PERSONAL FINANCE MANAGEMENT AND BUDGET APPLICATION

BY

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A REPORT

SUBMITTED TO

Universiti Tunku Abdul Rahman

in partial fulfillment of the requirements

for the degree of

BACHELOR OF COMPUTER SCIENCE (HONOURS)

Faculty of Information and Communication Technology

(Kampar Campus)

FEBRUARY 2025

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ACKNOWLEDGEMENTS

I would like to sincerely thank my supervisor, Ms Chai Meei Tyng, for guiding me through this project and providing valuable advice and encouragement. Your support has been instrumental in helping me stay focused and motivated.

I am also deeply grateful to my family for their love, understanding, and continuous support throughout my studies. Lastly, I want to thank my friends for their encouragement and for always being there when I needed them. Thank you all for being part of this journey with me.

ABSTRACT

With the growing complexity of modern financial systems, it has become essential for individuals to manage their personal finances wisely to stay informed and in control of their financial activities. While many finance-related mobile apps exist, most lack the comprehensive features needed for complete and flexible money management. This project, titled "Personal Finance Management and Budget Application," addresses this gap by offering a complete and user-friendly mobile platform for personal finance management. The application enables users to manage a variety of financial tasks, including adding income, expenses, and transfers, handling multiple accounts, setting budgets, and categorizing transactions into customizable categories and subcategories for both income and expense types. The app supports full CRUD (Create, Read, Update, Delete) operations for transactions, accounts, categories, subcategories, and budgets. To help users stay within their budgets, the app incorporates a built-in notification system that alerts users when their spending in any category reaches the predefined limit. Financial reports, presented via pie charts, bar charts, and line graphs, provide users with a visual representation of their spending habits and financial progress. Additionally, users can easily back up or transfer their data through JSON file imports and exports. A standout feature of the app is its ability to suggest categories and subcategories based on the transaction note, speeding up data entry. The receipt scanner, which reads transaction details from images of receipts, further enhances efficiency by automatically filling in important information. The app is developed using Flutter for mobile interfaces and SQLite for local data storage, offering a clean and intuitive user experience. With this app, users are empowered with the tools they need to better manage their finances, stay organized, and cultivate positive financial habits.

Area of Study (Minimum 1 and Maximum 2): Mobile Application, User Experience

Keywords (Minimum 5 and Maximum 10): Finance Management, Budget Tracking, Mobile Application, Data Visualization, Receipt Scanning

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LIST OF ABBREVIATIONS

FYP	Final Year Project
OCR	Optical Character Recognition
UI	User Interface
UX	User Experience
ML	Machine Learning
AI	Artificial Intelligence
API	Application Programming Interface
DB	Database
SQL	Structured Query Language
SDK	Software Development Kit
IDE	Integrated Development Environment

Chapter 1

Introduction

In today’s increasingly complex financial environment, managing personal finances effectively is crucial for individuals striving to make better financial decisions and maintain control over their money. Individuals must manage various financial accounts—such as bank accounts, credit cards, loans, and e-wallets—while also keeping track of income from different sources and managing expenses across categories like food, transportation, and utilities. In addition to managing daily finances, many people aim to achieve financial goals such as saving for a major purchase, repaying debts, or building emergency funds.

Given this complexity, it is unsurprising that many individuals rely on mobile applications to assist with personal finance management. Applications such as Monefy [1], 1Money [2], and Spendee [3] offer tools for tracking expenses and setting budgets. However, despite their popularity, these applications present several limitations that restrict their usefulness:

- Monefy simplifies expense tracking but lacks support for managing multiple financial accounts in a single interface.

- 1Money includes budgeting features but offers limited customization in organizing expense categories and subcategories.

- Spendee provides robust visual tracking tools but lacks features to streamline handling common user needs.

As a result of these limitations, users are often forced to use multiple apps or rely on manual workarounds to manage their finances effectively. This can be time-consuming, error-prone, and discouraging for users trying to maintain financial discipline.

To address these challenges, this project proposes the development of a comprehensive mobile application, the Personal Finance Management and Budget Application. The goal is to consolidate key financial management features into a single, user-friendly platform. The core features of the application include:

1. Managing Multiple Financial Accounts: Users can track various account types (e.g., cash, debit cards, credit cards, loans, e-wallets) from one dashboard.

2. Tracking Income and Expenses: The app allows users to log income and expenses using customizable categories and subcategories for better financial visibility.

3. Setting Budgets with Notifications: Users can assign budgets to different categories, and the app will send notifications when spending approaches or exceeds the set limits.

4. Exporting and Backing Up Data: Financial records can be exported or backed up for security, portability, and long-term accessibility.

The app is developed using Flutter [4] to ensure cross-platform compatibility on both Android and iOS devices, and SQLite [5] is used for local data storage, allowing users to access their information even without an internet connection.

This project aims to provide users with a powerful yet intuitive financial management tool that improves daily money management and encourages better financial decision-making. With its comprehensive features and user-centric design, the proposed application aspires to enhance how individuals interact with and control their personal finances.

1.1 Problem Statement and Motivation

In the modern fast-paced and financially intricate world, effective personal finance management has emerged as a critical necessity. The growing diversity of income sources and spending channels has made financial tracking more challenging than ever. Individuals are no longer limited to just cash or a single bank account; instead, they now juggle multiple financial instruments, such as cash, debit cards, credit cards, savings accounts, loans, and digital payment platforms like e-wallets. Additionally, modern lifestyles often include variable income from freelance work, side businesses, or government aid, which adds to the complexity of financial management.

In this evolving landscape, it is crucial for users not only to track daily transactions but also to gain a clear overview of their financial health. This includes understanding spending habits, monitoring cash flow, avoiding overspending, and planning for both short-term and long-term goals. However, despite the availability of numerous mobile apps designed to assist with personal finance, most fall short in delivering a holistic and user-friendly solution. Therefore, there is a growing demand for a comprehensive, centralized tool that simplifies personal finance management while offering meaningful insights and control over one’s financial activities.

Problem Statement for the Project

1. Lack of Integration and Tracking

Many existing finance apps do not support managing multiple account types within a single platform. For instance, applications like Monefy and Spendee do not allow users to manage different financial accounts under one system [1], [3]. As a result, users are forced to monitor their finances across different platforms or rely on manual tracking, increasing complexity and the risk of error.

2. Limited Expense Tracking

Most apps offer only basic expense tracking features and lack detailed categorization. Apps like Monefy, 1Money, and Spendee do not allow users to create subcategories under broader expense types [1], [2], [3]. For example, a general "Food" category cannot be broken down into "Breakfast," "Lunch," and "Dinner." Without this level of granularity, users struggle to fully understand their spending patterns or pinpoint areas for potential savings.

3. Insufficient Reporting and Visualization

Another limitation of many finance apps is their lack of detailed financial reporting. For example, apps like Monefy do not support visualizing total cash flow or tracking income and expenses separately by account or category [1]. Without clear visual insights, users may find it difficult to analyze their financial data over time or detect spending trends.

To address this, the proposed application includes features such as pie charts, bar charts, and line graphs to help users clearly visualize where their money is going and how their spending habits evolve over time.

4. Weak Budget Notifications

While some apps support basic budgeting, they often fail to actively notify users about their spending status. The proposed application improves on this by providing on-screen alerts and push notifications when a user is close to or has exceeded their set budget in any expense category. These timely alerts help users stay on track with their financial plans and prevent unintentional overspending.

Motivation for the Project

This project is motivated by the growing need for a better tool to manage personal finances, especially considering the limitations found in many current finance apps. The main driving factors include:

1. Increasing Financial Complexity

With the rise of e-wallets, digital banks, and multiple account types, users need a tool that can consolidate and manage all financial information in one place.

2. Gap in Existing Apps

As highlighted above, popular apps like Monefy, 1Money, and Spendee do not offer a complete set of features to support comprehensive money management [1], [2], [3]. There is a clear gap for a well-rounded app that offers better categorization, flexible tracking, useful visualizations, and budget alerts.

3. User Expectations for Better Features

Users today demand more than basic income and expense logs. They expect apps to help them analyze, visualize, and take action on their financial behavior.

4. Improving User Experience

Many apps either oversimplify or overwhelm users with complex UIs. This application is designed to strike a balance—providing a clean, intuitive interface while offering robust features for financial tracking.

5. Promoting Financial Awareness

By combining detailed tracking, categorized expenses, clear reports, and real-time alerts, the app helps users develop better financial habits and gain a clearer understanding of how they spend their money.

1.2 Objectives

The primary goal of this project is to develop a comprehensive and user-friendly personal finance management application that enables users to efficiently track and manage their finances. The proposed application aims to provide an all-in-one solution for managing various financial aspects, such as income, expenses, budgets, and account balances. The specific objectives of this project are as follows:

1. Develop Comprehensive Account Management Features

The application will allow users to manage multiple financial accounts, including cash, debit cards, credit cards, loans, and e-wallets. CRUD (Create, Read, Update, Delete) operations will be implemented for each account type, enabling users to efficiently maintain and track their financial data. By centralizing account management in one application, users will gain a clear overview of their financial status, making it easier to control and optimize their finances.

2. Enhance Financial Tracking and Reporting

The application will support detailed tracking of income and expenses, organizing them into user-defined categories and subcategories. This functionality will provide users with insights into their spending patterns and allow for better financial planning. Visual tools such as pie charts and line graphs will be integrated to represent income and expenses, offering users a clear and intuitive way to understand their financial trends over time.

3. Implement Budget Management and Notifications

Users will be able to set budgets for each expense category, enabling them to allocate a specific amount of money for different spending areas. The application will notify users when their spending approaches or exceeds the budget limits set, helping them stay on track with their financial goals and avoid overspending. This feature aims to promote financial discipline and enhance users’ budgeting capabilities.

4. Provide Advanced Financial Tracking

The app will enable users to track and analyze their income and expenses in detail, offering granular insights into their financial habits. Customizable subcategories under major expense categories will allow users to break down their spending into more specific terms, facilitating a deeper understanding of their financial behavior. Additionally, advanced filtering options will be provided to sort and analyze financial data by category, date, or account, ensuring users can access relevant information easily.

5. Improve User Experience and Functionality

A strong emphasis will be placed on ensuring the application is easy to use, with an intuitive interface that simplifies financial management. The app will feature smooth navigation and provide users with a well-organized and consistent experience, even as they manage complex financial data. User feedback will be incorporated to refine the app's functionality, ensuring that it remains user-centric and effective.

6. Provide Local Data Storage with Data Export and Backup Options

All user data will be stored locally on the device using SQLite [5], ensuring that financial data remains available even without an internet connection. Additionally, users will have the option to export their financial data for backup purposes or further analysis. This functionality will allow users to keep their data secure and ensure they can transfer or restore it when necessary.

By achieving these objectives, the project will deliver a feature-rich and reliable personal finance management application that meets users' needs for tracking and managing their finances effectively. The application will empower users to make informed financial decisions, improve their financial health, and achieve their financial goals with confidence.

1.3 Project Scope and Direction

The scope of this project is to design, develop, and implement a comprehensive personal finance management application that will cater to the essential needs of users in managing their personal finances. The primary focus will be on providing tools to manage financial accounts, track income and expenses, setting budgets, and ensure that the application remains simple yet effective for everyday use.

Scope of the Project

The key functionalities to be developed within the scope of this project include:

1. Account Management

The application allows users to create, view, edit, and delete multiple types of financial accounts, such as cash, debit cards, credit cards, loans, and e-wallets. These account types enable users to manage their various financial sources in a single app. Each account tracks its balance, transactions, and associated details like transaction dates, notes, and amounts. The app provides users with a comprehensive view of all their financial assets and liabilities, offering a centralized location for all their account activities.

2. Income and Expense Tracking

Income and expenses are central to the app's functionality. Users can log transactions across various accounts and categorize them under broader expense categories like Food, Transport, Apparel, etc. The app goes beyond these main categories by allowing users to create custom subcategories under each major category. For example, under the Food category, users can set subcategories like Breakfast, Lunch, and Dinner, offering more detailed insights into exactly where their money is being spent. This granularity enhances financial analysis, enabling users to track expenditures more accurately, recognize spending patterns, and make more informed decisions about managing their money. [6]

3. Budgeting and Expense Alerts

The budgeting feature allows users to set specific spending limits for different expense categories, such as Food or Transport, based on their personal financial goals. The app monitors user spending and notifies them when they approach or exceed their set budget for each category. This real-time feedback enables users to take corrective actions promptly, such as reducing discretionary spending in specific categories or adjusting their budgets. The ability to define both categories and subcategories within budgets offers more control and flexibility compared to traditional, broad budget settings.

4. Data Visualization

The app provides various data visualization tools, including pie charts, line charts, and bar graphs, to represent financial activities. Pie charts visually break down income and expenses, giving users a clear understanding of how their money is allocated across different categories and subcategories. Line charts track financial trends over time, such as comparing monthly income against expenses, helping users see whether they are sticking to their financial goals. These visual aids transform raw financial data into meaningful insights, enabling users to filter data based on accounts, categories, and subcategories for personalized financial analysis.

5. Data Export and Backup

The application enables users to export their financial data in the form of JSON files, which can be stored for backup purposes or transferred to another device. This ensures users have a secure and accessible backup of their data. By enabling data export, the app allows users to migrate their financial data to other platforms if needed, offering convenience and flexibility. Additionally, the ability to restore or import data on another device ensures continuity and prevents data loss in case of device failure.

6. Receipt Scanning and Categorization

A unique feature of this application is the ability to scan receipts directly through the app. Users can take a photo of their receipt, and the app will extract relevant details such as amount, date, and description of the purchase. The system will then automatically suggest an appropriate category and subcategory based on the receipt's contents. For example, a receipt for a meal at a restaurant will be categorized under the Food category and assigned to the Dinner subcategory. By minimizing the need for manual input, this feature enhances efficiency and ensures more accurate transaction classification. The automatic categorization ensures consistency across all financial data entries, helping users maintain organized financial records effortlessly.

1.4 Contributions

This project delivers several key contributions to the field of personal finance management by integrating diverse functionalities into a single, user-friendly mobile application:

1. Unified Account Management

Unlike many existing tools that support only one or two account types, this application consolidates multiple financial accounts—such as cash, debit cards, credit cards, loans, and e-wallets—into one interface. This feature ensures that users have a comprehensive view of their entire financial situation in one place, eliminating the need to switch between multiple apps or manually track each account separately. By enabling full CRUD (Create, Read, Update, Delete) operations for each account type, users can manage their accounts seamlessly, make adjustments as needed, and track their financial data in a single location. This integration streamlines financial tracking and reduces the complexity often associated with managing multiple account types.

2. Granular Expense Classification

A major enhancement over basic finance apps is the ability to create customizable subcategories under each main expense category. This feature allows users to classify their spending with much greater detail. For instance, under the broad "Food" category, users can create subcategories such as "Breakfast," "Lunch," and "Dinner" to gain clearer insights into where their money is being spent. This level of customization not only helps users better understand their spending habits but also enables them to track specific areas of overspending. By offering this flexibility, the application empowers users to make more informed financial decisions and adjust their budgets based on detailed data.

3. Budgeting with Real-Time Alerts

The application introduces a flexible budgeting system that allows users to set monthly or weekly spending limits for different categories, ensuring they remain financially disciplined. Users receive real-time alerts, both on-screen and via push notifications, when they approach or exceed their budgeted limit. This proactive approach helps prevent overspending, a common issue in many financial apps. By receiving instant feedback on their spending, users can make timely adjustments to their expenses, promoting better financial management and long-term savings.

4. Comprehensive Data Visualization

The application provides powerful visualization tools, including pie charts, bar charts, and line graphs, to help users understand their financial data more clearly. These visual aids allow users to analyze their income and expenses over different timeframes, such as monthly or annually. The ability to compare financial trends through line graphs, for example, enables users to monitor their spending habits and identify areas where they may be overspending or saving too little. Interactive filters further allow users to drill down into their financial data by account, category, or date, offering personalized analysis. This data-driven approach makes financial management more transparent and empowers users to make informed decisions.

5. Receipt Scanning and Automatic Categorization

To simplify expense tracking, the app includes a receipt-scanning feature that automatically captures transaction details such as amount, and merchant from photos of receipts. Automating this process cuts down on manual input, helping users save time and reducing the likelihood of mistakes. Additionally, the application uses keyword-based suggestions to automatically categorize expenses based on the receipt's content. This functionality is especially useful for users who frequently make purchases in various categories, ensuring that transactions are accurately classified without requiring manual input.

6. Offline Data Storage with Export/Import

For users who may not always have access to the internet, the app stores financial data locally using SQLite, allowing users to access and manage their information even when offline. This feature is particularly beneficial for users with limited internet connectivity or those who need to track their finances on the go. Furthermore, the app supports data export and import functionality through JSON files, enabling users to back up their financial data, transfer it to another device, or migrate it to another platform. This feature ensures users have full control over their data and can access it whenever needed, without risk of data loss.

7. Improved User Experience and Interface

The application prioritizes user experience, offering an intuitive, engaging, and seamless interface. Unlike many financial apps that suffer from cluttered layouts and overwhelming navigation, this application addresses common usability issues by providing a clean, simple, and accessible design. The layout is easy to navigate, and the fonts are large enough for comfortable reading, even on smaller devices. The goal is to enhance user engagement by creating a visually appealing, straightforward interface that simplifies financial management. By reducing friction in the user interface, the app helps users stay focused on their financial goals without being distracted by confusing or overly complex elements.

These contributions combine to deliver a robust, feature-rich application that simplifies personal finance management. With its intuitive design, flexible features, and detailed tracking capabilities, the app empowers users to take full control of their financial health while offering practical tools for budgeting, tracking, and planning.

1.5 Report Organization

This report is organized into seven chapters to comprehensively present the development, implementation, and evaluation of the Personal Finance Management and Budget Application.

Chapter 1 – Introduction:

This chapter introduces the project by outlining the background, motivation, and rationale behind the development of the application. It highlights the problems identified in existing financial apps and explains the need for an all-in-one solution. The chapter also defines the research objectives, scope, and direction of the project, emphasizes key contributions, and provides an overview of the structure of the report.

Chapter 2 – Literature Review:

This chapter reviews existing mobile applications and relevant studies in the field of personal finance management. It analyzes the strengths and limitations of popular apps such as Monefy, 1Money, and Spendee. Through comparative analysis, it identifies gaps in functionality, customization, and usability, which inform the design choices made in the proposed system.

Chapter 3 – System Methodology/Approach:

This chapter outlines the development methodology and system modeling techniques used in the project. It includes visual representations such as system architecture, use case, and activity diagrams, which describe the functional flow and interactions within the application. The chapter also details the step-by-step approach taken to transform user requirements into a working system.

Chapter 4 – System Design:

This chapter presents the technical blueprint of the application. It includes system block diagrams, detailed specifications for each software component, and descriptions of the design of interfaces and data structures. It also covers how the different components interact to achieve the core functionalities, including account management, transaction tracking, and budget control.

Chapter 5 – System Implementation:
This chapter discusses the practical implementation of the system. It covers the development environment setup, software tools, and technologies used, along with configuration procedures and key implementation strategies. The chapter features user interface screenshots to illustrate the construction of each functionality and includes a discussion of the challenges encountered during development and the solutions implemented.

Chapter 6 – System Evaluation and Discussion:
This chapter evaluates the performance and reliability of the application. It details the testing methods employed, presents test cases and results, and discusses how effectively the system meets its objectives. The chapter also reflects on the development experience, identifies key technical challenges, and assesses how well the implemented features align with user needs.

Chapter 7 – Conclusion and Recommendations:
The final chapter summarizes the outcomes of the project, including the achievements and lessons learned throughout the development process. It offers recommendations for future improvements, such as feature expansions or the integration of advanced financial analytics, to further enhance the value of the application.

In addition to the chapters, the report includes supplementary sections such as References, Appendix, and Poster. The References section provides bibliographic support, the Appendix includes additional materials like diagrams or source code, and the Poster offers a visual summary of the project.

Chapter 2

Literature Review

2.1 Overview of Reviewed Applications

Several popular personal finance applications were reviewed to understand the current landscape of mobile budgeting tools and identify existing gaps. The selected apps—Monefy, 1Money, and Spendee—are known for their popularity and usability. Each provides core financial tracking functionality, but they also exhibit limitations that restrict detailed financial analysis and customization. The sections below discuss each application in terms of its features, strengths, and limitations.

