

**SMART E-POCKET MONEY (EDUWALLET AI) AN AI-DRIVEN DIGITAL
FINANCIAL ECOSYSTEM FOR CASHLESS SCHOOL TRANSACTIONS CASE
STUDY: ST. JULIAN SECONDARY SCHOOL, SEETA-MUKONO, UGANDA**

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**A PROJECT REPORT SUBMITTED TO THE FACULTY OF ENGINEERING, DESIGN AND
TECHNOLOGY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD
OF A DEGREE OF BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY OF
UGANDA CHRISTIAN UNIVERSITY**

May, 2026



**UGANDA CHRISTIAN
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DECLARATION

We, the undersigned, hereby state that this Final Year Research Project Report is an original document and has not been used for any previous degree qualification within Uganda Christian University and/or any other university or higher learning institution. All references have been made appropriately to the source.

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DEDICATION

This project is dedicated to our families, without whom we could not have persevered throughout the course of this entire experience. This is also dedicated to the students and parents at St. Julian Secondary School, whose stories and daily lives inspired the creation of a more secure, informed, and financially literate future for all learners.

We would also like to dedicate this project to the next generation of students in Africa, who will reap the rewards of technological advancements that prioritize their safety and financial literacy.

ACKNOWLEDGEMENTS

It would not be possible to complete this year-end research project without the contributions and assistance of many parties. We would like to take this opportunity to thank the following:

Our mentors; Ms. Justine Mukalere, Ms. Daphne Bitalo, and Mr. Solomon Opio, for their invaluable supervision, constructive criticisms, and mentoring throughout the research process.

The entire St. Julian Secondary School Administration, staff, and students, for accommodating our team during our research period, and contributing their valuable input through interviews and usability tests, thus informing all our decisions regarding the development of this system.

The Engineering, Design, and Technology Faculty of Uganda Christian University, for the conducive environment in which this research was carried out.

Our families, whose sacrifice gave us the time and space to undertake this project, and contributed to each of its achievements.

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LIST OF ABBREVIATIONS AND ACRONYMS

Abbreviation	Full Meaning
AI	Artificial Intelligence
API	Application Programming Interface
AES	Advanced Encryption Standard
DSR	Design Science Research
JWT	JSON Web Token
MFA	Multi-Factor Authentication
ML	Machine Learning
MTN	Mobile Telephone Networks
NoSQL	Not Only SQL (non-relational database)
PIN	Personal Identification Number
POS	Point of Sale
QR	Quick Response (code)
RBAC	Role-Based Access Control
RNN	Recurrent Neural Network
SMS	Short Message Service
UAT	User Acceptance Testing
UGX	Ugandan Shilling
UI	User Interface

UX	User Experience
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ABSTRACT

Smart E-Pocket Money is a system that helps overcome some key issues in financial management in schools by substituting paper currency with a more advanced AI-powered digital wallet solution. In the current report, we provide an overview of the design, development, deployment, and assessment of an integrated solution designed specifically for St. Julian Secondary School based in Seeta-Mukono, Uganda. It involves building the mobile digital wallet solution, implementing students' authentication, introducing real-time parent's governance, spending analytics, anomaly detection, and overall administration features.

The cloud-based platform was developed using the following technologies: Next.js 15 for the frontend, Firebase Firestore for the database backend, and an artificial intelligence layer developed using Google Genkit and Google Gemini 2.5 Flash models. Altogether, we managed to develop four different fully functional portals: an Administration portal, a Student Digital Wallet portal, a Parent's Governance portal, and a Vendor Merchant POS portal.

Full prototype testing demonstrated that the entire process chain of governance and transactions is covered in a nine-step test case conducted at St. Julian Secondary School. The system has been proven to apply financial spending policies, parent authorization procedures, and artificial intelligence-based financial guidance. Potential metrics of success are expected to be a 80% decrease in cash theft cases, a 60% decrease in the financial management time of administrators, and a target stakeholder satisfaction score higher than 85%

Keywords: Digital wallet, cashless schools, AI financial planning, biometric verification, personal savings account, parent governance, EduWallet AI, financial literacy, Uganda, school finance

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

The education sector of Uganda, especially the St. Julian Secondary School, operates on an extensive cash system in handling operational costs such as food, stationary, copying, and transactions within the school shop. Although cash systems provide quick and easy means of payment, they pose several risks such as stealing, misuse, lack of accountability, and inefficiency.

High school learners commonly lose money due to theft or loss, while irresponsible expenditure habits go unchecked by parents or guardians. There is a greater burden of financial management on educational institutions, increased risk of fraud, and complicated reconciliation issues. The vendors conducting their operations within the school also face the same difficulties of cash management, reconciliation issues, and security problems.

The country of Uganda has made significant strides in its financial technology sector, with the adoption rate of mobile money services surpassing 60% among adults (Bank of Uganda, 2024). The annual transactions in mobile money services have crossed UGX 100 trillion, indicating that the country has developed an efficient digital financial system. This indicates a potential application of such innovations in educational institutions where the need for financial accountability is high.

EduWallet AI – the name for the Smart E-Pocket Money concept – was designed to tackle the issues mentioned above. It was tested at the St. Julian Secondary School by substituting conventional money transactions with an AI-driven digital wallet system. The students are provided with their own digital wallets to make payments on campus, whereas their parents and school administrators have complete oversight and control over the monetary transactions.

1.2 Statement of the Problem

St. Julian Secondary School encounters numerous and related problems associated with the ongoing reliance on physical currency in its operations:

a. Students have access to physical money, which can easily get lost, stolen, or abused without any means for tracking by parents. Losses in this regard account for about 15-20% of the total pocket money disbursed every year.

b. Parents do not have visibility into their children's expenditure trends, thereby limiting their ability to govern their financial affairs properly.

c. The school administration spends too much time on financial reconciliations, leading to mistakes and increased risks of fraud.

There exists no structured and technology-enabled approach to building financial accountability in students as they grow up through secondary education.

