



Personal Finance Management Application

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Abstract

Personal finance management is essential for achieving financial stability, yet many individuals, especially students with limited income and fluctuating expenses, find it challenging. This project aims to develop a personal finance management tool to help people better manage their finances through effective budgeting, expense tracking, and goal setting. The tool utilizes artificial intelligence to analyze cash flow, predict future expenses, and offer visualization graphs and charts tailored to users' financial situations.

The main purpose of this project is to simplify financial planning and enhance financial literacy among students by providing a user-friendly platform that translates complex financial data into practical insights. The project addresses the lack of adequate financial planning resources tailored to students' unique needs and seeks to bridge the gap between economic goals and actionable steps.

Despite the challenges involved, this project provides a strong foundation for a scalable and impactful personal finance management tool. By addressing these limitations and refining its design, this tool has the potential to empower students to make informed financial decisions and achieve greater financial stability.

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Chapter 1: Introduction

In today's fast-paced world, managing personal finances effectively has become an essential skill for achieving financial stability and independence. Nevertheless, with the increasing complexity of financial choices and transactions, many individuals face challenges in maintaining control over their spending, saving, and overall financial health. The advent of digital finance has provided numerous tools and platforms, yet many fail to deliver the personalized insights and predictive capabilities necessary for sound financial decision-making.

This project introduces a personal finance tool that leverages machine learning technology to bridge this gap, empowering users to gain greater awareness of their expenses. By analyzing historical spending data, the tool aims to forecast future expenses and provide actionable advice, enabling users to build healthy financial habits and work toward their financial goals.

1.1 Problem Statement

Many individuals struggle with managing their finances due to a lack of visibility into their spending patterns, inadequate financial planning, and the absence of tools that offer personalized recommendations. Without clear insights and accurate predictions, users are often unable to make informed financial decisions, which can lead to overspending, debt accumulation, and missed financial goals.

This project aims to address these challenges by developing a smart personal finance tool that leverages machine learning to analyze spending behavior, predict future expenses, and provide actionable recommendations.[1]

1.2 Project Vision

To enable individuals to achieve financial wellness through effective budgeting and personalized financial advice, promoting healthy financial habits and improved money management skills, thereby allowing them to take control of their financial lives.

1.3 Project Mission

This project aims to create a personal finance application that provides users with a comprehensive understanding of their financial behavior and offers actionable insights. The application will utilize machine learning models to predict spending patterns, establish financial goals, and deliver personalized recommendations based on each user's spending data.

1.4 Objectives

Our project seeks to enhance individuals' financial management by providing a comprehensive, data-driven overview of their economic status. This enables users to make informed, strategic decisions that optimize financial control and planning. We analyze users' cash flow and financial objectives through advanced machine learning algorithms, offering actionable insights to support effective business planning for future profits and expenses. Additionally, we assist users in setting realistic goals and managing expenses based on personalized spending patterns. Our focus remains on creating an intuitive, accessible interface that simplifies complex financial information, making it easily navigable.

1.5 Project scope

Managing personal finances can be daunting, particularly for individuals with limited experience or constrained financial resources. Our application is specifically designed to make financial management accessible and practical for all users, irrespective of their financial background or income level.

We offer straightforward tools that enable users to monitor their spending, prioritize essential needs, and uncover potential savings opportunities no prior expertise is necessary. Whether the objective is to optimize a budget, establish a small emergency fund

1.6 Survey Construction and Analysis

1.6.1 Survey Objectives:

Effective financial management is a challenge many face, particularly in Egypt, where the current economic conditions add additional pressures. For young adults balancing academic responsibilities, part-time jobs, and personal aspirations, the ability to save for goals, monitor daily expenses, and maintain financial discipline often proves especially difficult. Rising living costs, limited job opportunities, and fluctuating income levels have further complicated their financial journeys.

Recognizing the importance of addressing these challenges, we decided to develop an application designed to assist users in managing their finances more effectively. While our goal was to create a tool suitable for a broad audience, most responses to our initial survey came from our classmates—students aged 18 to 25. Their insights, gathered against the backdrop of Egypt's economic realities, provided valuable input, shaping our application's core features and highlighting this age group's unique financial priorities.

1.6.2 Survey overview, containing details about:

1. Demographics (age, gender, occupation).
2. Current finance management methods.
3. Goals in managing finances(budgeting).
4. Frequency of expense tracking.
5. Preferred features in a budget tracker.
6. Importance of visual spending representations.
7. Setting financial goals.
8. Interest in reminders, chatbots, and AI-powered features.
9. Ranking features like alerts, expense tracking, and goal setting.
10. Suggestions and challenges (optional).

1. Demographics

- **Age Groups:** Most respondents are likely in the 18–34 age range, which suggests that our app's primary audience will be younger individuals, likely students or early-career professionals.
- **Gender and Occupation:** A mix of respondents includes students, freelancers, and employed individuals, highlighting the need for versatile features that cater to both structured (employed) and flexible (students/freelancers) financial needs.

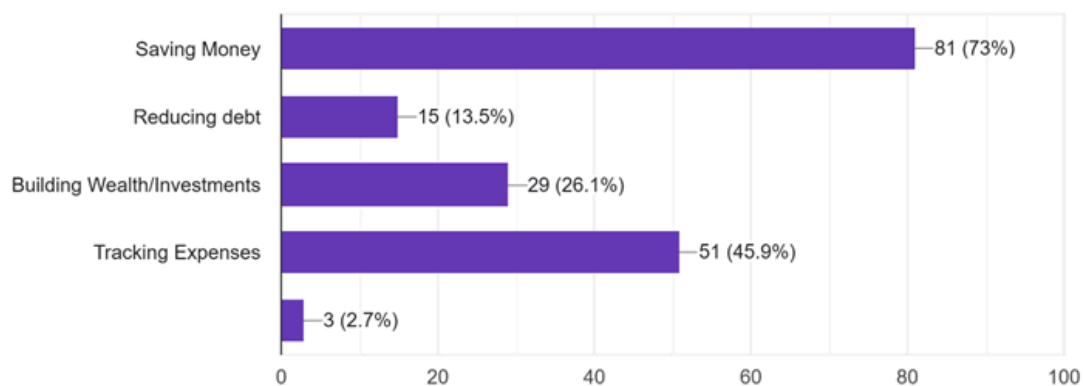
2. Current Finance Management Methods

- “No specific system; I manage it as I go” highlights a gap in structured finance management for many users.
- “Manual tracking (notebooks, spreadsheets)”: Suggests the need for a user-friendly digital transition.
- “Bank apps”: Indicates a familiarity with technology and digital tools.

3. Financial Goals

What is your primary goal in managing your finances? (Select all that apply)

111 responses



- **Saving Money:** Universally desired.
- **Tracking Expenses:** Strong demand for monitoring financial flows.
- **Reducing Debt:** Less common but essential for certain users.

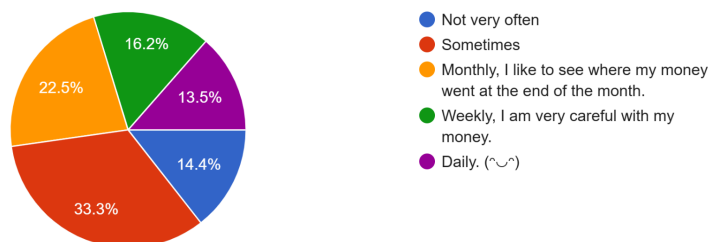
4. Frequency of expense tracking

- Sometimes (33.3%): The majority of respondents indicated that they only track their expenses occasionally. They may recognize the importance of tracking finances but lack consistency or a structured system.
- Monthly (22.5%): A significant portion of participants review their finances at the end of the month.
- Weekly (16.2%): A smaller group is highly organized and tracks their expenses weekly, reflecting a more disciplined approach to financial planning.
- Daily (13.5%): The smallest group of respondents track their expenses daily. This indicates a high level of commitment to financial management, possibly due to specific financial goals or habits.
- Not Very Often (14.4%): A notable portion of respondents do not track their expenses often, highlighting a potential gap in financial awareness or interest.

Insight: A significant portion of users are inconsistent in tracking their expenses ("Sometimes" and "Not Very Often"). The system should include features that encourage regular engagement, such as reminders or gamification elements.

For users who track expenses monthly, the system can provide monthly summaries or automated reports to simplify their process.

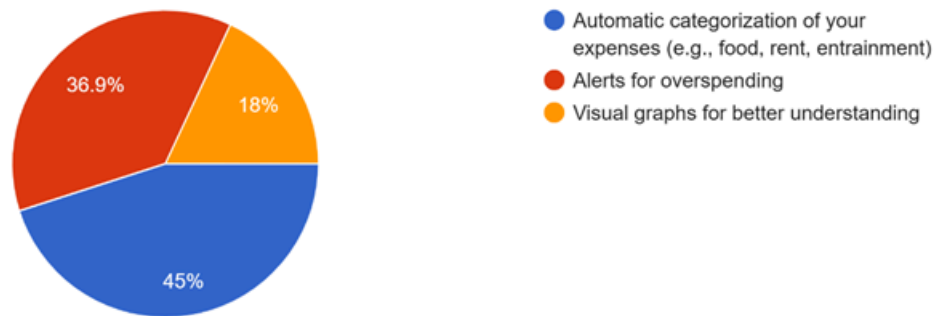
How often do you track your expenses?
111 responses



5. Preferred features in a budget tracker

What would you find most helpful in a budget tracker?

