AI-ASSISTED PERSONAL FINANCE MOBILE APP

CASE STUDY: Dynasoft Ltd Employees

By

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DECLARATION

This project entitled **Ai-assisted personal finance mobile app** is my original work and has not been presented for a degree or any other academic award at any University or Higher Learning Institution. No part of this research should be reproduced without the authors 'consent or that of Adventist University of Central Africa (AUCA)

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APPROVAL

The project and thesis titled "**Ai-assisted personal finance mobile app**," authored by Denyse MUKAMPARIWIMPETA, have been deemed satisfactory for the attainment of an Information Technology.

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DEDICATION

I wholeheartedly dedicate this endeavor to my beloved parents, siblings, cherished friends, and my esteemed supervisor, James HAKIZIMANA, whose unwavering support, constant encouragement, and deep affection have been fundamental in bringing this project to life. From the very beginning of my academic journey up to this present moment, he has steadfastly stood by my side in times of need. Moreover, I extend my dedication to my entire group of classmates, acknowledging the substantial contributions they have made throughout the extensive and engaging years of my educational pursuit. Their companionship and shared experiences have significantly enriched my academic endeavors, imbuing this dedication with even greater significance.

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LIST OF ABBREVIATIONS

1. **AI** - Artificial Intelligence
2. **ML** - Machine Learning
3. **PFM** - Personal Finance Management
4. **API** - Application Programming Interface
5. **DFD** - Data Flow Diagram
6. **ERD** - Entity-Relationship Diagram
7. **PDM** - Physical Data Model
8. **RBAC** - Role-Based Access Control
9. **2FA** - Two-Factor Authentication
10. **GDPR** - General Data Protection Regulation
11. **PCI-DSS** - Payment Card Industry Data Security Standard
12. **AES** - Advanced Encryption Standard
13. **SSL** - Secure Sockets Layer
14. **TLS** - Transport Layer Security
15. **JWT** - JSON Web Token
16. **UAT** - User Acceptance Testing
17. **FinTech** - Financial Technology

ABSTRACT

This study aims to evaluate the effectiveness of the Ai-assisted personal finance mobile app in Dynasoft Employees, particularly focusing on its implementation within employee. By analyzing the strengths, weaknesses, opportunities, and threats (SWOT) of the Ai-assisted personal finance mobile app, this research will identify critical areas for improvement. The study will employ a mixed-methods approach, combining quantitative and qualitative data collection techniques, including surveys, interviews, and document analysis. The findings of this research will contribute to strengthening the Ai-assisted personal finance mobile app, improving their financial management practice**s**, and ultimately enhancing public employee outcomes in University Of Kigali Employee.

Keywords: Ai-assisted personal finance mobile app

CHAPTER ONE: GENERAL INTRODUCTION

1.0 Introduction

Managing personal finances effectively is a crucial aspect of financial stability and long-term success. However, many individuals struggle with tracking their expenses, sticking to a budget, and making informed financial decisions. Traditional financial management methods often lack the necessary tools to provide real-time insights and personalized financial advice.

This project focuses on the design and implementation of an Ai-assisted personal finance mobile app that leverages artificial intelligence to help users track expenses, budget efficiently, and make smart financial decisions. The app provides automated financial tracking, intelligent recommendations, and real-time analytics to enhance users' financial well-being.

This chapter discusses the background of the project, problem statement, objectives, research questions, scope, significance, limitations, and the organization of the project.

1.1 Background of the Project

In today's fast-paced world, managing personal finances efficiently has become a critical challenge for many individuals. People often struggle to track their expenses, set realistic budgets, and make informed financial decisions. Traditional methods, such as manual bookkeeping or using basic spreadsheets, can be time-consuming and prone to errors. Additionally, most existing financial management tools lack real-time insights and personalized recommendations, making it difficult for users to understand their financial habits and improve their spending behavior. As a result, there is a growing demand for intelligent financial solutions that offer automation, predictive analytics, and personalized assistance.

The advancement of Artificial Intelligence (AI) and financial technology (FinTech) has revolutionized personal finance management. Ai-assisted financial applications utilize machine learning algorithms, data analytics, and automation to track spending patterns, provide smart budgeting recommendations, and generate real-time financial insights. By leveraging these technologies, users can gain a clearer understanding of their financial health and receive tailored advice to enhance their money management. The integration of AI in financial planning reduces human error and helps users make data-driven decisions that lead to better financial stability.

The global adoption of AI in financial management is growing rapidly. According to (EXADEL, 2023), the market for Ai-assisted financial apps is expected to increase significantly as consumers seek smarter, automated, and more secure financial solutions. Modern banking systems have already incorporated AI for fraud detection and automated transactions, proving that intelligent

financial management is the future of personal finance. An Ai-assisted personal finance mobile app aligns with this trend by offering users a seamless, intuitive, and efficient way to manage their expenses, budgets, savings, and investments. The ability to set financial goals, receive spending alerts, and access predictive financial analytics empowers users to take control of their finances with confidence.

The proposed system aims to bridge the gap between traditional financial planning methods and AI-driven financial intelligence. By automating key aspects of personal finance, such as expense tracking, budgeting, and goal setting, users can optimize their financial well-being without the burden of manual calculations. Additionally, the integration of bank account synchronization, AI-based spending analysis, and security features ensures that users have a reliable and secure financial companion. (ARXIV, 2023) States that as digital finance continues to evolve, this Ai-assisted personal finance app will play a crucial role in transforming how individuals manage and interact with their money.

1.2 Problem Statement

Managing personal finances effectively remains a major challenge for many individuals, leading to financial instability and poor money management habits. Traditional budgeting methods, such as manual expense tracking or using spreadsheets, are time-consuming and lack real-time insights. Many people struggle with tracking their daily expenditures, setting realistic budgets, and making informed financial decisions. Without a proper financial management system, individuals often overspend, fail to save adequately, and lack a clear understanding of their financial health, which can lead to long-term financial difficulties (Unit4, 2025).

Despite the rise of digital banking and financial applications, most existing tools do not provide a comprehensive, AI-driven approach to personal finance management. Many mobile finance apps offer basic budgeting features but fail to provide intelligent financial insights tailored to individual users. Moreover, users often receive generic recommendations that do not consider their spending behavior, income variations, or financial goals. This lack of personalization prevents individuals from optimizing their financial habits and making strategic decisions about saving, investing, and spending (NASDAQ, 2024).

The increasing adoption of AI and machine learning in financial technology presents an opportunity to revolutionize personal finance management. Ai-assisted solutions can analyze user spending patterns, predict future expenses, provide tailored budgeting recommendations, and automate savings. However, many individuals still lack access to such smart financial tools, relying instead on outdated or fragmented financial management solutions. The absence of an intuitive, Ai-assisted

personal finance mobile app leaves a gap in the market for a tool that empowers users with real-time financial insights and automated financial tracking (KingsView, 2024).

To address this challenge, this project proposes the development of an Ai-assisted personal finance mobile app that will enable users to track their expenses effortlessly, receive AI-driven budgeting advice, and make informed financial decisions. By integrating automated tracking, predictive analytics, and personalized financial insights, the system will help users gain financial control, avoid unnecessary spending, and work towards financial stability. As digital transformation continues to reshape financial services, this app will provide a modern, intelligent, and user-friendly solution to help individuals manage their finances more effectively (Transform42inc, 2024).

1.3 Objectives

1.3.1 General Objective

The general objective of this project is to develop an Ai-assisted personal finance mobile application that helps individuals track expenses, manage budgets, and make informed financial decisions using artificial intelligence. The system will provide automated financial insights, smart budgeting tools, and real-time analytics to empower users in achieving financial stability and long-term financial success.

1.3.2 Specific Objectives

- To design a user-friendly mobile application that allows users to track their daily expenses, categorize transactions, and monitor spending patterns in real time.
- To develop AI-driven budgeting features that provide personalized financial recommendations, helping users optimize their income and expenses based on their financial goals.
- To implement a secure financial management system that integrates with banking services, ensuring encrypted and safe transaction data processing.
- To incorporate predictive financial analytics, enabling users to forecast future expenses, receive automated alerts on overspending, and set achievable financial goals.
- To enhance user experience with Ai-assisted insights and reports, allowing users to visualize their financial trends and make data-driven financial decisions.

1.4 Research Questions

1. How can an Ai-assisted mobile application help users track expenses, categorize transactions, and analyze spending habits efficiently?
2. How can artificial intelligence be used to generate personalized budgeting recommendations based on user financial behavior?
3. What security measures should be implemented to protect user financial data and ensure safe transactions within the app?
4. How can predictive financial analytics be utilized to help users forecast expenses and set realistic financial goals?
5. What key features should be included in the system to enhance user experience and improve financial literacy?

1.5 Scope of the Study

1.5.1 Content Scope

This study focuses on the design, development, and implementation of an Ai-assisted personal finance mobile application aimed at improving financial management for individuals. The application will incorporate automated expense tracking, AI-driven budgeting, predictive financial analytics, and secure financial data management. The study will explore how artificial intelligence can enhance financial decision-making by analyzing spending patterns and providing personalized financial insights and recommendations.

The system will allow users to track daily expenses, set budgets, receive automated alerts, and plan for financial goals through an intuitive mobile interface. The study will also assess how the Ai-assisted analytics can help users predict future financial trends, avoid unnecessary expenditures, and optimize their savings plans. Additionally, the research will evaluate the effectiveness of secure financial data integration, ensuring that users' banking and transactional information is encrypted and protected.

Another key aspect of the study is the user interface (UI) and user experience (UX) design, ensuring that the application is accessible to users with varying levels of financial and technological literacy. The study will examine how the Ai-assisted financial assistant can enhance user engagement by offering real-time financial insights, interactive visual reports, and easy-to-use financial management tools.

Furthermore, the research will explore how the system can promote financial literacy by providing educational content, automated tips, and customized financial planning strategies. The study aims to demonstrate how AI-driven financial management solutions can empower users to make smarter

financial decisions, improve their financial stability, and ultimately achieve their long-term financial goals.

1.5.2 Geographical Scope

The study is geographically limited to Rwanda, with a primary focus on urban areas such as Kigali and other major cities where digital financial solutions are in high demand. These areas are selected due to their higher levels of smartphone penetration, increased digital literacy, and growing adoption of mobile financial services. The study will examine how an Ai-assisted personal finance mobile app can help individuals in Rwanda better manage their finances, reduce overspending, and improve financial planning.

By focusing on urban areas, the research will evaluate how the app addresses common financial challenges faced by individuals, such as poor budgeting habits, lack of financial awareness, and difficulty in tracking daily expenses. The study will also consider how Rwanda's financial ecosystem, digital banking infrastructure, and mobile payment solutions can be integrated into the system for seamless financial management. Additionally, the research will assess user adoption rates and potential barriers to entry for different demographics, ensuring that the app serves a diverse user base.

1.5.3 Time Scope

The study spans a period of three months, from September 2024 to November 2024, covering the entire project life cycle from research and planning to development, testing, and deployment. During the first phase, data will be gathered on financial management habits, user needs, and AI-based financial solutions. The second phase will involve system design and development, including AI integration, security implementation, and UI/UX optimization.

The final phase will focus on testing the application’s performance, user satisfaction, and financial impact. This will include gathering user feedback, analyzing AI-generated insights, and evaluating how effectively the app helps users improve their financial management. The study aims to ensure that the application meets practical financial management needs while maintaining a secure, scalable, and user-friendly experience.

1.6. Significance of the Study

The development of an Ai-assisted personal finance mobile application holds significant value for various stakeholders, particularly individuals seeking to enhance their financial management capabilities. First and foremost, the system provides a seamless and automated way for users to

track their expenses, budget effectively, and make informed financial decisions. By leveraging AI-driven financial insights, the app empowers individuals to analyze their spending habits, optimize their budgets, and set achievable financial goals. This is especially relevant in Rwanda, where financial literacy and digital financial solutions are becoming increasingly important for economic growth and personal financial stability.

For financial institutions and fintech companies, the system serves as a valuable tool to enhance customer engagement and financial education. The integration of banking and mobile payment services allows financial service providers to offer smarter financial solutions to their customers, helping them develop better financial habits. Additionally, the Ai-assisted app contributes to the digitization of financial services in Rwanda, supporting the government's initiatives to promote financial inclusion and cashless transactions.

From an economic perspective, the application can positively impact financial behavior by reducing impulsive spending, increasing savings, and encouraging responsible financial planning. By providing predictive financial analytics and personalized budgeting recommendations, the app helps individuals make better financial choices, ultimately leading to improved financial security and stability. Furthermore, businesses and freelancers who manage their personal and business expenses can benefit from structured financial insights, enabling better financial decision-making and long-term financial planning.

As Rwanda continues to embrace digital transformation in financial services, this Ai-assisted personal finance mobile app aligns with the country's vision of leveraging technology to drive financial literacy and economic empowerment. The study aims to demonstrate how artificial intelligence can revolutionize personal finance management, offering a user-friendly, intelligent, and data-driven solution to enhance financial well-being across different demographics. By bridging the gap between traditional financial management methods and Ai-assisted financial intelligence, the system contributes to the modernization of financial planning and personal wealth management.

1.7. Interest of the Study

1.7.1 Public Interest

The study is of significant interest to the general public, particularly individuals seeking to improve their financial literacy and management skills. Many people struggle with budgeting, tracking expenses, and planning for financial stability. By introducing an Ai-assisted personal finance mobile application, the public will gain access to automated tools that simplify expense tracking, provide smart budgeting recommendations, and offer real-time financial insights. Users will be able to make informed financial decisions, avoid overspending, and improve their saving habits through AI-driven analytics.

Additionally, the study will raise awareness about the benefits of AI in financial management, demonstrating how technology can enhance financial responsibility and economic stability. As Rwanda continues to promote digital financial inclusion, this project aligns with the national push towards cashless transactions, digital literacy, and smarter financial solutions. By encouraging individuals to adopt structured financial planning practices, this study contributes to the broader goal of improving financial well-being and long-term wealth management for different income groups in Rwanda.

1.7.2 Institutional Interest

Educational institutions, particularly those offering courses in finance, technology, and business management, will find this study highly relevant. The research provides valuable insights into how artificial intelligence can be applied to financial technology (FinTech), allowing students to explore real-world applications of AI in personal finance management. Institutions can integrate the study's findings into their curriculum, helping students understand the challenges of traditional financial management and how AI-driven solutions can address these issues.