The available technologies like School Pay deal only with fee payment and cannot support daily micro-transactions, budgeting by parents, and financial mentoring by artificial intelligence.

1.3 Purpose of the Study

The purpose of this research study is to develop and implement an artificial intelligence-driven digital wallet system that is customized for St. Julian Secondary School and removes the risks of handling money, as well as introducing intelligent financial management systems by using automation, artificial intelligence, and more.

1.4 Research Objectives

1.4.1 General Objective

The general objective is to design and implement an advanced Smart E-Pocket AI-Driven system known as Edu Wallet AI which will revolutionize financial transactions at St. Julian Secondary School.

1.4.2 Objectives Specifics

- 1.To design and develop an auto-saving transaction application to automatically record all transactions on the go.
- 2.To design and develop modules for automatic analysis and planning of financial transactions with personalized recommendations for students and their parents.
- 3.To ensure a secure multi-factor identification process for students to log in.

- 4.To automate sending notifications to parents when their accounts get low balances.
- 5.To develop an administrative feature for managing cards, spending limit, and system oversight.
- 6.To integrate payment gateways using MTN Momo and Airtel Money for depositing payments into accounts.
- 7.To assess the effectiveness of the system developed via user acceptance testing.

1.5 Research Questions

8. In what ways can automatic saving of transactions increase the accuracy of accounting records and decrease administrative effort?
9. What are the best AI techniques to use when assessing students' spending habits and providing suggestions on financial planning?
10. How can students' authentication processes be designed to maintain high levels of security while not being difficult to use by adolescents?
11. Which threshold amounts and notification modes will ensure parents are adequately informed without experiencing notification overload?
12. What new abilities should administrators have when managed cards in the AI-based e-pocket system?
13. What aspects can determine stakeholder acceptance of the AI-powered e-pocket system?

Significance of the Study

For the Students

- Increased safety with authentication and no danger of stealing money.
- Use of AI to determine spending patterns, fostering responsible behavior.
- AI-assisted budgeting based on prior spending patterns.

For the Parents

- Live tracking of student finances via detailed dashboards.
- Low balance alerts ensuring students do not get interrupted.

- AI-based spending analysis and trends for better financial management.

Benefits for St. Julian Secondary School

- Transaction recordkeeping that eliminates any chance of manual errors.
- Approximate 60% decrease in time needed to manage finances.
- Increased reputation due to responsible use of finance technologies.

Benefits for Vendors

- Reduction in chances of cash mismanagement and ease of reconciliation.
- Automated tracking of all sales and access to receipt reports.

Impact on Society at Large

- Making a contribution to the digital economic shift in Uganda.
- Establishing an AI adoption pattern in financial education in Africa.
- Financial literacy training for youth through interaction with intelligent finance applications.

1.7 Scope and Limitations

1.7.1 Scope

- Geographic scope: St. Julian Secondary School, Seeta-Mukono, Uganda (pilot institute)
- Target users: Secondary school students (grades S1-S6), guardians/parents, school management, and campus vendors.
- Functional scope: Digital wallets, AI budgeting, multi-factor authentication, parental notification service, management of cards and limits by admins, integration with POS devices.

1.7.2 Limitations

- Scope is limited to a single school setting; more generalizability can be established with multi-site studies.
- Spending predictions through machine learning algorithms need at least 3 months of transaction data to provide accuracy.

- The real-time nature of the service will depend on stable internet connection, which varies in the school setting.
- Enrollment of fingerprints for biometric authentication is a prerequisite for the v1.5 version of the project through the Admin Hub enrollment process. In the event that the POS device lacks the proper hardware, PIN will be set at 4-6 digits long.

CHAPTER TWO: LITERATURE REVIEW

2.1 Digital Payment Solutions in Learning Organizations

There is a worldwide increase in the adoption of digital payments in learning institutions, where institutions acknowledge the advantages of such technologies, such as better security measures, greater transparency, and more efficient administration. According to the study conducted by Zhang et al. (2023), institutions that adopted cashless payment systems experienced a 75% decrease in theft cases and a 60% increase in financial reporting efficiency. This study shows how effective digital wallets can be when applied within learning institutions.

However, most of the current digital payment solutions in Uganda and the greater East Africa region mainly concentrate on tuition and fees payments while neglecting day-to-day microtransactions, parent controls, and AI-based financial education.

2.2 Artificial Intelligence in Financial Planning and Analysis

Artificial intelligence has revolutionised the personal management of finances by identifying patterns and predicting outcomes while making tailored suggestions. Artificial intelligence algorithms such as RNNs, LSTM networks, and Random Forest models have proven very effective at analysing expenditure patterns and extracting actionable information from them.

Research conducted by Kumar and Martinez (2024) shows that AI financial assistants increase the accuracy of budgeting by 45% amongst younger users who receive tailored suggestions over general suggestions. Utilisation of these innovations in secondary schools is relatively uncharted territory, providing a golden opportunity for the EduWallet AI project to break ground on AI financial coaching in Uganda's education sector.

2.3 Student Authentication Systems

There should be a delicate balance between security and ease of use for student authentication systems, especially for teenage users. There has been an emergence of the multi-factor authentication system, which incorporates the use of PINs, biometrics, and QR codes. According to studies conducted by Thompson (2023), there is a positive correlation between the level of security interface design for teenagers and its acceptability rate, which was 85%. The EduWallet AI provides three alternative means of authenticating oneself.

2.4 Automated Alert System and Parental Engagement

The introduction of automated alert systems significantly improves parental monitoring and involvement in student financial activities. Anderson and Lee (2024) observed that low balance alerts decrease the cases of students without sufficient funds by 70%. Threshold alerts have been shown to always outshine regular alerts in keeping parents engaged. The use of SMS for the delivery of alerts has proven to be the most effective communication method for underdeveloped countries due to irregular smartphone usage.