111 responses

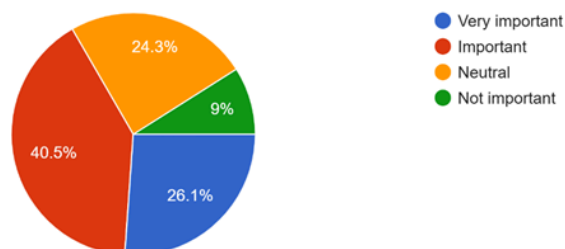


- Automatic categorization of expenses (e.g., food, rent, entertainment) emerged as the most desired feature, with 45% of respondents selecting it.
- Alerts for overspending were the second most popular feature, chosen by 36.9% of respondents. This reflects a strong need for tools to help users stay within their budgets and avoid financial pitfalls.
- Visual graphs for better understanding were favored by 18% of respondents, showing that some users prefer graphical representations for analyzing their financial data.

6. Importance of visual spending representation

How important is it for you to have a visual representation of your spending habits (e.g., charts, graphs)?

111 responses



- Majority Preference (40.5% - "Important"):

A significant proportion finds visual representation important. This suggests that clear, visually appealing charts and graphs are a crucial feature.

- Strong Preference (26.1% - "Very Important"):

More than a quarter of respondents highly value visual tools, emphasizing that such features will improve user satisfaction and engagement.

- Moderate Interest (24.3% - "Neutral"):

While neutral respondents might not prioritize visuals, they are likely to still benefit from them as part of a well-rounded app.

- Minimal Disinterest (9% - "Not Important"):

A small minority does not find visuals important, indicating a marginal trade-off for users who prefer other features.

Insights:

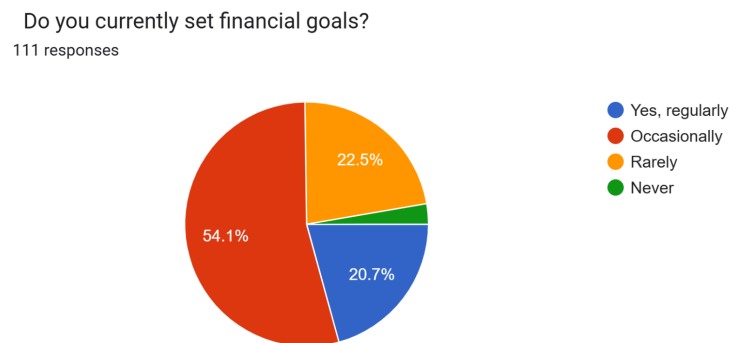
- Prioritizing Visuals:
 - Include charts, and graphs to display spending trends, budget progress, and savings goals. Examples: Bar graphs for monthly expenses.
- Customizable Options:
 - Allow users to select which data to visualize, such as weekly trends or specific categories.

7. Setting financial goals

Asking this question allowed us to measure whether users already set financial goals and how regularly they do so.

We found that a majority of respondents—**54.1%**—reported setting financial goals "occasionally," while **22.5%** indicated that they "rarely" set goals, and only **20.7%** stated they do so "regularly." A small minority of **2.7%** never set financial goals at all.

These findings emphasize the need for features that encourage and simplify goal-setting. By providing tools that make the process engaging and trackable, we aim to foster more consistent goal-setting habits among users. Additionally, the data underlines the importance of integrating motivational features, such as progress trackers and reminders, to help users stay committed to their financial objectives.



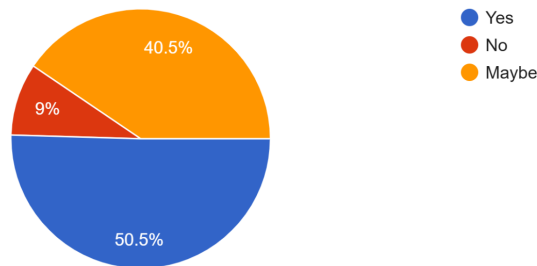
8. Interest in reminders, chatbots, and AI-powered features

- a. Would you use a feature that tracks your progress toward financial goals? When we asked if users would benefit from a progress-tracking feature, the responses reflected an overwhelming interest. This affirmed the need for a dynamic, visual tool that motivates users to achieve their financial aspirations.

- b. Would you trust AI to provide insights into your spending habits? We were curious about users' openness to leveraging AI for personalized insights. The majority of responses said yes, this indicates that a significant portion of the audience is open to the idea of using AI for financial guidance, although some remain uncertain. Only a small percentage (9%) expressed a lack of trust in AI.

Would you trust AI to provide recommendations and insights on your spending habits?

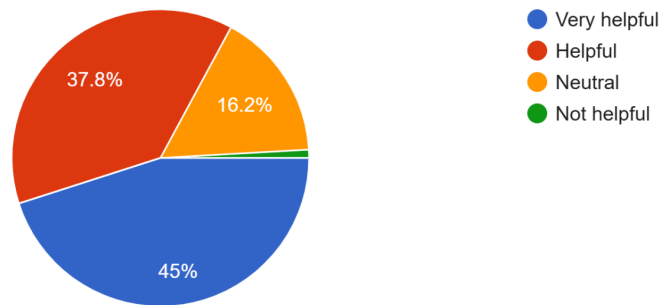
111 responses



- c. The question, “How helpful would reminders for bill payments or savings goals be?” is crucial as it addresses a common challenge in personal finance management. Many people struggle to remember important financial tasks due to busy lifestyles, leading to missed payments and delayed savings. By incorporating timely reminders, users can stay on track with bill payments and savings goals, improving their financial management.

How helpful would reminders for bill payments or savings goals be?

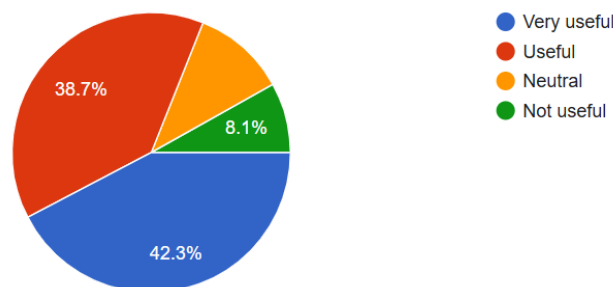
111 responses



- d. The question, “How useful would chatbot for answering queries like ‘What did I spend on food last month?’ be?” is important as it addresses the convenience and efficiency of using a chatbot to quickly access personal finance data. A chatbot can provide immediate answers, saving time and improving user experience. A chatbot can streamline this process by instantly retrieving relevant data, making it easier for users to track their spending. Feedback and usage data can reveal how much users value having such instant access to information, leading to improved financial awareness and decision-making.

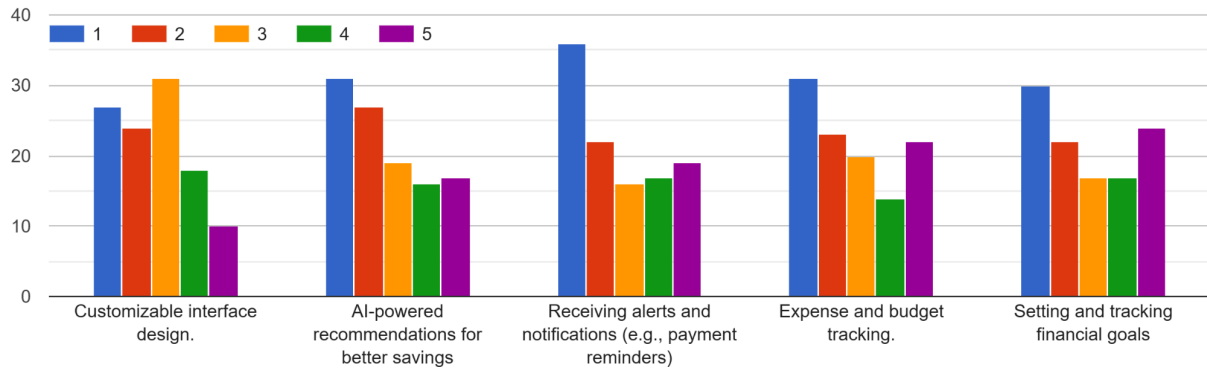
How useful would chatbot for Answering queries like “What did I spend on last month?” be?

111 responses



9. The visualized data represents how respondents rank various features of a financial tool based on their importance.

Rank the following features based on their importance to you (1 for the most important, 5 for the least important):



Each bar indicates the number of respondents who assigned a specific rank (1 being the most important, 5 being the least important) to the following features:

- **Receiving Alerts and Notifications:** Dominantly ranked as the most important, this demonstrates the critical role of timely reminders in managing finances effectively.
- **Expense and Budget Tracking:** Similar to notifications, this feature garners significant importance, showcasing users' reliance on tools that help monitor and control spending habits.
- **AI-Powered Recommendations for Better Savings:** This feature shows a balanced distribution, highlighting a diverse perception of its usefulness, likely influenced by individual comfort with AI-driven tools.
- **Customizable Interface Design:** A significant number prioritize this feature moderately, indicating that while personalization is valued, it is not the top priority for most users.
- **Setting Financial Goals:** While not as heavily prioritized as notifications or budget tracking, goal setting still holds relevance, particularly for long-term financial planning.

10. Suggestion questions: The challenges users face with managing finances reveal pain points that a financial app can aim to solve effectively. Based on the feedback:

Challenges:

- **Difficulty in Budgeting and Predicting Expenses:** Many users struggle to set budgets for upcoming months or estimate their future expenses accurately. This highlights a need for tools that provide **flexible budgeting options** and **predictive analytics** based on past spending habits to help users prepare better for the future.
- **Economic Pressures in Egypt:** The high prices and inflation make financial management even more challenging. Users are likely looking for solutions that help them **track spending, identify savings opportunities, and prioritize essential expenses** to cope with economic uncertainty.
- **Complexity of Existing Financial Apps:** A recurring concern is that many apps are not user-friendly. They lack simplicity, making it harder for people to navigate and utilize their features effectively. This highlights a significant gap where an app offering **intuitive design, clear workflows, and minimal steps** can stand out.

