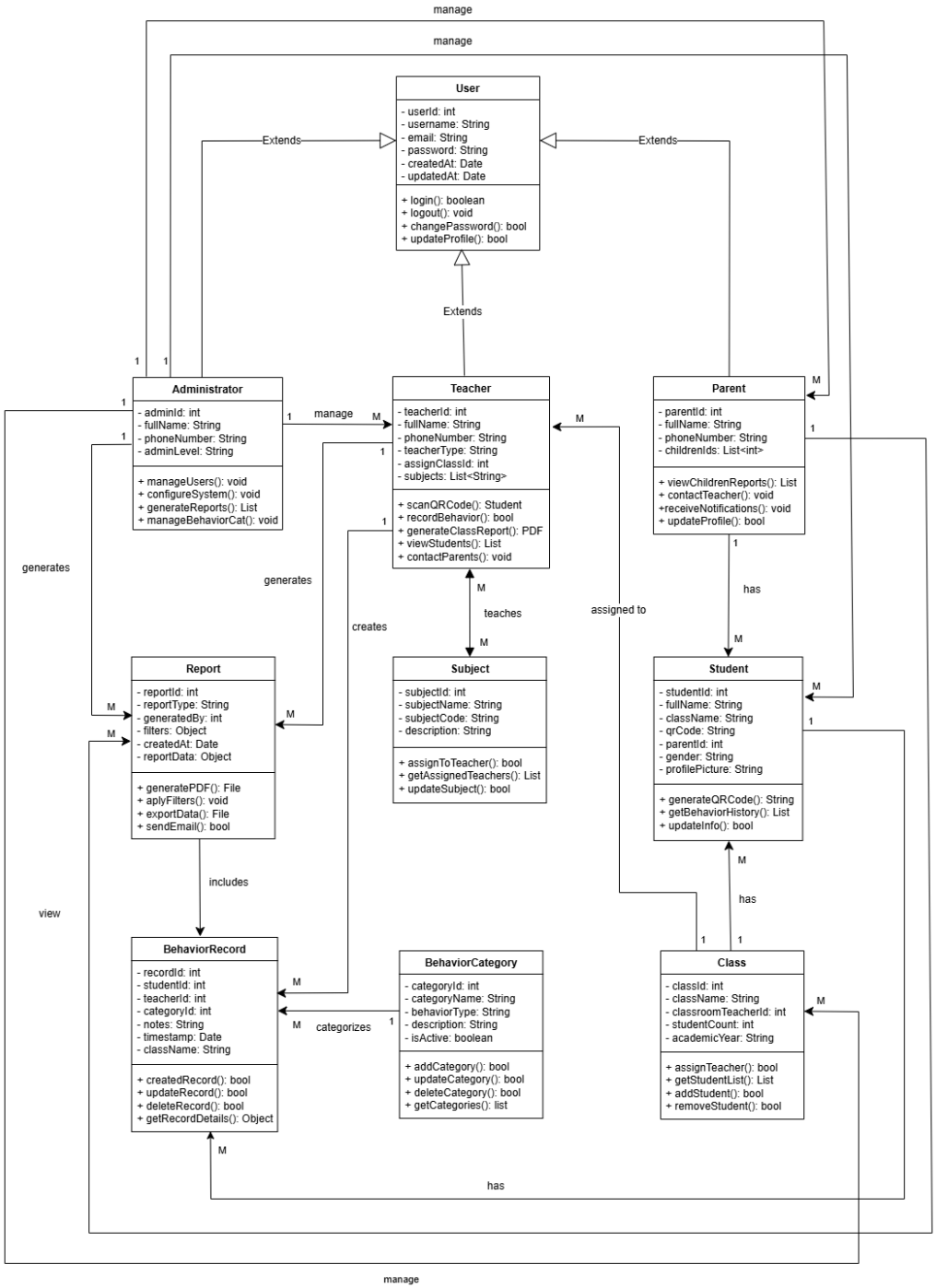

Fig. 4 *Class Diagram*

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4.5 System Flowchart

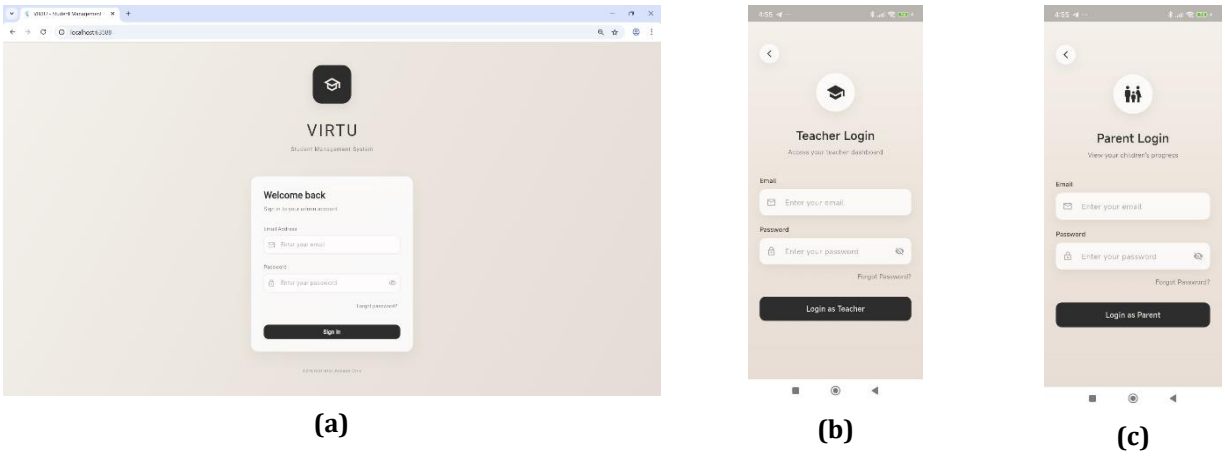
System flowchart defines the flow of procedures or functionality in the developed system. Symbols such as rectangles, diamonds, and arrows indicate the flow of the process in the system flowchart. The overall system flowchart for VIRTU is shown in Figure 5, demonstrating the complete workflow from user authentication to QR code scanning and behavior reporting processes. This figure is in Appendix A.