2.1.1 Monefy Overview

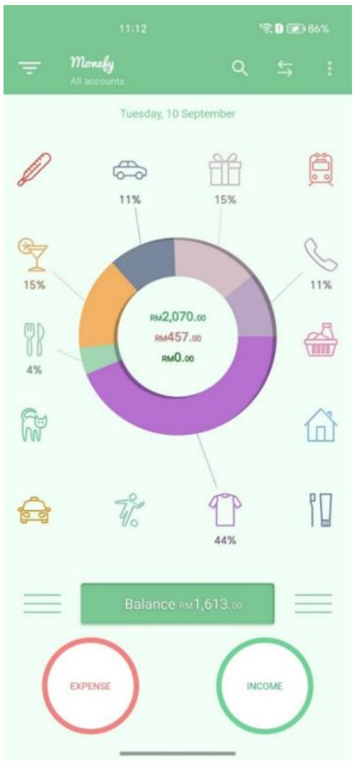


Figure 2.1.1 Monefy Homepage – 1

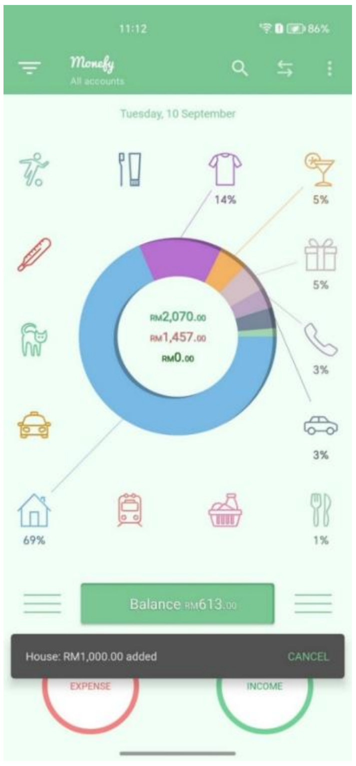


Figure 2.1.2 Monefy Homepage – 2

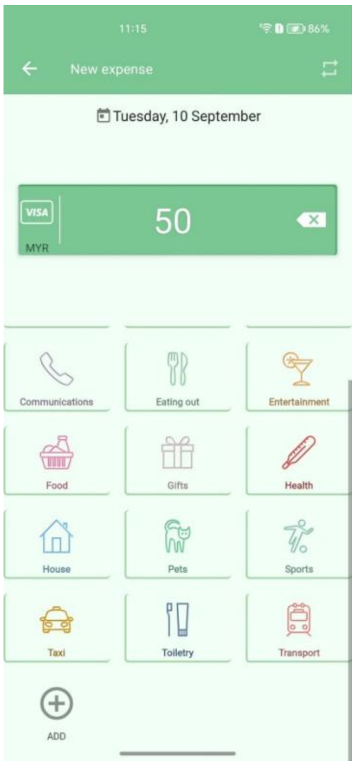
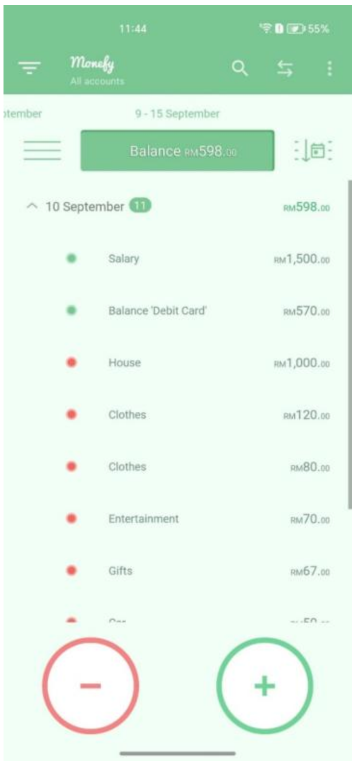


Figure 2.1.3 Monefy Add Transaction



10 September 11 RM598.00

Salary	RM1,500.00
Balance 'Debit Card'	RM570.00
House	RM1,000.00
Clothes	RM120.00
Clothes	RM80.00
Entertainment	RM70.00
Gifts	RM67.00

Figure 2.1.4 Monefy View Transaction

Monefy is a popular mobile application for expense tracking that emphasizes ease of use and speed of data entry. It allows users to log income and expenses using a simple and colorful interface. One of Monefy’s main strengths is its visual and intuitive design, where users can quickly understand their financial standing through pie charts and other visual summaries. It also supports different currencies and allows simple category-based tracking.

However, despite its user-friendly interface, Monefy has several notable limitations when it comes to detailed financial management. The application does not support the tracking of multiple account types separately. All transactions are pooled into a single account view, which restricts users from managing funds across different financial sources such as e-wallets, debit cards, and loans. Furthermore, Monefy lacks the flexibility to customize or create subcategories under major expense categories. This limits the user's ability to track specific patterns of spending. For example, while a user may be able to track food-related expenses, they cannot further classify them into “Breakfast,” “Lunch,” and “Dinner” for deeper insight.

Another limitation is the absence of advanced budgeting and financial analysis tools. Monefy offers only basic monthly budgeting, and it lacks features like spending alerts, automated recurring transactions, or goal setting. It also provides limited options for exporting or backing up data securely.

In contrast, the proposed application in this project addresses several of these shortcomings. It supports multiple account types with independent tracking, allows users to define subcategories for greater precision, and includes budget notifications to help users stay within their financial limits. The goal is to provide a more comprehensive and flexible solution for personal finance management, building upon the strengths of apps like Monefy while filling in the gaps they leave behind.

2.1.2 1Money Overview

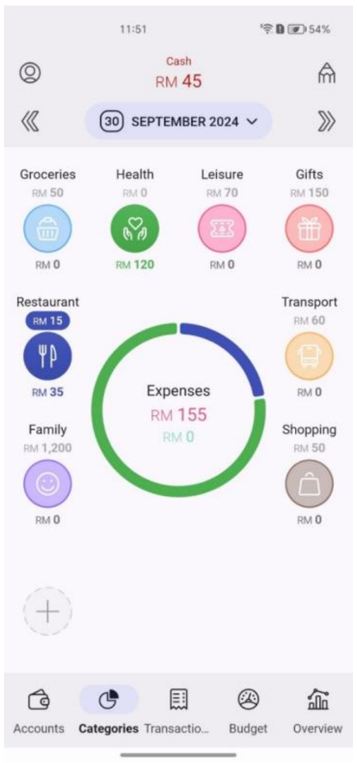


Figure 2.1.5 1Money Category Page

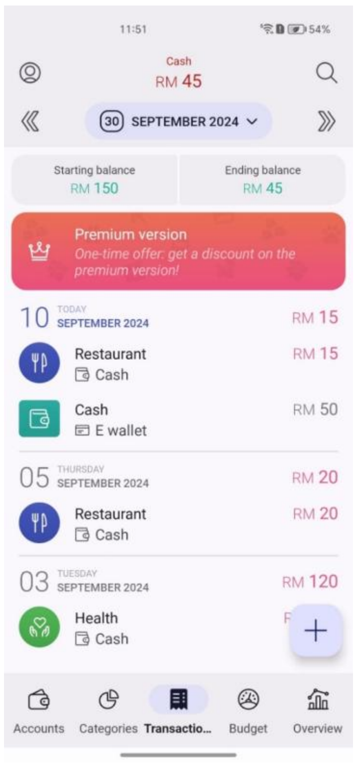


Figure 2.1.6 1Money Transaction Page

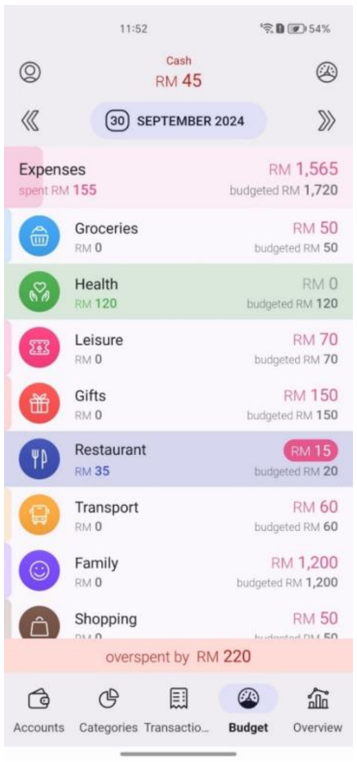

Cash
RM 45
30 SEPTEMBER 2024
Expenses spent RM 155 RM 1,565 budgeted RM 1,720
Groceries RM 0 RM 50 budgeted RM 50
Health RM 120 RM 0 budgeted RM 120
Leisure RM 0 RM 70 budgeted RM 70
Gifts RM 0 RM 150 budgeted RM 150
Restaurant RM 35 RM 15 budgeted RM 20
Transport RM 0 RM 60 budgeted RM 60
Family RM 0 RM 1,200 budgeted RM 1,200
Shopping RM 50
overspent by RM 220
Accounts
Categories
Transactio...
Budget
Overview

Figure 2.1.7 1Money Budget Page

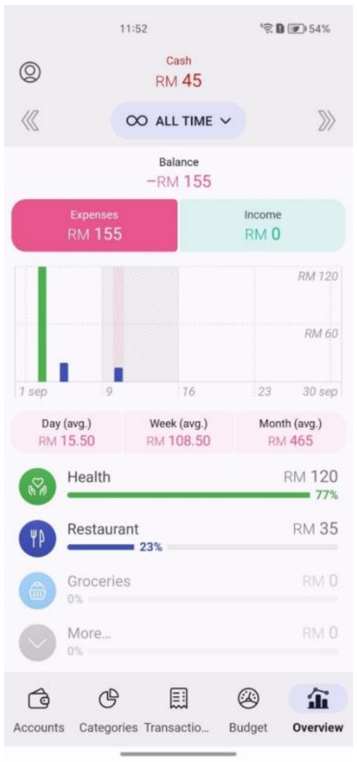


Figure 2.1.8 1Money Overview Page

1Money is a popular mobile application designed to assist users in managing their personal finances. It offers core features such as expense and income tracking, and supports multiple account types including cash, debit cards, and bank accounts. These features help users maintain an organized overview of their financial status.

The interface of 1Money is clean and user-friendly, allowing quick entry of transactions and providing summary views with pie charts for visual representation. It also allows users to set monthly budgets for various expense categories, helping them monitor and control their spending habits.

However, 1Money has several limitations that impact the level of detail and customization available to users. Most notably, it does not support the creation of subcategories within main categories, which restricts users from tracking expenses at a more granular level. For example, within the “Transportation” category, users cannot separately view expenses for fuel, public transport, or parking.

Another key limitation is that many of 1Money’s more advanced features—such as multiple account support, visualizations, and budget tracking—require users to purchase the premium version of the app. This paywall can be a barrier for users who seek a full-featured finance management tool without incurring additional costs.

In contrast, the application developed in this project addresses these issues by offering subcategory support for detailed classification, account-level tracking, budget notifications, and visual reports—all without requiring any premium purchase. This makes it a more accessible and flexible alternative for users who need comprehensive personal finance management features.

2.1.3 Spendee Overview

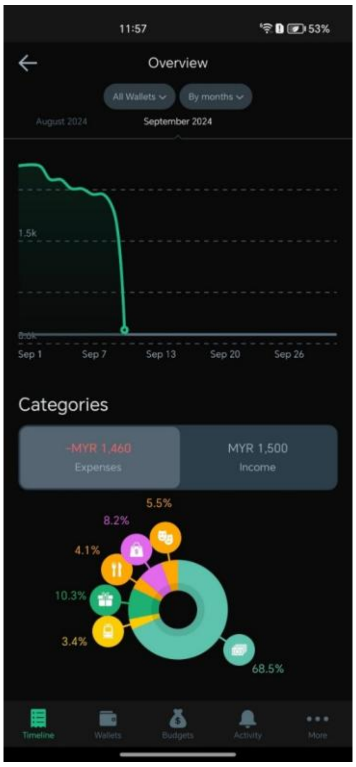
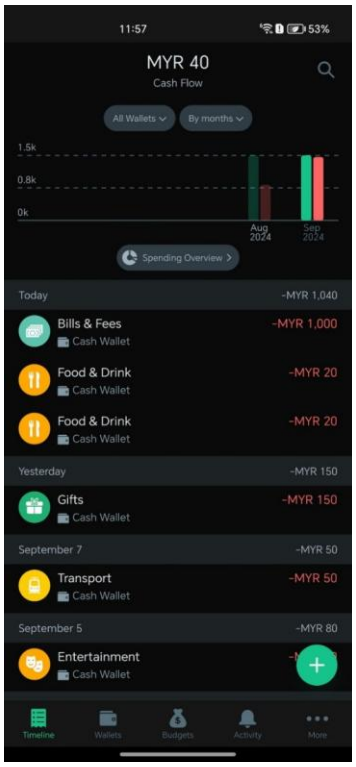
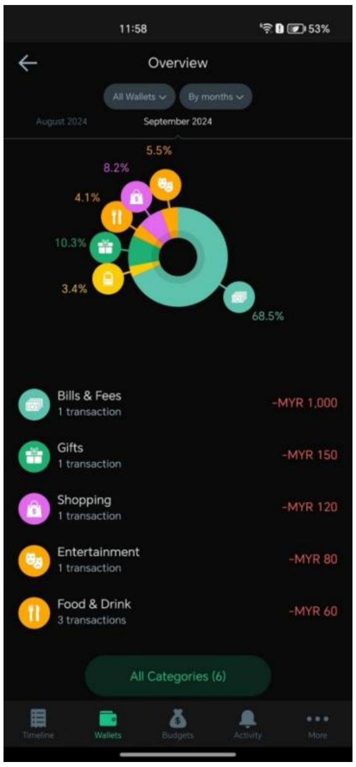


Figure 2.1.9 Spendee Spending Overview



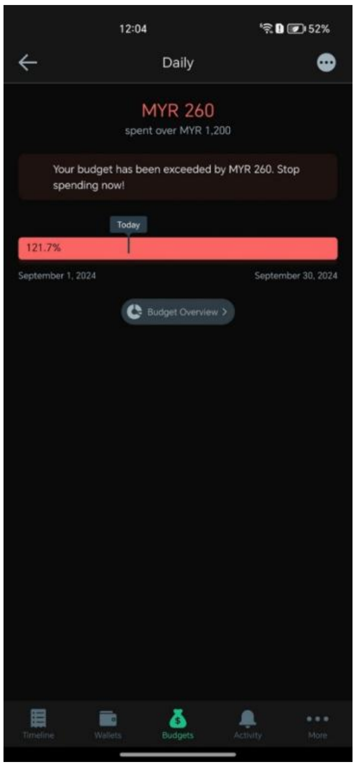
Today	-MYR 1,040
Bills & Fees Cash Wallet	-MYR 1,000
Food & Drink Cash Wallet	-MYR 20
Food & Drink Cash Wallet	-MYR 20
Yesterday	-MYR 150
Gifts Cash Wallet	-MYR 150
September 7	-MYR 50
Transport Cash Wallet	-MYR 50
September 5	-MYR 80
Entertainment Cash Wallet	

Figure 2.1.10 Spendee Timeline



Bills & Fees 1 transaction	-MYR 1,000
Gifts 1 transaction	-MYR 150
Shopping 1 transaction	-MYR 120
Entertainment 1 transaction	-MYR 80
Food & Drink 3 transactions	-MYR 60

Figure 2.1.11 Spendee Wallet



MYR 260
spent over MYR 1,200

Your budget has been exceeded by MYR 260. Stop spending now!

Figure 2.1.12 Spendee Budget Overview

Spendee is a well-known personal finance app that provides users with tools to manage their income and expenses. It allows tracking across various financial accounts, offering an organized dashboard for visualizing financial activity. The app is popular for its appealing design and ease of use, especially for quick transaction entry and budget tracking.

One of Spendee’s strengths lies in its use of visual elements such as colorful pie charts and graphs to represent spending distributions. Users can categorize their expenses, set budgets, and view how their spending aligns with those limits. However, the app offers limited flexibility in category customization, as it does not support the creation of detailed subcategories within each main category. This restricts users who wish to track expenses with more precision. [6]

Furthermore, while Spendee includes features for tracking multiple accounts and setting budgets, many of these capabilities—along with additional visualizations and analytics—are locked behind a premium subscription. Users who do not upgrade may find themselves restricted in terms of how much financial insight and control they can gain through the app.

The application developed in this project aims to overcome these limitations by allowing users to define their own subcategories under each expense category, track transactions in detail, and visualize spending through pie and line charts. All of these features are included without requiring a paid subscription, making it a more accessible and user-friendly option for those who need a robust finance management solution.

2.2 Summary of Limitations in Existing Applications

Despite the popularity and user base of existing personal finance applications such as Monefy, 1Money, and Spendee, they exhibit notable limitations that reduce their effectiveness for comprehensive financial management.

Limitation Table

Limitation	**Monefy**	**1Money**	**Spendee**	**Proposed App**
Subcategory Support	✕	✕	✕	✓
Multi-Account Support	✕	✓	✕	✓
Budget Alerts	✕	✓	✕	✓
Export/Backup Options	✓	✓	✕	✓
Interface Clutter or Limited Customization	✕	✕	✓	✓
Smart Scanning and Prediction	✕	✕	✕	✓
Premium Required for Full Features	✕	✓	✓	✕

Table 2.2.1 Limitation Table

Monefy is known for its simplicity and ease of use, but it falls short in a few critical areas. It lacks support for managing multiple financial accounts separately; all transactions are pooled together, making it difficult for users to track their finances across different sources like e-wallets, debit cards, or loans. It also does not allow the creation of subcategories under expense categories, limiting users from tracking detailed spending patterns (e.g., distinguishing between breakfast, lunch, and dinner under the “Food” category). Additionally, it lacks advanced budgeting tools and does not provide spending alerts or future projections.

1Money improves on Monefy by supporting multiple accounts and budget tracking but still lacks subcategory support. Users can assign budgets to the main categories, but they cannot further classify expenses within them. Furthermore, many of its core features, such as detailed budgeting and advanced visual analytics, are locked behind a premium version, restricting access for users who prefer free tools.

Spendee offers a visually appealing dashboard and multiple account support, but customization is still limited. Like the others, it does not support subcategory creation, and many of its premium features (such as detailed charts, custom reports, and cloud sync) require payment. This again limits accessibility and flexibility for users without a premium subscription.

These gaps in functionality highlight a clear opportunity for improvement. The proposed application aims to fill these gaps by offering all key features—such as multi-account tracking, subcategory creation, budget alerts, and visual reporting—without requiring a paid upgrade.

2.3 Proposed Solution

The proposed application is developed to overcome the limitations observed in existing applications. Its design is centered on delivering a more detailed, flexible, and accessible personal finance management experience. Key improvements include:

1. Support for Multiple Account Types:

Unlike Monefy, this application allows users to manage transactions across various account types including cash, debit cards, credit cards, loans, and e-wallets. Each account is tracked independently to offer clearer financial insights.

2. Custom Subcategory Creation:

To provide more detailed expense tracking, users can define subcategories under each main category. For instance, under "Food," users can create subcategories like "Breakfast", "Lunch" or "Dinner". This allows deeper analysis of spending habits. [6]

3. Budget Alerts and Notifications:

The app supports setting monthly budgets and provides real-time notifications when users approach or exceed their limits. This feature encourages responsible spending and budget discipline.

4. Visual Reporting:

Comprehensive pie and line charts offer users an intuitive overview of their financial behavior. Users can view income vs. expenses over time and identify trends or anomalies easily.

5. Smart Scanning and Prediction:

To streamline data entry, users can scan receipts or bills, and the system automatically extracts relevant details such as amount, category, and date. Additionally, a prediction system uses past behavior to suggest subcategories when entering a new transaction, reducing manual input and improving consistency.

By addressing the shortcomings in current applications and integrating these enhancements, the proposed solution provides a more complete and user-friendly financial management tool for everyday use.

Chapter 3
System Methodology

3.1 System Design Overview

The proposed financial management application is designed as an offline mobile solution developed using the Flutter [4] framework. The goal is to provide users with a fast, lightweight, and intelligent platform for managing their finances without relying on constant internet connectivity. The system emphasizes efficiency, privacy, and user convenience, especially through features like receipt scanning and smart category prediction.

The overall system architecture consists of multiple interconnected components, each designed to perform a specific role while maintaining a modular structure for ease of maintenance and future scalability.

Core Features and Design Components

1. Offline Functionality and Data Privacy

The application is designed to function entirely offline, eliminating the dependency on internet connectivity. This approach ensures that users can access and manage their financial data at any time, regardless of network availability. By not requiring cloud storage or external servers, the system also enhances data privacy, giving users full control over their sensitive financial information.

2. Local Database Management (SQLite)

At the core of the application is a local SQLite database that manages all transactional data, including accounts, categories, subcategories, and user preferences. This database enables fast data operations such as insertions, updates, deletions, and queries, all performed locally on the user’s device. This ensures both speed and efficiency while maintaining the integrity of the stored data.

3. Receipt Scanning Using Google ML Kit

The application features a receipt scanning functionality that leverages Google's ML Kit [7] for optical character recognition (OCR). Users can capture a photo of their receipt or select an image from their gallery. The app then processes the image to enhance text clarity before extracting the content. This content is analyzed to detect the transaction amount and related notes, which are automatically filled into the input form, reducing manual entry and enhancing convenience.