Additional features users ordered:

The written responses provide deeper insight into user preferences and emphasize critical factors for designing a successful financial app. Users consistently highlight **ease of use** and an **understandable interface** as top priorities, indicating their preference for a straightforward and intuitive experience. They want an app that simplifies financial management rather than complicates it.

Additionally, **security** emerges as a crucial factor, as users want to feel confident sharing sensitive financial data. This underscores the importance of robust security measures and transparent communication about data protection practices.

Alert notifications are frequently mentioned as an essential feature to keep users informed about deadlines, payments, or progress toward their goals. Beyond that, users express the need for **features that motivate and encourage them to stay engaged**, such as progress tracking, rewards, or insights that inspire continued usage.

Chapter 2: Related work

Introduction:

This section reviews prior studies and techniques employed in developing finance management applications. The focus is identifying methodologies and technologies that enhance user financial planning, budgeting, and goal achievement.

2.1 Understanding financial modeling:

A financial model uses academic theories to analyze accounting and business metrics and make data-driven predictions.

Financial models have diverse practical applications across various industries. Organizations are inaccurate or biased. Consequently, businesses may face the risk of making misguided decisions based on these erroneous forecasts, potentially leading to financial losses, inefficiencies, or missed opportunities.

Finance professionals can reduce model risk by conducting model validation. This process examines every part of a financial model to detect errors and ensure that the model works as expected. Model validation also helps identify limitations in the model so that business leaders can account for these imperfections when making decisions.

2.2 Techniques Used in Financial Management Applications:

2.2.1 Monte Carlo simulation :

The Monte Carlo simulation—also known as the multiple probability simulation—uses statistical analysis to predict every possible outcome of an uncertain scenario that involves one or more undefined variables. The simulation assigns many different random values to these variables and runs the scenario repeatedly, generating numerous outcomes. Finally, the simulation takes the average of these outcomes to estimate the most likely result.[2]

The Monte Carlo method has many practical applications. For example, investors can use this technique to predict the likelihood of earning a profit from an investment. Finance professionals can also use the Monte Carlo simulation to estimate the future value of portfolios.

2.2.2 Scenario analysis :

Evaluates how future events could impact a business's operations and performance over a long-term period. This method allows finance professionals to predict the effects of a wide range of deterrents, such as cyber threats, government collapse, hiring shortages, new technological developments, and terrorism. Business leaders can use scenario analysis to plan how they would respond to possible situations to achieve the best possible outcome for their company. This technique also allows companies to identify their strengths and weaknesses so they're better prepared to act in case of crisis.

2.2.3 Neural Networks in Financial Forecasting :

Neural networks are particularly effective because they can capture the non-linear and complex relationships between various financial indicators. For example, consider the task of predicting stock prices. Traditional methods might use linear regression, which assumes a linear relationship between the independent variables (such as historical prices, trading volumes, and interest rates) and the dependent variable (the future stock price). A neural network, on the other hand, does not assume any specific functional form for these relationships. Instead, it learns from the data, allowing it to model the intricate dependencies that exist between the input variables. For instance, the network might learn that a combination of rising interest rates, increasing trading volumes, and negative sentiment in news articles can signal a potential decline in stock prices. By capturing such complex patterns, neural networks can generate more accurate and reliable forecasts. Average modeling techniques to execute tasks such as:

- Generate reports for regulatory agencies.
- Manage assets

- Make significant financial decisions, such as merging with another company or securing a new investment.
- Evaluate business strategies
- Project future sales trends

Models play a critical role in supporting decision-making processes within organizations, offering valuable insights into potential events and trends. They are widely used to simulate scenarios, optimize strategies, and forecast future outcomes, enabling businesses to plan effectively. However, while models offer significant utility, they also have inherent risks.

One of the primary challenges lies in their reliance on assumptions and incomplete data to predict events or trends that have yet to occur. This inherent uncertainty can result in flawed predictions if the underlying assumptions are accurate or if the input data needs to be more of a

2.2.4 Time series analysis :

Time series analysis is a powerful tool for examining non-stationary data—data that fluctuates over time or is influenced by temporal factors. This analytical method is particularly valuable in industries such as finance, retail, and economics, where variables like currency exchange rates, sales figures, and market trends are constantly changing. A notable application of time series analysis is in stock market analysis, where it forms the foundation of automated trading algorithms designed to predict price movements and optimize trading strategies. In the retail sector, companies like Amazon utilize time series forecasting to prepare for significant events, such as Black Friday. By analyzing historical sales data, they can anticipate demand surges, allowing them to strategically manage inventory and logistics. This approach ensures that stock levels are adequate and resources are available, thereby optimizing operations and efficiently meeting customer demand.

2.3 Main features most Personal Finance Applications have:

Personal finance applications have become a critical tool for individuals seeking to manage their financial health. These applications typically provide functionalities such as expense tracking, budgeting, investment management, and debt reduction strategies. With the rapid advancements in artificial intelligence (AI), many such apps have incorporated AI-driven features, transforming them into intelligent financial assistants. The integration of AI not only enhances the user experience but also offers personalized insights, predictive analytics, and automated financial management, which are reshaping the landscape of financial technology (FinTech). Most personal finance applications share a core set of features designed to help users manage their money effectively. The following features are commonly found:[3]

2.3.1 Expense Tracking and Budgeting:

AI has significantly improved the accuracy and usability of expense tracking and budgeting. Applications leverage AI to automatically categorize transactions and sync with bank accounts and credit cards or offer manual entry. Research indicates that automation reduces user effort and increases engagement by providing tailored suggestions for budget adjustments based on past behaviors [4]. AI-driven alerts and nudges also play a critical role in preventing overspending and promoting savings habits.

Examples of Applications that have this feature: are Mint, Lunch Money, and PocketGuard.

2.3.2 Budgeting tools :

Allows users to create budgets and track how their spending aligns with predefined categories. Users can set monthly budgets tailored to their spending habits, or the application will offer a suggested budget category based on past spending.[5]

Examples of Applications that have this feature:

You Need A Budget (YNAB) which uses Zero-Based Budgeting for allocating users' money in which every dollar has a job and another application similar to it called EveryDollar focuses on budgeting.[6]

2.3.3 Financial Insights and Reports :

AI models integrated into personal finance apps enable predictive financial analytics and insights. Tools use machine learning to forecast future expenses and suggest optimal savings plans. These models rely on historical data and external factors such as economic trends to deliver actionable insights. Users of AI-enabled forecasting tools demonstrate better financial outcomes, such as increased savings rates and reduced debt.[7]

Examples of Applications that have this feature: are Albert and Clarity Money.

2.3.4 Investment and Net Worth Tracking :

Investment and net worth tracking apps help users monitor their financial health by aggregating and analyzing their assets and liabilities. These tools provide insights into portfolio performance, asset allocation, and hidden investment fees, along with retirement and growth projections. For net worth, they consolidate accounts, and track assets (e.g., savings, properties, investments), and liabilities (e.g., loans, credit card debt) to calculate total net worth, displaying trends over time. Examples of Applications that have this feature:

The Personal Capital (Empower) application Offers paid advisory services for personalized financial planning and investment management. It tracks net worth by consolidating all assets and liabilities, offering a clear view of financial health.

Range application is a financial advisory platform focused on investment management, financial planning, and wealth management. The platform provides users access to a team of advisors and tools to support various financial aspects, including investment strategies, retirement planning, and equity compensation.

Also, the rise of robo-advisors demonstrates the role of AI in investment management. These systems utilize algorithms to create and manage diversified portfolios based on individual risk tolerance and financial goals. The incorporation of Natural Language Processing (NLP) enables apps to offer user-friendly explanations of complex investment strategies. Literature suggests that AI-based investment tools outperform traditional methods by optimizing returns while minimizing risk through continuous data-driven analysis.[8]

Examples of Applications that have this feature: are Wealthfront, Betterment, Acorns, and Robinhood.d.

2.3.5 Goal setting and tracking :

Users specify their financial goals, such as saving for a vacation, building an emergency fund, paying off debt, or planning for retirement. This is often done through a simple, guided process where the user selects the type of goal and sets a target amount and time frame.

They automatically track and categorize transactions to ensure that each expense and income is accounted for within the context of the user's goal. The apps visually display goal progress, often through graphs, progress bars, or percentage completions. As users contribute funds or reach spending milestones, these tools update dynamically.

A lot of applications have this feature like YNAB, and Mint.

2.3.6 Multi-Currency and International Features :

Multi-currency support and international features are becoming increasingly important in financial apps, especially for users who deal with multiple currencies, travel frequently, or have international income sources.

An application like Mint is primarily designed for the U.S. and Canadian markets. It links to financial institutions, credit cards, loans, and investment accounts in these countries so it does not support financial institution integration or currency outside the U.S. and Canada.

YNAB also focuses on users in specific countries, primarily the U.S. and Canada, and it does not provide built-in multi-currency support. However, YNAB users can manage multi-currency budgets by manually adding foreign bank accounts or adjusting conversion rates in their budget categories. Third-party integrations are also available for currency exchange calculations.