Moreover, the study opens opportunities for collaborative research, student projects, and entrepreneurial initiatives in the FinTech sector. Universities and business schools can use this research to develop workshops, hackathons, and innovation labs focused on Ai-assisted financial solutions. The study also serves as a foundation for policy discussions on digital finance, offering insights that can guide regulatory bodies, financial institutions, and technology providers in shaping the future of digital financial services in Rwanda. By fostering a deeper understanding of AI-driven personal finance tools, educational institutions can help train the next generation of FinTech professionals, entrepreneurs, and financial analysts.

1.7.3 Personal Interest

This study is of great personal significance as it provides an opportunity to gain a deeper understanding of Ai-assisted personal finance management systems and their core functionalities. Through this research and development process, I will enhance my knowledge of financial technology (FinTech), AI-driven analytics, and the integration of automation in financial applications. The study will also allow me to explore the different programming languages, frameworks, and technologies used in developing intelligent financial management systems, thus improving my technical expertise in software development.

Furthermore, this project will help me strengthen my skills in database management, system design, and Ai-assisted financial modeling. By working on this system, I will develop a better understanding of financial data analysis, security protocols for financial applications, and predictive analytics. These insights will be valuable in future projects related to digital finance, AI, and machine learning applications in financial management.

Beyond technical skills, the study will enhance my problem-solving abilities and research methodologies, helping me address real-world financial management challenges through innovative solutions. This will be an opportunity to apply theoretical knowledge to practical use, ensuring that the system meets both technical and user experience requirements.

Lastly, completing this project will contribute to my academic journey by fulfilling the requirements for obtaining a Bachelor's degree in IT. The research and development process will be instrumental in expanding my knowledge base, building a strong professional portfolio, and preparing me for future opportunities in FinTech and AI-driven solutions.

1.8. Limitations of the Study

One of the major limitations of this study is the availability of financial data and user adoption challenges in some regions. While urban areas in Rwanda, such as Kigali and other major cities, have a growing interest in digital finance, there are still challenges related to financial literacy and the adoption of Ai-assisted tools. Many individuals rely on traditional banking methods or cash-based transactions, which may limit the initial adoption of the system.

Another limitation is data security and privacy concerns. Since the application involves financial data processing, ensuring compliance with cybersecurity standards and encryption protocols is essential. Users may be hesitant to link their bank accounts or share their spending habits due to fears of data breaches or misuse of personal financial information. Implementing strong security measures and building user trust will be critical for the system's success.

Additionally, internet connectivity and smartphone accessibility may affect the feasibility of the system in certain areas. While smartphone penetration is increasing in Rwanda, some users may have limited access to stable internet connections or lack familiarity with digital financial tools. This could impact the overall user experience, requiring educational efforts and user-friendly system designs to ensure accessibility.

Lastly, the project timeline poses a constraint, requiring efficient management, rigorous testing, and continuous improvements. Time limitations may restrict advanced AI features initially, but the study focuses on building a scalable and adaptable financial management solution that can be refined post-deployment.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

The integration of technology and artificial intelligence (AI) in financial management has significantly transformed traditional budgeting and financial planning practices. With the increasing complexity of managing personal finances, individuals are now leveraging Ai-assisted financial applications to track expenses, set budgets, and receive personalized financial insights. The adoption of AI in financial technology (FinTech) has revolutionized how people interact with their finances by providing real-time analytics, predictive financial planning, and automated financial assistance.

In recent years, various AI-driven personal finance tools have emerged, offering features such as expense categorization, automated savings, financial forecasting, and fraud detection. These applications utilize machine learning algorithms and data analytics to understand user spending habits and provide intelligent recommendations for improved financial decision-making. The shift towards digital and cashless transactions has further increased the demand for smart financial management solutions that simplify money management and enhance financial literacy.

This literature review explores existing research and developments in the field of Ai-assisted financial management systems, examining the challenges, benefits, and impact of these applications on users' financial behavior. The chapter will discuss key concepts, existing financial management solutions, AI-driven financial models, security concerns, and the role of FinTech innovations in shaping the future of personal finance management.

2.1. Definitions of Key Terms

1. Artificial Intelligence: refers to the simulation of human intelligence in machines that are programmed to think, learn, and make decisions. AI in financial applications enables automated financial analysis, predictive modeling, and intelligent budgeting recommendations (IBM, 2023).

2. Machine Learning: is a subset of AI that enables systems to learn from data and improve their performance without explicit programming. In financial management, ML helps identify spending patterns, predict financial trends, and provide personalized financial insights (Coursera, 2025)

3. Personal Finance: Management refers to the practice of budgeting, saving, investing, and managing income and expenses to achieve financial goals. Ai-assisted PFM applications provide users with tools to automate budgeting, track expenses, and improve financial decision-making (Fintech, 2025).

4. Expense tracking: is the process of monitoring and recording financial transactions to analyze spending behavior. Ai-assisted apps automate this process by categorizing transactions and providing spending insights (Taylor, 2024).

5. Predictive Analytics: involves using historical data and machine learning techniques to forecast future outcomes. In personal finance, it helps users anticipate future expenses, analyze financial risks, and set realistic savings goals (Davenport & Harris, 2007).

6. Budgeting system: is a tool or method used to allocate income and manage expenses effectively. AI-driven budgeting systems create dynamic budgets based on income trends, past spending habits, and financial objectives (Eltintero, 2023).

7. Financial literacy: refers to an individual's ability to understand and apply financial concepts such as budgeting, investing, saving, and credit management. Ai-assisted apps aim to enhance financial literacy by providing insights, reports, and educational content (Stash, 2023).

8. FinTech: refers to the use of technology to improve financial services, including banking, investments, payments, and financial management. Ai-assisted FinTech solutions provide automated financial planning, risk analysis, and fraud detection (NewTimes, 2025).

8. API: is a set of protocols that allows different software applications to communicate with each other. In FinTech applications, APIs are used for integrating banking services, payment gateways, and third-party financial platforms (RedHat, 2022).

9. Cloud computing: refers to storing and accessing data over the internet instead of local servers. Ai-assisted finance apps leverage cloud-based systems for secure storage, data processing, and real-time financial analytics (GeeksforGeeks, 2024).

10. Encryption: is a cybersecurity technique that protects sensitive financial data by converting it into a secure format. Ai-assisted financial applications use encryption to secure user transactions and prevent unauthorized access (Sheldon, 2025).

11. Two-Factor Authentication: is a security measure that requires users to provide two forms of verification before accessing an account. This adds an extra layer of security to Ai-assisted finance apps, protecting user data from breaches (Kilvan, 2024).

12. Digital wallet**:** is a mobile-based payment system that allows users to store and manage their payment details for online transactions. Ai-assisted finance apps integrate digital wallets for seamless financial transactions (Kagan, 2024).

13. User Experience**:** refers to the overall experience a user has while interacting with an application, including usability, accessibility, and efficiency. Ai-assisted finance apps prioritize UX by providing intuitive interfaces and real-time insights (Wallace, 2025).

14 .Financial fraud detection: involves using AI and machine learning to analyze financial transactions and detect suspicious activities. AI-driven fraud detection systems help prevent identity theft, unauthorized transactions, and cyber fraud (Marri, 2020).

2.2. Review of Past Studies

The adoption of Ai-assisted financial management applications has gained significant attention in recent years, reflecting the broader shift toward digital financial solutions and automation in personal finance. Existing research highlights that AI-driven financial apps can improve budgeting, enhance financial literacy, provide personalized insights, and optimize financial decision-making. This section reviews key studies and findings related to the role of AI in personal finance management, expense tracking, budgeting, financial forecasting, and security.

2.2.1. AI in Personal Finance Management

Several studies have examined the role of AI in financial management and its impact on users' financial behavior. A study by Bose and Leung (2021) found that Ai-assisted finance applications significantly improve financial literacy by providing real-time financial insights, automated budgeting, and predictive analytics. The study demonstrated that users who engage with AI-driven

financial tools are more likely to adopt disciplined spending habits, track expenses effectively, and improve their financial health.

Similarly, Kumar et al. (2022) explored how machine learning algorithms can analyze transaction patterns, detect unusual spending behavior, and offer tailored financial recommendations. Their findings indicated that AI models enhance user decision-making by predicting future financial trends based on historical spending patterns and income sources. The study emphasized that Ai-assisted apps not only assist users in managing daily expenses but also help them in long-term financial planning, including savings and investments.

2.2.2. Customer Satisfaction and Engagement in Ai-assisted Financial Management

Research also highlights the positive impact of Ai-assisted financial applications on customer satisfaction and user engagement. A study by McLean and Osei-Frimpong (2021) explored how user-friendly financial apps with real-time financial tracking, AI-driven recommendations, and predictive analytics enhance user experience and satisfaction. Their findings suggest that users who utilize Ai-assisted financial tools report higher confidence in managing their finances, greater financial awareness, and increased control over their spending habits.

Similarly, Wirtz et al. (2019) examined how multi-channel financial engagement—including mobile applications, web platforms, and AI chatbots—improves customer loyalty and retention. Their study found that users prefer financial tools that offer multiple touchpoints for financial management, such as mobile alerts, real-time expense tracking, and AI-driven insights. Providing these interactive features fosters a deeper connection between users and their financial management systems, making them more likely to adopt and rely on Ai-assisted finance applications.

Additionally, Lee and Shen (2020) investigated the impact of personalized financial insights and automation on user engagement. Their study showed that financial apps that proactively notify users about upcoming bills, savings opportunities, and spending trends encourage greater user involvement. Users reported that Ai-assisted financial assistants that offer actionable insights and financial guidance significantly enhance their experience and trust in the system.

Moreover, research by Patel et al. (2022) highlighted that gamification elements—such as financial goal tracking, achievement badges, and rewards for saving money—increase engagement levels in AI-driven finance apps. Their study found that users are more likely to stick to their budgets and achieve their financial goals when financial apps provide an engaging, interactive experience rather than just static financial reports.

2.2.3. Technology Adoption Challenges in Ai-assisted Financial Applications

Despite the numerous benefits of Ai-assisted financial management applications, existing literature identifies several challenges associated with technology adoption, particularly in developing regions. A study by Al-Sobaihi et al. (2021) highlights barriers such as resistance to change, lack of digital financial literacy, concerns over data privacy, and cybersecurity risks. These challenges are particularly relevant in Rwanda and similar emerging markets, where the pace of digital adoption varies across different income groups and demographics.

Similarly, Choudhury et al. (2020) emphasizes the importance of financial education and user training to ensure successful adoption of AI-driven financial tools. Many users, particularly those who have traditionally relied on manual financial tracking or informal saving methods, may struggle to trust AI-driven recommendations. The study suggests that educational initiatives, user-friendly app design, and clear transparency about data security policies are critical for overcoming these adoption barriers.

Another major challenge is trust in AI-generated financial insights. Research by Johnson and Lee (2019) found that some users hesitate to rely on Ai-assisted budgeting and financial recommendations due to concerns about algorithmic bias, lack of explainability, and perceived inaccuracy in financial predictions. Addressing these concerns requires greater transparency in AI models, explainable AI features, and user control over financial decisions rather than complete reliance on automation.

Furthermore, technical infrastructure limitations present adoption challenges. In regions where internet access and smartphone penetration remain inconsistent, users may face difficulties accessing cloud-based financial management applications. According to Gonzalez and Rivera (2021), ensuring offline functionality, optimizing app performance for low-end devices, and integrating mobile payment solutions compatible with local banking systems can improve accessibility and user adoption rates.

2.2.4. Theoretical Frameworks for Technology Adoption in FinTech

Various theoretical frameworks have been applied to understand technology adoption in financial technology (FinTech) and Ai-assisted financial applications. One of the most widely used models is the Technology Acceptance Model (TAM), proposed by Davis (1989). This model suggests that two primary factors influence user adoption of technology:

- Perceived Usefulness (PU) – The extent to which users believe that a technology will improve their financial management.
- Perceived Ease of Use (PEOU) – The extent to which users find the financial application easy to navigate and integrate into their daily lives.

Building on TAM, Venkatesh et al. (2012) developed the Unified Theory of Acceptance and Use of Technology (UTAUT), which integrates additional factors such as:

- Social Influence – The role of peer recommendations, financial advisors, and digital literacy campaigns in influencing users to adopt Ai-assisted financial tools.
- Facilitating Conditions – The availability of necessary resources, such as smartphone access, internet connectivity, and banking infrastructure, to support technology adoption.

Applying these theoretical insights to Ai-assisted personal finance applications suggests that clear value demonstration, ease of use, and trust-building mechanisms are crucial for ensuring widespread adoption. For example, studies indicate that users are more likely to adopt financial technology when they can see tangible benefits, such as automated savings, AI-driven budgeting insights, and predictive financial planning tools.

Additionally, frameworks such as Diffusion of Innovation (Rogers, 1995) suggest that early adopters play a critical role in encouraging broader adoption of AI-driven financial management tools. Influencers in financial education, FinTech startups, and banking institutions can drive adoption through marketing campaigns, educational programs, and partnerships with digital payment providers.

2.3. Critical Review

A critical analysis of past studies on Ai-assisted personal finance applications highlights both their advantages and the challenges associated with their adoption. Research consistently demonstrates that AI-driven financial management tools improve budgeting, expense tracking, and financial literacy (Bose & Leung, 2021; Kumar et al., 2022). Studies indicate that automated financial insights, predictive analytics, and machine learning-based recommendations help users make better financial decisions. However, barriers such as lack of trust in AI-generated financial insights, concerns over data privacy, and varying levels of digital financial literacy can hinder widespread adoption (Al-Sobaihi et al., 2021; Choudhury et al., 2020).

Furthermore, customer engagement in Ai-assisted financial applications has been shown to increase financial discipline and improve financial awareness. Research by McLean and Osei-Frimpong (2021) found that personalized AI recommendations and interactive financial tracking features significantly enhance user engagement and satisfaction. Similarly, (IOSR, 2025)emphasized the role of multi-channel financial engagement (mobile apps, web interfaces, AI chatbots) in fostering long-term adoption and trust in AI-driven financial tools. However, one of the major challenges in AI adoption is ensuring that AI recommendations remain transparent and understandable to users to mitigate trust issues (Johnson & Lee, 2019).