4. Lightweight Prediction for Auto-Categorization

Rather than implementing complex machine learning models, the app uses a lightweight, rule-based prediction system based on user history. When a user enters a transaction note, the app searches the local database for previous notes and retrieves the most associated category and subcategory. This intelligent but resource-efficient method allows the app to suggest relevant categories quickly, mimicking smart prediction while maintaining speed and storage efficiency.

5. Dynamic Category and Subcategory Handling

To improve accuracy and user experience, the application supports dynamic linking between categories and subcategories. When a user selects a category, the subcategory dropdown updates to show only the relevant options. This ensures that users do not accidentally assign unrelated subcategories, maintaining consistent and meaningful categorization of transactions.

6. Intuitive and Accessible User Interface

The interface of the application is designed to be clean, colorful, and intuitive. Color codes are used to visually differentiate between income, expenses, and transfers. Large buttons, dropdown menus, and input fields make navigation and usage simple for users of all backgrounds. This user-centered design philosophy promotes usability and encourages regular interaction with the app.

7. Modular System Architecture

The application's architecture is built using a modular structure. Components such as database operations, OCR processing, category prediction, and UI logic—is developed independently. This separation of concerns makes the system easy to maintain, debug, and extend in the future.

Developers can introduce new features or modify existing ones without disrupting the entire codebase.

These features work together in a loosely coupled architecture, improving maintainability and promoting modular development. Each component operates independently yet integrates seamlessly with the system's core flow.

3.1.1 System Architecture Diagram

The financial management application is designed using a layered architecture that separates concerns across different responsibilities. This design approach improves code maintainability, scalability, and testability while also enhancing performance and offline reliability. The architecture is divided into four primary layers:

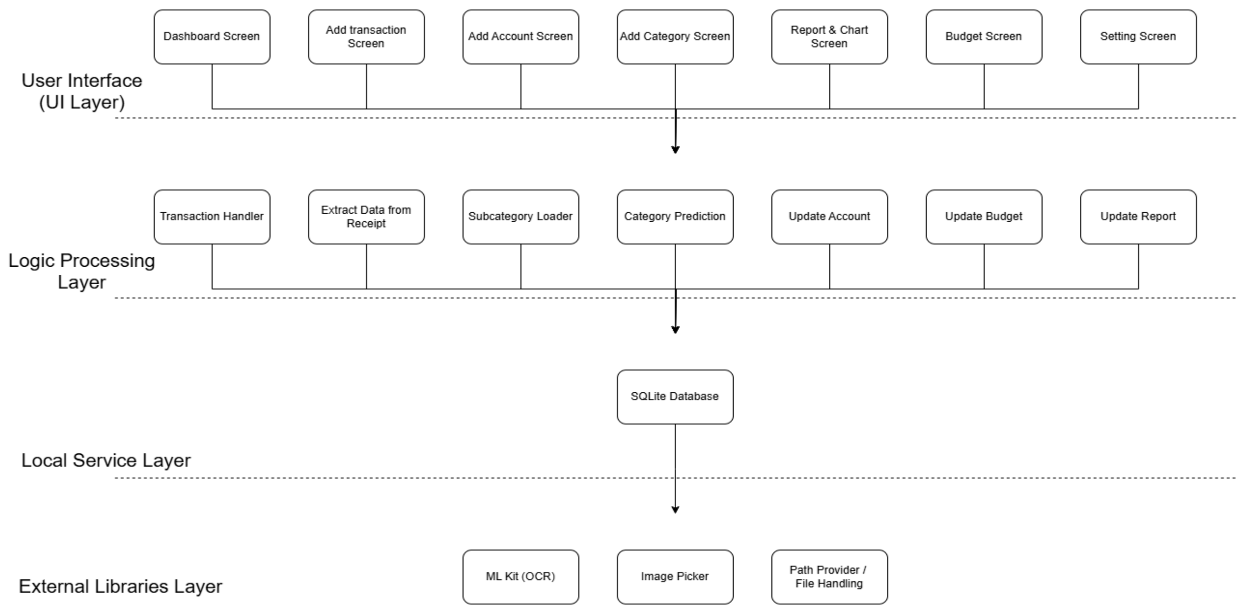


Figure 3.1.1 System Architecture Diagram

1. UI Layer

The UI layer includes all user-facing screens and components that allow users to interact with the system. Each screen serves a specific function and reflects real-time data updates:

- Dashboard Screen: Displays a summary of financial activities, recent transactions, account balances, and budget status.

- Add Transaction Screen: Allows users to input new transactions (income, expense, transfer). Includes dynamic dropdowns for category/subcategory selection and optional receipt scanning.
- Add Account Screen: Enables users to add, view, or delete financial accounts (e.g., cash, debit, e-wallet).
- Add Category Screen: Lets users define new categories and subcategories for organizing transactions.
- Report & Chart Screen: Presents financial insights using visual aids such as pie charts and line graphs, helping users analyze spending and budgeting trends.
- Budget Screen: Allows users to set monthly budgets per category and get notified when approaching the limit.
- Setting Screen: Offers general configuration, theme selection, and app behavior settings.

Each of these screens is developed using Flutter [4] widgets and follows best practices for reactive UI rendering.

2. Logic Layer

This layer handles the application's core business logic. It is responsible for processing data, implementing rules, and coordinating between the UI and the database:

- Transaction Handler: Manages CRUD operations for transactions, including validation and linking to accounts/categories.
- Extract Data from Receipt: Utilizes ML Kit [7] to recognize text from receipt images and extract relevant transaction data (e.g., amount, merchant name).
- Subcategory Loader: Dynamically loads subcategories based on the selected category to support detailed expense classification.
- Category Prediction: Predicts the category and subcategory from user-entered notes using a lightweight, non-AI-based matching system that looks up past patterns from stored data.
- Update Account: Adjusts account balances in real time after adding, editing, or deleting transactions.
- Update Budget: Calculates current budget usage and checks whether a user is approaching or exceeding limits.

- Update Report: Aggregates transaction data and feeds it into visual representations for reporting purposes.

This layer ensures smooth and accurate data flow between the interface and storage systems, supporting intelligent behavior while maintaining offline capability.

3. Local Services

All persistent data is stored using SQLite [5], a lightweight local relational database. It provides structured storage for:

- Transactions
- Accounts
- Categories & Subcategories
- Budgets
- User Preferences
- Category prediction mappings

This offline approach ensures users can manage their finances anytime, even without an internet connection.

4. External Libraries

To enhance functionality and simplify complex operations, several third-party libraries are integrated:

- ML Kit: Google's machine learning SDK used for Optical Character Recognition (OCR) to extract text from scanned receipts.
- Image Picker: Allows users to capture a photo from the camera or select one from the device gallery.
- Path Provider: Identifies platform-specific storage paths to save and retrieve files locally.
- File Handling: Supports image preprocessing and temporary storage for improving OCR accuracy.

These libraries enable robust features such as receipt scanning and prediction while maintaining lightweight, device-local architecture.

3.1.2 Use Case Diagram

The use case diagram outlines the key functional interactions between the user and the financial management system. It presents a high-level visual representation of how the user performs various actions within the application and how different system components support these operations. The system is designed to be intuitive and user-centric, allowing users to manage their finances efficiently and flexibly through a set of core and enhanced functionalities. [8]

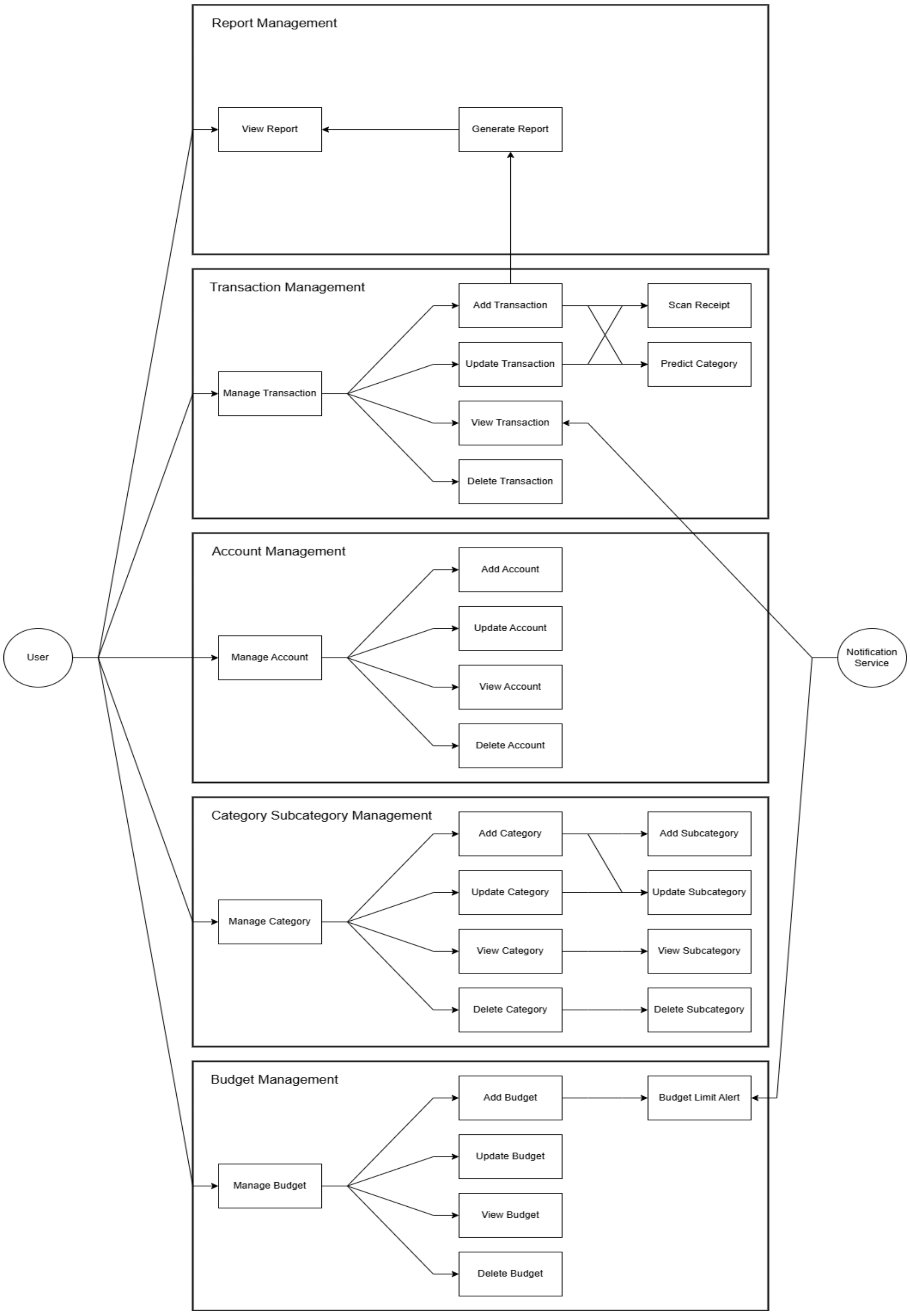


Figure 3.1.2 Use Case Diagram

Primary Actor

- User: The user is the central actor who interacts with the application. The user is responsible for inputting, managing, and reviewing financial data and is the recipient of system-generated feedback such as budget alerts and category predictions.

Use Cases and System Interactions

1. Create, Read, Update, Delete (CRUD) Transactions

- The user can perform all CRUD operations on financial transactions, including income, expenses, and transfers.
- For income and expense entries, the user selects the relevant account, category, and subcategory, and inputs the amount, note, and date.
- For transfers, the user specifies the source and destination accounts and transfer amount.
- Each transaction updates the associated account balance and contributes to budget and report calculations.
- Transactions can be edited later if mistakes occur or deleted if no longer needed.

2. Create, Read, Update, Delete (CRUD) Accounts

- Users can manage multiple types of accounts such as cash, debit cards, credit cards, or e-wallets.
- Each account maintains a separate balance and transaction history.
- The application allows users to create new accounts with custom names and initial balances, update account names or values, and delete unused accounts.
- Transfers between accounts are also supported and reflected in both source and destination balances.

3. Create, Read, Update, Delete (CRUD) Categories and Subcategories

- Users can define their own categories (e.g., Food, Transport) and subcategories (e.g., Lunch, Taxi) to tailor the application to their spending patterns.
- This customization enables more precise tracking of financial behavior.
- Categories can be renamed, deleted, or reorganized, and subcategories are dynamically loaded based on the selected category during transaction entry.

4. Create, Read, Update, Delete (CRUD) Budgets

- Users can assign monthly budget limits to specific categories.
- Budgets help users control their spending by setting financial boundaries for each area.
- The system monitors budget consumption and alerts the user when spending approaches or exceeds the limit.

5. View Reports and Charts

- The application provides visual summaries of financial data in the form of pie charts (for category-based spending), bar charts and line charts.
- Users can review spending distribution, income vs. expense comparison, and identify areas where they may need to cut costs or reallocate budgets.

6. Receive Budget Limit Notifications

- The system includes a Notification Provider module that continuously evaluates spending against the user's defined budgets.
- When the spending in any budgeted category reaches a predefined threshold (e.g., 80% of the budget), a local notification is triggered to warn the user.
- This real-time feedback helps users stay disciplined and adjust spending accordingly.

7. Scan Receipt and Extract Data

- When adding a transaction or transfer, users can choose to scan a physical receipt using their device camera or select an image from the gallery.
- The image undergoes preprocessing to enhance OCR accuracy, and Google ML Kit's Text Recognition API is used to extract textual information.
- The extracted text is parsed to identify the transaction amount and possibly a note or merchant name.

8. Predict Category from Note

- After scanning, the extracted note is used to predict the most relevant category and subcategory based on past user behavior.
- A lightweight local algorithm (without requiring AI services or online connectivity) matches the note with previously recorded transactions.
- If a likely match is found, the category and subcategory fields are auto-filled to speed up the transaction entry process and reduce user input errors.

3.1.3 Activity Diagram

The activity diagram illustrates the dynamic behavior and flow of actions when a user interacts with the financial management application, particularly during the process of adding a transaction. It helps visualize the step-by-step logic, including decision points and system responses that occur during user interaction. [9]

The following description focuses on the **"Add Transaction"** activity, incorporating advanced features like receipt scanning and category prediction.

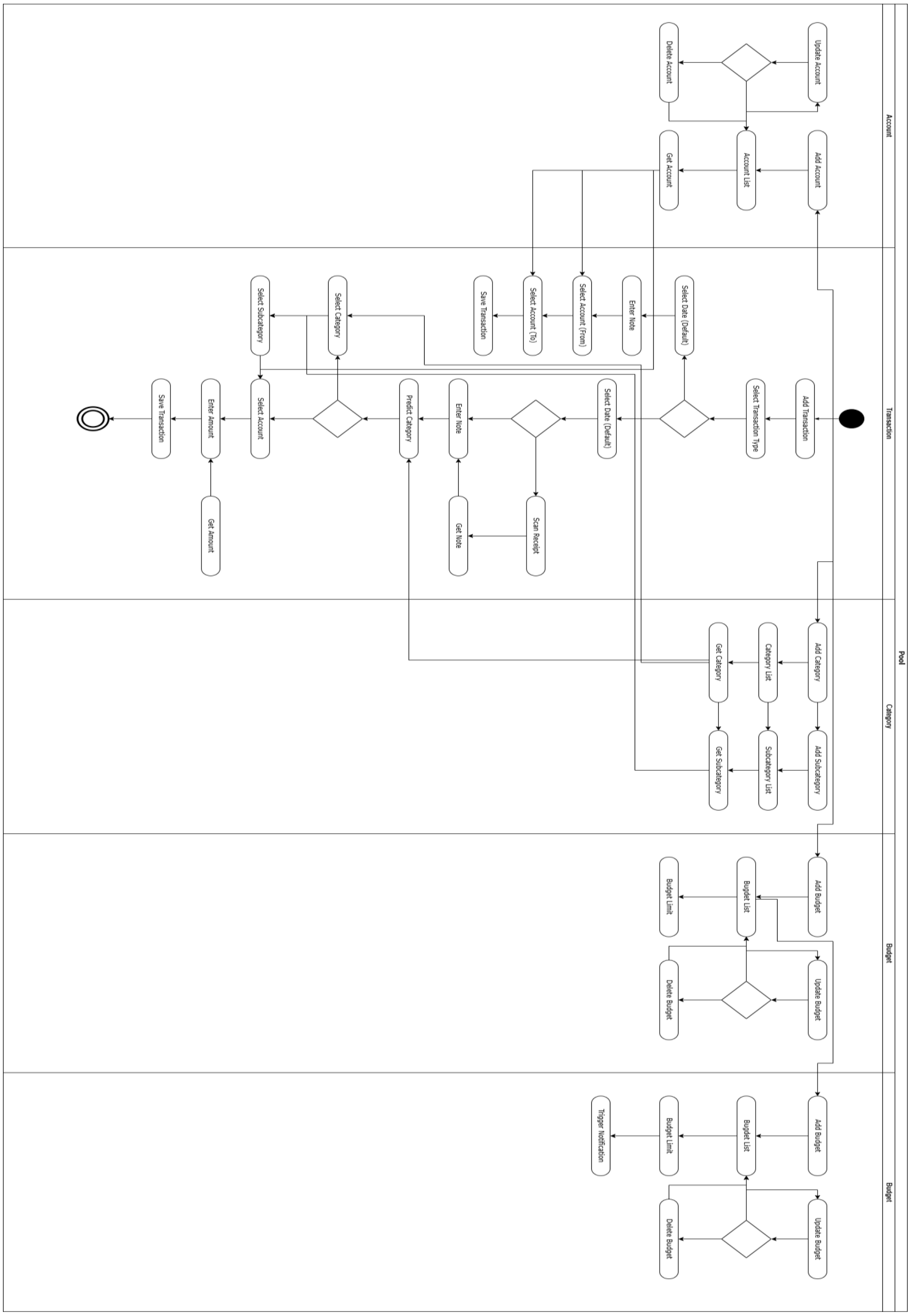


Figure 3.1.3 Full Activity Diagram

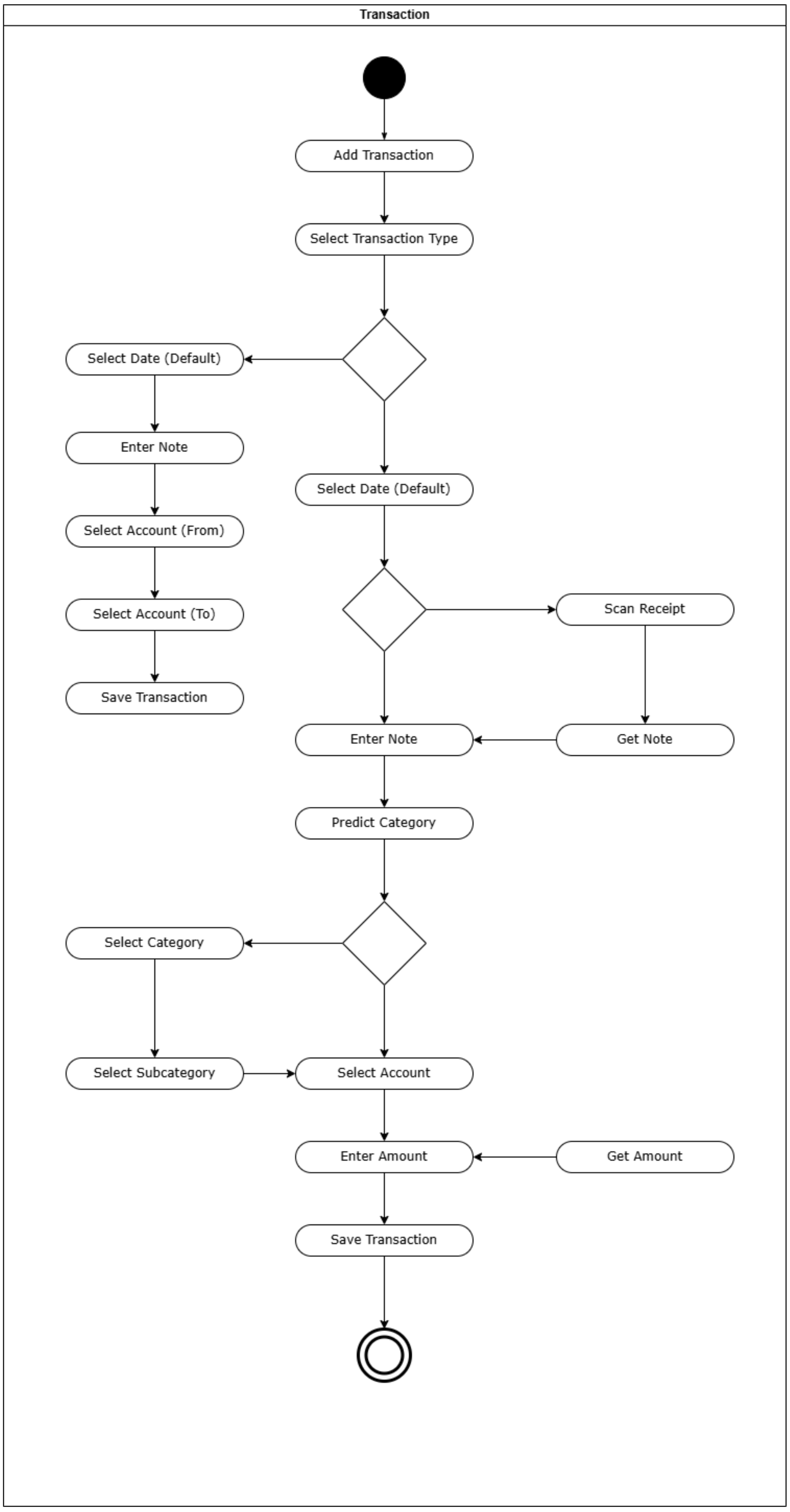


Figure 3.1.4 Activity Diagram (Add transaction)

Activity Flow Description

1. Start

- The activity begins when the user navigates to the "Add Transaction" screen from the dashboard.