Personal Capital supports the tracking of multiple accounts and investments, but its international features are more limited. It mainly serves U.S.-based users, though international assets can be tracked manually. Multi-currency functionality is not a key feature, making it less suitable for global users who need automatic currency conversions.

Lunch Money supports both multi-currency and cryptocurrency tracking, making it versatile for international users and those with digital asset portfolios. The app allows users to track financial data across over 90 currencies, ensuring that transactions in different currencies are accurately accounted for.

2.3.7 Data Security and User Privacy

Despite their benefits, AI-driven personal finance apps face challenges such as data security, user privacy, and algorithmic bias. The reliance on sensitive financial data necessitates robust security measures and compliance with regulations like GDPR. Moreover, biased algorithms can lead to unfair financial recommendations, disproportionately affecting certain user demographics.[9]

2.3.8 Emerging Trends and Future Directions :

Recent advancements, such as conversational AI and generative models, are expected to further revolutionize personal finance apps. Voice-activated financial assistants powered by technologies like GPT (Generative Pre-trained Transformers) are increasingly popular. Furthermore, the integration of blockchain for enhanced security and decentralized finance (DeFi) capabilities is an emerging area of interest. Future research should focus on combining these technologies with AI to create more robust, secure, and user-centric financial solutions.

2.4 Additional Features in Our Application

Our personal finance application differentiates itself by incorporating innovative features that enhance user experience and deliver auto data entry and extraction. This feature is designed to provide added value and cater to specific user needs beyond the common functionalities found in most personal finance applications:

- **AI Chatbot**

Our **Conversational AI Assistant** streamlines financial management by handling user transactions efficiently. Key features include:

- **Answering User Queries**

Provides instant responses to questions like, “What did I spend on food last month?”

- **Automatic Transaction Categorization**

Automatically classifies expenses into the correct category based on user input. For example:

- User: "I ate lunch today for 200."
- Chatbot: "Recorded 200 in the Food category."

This functionality ensures accurate expense tracking with minimal effort, helping users stay organized and focused on managing their finances.

2.5 Feature Matrix

Feature	Savvy	Mint	YNAB	PocketGuard	EveryDollar	GoodBudget
Expense & Income Tracking	✓	✓	✓	✓	✓	✓
Budget Tracking	✓	✓	✓	✓	✓	✓
Customizable Categories	✓	✓	✓	✓	✓	✓
Goal Setting & Monitoring	✓	✓	✓	✓	✓	✓
Reports & Analytics	✓	✓	✓	✓	✓	✓
Spending Notifications	✓	✓	✓	✓	✓	✓
Security & User Management	✓	✓	✓	✓	✓	✓
Personalized Recommendations	✗	✓	✓	✓	✗	✗
Expense Predictions	✓	✓	✗	✗	✗	✗
Auto Categorization	✓	✓	✓	✓	✗	✓
Bank Sync	✗	✓	✓	✓	✓	✓
AI Chatbot	✓	✗	✗	✗	✗	✗

Chapter 3: Requirements Specification

This chapter outlines the essential requirements for the **Personal Finance Tracking Application**, a tool designed to empower users with effective financial management capabilities. It delves into the system's functional and non-functional requirements, providing a clear roadmap for implementation.

3.1 Functional Requirements

Functional requirements clearly outline the specific behaviors and functionalities that the system must exhibit. These core features are vital to our application's value and effectiveness.

3.1.1 User Registration and Authentication

- Users can register using an email address and a password.
- Users can log in securely and manage their accounts.

3.1.2 Expense Tracking

- Users can input daily expenses into predefined or custom categories.

3.1.3 Income Tracking

- Users can log their sources of income and track earnings over time.

3.1.4 Budgeting

- Users can set monthly or annual budgets for specific categories.
- The system alerts users when they approach or exceed budget limits.

3.1.5 Spending Analysis

- The system provides visual reports (charts, graphs) of spending patterns.
- Users can view their spending aligns with their financial goals.
- Periodic Summaries: Summarize income, expenses, and savings to reflect financial health.

3.1.6 Predictive Analysis

- Machine learning models predict future expenses based on historical spending data.

3.1.7 Goal Setting

- Users can define financial goals (e.g., vacation savings).
- The system provides progress updates and goals.
- Allow users to set specific savings goals (e.g., save \$1,000 in 6 months) and monitor progress.
- Provide visual indicators for goal completion percentages and remaining amounts.

3.1.8 Notifications and Alerts

- Notifications for overspending, upcoming bill payments, or budget limits.
- Notify users when category budgets are exceeded.
- Balance Warnings: Alert users when balances fall below a specific threshold to avoid overdrafts.

3.1.9 AI Chatbot :

Conversational AI Assistant: A planned feature to enhance user interaction, providing capabilities such as:

- Answering queries like “What did I spend on food last month?”
- Automatic Transaction Categorization, e.g., “I ate lunch today for 200.”

3.2 Non-Functional Requirements

Non-functional requirements specify the quality attributes of the system.

3.2.1 Performance

- The application should load data and provide insights within 2 seconds for a seamless user experience.

3.2.2 Scalability

- The system should handle increasing numbers of users and data inputs without performance degradation.

3.2.3 Security

- All data must be encrypted during storage and transmission.
- Two-factor authentication should be implemented for user accounts.

3.2.4 Usability

- The interface must be intuitive and user-friendly for people with varying levels of technical expertise.

3.2.5 Reliability

- The system must maintain 99.9% uptime.

3.2.6 Maintainability

- The codebase should be modular to facilitate updates and bug fixes.
- The application should load data and provide insights within 2 seconds for a seamless user experience

3.2.7 Compliance

- Ensure that the application complies with the General Data Protection Regulation (GDPR) to protect the personal data of users.

3.3 Software Diagrams:

Software diagrams serve as visual representations of a system's architecture, components, and interactions.

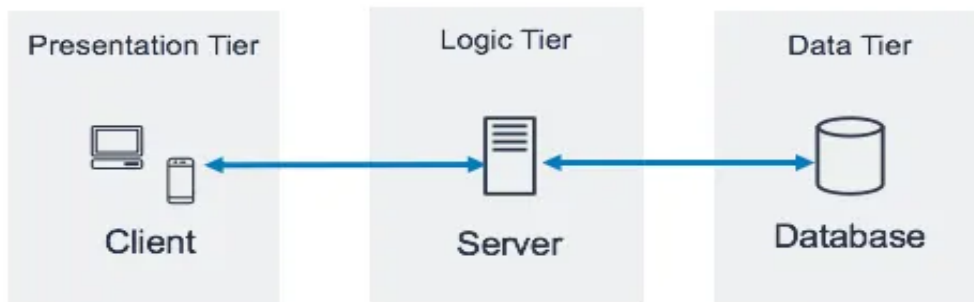
This helps to understand the structure and functionality of the software, ensuring clear communication

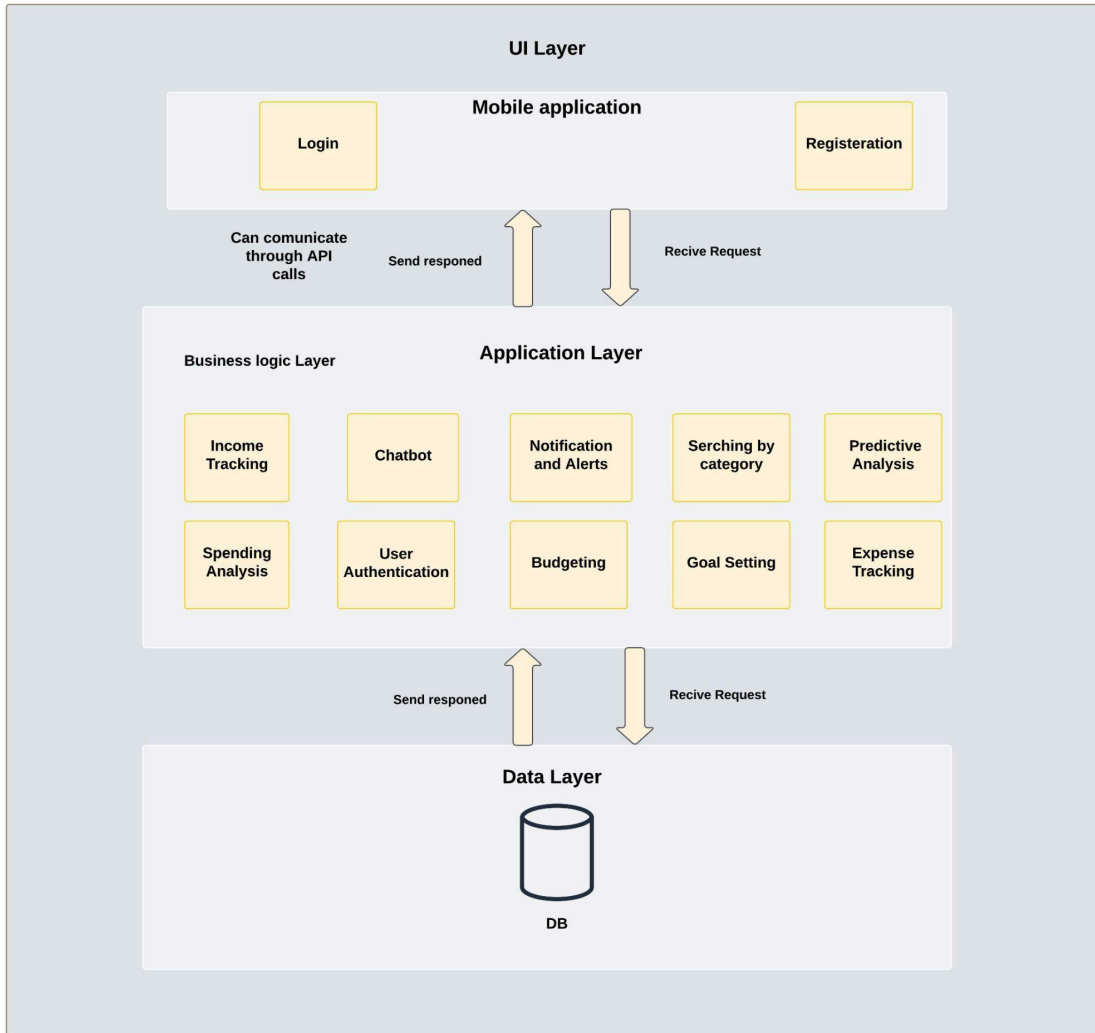
and alignment during development.[10]

3.3.1 Three-Tier System Architecture :

The Three-Tier Architecture consists of three distinct layers or tiers:

1. **Presentation Layer (Frontend):** This is where the user interacts with the application.
2. **Application Layer (Backend/Logic):** This layer contains the business logic and processes user requests.
3. **Data Layer:** This tier stores and retrieves data as needed by the application layer.