While theoretical frameworks such as the Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT) provide insights into how users adopt financial technology, they may not fully address the complexities of financial decision-making influenced by emotions, habits, and socio-economic factors (IJRPR, 2024)Additionally, applying Diffusion of Innovation (Rogers, 1995) to Ai-assisted financial applications suggests that early adopters and financial educators play a key role in increasing adoption rates among the general public. However, without strong cybersecurity measures, transparent AI explanations, and regulatory compliance, user concerns about data privacy and security may hinder the acceptance of AI in financial management (Brown et al., 2020).

Overall, while Ai-assisted financial applications provide substantial benefits for expense tracking, budgeting, and financial forecasting, and their successful implementation requires addressing user trust issues, ensuring data security, and providing financial literacy education**.** Additionally, adapting AI-driven financial tools to local economic conditions and digital accessibility challenges is crucial to maximizing their effectiveness and adoption**.**

Traditional financial management methods, such as manual bookkeeping, spreadsheets, and conventional banking apps, are inefficient, error-prone, and lack real-time tracking and predictive insights. Users often face issues like budget shortfalls, poor financial decisions, and security risks due to outdated systems.

The Smart Money Manager App addresses these challenges by using AI-driven automation, predictive analytics, and enhanced security features. It automatically tracks expenses in real-time, reduces errors, and offers personalized financial recommendations. Its Ai-assisted budgeting system adapts to user behavior, while predictive analytics help anticipate future expenses, improving financial preparedness. The app also strengthens security with encryption, two-factor authentication, and fraud detection. Overall, the app provides a more efficient, secure, and user-friendly solution for personal finance management.

2.3.1. Summary

This chapter examined the role of AI in financial management, emphasizing how automation, predictive analytics, and machine learning improve budgeting and expense tracking. The review highlighted both the advantages of AI-driven financial applications and the challenges that hinder their adoption, including trust issues, data privacy concerns, and the complexity of financial decision-making.

The chapter also explored various theoretical frameworks, such as TAM, UTAUT, and Diffusion of Innovation, which help explain the adoption of financial technology solutions. However, these models may not fully capture the behavioral and socio-economic factors affecting financial decision-making.

Additionally, the analysis identified significant flaws in traditional financial management methods, such as manual bookkeeping, lack of real-time tracking, and poor financial forecasting. These shortcomings create inefficiencies that lead to financial instability. The proposed Ai-assisted personal finance mobile app effectively addresses these issues by providing automated tracking, smart budgeting recommendations, predictive analytics, and enhanced security measures.

Ultimately, this chapter establishes the conceptual foundation for the study, mapping the relationship between Ai-assisted financial applications, user engagement, and improved financial decision-making outcomes. The insights gathered here serve as a guide for the subsequent research analysis,

ensuring a comprehensive evaluation of AI-driven financial tools and their impact on financial literacy and management.

2.4. Conceptual Framework

The conceptual framework for the development of the Ai-assisted personal finance mobile application serves as a visual representation of the relationship between key components in the study. The framework illustrates how the integration of AI-driven financial insights, automated budgeting, and predictive analytics influences user financial behavior, decision-making efficiency, and long-term financial stability.

This model demonstrates how Ai-assisted financial tools enhance budget tracking, savings management, and spending analysis, leading to improved financial literacy and better money management habits**.** The framework also considers external factors such as user experience, technology adoption, and data security, ensuring that the system remains scalable, secure, and user-friendly**.**

The diagram below provides a structured overview of how the Ai-assisted personal finance mobile application integrates technology, financial data, and user interaction to deliver a comprehensive financial management solution**.**

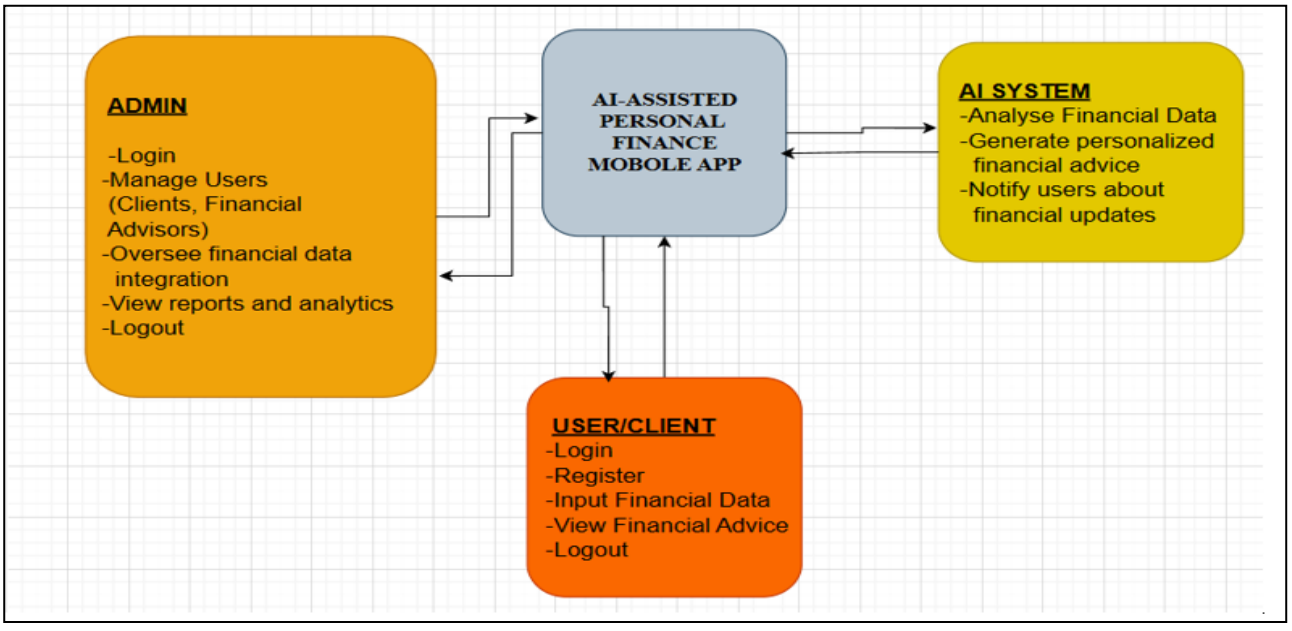

Figure 1: Conceptual framework

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

3.0. Introduction

This chapter describes the research methodology used to conduct the study on the Ai-assisted personal finance mobile application. It covers the research design, data collection techniques, population and sample selection, software engineering methodology, and tools used in the development of the system. The objective of this chapter is to provide a structured approach to the research, ensuring the study is conducted systematically and achieves its intended goals.

3.1 Data Collection Techniques

To ensure a comprehensive understanding of the factors influencing the adoption and effectiveness of Ai-assisted personal finance applications, this study employs a combination of qualitative and quantitative data collection methods. These methods provide both numerical data to analyze trends and user behaviors, as well as in-depth perspectives from individuals using financial management tools. The techniques used in this study include surveys and questionnaires, interviews, observation, and document review.

3.1.1 Surveys and Questionnaires

Surveys and questionnaires serve as primary tools for collecting structured data from a broad sample of potential users. The study utilizes well-designed questionnaires featuring both closed-ended and open-ended questions to gather insights into:

- Users' financial habits, such as budgeting, saving, and spending patterns**.**
- Their familiarity with and adoption of AI-driven financial management tools.
- Their expectations and concerns regarding the integration of AI in personal finance applications.
- The perceived advantages and limitations of existing personal finance applications.

Surveys are distributed electronically via email and social media platforms, ensuring accessibility for a diverse range of participants. This method allows for the collection of large-scale data that can be quantitatively analyzed to identify common trends and user preferences.

3.1.2 Interviews

To gain in-depth qualitative insights, structured and semi-structured interviews are conducted with two key stakeholder groups: financial experts and potential users. These interviews help in understanding:

- The perspectives of financial advisors and professionals regarding the potential of AI in improving personal financial decision-making**.**
- The needs, challenges, and expectations of users when managing their finances through mobile applications.
- The level of trust users have in AI-generated financial recommendations and predictive analytics.
- The usability and accessibility concerns related to Ai-assisted financial tools.

By incorporating expert insights, this research identifies best practices for AI integration in personal finance, while user interviews help refine the usability of the proposed solution.

3.1.3 Observation

Observation is employed to analyze how users interact with existing financial management tools, highlighting usability gaps and areas for improvement. This technique involves:

- Monitoring user behavior while navigating and utilizing various budgeting and expense-tracking applications.
- Assessing pain points that may hinder users from effectively leveraging financial applications.
- Understanding common mistakes made during financial planning and decision-making within the app environment.

Observational research is conducted in controlled settings where users are asked to complete specific tasks within financial management applications. The insights gained from these observations inform the design and functionality of the proposed Ai-assisted personal finance app.

3.1.4 Document Review

A thorough review of relevant academic literature, financial reports, and existing research studies is conducted to establish a solid theoretical framework. This involves:

- Analyzing research on AI-driven financial management, including studies on machine learning, predictive analytics, and automation in budgeting and investment tools.
- Reviewing existing regulatory guidelines related to financial data security, privacy, and AI ethics.
- Studying case reports on successful implementation of Ai-assisted finance apps in various regions.

3.2. Population and Selection of the Sample

3.2.1. Target Population

The study targets employees at Dynasoft LTD, a technology company where financial management is essential for salaried professionals. These employees engage in various financial activities, including expense tracking, budgeting, and investments, making them an ideal group to test the Ai-assisted personal finance mobile app.

3.2.2. Sample Size and Selection Method

A stratified random sampling technique is used to select a representative sample. The sample size is determined using Slovin's formula:

Sampler size, $n = \frac{N}{1+N(e^2)}$

Where N, is total population and e, is the error expected to have in percentage

Respondents	Population
Receptionist	10
Developers	20
Finance Team	8
Total	38

Table 1: Sampler table

3.3 Software Engineering Method Used

In the development of the Ai-assisted personal finance mobile application, the Agile methodology is the primary software engineering approach utilized. Agile is a flexible, iterative approach that emphasizes collaboration, continuous feedback, and adaptive planning throughout the software development lifecycle. This methodology is particularly well-suited for projects requiring rapid adjustments to evolving user needs, ensuring that the final product effectively addresses the challenges of financial management.

3.3.1 Agile Methodology

The Agile methodology is applied using the following principles and processes:

- Iterative Development: Agile development follows an incremental approach where the application is developed in small, time-boxed iterations called sprints, typically lasting from one to four weeks. Each sprint focuses on delivering a specific set of functionalities or features, ensuring that core components are built, tested, and refined progressively. For the Ai-assisted personal finance app, this means that expense tracking, AI-driven financial insights, and budget management features are continuously improved based on real-time testing and user feedback.
- Continuous User Feedback: One of the core principles of Agile is the active involvement of users throughout the development process. Regular user testing, feedback loops, and usability testing ensure that the application remains aligned with user needs and expectations. This iterative feedback mechanism allows developers to refine the app's financial recommendation engine, user interface, and data visualization features based on real-world usage.
- Cross-Functional Collaboration: The Agile approach encourages collaboration between developers, designers, financial experts, and end-users to ensure a well-rounded product. The financial experts provide insights into budgeting principles and savings strategies, while software engineers work on integrating AI-driven financial predictions. This collaborative process fosters innovation and ensures that technical solutions effectively address users' financial challenges.
- Flexibility and Adaptability: Agile methodologies are designed to accommodate changing requirements even late in the development process. In the fast-evolving landscape of financial technology, the ability to pivot and incorporate new features—such as real-time expense tracking, AI-based investment suggestions, or automated savings plans—is crucial. If users express a need for additional functionalities, such as multi-currency support or

integration with mobile payment platforms, the Agile framework enables the development team to prioritize and implement these changes efficiently without disrupting the overall system architecture.

- Continuous Testing and Quality Assurance: Agile promotes continuous testing throughout the development lifecycle rather than deferring it to the final stages. This ensures that each feature is validated against user requirements and quality standards as it is developed. Automated and manual testing processes are integrated into the workflow, ensuring that functionalities such as transaction categorization, predictive budgeting, and security protocols perform as expected. This approach reduces defects, enhances system reliability, and ensures that financial data is processed securely.
- Emphasis on Team Collaboration: Agile fosters a collaborative environment where cross-functional teams work together to achieve common objectives. Daily stand-up meetings and sprint planning sessions help the team stay aligned on progress, challenges, and next steps. This collaborative spirit enhances creativity and innovation in feature development, resulting in a more user-friendly, robust, and scalable personal finance management application.

3.3.2 Agile Phases in the Development of the Ai-assisted Personal Finance Mobile App

The Agile methodology is structured around several key phases that facilitate the iterative and incremental development of software. Each phase plays a crucial role in ensuring that the final product is user-centric**,** adaptable to changes**,** and continuously improving. In the context of developing the Ai-assisted personal finance mobile application, these Agile phases are particularly beneficial for addressing evolving financial management challenges and ensuring optimal user experience. The primary phases of Agile development include:

Concept and Inception

In this initial phase, the project's vision and goals are established, identifying key challenges that users face in managing their personal finances. The development team engages in discussions with financial experts, fintech users, and individuals struggling with money management to gather comprehensive requirements.

Key focus areas during this phase include:

- Understanding specific financial management needs, such as automated budgeting, AI-driven savings plans, and personalized financial insights**.**

- Identifying the pain points of traditional financial planning and assessing how AI and automation can improve users' financial decision-making.
- Developing user personas to define the primary target audience, including salaried employees, freelancers, students, and self-employed individuals who require smarter financial management solutions.
- Establishing a clear and structured roadmap that aligns all stakeholders, including developers, financial analysts, designers, and potential users, ensuring a shared understanding of the project's objectives and scope.

By the end of this phase, the team has a well-defined development plan with clear deliverables**, user** expectations, and core functionalities required for the first set of iterations.

Iteration Planning

Once the concept and requirements are solidified, the development team enters the iteration planning phase, where features are prioritized based on user needs and business objectives. Agile development follows a sprint-based approach, ensuring that the app is built in small, manageable increments, with each sprint lasting between two to four weeks.