4.6 Implementation

The implementation phase translated the system design into functional applications using Flutter for mobile development, Firebase for backend services, and web technologies for administrative interfaces. The Firebase database is utilized to store all the data.

4.6.1 Authentication Interface

Figure 5 displays the authentication interfaces for different user types within VIRTU system. The interface provides secure login capabilities for administrators, teachers, and parents with role-based access control. Users can enter their credentials and access their respective dashboards based on their assigned roles and permissions.

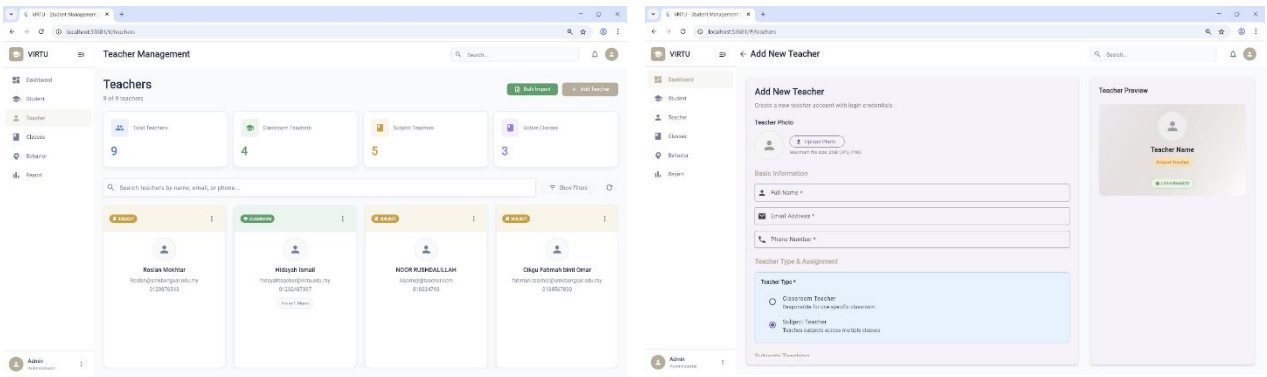


(a) **(b)** **(c)**

Fig. 5 *Authentication Interface (a) Admin Login Page; (b) Teacher Login Page; (c) Parent Login Page*

4.6.2 Manage Teacher Information Interface

Figure 6 shows the teacher management dashboard where administrators can comprehensively manage teacher accounts. Within this interface, administrators can add new teachers, edit existing teacher profiles, assign roles (Classroom Teacher or Subject Teacher), and maintain teacher information with proper role-based permissions.

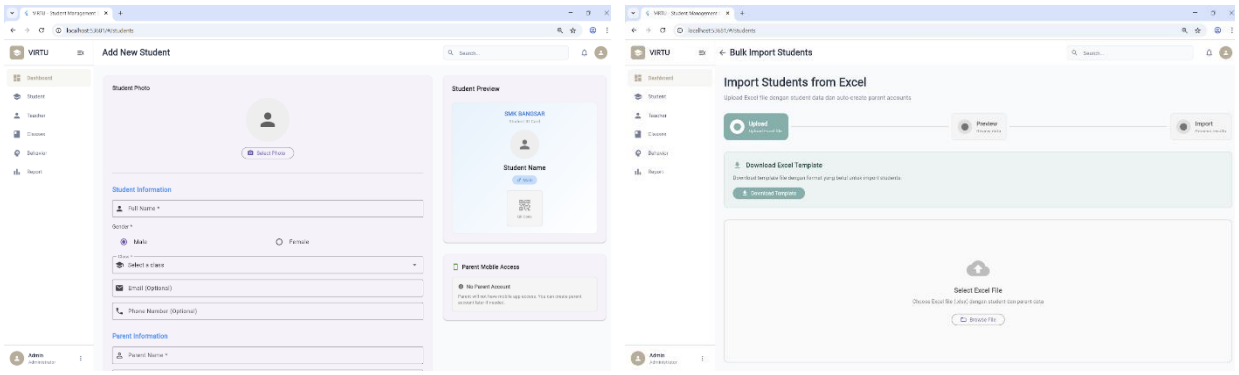


(a) **(b)**

Fig. 6 *Manage Teacher Information Interface (a) Teacher List Page; (b) Add Teacher Page*