3.3.1.1 User Interface Layer (Presentation layer):

- **Mobile Application:**

This is the front-end layer where users interact with the application through their mobile devices. It serves as the interface for users to log in, register, and access various features such as budgeting and tracking expenses.

- **Login & Registration:**

These are the key features that allow users to Login and register if they don't have an account within the system. Once logged in, users gain access to their personal finance data.

3.3.1.2 Application Layer (Business Logic Layer):

This layer manages the application's core functionalities. It is responsible for processing data, implementing the business logic, and facilitating communication between the UI layer and the data layer.

- **Spending Analysis:**

This feature analyzes the user's spending patterns to identify trends and provide insights into their financial habits.

- **Budgeting:**

A budgeting feature allows users to create, track, and manage their budget goals, providing them with the ability to set limits on spending categories.

- **Chatbot:** Users can ask to add income or expense transactions automatically, and they can receive answers to queries like, "What did I spend on food last month?"

- **Notification and Alerts:**

This functionality sends real-time alerts and reminders to users about important financial events, like bill due dates or budget thresholds being exceeded.

- **Income Tracking:**

Users can track their income sources, helping them to get an overview of their financial inflows.

- **Goal Setting:**

This feature allows users to define financial goals (such as saving for a trip or purchasing an item), and track their progress.

- **Expense Tracking:**

Users can log and categorize their expenses, enabling better monitoring of their spending habits and they can track their expenses using visual graphs.

- **User Authentication:**

This ensures secure login and access to user data, verifying identities through login credentials.

- **Search by category :**

Users can search their expenses or income by category.

- **Predictive Analysis:**

This feature uses machine learning or statistical methods to predict future financial trends based on past data.

3.3.1.3 Data Layer :

This layer is responsible for storing, managing, and retrieving all the data used by the system.

- **SQL Database (SQL DB):**

All sensitive user data and financial records are securely stored in this database.

Encryption ensures that data is protected and complies with privacy standards.

1. **User Data:**

Contains personal information such as the user's login credentials, preferences, and profile.

2. **Financial Records:**

Includes transaction data, budget details, income, expenses, and other financial records.

3. **Budget and Goals:**

Stores the users' budgets, financial goals, and their progress toward achieving them.

4. **Machine Learning (ML) Models:**

This component houses the trained AI models used for predictive analysis, personalized recommendations, and spending analysis.

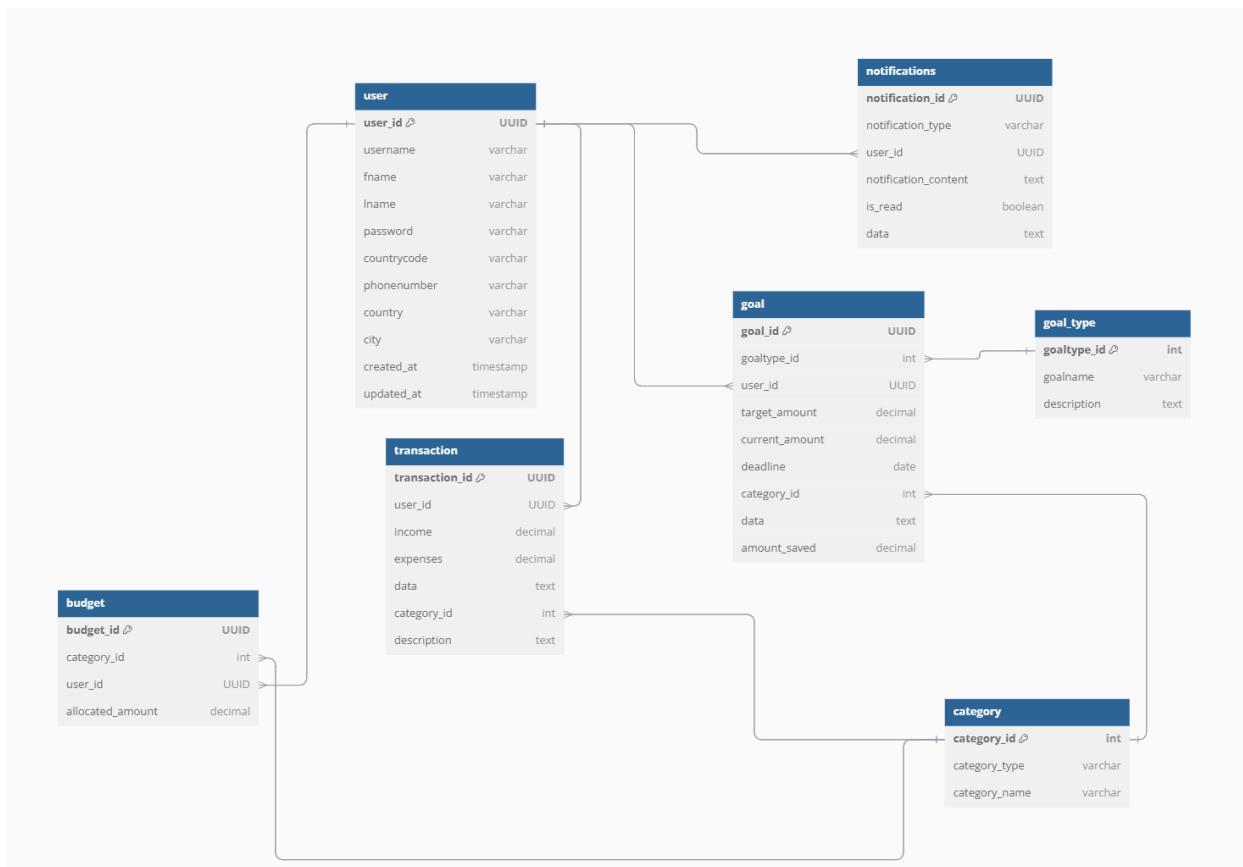
Data Flow and Interaction:

- **UI Layer to Application Layer:** The user interacts with the mobile application, triggering actions such as logging in, registering, or setting goals, which are processed by the application layer.
- **Application Layer to Data Layer:** The application layer communicates with the data layer to store and retrieve user data, financial records, and other information.

- **AI and Predictive Analysis:** The system utilizes machine learning models stored in the data layer for analysis and prediction, feeding insights back to the application layer for user interaction.

3.3.2 Entity-Relationship Diagram (ERD):

This ERD explains the structure and relationships of the database designed for a Personal Financial Management Application. The database consists of seven interconnected tables: User, Goal, Goal Type, Category, Transaction, Budget, and Notifications. Each table serves a specific purpose and is linked to others through well-defined relationships to ensure data integrity.



Tables and Attributes

1. User Table: Stores information about the users of the application.

- **Attributes:**

- user_id: Unique identifier for each user (Primary Key, UUID).
- username: The username of the user.
- fname and lname: First and last names of the user.
- password: Encrypted password for authentication.
- countrycode and phonenumber: Contact details of the user.
- country and city: Location details of the user.
- created_at and updated_at: Audit columns to track record creation and modification times.

2. Goal Table: Stores details about the financial goals set by users.

- **Attributes:**

- goal_id: Unique identifier for each goal (Primary Key, UUID).
- goaltype_id: References the type of the goal from the Goal Type table (Foreign Key).
- target_amount: The financial target for the goal.
- current_amount: The amount currently saved toward the goal.
- deadline: The date by which the goal should be achieved.
- category_id: References the category of the goal from the Category table (Foreign Key).
- data: Additional information about the goal.

- amount_saved: The amount saved so far.

3. Goal Type Table: Defines the types of financial goals users can set.

- **Attributes:**

- goaltype_id: Unique identifier for each goal type (Primary Key).
- goalname: Name of the goal type.
- description: Description of the goal type.

4. Category Table: Categorizes transactions, budgets, and goals for better organization.

- **Attributes:**

- category_id: Unique identifier for each category (Primary Key).
- category_type: The type of category (e.g., Income, Expense).
- category_name: The name of the category.

5. Transaction Table: Tracks financial transactions made by users.

Attributes:

- transaction_id: Unique identifier for each transaction (Primary Key, UUID).
- user_id: References the user who made the transaction (Foreign Key).
- income: Amount of income in the transaction.
- expenses: Amount of expense in the transaction.
- data: Additional information about the transaction.
- category_id: References the category of the transaction (Foreign Key).

- description: Description of the transaction.