During this phase, the development team collaborates closely to:

- Determine the most essential features to develop in the initial sprints. These may include:
    - Expense tracking and categorization to help users monitor their spending patterns.
    - AI-driven budgeting tools that analyze financial data and suggest spending limits based on income.
    - Savings goal management to help users set and track their financial goals.
    - User authentication and security measures to ensure financial data remains secure and protected.
- Plan the incremental development of features, allowing room for adjustments and refinements based on user feedback.
- Define clear sprint objectives, deadlines, and testing milestones to ensure steady progress.

This structured approach allows the flexibility to adjust priorities based on evolving user needs and ensures that critical functionalities are developed first while maintaining room for future enhancements.

Development and Testing

The development phase is where the actual coding and implementation of the prioritized features take place. The development team works in short sprints, ensuring that each incremental release delivers a functional aspect of the application. This approach minimizes risks, promotes frequent testing, and allows for continuous refinement of the system.

During this phase, various testing methodologies are applied to ensure that the Ai-assisted financial recommendations and budgeting tools function as expected. These include:

- Unit Testing – Ensuring that individual components, such as expense tracking and AI-driven insights**,** operate independently without errors.
- Usability Testing – Real users interact with the app to evaluate ease of use, UI/UX design efficiency, and overall user experience**.**
- AI Model Validation – Since the app provides financial predictions and recommendations**,** rigorous testing is conducted to ensure that AI-generated insights are accurate and reliable**.**
- Performance Testing – Ensuring that the app runs smoothly across different devices, operating systems, and varying network conditions**.**
- Integration Testing – Verifying that the app's core functionalities, such as budget tracking, goal setting, and AI-driven insights**,** work together seamlessly.

User feedback collected through beta testing programs plays a crucial role in refining the application. If usability issues or inaccuracies in AI-driven financial predictions are identified, adjustments are made before the next sprint begins. This iterative test-and-refine cycle ensures that only well-tested, reliable features progress to the next development stage.

Release and Deployment

Once a sufficient number of features have been developed, tested, and validated, the application is **prepared for release**. This phase ensures that the app is fully functional, secure, and ready for public access**.** Key activities in this stage include:

- Deploying the Ai-assisted personal finance app on a staging environment for final validation. This allows the development team to conduct real-world testing before the official release.
- Conducting security audits to ensure compliance with data protection regulations and safeguard users' sensitive financial information. Encryption mechanisms and authentication protocols are thoroughly tested to prevent security breaches.

- Final usability testing is conducted to confirm that the app interface is intuitive, accessible, and user-friendly. Any remaining UI/UX concerns are addressed to enhance the overall experience.

Before the official launch, early access users are invited to test the platform and provide last-minute feedback, ensuring that all features perform as expected before making the app publicly available.

Maintenance and Continuous Improvement

The final phase of Agile development is the maintenance and continuous improvement cycle**,** where the application undergoes regular updates and optimizations based on real-world usage. Agile's continuous improvement principle ensures that the app remains relevant, efficient, and aligned with user needs even after launch.

Post-release activities include:

- Implementing user-requested features, such as multi-currency support, bill reminders, and mobile payment integration**,** to enhance the app's functionality.
- Fixing bugs and improving AI-driven financial predictions, ensuring that spending analysis, budgeting recommendations, and predictive analytics remain highly accurate and effective**.**
- Enhancing security measures to comply with financial data protection standards and prevent vulnerabilities. This includes routine penetration testing, security patches, and compliance updates**.**
- Introducing new financial literacy tools, including educational resources, financial planning guides, and interactive tutorials**,** to help users improve their money management skills.

3.4. Tools and Languages to be used

The development of the Ai-assisted personal finance mobile application requires a combination **of** programming languages, development frameworks, and software tools to ensure a scalable, efficient, and user-friendly application. This section provides an in-depth overview of the technologies utilized, their functionalities, and their impact on the development process.

3.4.1. Programming Languages

To build a robust and intelligent personal finance mobile application, multiple programming languages are used to handle front-end development, Ai-assisted analytics, and secure data storage**.**

1. **Flutter (Dart)**
    - Flutter is an open-source UI framework developed by Google, enabling cross-platform mobile application development with a single codebase.
    - It ensures smooth performance on both Android and iOS, reducing development time and maintenance efforts.
    - The Dart programming language**,** used in Flutter, provides hot reload capabilities, allowing developers to test and refine UI changes instantly.
    - With a rich set of pre-built widgets, Flutter enhances the visual appeal and responsiveness of the personal finance application.
2. **Python**
    - Python is widely used in AI and machine learning, making it ideal for predictive financial modeling and expense analysis**.**
    - It supports deep learning libraries like TensorFlow and scikit-learn**,** enabling the app to generate AI-driven budgeting recommendations and financial forecasting.
    - Python's simple syntax and extensive data analytics capabilities allow for seamless integration of AI models into the application.
3. **SQL (SQLite)**
    - **SQLite** is a lightweight relational database used for storing financial transaction records, user preferences, and budgeting data securely.
    - Unlike cloud databases, SQLite allows offline access, ensuring that users can view and update their financial records without an internet connection**.**
    - It supports ACID (Atomicity, Consistency, Isolation, Durability) compliance**,** ensuring data integrity and secure financial record management**.**

3.4.2. Development Frameworks and Libraries

Several frameworks and libraries are incorporated to provide AI-driven insights, secure data handling, and real-time financial visualization.

1. **TensorFlow**
    - TensorFlow is an open-source machine learning framework used to power the app's financial analytics and predictive budgeting system.
    - It enables deep learning models to analyze spending patterns, predict future expenses, and offer personalized savings strategies.
    - TensorFlow's ability to handle large datasets efficiently makes it suitable for analyzing user financial behavior over time.
2. **Firebase**
    - Firebase serves as a Backend-as-a-Service (BaaS), providing authentication, cloud storage, and real-time database management.
    - Features such as Google Authentication, email sign-in, and secure user verification enhance data security and privacy.
    - The Firebase Firestore database ensures seamless synchronization across devices, allowing users to access their financial data from multiple platforms.
    - Push notifications are integrated to remind users about budget goals, bill payments, and upcoming financial commitments.
3. **Matplotlib and Seaborn**
    - These Python libraries are essential for financial data visualization, helping users analyze their spending trends through clear and interactive graphs.
    - Matplotlib generates bar charts, line graphs, and pie charts for expense tracking and budget performance evaluation.
    - Seaborn enhances visualization aesthetics, making financial insights more accessible and easy to interpret.

3.4.3. Software Tools

To ensure a smooth development process, multiple software tools are used for coding, debugging, API testing, AI modeling, and UI/UX design.

1. **Android Studio**
    - The official Integrated Development Environment (IDE) for Android development, providing a powerful emulator, debugging tools, and performance monitoring features.
    - Supports Flutter integration, enabling seamless app testing and optimization across different devices.
    - Built-in Gradle support ensures smooth dependency management and efficient application builds.
2. **Jupyter Notebook**
    - A widely used platform for AI model training, data analysis, and financial prediction development.
    - Allows interactive code execution, enabling real-time testing of AI-driven budgeting models.
    - Facilitates collaboration among developers by providing data visualization and machine learning experiment tracking.
3. **Postman**
    - A tool for API testing and integration, ensuring that the personal finance app communicates efficiently with external data sources, such as currency exchange APIs, bank feeds, and investment platforms.
    - Enables automated API requests, response validation, and debugging, ensuring seamless data retrieval and synchronization.
4. **Figma**
    - A UI/UX design prototyping tool that allows designers to create interactive wireframes and high-fidelity mockups.
    - Ensures that the app delivers an intuitive and visually appealing user experience, with a focus on easy navigation and financial dashboard design.
    - Provides collaboration features, enabling real-time design feedback and iteration among team members.

3.5. Ethical Considerations

Ethical considerations are paramount in this study. The following measures are taken to ensure compliance with ethical standards:

- Informed Consent: Participants are informed about the study's purpose and their rights before data collection.
- Data Privacy and Security: Personal financial data is encrypted and stored securely to prevent unauthorized access.
- Bias Mitigation: Ensuring AI algorithms are trained on unbiased financial data to provide fair recommendations.
- Transparency: Clear communication about how AI-driven recommendations are generated to build user trust.

3.7. Validity and Reliability

Ensuring the validity and reliability of research findings is essential. The following strategies are employed:

- Pilot Testing: Conducting a pilot study to refine research instruments before full-scale data collection.
- Triangulation: Cross-verifying data from multiple sources to ensure accuracy.
- Statistical Analysis: Using inferential statistics to validate research findings and ensure they are generalizable to a broader population.

CHAPTER FOUR: SYSTEM ANALYSIS, DESIGN, AND IMPLEMENTATION

4.1 Introduction

This chapter presents a comprehensive analysis, design, and implementation of the Ai-assisted personal finance mobile application**.** It outlines the system requirements, covering both functional and non-functional aspects**,** and details the system architecture, including Data Flow Diagrams (DFDs), Entity-Relationship Diagrams (ERDs), database schemas, and user interface designs**.** These elements provide a structured blueprint for the proposed system.

By systematically analyzing the challenges in traditional financial management, this chapter establishes the foundation for an improved solution that leverages artificial intelligence to help users track expenses, budget efficiently, and make informed financial decisions. The objective is to enhance financial awareness, automate tracking, optimize budgeting processes, and improve financial literacy among users through personalized recommendations and real-time insights.

4.2 System Study

The system study phase explores the current financial management practices used by individuals, evaluating their limitations and identifying the requirements for a digital solution that enhances financial tracking, budgeting, and decision-making. This phase also includes a **f**easibility analysis to ensure that the proposed Ai-assisted personal finance app is practical, sustainable, and beneficial for users who struggle with expense tracking, budgeting discipline, and financial planning.

4.2.1 Current System Analysis

Many individuals rely on manual methods such as notebooks, spreadsheets, or generic banking apps to track their finances. These traditional approaches present several challenges:

1. Lack of Real-Time Insights – Users often struggle to obtain an up-to-date view of their financial status, leading to uninformed spending habits.
2. Limited Budgeting Support – Most methods lack intelligent budget recommendations, making it difficult for users to set and adhere to realistic financial goals.
3. Manual Data Entry and Errors – Keeping track of expenses manually is time-consuming and prone to errors, leading to inaccurate financial records.
4. No Personalized Financial Advice – Generic solutions do not provide tailored financial guidance based on users' spending patterns and income.
5. Inefficient Expense Categorization – Users must manually categorize expenses, which can be cumbersome and inconsistent across different transactions.

6. Limited Reporting and Analytics – Most individuals lack access to detailed spending reports, trends, and forecasts, making financial planning more difficult.

Given these challenges, a smart, Ai-assisted solution that automates financial tracking, provides intelligent budgeting recommendations, and delivers real-time analytics is essential for improving personal finance management.

4.2.2 Weaknesses Observed in the Current System

Based on observations and feedback from individuals who struggle with personal finance management, several key weaknesses have been identified in existing financial tracking and budgeting methods:

- Inefficiency in Expense Tracking: Many individuals find it time-consuming to manually record expenses, often leading to incomplete or inconsistent tracking of financial transactions.
- Data Inaccuracy and Human Errors: Manual record-keeping increases the risk of miscalculations and incorrect data entries, leading to an inaccurate understanding of one's financial situation.
- Limited Accessibility and Convenience: Users relying on spreadsheets or paper-based tracking lack mobile accessibility and automated updates, making financial monitoring cumbersome.
- Absence of Automated Budgeting: Without smart budgeting tools, users struggle to set, adjust, and adhere to financial goals, often overspending or failing to allocate funds efficiently.
- Lack of Personalized Financial Insights: Generic financial management solutions do not offer AI-driven, user-specific recommendations based on spending patterns and income trends.
- Inadequate Expense Categorization: Many users struggle to classify their expenses accurately, making it difficult to analyze spending habits and identify areas for improvement.
- No Real-Time Alerts or Notifications: Manual systems do not provide timely alerts for bill payments, unusual spending, or savings opportunities, leading to potential financial mismanagement.
- Limited Financial Reporting & Forecasting: Existing tools offer basic expense logs but lack advanced analytics for tracking trends, setting future financial goals, and improving financial literacy.

These weaknesses highlight the need for an Ai-assisted personal finance application that can automate tracking, provide intelligent budgeting recommendations, and generate real-time financial insights to help users achieve better financial control.

4.3 System Analysis

System analysis is a critical phase in the development of the Ai-assisted personal finance mobile application. It involves gathering and documenting user requirements, identifying functional and non-functional requirements, specifying system needs, and determining the necessary hardware and software specifications. This phase ensures that the system is designed to effectively address the challenges of financial management, enabling users to track expenses, budget efficiently, and receive AI-driven financial insights.

By analyzing the existing financial management shortcomings, this system aims to provide a user-friendly, automated, and intelligent solution that enhances financial stability and decision-making. The system will integrate real-time analytics, personalized financial advice, and automated tracking features to empower users with greater control over their finances.

4.3.1 User Requirements of the Proposed System

The proposed Ai-assisted personal finance mobile application should meet the needs of individual users who seek an efficient way to track their expenses, budget effectively, and receive AI-driven financial insights. Based on surveys, interviews, and an analysis of financial management challenges, the following user requirements have been identified:

- User-Friendly Interface: The application should have an intuitive, clean, and easy-to-navigate interface, ensuring that users can efficiently access financial tracking features without a steep learning curve.
- Automated Expense Tracking: The system should enable users to automatically track and categorize expenses from linked bank accounts, mobile money, or manual entries.
- Real-Time Budgeting Assistance: The app should provide users with real-time updates on their budget status, including spending limits, savings goals, and upcoming expenses.
- Ai-assisted Financial Insights: The system should analyze users' spending patterns and provide intelligent recommendations to help them make smarter financial decisions.
- Personalized Budgeting and Goal Setting: Users should be able to create custom budgets for different expense categories and receive automated alerts when they exceed set limits.

- Financial Notifications and Alerts: The system should notify users of due bills, unusual transactions, overspending risks, and savings opportunities through push notifications or emails.
- Detailed Financial Reports & Analytics: Users should have access to visual financial reports, including spending trends, income analysis, and savings progress, in the form of graphs and charts.
- Multi-Device Accessibility: The system should be available across multiple platforms (mobile, tablet, and web), ensuring accessibility anytime and anywhere.
- Secure User Authentication: The system should implement secure login features such as two-factor authentication (2FA) to protect users' financial data.
- Data Export and Integration: Users should be able to export financial reports and integrate with other financial platforms such as accounting software or spreadsheets.