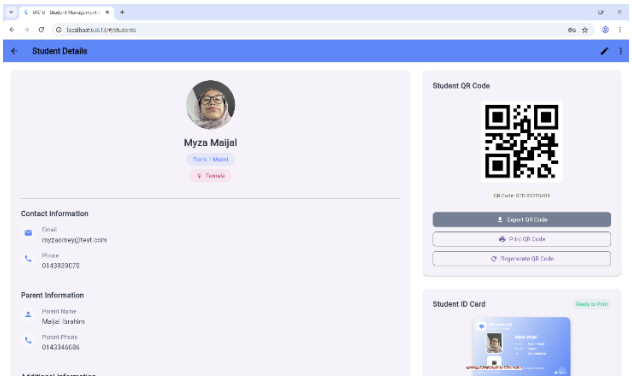
4.6.3 Manage Student Information Interface

Figure 7 and Figure 8 demonstrates the student registration and management system with automated QR code generation capabilities. The interface allows administrators to add individual students, import multiple students from Excel files, and automatically generate unique QR codes for each student to facilitate behavior tracking processes.



(a) **(b)**

Fig. 7 *Manage Student Information Interface (a) Add Student Page; (b) Import Student from Excel Page*

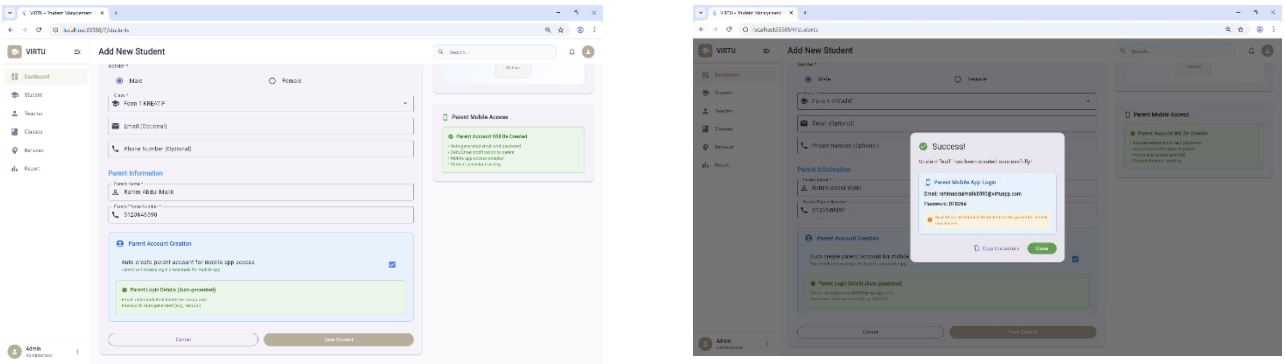


(a)

Fig. 8 *Student Details*

4.6.4 Manage Parent Information Interface

Figure 9 presents the parent enrollment interface where administrators can create parent accounts and establish parent-child relationships. The system enables linking multiple children to single parent accounts and configures communication preferences for behavior notifications and system updates.



(a) **(b)**

Fig. 9 *Manage Parent Information Interface (a) Add Parent Information; (b) Parents Credential*

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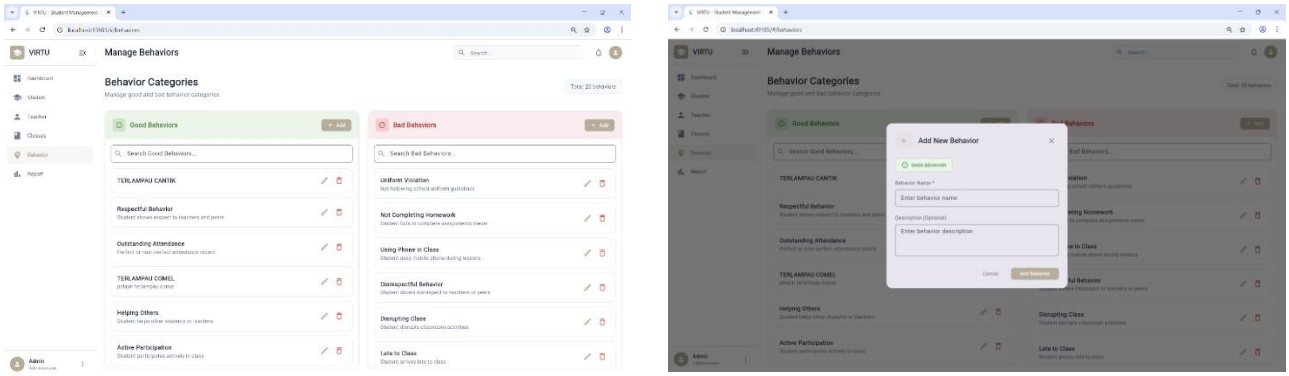
4.6.5 Manage Behavior Categories Interface

Figure 10 shows the behavior configuration module where administrators can define and manage behavior categories with flexible classification options. The interface provides behavior category creation, modification, and deletion capabilities with positive or negative impact level settings for reporting and analytics purposes