6. Budget Table: Manages the allocation of funds to different categories for users.

Attributes:

- budget_id: Unique identifier for each budget (Primary Key, UUID).
- category_id: References the category for which the budget is allocated (Foreign Key).
- user_id: References the user who owns the budget (Foreign Key).
- allocated_amount: The amount allocated to the category.

7. Notifications Table: Sends notifications to users about their financial activities or goals.

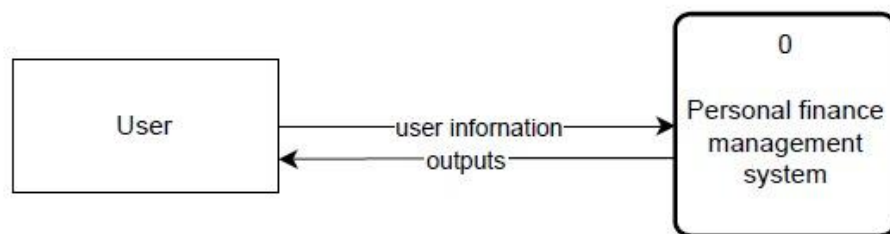
Attributes:

- notification_id: Unique identifier for each notification (Primary Key, UUID).
- notification_type: The type of notification (e.g., Reminder, Alert).
- user_id: References the user receiving the notification (Foreign Key).
- notification_content: The content of the notification.
- is_read: Boolean to indicate if the notification has been read.
- data: Additional information about the notification.

3.3.3 Data Flow Diagram (DFD):

In this graphical representation, the flow of data within a system is provided showing how data moves through different processes and how they are transformed.

Context level/ level 0: (Overview)



User Information is data provided by the user, such as personal details, income, expenses, and financial goals.

Outputs: Information the system generates, such as financial reports, budgets, and charts.

Level 1 DFD:

- **Overview:** This DFD level provides a more detailed system view, breaking down the Level 0 process into several sub-processes.
- **External Entity:** user interacting with the system
- **Key Processes:**
 - **1.0 Register:** Handles user authentication and registration.

- **2.0 Tracking transactions:** Records and stores expense and income details entered by the user and categorizes them for analysis.
- **3.0 Manage budget:** Creates, updates, and manages budgets.
- **4.0 Analyze Spending and Visualize Summaries:** Analyzes user spending patterns and visualizes summaries to help users understand their financial behavior.
- **5.0 Predict Future Expenses:** Uses historical transaction data and spending trends to predict future expenses.
- **6.0 Collect Financial Data:** Gathering external financial data for integration into the system.
- **7.0 Generate and Send Notification:** Generates alerts and notifications based on user-defined rules, such as goal reminders, budget warnings, or spending updates.
- **8.0 Set and Track User Goals:** Enables users to define financial goals and track progress toward achieving them.
- **9.0 Interacting with Chatbot:** provides an interactive interface for users to ask questions, get insights, and receive financial advice based on real-time or historical data.
- **Data Stores:**

User Data: Stores user credentials, preferences, and profile information.

- **Inputs:** Data from the registration process and user preferences.
- **Outputs:** Used for authentication and personalization of features like notifications.

Expense/Income Data: Stores all income and expense transactions.

- **Inputs:** Transaction details from users and external financial data.
- **Outputs:** Used for budgeting, analysis, and visualizations.

Budget Data: Stores user-defined budgets and spending limits.

- **Inputs:** Budget details entered by users.
- **Outputs:** Provides insights, alerts, and analysis of budget compliance.

Historical User Behavior Data: Maintains historical transaction and spending pattern data.

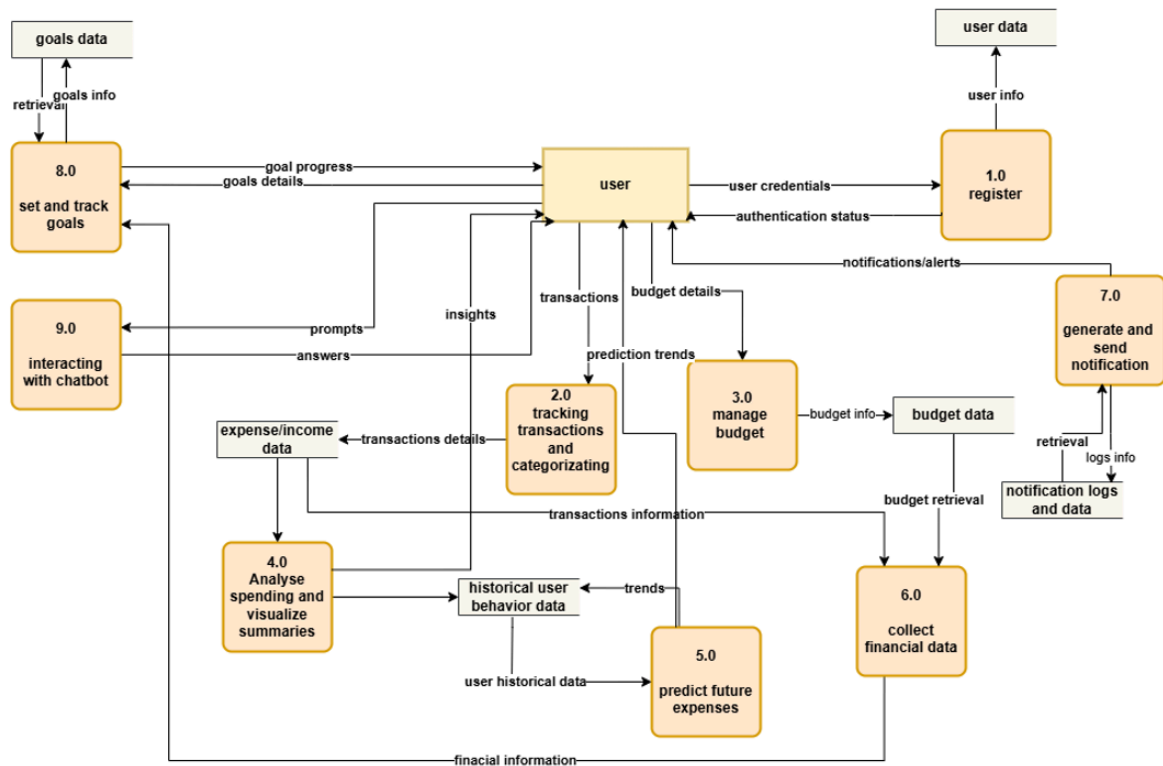
- **Inputs:** Processed data from spending analysis.
- **Outputs:** Used for predicting future expenses and generating trends.

Goals Data: Stores user-defined financial goals and their progress.

- **Inputs:** Goal details and updates from the goal-tracking process.
- **Outputs:** Provides updates and insights for tracking goals and chatbot interactions.

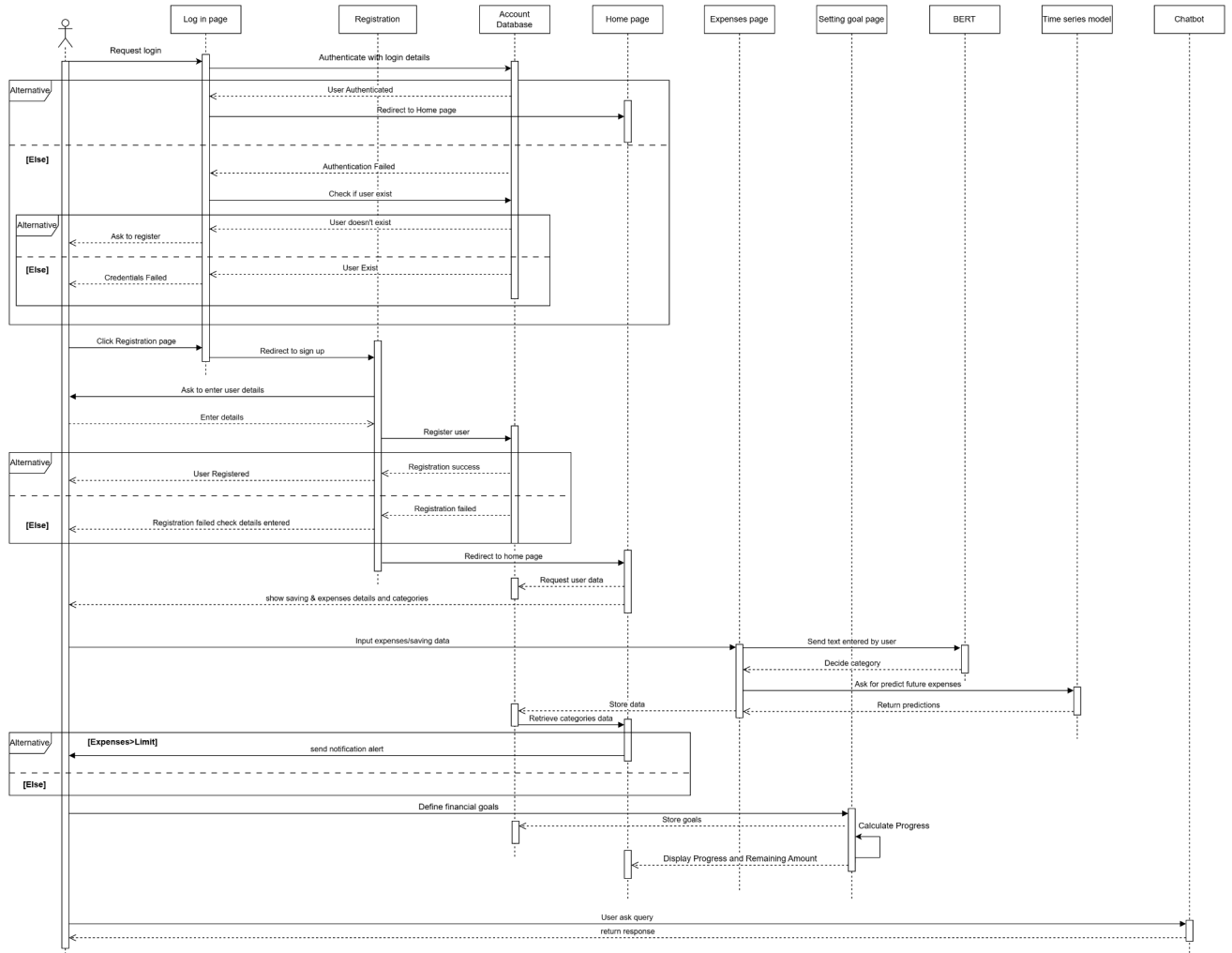
Notification Logs and Data: Logs notifications and alerts sent to users.