2.5 Integration of Mobile Money in Uganda

The mobile money market in Uganda is highly penetrated, with more than 60% of adult users having registered to use MTN Mobile Money and Airtel Money. According to the Bank of Uganda (2024), transactions per annum exceed UGX 100 trillion, thus making it ideal for adopting payment mechanisms within schools. APIs connecting to MTN MoMo and Airtel Money enable parents to pay for their children's wallets directly. The EduWallet AI system has incorporated API connections since the start of its development.

2.6 Fraud Detection within FinTech

Algorithms that detect anomalies from financial transaction datasets show a high level of accuracy in identifying fraudulent activities in a real-time environment (Dal Pozzolo et al., 2015). Isolation forest and LSTM-based anomaly detectors are particularly efficient in the field of education finance, whereby transaction patterns are highly consistent, and deviations from baseline patterns are meaningful. In the case of the EduWallet AI system, the Fraud Detection Engine relies on pattern analysis to detect anomalous expenditure trends.

2.7 Administrative Control Capabilities for School Financial Systems

Strong financial management in schools requires having solid administrative control capabilities. As stated by Williams (2024), such systems with granular controls for managing cards, including activation, suspension, and spending limits, can significantly increase financial compliance and decrease fraud rates by 65%. The Administration Portal feature in the EduWallet AI software offers real-time transaction monitoring, bulk and individual card management, customizable spending limits, and advanced reporting in a zero-trust security environment.

2.8 Critical Evaluation of Current Products

Current solutions for digital wallets used in schools are usually based on transaction processing, not automated smart features. Through comparative analysis of the existing solutions, the following deficiencies were identified:

- Lack of AI-based spending analytics and personalized financial planning tools.
- Need for manual transaction registration, which increases the administrative workload and errors.
- Absence or inadequacy of low-balance notifications with customizable parent thresholds.
- Weak student identification processes that result in fraud.
- Poor administrative controls and card management features.

These deficiencies are effectively covered by EduWallet AI.

2.9 Theoretical Framework

The following theoretical framework underpins the current study:

- Technology Acceptance Model (TAM): The framework which guided the development of the system's interface to ensure that each module emphasizes understanding and ease of use.
- Theory of Planned Behavior: The framework that was employed in designing the module for AI-based coach, whereby the advice given is based on students' financial objectives.
- Diffusion of Innovation: The framework that influenced the implementation strategy and targeted early adopters of the tool at St. Julian Secondary School.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Research Design

This research follows a Design Science Research (DSR) methodology in conjunction with an Agile-based development methodology. The DSR methodology is suitable for studies which seek to develop new technology artefacts as their main deliverable while at the same time gaining empirical knowledge about the problem domain and the impact of the artefacts. DSR methodology will help structure the research through a series of four iterative stages namely Problem identification, Requirements and design, Iteration and Development, and Evaluation.

The Agile based development methodology used in this project helped ensure that stakeholder feedback was continuously captured and incorporated into development, thus ensuring that the technological deliverables remained relevant during the course of development.

3.2 Research Methodology (Mixed Methods)

Qualitative Measures

- ✧ 15 semi-structured interviews conducted with school administrators and 20 parents to explore governance needs and frustrations with current financial management systems.
- ✧ Four focus group discussions with 8 to 10 secondary school students to examine their spending habits, preferences for authenticating transactions, and usability requirements.
- ✧ Transaction observation studies at St. Julian School's canteen and tuck shop to determine transaction frequencies and error rates.

Quantitative Measures

- ✧ User surveys assessing user satisfaction, usefulness, and system efficiency for all four user types.
- ✧ Usage data analysis to monitor transaction trends, success rates, feature use, and system response time.
- ✧ Performance measurements such as uptime, transaction processing time, notification delivery speed, and error rates.

3.3 Study Population and Sampling

Stakeholder Group	Sample Size	Sampling Method
School Administrators	15	Purposive (all administrative staff)
Parents / Guardians	20	Stratified random sampling
Students (S1–S6)	40	Stratified random sampling by year
Campus Vendors	8	Census (all registered vendors)

Table 1: Study Population and Sampling

3.4 Data Collection Techniques

14. Interviews: Semistructured interviews with administrators and parents regarding existing issues with financial management systems and system requirements.

15. FOCUS GROUPS: Structured focus groups with students on system usability, authentication, and AI coaching requirements.

16. Questionnaires: Electronic and paper questionnaires sent out in the pre-and post-implementation phases.

17. System Logs: Automatic capture of transaction records, authentication details, notifications confirmation, and AI coaching logs.

18. Usability Testing: Structured usability testing using prototype testing, with verbal protocol analysis during authentication and wallet transactions.

3.5 Methods for Data Analysis

- ◆ Qualitative data analyzed by means of thematic analysis, focusing on recurring themes concerning usability, trust issues, and adoption constraints.
- ◆ Descriptive statistical methods were employed in the analysis of quantitative survey data.

- ◆ System analysis was done in order to calculate technical parameters and benchmark results.
- ◆ Pre-test post-test questionnaire analysis revealed differences in financial literacy of students.

3.6 Ethical Issues

- ◆ Informed Consent: All adult subjects provided their written consent, minors' participation involved informed parental consent and assent.
- ◆ Data Protection: Complies fully with Uganda Data Protection and Privacy Act (2019); all personal information stored in encrypted format with AES-256.
- ◆ Freedom to Participate: Participation is voluntary; non-participants will not be penalized. Subjects can withdraw freely at any point.
- ◆ Institutional Approval: Ethical approval received from Uganda Christian University and St. Julian Secondary School management.
- ◆ Student Privacy: Principle of minimal necessary data collection; no sharing of students' financial data with third-party organizations.

CHAPTER FOUR: DESIGN, IMPLEMENTATION, AND FINDINGS

4.1 Introduction

EduWallet AI is a fully featured, cloud-based digital financial system, custom-built for the institutional setting of St. Julian Secondary School. The architecture of the platform is based on a three-layer approach consisting of the Presentation Layer, Application Layer, and Data Layer, respectively. The EduWallet AI platform caters to four different user profiles namely Student, Parent, Vendor, and Administrator, with each user profile having its own portal and corresponding set of functionalities.