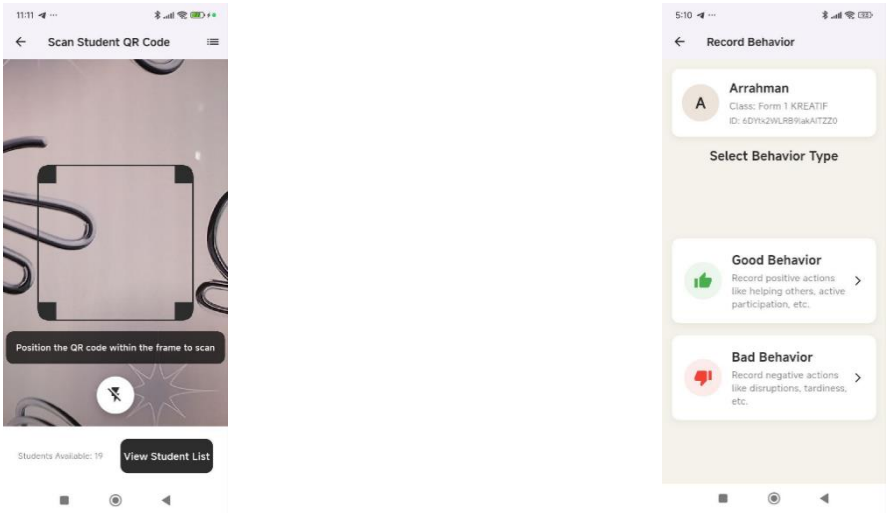


(a) **(b)**

Fig. 10 *Manage Behavior Information Interface (a) Behavior Categories Page; (b) Add New Behavior*

4.6.6 Manage Behavior Records Interface

Figure 11 displays the core behavior tracking functionality enabling teachers to record student behaviors using QR code scanning technology. The interface includes real-time QR code scanning for student identification, behavior category selection, and detailed note addition capabilities with automatic timestamp recording.

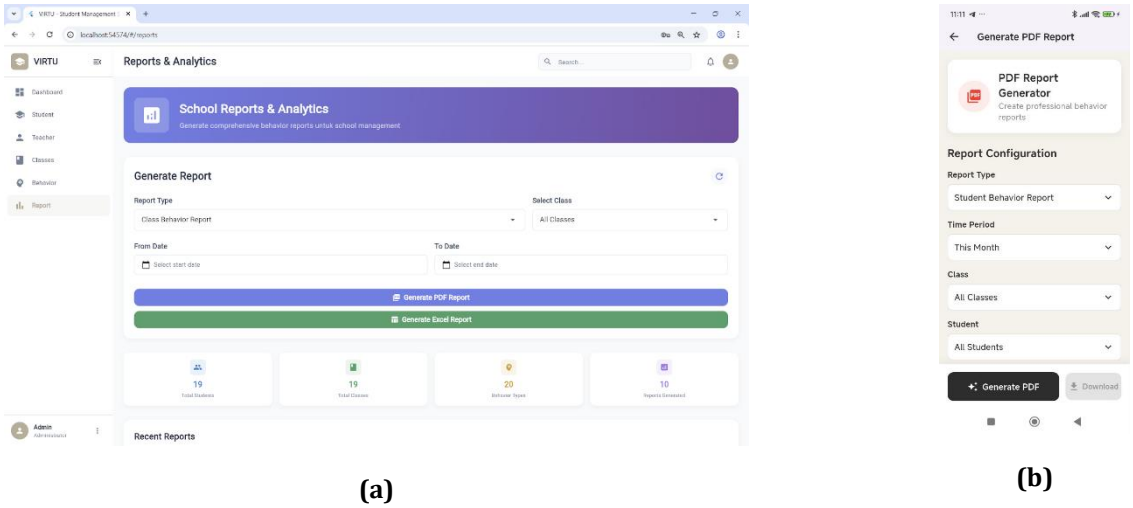


(a) **(b)**

Fig. 11 *Manage Behavior Record Interface (a) QR Scanner; (b) Behavior Selection*

4.6.7 Generate Behavior Report Interface

Figure 12 demonstrates the comprehensive reporting module providing advanced filtering and export functionalities for all user types. The interface enables customizable report generation with date range selection, behavior category filtering, visual data representation through table, and PDF export capabilities for documentation purposes.



(a) **(b)**

Fig. 12 *Generate Behavior Report Interface (a) Admin Generate Report Page; (b) Teacher Generate Report Page*

4.7 Testing

4.7.1 Alpha Testing

The requirements analysis phase established comprehensive specifications for VIRTU system development, categorized into functional and non-functional requirements to ensure complete coverage of stakeholder needs and system performance expectations.