2. Select Transaction Type

- The user selects the transaction type: Income, Expense, or Transfer.
- Based on the selection, the input form dynamically adjusts (e.g., source and destination accounts for transfer).

3. Input Transaction Details

- The user enters details such as amount, note, date, account, category, and subcategory.
- The app provides dropdowns for selecting account, category, and subcategory. Subcategories are loaded dynamically based on the selected category.

4. (Optional) Scan Receipt

- If the user chooses to scan a receipt:
- The app opens the camera or gallery via Image Picker.
- The image is preprocessed and analyzed using ML Kit's Text Recognition.
- The system extracts transaction details (e.g., amount, note) and autofills them into the form.

5. (Optional) Predict Category

- If a note is available (manually entered or scanned), the system attempts to predict a category and subcategory.
- The prediction is made based on the user's previous transactions stored in the local SQLite database.
- If a match is found, the predicted category and subcategory are selected automatically.

6. Validate Inputs

- The system checks that all required fields (e.g., amount, account, category) are filled correctly.
- If validation fails, an error message is shown and the user must correct the input.

7. Transaction Submit

- Once valid, the transaction is stored in the SQLite database.

8. Update Related Data

- The related account balance is updated based on the transaction type.
- The budget consumption is recalculated if the category is part of a budget.
- The transaction contributes to the report and chart statistics.

9. End

- The user is redirected back to the previous screen or remains on the same screen to add another transaction.

This activity diagram provides a clear and comprehensive view of how the transaction addition process works, including the seamless integration of advanced features like OCR and prediction.

3.1.4 User Interface Design

The user interface (UI) of the application is designed to provide a clean, intuitive, and efficient user experience for managing personal finances. Each screen is structured to support a specific function of the system while maintaining consistency in layout and usability across the application. Below is an overview of each screen and its purpose:

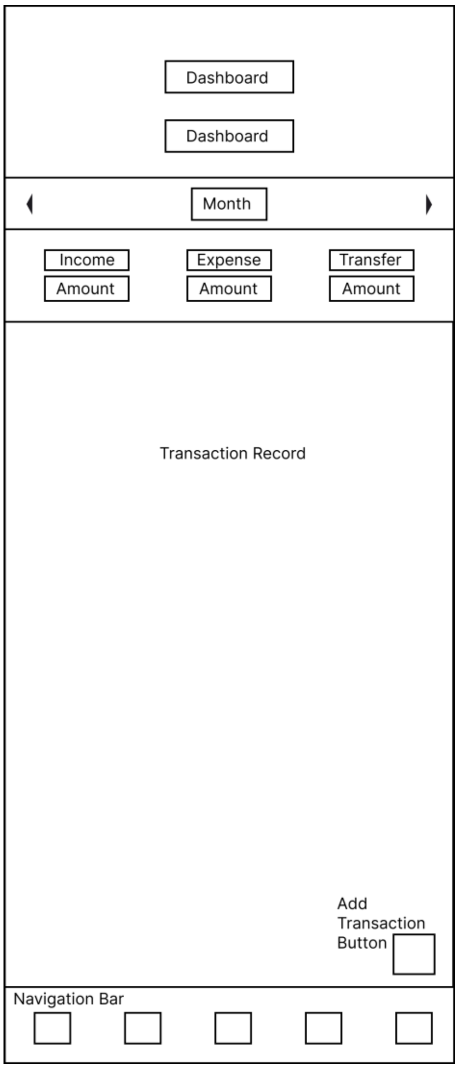


Figure 3.1.5 Dashboard Screen UI

1. Dashboard Screen

Acting as the application's starting screen, the dashboard offers users a summary of their overall financial condition. It displays the total balance, income, and expense values. The screen may also feature quick access buttons to add new transactions or view reports. It provides a high-level snapshot of the user's finances at a glance.

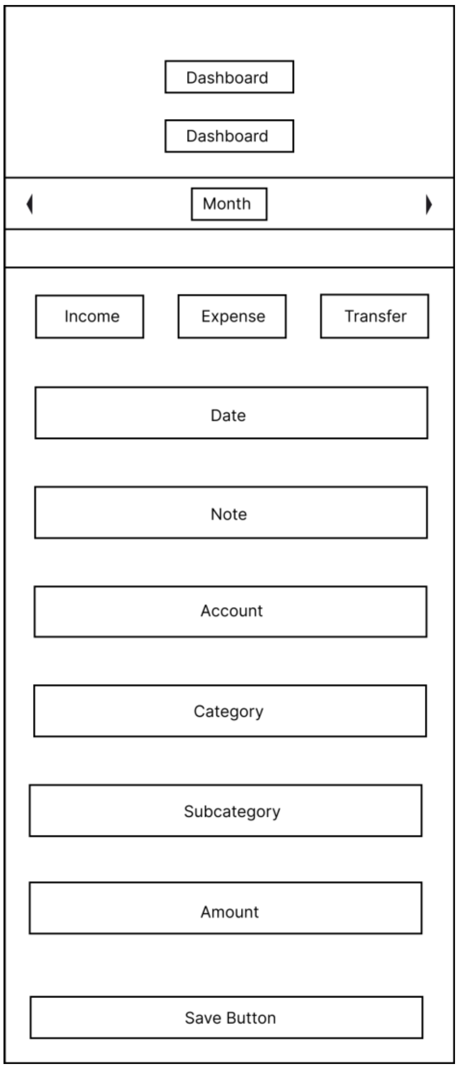


Figure 3.1.6 Transaction Add Screen UI

2. Transaction Add Screen

This screen allows users to add new transactions, including expenses, income, or transfers. Users can:

- Enter transaction amount and date.
- Choose a category and subcategory (dynamically loaded).
- Add a note for reference.
- Scan receipt using the device camera and extract transaction details using ML Kit [7].
- Automatically predict the transaction category based on the content of the note.

The screen dynamically adjusts input fields based on the transaction type, ensuring simplicity and minimizing input errors.

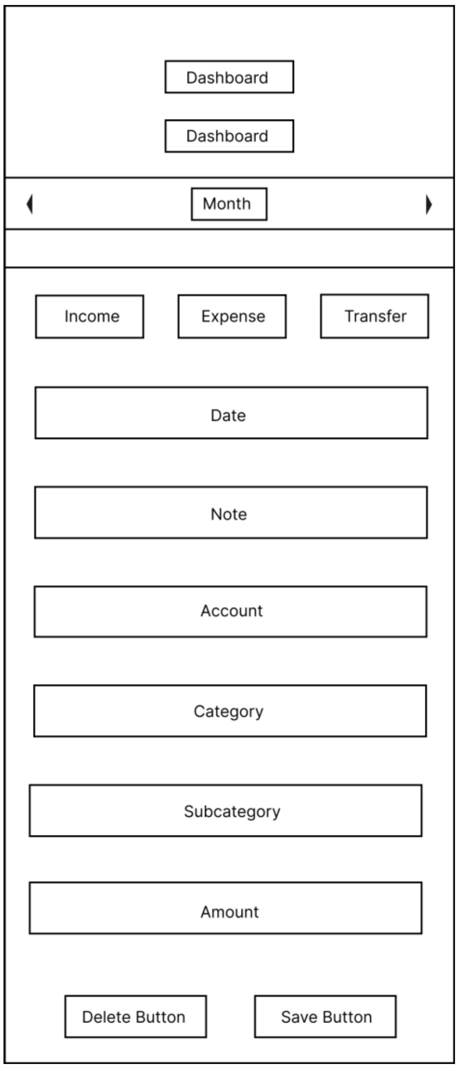


Figure 3.1.7 Transaction Update Screen UI

3. Transaction Update Screen

The transaction update screen functions similarly to the add screen but is used to modify existing entries. Users can view the current transaction details, make changes to the amount, category, date, or note, and save updates. This feature ensures that users can correct mistakes or update information as needed.

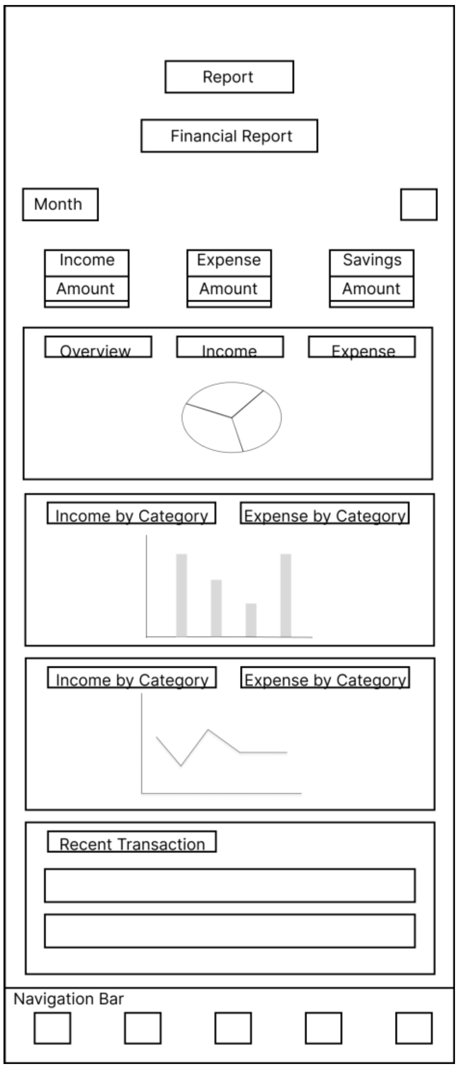


Figure 3.1.8 Report Screen UI

4. Report Screen

The report screen visualizes the user's financial data through interactive charts and summaries. It includes:

- Pie charts showing expense distribution by category.
- Line or bar charts showing trends over time.
- Filters to view reports by time period (daily, monthly, custom range).

This helps users understand their spending habits and manage their budget more effectively.

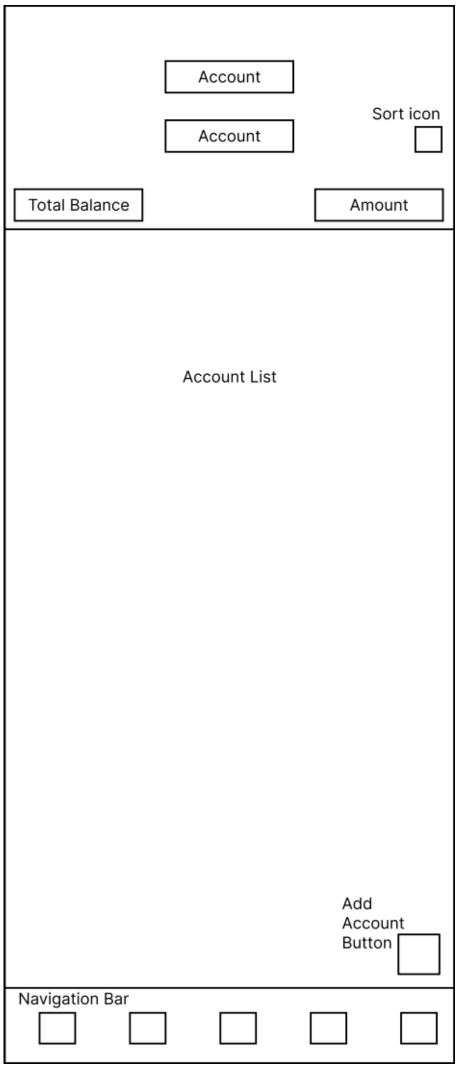


Figure 3.1.9 Account Screen UI

5. Account Screen

In this screen, users can manage different financial accounts such as cash, e-wallets, debit cards, or bank accounts. The screen allows:

- Adding new accounts.
- Editing or deleting existing accounts.
- Viewing balance summaries per account.

This feature helps users track how their money is distributed across different financial sources.

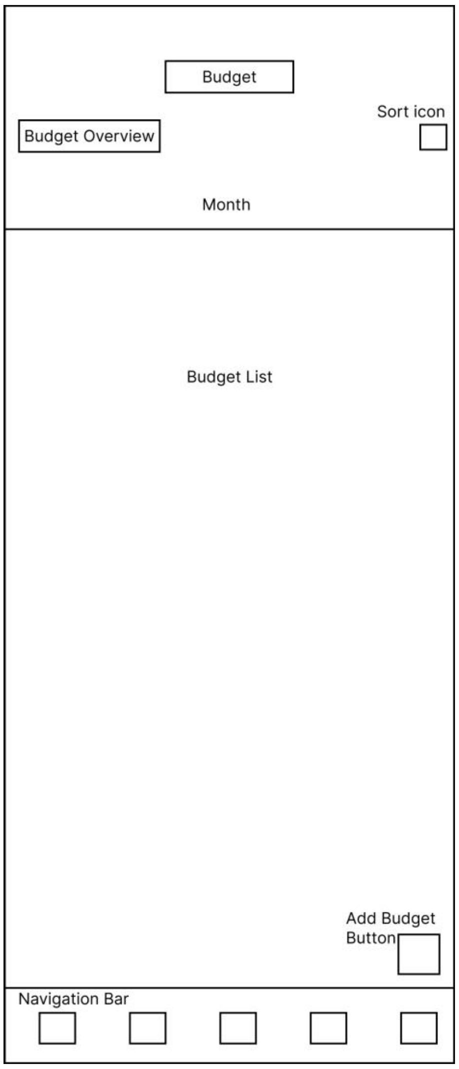


Figure 3.1.10 Budget Screen UI

6. Budget Setting Screen

This screen lets users set monthly budgets for selected categories. Key features include:

- Input fields for budget amount per category.
- Visual indicators of spending progress relative to budget.
- Budget alerts if the user is approaching or exceeding the limit (handled by notification logic).

This feature encourages responsible financial behavior and helps users stay on track with their goals.

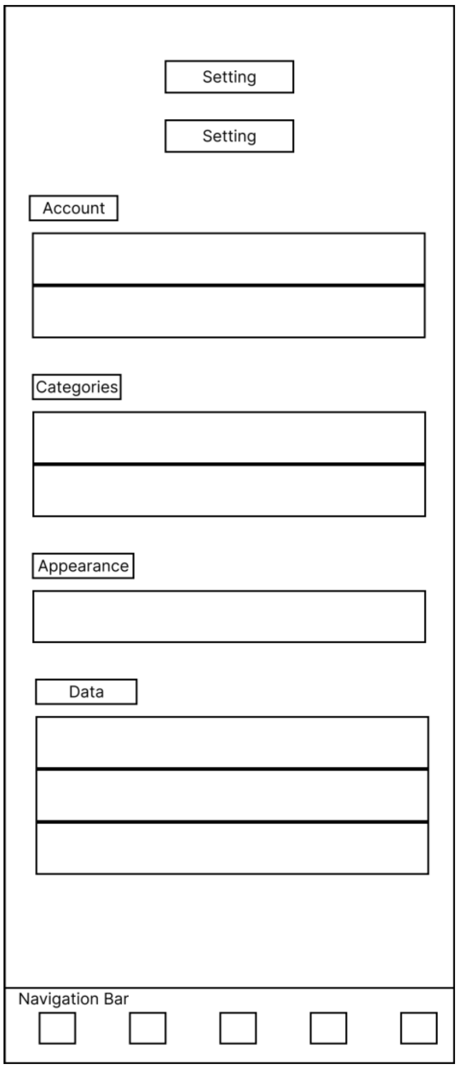


Figure 3.1.11 Category Screen UI

7. Category Screen

Users can manage both categories and subcategories through this screen. It supports:

- Adding, editing, and deleting main categories.
- Adding nested subcategories to allow detailed classification of expenses and income.

This customization enhances the accuracy of tracking and reporting by aligning with individual financial preferences.

Chapter 4

System Design

4.1 System Block Diagram

The system block diagram illustrates the overall structure and interaction between the key components within the application. It outlines the flow of data and the connection between the user interface, logic processing, and the storage layer. [10]

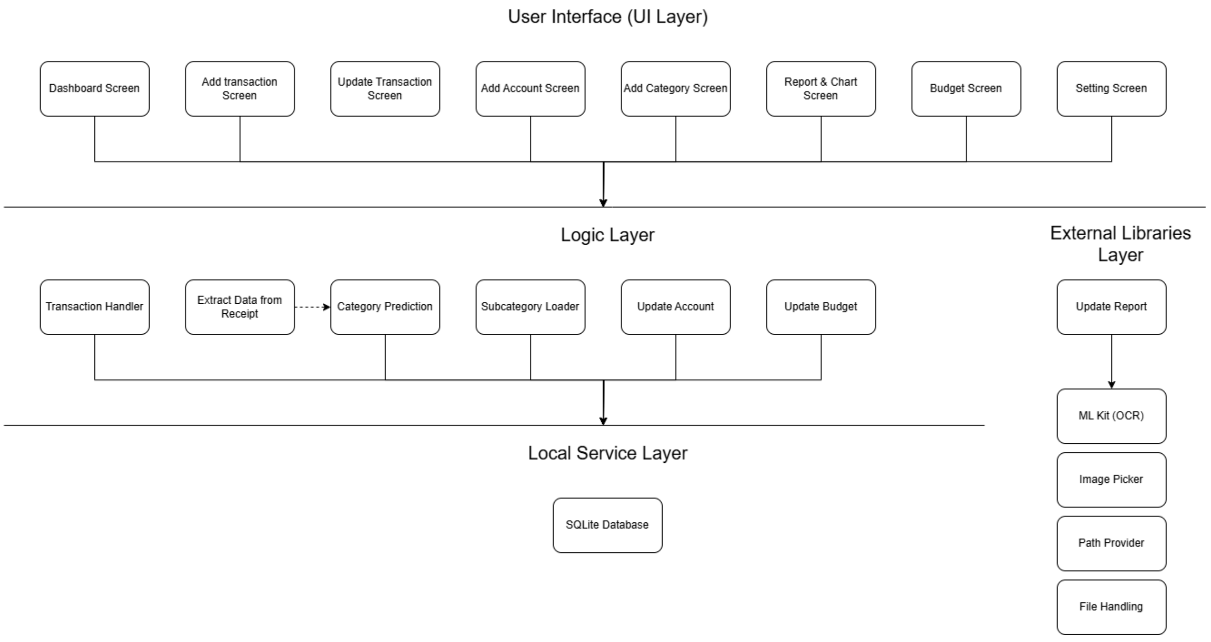


Figure 4.1.1 Block Diagram

The application consists of the following major components:

User Interface (UI): Handles user interaction through screens such as Dashboard, Add Transaction, Add Account, Category Management, Report, and Budget Settings.

1. Logic Layer:

Processes input data, performs validation, handles operations like category prediction and report generation, and communicates between UI and database.

2. SQLite Database:

Acts as the local data store for transactions, categories, accounts, budgets, and preferences.

3. External Libraries and Tools:

- Google ML Kit: Used for OCR (optical character recognition) when scanning receipts.
- Image Picker: For capturing or selecting receipt images.
- Path Provider and File Handling: For managing local file paths and storage access.

4. Block Diagram Explanation:

- The UI layer initiates requests such as adding a transaction or scanning a receipt.
- The Logic layer handles prediction and parsing operations, such as extracting data from OCR text and matching it with past user preferences.
- Extracted and processed data is stored or retrieved from the SQLite database.
- External libraries assist in extracting and analyzing image content.

This modular separation enhances maintainability and offline usability, as all operations are conducted locally without requiring internet access or external APIs.

4.2 System Components Specifications

This section provides a comprehensive description of each major component involved in the development of the offline financial management application. The system was developed using Flutter and Dart [11], with a modular architecture to support scalability, maintainability, and smooth user interactions. The application is designed to work entirely offline, relying on a local SQLite database, while integrating essential functionalities such as receipt scanning and lightweight prediction to enhance user experience.

1. User Interface Components

The user interface layer serves as the bridge between the user and the system’s core logic. It is designed with simplicity and usability in mind, allowing users to manage their financial activities with minimal effort.

