AI POWERED EXPENSE SPLITTER.

Nirikshan K[1], Sandarsh Gowda M. M[2]

Department of MCA, BIT, Bengaluru, India[1]

Assistant Professor, Department of MCA, BIT, Bengaluru, India [2]

Abstract: The increasing use of digital payments and group-based activities such as travel, shared accommodation, and events has created a strong need for efficient expense management systems. Many existing solutions provide basic expense tracking but lack intelligent automation, transparency, and user-friendly settlement mechanisms. This paper presents the **AI Powered Expense Splitter**, a web-based application designed to simplify shared expense tracking and settlement using automation and AI-assisted features.

The system allows users to securely authenticate, create expense groups, add members, record expenses, and automatically split costs among participants. AI-based receipt processing reduces manual data entry by extracting expense details directly from uploaded receipts. The application provides clear balance summaries, showing how much each user owes or is owed. The system is developed using modern web technologies including Next.js, React, Tailwind CSS, Convex for backend and database management, and Clerk for secure authentication. The modular architecture ensures scalability, security, and ease of maintenance, making the system suitable for real-world personal and group expense management.

1. INTRODUCTION

In today's digital lifestyle, shared expenses are common in situations such as group travel, shared housing, family outings, and collaborative activities. Managing these expenses manually often leads to confusion, calculation errors, and misunderstandings among participants. Traditional methods such as spreadsheets, handwritten notes, or messaging applications are inefficient and time-consuming, especially as the number of participants and transactions increases. These approaches also lack real-time updates and proper record keeping, making it difficult to track who owes money and who should receive it.

Although several expense management applications exist, many of them provide only basic bill-splitting functionality. They often lack intelligent automation, seamless user experience, and advanced features such as receipt scanning, automatic categorization, and AI-driven insights. Users are usually required to manually enter expense details, which increases the possibility of errors and inconsistencies. Additionally, settlement calculations and balance summaries are not always presented clearly, making them difficult to understand for non-technical users.

To address these challenges, this project presents the **AI Powered Expense Splitter**, a smart and user-friendly expense management platform that automates expense splitting, balance calculation, and settlement tracking. The system allows users to create groups, add members, record expenses, and instantly view updated balances. Automated calculations ensure fairness and accuracy while reducing manual effort.

A key feature of the proposed system is the integration of **AI-based receipt processing**, which enables users to upload receipt images and automatically extract relevant expense details. This significantly reduces data entry effort and improves accuracy. The intuitive user interface and clear settlement summaries ensure transparency among group members and help maintain trust. Overall, the AI Powered Expense Splitter provides an efficient, accurate, and scalable solution for managing shared expenses in real-world scenarios.

2. LITERATURE SURVEY

A literature survey helps in understanding existing approaches and limitations in expense management and financial tracking systems. Several expense-splitting applications and financial tools provide basic bill-sharing functionality but often lack automation and intelligent features.

Many existing systems require manual entry of expense details and do not support receipt-based data extraction. Some applications provide balance summaries but fail to clearly present settlement information, leading to user confusion. Studies also highlight the importance of secure authentication, data consistency, and scalable backend systems in financial applications.Recent research emphasizes the growing role of AI in financial applications, particularly in automating data extraction and improving user experience. However, limited implementations effectively combine AI features with real-time expense management and user-friendly design. These gaps motivated the development of the AI Powered Expense Splitter.

2.1 Existing System vs Proposed System

Existing System

The existing expense management systems suffer from the following limitations:
• Manual entry of expense details
• Lack of AI-based automation
• Limited transparency in balance calculation
• Confusing settlement summaries
• Minimal scalability and customization options