Table 4 *List of Test Cases*

Module	Test Case	Description	Expected Result	Test Result
Authentication	Valid Login	User enters correct email and password	System successfully authenticates user and redirects to appropriate dashboard	PASS
	Invalid Credentials	User enters incorrect email or password	System displays appropriate error message and remains on login page	PASS
	Empty Fields	User submits login form with empty credentials	System highlights required fields and displays validation message	PASS
	Password Reset	User requests password reset with valid email	System sends reset emails and displays confirmation message	PASS
Manage Teacher Information	Add Teacher	Admin creates new teacher with role assignment	System creates teacher accounts with appropriate permissions	PASS

Table 4 *Continued*

	Edit Teacher	Admin modifies teacher profile information	The system updates teacher details and maintains data consistency	PASS
	Delete Teacher	Admin removes teacher with confirmation	System deactivates accounts and preserves historical data	PASS
	Search Teacher	Admin searches for teacher using name	System filters and displays matching teacher records	PASS
	Role Assignment	Admin assigns Classroom/Subject Teacher role	System applies correct permissions based on role	PASS
Manage Student Information	Add Student	Admin creates student with QR code generation	System creates profile and generates unique QR code	PASS
	Edit Student	Admin modifies student information	System updates record and maintain QR code association	PASS
	Delete Student	Admin removes students from system	System archives data and deactivates QR code	PASS
	Bulk Import	Admin imports students via CSV file	System processes all records and generates QR codes	PASS
	Print QR Codes	Admin generates printable QR codes	System creates formatted PDF with QR codes	PASS
Manage Parent Information	Create Parent Account	Admin establishes parent account	System creates access and generates login credentials	PASS
	Link to Child	Admin associates' parent with student	System establishes parent-child relationship	PASS
	Multiple Children	Admin links parent to multiple students	System creates all associations successfully	PASS
	Edit Parent Info	Admin modifies parent contact details	System updates profile and maintains relationships	PASS
Manage Behavior Categories	Add Behavior	Admin creates new behavior with selected type (good or bad)	System adds behavior category and makes available for teacher selection	PASS
	Edit Behavior	Admin edits existing behavior	System updates behavior category and maintains consistency across records	PASS
	Delete Behavior	Admin removes existing behavior	System handles existing records appropriately	PASS
Manage Behavior Records	QR Code Scan	Teacher scans student QR code	System identifies student and shows recording interface	PASS
	Select Behavior	Teacher chooses behavior from categories	System records selection with proper categorization	PASS

Table 4 *Continued*

	Add Notes	Teacher includes detailed behavior notes	System stores notes with timestamp information	PASS
	Submit Record	Teacher completes behavior entry	System saves record with teacher ID and timestamp	PASS
	View History	Teacher accesses student behavior history	System displays chronological records with filters	PASS
Generate Behavior Report	Generate Report	Admin creates behavior reports with filters	System compiles data with table	PASS
	Export PDF	User exports report in PDF format	System generates downloadable formatted PDF	PASS
	Parent Access	Parent views child's behavior report	System displays data with privacy protection	PASS
	Date Filtering	User applies date range to reports	System filters data according to time	PASS
	Report Visualization	System displays data in table	System creates visual behavior trends and patterns	PASS

4.7.2 Beta Testing

Beta testing evaluated system usability and user satisfaction through real-world usage scenarios with target user groups including administrators, teachers, and parents.

4.7.2.1 User Acceptance Testing for Administrators

Regarding the survey for admin users of the system, there were 9 respondents. 77.8% found it very easy to navigate through the administrative dashboard, while 22.2% found it easy. For dashboard usefulness, 77.8% strongly agreed it was helpful for monitoring and managing information, with 22.2% agreeing. All respondents (100%) confirmed they could manage teacher accounts efficiently. Report generation and export capabilities received strong satisfaction with 77.8% strongly agreed and 11.1% agreed. Overall system performance was rated as excellent by 77.8% and good by 22.2%. The behavior category configuration interface was found very effective by 77.8% and effective by 22.2%. The student registration process received excellent ratings from 66.7%, good from 22.2%, and average from 11.1%. The parent enrollment system met expectations with 66.7% strongly agreeing and 22.2% agreeing. Finally, 77.8% would highly recommend the system to other schools, demonstrating strong admin satisfaction with the system's administrative capabilities and user-friendly interface design.