UI Screen	**Functionality Description**
Dashboard Screen	Acts as the central hub showing an overview of total balance, income, expenses, and view for all transaction records. It also includes shortcuts to add transaction.
Add Transaction Screen	Allows users to add new income, expense, or transfer transactions. Users can scan receipts to auto-fill fields and trigger category prediction based on the note entered.
Update Transaction Screen	Provides users the ability to edit or delete existing transactions, ensuring accuracy and flexibility in managing records.
Account Screen	Enables users to create, update, or delete financial accounts such as Cash, Bank, or E-Wallet. Account balances are dynamically updated based on transactions.
Budget Setting Screen	Users can define monthly budget limits for each category. The system monitors spending and provides alerts when nearing or exceeding the limit.
Category Screen	Supports creation, update, and deletion of categories and subcategories. Useful for organizing financial records under personalized labels.
Report Screen	Displays visual summaries such as pie charts and bar charts to reflect spending patterns, income sources, and category-wise breakdowns over selectable time ranges.

Table 4.2.1 User Interface Components

2. Logic Layer Components

This layer handles the core application logic. It processes data input by the user or from external sources (e.g., image OCR), updates the local database, and ensures consistency across UI displays.

Logic Component	**Role and Functionality**
Transaction Handler	Manages creation, update, and deletion of transactions. Ensures account balances are adjusted accordingly and updates are reflected in reports and budgets.
Extract Data from Receipt	Integrates Google ML Kit for OCR to extract text data (amount, notes) from receipt images. Preprocesses the image for improved accuracy.
Category Prediction	Uses a lightweight matching system to compare the note with previous entries. Suggests a category and subcategory without using AI/ML models or remote servers.
Subcategory Loader	Automatically loads subcategories relevant to the chosen category. Enhances dynamic UI behavior and simplifies data input.
Update Account	Adjusts the balance of involved accounts (source and destination) during transactions or transfers. Ensures real-time synchronization with UI.
Update Budget	Checks current spending against user-defined budgets. Sends alerts when budget usage reaches critical levels.
Update Report	Regenerates visual reports and data summaries whenever transactions are added, updated, or deleted. Maintains historical accuracy.

Table 4.2.2 Logic Layer Component

3. Local Storage Layer

The local storage component provides persistent and structured data management for the application without requiring internet connectivity.

Component	**Details**
SQLite Database	Used as the core storage system for all app data including transactions, accounts, categories, subcategories, budgets, and user preferences. It enables complex querying and supports the app’s offline-first nature.
Prediction Preferences	Maintains mapping between transaction notes and categories/subcategories. Supports instant lookup for prediction functionality.

Table 4.2.3 Local Storage Layer

4. External Libraries and Tools

These libraries extend the core functionality of the application without adding server dependencies. Each tool serves a specific purpose in supporting system performance, accuracy, or user interaction.

Library / Tool	**Purpose and Contribution**
Google ML Kit (Text Recognition)	Performs OCR on receipt images to extract text such as amount and note. Enables the scanning feature in a lightweight and efficient way.
Image Picker	Allows users to select images from their gallery or take a new photo using the device camera. Supports both iOS and Android.
Path Provider	Accesses and manages file system paths for temporary or permanent storage on the device. Ensures compatibility with offline behavior.
File Handling	Reads, stores, and processes images and text files. Supports image preprocessing before OCR and general data operations.

Table 4.2.4 External Libraries and Tools

By combining these components, the system offers a robust financial management solution that operates entirely offline while still offering advanced features such as receipt scanning and transaction prediction. The layered design allows for future scalability and integration without major architectural overhauls.

4.3 Components Design

This section explains the design of each major component in the system, categorized according to the architectural layers. The goal is to clarify the function of each part and how they work together to form a cohesive, maintainable, and scalable mobile application. The system is divided into four primary layers: the UI layer, logic layer, local services, and external libraries.

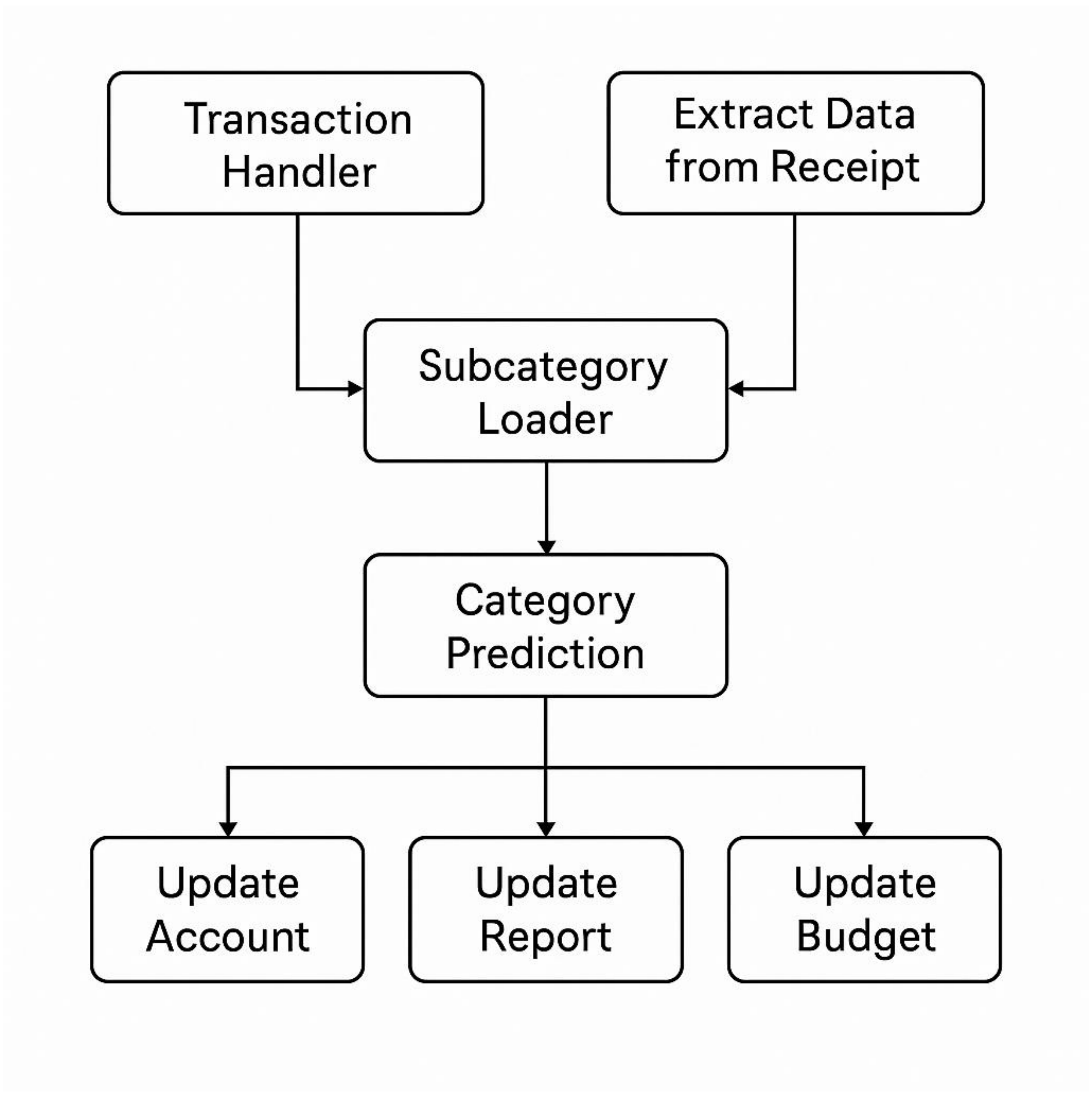


Figure 4.3.1 System Flow Chart

4.3.1 UI Layer Components

The User Interface (UI) layer serves as the interaction point between the user and the system. Each screen is designed to be intuitive, responsive, and aligned with user expectations for managing financial records.

1. Dashboard Screen

Displays a summary of financial data such as total balance, recent transactions, and quick navigation shortcuts. Designed for rapid overview and access to key functionalities.

2. Transaction Add Screen

Enables users to input new financial entries with fields such as amount, category, subcategory, account, date, and optional notes. Supports features like receipt scanning and category prediction.

3. Transaction Update Screen

Allows users to edit existing transaction entries. Pre-fills current data for modification and maintains data consistency with the database.

4. Report Screen

Generates visual charts and summaries of spending, income, and budgets. Uses filtered queries from SQLite [5] to display data by date, category, or account.

5. Account Screen

Lets users add, update, or delete accounts (e.g., cash, bank, e-wallet). Automatically updates balance calculations.

6. Budget Setting Screen

Provides options to set monthly budgets per category. Triggers notifications when limits are approached or exceeded.

7. Category Screen

Enables CRUD operations for categories and subcategories, allowing full customization of expense/income classification.

4.3.2 Logic Layer Components

The Logic layer handles data processing, business rules, and internal operations of the app. This layer ensures that user inputs and actions are correctly translated into system behavior.

1. Transaction Handler

Manage all operations related to transactions: adding, updating, deleting, and validating input data before inserting into the database.

2. Extract Data from Receipt

Integrates with Google ML Kit [7] to perform OCR on receipt images. Parses recognized text to identify amounts and descriptions for pre-filling transaction fields.

3. Subcategory Loader

Dynamically loads subcategories based on the selected category from the database. Ensures accurate data binding in the UI dropdowns.

4. Category Prediction

Implements lightweight prediction logic by matching normalized keywords in the note field with user-preferred categories from past transactions. Enhances user efficiency without heavy AI models.

5. Update Account

Ensures that account balances reflect real-time updates based on transaction changes or transfers.

6. Update Budget

Tracks current spending per category and compares it with user-defined budget thresholds. Also handles logic for triggering limit alerts.

7. Update Report

Collects and processes filtered data to generate charts and summaries shown in the report screen.

4.3.3 Local Services

This layer represents the system's storage mechanism and internal services that ensure persistent data across user sessions.

1. SQLite Database

Acts as the primary data store for transactions, accounts, categories, budgets, and preferences. Supports relational data integrity and local queries with indexing for performance.

2. Data Access Helper (DatabaseHelper)

A singleton service that wraps SQL queries and abstracts low-level database operations like table creation, data insertion, updates, and joins.

4.3.4 External Libraries

These components extend the system's capability beyond native Flutter [4] functions, enabling advanced features such as OCR and file handling.

1. Google ML Kit

Provides text recognition (OCR) for extracting information from scanned receipts. Used to improve transaction input accuracy and speed.

2. Image Picker

Allows users to capture or select receipt images from the device camera or gallery. Integrates with the ML Kit pipeline.

3. Path Provider

Retrieves paths for temporary or persistent file storage on the device, used during receipt preprocessing or exporting.

4. File Handling

Custom logic for managing image loading, caching, and temporary storage during scanning or preview.

4.4 System Components Interaction Operations

This section describes how different system components interact during key operations in the application. It outlines the flow of data and the collaboration between UI, logic, local services, and external libraries to deliver core functionalities such as adding a transaction, scanning a receipt, updating budgets, and generating reports. These interaction processes ensure the system behaves reliably and intuitively from the user's perspective.

4.4.1 Adding a Transaction

1. User Input (UI Layer)

- The user navigates to the Transaction Add Screen and fills in details such as amount, category, subcategory, note, and date.
- If a receipt is used, the user taps the scan button to initiate OCR.

2. Receipt Scanning (External Library + Logic Layer)

- Image Picker captures the image.
- The image is passed to ML Kit [7] for text recognition.
- Extracted text is parsed to identify the amount and optional note.
- The logic attempts to predict the category based on keywords in the note.

3. Transaction Processing (Logic Layer)

- The validated transaction data is passed to the Transaction Handler.
- Account balance is updated via the Update Account logic.
- The transaction is stored in the SQLite Database.

4.4.2 Updating a Transaction

1. Load Existing Data (UI + Local Services)

- The Transaction Update Screen fetches the current transaction details from the database.
- Pre-fills all form fields for editing.

2. Modify and Save (Logic Layer)

- Upon user changes, the system verifies and updates the transaction in the database.
- If the amount or account changes, the account balance is recalculated.
- Linked budget and reports are also updated accordingly.

4.4.3 Budget Management and Notifications

1. Budget Setup (UI + Logic Layer)

- Users define a spending limit per category in the Budget Setting Screen.
- Limits are stored locally in the SQLite Database.

2. Spending Monitoring (Logic Layer)

- Each new transaction triggers a recalculation of the total spent in a budgeted category.
- If the amount exceeds or nears the limit, a budget alert notification is triggered via a custom alerting service.

4.4.4 Generating Reports and Charts

1. Report Screen Access (UI Layer)

- The user navigates to the Report Screen, selecting filters like date range or category.

2. Data Aggregation (Logic Layer)

- The Update Report logic queries SQLite [5] for all relevant transactions.
- Data is grouped and aggregated based on the selected filters.

3. Chart Rendering (UI Layer)

- The summarized data is visualized using pie or bar charts, providing insights on income vs expenses, top spending categories, and budget progress.

4.4.5 Managing Categories and Subcategories

1. Category CRUD (UI + Logic)

- Users can add or edit main categories and their associated subcategories.
- Changes are reflected immediately in the Add Transaction dropdowns.

2. Data Binding (Logic Layer)

- When a category is selected, the Subcategory Loader loads the corresponding subcategories dynamically from the database.

4.4.6 Account and Transfer Handling

1. Account Operations

- Users can create or delete accounts. Balances are calculated based on linked transactions.

2. Transfers Between Accounts

- The user selects source and destination accounts and enters the amount.

- The logic deducts from the source and adds to the target account, logging the transaction accordingly.

These interaction flows ensure a smooth and cohesive user experience, where each component of the system is tightly integrated to deliver reliable financial management functionality.

Chapter 5

SYSTEM IMPLEMENTATION

This chapter describes the process of implementing the financial management mobile application. It outlines the setup required to run the system, including the hardware and software configurations. Additionally, it covers the key configurations needed, provides a walkthrough of system operation with illustrative screenshots, discusses encountered challenges, and ends with a summary of the implementation experience.

5.1 Hardware Setup

The development and testing of the financial management mobile application required both a computer system for coding and compiling, and a smartphone for deployment and real-environment testing. The project was developed and tested in an offline environment to ensure efficiency and responsiveness without reliance on cloud services.

5.1.1 Development Machine (Laptop) Specification

Description	Specifications
Model	Illegear Arte 14
Processor	11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz 3.30 GHz
Operating System	Windows 11
Graphic	Intel Iris Xe Graphics
Memory	32GB RAM
Storage	500GB ROM

Table 5.1.1 Specifications of Computer

This laptop was used for the installation and usage of Android Studio, code writing in Dart [11] using Flutter [4] SDK, emulation testing, and GitHub version control for collaborative development.

5.1.2 Mobile Device for Testing

Description	Specifications

Model	Honor Magic 4 Pro
Processor	Snapdragon 8 Gen 1
Operating System	Android 14
Graphic	Adreno 730
Memory	16GB RAM
Storage	256GB ROM

Table 5.1.2 Specifications of Smartphone

This smartphone was used to test real-world functionality, especially features involving camera access, such as scanning receipts using ML Kit OCR, and performance during offline operation.

5.1.3 Peripheral Devices and Tools

Smartphone Camera – Used for testing receipt scanning in natural environments (lighting, focus, etc.)

Mouse and Keyboard – Connected to the laptop to aid in longer development sessions.

Internet Connection – Required only for library and SDK updates; the app itself functions fully offline.

5.2 Software Setup

The development and deployment of the financial management application required an appropriate software environment to ensure a stable and efficient development workflow. This section describes the tools, platforms, and dependencies used in the project setup.

5.2.1 Development Environment

Software Component	**Specification**
IDE	**Android Studio (Giraffe 2022.3.1)** - Primary IDE for Flutter development
SDK	**Flutter SDK (v3.0.0)** - Framework for cross-platform mobile development
Programming Language	**Dart (v3.7.3)** - Language used by Flutter

Build Tools	Android Gradle Plugin, Dart DevTools
Emulator / Debug Device	Android Emulator / Physical Android Device (for real-world testing)
Version Control	**Git & GitHub** - For source control and collaborative development

Table 5.2.1 Development Environment

5.2.2 Flutter Dependencies

The application relies on various open-source Flutter [4] packages to support core functionality and enhance user experience. The following table explains each dependency:

Package Name	**Version**	**Purpose in the Application**
intl	^0.19.0	Used for date and currency formatting.
fl_chart	^0.69.0	Enables rendering of visual data representations like pie charts and bar charts for reports.
sliding_up_panel	^2.0.0	Provides an interactive sliding panel UI, enhancing UX in sections like budget or reports.
sqflite	^2.0.3	Enables local SQLite database storage for offline transaction, category, and budget data.
path	^1.8.3	Assists in file path manipulation needed for file operations.
provider	^6.0.5	Implements state management to reflect UI changes dynamically across the app.
pull_to_refresh	^2.0.0	Allows users to refresh data manually using a swipe gesture, enhancing UX.
shared_preferences	^2.2.2	Stores lightweight data such as user preferences or settings.
google_mlkit_text_recognition	^0.13.0	Provides OCR capabilities used in receipt scanning to extract amount and note details.
image_picker	^1.0.4	Allows users to pick or capture receipt images from camera or gallery for OCR scanning.
path_provider	^2.1.1	Locates common storage paths for reading/writing files during OCR and receipt handling.

permission_handler	^10.4.4	Manages runtime permissions for accessing camera, storage, and notifications.
share_plus	^7.0.2	Allows users to share exported file into Google Drive or save as link.
flutter_local_notifications	^18.0.0	Triggers budget alert notifications locally based on user-defined thresholds.
file_picker	^5.3.1	Provides file browsing UI, could support importing/exporting data in future iterations.

Table 5.2.2 Flutter Dependencies

5.2.3 Summary

This carefully curated software stack allowed the development of a fully offline-capable mobile app with intelligent features like receipt scanning and category prediction, without relying on cloud services like Firebase. The integration of OCR through ML Kit [7] and local prediction logic enhances user convenience while ensuring data privacy.

5.3 Setting and Configuration

This section outlines the key configurations and initial setup steps taken to ensure the system operated correctly on both development and testing environments. These configurations include the setup of the Flutter [4] environment, permission settings, database initialization, and integration with ML Kit [7] for text recognition.

5.3.1 Flutter Environment Configuration

Before development, the Flutter [4] SDK was installed and configured with the Android Studio IDE. The environment variables were set, and device emulators were installed and linked via AVD Manager.

- **Flutter SDK Path**: Added to system environment variables.
- **Dart SDK**: Bundled with Flutter and used for application logic.
- **AVD Manager**: Used to create and manage emulators for testing.
- **Flutter Doctor**: Run to verify setup and detect missing dependencies.

5.3.2 Android Manifest Configuration

Several permissions and services were declared in the AndroidManifest.xml file to support the application features.

Feature	Permission/Service Added
Camera Access	<uses-permission android:name="android.permission.CAMERA"/>
Storage Access	<uses-permission android:name="android.permission.READ_EXTERNAL_STORAGE"/> and <uses-permission android:name="android.permission.WRITE_EXTERNAL_STORAGE"/>
Notification Access	<uses-permission android:name="android.permission.POST_NOTIFICATIONS"/> (for Android 13+)
File Access	File provider declared for sharing and saving receipts

Table 5.3.1 Android Manifest Configuration

5.3.3 SQLite Database Initialization

The application uses SQLite [5] as a lightweight local database solution, ensuring all user data is stored securely on the device. The database schema was initialized during the first application launch using the sqflite package in Flutter [4]. The _onCreate function defines and creates multiple interrelated tables to support core functionalities like transaction tracking, budget planning, and goal setting.

The structure of the database is normalized for data consistency and efficient retrieval. Below is the breakdown of each table:

Table: accounts

Field	Type	Description
id	INTEGER	Primary key (auto-increment)
name	TEXT	Account name (e.g., Wallet, Bank)
balance	REAL	Initial or updated balance
accountType	TEXT	Type of account (Cash, Bank, etc.)

color	INTEGER	Color code for UI display
isArchived	INTEGER	Used to hide inactive/archived accounts

Table 5.3.2 Account Table in Database

Table: transactions

Field	**Type**	**Description**
id	INTEGER	Primary key
type	TEXT	Income, Expense, or Transfer
date	TEXT	Date of transaction
account_id	INTEGER	FK to accounts.id for regular income/expense
from_account_id	INTEGER	FK to accounts.id (transfer source)
to_account_id	INTEGER	FK to accounts.id (transfer destination)
category	TEXT	Category name
subcategory	TEXT	Subcategory name (default: 'No Subcategory')
amount	REAL	Amount involved in the transaction
note	TEXT	Optional user note
isRecurring	INTEGER	Flag for recurring transactions
recurrencePattern	TEXT	Daily/Weekly/Monthly, etc.