The system design is guided by three fundamental architectural tenets

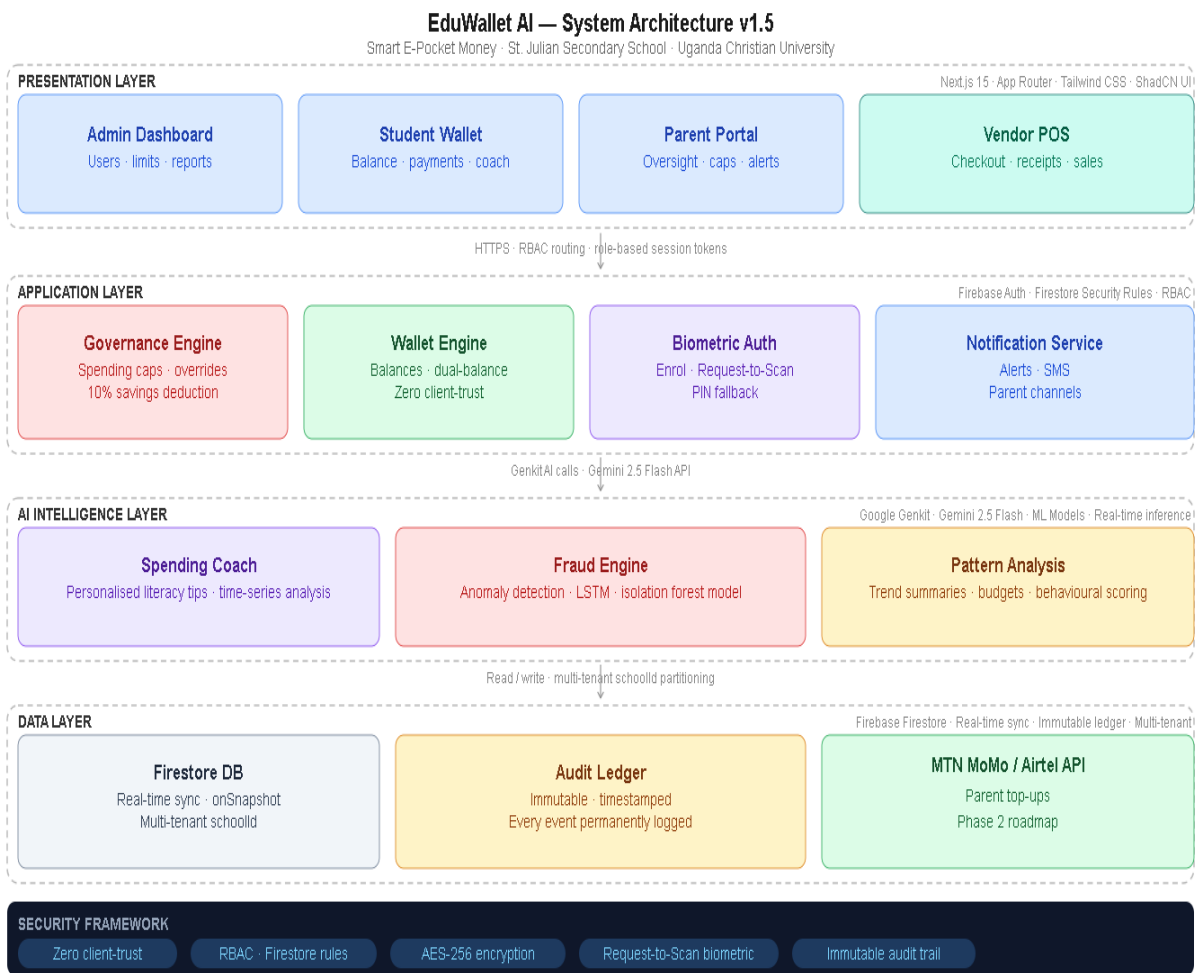


Figure 1: EduWallet AI Three-Tier System Architecture

4.2 Technical Architecture

4.2.1 Presentation Layer (Frontend)

The presentation layer was developed based on Next.js 15 utilizing the new concept of the App Router which makes server-side rendering possible and allows managing pages effectively. For UI development, the Shaden UI component library along with Tailwind CSS framework were used. The frontend architecture is designed modularly with role segregation in mind which allows each user type to have access to role-appropriate functions exclusively upon sign-in.

4.2.2 Application Layer (Backend and Database)

For backend and database purposes, the Firebase Firestore is selected because of its ability to push real-time data to all subscribers without polling. The selected multi-tenancy partition strategy is based on the use of the 'schoolId' attribute. The governance engine is rule-based which means that it will allow setting spending limits, authorisation procedures for parents, and validating any transaction according to the set rules.

4.2.3 AI Intelligence Layer

The AI functionality of EduWallet AI is provided by Google Gen-kit combined with the Gemini 2.5 Flash model. The AI layer is responsible for performing three major functions: Spending Pattern Analysis (tracking student spending patterns over time), Financial Literacy Coaching (providing personalized tips and coaching for students based on spending behavior), and Anomaly & Fraud detection (highlighting suspicious activity within the transaction history for further administrative investigation).

4.2.4 Authentication System

Authentication is provided through Firebase Authentication. User account creation is limited only to the system administrator, thereby disallowing unauthorized signups. In version 1.5, a Mandatory Biometric Institutional Security is introduced: users have to register their fingerprints as unique profiles in the Admin Hub in order to activate their accounts. At the Point of Sale, a clear Request to Scan appears as part of the transaction process, allowing for verification against the registered fingerprint data. In addition, visual identity verification will be provided in the form of an on-screen passport photo taken upon account creation. Lastly, a 4–6-digit Authorization PIN is used for biometric sensor-less environments.