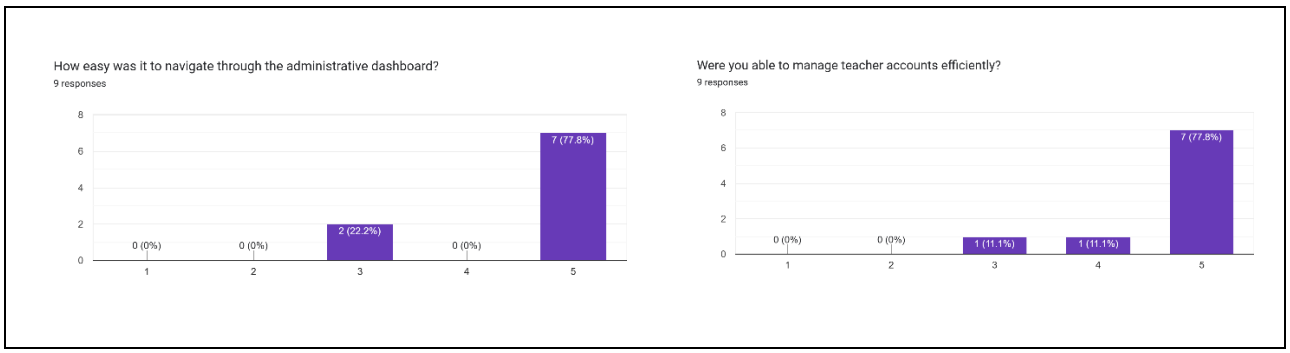


Fig. 13 *User Acceptance Testing Result for Admin*

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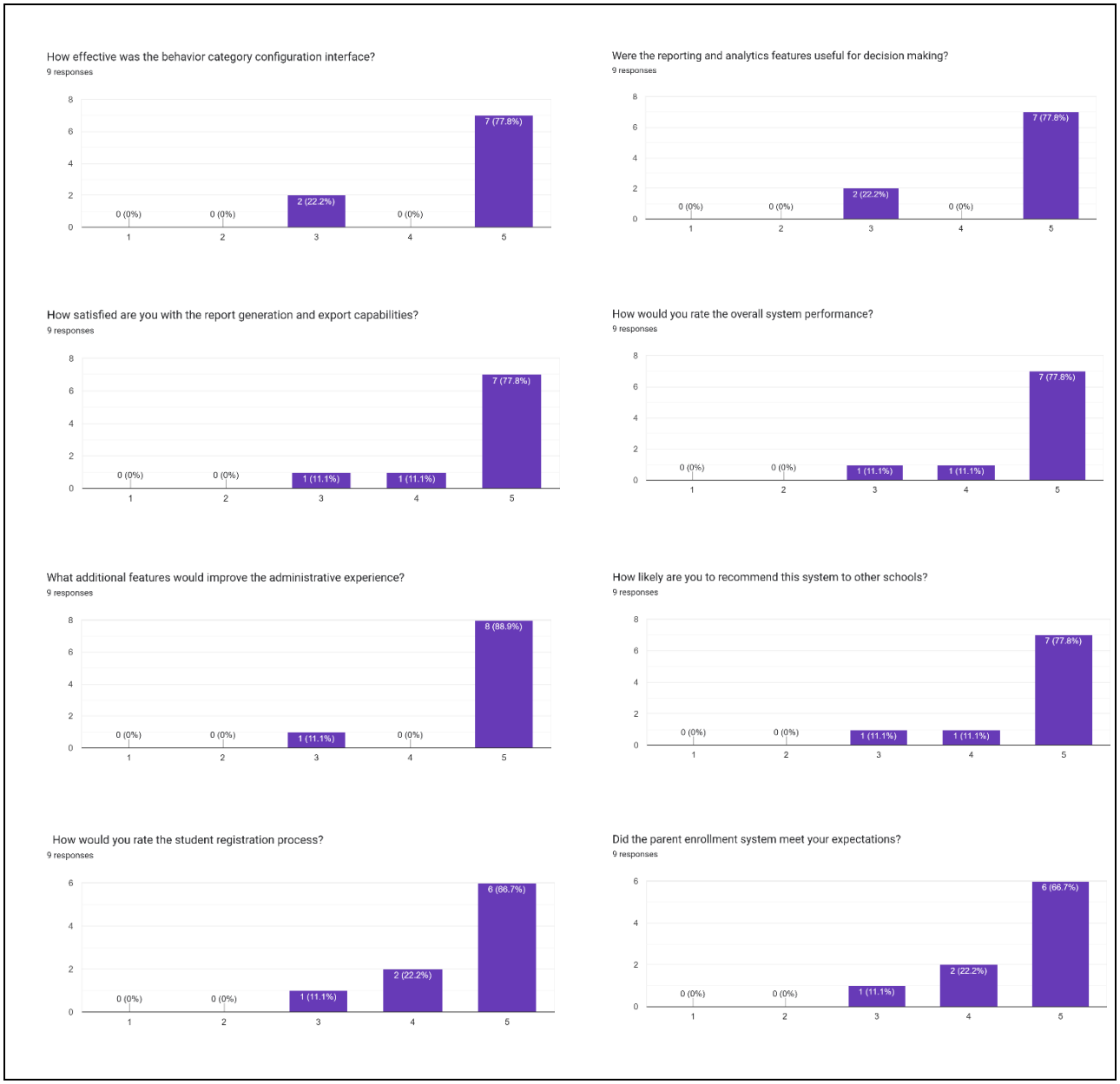

Fig. 14 *User Acceptance Testing Result for Admin*

4.7.2.2 User Acceptance Testing Teacher

Regarding the survey for teacher users of the system, there were 10 respondents. 80% strongly agreed that it was easy to login and access their teacher dashboard, with 10% agreeing and 10% remaining neutral. For QR code scanning functionality, 70% strongly agreed they were able to scan QR codes and identify students quickly, while 20% remained neutral and 10% agreed. In terms of behavior recording process convenience, 70% strongly agreed the process was convenient, with 20% agreeing and 10% neutral. The system provided adequate behavior category options with 70% strongly agreeing, while 20% agreed and 10% neutral. For mobile application interface satisfaction, 80% strongly agreed they were satisfied with the interface, while 20% remained neutral. Additionally, 80% strongly agreed the behavior reports were useful for parent meetings and documentation, with 10% agreeing and 10% neutral. Teachers also indicated 80% strongly agreed they would use the system regularly for behavior tracking, with 10% agreeing and 10% neutral. The system's impact on workflow efficiency received 80% strong agreement. The overall feedback demonstrates high teacher satisfaction with the QR code functionality, mobile interface usability, and workflow integration.