- **Inputs:** Generated notifications based on user activity and rules.
- **Outputs:** Keeps a record of notifications for audit and reprocessing.



3.3.4 Sequence Diagram:

A sequence diagram visually represents the flow of interactions between components in a system over time, making it ideal for understanding and designing complex workflows. This sequence diagram illustrates the flow of interactions between the user, various application components, and external services in the system. The primary goal is to depict the user journey from login or registration to interacting with savings and expense management, goal setting, and the dashboard.



3.3.4.1 Actors and Components

- User: The person interacting with the system.
- Pages (Login, Registration, Home): Represent the UI elements of the application.
- Account Database: Manages user authentication and profile data.
- Expenses Page: Allows users to input and view their financial data.
- BERT: used for automatic categorization.
- Time Series Model: Used for predictions related to future expenses.
- Chatbot: Interacts with users and responds.

3.3.4.2 Flow Description

1. Login Process:

- The user provides credentials on the login page.
- The system authenticates the details with the account database.
- If successful, the user is redirected to the home page; otherwise, they are prompted to register.

2. Registration Process:

- If the user chooses to register, they are redirected to the registration page to enter their details.
- The system registers the user in the account database and redirects them to the home page.

3. Home Page Interaction:

- Displays savings and expenses categories.

4. Expense Prediction:

- The system categorizes the user's data and predicts future expenses using a time series model.
- If expenses exceed predefined limits, a notification is sent.

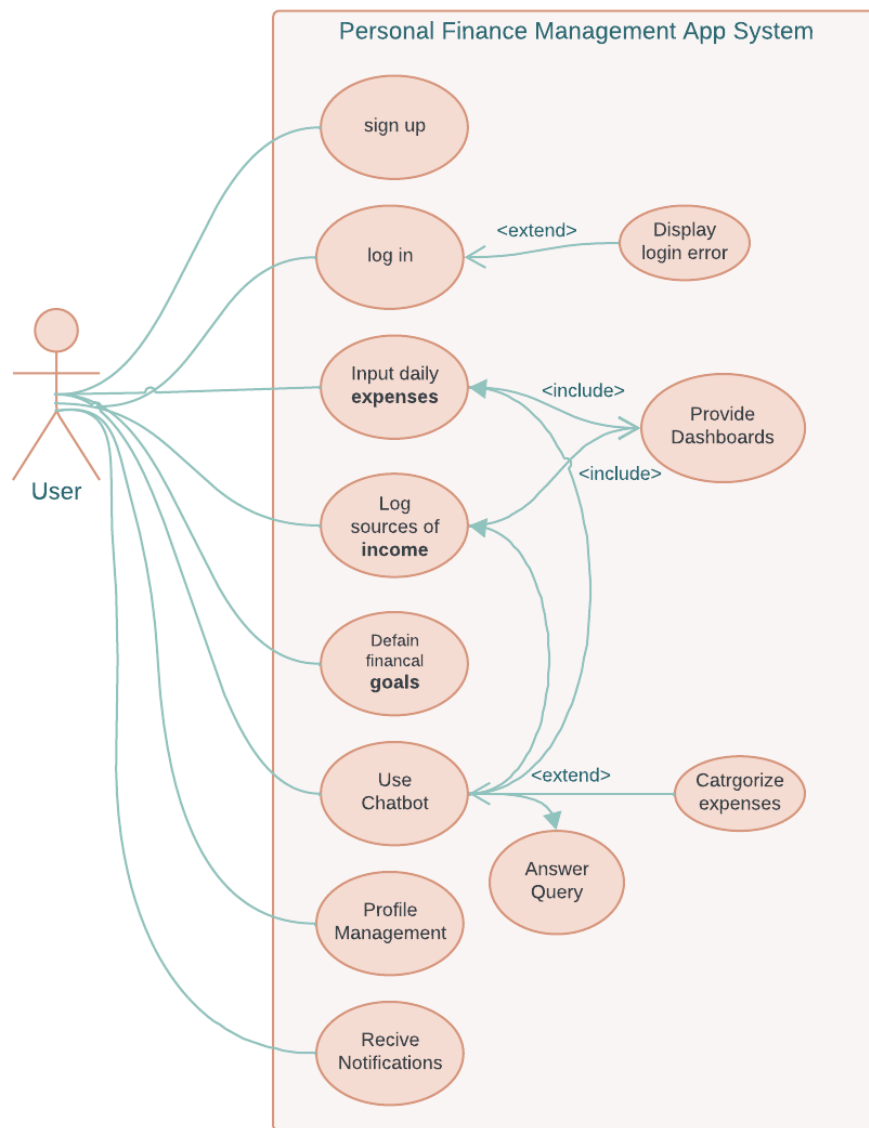
5. Goal Setting:

- The user defines financial goals, which are stored in the system.
- Progress and remaining amounts are calculated and displayed.

6. Chatbot:

- The user asks a query, and the chatbot responds to it.

3.3.5 Use Case diagram



3.3.5.1 Main Components

1. Actor

- **User:** The primary user of the system interacts with various functionalities provided by the app.

2. System Boundary

- The rectangle labeled **Personal Finance Management App System** encloses all the use cases (functionalities) available in the system.

3.3.5.2 Use Cases

Each oval represents a specific use case, or feature, that the system offers. The diagram also specifies relationships between use cases, such as include and extend, which provide additional context.

3.3.5.3 Use Cases and Descriptions

1. Sign Up:

- Allows the user to register for the app by providing the necessary credentials or information to create an account.

2. Log In:

- Enables the user to access the app by entering their credentials (e.g., username and password).
- Extend Relationship: If login credentials are incorrect, the system triggers the Display Login Error use case to notify the user.

3. Input Daily Expenses:

- Provides functionality for the user to record their daily expenses.
- Include Relationship: Automatically triggers the Provide Dashboards use case to visually represent the entered expenses for better tracking and analysis.

4. Log Sources of Income:

- Allows the user to record their income sources, such as salary, freelance payments, or passive income.
- Include Relationship: Similar to expenses, logging income also triggers Provide Dashboards to visually show the income trends.

5. Define Financial Goals:

- Lets the user set specific financial goals, such as saving a target amount or reducing expenses.

6. Use Chatbot:

- Provides an AI-powered chatbot for answering user queries and assisting with financial management.
- **Extend Relationship:** The chatbot can trigger the Categorize Expenses use case when the user asks to add expenses without specifying a category.
- Answer queries, input expenses, and income are core parts of the chatbot's functionality.

7. Profile Management:

- Offers functionality for users to update their personal information, account settings, and preferences.

8. Receive Notifications:

- Sends timely notifications to users about their financial activities, reminders for goals, or unusual spending patterns.

3.4 SWOT Analysis

3.4.1 Strengths

- **AI Chatbot:** Unique selling point compared to basic budgeting apps.
- **Predictive Analysis:** Uses machine learning models to provide accurate predictions, such as spending trends or goal achievement probabilities.
- **Auto Categorization:** Automatically categorizes transactions and budgets based on user data and past patterns, saving time and improving accuracy.
- **User-Friendly Interface:** Designed to simplify financial management for non-experts.
- **Customization:** Users can define their goals and budgets, offering flexibility

3.4.2 Weaknesses

- **Limited Resources:** Small team with restricted budget and time.
- **Technical Challenges:** Implementing AI and ML models accurately may require advanced expertise.
- **User Adoption:** Convincing users to trust a new app for financial management.

- **Data Privacy Concerns:** Ensuring robust security measures to protect sensitive user data.

3.4.3 Opportunities

- **Growing Demand:** Increasing interest in personal finance tools, Between students, freelancers, and all individuals
- **Partnerships:** Potential collaboration with universities, banks, or financial organizations.
- **Growing Awareness:** Increasing interest in financial literacy among younger generations could boost app demand.
- **Technological Advancements:** Leveraging new AI/ML tools to improve predictions and insights.

3.4.4 Threats

- **Competition:** Established apps like Mint or YNAB may overshadow the project.
- **Regulatory Issues:** Handling user data responsibly and complying with privacy laws like GDPR is essential.
- **Technical Failures:** Bugs or inaccuracies in predictions could harm user trust.
- **User Retention:** If the app doesn't provide unique value, users may switch to competitors.[11]

3.5 Risk Analysis

3.5.1 Data Privacy and Security Risks:

Storing and processing sensitive financial data exposes the project to risks of data breaches.

Solutions:: Implement end-to-end encryption, secure authentication methods, and regular security audits.

3.5.2 Model Accuracy and Reliability:

Inaccurate predictions due to flawed algorithms or insufficient data could harm user trust.

Solutions:: Use diverse datasets for training, validate models rigorously, and provide disclaimers about prediction limitations.