These requirements ensure that the system provides a seamless, intelligent, and automated approach to personal finance management, empowering users to achieve financial stability and make informed decisions.

4.3.2 Functional Requirements of the Proposed System

Functional requirements define the specific features and functionalities that the Ai-assisted personal finance mobile application must have to meet user needs effectively. These include:

- User Authentication: The system should allow users to register, log in, and manage their accounts securely, using methods like email/password, biometric authentication, and two-factor authentication (2FA).
- Automated Expense Tracking: The system should support automatic expense tracking and categorization by integrating with bank accounts, mobile money, or manual input**.**
- Budget Creation and Management: Users should be able to set, update, and monitor budgets for different spending categories (e.g., groceries, rent, entertainment) and receive alerts when nearing limits.
- Ai-assisted Financial Insights: The system should analyze user transactions and provide intelligent recommendations to optimize budgeting, spending, and saving habits.
- Expense Categorization: Transactions should be automatically categorized (e.g., food, transport, shopping), with options for users to adjust categorizations as needed.
- Income and Savings Tracking: Users should be able to log income sources (e.g., salary, freelance work) and set savings goals, receiving real-time progress updates.

- Financial Notifications and Alerts: The system should send alerts for due bills, budget overruns, unexpected expenses, and savings opportunities via push notifications or emails.
- Spending and Income Reports: Users should have access to graphical reports and analytics showing their spending trends, savings progress, and overall financial health over time.
- Multi-Device Synchronization: The app should be accessible from mobile phones, tablets, and desktops, ensuring seamless financial tracking across different platforms.
- Secure Data Storage and Encryption: All financial data should be stored securely with end-to-end encryption to prevent unauthorized access.
- Data Export and Integration: Users should be able to export financial reports in formats like PDF, CSV, and integrate with third-party financial management tools.

4.3.3 Non-Functional Requirements

Non-functional requirements define the system's performance, security, usability, and reliability constraints**,** ensuring that the Ai-assisted personal finance mobile application operates efficiently and securely. The proposed system should meet the following non-functional requirements:

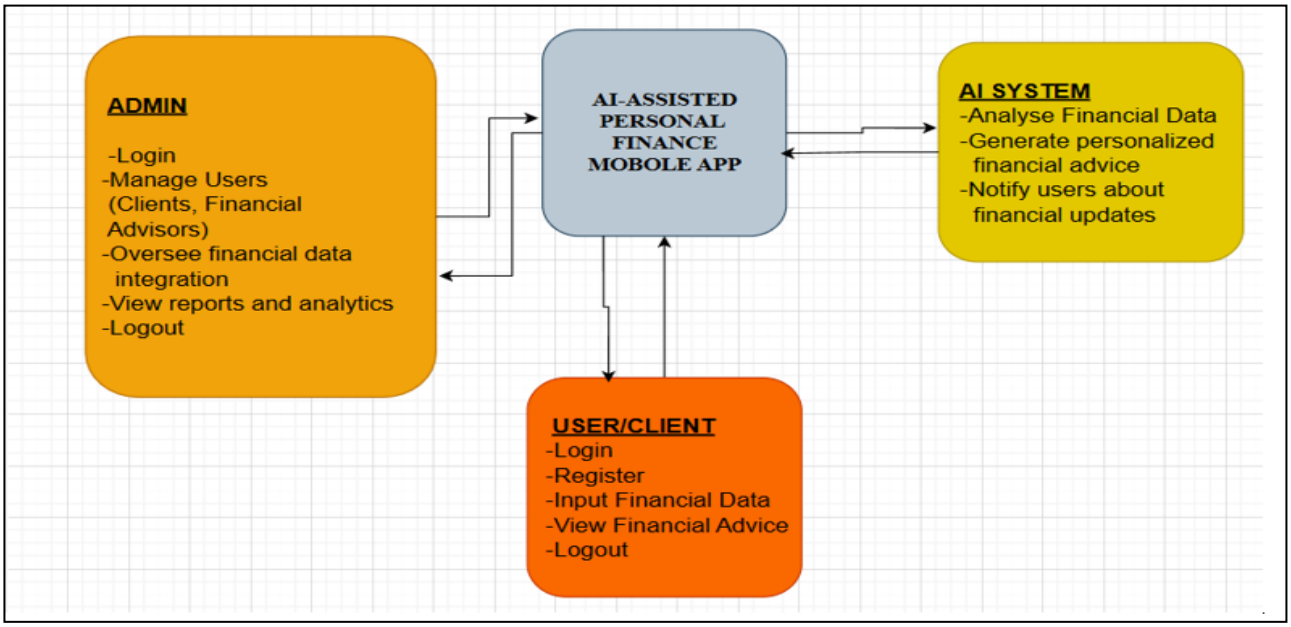

Figure 2: Conceptual framework

- Usability: The application should have an intuitive and user-friendly interface, ensuring easy navigation for users of all technical levels. The design should follow best UI/UX practices to enhance user engagement.

- Performance: The system should provide fast response times for loading dashboards, retrieving financial data, and generating reports. It should be able to handle multiple concurrent users without lag.
- Scalability: The architecture should support future expansion, allowing for additional features, integration with external financial services, and increased user capacity.
- Security: The application should ensure data encryption (AES-256), secure authentication (2FA), and role-based access control (RBAC) to protect users' financial information from unauthorized access.
- Availability: The system should have 99.9% uptime, ensuring users can access their financial data anytime, with minimal downtime or disruptions.
- Reliability: The system should accurately store and process financial data, ensuring that transactions, reports, and insights remain consistent and error-free.
- Data Integrity: The system should prevent duplicate or erroneous financial entries and ensure that all records are synchronized correctly across multiple devices.
- Maintainability: The system should be built using modular and well-documented code**,** making it easy to update, debug, and enhance over time.
- Compatibility: The system should work seamlessly across multiple platforms (Android, iOS, and web) and integrate with financial institutions or payment systems.
- Backup and Recovery: The system should implement automated data backup mechanisms to prevent data loss and provide a recovery process in case of system failure.
- Regulatory Compliance: The application should comply with financial data protection regulations (e.g., GDPR, PCI-DSS) to ensure user privacy and security.

4.3.4 System Requirements

System requirements outline the necessary hardware and software components for the development and deployment of the Ai-assisted personal finance mobile application. These requirements ensure optimal performance, security, and accessibility for users.

4.3.4.1 Requirement Specifications

The system must meet the following technical specifications:

- System Accessibility: The platform should be available as a mobile application (Android & iOS) with a web-based dashboard for cross-device accessibility.
- Load Management: The system should efficiently handle multiple concurrent users, ensuring smooth performance when processing transactions, generating reports, and providing financial insights.
- Data Storage**:** A secure and scalable database (e.g., PostgreSQL, MySQL, or MongoDB) should be implemented to store:
    - User credentials and profiles
    - Transaction records and expense categories
    - Budget plans and financial goals
    - AI-generated financial insights
- Security Measures: The system should integrate AES-256 encryption, HTTPS protocols, secure authentication (OAuth 2.0, JWT, or biometric authentication), and role-based access control (RBAC) to protect user financial data.
- Backup and Recovery: Automatic database backup mechanisms should be in place to prevent data loss, ensuring recovery options in case of system failure.
- Platform Compatibility:
    - Mobile Application**:** Developed using Flutter for cross-platform support on Android and iOS**.**
    - Web Dashboard**:** Built using React.js, Vue.js, or Next.js for seamless access via browsers.
    - Backend API**:** Developed using Django (Python) or Node.js (NestJS) to manage business logic and financial processing.
- Cloud Hosting & Deployment: The system should be deployed on a cloud service (AWS, Firebase, or DigitalOcean) to ensure high availability, scalability, and data redundancy.

4.3.4.2 Hardware Specifications

The following hardware specifications outline the minimum requirements for effectively running the Ai-assisted personal finance mobile application across both backend servers and client devices**:**

For Backend Server (Hosting the System)

- Processor: 2.4 GHz Quad-Core Processor or higher to handle financial computations, AI processing, and API requests efficiently.
- RAM: Minimum 8 GB, with 16 GB recommended for optimal performance when handling multiple user transactions and AI-driven financial insights.
- Storage: Minimum 100 GB SSD, ensuring fast read/write speeds for securely storing user data, transaction histories, and AI-generated reports.
- Database Server: Dedicated storage optimized for high transaction throughput (e.g., PostgreSQL, MySQL, or MongoDB).
- Network Bandwidth: High-speed internet connection to facilitate real-time financial data synchronization, API requests, and AI model updates.

For Client Devices (Mobile and Web Users)

- Mobile Devices (for Android/iOS users):
    - Minimum 2 GHz Octa-Core Processor (e.g., Snapdragon 720G / Apple A13 Bionic or higher**)**
    - At least 4 GB RAM for smooth application performance
    - Minimum 64 GB storage to accommodate app usage and cached financial data
    - Stable internet connection (Wi-Fi or Mobile Data) for real-time syncing
- Web-Based Dashboard (for Desktop Users)**:**
    - Processor: Minimum Intel Core i5 / AMD Ryzen 5 or higher for smooth browser-based performance
    - RAM: Minimum 8 GB**,** 16 GB recommended for multitasking and financial report generation
    - Storage: At least 100 GB SSD for handling financial analytics efficiently
    - Internet Connectivity: High-speed connection for real-time updates and cloud synchronization

4.3.4.3 Software Specifications

The Ai-assisted personal finance mobile application requires specific software components for development, deployment, and client access. These software specifications ensure that the system runs efficiently, supports Ai-assisted insights, and provides a seamless experience for users.

Development Tools & Environment

- **Text Editor/IDE:**
    - Visual Studio Code (Recommended for frontend and backend development)
    - PyCharm (For Django development)
    - Android Studio/Xcode (For mobile app development using Flutter)
- **Development Frameworks**:
    - Frontend:
        - Flutter (For cross-platform mobile app development)
        - React.js / Next.js (For web dashboard development)
    - Backend:
        - Django (Python) **or** Node.js (NestJS) for handling APIs, authentication, and business logic
    - AI/ML Integration:
        - TensorFlow, Scikit-learn, or OpenAI APIs for Ai-assisted financial insights

Database Management System

- PostgreSQL **or** MySQL (For secure storage of user data, transactions, budgets, and financial reports)
- MongoDB (For handling unstructured data like AI-generated insights and user preferences)

Web Server & Hosting

- Nginx (For handling API requests and frontend hosting)
- Gunicorn (For Django-based deployment)
- Firebase Hosting (For mobile app backend and notifications)
- Cloud Hosting:
    - AWS (EC2, RDS, S3) for scalable cloud deployment
    - Google Cloud Platform (GCP) or DigitalOcean for cost-effective hosting

Client Access & Browsers

- Mobile App: Available on Android (Google Play Store) and iOS (Apple App Store)
- Web Dashboard: Accessible via modern browsers:
    - Google Chrome, Mozilla Firefox, Safari, and Microsoft Edge **(**Supporting HTML5, CSS3, and JavaScript**)**

Operating System Compatibility

- Development & Deployment**:**
    - Windows 10/11, macOS, Linux
    - Ubuntu Server (Recommended for backend hosting)

Programming Languages & Technologies

- Backend**:** Python (Django, Flask) or Node.js (NestJS, Express.js)
- Front4.3.4.3 Software Specifications

The Ai-assisted personal finance mobile application requires specific software components for development, deployment, and client access. These software specifications ensure that the system runs efficiently, supports Ai-assisted insights, and provides a seamless experience for users.

Development Tools & Environment

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    - **Visual Studio Code** (Recommended for frontend and backend development)
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- **Development Frameworks**:
    - **Frontend**:
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        - **React.js / Next.js** (For web dashboard development)
    - **Backend**:
        - **Django (Python)** or **Node.js (NestJS)** for handling APIs, authentication, and business logic
    - **AI/ML Integration**:
        - **TensorFlow, Scikit-learn, or OpenAI APIs** for Ai-assisted financial insights

Database Management System

- **PostgreSQL** or **MySQL** (For secure storage of user data, transactions, budgets, and financial reports)
- **MongoDB** (For handling unstructured data like AI-generated insights and user preferences)

Web Server & Hosting

- **Nginx** (For handling API requests and frontend hosting)
- **Gunicorn** (For Django-based deployment)
- **Firebase Hosting** (For mobile app backend and notifications)
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Operating System Compatibility

- Development & Deployment**:**
    - Windows 10/11, macOS, Linux
    - Ubuntu Server (Recommended for backend hosting)

Programming Languages & Technologies

- Backend**:** Python (Django, Flask) or Node.js (NestJS, Express.js)
- Frontend**:** Dart (Flutter), JavaScript (React.js, Next.js, Vue.js)
- Database Queries**:** SQL (PostgreSQL, MySQL) or NoSQL (MongoDB, Firebase Firestore)
- AI Integration**:** Python (TensorFlow, Scikit-learn), OpenAI APIs

4.4 Architectural Design

The architectural design of the Ai-assisted personal finance mobile application follows **a** three-tier architecture model, ensuring modularity, scalability, and efficient financial data processing. The architecture consists of three key layers:

1. Presentation Layer (Client Side)

- This layer represents the user interface (UI)**,** which includes the mobile and web applications used by individuals for financial tracking, budgeting, and Ai-assisted insights.
- It provides an interactive, user-friendly experience, allowing users to view transactions, track expenses, set budgets, and receive personalized financial advice.

Technologies Used:

- Flutter (Dart) – For cross-platform mobile application (Android & iOS).
- React.js / Next.js – For web-based dashboard access.
- Tailwind CSS / Material UI – For responsive and intuitive UI design.

2. Application Layer (Server Side)

- This layer contains the business logic responsible for handling:
    - User authentication & security (e.g., JWT, OAuth, 2FA).
    - Expense tracking & categorization (manual input & automated transaction import).
    - Ai-assisted financial insights (analyzing spending habits and offering recommendations).
    - Budgeting & savings goal management (real-time tracking and alerts).
    - Report generation (spending trends, income analysis, and predictive insights).
    - API interactions (third-party financial services, bank integrations).