Table 5.3.3 Transaction Table in Database

Table: categories

Field	**Type**	**Description**
id	INTEGER	Primary key
name	TEXT	Category name
type	TEXT	Type of transaction (Income/Expense)
iconCode	INTEGER	Icon code for UI display
color	INTEGER	Category-specific color

Table 5.3.4 Categories Table in Database

Table: subcategories

Field	**Type**	**Description**

id	INTEGER	Primary key
name	TEXT	Subcategory name
category_id	INTEGER	FK to categories.id

Table 5.3.5 Subcategories Table in Database

This table allows dynamic nesting of subcategories under each main category, enhancing organization.

Table: budgets

Field	**Type**	**Description**
id	INTEGER	Primary key
category	TEXT	Category under budgeting
type	TEXT	Expense or Income budget
budget_limit	REAL	Monthly limit set by user
current_month_spent	REAL	Total spent in the current month
previous_months_spent	REAL	Cumulative value from past months
year_month	TEXT	YYYY-MM string for grouping
created_at	TEXT	Date when budget entry was created
is_active	INTEGER	Toggles the budget on/off for tracking

Table 5.3.6 Budgets Table in Database

Table: category_preferences

Field	**Type**	**Description**
id	INTEGER	Primary key
merchant	TEXT	Merchant or keyword (from receipt/note)
category	TEXT	Default predicted category
subcategory	TEXT	Default predicted subcategory

Table 5.3.7 Category Preferences Table in Database

Table: user

Field	**Type**	**Description**
id	INTEGER	Primary key

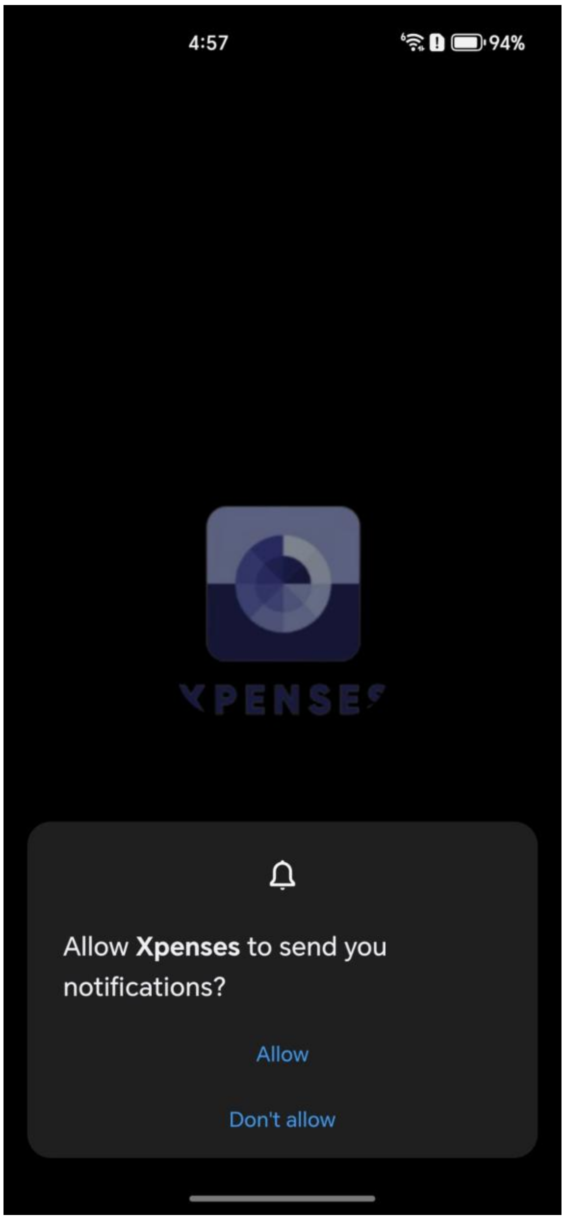
name	TEXT	User’s name
dob	TEXT	Date of birth
gender	TEXT	Gender
budget_notifications	INTEGER	Toggles alerts on budget limit exceeded

Table 5.3.8 User Table in Database

This schema supports scalable personal finance features with support for custom accounts, subcategories, goal planning, and AI-enhanced categorization while maintaining performance and offline capability.

5.4 System Operation (with Screenshot)

This section presents the full operational flow of the financial management application from launching to managing financial data, highlighting how each component works within the system. Screenshots should be inserted accordingly to visually demonstrate each described process.

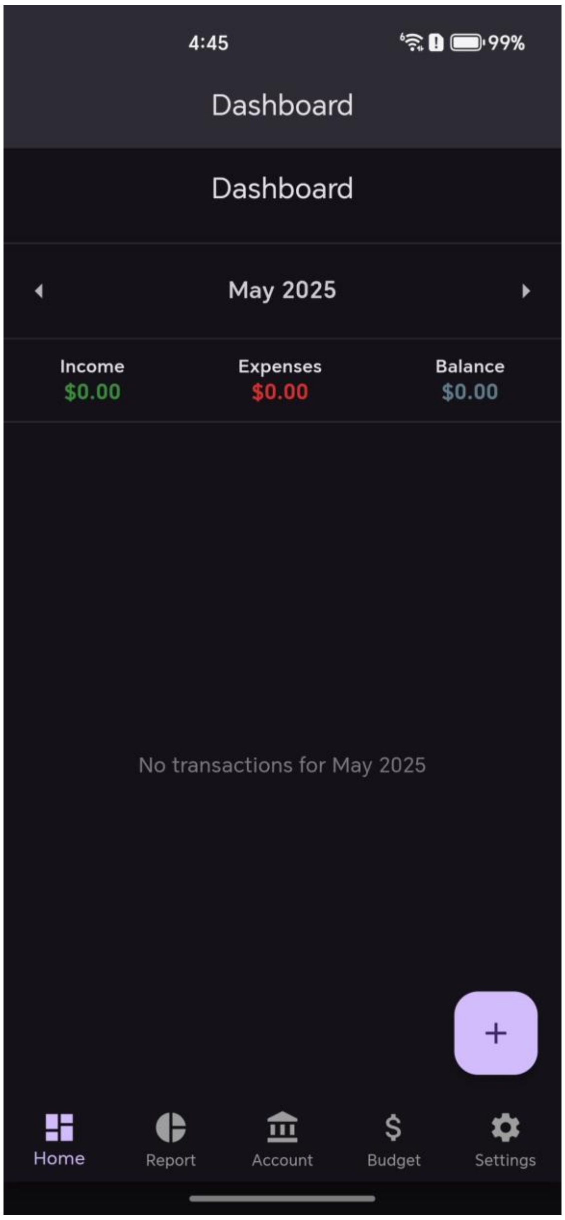


Allow **Xpenses** to send you notifications?

Figure 5.4.1 Splash Screen

5.4.1 Application Launch

The application begins with a splash screen displaying the app logo while initializing the local services. After the splash screen, the user is directed to the main Dashboard.


4:45 99%

Dashboard

Dashboard

May 2025

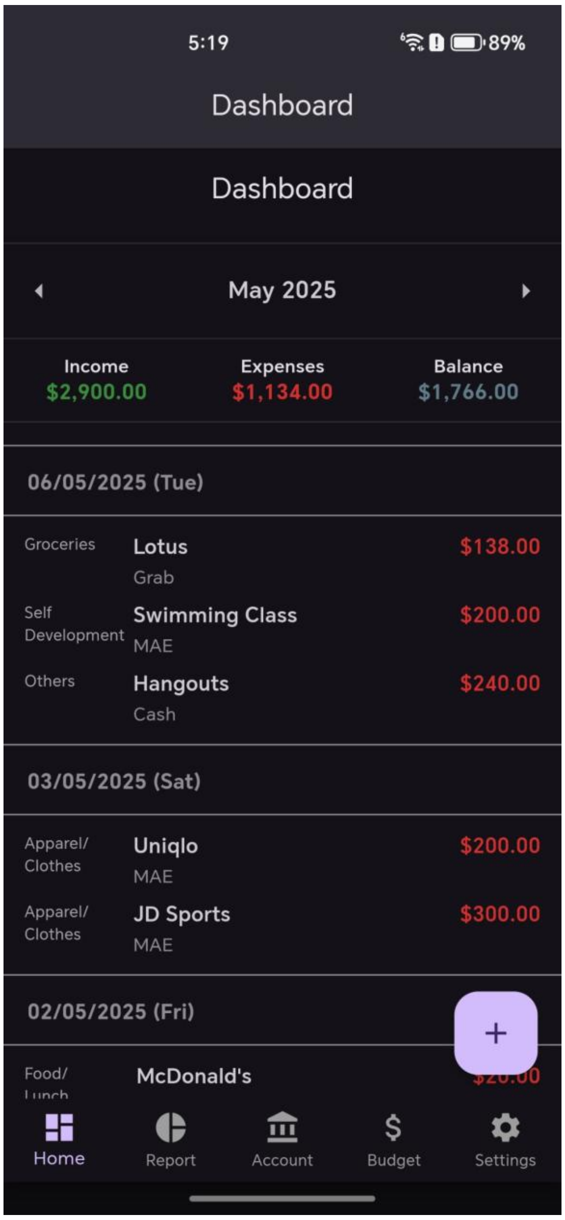
Income $0.00
Expenses $0.00
Balance $0.00

No transactions for May 2025

+

Home Report Account Budget Settings

Figure 5.4.2 Dashboard Screen (Empty)


5:19 89%

Dashboard

Dashboard

May 2025

Income $2,900.00
Expenses $1,134.00
Balance $1,766.00

06/05/2025 (Tue)

Groceries	Lotus Grab	$138.00
Self Development	Swimming Class MAE	$200.00
Others	Hangouts Cash	$240.00

03/05/2025 (Sat)

Apparel/ Clothes	Uniqlo MAE	$200.00
Apparel/ Clothes	JD Sports MAE	$300.00

02/05/2025 (Fri)

Food/ Lunch	McDonald's	$20.00

+

Home Report Account Budget Settings

Figure 5.4.3 Dashboard Screen

5.4.2 Dashboard

The Dashboard acts as the central hub for the user. It shows an overview of:

- Total balance across all transactions.
- A quick summary of income and expenses.
- Quick access buttons for common actions (e.g., Add Transaction, Bottom Navigation).

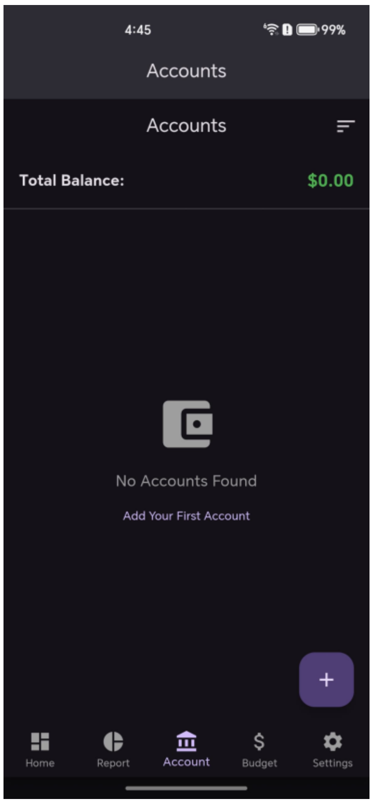


Figure 5.4.4 Account Screen (Empty)

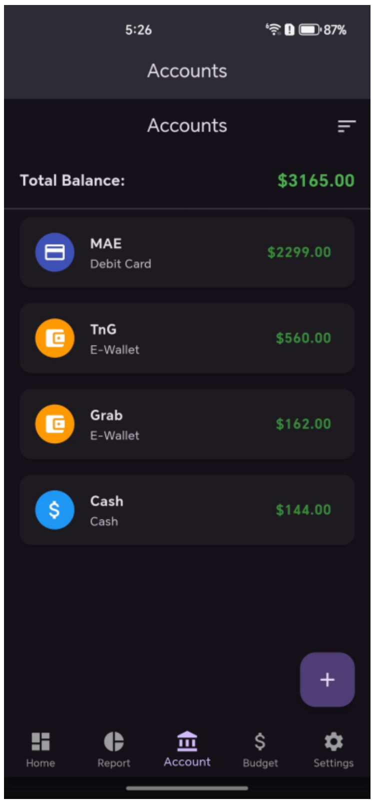


Figure 5.4.5 Account Screen

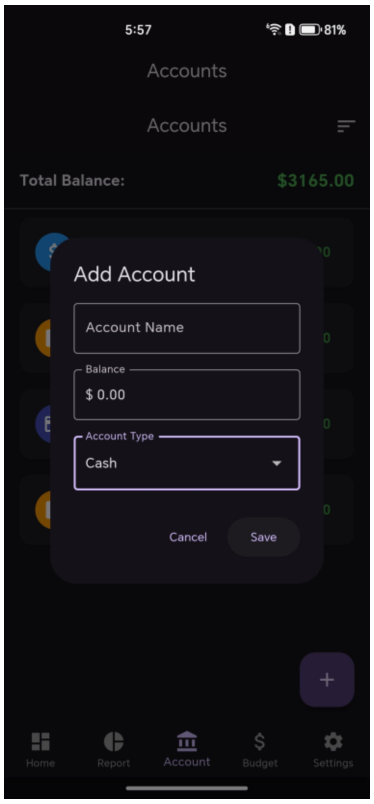


Figure 5.4.6 Add Account

5.4.3 Add Account

Users can create and manage financial accounts such as Cash, Bank, or E-Wallets. Each account can have:

- A custom name
- Initial balance
- Account type
- Assigned color for display

These are stored in the local database for future transactions and balance tracking.

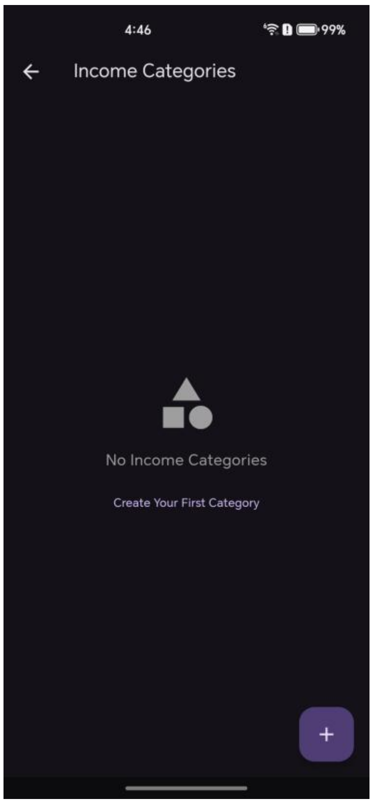


Figure 5.4.7 Category Screen (Empty)

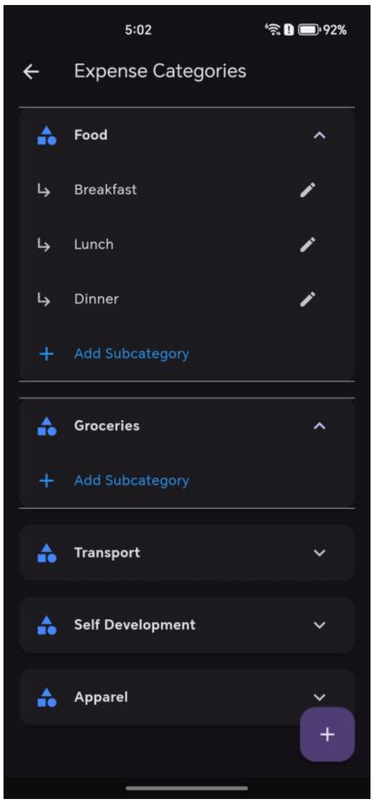


Figure 5.4.8 Category Screen

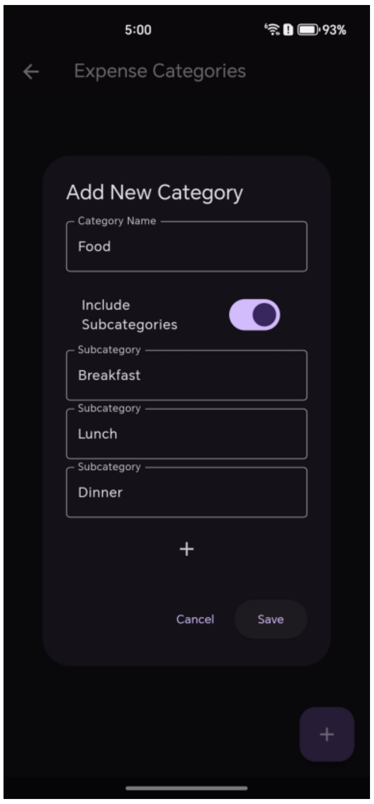
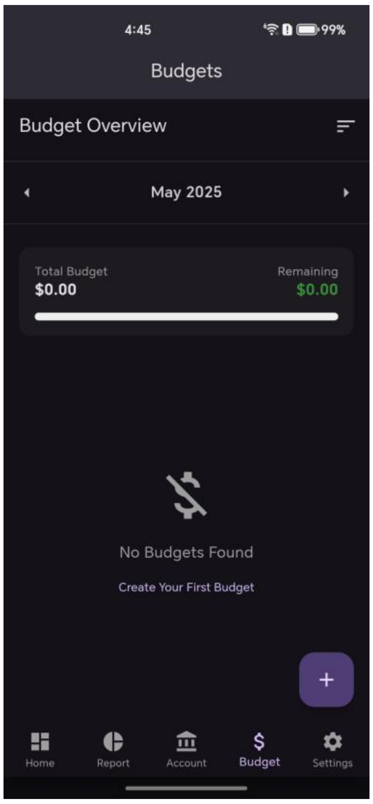


Figure 5.4.9 Add Category

5.4.4 Add Category with Subcategory

Users can define custom categories (e.g., Food, Transport) and assign subcategories (e.g., Lunch, Grab). Each category includes:

- Name and Type (Income or Expense)
- Associated subcategories for more detailed tracking


4:45 99%

Budgets

Budget Overview

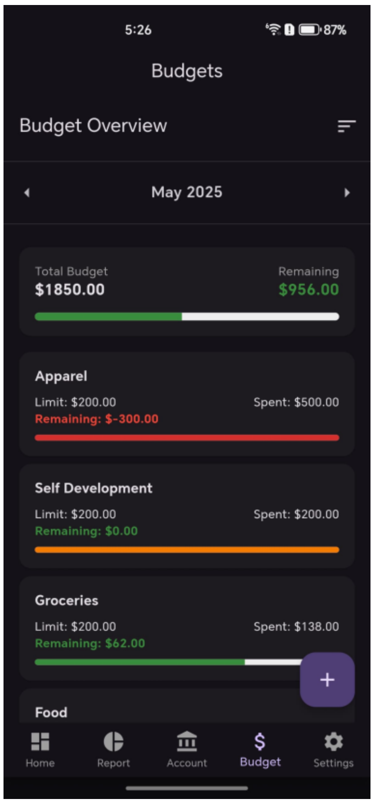
May 2025

Total Budget $0.00 Remaining $0.00

No Budgets Found

Create Your First Budget

Figure 5.4.10 Budget Screen (Empty)


5:26 87%

Budgets

Budget Overview

May 2025

Total Budget $1850.00 Remaining $956.00

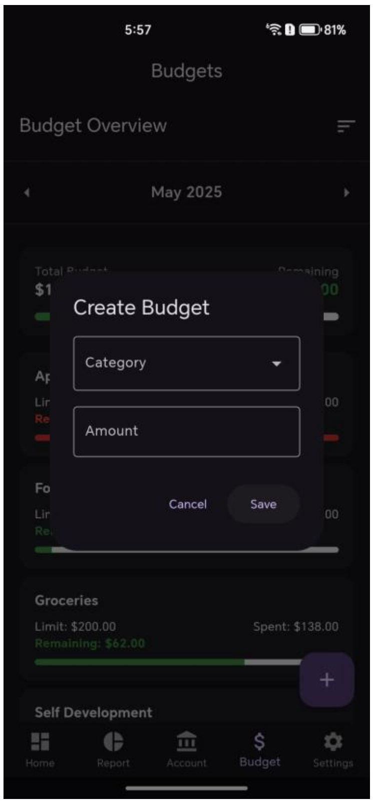
Apparel
Limit: $200.00 Spent: $500.00
Remaining: $-300.00

Self Development
Limit: $200.00 Spent: $200.00
Remaining: $0.00

Groceries
Limit: $200.00 Spent: $138.00
Remaining: $62.00

Food

Figure 5.4.11 Budget Screen


5:57 81%

Create Budget

Category

Amount

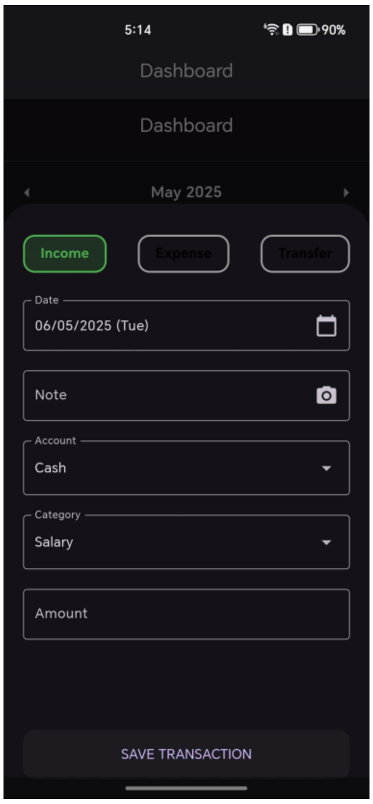
Figure 5.4.12 Add Budget

5.4.5 Add Budget

The budget module allows users to set monthly spending limits for specific categories. It shows:

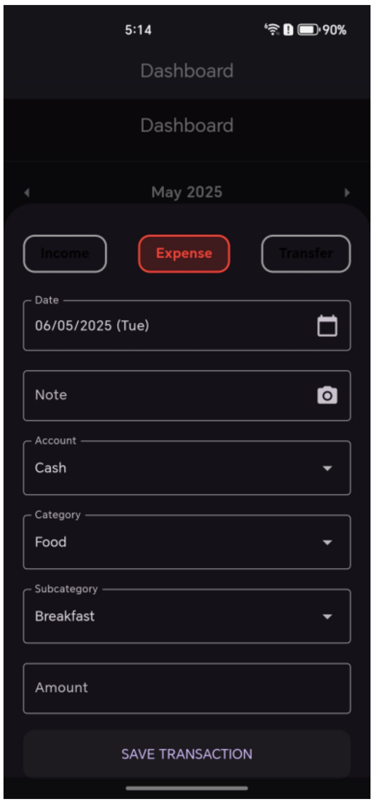
- Budget amount
- Category and type
- Spent amount (tracked dynamically)
- Visual indicators (e.g., progress bar)

Budgets help users control spending and are updated automatically based on transactions.