3.5.3 User Engagement Risks:

The application may fail to engage users if the interface is not intuitive or if the recommendations are not actionable.

Solutions:: Conduct user testing and feedback sessions to refine the UI/UX and recommendation engine.

3.5.4 Competition Risks:

Competing products with similar or better features may overshadow the project.

Solutions:: Highlight unique selling points, such as a focus on AI Chatbot, in marketing efforts.[12]

3.6 Software Development Methodology:

3.6.1 Introduction

The personal finance application will be conducted based on Incremental methodology. This choice was driven by the evolving nature of our project and the need for flexibility and adaptability throughout its development lifecycle. [13]

3.6.2 Project increments

Increment 1: Core Features

Objective: Establish the foundational functionalities, allowing users to register, log in, and input basic financial data (expenses and income).

Features to Develop:

- **User Registration and Authentication**
 - Email/password registration and secure login.
 - Profile management (update email/password).
- **Expense Tracking using BERT**
 - Predefined categories for expense classification.
- **Income Tracking**
 - Input sources of income.
 - Track earnings over time.
- **Goal Setting:**
 - Users can define financial goals (e.g., saving \$500 in 6 months).
 - Provide visual progress indicators for goals.

Expected Deliverables:

- Fully functional registration, login, and profile management.
- Functional expense and income tracking.
- Data is saved to the database for retrieval.
- Users can set financial goals.

Increment 2: Budgeting and chatbot

Objective: Add features for setting budgeting limits and chatbot for interaction.

Features to Develop:

- **Budgeting**
 - Users can set budgets for specific categories (Food, Rent, Entertainment, and others).
- **Chatbot**
 - Users can interact with the chatbot.[14]
- **Notifications and Alert**
 - Notify users about:
 1. Approaching budget limits.
 2. Exceeding budgets.
 3. Predicted overspending in specific categories.

Expected Deliverables

- Functional budgeting system with category-specific settings.
- Chatbot integration.
- Notifications and Alerts.

Increment 3: Spending Analysis

Objective: Implement insights for spending patterns and create charts for visualization.

Features to Develop:

- **Time Series Model:**
 - Develop a financial forecasting system using historical expense data.
- **Spending Analysis Charts:**
 - Create visual reports (bar charts, pie charts, etc.) showing spending by category.

Expected Deliverables:

1. Users can view visual spending trends.
2. Future Expenses prediction.

3.7 Mobile application development:

3.7.1 Framework and development tools:

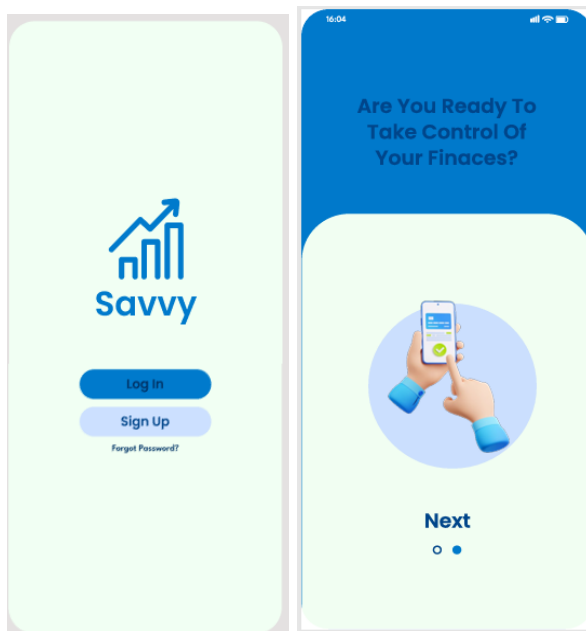
1. Flutter SDK (Version 3.0 or later): For cross-platform mobile app development.
2. Dart language (Version 2.12 or later): For building the app's logic and UI components.
3. Visual Studio code with flutter extensions.
4. Flutter DevTools for debugging and performance profiling.

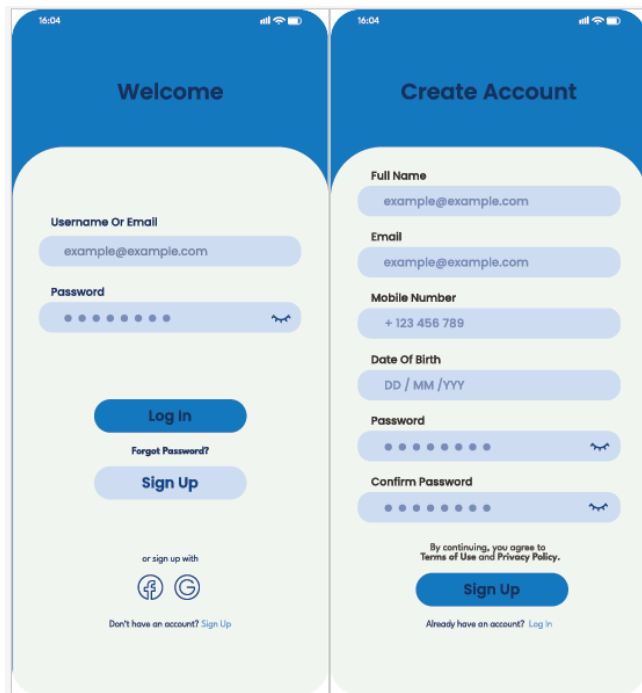
3.7.2 Backend and Database:

1. PostgreSQL: A relational database for storing structured financial data.
2. FastAPI /RestAPI or Flask.

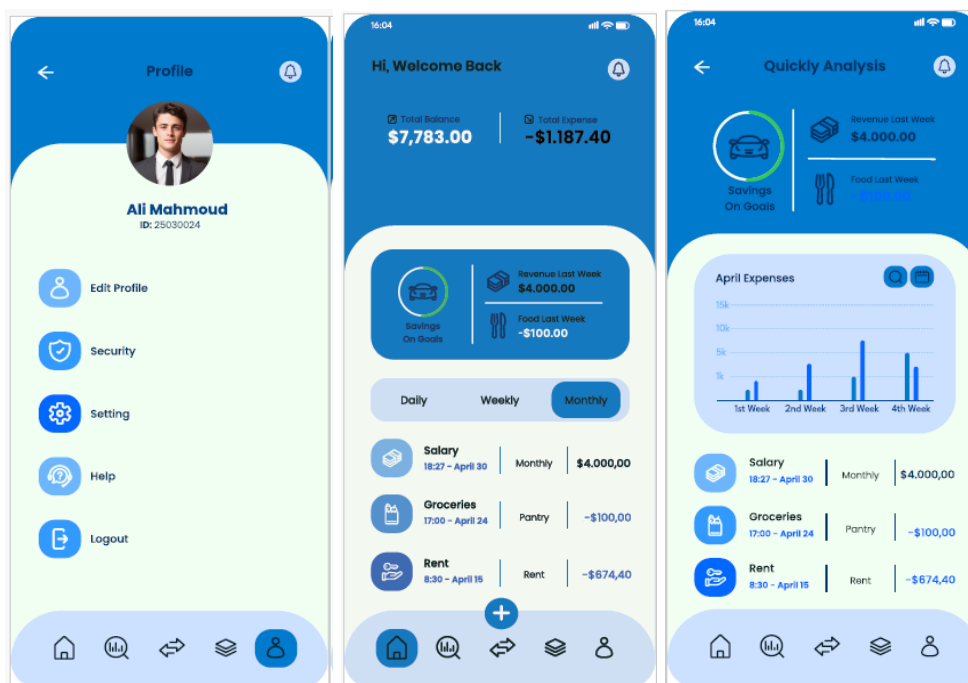
3. SQLAlchemy: An ORM (Object Relational Mapper) for interacting with the database efficiently.
4. Supabase Authentication: for secure user authentication and identity management.
5. Git/Github: for Version Control and Collaboration

3.8 Prototype





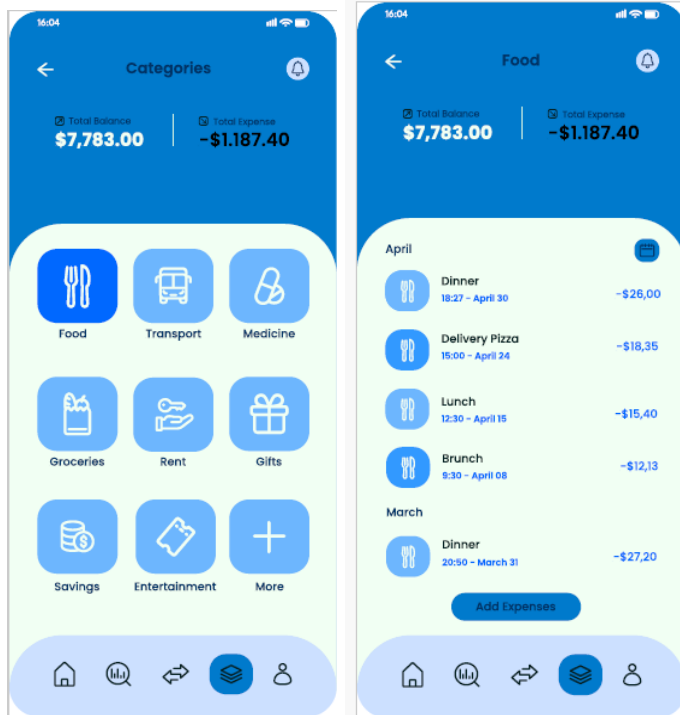
Sign up/sign in



User profile

home page

quick analysis



Categories

Resources

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