Proposed System

The proposed **AI Powered Expense Splitter** overcomes these limitations by offering:
• Automatic expense splitting and balance calculation
• AI-based receipt scanning and data extraction
• Clear and transparent settlement summaries
• Secure authentication and protected data access
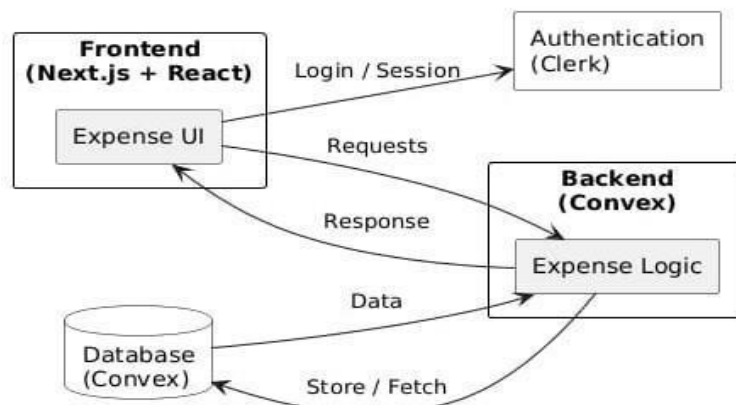• Scalable and modular architecture

SYSTEM ARCHITECTURE DIAGRAM

Fig.1 System Architecture Diagram

3.   SYSTEM DESIGN

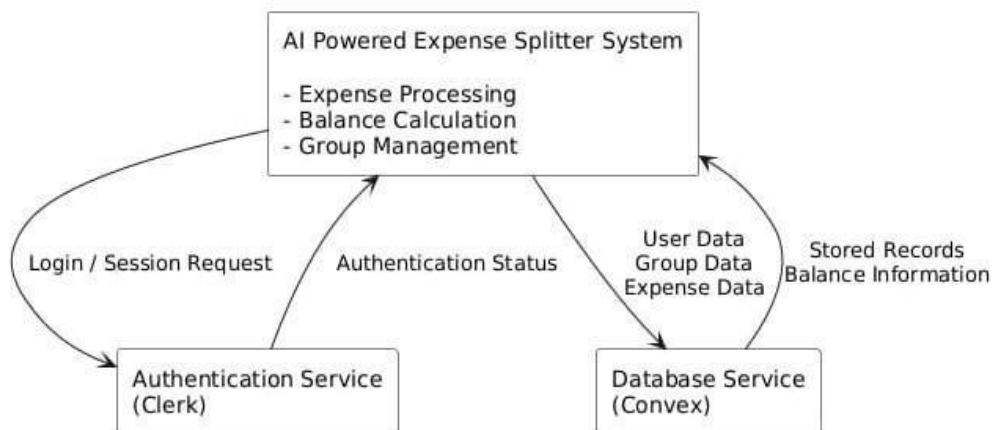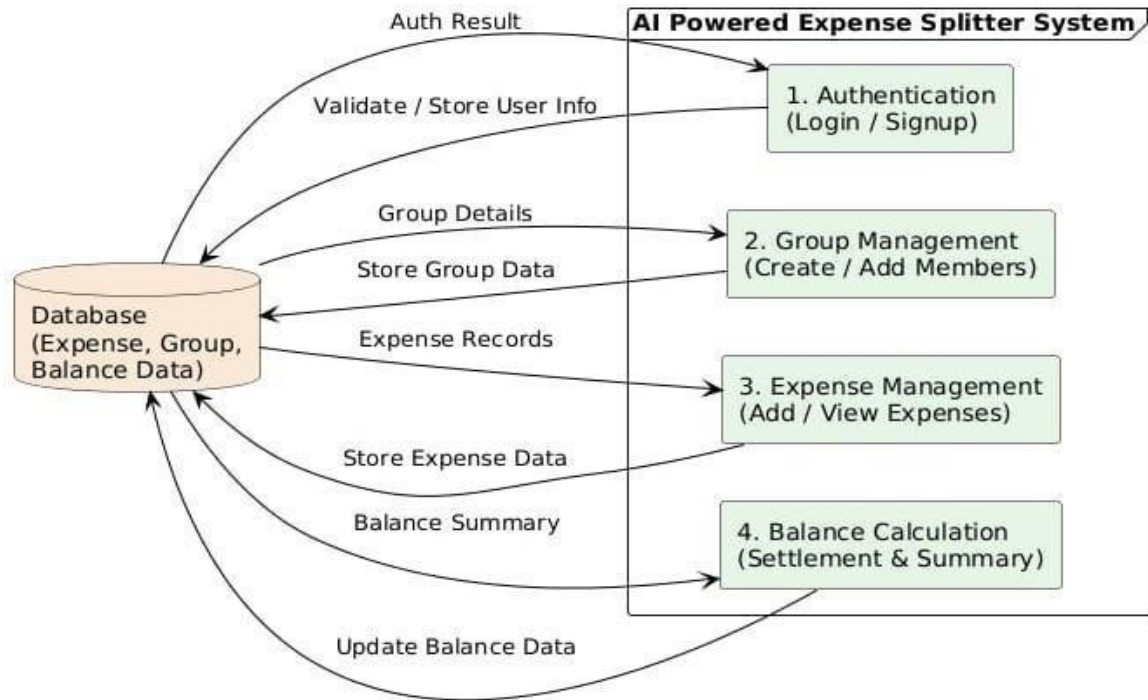### 3.1 Data Flo Diagram