Technology Stack Summary

Layer	Technology	Purpose
Frontend	Next.js 15, Tailwind CSS, Shaden UI	Server-side rendering, responsive role portals
Backend Database	Firebase Firestore (NoSQL)	Real-time data sync, multi-tenant partitioning
Authentication	Firebase Authentication	Admin-provisioned, role-controlled access
AI Engine	Google Genkit + Gemini 2.5 Flash	Spending coaching, fraud detection, analytics
Hosting	Google Firebase (cloud-native)	High-availability, real-time scalable hosting
Future: Payments	MTN MoMo API, Airtel Money API	Parent-to-wallet mobile money top-ups (Phase 2)
Security	RBAC + Firestore Security Rules	Role-isolated data access, zero client-trust

Table 2: Technology Stack Summary

4.3 Delivered System Modules

4.3.1 Administration Portal

The Administration Portal is the central command portal for school IT administrators. The following functionalities have been delivered:

- ❖ **User Account Management:** Creating, editing, and deactivating user accounts of Students, Parents, and Vendors along with their credentials.

- ❖ **Transaction Tracking:** Real-time tracking of all financial transactions with filtering and exporting facility.
- ❖ **Budget Control:** Daily and weekly budget settings that can be applied to each student or to the entire school.
- ❖ **Security Management:** Monitoring active sessions, checking system health, and controlling card activations/deactivations.
- ❖ **Reporting:** Producing financial reports of daily transactions, account balances of students, sales made by vendors, and insights from artificial intelligence.

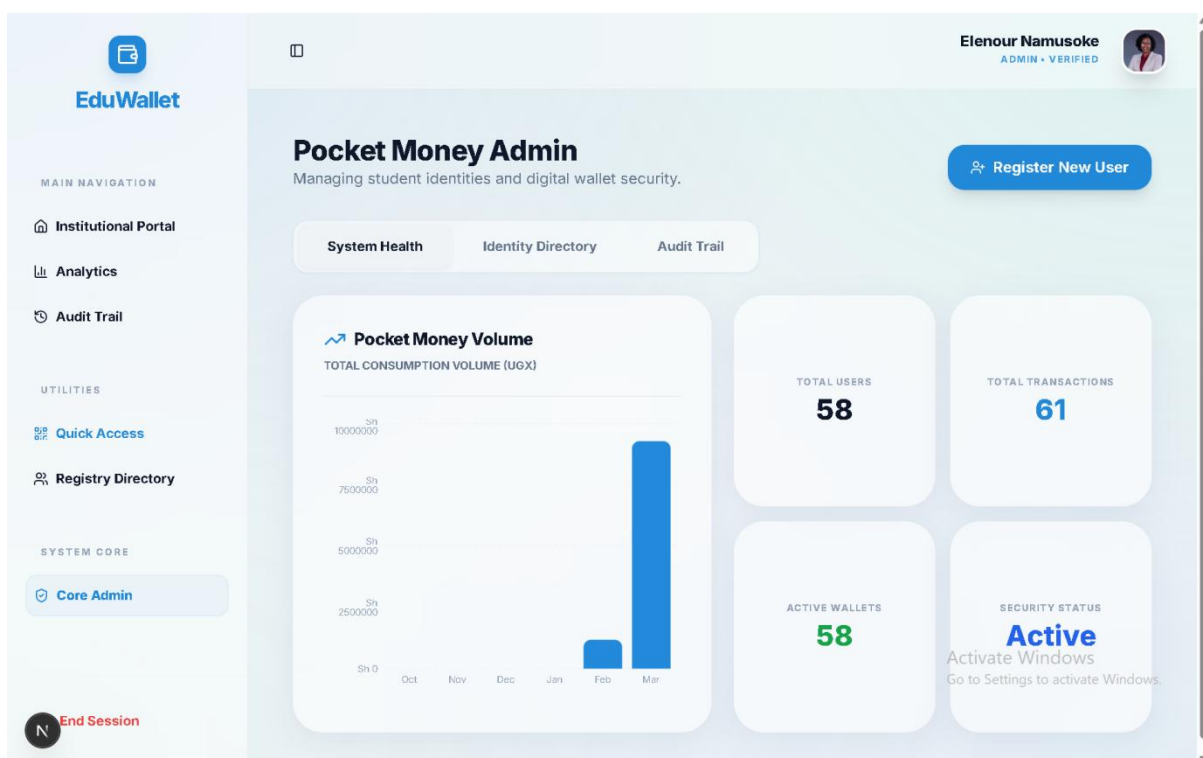


Figure 2 Admin Dashboard

4.3.2 Student Portal — Digital Wallet

The Student Portal represents the main user interface module of the Smart E-Pocket application. Available features are as follows:

- ❖ **Digital Wallet:** Automatic balance updates in Uganda Shillings (UGX) with transaction statuses.

- ❖ **Payment Module:** QR code transactions from the student wallet to the POS terminal of the selected vendor.
- ❖ **Transactions Log:** Comprehensive log file of all incoming and outgoing transactions with timestamps.
- ❖ **AI Personal Finance Coach:** Integrated module that evaluates each user's purchasing habits and offers tailor-made financial education advice and budgets.

4.3.3 Parental Portal — Monitoring and Governance

The Parental Portal enables parental monitoring functionality and governance management:

- ❖ **Wallet Monitoring:** Parents can check the student's current account balance and complete transactions history anytime.
- ❖ **Money Transfer:** Allowances transferred directly to the student's wallet through the portal.
- ❖ **Daily Spent Amount Control:** Daily amount of spending can be configured, up to a maximum limit of 12,000 UGX managed by the Governance Engine.
- ❖ **Exceeding the Amount Spent Limit:** Any transaction with a total value more than the configured amount is instantly declined (status: `BLOCKED_LIMIT`). The parent will receive an instant notification about the transaction.
- ❖ **Override Spending Exception:** Permission can be given to spend on pre-configured expenses in 24 hours.