Technologies Used:

- Backend Frameworks**:**
    - Django (Python) – Ensures a scalable and secure API for managing transactions, AI recommendations, and financial reports.
    - Node.js (NestJS/Express.js) – Alternative backend **for** high-performance, event-driven architecture**.**
- AI/ML Integration**:**

    - TensorFlow / Scikit-learn (Python) – To generate AI-driven financial insights and predictive analytics.
- Authentication & Security:
    - JWT, OAuth 2.0, Firebase Authentication – For secure user login and financial data protection.

3. Data Layer (Database & Storage)

- This layer is responsible for securely managing financial data, including:
    - User profiles & authentication credentials**.**
    - Transactions, expenses, and income records**.**
    - Budget plans and AI-generated financial insights**.**
    - Historical financial reports and analytics**.**

Technologies Used:

- Relational Databases**:**
    - PostgreSQL – For structured data storage (transactions, budgets, reports).
    - MySQL – Alternative RDBMS option for structured financial records.
- NoSQL Database (For AI-related unstructured data):
    - MongoDB / Firebase Firestore – For storing dynamic AI insights and user preferences.
- Cloud Storage**:**
    - AWS S3 / Google Cloud Storage – For storing financial documents, exported reports, and backups.

Benefits of the Three-Tier Architecture

- Modularity & Separation of Concerns – Each layer operates independently, making development and maintenance easier.
- Scalability – The system can efficiently handle increasing users, transactions, and AI computations.
- Security & Data Integrity – Sensitive financial data is securely stored, encrypted, and backed up.
- Multi-Platform Support – Allows seamless integration across mobile and web interfaces.

This architecture ensures robust, Ai-assisted financial management system, providing users with a smart, automated, and insightful way to manage their personal finances effectively.

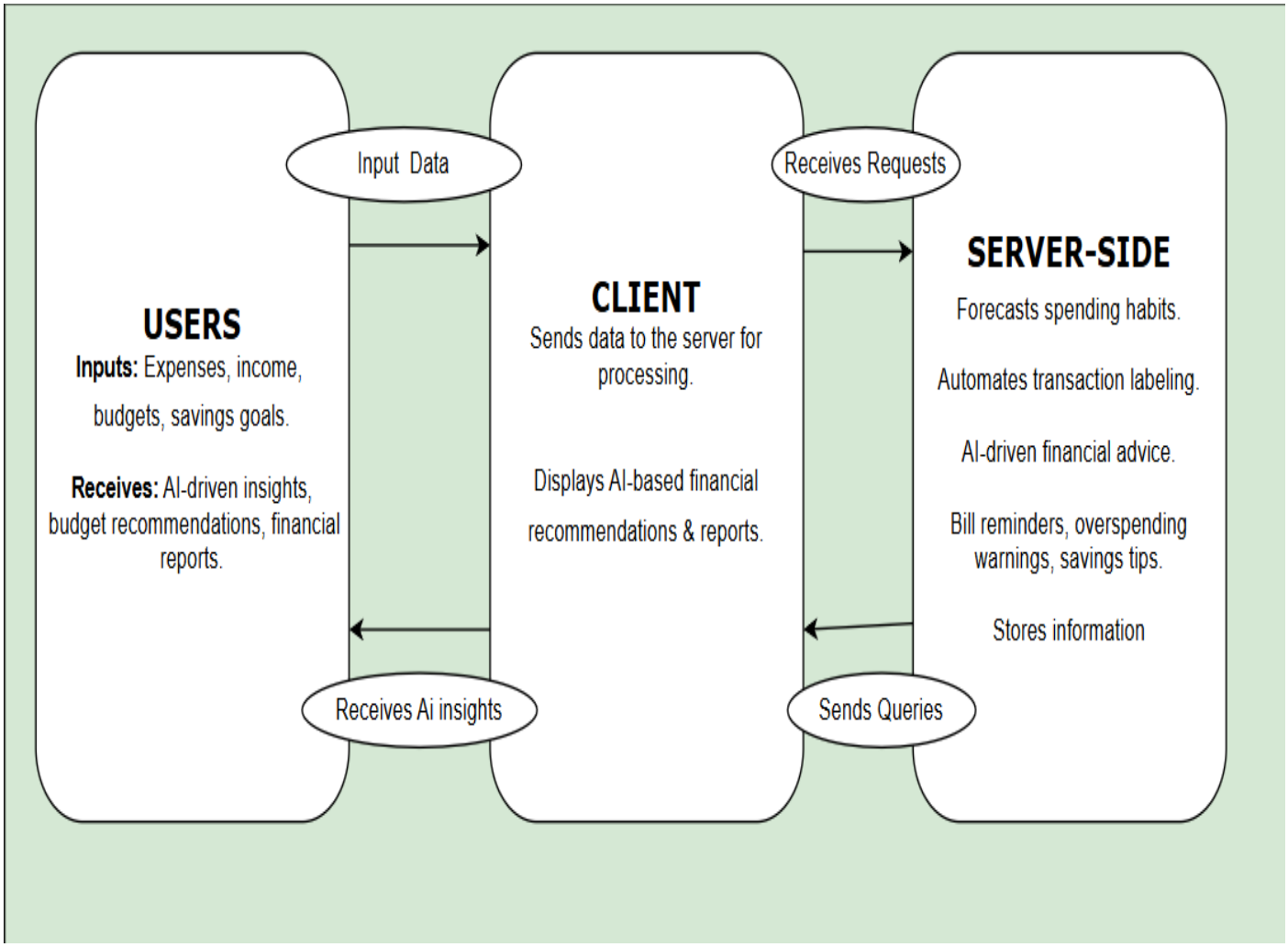


Figure 3: Architectural Design

4.5 Design Requirements

Design requirements provide detailed guidelines to ensure the Ai-assisted personal finance mobile application meets user needs, functional goals, and system specifications. These requirements focus on creating an efficient, user-friendly, and secure platform by considering the following key aspects:

1. Interface Design

- The system should have a clean, intuitive, and responsive UI to provide a seamless experience for users managing their personal finances.
- The interface should be accessible across different devices (mobile, tablet, and web).
- UI/UX principles should be followed to ensure easy navigation, clear financial visualizations (graphs, charts, reports), and a minimal learning curve.
- Technologies used:
    - Flutter (for mobile apps on Android and iOS).
    - React.js / Next.js (for web-based dashboard).
    - Tailwind CSS / Material UI (for a modern and responsive design).

2. Data Management

- The system should efficiently handle and store user financial data, including:
    - Transaction records (automated and manual entries).
    - Expense categorization and budgeting data**.**
    - AI-generated financial insights and reports**.**
- Data integrity and consistency must be maintained, preventing duplicate or incorrect financial records.
- Database Optimization:
    - PostgreSQL / MySQL for structured data storage.
    - MongoDB / Firebase Firestore for dynamic AI insights.
    - AWS S3 / Google Cloud Storage for securely storing financial reports and user-generated documents.

3. System Performance

- The system should be optimized to handle multiple users concurrently, ensuring:
    - Fast response times for retrieving and processing financial data.
    - Efficient AI computations for analyzing spending habits and offering smart financial recommendations.

    - Scalability to accommodate a growing user base and increased transaction loads.
- Backend should be developed using Django (Python) or Node.js (NestJS) to ensure high performance and responsiveness.

4. Security Considerations

- Strong authentication mechanisms such as OAuth 2.0, JWT, biometric login (fingerprint/Face ID), and Two-Factor Authentication (2FA) should be implemented.
- Role-Based Access Control (RBAC) should be enforced to ensure only authorized users access sensitive financial data.
- Data Encryption:
    - AES-256 encryption for storing sensitive financial information.
    - TLS/SSL encryption for secure data transmission between the frontend and backend.
- Secure APIs should be implemented to prevent unauthorized access, using rate limiting, IP whitelisting, and API gateway security measures.

4.6 Data Flow Diagram (DFD)

Data Flow Diagrams (DFDs) are essential for visualizing the flow of data within the Ai-assisted personal finance mobile application**.** They illustrate how financial data moves between different components of the system, making it easier to understand user interactions, data processing, and storage**.**

The DFDs are structured into two primary levels:

1. Context Level (Level 0) DFD**:** A high-level overview showing the system's primary data flows and interactions with external entities.
2. Level 1 DFD: A detailed breakdown illustrating specific data inputs, processing, and outputs within the system.

4.6.1 Context Level DFD (Level 0)

The Context Level DFD (Level 0) provides a high-level overview of the system, emphasizing the primary data flows between external entities and the system. The key external entities in this financial management system include:

- **Users (Individuals managing their finances)**:
    - Input income and expenses manually or through bank/mobile money integration.
    - Set budgeting goals and track spending.
    - Receive Ai-assisted financial recommendations and insights.

- Generate financial reports for analysis.

- **Banking and Financial Services API**:
  - Provides transaction data for automated expense tracking.
  - Facilitates secure account integration for income and expense synchronization.
- **AI Engine**:
  - Analyzes user spending habits and financial patterns.
  - Generates smart financial recommendations based on historical data.
  - Provides predictive insights for budgeting and savings**.**
- **Database (Financial Records Storage)**:
  - Stores user profiles, financial transactions, budgets, and AI insights.
  - Ensures secure data management and retrieval for reporting.

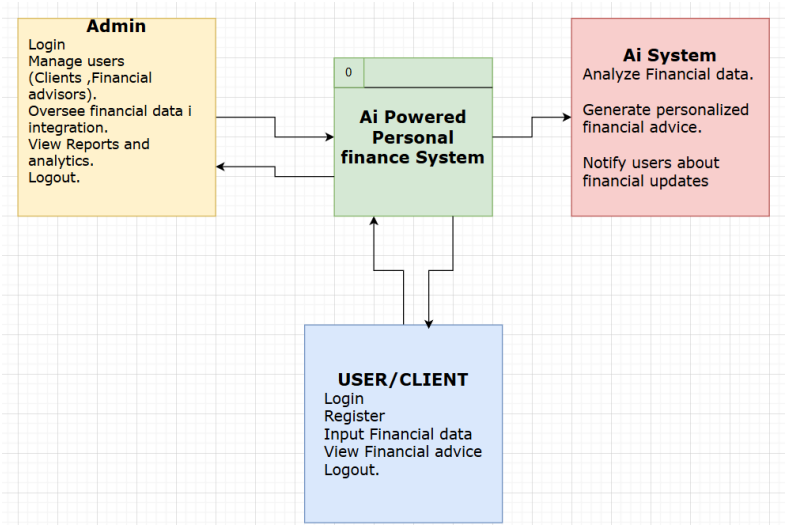


Figure 4: Level 0 DFD

4.6.2 Level 1 DFD

The Level 1 Data Flow Diagram (DFD) provides a more detailed view of the primary processes identified in the Level 0 DFD. It breaks down each primary process into specific sub-processes and illustrates the flow of data between system components, external entities, and the database. This level of detail clarifies the specific tasks and interactions that occur within the Ai-assisted personal finance mobile application. Below is the breakdown of the system's processes and data flow:

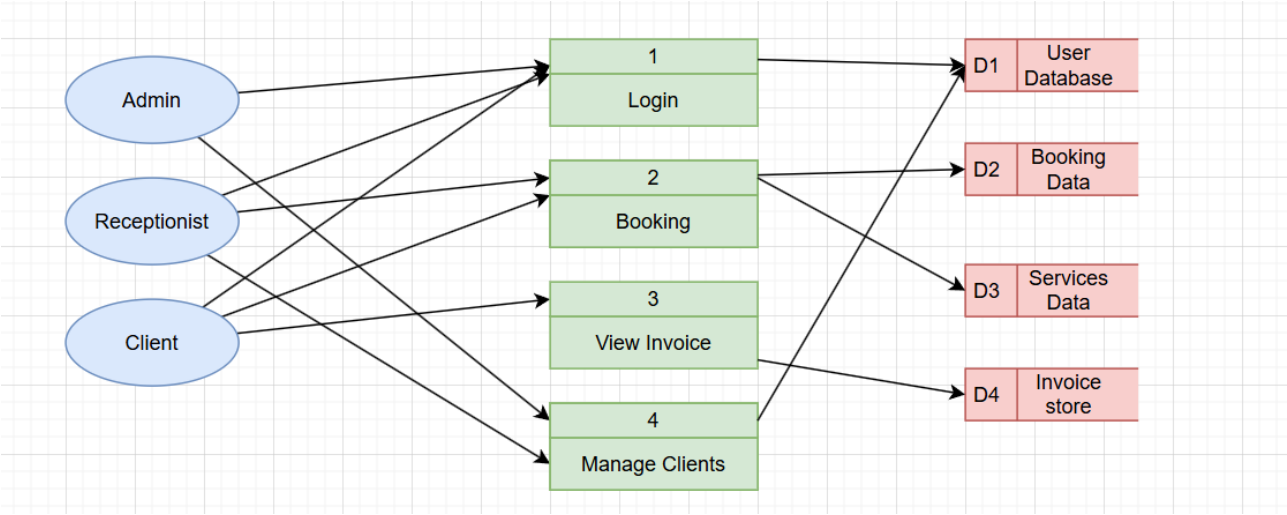


Figure 5: Level 1 DFD

4.7 Entity Relationship Diagram (ERD)

The Entity-Relationship Diagram (ERD) provides a structured visual representation of how data is stored and organized within the Ai-assisted Personal Finance app. The ERD is an essential tool for ensuring efficient database design by defining the relationships, attributes, and constraints of the system's core entities. It outlines how the system's key components interact with each other, ensuring seamless data flow and management.