Fig 3.1.1: Level 0 Data Flow Diagram

Fig 3.1.2: Level 1 Data Flow Diagram
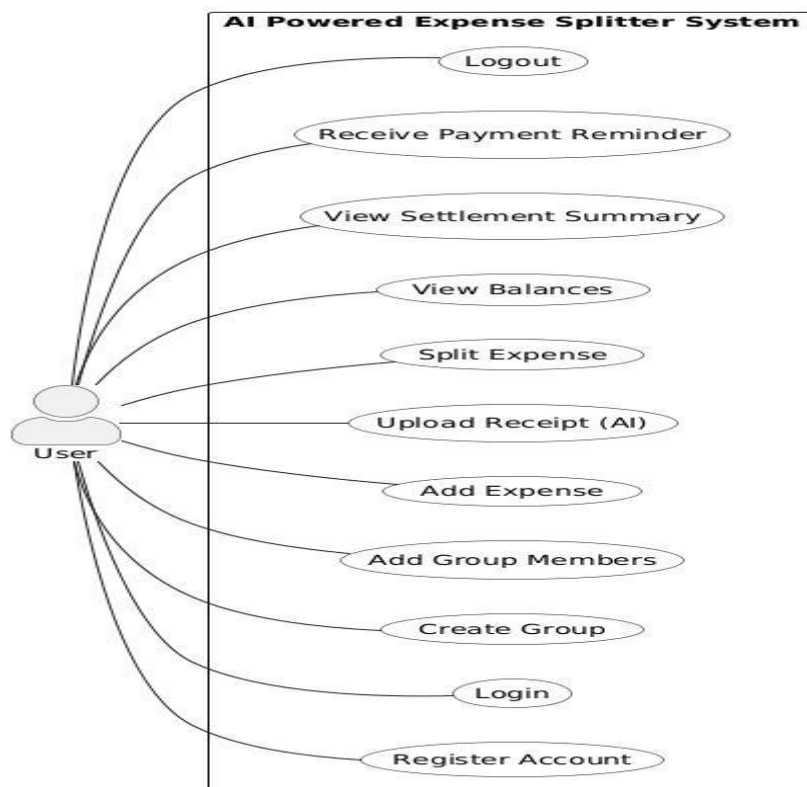
3.2 Use Case diagram

Fig 3.2.1 Use Case Diagram

4.   IMPLEMENTATION DETAILS

A. User Interface and Client Processing

The frontend allows users to register, log in, create groups, add expenses, and view balance summaries. The interface is designed to be intuitive and easy to use, even for non-technical users.

B. Expense Processing and AI Integration

Expenses can be added manually or by uploading receipts. The AI module extracts relevant information from receipts, reducing manual effort and improving accuracy.

C. Backend Services and Data Management

The backend manages business logic, expense calculations, and balance updates. Data related to users, groups, expenses, and settlements is stored securely and retrieved efficiently.

D. Security and Configuration

Secure authentication, protected routes, and controlled access ensure that user data remains private and tamper-proof.

4.1 System Modules and Workflow

User Authentication and Profile Management Module

This module manages secure user registration and login using authentication services. It ensures that only authorized users can access expense groups, add expenses, and view balance information. User session handling and profile-related data are securely maintained.

Group Management Module

This module allows users to create expense groups and add or manage group members. It helps organize expenses based on trips, events, or shared activities and ensures that only group members can participate in expense sharing.