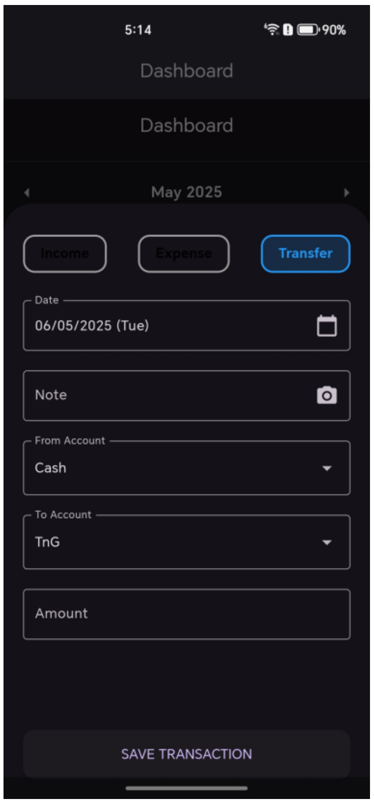
Date
06/05/2025 (Tue)
Note
Account
Cash
Category
Salary
Amount

Figure 5.4.13 Transaction Add Screen (Income)



Date
06/05/2025 (Tue)
Note
Account
Cash
Category
Food
Subcategory
Breakfast
Amount

Figure 5.4.14 Transaction Add Screen (Expense)



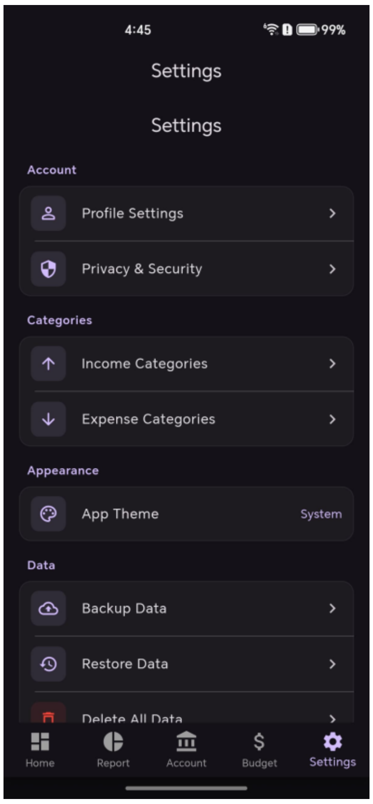
Date
06/05/2025 (Tue)
Note
From Account
Cash
To Account
TnG
Amount

Figure 5.4.15 Transaction Add Screen (Transfer)

5.4.6 Add Transaction

The transaction screen dynamically adapts based on the transaction type:

- Income / Expense: Requires account, category, subcategory, amount, and optional note.
- Transfer: Requires selecting "From" and "To" accounts and the amount.
- Category prediction can pre-fill values based on previous behaviors.



Settings

Settings

Account

Profile Settings

Privacy & Security

Categories

Income Categories

Expense Categories

Appearance

App Theme System

Data

Backup Data

Restore Data

Delete All Data

Figure 5.4.16 Setting Screen

5.4.7 Setting Page

The Settings page allows configuration of:

- Income/Expense Category Setting
- Theme Selection
- Export/import options
- Access to user profile

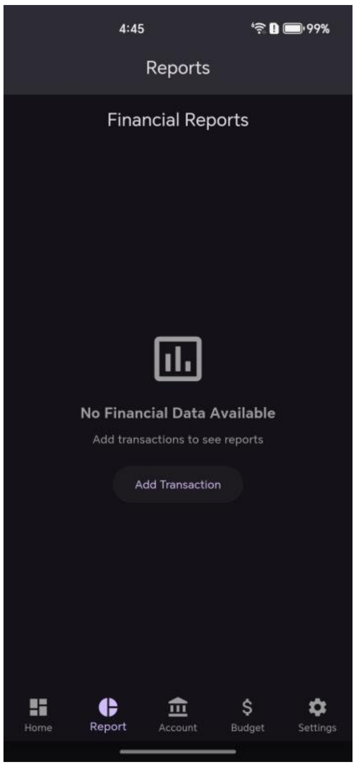


Figure 5.4.17 Report Screen (Empty)

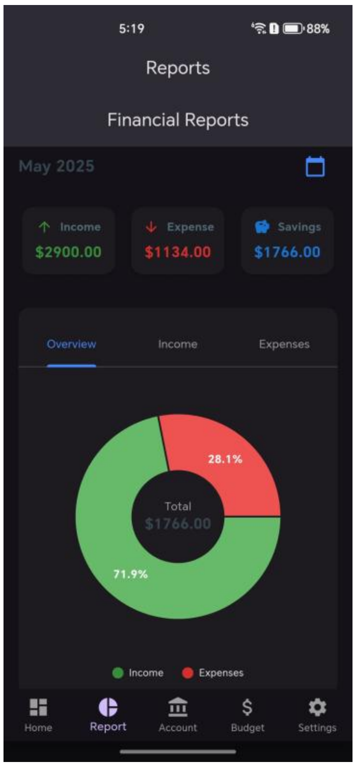
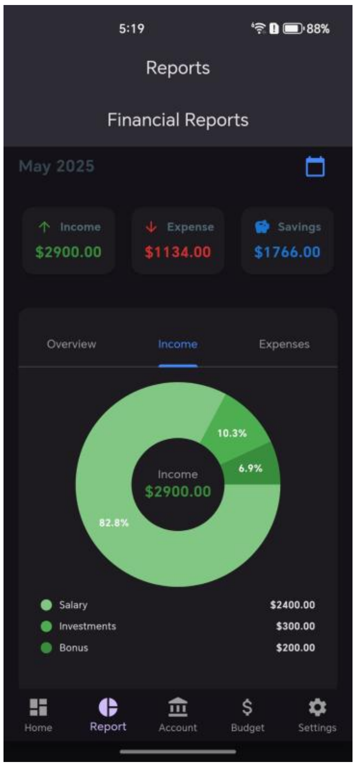
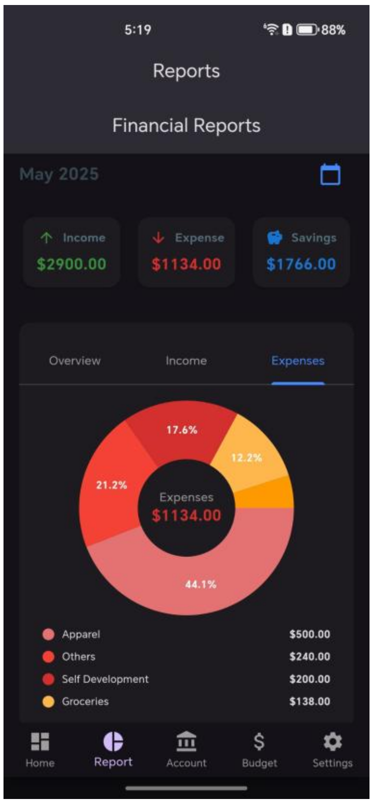


Figure 5.4.18 Report Screen (Pie Chart for Overview)



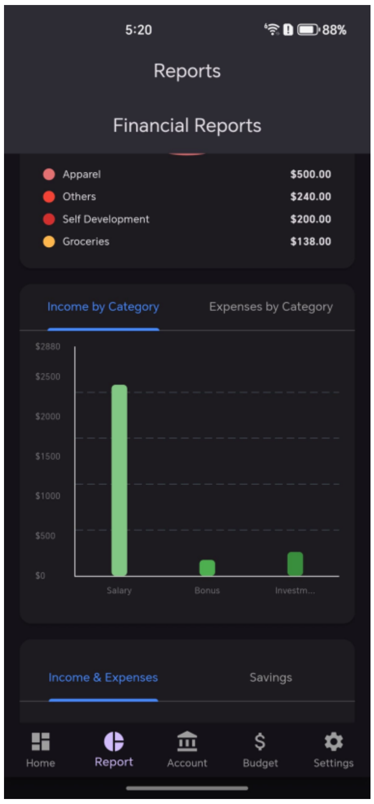
● Salary	$2400.00
● Investments	$300.00
● Bonus	$200.00

Figure 5.4.19 Report Screen (Pie Chart for Income)



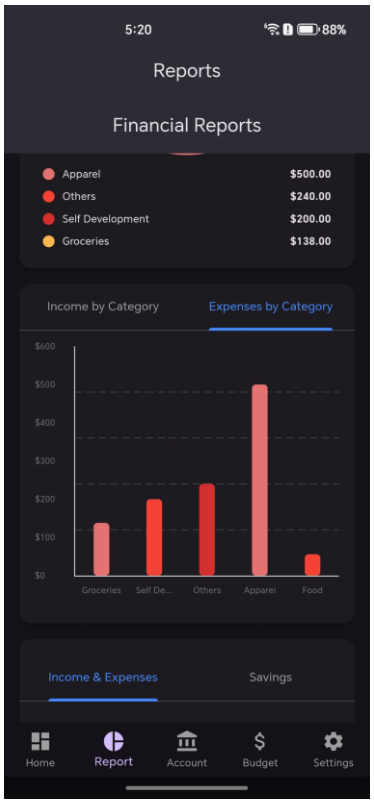
● Apparel	$500.00
● Others	$240.00
● Self Development	$200.00
● Groceries	$138.00

Figure 5.4.20 Report Screen (Pie Chart for Expense)



● Apparel	$500.00
● Others	$240.00
● Self Development	$200.00
● Groceries	$138.00

Figure 5.4.21 Report Screen (Bar Chart for Income)



● Apparel	$500.00
● Others	$240.00
● Self Development	$200.00
● Groceries	$138.00

Figure 5.4.22 Report Screen (Bar Chart for Expense)

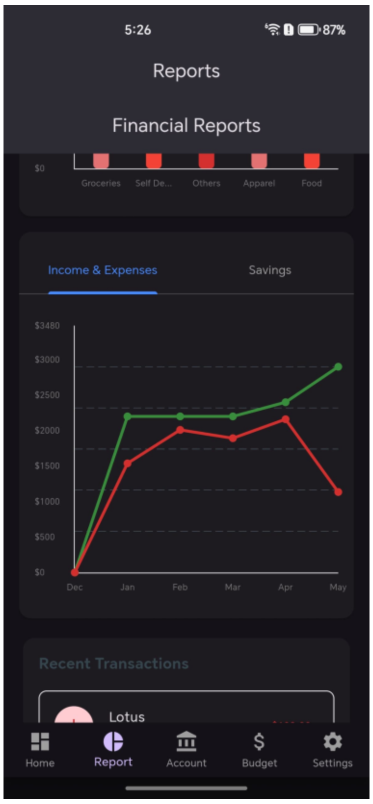


Figure 5.4.23 Report Screen (Line Chart for Income & Expense)

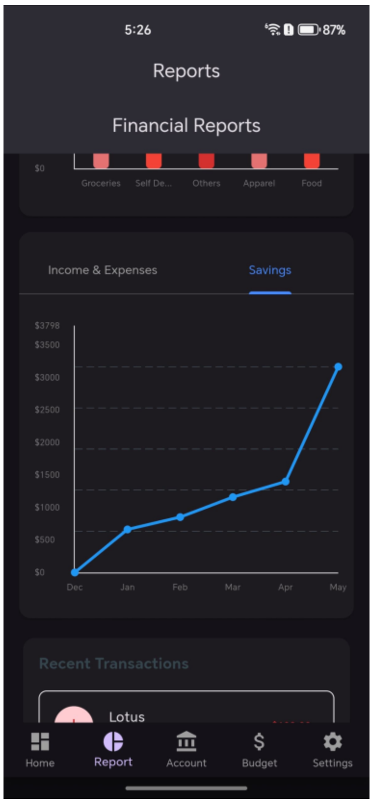
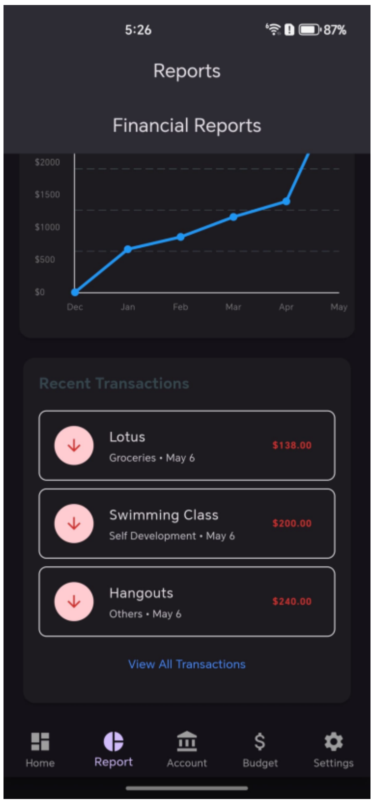


Figure 5.4.24 Report Screen (Line Chart for Overall Savings)



Lotus
Groceries • May 6
$138.00

Swimming Class
Self Development • May 6
$200.00

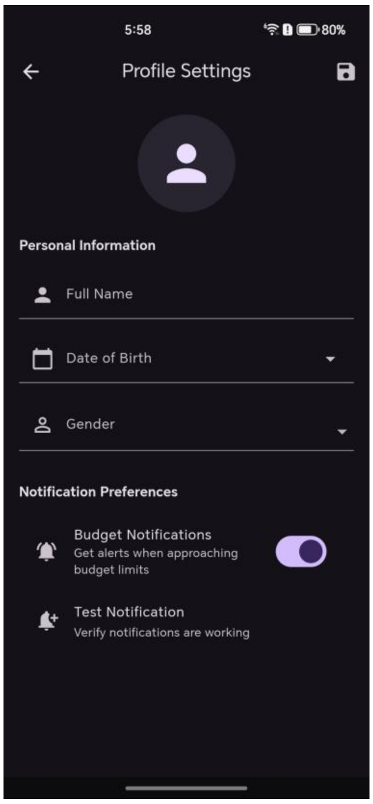
Hangouts
Others • May 6
$240.00

Figure 5.4.25 Report Screen (Recent Transaction)

5.4.8 Report Page

Reports include visual and statistical breakdowns of financial behavior. Using fl_chart, it displays:

- Pie chart of expenses by category
- Bar graph of income and expense trends



Personal Information

Full Name

Date of Birth

Gender

Notification Preferences

Budget Notifications
Get alerts when approaching budget limits

Test Notification
Verify notifications are working

Figure 5.4.26 User Profile Page

5.4.9 User Profile Page

Accessible from the Settings page, the User Profile Page allows users to:

- Edit personal information (name, gender, date of birth)
- Configure personal preferences

Summary

Each function in the app is designed to operate smoothly in an offline environment, with data stored locally using SQLite. The interface remains intuitive and responsive, allowing users to manage finances efficiently.

5.5 Implementation of Issues and Challenges

During the system implementation phase of the financial management mobile application, several technical and functional challenges were encountered. These challenges affected both the frontend and backend components and required thoughtful solutions to maintain the stability and reliability of the application. The key issues and their corresponding resolutions are detailed below:

5.5.1 Database Design and Schema Relationships

- Challenge: Establishing relational integrity among complex tables such as transactions, accounts, budgets, and goals was challenging. Special attention was needed for optional fields (e.g., from_account_id, to_account_id) and foreign keys.
- Resolution: Implemented well-defined foreign key constraints and default values, alongside data validation logic in the app, ensuring consistency and preventing orphaned records.

5.5.2 Receipt Scanning and OCR Integration

- Challenge: The receipt scanning feature using Google ML Kit Text Recognition often captured too much unwanted or irrelevant data from receipts, such as logos, ads, or decorative lines, making it difficult to extract only the useful financial information (merchant, total amount, etc.).
- Resolution: Added basic preprocessing to remove noise and allowed manual user input to verify or correct the extracted content. Also introduced the option to skip categorization if parsing failed.

5.5.3 Transaction Logic Integration

- Challenge: Implementing robust transaction logic that accurately updated related components such as accounts and budgets was complex, especially when handling different transaction types (Income, Expense, Transfer). Transfer logic in particular required dual updates (subtract and add) across two accounts, while maintaining budget integrity.
- Resolution: Developed a modular logic layer that handles each transaction type with condition-based checks. Ensured budgets were updated correctly and accounts were synced with every transaction or deletion.

5.5.4 Report Generation and Chart Extraction

- Challenge: When extracting data for visual charts and summary reports, encountering null values or missing categories could cause application crashes or UI inconsistencies.

- Resolution: Used SQL IFNULL or COALESCE functions in queries to provide fallback values. Also applied defensive programming to handle empty or null datasets gracefully, ensuring the chart UI loaded without breaking.

5.5.5 Dynamic UI State Management

- Challenge: Synchronizing UI elements across multiple screens (e.g., dashboard, report, account list) after data changes was crucial for real-time feedback.
- Resolution**:** Utilized the Provider package to manage state efficiently. Ensured reactive updates using ChangeNotifier and listeners, which minimized performance overhead and maintained consistent data views.

5.5.6 Testing on Emulators and Physical Devices

Ensuring consistent UI behavior and functionality across different devices introduced device compatibility challenges.

- Challenge: UI scaling and layout differences across screen sizes and resolutions.
- Resolution: Tested on both emulators and physical Android devices, using responsive widgets and layout builders to accommodate various screen dimensions.

5.5.7 Category and Subcategory Handling

- Challenge: Implementing a system with both categories and subcategories added significant development complexity. This affected multiple modules including the transaction screen, budget setting, and report generation. Additional challenges included:
    - Dynamically updating subcategory lists based on selected category.
    - Storing and retrieving nested data properly.
    - Designing an intuitive UI to display and allow editing of subcategories.
- Resolution: Created a dedicated subcategory UI and linked it with category selection logic. Applied filtering in the logic layer to ensure subcategories displayed appropriately. Modified related SQL queries and logic structures to account for subcategories wherever relevant.

5.6 Concluding Remark

The system implementation phase marked a crucial milestone in transforming the conceptual design into a fully functional mobile application. Throughout this chapter, each component—from hardware and software setup to implementation challenges—has been systematically discussed to reflect the depth of development efforts invested.

The application successfully integrates core features such as account management, category and subcategory handling, budgeting, transaction logging, and comprehensive reporting. Despite the absence of Firebase or any cloud-based synchronization mechanisms, the system operates efficiently in an offline environment using a local SQLite database for data persistence and reliability. This design choice promotes user data privacy and ensures accessibility without requiring internet connectivity.

Key functionalities like receipt scanning and automated category prediction were implemented using Google ML Kit [7] and a local rule-based prediction engine. These features enhance user experience and reduce the manual effort needed to input data, though they also introduced unique development and debugging challenges. Each issue—such as managing complex subcategory relationships or preventing UI crashes from null data—was addressed through iterative testing and code refinement.

In summary, this chapter documented not only the technical foundation of the system but also the problem-solving mindset adopted during development. The successful implementation of this personal finance application lays a strong groundwork for further evaluation and refinement in the subsequent chapter.

Chapter 6

SYSTEM EVALUATION AND DISCUSSION

6.1 System Testing and Performance Metrics

System testing plays a vital role in the software development process, serving to verify that the completed application adheres to both functional and non-functional specifications. For this financial management mobile application, extensive testing was performed to validate user interface flow, database interactions, logic correctness, performance stability, and usability of features including receipt scanning and offline prediction logic.