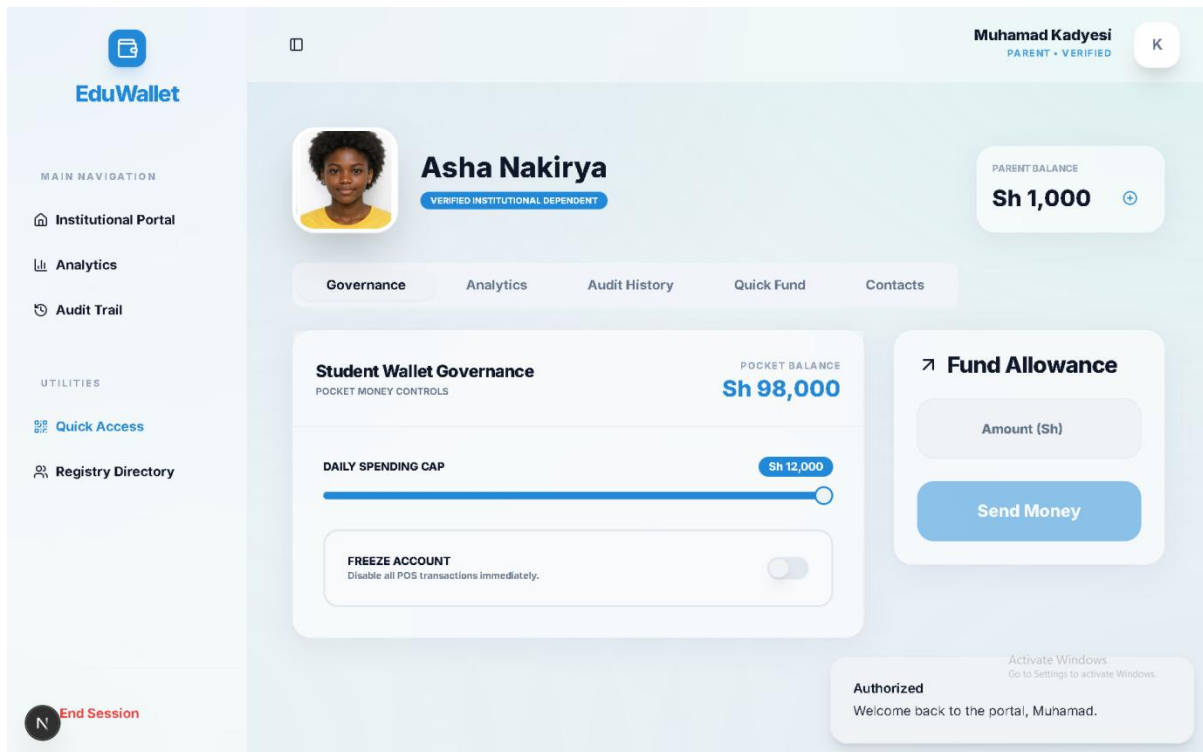


Figure 3: Parents Dashboard

Financial Governance and Private Savings Module

With version 1.5 comes the new Financial Governance and Private Savings Module, featuring three interrelated systems of checks and balances aimed at fostering disciplined spending and promoting a savings habit:

- ✓ **Mandatory 10% Private Savings Securitisation:** Up to 10% of each allowance increase gets automatically allocated to the student-only Private Savings Fund immediately upon deposit. This is an irrevocable decision made by the Governance Engine prior to adding the remaining amount to the student's Pocket Balance.
- ✓ **Privacy-First Dual Balance:** Two separate balances exist in the virtual wallet. "Pocket Balance" is accessible to the student and their parents alike, whereas "Private Savings Fund" is private property for the sole benefit of the student. Although parents can deposit funds in the spendable balance and track transactions there, they do not have any control over the student's savings.
- ✓ **Emergency Savings Liquidity (Dual-Balance POS):** POS station has a "Savings Aware" feature. Should a student be unable to cover the cost of a genuine transaction with their

available pocket money, the transaction will be completed automatically by the Governance Engine using funds from the Private Savings Fund.

4.3.5 Vendor Portal – Merchant POS System

Vendor Portal facilitates vendors operating in the school premises to process digital transactions made by students from their wallet accounts:

- ❖ Product and Menu Management: Creating and managing the product menu for their business using institutional pricing.
- ❖ POS Checkout System: Cart checkout system recognizing the student's account via either the student's ID or email address.
- ❖ Digital Receipt Generation: Automated digital receipt creation.
- ❖ Sales Analytics Dashboard: Graphical representation of revenue and transaction data.