Expense Management and Splitting Module

This module handles the addition of expenses, selection of payers and participants, and automatic splitting of expenses. It calculates individual shares and updates balances accurately, eliminating the need for manual calculations.

AI-Based Receipt Processing Module

This module enables users to upload receipt images while adding expenses. The AI system extracts relevant expense details such as amount, date, and description, reducing manual input and improving accuracy.

Balance Calculation and Settlement Module

This module computes individual balances for each group member and generates settlement summaries. It clearly shows how much a user owes or is owed, ensuring transparency and easy settlement tracking.

Data Storage and Management Module

This module securely stores user data, group information, expense records, and balance details in the backend database. It supports reliable data retrieval, real-time updates, and scalability of the system.

Workflow

1. User Authentication

The user registers or logs into the system. After successful authentication, access to expense groups and management features is granted.

2. Group Creation and Selection

The user creates a new expense group or selects an existing group to manage shared expenses.

3. Expense Entry

The user adds expense details manually or uploads a receipt for AI-based data extraction.

4. Expense Splitting and Processing

The system automatically splits the expense among selected group members and calculates individual shares.

5. Balance Update and Settlement

Updated balances are stored and displayed. Users can view settlement summaries showing pending payments.

6. Session Termination

The user logs out of the application. All active sessions are safely closed and secured

5.   RESULTS AND DISCUSSION

1. The performance of the AI Powered Expense Splitter was evaluated based on three primary metrics: Expense Calculation Accuracy, AI Processing Reliability, and System Responsiveness.

2. **A. Expense Calculation Accuracy**
   The system was tested with multiple users and groups by adding different types of expenses under normal usage conditions.
   • Expense Split Accuracy: 100%
   • Balance Calculation Accuracy: 100%
   • Settlement Consistency: No discrepancies observed across multiple expense entries
   The automated splitting logic ensured fair and accurate distribution of expenses among group members without manual intervention.

3. **B. AI Processing Reliability**
   The AI-based receipt processing feature was tested using multiple receipt images of varying formats and clarity.
   • Receipt Data Extraction Accuracy: 90–95%
   • AI Description Generation Success Rate: 100%
   • Manual Correction Requirement: Minimal
   The AI module successfully extracted key details such as amount and date, significantly reducing manual data entry effort.

4. **C. System Responsiveness**
   System performance was evaluated on a standard laptop with stable internet connectivity.
   • Login Response Time: < 1.5 seconds
   • Expense Submission Time: < 1 second
   • Balance Update Time: Instant after expense submission
   These results demonstrate that the system provides real-time feedback suitable for daily expense management.

5. **D. Discussion of Findings**
   Accuracy and Reliability:
   Automated expense splitting and balance calculations eliminated common human errors associated with manual calculations.
   AI Feature Effectiveness:
   The AI-powered receipt processing improved usability by reducing the time required to add expenses and minimizing input mistakes.
   User Convenience:
   Clear balance summaries and settlement views improved transparency and reduced confusion among group members.

6.   CONCLUSION

The **AI Powered Expense Splitter** project successfully demonstrates the development of an intelligent and user-friendly web-based application for managing shared expenses. The system effectively automates expense tracking, splitting, and balance calculation, reducing manual effort and eliminating common calculation errors. By integrating AI-based receipt processing, the application enhances usability and accuracy while simplifying expense entry for users.
The system delivers reliable performance, real-time balance updates, and clear settlement summaries, making it suitable for personal, academic, and group-based financial management. The use of modern full-stack technologies ensures scalability, security, and maintainability. Overall, the project meets its objectives and provides a practical solution for transparent and efficient expense management, while also serving as a strong foundation for future enhancements and real-world deployment.

7.   FUTURE WORK

The AI Powered Expense Splitter can be further enhanced by developing mobile applications for Android and iOS platforms to improve accessibility and user convenience. Integration of online payment gateways such as UPI or digital wallets can allow users to settle balances directly within the application. Advanced AI features such as automatic expense categorization, spending analysis, and predictive insights can further improve financial management.
Additional features like multi-currency support, real-time notifications, and detailed expense analytics can enhance usability for international and large user groups. Strengthening security through multi-factor authentication and optimizing system performance will further improve reliability and scalability of the application.

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