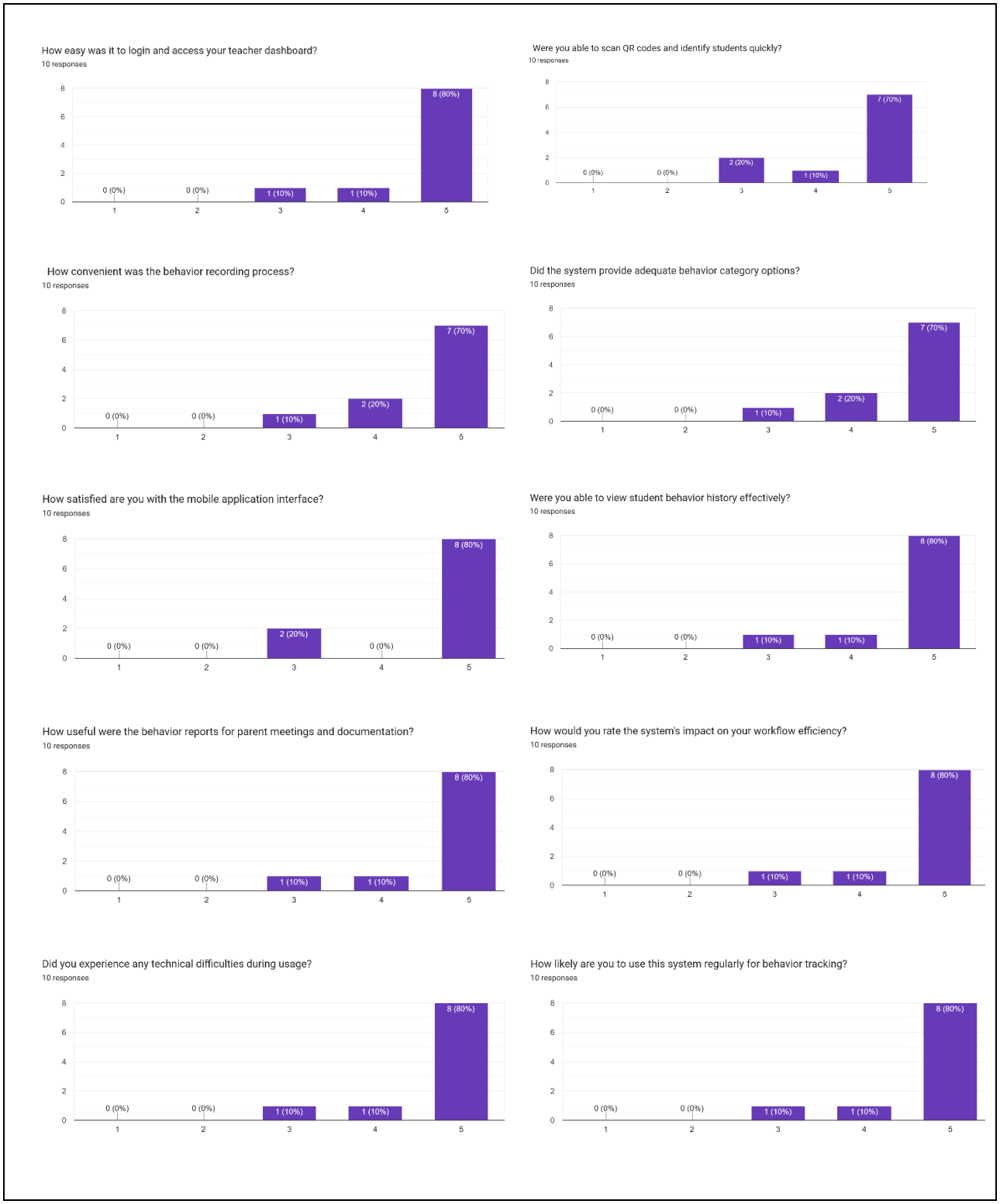

Fig. 15 *User Acceptance Testing Result for Teacher*

4.7.2.3 User Acceptance Testing for Parent

Regarding the survey for parent users of the system, there were 9 respondents. 77.8% strongly agreed that it was easy to access their parent account and view children's information. For behavior report clarity and informativeness, 66.7% strongly agreed that the reports were clear and informative, while 22.2% agreed and 11.1% remained neutral. In terms of real-time notification system satisfaction, 77.8% strongly agreed they were satisfied with the notification features, with 11.1% agreeing and 11.1% neutral. Communication features met

expectations with 66.7% strongly agreeing, while 22.2% agreed and 11.1% neutral. For the mobile application user interface, 66.7% strongly agreed it was user-friendly, while 22.2% agreed. Additionally, 77.8% strongly agreed they would continue using the system for monitoring their child's behavior. The overall feedback demonstrates high parent satisfaction with the system's accessibility, communication capabilities, and user interface design.