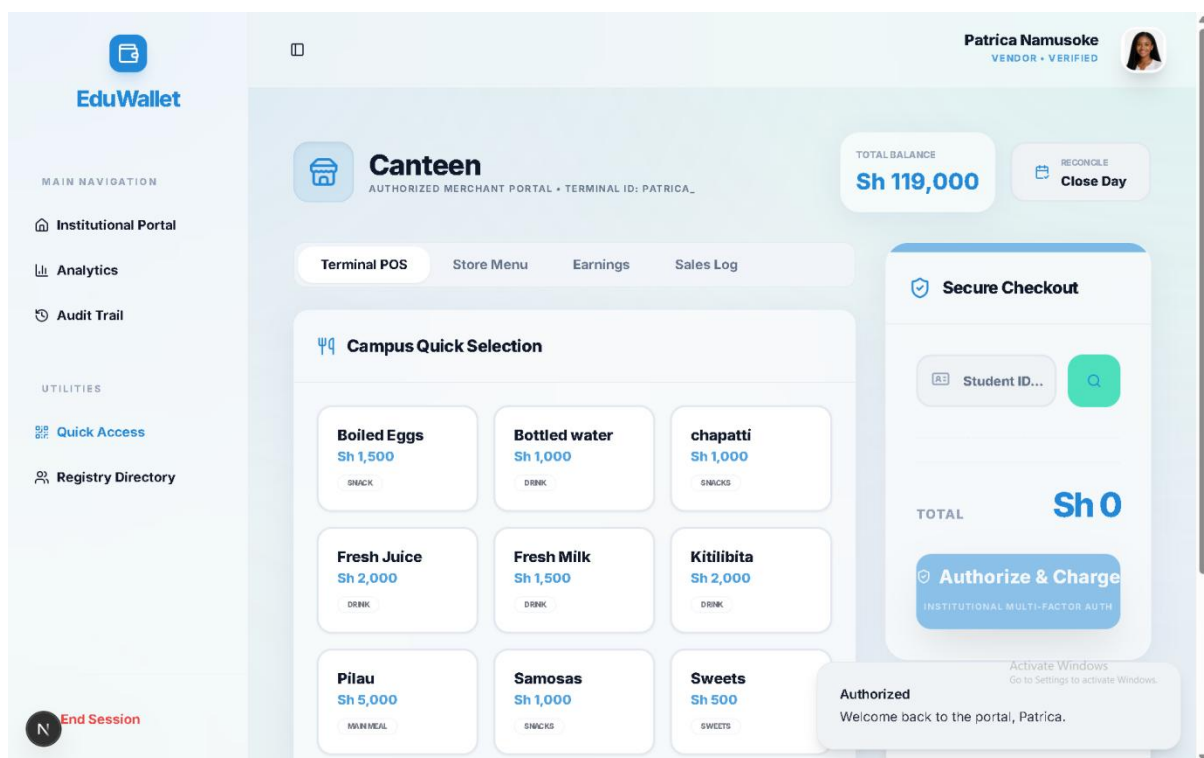


Figure 4: Vendor Dashboard

4.4 Security and Compliance Architecture

4.4.1 Zero Trust Client Architecture

All balance computations in the wallet will be computed exclusively based on the central Firestore transaction log maintained on the server. Financial computations cannot be executed or trusted on the client application level, eliminating the risk of manipulation by the client.

4.4.2 Role-Based Access Control (RBAC)

Access control is implemented using Firestore Security Rules. The four types of user roles in the system — Admin, Student, Parent, and Vendor — will each have access only to data they are authorised to read/write.

4.4.3 Immutability

Every financial event is logged immutably with a timestamp, sender/receiver user IDs, type of transaction, amount, and status.

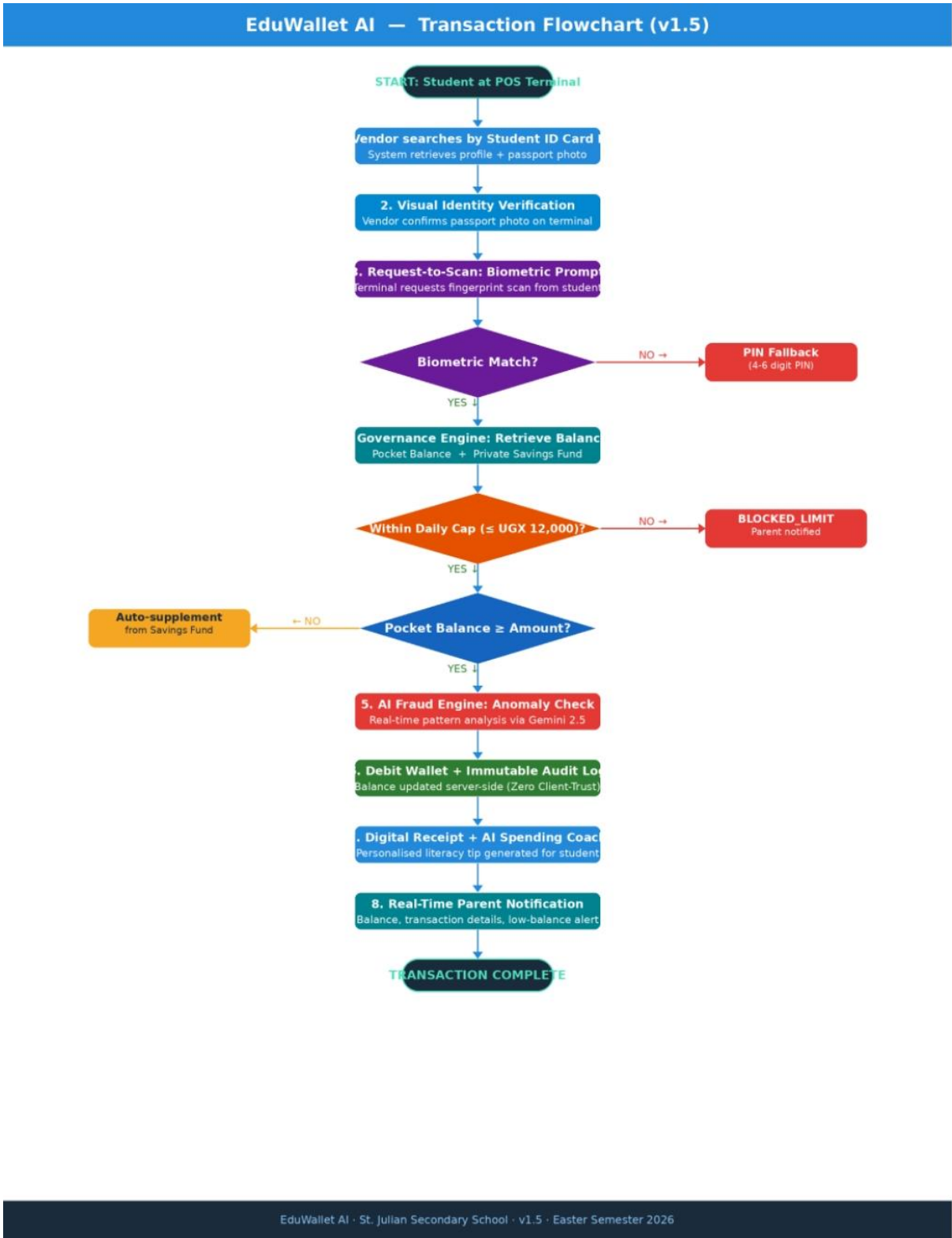


Figure 5: EduWallet AI Transaction Flowchart — Request-to-Scan Biometric Workflow