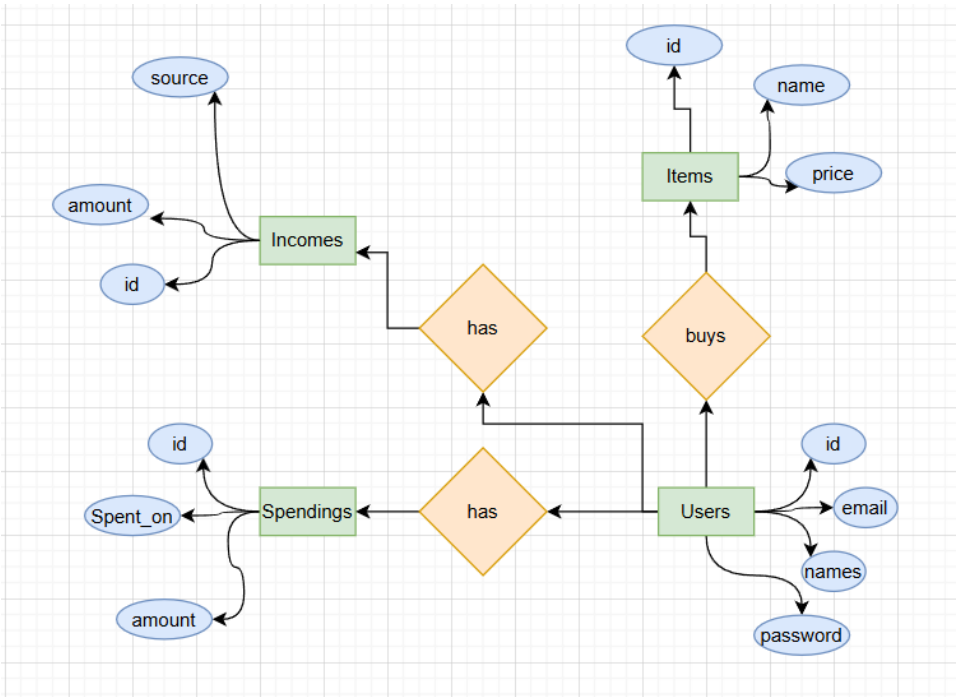


Figure 6: ERD

4.8 Physical Data Model (PDM)

The Physical Data Model (PDM) defines the structure of the database in a way that is optimized for implementation in a Database Management System (DBMS). It takes the logical design from the Entity-Relationship Diagram (ERD) and translates it into a physical structure that ensures efficient data storage and retrieval. The PDM specifies the exact tables, columns, data types, keys, indexes, and any additional structures needed to support the operations of the Ai-assisted Personal finance mobile app

The PDM focuses on performance and scalability, making sure that the system can handle large volumes of data and quickly. This model ensures that data is stored in a manner that optimizes query execution and supports the system's transactional needs.

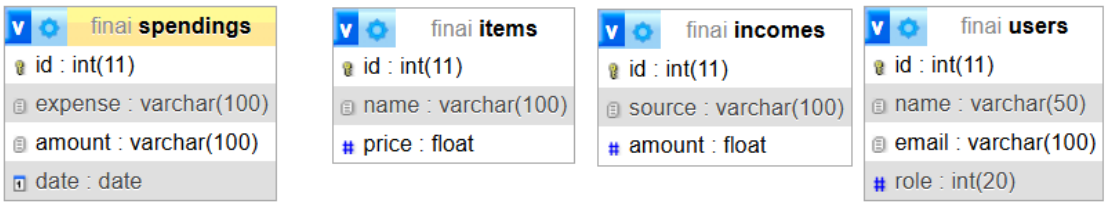


Figure 7: PDM

4.9 Data Dictionary

The Data Dictionary provides an organized reference for the data elements used in the AI-Assisted personal finance Mobile app. It includes detailed descriptions of each table, its columns, data types, and constraints, helping to maintain consistency and clarity throughout the database schema. This documentation is essential for developers, database administrators, and stakeholders to ensure proper database management, optimization, and smooth integration of system components.

Table 2: Items

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
1	id	int(11)			No	*None*		AUTO_INCREMENT	Change Drop More
2	name	varchar(100)	latin1_swedish_ci		No	*None*			Change Drop More
3	price	float			No	*None*			Change Drop More

Table 3: Spending

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
1	id	int(11)			No	*None*		AUTO_INCREMENT	Change Drop More
2	expense	varchar(100)	latin1_swedish_ci		No	*None*			Change Drop More
3	amount	varchar(100)	latin1_swedish_ci		No	*None*			Change Drop More
4	date	date			No	*None*			Change Drop More

Table 4: Users

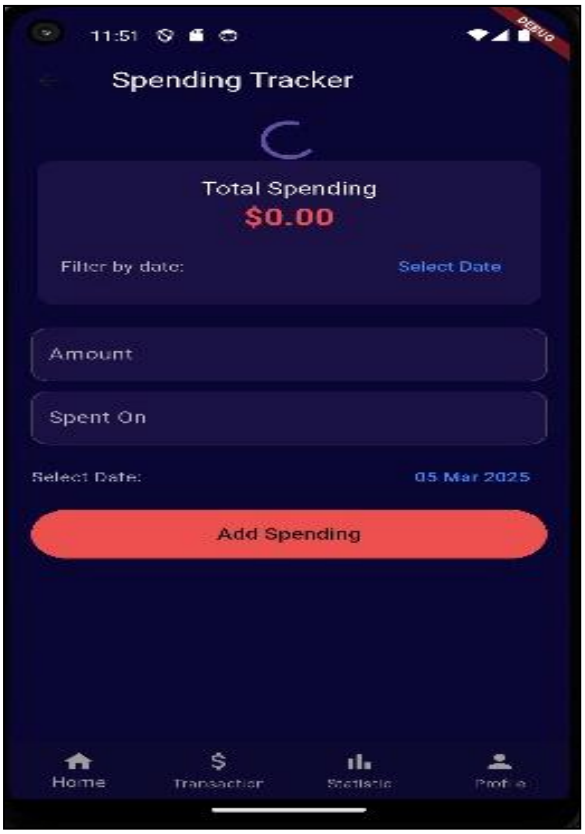
	#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
☐	1	**id** 🔑	int(11)			No	*None*		AUTO_INCREMENT	Change Drop More
☐	2	**name**	varchar(50)	latin1_swedish_ci		No	*None*			Change Drop More
☐	3	**email**	varchar(100)	latin1_swedish_ci		No	*None*			Change Drop More
☐	4	**role**	int(20)			No	*None*			Change Drop More

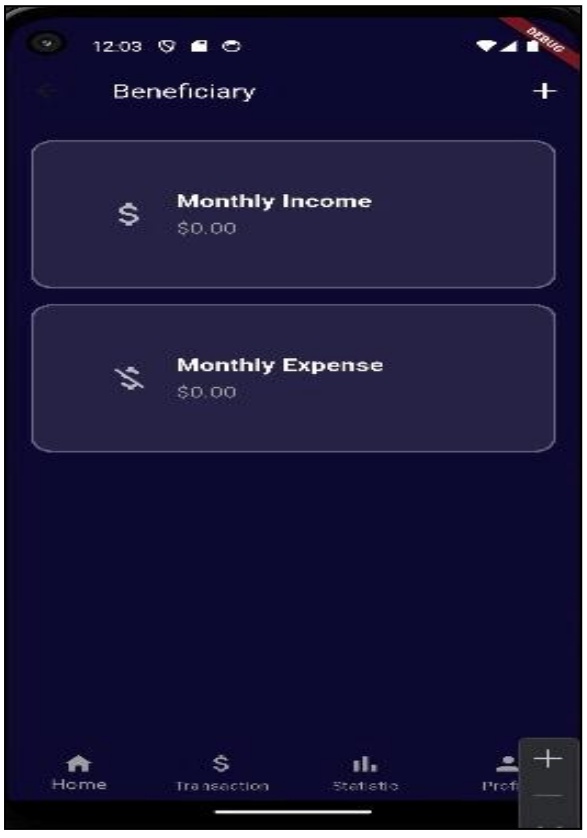
Table 5: Income

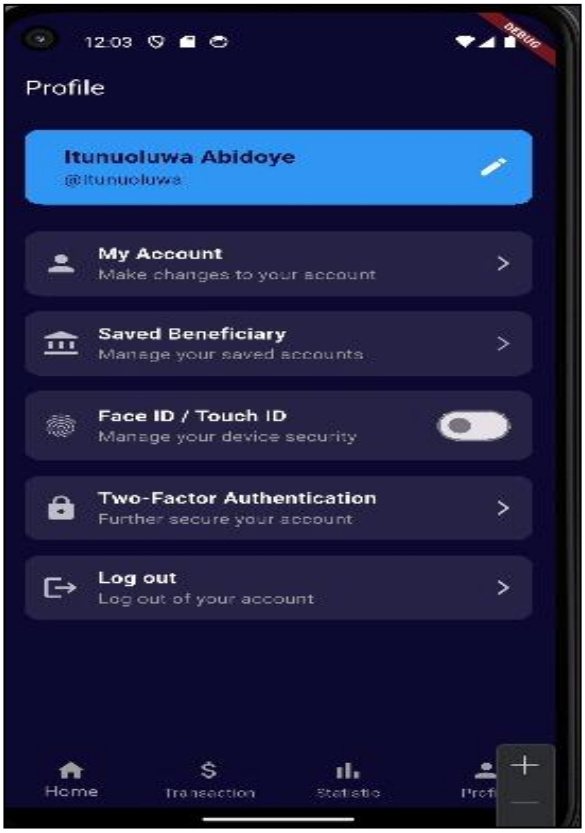
	#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
☐	1	**id** 🔑	int(11)			No	*None*		AUTO_INCREMENT	Change Drop More
☐	2	**source**	varchar(100)	latin1_swedish_ci		No	*None*			Change Drop More
☐	3	**amount**	float			No	*None*			Change Drop More

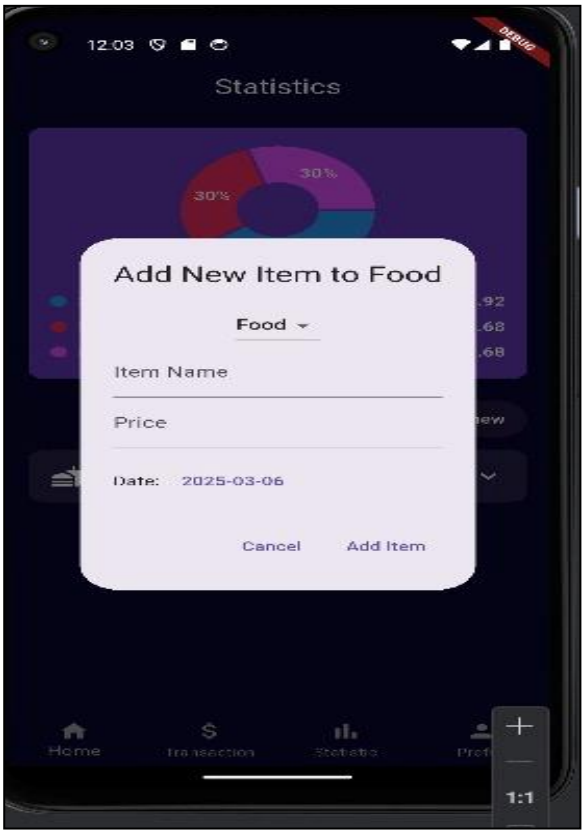
4.10 System implementation

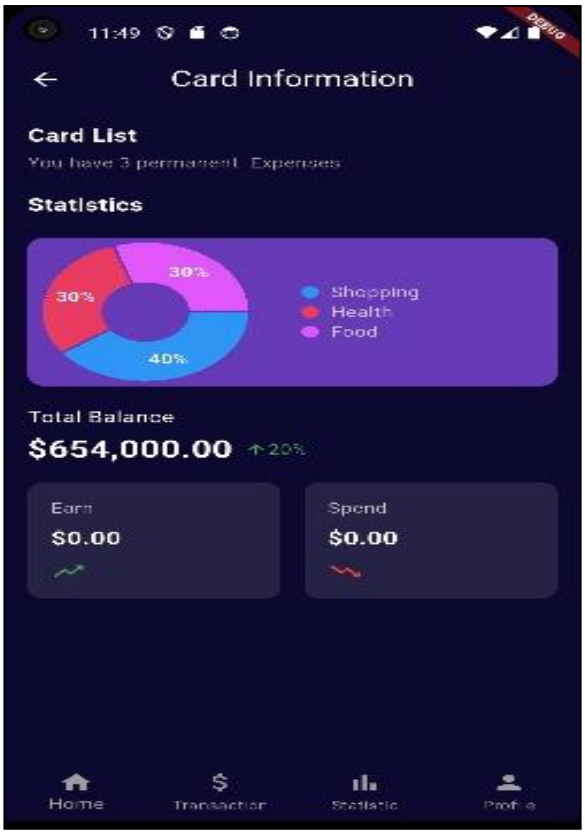
4.10.1. Presentation of the New System






12:03
Profile
Itunuoluwa Abidoye
@itunuoluwa
My Account
Make changes to your account
Saved Beneficiary
Manage your saved accounts
Face ID / Touch ID
Manage your device security
Two-Factor Authentication
Further secure your account
Log out
Log out of your account
Home
Transaction
Statistic


12:03
Statistics
30%
30%
Add New Item to Food
Food
Item Name
Price
Date: 2025-03-06
Cancel
Add Item
Home
1:1


11:49
Card Information
Card List
You have 3 permanent Expenses
Statistics
30%
30%
40%
Shopping
Health
Food
Total Balance
$654,000.00
↑20%
Earn
$0.00
Spend
$0.00
Home
Transaction
Statistic