Since the application operates entirely offline without Firebase or cloud-based services, all tests were conducted in a standalone environment on both real devices and emulators. The testing focused on the application's reliability under typical user operations such as adding transactions, scanning receipts, generating reports, and handling categories and subcategories.

6.1.1 Testing Approach

The following testing methodologies were applied:

1. Manual Functional Testing

Each core feature was manually tested by simulating real-life use cases:

- Adding, editing, and deleting accounts, transactions, budgets, categories, and goals.
- Transferring funds between accounts.
- Switching between different transaction types (income, expense, transfer).
- Checking the correctness of calculations, category suggestions, and UI responses.

2. Unit Testing

The logic for prediction, budget calculations, transaction type handling, and subcategory assignment was modularized and tested independently. Flutter's test framework was used to automate unit testing for selected Dart functions.

3. Integration Testing

Multiple components were tested together to ensure:

- Data flows from UI to the SQLite database correctly.
- Budget calculations update in real-time with each transaction.

- Subcategory loading is consistent across different transaction screens.
- Receipt scanning and prediction trigger updates to UI and database without delay.

4. UI/UX Testing

- Focused on layout responsiveness across screen sizes and orientations.
- Verified consistency in theme colors, icons, and user interactions.
- Ensured modals, dropdowns, and forms were working smoothly, especially in the Add Transaction screen.

5. Performance Testing

The app was subjected to tests measuring:

- Cold and warm start times.
- Latency in form submission.
- Database query efficiency under different data volumes.
- Memory usage and CPU load during OCR scanning.

6.1.2 Performance Metrics and Results

Metric	**Target Value**	**Observed Result**	**Status**
App Initial Launch Time	< 2 seconds	< 1 seconds on average	✅ Passed
App Resume (Warm Start)	< 1.5 seconds	< 1 seconds	✅ Passed
Add Transaction Delay	< 1 second	< 1 seconds	✅ Passed
Receipt Scan to Prediction Time	< 5 seconds (for 720p image)	Avg. 1-2 seconds depending on image quality	✅ Passed
Category Prediction Accuracy	≥ 80% (based on trained local pattern)	100% accuracy with repeated merchants	✅ Passed
Budget Auto-Update Accuracy	100% correct budget deduction/update	Fully accurate across all tested categories	✅ Passed
Chart Rendering Time (Report Page)	< 2 second	< 1 seconds for pie and bar charts	✅ Passed

App Crashes during Operations	0	None observed	✅ Passed
Error Handling Coverage	100% (fallback UI, null checks)	Handled gracefully with validation	✅ Passed

Table 6.1.1 Performance Metrics and Results

6.1.3 Usability Observations

1. Navigation and Layout:

The bottom navigation bar and sliding panels offered intuitive transitions. All major functions were reachable within 2 taps from the home screen.

2. Feedback and Notifications:

Budget warning notifications, toast messages, and form validations improved the user experience.

3. Manual Edit Support:

After OCR scanning, users could adjust extracted data—essential for correcting any mismatches in prediction.

4. Subcategory Display:

While useful for detailed tracking, maintaining subcategory visibility across UI screens added development complexity but resulted in better user control.

6.1.4 Limitations and Observed Constraints

1. Device-Specific OCR Behavior:

Lower-end devices with poor camera quality affected the accuracy of receipt recognition.

2. Data Volume Lag:

Inserting over 1000 transactions into the database showed minor performance lag during report generation, though optimization with indexing and optimized SQL helped mitigate this.

3. Single Device Testing:

As the app is offline-only, cross-device syncing and backup testing were not applicable and not implemented.

4. Limited Prediction Context:

The category predictor works well for recurring merchants or notes but lacks accuracy for one-time purchases or vague descriptions.

6.1.5 Summary

Overall, the application passed all major system testing benchmarks. The performance and stability under offline conditions were solid, and the inclusion of AI-powered categorization and OCR added practical value. The integration of subcategories, budget tracking, and reporting features performed reliably even under moderate data loads.

These testing results validate that the system meets its initial design goals and is ready for real-world deployment with future improvements such as cloud backup, enhanced AI modeling, and multi-device support.

6.2 Testing Setup and Result

This section outlines the configuration of the testing environment, emulator and physical device setup, types of tests performed, test data used, and the actual outcomes. It ensures that all key modules, especially those related to account management, transactions, receipt scanning, and reports—operate as expected under various conditions.

6.2.1 Testing Environment Overview

Component	**Specification / Tool Used**
IDE	Android Studio Giraffe (2022.3.1 Patch 3)
Framework	Flutter SDK 3.19.5
Testing Tools	Flutter Test, Manual Functional Testing, SQLite Viewer
Database Inspection	Android Studio Inspector, DB Browser for SQLite
Version Control	Git (Main Branch only) using GitHub

Table 6.2.1 Testing Environment Overview

6.2.2 Emulator and Device Setup

To ensure compatibility, UI responsiveness, and real-world behavior, the application was tested on both emulator and actual physical devices.

Device Type	Details
Emulator	Pixel 6 Emulator (Android 13, API 33), 1080x2340 screen, 8GB virtual RAM
Physical Device	Honor Magic 4 Pro (Android 13), 12GB RAM, Snapdragon 8 Gen 1

Table 6.2.2 Emulator and Device Setup

Emulator Testing Goals:
Conduct rapid validation for UI layout, component interaction, database integration, and network permissions (for ML Kit OCR).

Physical Device Testing Goals:
Focus on camera handling, receipt image processing, real-time OCR recognition, gesture behavior, and app responsiveness on a high-performance device.

6.2.3 Test Data Setup

To simulate real-world financial activity and verify functionality under different scenarios, custom datasets were inserted into the SQLite database:

Data Type	Sample Values
Accounts	Cash Wallet, CIMB Bank, Touch 'n Go Wallet, Tabung Haji
Categories/Subcategories	Food (Lunch, Dinner), Transport (Car, Bus), Bills (Electric, Water)
Transactions	200 entries of income, expense, and transfer (diverse types and dates)
Budgets	Monthly budget for Food, Transport, Entertainment, and Bills
Receipts (for OCR)	10 real photo receipts taken under varying lighting and text conditions

Figure 6.2.3 Test Data Setup

6.2.4 Functional Testing Results

Testing was conducted on major application modules. The outcomes are summarized below:

Feature	Expected Outcome	Result	Remarks
App Launch	Splash screen loads, main dashboard appears without crash	✅ Passed	Smooth even in offline mode
Account Creation/Editing	New accounts saved, color and type displayed correctly	✅ Passed	No data duplication
Add Category/ Subcategory	All categories saved; subcategories linked and displayed properly	✅ Passed	Dynamic dropdowns work well
Budget Setup and Monitoring	Budgets applied by category; warnings on limit exceed	✅ Passed	Alert shown on overspending
Add Transaction (Income/Expense /Transfer)	Amount, account, category updates reflected in DB and UI	✅ Passed	Balanced transfers verified
OCR Receipt Scanning	Recognized amount, merchant, and optional note from image	✅ Passed (minor edits)	Preprocessing helps with image clarity
Auto-Categorization Prediction	Predicts category from merchant/note data	✅ Passed	Fallback to manual edit available
Monthly Report Generation	Displays correct charts with category-wise summary	✅ Passed	Handled null values to avoid crash
Subcategory Visibility	Visible in transaction, budget, and report screens	✅ Passed	UI designed to display sub-layer hierarchy
Data Sync and Offline Usability	Full app usability without cloud services	✅ Passed	All features function offline as intended

Figure 6.2.4 Functional Testing Results

6.2.5 Key Observations and Notes

1. OCR Testing: Most receipts worked well, especially with good lighting. Some required manual edits due to unclear print or unusual formatting.

2. Null and Edge Handling: Special attention was given to avoid null-related crashes in charts and reports using default values and fallback logic in SQL queries.

3. Subcategory Complexity: Required nested UI elements and database linkage logic for accurate rendering, particularly when fetching filtered report data.

6.2.6 Summary

All functional and visual components of the financial management application passed testing criteria across emulator and physical devices. The SQLite database schema, offline-first architecture, and dynamic UI logic proved stable and effective. The testing approach highlighted the importance of preprocessing for OCR and precise handling of subcategory data in multi-layer modules such as transactions, budgets, and reports.

6.3 Project Challenges

This section outlines the major challenges encountered during the development and testing of the financial management application. These challenges involved technical complexities, data handling, and interface integration that required careful planning and iterative solutions.

6.3.1 Dynamic Transaction Logic with Account and Budget Handling

Challenge:

Managing various transaction types (Income, Expense, Transfer) required precise logic to update account balances and budget limits appropriately. Incorrect implementation could lead to mismatched balances or over/under-budgeting.

Resolution:

- Developed a transaction handler that dynamically updates related account and budget values.
- Implemented logic to differentiate handling for single-account (income/expense) and dual-account (transfer) operations.
- Ensured rollback mechanisms for transaction edits and deletions to maintain data accuracy.

6.3.2 Subcategory Implementation Across Multiple Screens

Challenge:

Supporting subcategories introduced added complexity across multiple application components including the transaction screen, budget setup, and report generation.

Resolution:

- Built a dedicated subcategory table linked with parent categories.
- Updated UI to support dynamic subcategory dropdowns and implemented conditional loading logic.
- Designed a custom subcategory view within the budget and report screens to enhance clarity.

6.3.3 OCR Integration and Data Filtering

Challenge:

Text recognition via Google ML Kit [7] often returned excessive and irrelevant data, which made it difficult to extract meaningful information like merchant name or total amount.

Resolution:

- Applied image preprocessing to enhance text clarity.
- Implemented filtering logic to extract values associated with keywords like "total", "amount", and "merchant".
- Enabled manual editing of auto-filled values to correct inaccuracies from OCR output.

6.3.4 Report Generation from Complex Data Sets

Challenge:

Generating visual reports from inconsistent or sparse transaction data (e.g., missing values) sometimes caused runtime errors or blank charts.

Resolution:

- Incorporated SQL functions like IFNULL and COALESCE to ensure fallback values for missing data.
- Built robust error handling within chart-rendering logic to gracefully display "No data" messages.
- Validated data structures before visualization to prevent application crashes.

6.3.5 Emulator vs. Device Discrepancies

Challenge:

Differences in UI rendering and interactions between the emulator and physical devices (e.g., Honor Magic 4 Pro) led to unexpected layout shifts and gesture handling issues.

Resolution:

- Extensively tested on both platforms to identify and correct layout discrepancies.
- Utilized flexible layout strategies (MediaQuery, Expanded, SafeArea) to adapt UI components across screen sizes.
- Tuned gesture responsiveness and spacing to align with actual device behaviors.

6.3.6 Permission Handling and File Access

Challenge:

Accessing device features like the camera and storage required careful permission management, especially with different Android API behaviors.

Resolution:

- Integrated permission_handler to request and check runtime permissions dynamically.
- Developed user prompts and fallbacks for denied permissions.
- Ensured compatibility across common Android versions during file and image operations.

6.3.7 Time and Scope Constraints

Challenge:

Balancing feature completeness with time limitations was a significant challenge. Advanced features like category prediction and full cloud sync were out of scope due to limited development time.

Resolution:

- Focused on building and refining core functionality first (account, transaction, budget, and reporting).
- Modularized the codebase to allow easy future expansion of postponed features.
- Maintained clean documentation and version tracking for consistent project progress.

6.4 Objectives Evaluation

This section evaluates the extent to which the project achieved its predefined objectives, as outlined during the proposal phase. The financial management application was designed with the aim of helping users track, manage, and analyze their personal finances through an intuitive mobile interface.

Objective	**Evaluation**
1. Allow users to manage multiple accounts	✅ *Achieved.* Users can add, update, and delete multiple accounts (e.g., Cash, Bank, eWallet) with customizable names, balances, and colors.
2. Enable income, expense, and transfer tracking	✅ *Achieved.* The app supports all three transaction types, including transfer logic between accounts, with accurate balance calculations.
3. Implement a categorization system with subcategories	✅ *Achieved.* Categories and subcategories are fully integrated into transaction entries, budgeting, and reporting.
4. Support custom budget setting and tracking	✅ *Achieved.* Users can define monthly budgets for specific categories and monitor current and previous spending performance.
5. Generate visual reports and summaries of transactions	✅ *Achieved.* Bar charts and pie charts summarize expenses by category and account, with filterable options for time periods.
6. Implement a receipt scanning feature using OCR	✅ *Achieved.* Google ML Kit is integrated to scan receipt images and extract relevant data like amount and merchant name.
7. Allow offline usage with local data storage	✅ *Achieved.* Data is stored locally using sqflite, with no internet or cloud sync required.
8. Provide basic user profile and settings customization	✅ *Achieved.* Users can update their profile and manage app preferences such as budget notifications.
9. Ensure a responsive and user-friendly interface	✅ *Achieved.* The app is designed using Flutter with adaptive layout widgets, ensuring a smooth user experience across screen sizes.

10. Use structured and maintainable code with version control	✅ *Achieved.* The app was developed using modular architecture with provider for state management and Git for version tracking.

Table 6.4.1 Objectives Evaluation

Overall Assessment

All core objectives were successfully implemented and tested. While some advanced enhancements (e.g., predictive categorization, cloud sync, goal setting) were excluded due to time constraints, the project delivered a complete, functional, and extensible financial management application.

CHAPTER 7:
CONCLUSION AND FUTURE WORK

7.1 Conclusion

This Final Year Project was initiated to design and develop a mobile-based financial management application that empowers users to manage their daily financial activities conveniently and efficiently — even in offline environments. The objective was to create a comprehensive personal finance tracking solution incorporating features such as account management, categorized transactions, budget monitoring, and receipt-based input automation. The entire development followed a systematic methodology. Chapter 3 detailed the architectural and behavioral aspects of the system including use case, activity flow, and layered design. Chapter 4 outlined the structural design and modular components comprising the UI Layer, Logic Layer, Local Services, and External Libraries. Subsequently, implementation was carried out using the Flutter [4] framework, and SQLite [5] was utilized for local data persistence. The system was built to be fully functional without any reliance on cloud services or internet connectivity, addressing a key real-world pain point for users in data-restricted or privacy-sensitive environments.

The application now supports the following major functionalities:

- User-friendly dashboard with summarized financial overview.
- Ability to add, update, and archive multiple accounts.
- Transaction handling for income, expenses, and transfers.
- Category and subcategory assignment for better classification.
- Monthly budget management with current vs. historical comparison.
- Receipt scanning using Google ML Kit's OCR feature to assist in faster input and auto-categorization.
- Reporting and visual analytics to present monthly spending trends.
- A setting screen for basic customization and user profile handling.

Despite a wide array of completed features, the project did encounter notable development challenges. For instance, integrating a category–subcategory system required careful coordination across multiple modules (e.g., transaction input, budgeting, reporting), and creating a dedicated UI for managing subcategories. In addition, developing logic to properly synchronize transactions with account balances and budget utilization, along with robust error handling in SQL queries for chart generation, was technically demanding.

Nonetheless, these challenges were effectively addressed, resulting in a stable and maintainable codebase. Testing on an actual physical device (Honor Magic 4 Pro) ensured that the system performed reliably in real-life usage scenarios.

In conclusion, the project has successfully met its primary goal: to deliver an intuitive and practical financial management application that operates without internet dependency. It serves as a strong proof of concept and a functional tool that could benefit a wide range of users in managing their personal finances more effectively.

7.2 Future Work

While the core objectives of the application have been achieved, there remains significant potential for enhancement and scalability. The following points outline promising future directions:

7.2.1 Cloud Synchronization and Multi-Device Support

Currently, all data resides locally on the user’s device. A future version can integrate cloud services (e.g., Firebase Firestore or Google Drive backup) to enable seamless synchronization across multiple devices. This will also allow data recovery in cases of device failure or replacement.

7.2.2 Advanced AI-Powered Analytics

Introducing AI/ML-based predictive features would increase the application’s intelligence. For instance, automatic suggestion of categories based on past user behavior, predictive budget setting, or anomaly detection in transactions (e.g., unusually high expenses) could offer proactive financial insights.

7.2.3 Multi-Currency and Localization Support

To expand the application’s user base, future development could support multiple currencies, exchange rate tracking, and language localization, making it adaptable to various countries and regions.

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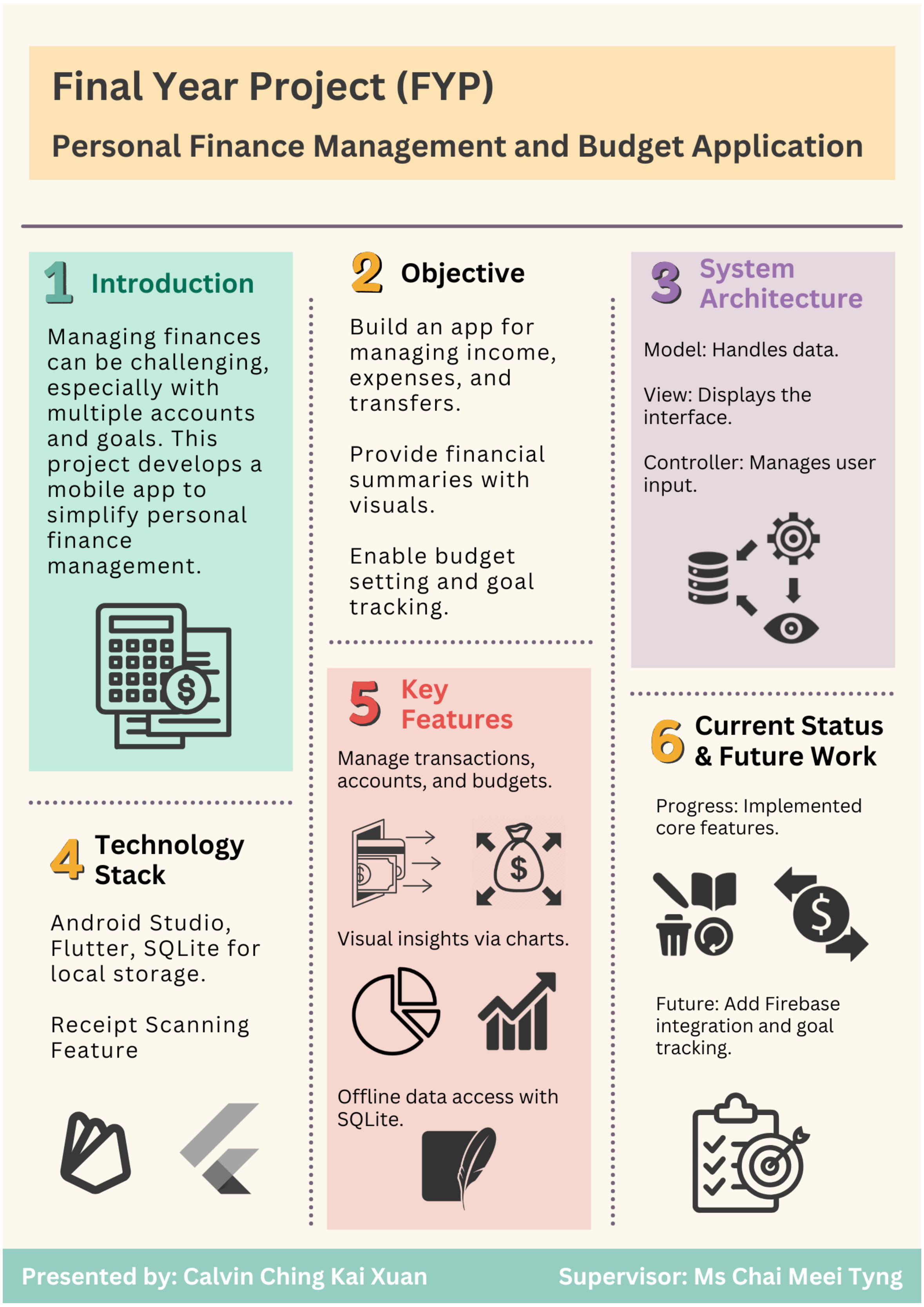
APPENDIX

POSTER



Final Year Project (FYP)

Personal Finance Management and Budget Application

1 Introduction

Managing finances can be challenging, especially with multiple accounts and goals. This project develops a mobile app to simplify personal finance management.

2 Objective

Build an app for managing income, expenses, and transfers.

Provide financial summaries with visuals.

Enable budget setting and goal tracking.

3 System Architecture

Model: Handles data.

View: Displays the interface.

Controller: Manages user input.

4 Technology Stack

Android Studio, Flutter, SQLite for local storage.

Receipt Scanning Feature

5 Key Features

Manage transactions, accounts, and budgets.

Visual insights via charts.

Offline data access with SQLite.

6 Current Status & Future Work

Progress: Implemented core features.

Future: Add Firebase integration and goal tracking.

Presented by: Calvin Ching Kai Xuan **Supervisor: Ms Chai Meei Tyng**