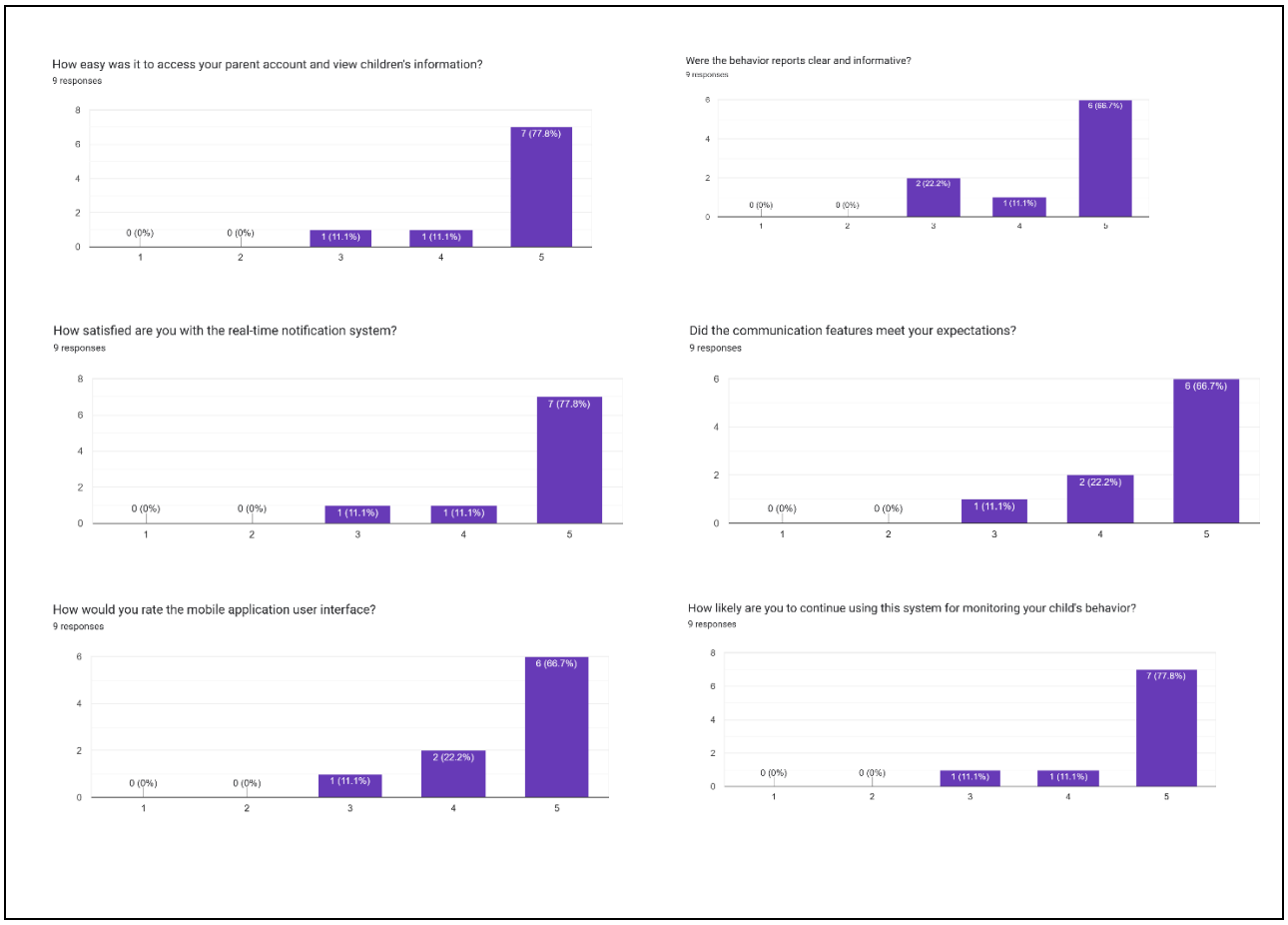

Fig. 16 *User Acceptance Testing Result for Parent*

5. Conclusion

The development of VIRTU Student Behavior Reporting System successfully addresses the critical limitations of existing SSDM implementation by integrating QR code technology for automated student identification, eliminating time-consuming manual data entry processes. Through comprehensive implementation of seven core modules including authentication, teacher management, student registration, parent enrollment, behavior configuration, tracking, and reporting capabilities, the system demonstrates significant improvements in workflow efficiency and data accuracy. Alpha testing confirmed 100% functionality across all modules while the enhanced mobile-first approach with real-time synchronization provides immediate access to behavior data for all stakeholders. The system establishes a scalable foundation for digital transformation in Malaysian secondary education behavior management and serves as an effective upgrade path for existing SSDM implementations across educational institutions.

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 interest 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: Amyza Apiva binti Maijal, Ts. Dr. Mazidah Binti Mat Rejab; data collection: Amyza Apiva binti Maijal, Ts. Dr. Mazidah Binti Mat Rejab; analysis and interpretation of results: Amyza Apiva binti Maijal, Ts. Dr. Mazidah Binti Mat Rejab; draft manuscript preparation: Amyza Apiva binti Maijal, Ts. Dr. Mazidah Binti Mat Rejab. All authors reviewed the results and approved the final version of the manuscript.

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Applied Information Technology and Computer Science Vol. 7 No. 1 (2026) p. 723-741

APPENDIX A : Flowchart