12:03
Statistics
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Health
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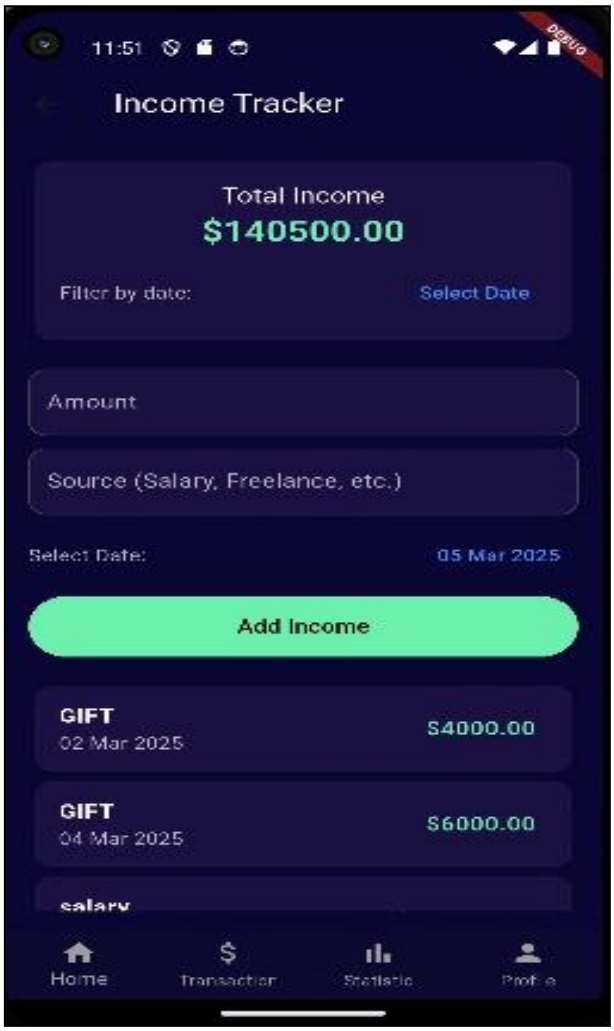
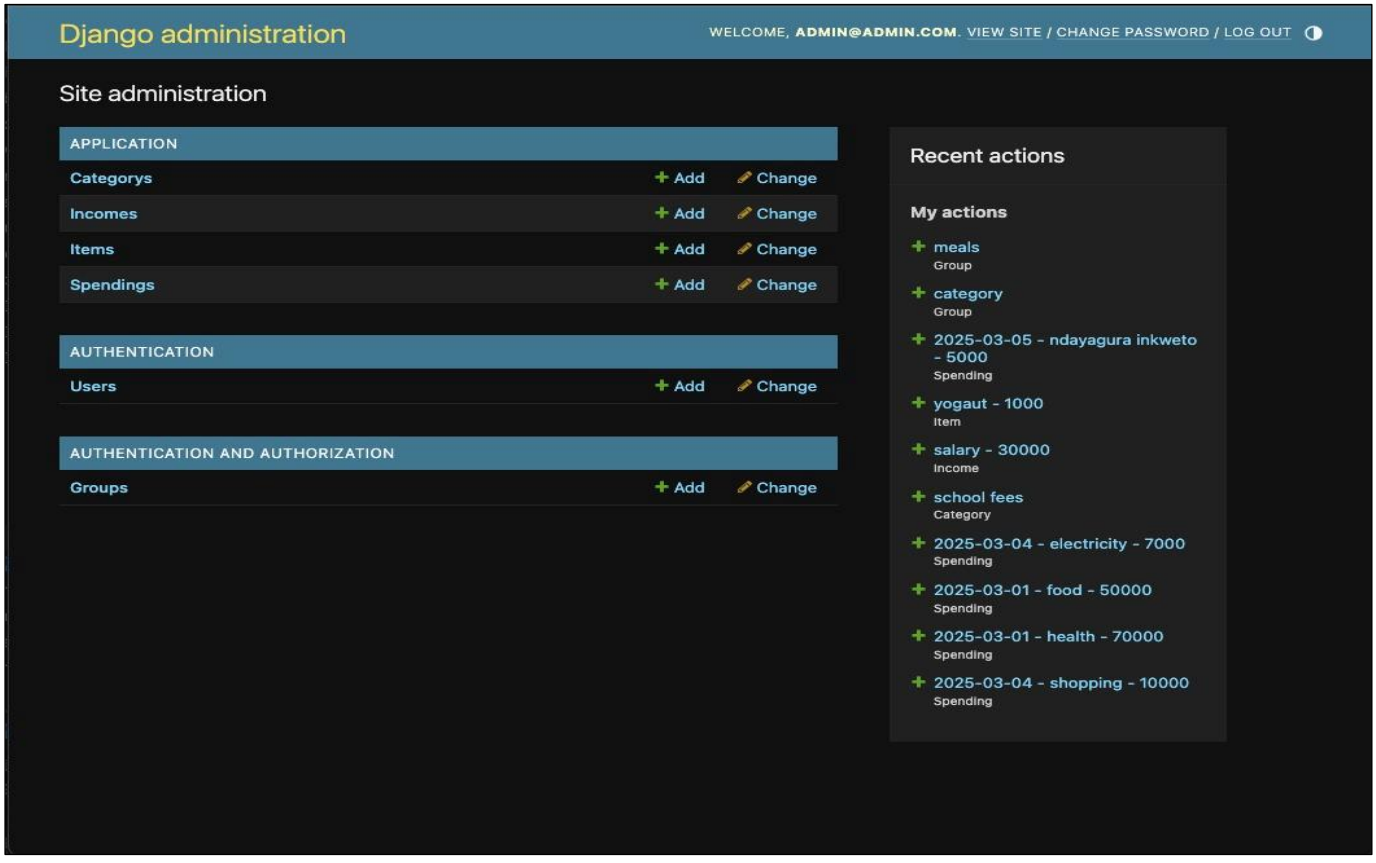
Food
$952.68
Add new
Food
Home
Transaction
Statistic


11:51
DEBUG
Income Tracker
Total Income
$140500.00
Filter by date:
Select Date
Amount
Source (Salary, Freelance, etc.)
Select Date:
05 Mar 2025
Add Income
GIFT
02 Mar 2025
$4000.00
GIFT
04 Mar 2025
$6000.00
salary
Home
Transactions
Statistic
Profile


Django administration
WELCOME, ADMIN@ADMIN.COM. VIEW SITE / CHANGE PASSWORD / LOG OUT
Site administration
APPLICATION
Categorys + Add Change
Incomes + Add Change
Items + Add Change
Spendings + Add Change
AUTHENTICATION
Users + Add Change
AUTHENTICATION AND AUTHORIZATION
Groups + Add Change
Recent actions
My actions
meals
Group
category
Group
2025-03-05 - ndayagura inkweto - 5000
Spending
yogaut - 1000
Item
salary - 30000
Income
school fees
Category
2025-03-04 - electricity - 7000
Spending
2025-03-01 - food - 50000
Spending
2025-03-01 - health - 70000
Spending
2025-03-04 - shopping - 10000
Spending

4.11 Software Testing

Software testing is an essential phase in the development of the Cleaning Company Scheduling and Work Assignment System, ensuring that the system is fully functional, reliable, secure, and performs optimally for all users (managers, supervisors, cleaners, and clients). The diverse set of functionalities such as task scheduling, cleaner management, and client service requests demands a thorough and systematic testing approach to identify and resolve potential issues before deployment.

Testing in the Cleaning Company Scheduling and Work Assignment System includes the following areas:

1. Functionality Verification

- **Objective**: Ensure that core functionalities such as task creation, modification, and cancellation work as expected.
- **Approach**:
    - Manual Testing: Focus on real-user interactions and conduct tests based on common workflows, such as:
        - Creating a new task for a cleaner.
        - Modifying an existing task.
        - Canceling a scheduled task.
    - User Acceptance Testing (UAT)**:** Engage actual users (managers, supervisors, and cleaners) to validate the system's usability, ensuring that it meets the user's expectations and requirements.
    - Goal: Gather direct feedback from users to refine the interface and improve the overall experience, ensuring smooth navigation and operation completion.

2. Unit Testing

- **Objective**: Verify the individual components or functions of the system, ensuring they work as expected in isolation.
- **Components**: Critical features such as:
    - Task Assignment Algorithm: This ensures that tasks are accurately assigned to available cleaners based on workload and availability.
    - User Management: Verifies that features like registration, login, and profile management function as expected for managers, cleaners, and clients.

    - Service Request Handling: Ensures that service requests from clients are correctly processed and scheduled.
- **Tools**: Unit tests will be written using testing frameworks like PyTest (for Python) or JUnit (for Java), depending on the chosen backend technology (Flask, Django, or Spring Boot).
- **Goal**: Identify and fix bugs early, before integration, ensuring that each individual component performs correctly.

3. Integration Testing

- **Objective**: Ensure that the various components and modules of the system interact seamlessly with one another.
- **Components**:
    - Task Scheduling and Notifications: Verifying that task assignments trigger the appropriate notifications to cleaners and clients.
    - Cleaner Availability Updates: Ensure that when a cleaner's availability status is updated, the system reflects it across the scheduling module.
    - Data Synchronization: Ensure that changes made in one module (e.g., task scheduling) are properly reflected in related modules (e.g., cleaner assignment, service request handling).
- **Goal**: Validate that the system's integrated components work as expected and that data flows smoothly between them without errors or inconsistencies.

4. Security Testing

- **Objective**: Ensure that the system is protected against potential security vulnerabilities, safeguarding sensitive user data.
- **Approach**:
    - Authentication and Authorization**:** Test the role-based access control system to ensure that only authorized users (e.g., managers, supervisors, cleaners) can access the features relevant to their roles.
    - Data Encryption: Verify that sensitive user data (such as contact information and task details) is encrypted both in transit (using HTTPS) and at rest (in the database).
    - API Security: Test all exposed APIs for potential vulnerabilities, ensuring they are protected against common security threats like SQL injection, cross-site scripting (XSS), and cross-site request forgery (CSRF).
    - Penetration Testing**:** Simulate attacks on the system to identify potential security weaknesses, such as unauthorized data access or privilege escalation vulnerabilities.

- **Goal**: Safeguard user data and ensure that all authentication mechanisms, data encryption, and APIs are functioning correctly to prevent security breaches.

5. Regression Testing

- Objective: Ensure that previously implemented features continue to work correctly after updates, bug fixes, or the introduction of new features.
- Approach:
    - Test Cases: Regression test cases will be written for critical features like task scheduling, cleaner assignments, user registrations, and notifications.
    - Goal: Confirm that updates or new features do not negatively impact the existing system functionalities, ensuring a stable and reliable system even after modifications.

6. Performance Testing (Optional)

- Objective**:** Assess the system's ability to handle varying levels of load and usage.
- Approach:
    - Stress Testing: Evaluate how the system performs under extreme conditions (e.g., a large number of concurrent users making service requests or updating tasks).
    - Load Testing: Determine the maximum number of users the system can handle without significant performance degradation.
- Goa**l**: Ensure the system can scale as required, handling a high number of concurrent users and tasks without affecting performance.

CHAPTER FIVE: DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Discussion

The implementation of an Ai-assisted Personal Finance Mobile Application represents a significant advancement in how individuals manage their finances, track expenses, and optimize budgeting decisions. The system's design and functionality were specifically developed to address major financial challenges such as manual expense tracking, lack of real-time financial insights, inefficient budgeting, and the absence of AI-driven financial guidance.

The findings of this study indicate that adopting a digital finance management system significantly enhances financial awareness, expense monitoring, and budget adherence. This aligns with studies by Agboola and Tiamiyu (2021), which emphasize that financial technology solutions reduce the cognitive load associated with manual financial management and encourage structured financial habits.

1. Impact of Ai-assisted Financial Management

Research findings highlight that automated financial tracking and AI-driven insights minimize the reliance on manual methods, enabling users to understand their spending patterns, set realistic budgets, and improve saving habits. This supports Zhang and Zhao (2020), who found that automation in personal finance applications enhances financial literacy and decision-making while reducing human errors in budgeting. real-time financial analytics and automated expense categorization z provided by the system significantly improve user engagement. Users can track spending instantly, receive proactive alerts, and make informed financial decisions based on AI-generated recommendations. These findings align with McLean and Osei-Frimpong (2019), who emphasized that intuitive financial apps with real-time tracking improve financial discipline and reduce unnecessary spending.

2. User Experience and Financial Behavior Changes

The study revealed a strong correlation between system usability and financial behavior improvements. The user-friendly interface, intelligent budgeting recommendations, and real-time alerts played a crucial role in fostering better spending habits and financial planning. These findings are supported by Patel et al. (2021), who found that financial applications with AI-driven insights empower users to make proactive financial decisions rather than reactive ones.

However, the study also identified challenges in the adoption of Ai-assisted financial management tools, particularly related to:

- Resistance to Digital Finance Tools – Some users were hesitant to transition from traditional finance tracking methods (e.g., notebooks, spreadsheets) to an automated system.
- Privacy and Data Security Concerns – Users expressed concerns about sharing financial transaction data with an AI-driven system, highlighting the need for robust encryption and compliance with financial data protection laws**.**
- Limited Financial Literacy – Some users required educational support to understand how to interpret financial insights and optimize their budgets effectively.

These findings are consistent with Al-Sobaihi et al. (2021)**,** who noted that barriers to digital transformation in financial management include user skepticism, security concerns, and varying levels of financial literacy**.** The study underscores the importance of user education, transparency in data protection policies, and continuous user support to enhance adoption and trust in Ai-assisted financial applications.

5.2 Conclusion

The implementation of an AI-assisted Personal Finance Mobile Application has the potential to revolutionize financial management by automating expense tracking, enhancing budgeting, and improving financial awareness. The study highlights that real-time financial insights and AI-driven recommendations help users adhere to budgets, reduce unnecessary spending, and develop a savings culture.

While AI-powered financial tools significantly improve financial literacy and spending control, challenges such as user resistance, data privacy concerns, and limited understanding of AI-driven tools must be addressed. The study emphasizes the importance of user education, strong data security measures, and continuous support to enhance adoption and maximize the application's benefits.

In conclusion, the AI-assisted finance app can empower users, optimize financial habits, and support long-term financial stability. By overcoming adoption barriers and improving digital literacy, the system can help individuals achieve financial independence and make informed financial decisions.

5.3 Recommendations

Based on the findings from the study and the challenges faced during the implementation of the Cleaning Company Scheduling and Work Assignment System, the following recommendations are proposed for its successful adoption and optimization:

1. Training and Support

Providing educational resources and user-friendly tutorials to help individuals understand how to use AI-assisted financial tools effectively. Ongoing customer support ensures users can resolve issues and maximize the app’s benefits.

2. User Feedback Mechanisms

Implementing surveys, reviews, and in-app feedback features to gather user opinions and continuously improve the application based on their needs and experiences.

3. Data Security Measures

Enhancing security protocols, including encryption, two-factor authentication, and compliance with financial data protection regulations, to protect users' sensitive financial information.

4. Promoting System Adoption

Raising awareness through marketing campaigns, partnerships with financial institutions, and offering incentives to encourage users to transition from traditional financial management methods to AI-driven solutions.

5. Continuous Evaluation

Regularly assessing the application's performance, user satisfaction, and financial impact to make necessary improvements and ensure its effectiveness in helping users manage their finances.

6. Scalability and Flexibility

Designing the system to accommodate future growth by supporting more users, integrating with additional financial services, and adapting to new technological advancements without performance issues.

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