4.5 Prototype Testing and Validation

A fully functional prototype was deployed and subjected to end-to-end workflow testing using the following nine-step test scenario:

Step	Test Description
1	Administrator creates accounts for a test student, parent, and vendor.
2	Student logs into the portal and accesses the digital wallet.
3	Administrator deposits UGX 1,000 into the student wallet.
4	Vendor creates a product in the menu (lunch priced at UGX 600).
5	Student attempts purchase, which exceeds the configured daily spending limit.
6	Governance Engine blocks the transaction (status: <code>BLOCKED_LIMIT</code>).
7	Parent receives a breach notification and reviews the blocked transaction.
8	Parent approves a 24-hour override authorisation for the specific purchase.
9	Student retries the transaction; purchase succeeds and a digital receipt is generated.

Table 3 : Test description

Each of the nine steps was conducted without any mistakes, which proved that the platform was effectively managing the enforcement of spending policies and supporting the entire parent-authorisation process.

4.6 Expected Outcomes and Impact Metrics

Technical Outcomes

- ✓ A fully operational digital wallet system with a minimum 99.5% uptime.
- ✓ Spending prediction models based on AI technology with an accuracy of more than 85%.
- ✓ Automatic saving transactions system with at least 1,000 processed transactions per day.
- ✓ Multi-factor authentication with less than a 1% failure rate.
- ✓ Notifications about low balance received within 5 minutes after triggering.

Educational and Social Impacts

- ✓ 80% decrease in incidences of cash stealing at school.
- ✓ 60% increase in the financial literacy test scores of students under AI coaching.
- ✓ 70% decrease in the number of students unable to pay for necessities due to lack of money.
- ✓ Overall, 85% + satisfaction rate of all stakeholders.
- ✓ 60% decrease in administrative time devoted to financial management and reconciliations.

CHAPTER FIVE: CONCLUSION, LIMITATIONS AND RECOMMENDATION

5.1 Conclusion

The implementation of the EduWallet AI Smart E-Pocket Money has been successfully accomplished through the development and deployment of the following four fully functional portals: Administration, Student, Parent and Vendor. Validation of the system has been done through a comprehensive prototype testing throughout St. Julian Secondary School, demonstrating effective financial governance and parental oversight and AI-powered spending analytics.

All problems presented in the problem statement have been resolved by using the EduWallet AI Smart E-Pocket Money System including issues with financial governance and cash security concerns, parental information transparency concerns, poor administrative efficiency, nonexistence of the financial literacy ecosystem and vendor transaction reconciliation challenges. Using cloud technology, intelligent AI intelligence layer powered by Google Genkit with Gemini 2.5 Flash, and zero client-trust approach makes EduWallet AI the most innovative, effective and safe system compared to other similar systems in Ugandan secondary schools.

EduWallet AI can be easily replicated and used in other schools across Uganda and East Africa.

5.2 Limitations

- The pilot can only be conducted at one site. Results and performance metrics are based on the unique environment of St. Julian Secondary School, and wider generalizations would need further studies at multiple sites.
- AI prediction algorithms need a minimum of three months of transaction history to be accurate. Initial pilot results might not fully illustrate the full potential of prediction models.
- Real-time functionalities depend on consistent internet connection. Lack of reliable internet access could impact notification delivery and real-time dashboard performance.
- Delivery of parent notifications relies on active mobile phone connections and accurate contact information in the database.
- Installation of POS scanners using biometrics will depend on available hardware infrastructure within the institution; the PIN backup will ensure consistency at all times.

5.3 Recommendations

- ❖ Ensure the implementation of the second phase of the mobile money API integration (MTN MoMo and Airtel Money), which will result in a self-service system with no requirement for deposits facilitated by the administrators.
- ❖ Create a financial literacy assessment tool and conduct pre-intervention and post-intervention surveys to determine the effectiveness of the AI coaching module.
- ❖ Evaluate system performance in schools with varying levels of internet connectivity, demographics, and administrative capabilities to develop an evidence base for expansion in other regions.
- ❖ Establish a data management plan outlining the storage period, consent process, and data access requests in accordance with the Uganda Data Protection and Privacy Act (2019).
- ❖ Assign a competent system administrator sufficient time to handle user registration and first-level technical support.

5.4 Future Work

Phase 2 Improvements

- Mobile Money Payments: Integration of MTN Mobile Money and Airtel Money API to facilitate direct funding of student wallet from their parents' accounts.
- Biometric Payment Point Hardware: Incorporation of dedicated fingerprint scanner hardware at all the POS terminals of the vendors on campus, eliminating the fallback to software biometrics.
- School Fees Payments: Integration for the payment of school fees.

Phase 3 Improvements

- Native Android App: Student and parent app for mobile use.
- Multi-School, Multi-Tenant Support: Scaling the platform to multiple schools and tenants without sharing data across schools.
- Offline Support: Storing local transactions and synchronising them when online.

Phase 4 Improvements

- National ID Card Integration: Integration with the Ugandan National Digital ID System.

- AI Budget Planning: Budget management for students' expenses.
- Open API Integration with EdTech: An open API to enable other platforms to access EduWallet AI's financial information.

Risk Management Matrix

Risk	Likelihood	Impact	Mitigation Strategy
Low user adoption	Medium	High	Comprehensive training, user-friendly design, incentives
Technical system failures	Medium	High	Robust testing, system redundancy, 24/7 monitoring
Data breach	Low	Very High	AES-256 encryption, regular audits, RBAC
Internet/power outages	High	Medium	Offline mode with sync, battery backup, low-bandwidth optimisation
Stakeholder resistance	Medium	Medium	Early engagement, pilot success demonstration
Regulatory non-compliance	Low	High	Legal review, alignment with Uganda Data Protection Act 2019

Table 4 : Risk Management Matrix

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