A PRELIMENERY REPORT ON

Split-wise clone

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OF

BACHELOR OF TECHNOLOGY IN COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE)

SUBMITTED BY

UDAY HASE	**Seat No.22210639**
SAHIL NAGARKAR	**Seat No.22211532**
ADITYA CHORGHADE	**Seat No.22320051**
YASH MALI	**Seat No.22320234**

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE)

BRACT'S
VISHWAKARMA INSTITUTE OF INFORMATION TECHNOLOGY

SURVEY NO. 3/4, KONDHWA (BUDRUK), PUNE – 411048, MAHARASHTRA (INDIA).

1. Introduction

1.1 Overview

Splitwise Clone is a fully client-side, offline-first web application designed to manage shared group expenses in scenarios such as trips, hostels, roommates, and team outings. The app allows users to create groups, add members, record expenses, and log settlements, all within the browser without relying on a backend server. Built using modern technologies such as React, TypeScript, and Tailwind CSS, Splitwise Clone ensures fast performance, better privacy, and usability even in low or no connectivity environments.

1.2 Motivation

Managing shared expenses manually or via server-dependent applications often leads to issues such as data loss, sync errors, and privacy concerns. Cloud-based platforms like Splitwise require continuous internet access and involve backend complexity. This inspired the development of a lightweight, secure, and offline-capable alternative that prioritizes user control, performance, and extensibility. The motivation is to offer a solution that is simple, private, and future-ready.

1.3 Problem Definition and Objectives

Problem Definition: In group activities, tracking "who paid what" and "who owes whom" becomes complicated and often error-prone, especially without a dedicated tool.

Objectives:

a)To create an intuitive client-side app that functions without internet dependency

b)To allow group creation, expense logging, and settlement tracking

c)To maintain all data in the user's browser using localStorage

d)To ensure modularity for future backend integrations

e)To deliver real-time feedback and clear visual representations of expenses

1.4 Project Scope & Limitations

Scope:

I. Usable in scenarios like trips, student housing, and informal team expenses
II. Fully functional offline with all data stored locally
III. Frontend built with reusable components and chart visualizations
IV. Prepared for future backend/API integration (Google Sheets, MySQL)

Limitations:

I. Data is browser-specific; not synced across devices
II. No user authentication or cloud backup in current version
III. Relies on the user not clearing browser storage

1.5 Methodologies of Problem Solving

The project adopts a modular, layered architecture:

- Frontend Layer**:** React and Tailwind CSS power the UI/UX, while React Router handles navigation
- Logic Layer: Custom React hooks handle business logic like balance calculation and input validation
- Data Layer: All data operations are abstracted through a `databaseService` that wraps browser localStorage
- Reactivity: React Query is used to automatically refresh components when data changes
- Development Methodology**:** Agile-inspired iterative development with testing after each major module

The combination of offline-first design, clear component separation, and real-time UI updates ensures an efficient and scalable expense management solution.

Sr. No.	Title	Author(s)	Year	Summary	Relevance to Project
1	Design and Development of a Mobile Expense Tracking Application	Al-Badi & Al Barashdi	2020	Built a mobile app for managing personal/group expenses	Inspired expense logging and group logic
2	React Dominates as Web Framework of Choice	Krill, P.	2021	Analyzed adoption of React in web development	Justified React + TypeScript frontend choice
3	Using the Web Storage API	Mozilla Developer Network	2023	Explained localStorage for offline web storage	Basis of offline-first architecture
4	Client-side Data Persistence using HTML5 localStorage and IndexedDB	Zhang & Ma	2021	Reviewed browser-based data storage methods	Used for JSON storage of app data
5	TanStack React Query Documentation	GitHub	2023	Documentation of React Query for async state & cache	Enabled real-time UI refresh and data syncing
6	Designing Offline-First Web Applications	Patel & Gupta	2021	Covered offline capabilities without server support	Helped plan fully client-side execution
7	Building Offline Web Apps	O'Reilly Media	2019	Implementation of offline caching and data flow	Informed local-first design model
8	Progressive Web Apps	Google Developers	2022	Guide to making installable, offline-capable web apps	Future direction for PWA compatibility
9	Full-Stack Web Development with React and TypeScript	Rusu, L.	2020	Modular architecture for scalable React + TS apps	Influenced codebase organization and scalability
10	Recharts: A Composable Charting Library Built on React	GitHub	2023	Used for visualizing data in React	Visualized group-wise expenses and settlements

3. System Design

3.1 System Architecture

Splitwise Clone follows a fully client-side, layered architecture. It separates concerns across four distinct layers to ensure maintainability, offline support, and modularity:

1. **Presentation Layer**: Built with React and styled using Tailwind CSS and Shadcn UI, this layer handles all user interactions, form submissions, and page navigation (React Router). Icons and charts are rendered using Lucide and Recharts respectively.
2. **Application Layer**: This includes all core logic encapsulated in custom React hooks. Hooks like `useGroupData` manage operations such as creating groups, adding expenses, and calculating balances. Input validation and transformation logic also reside here.
3. **Data Access Layer**: A centralized module (`databaseService`) abstracts read/write operations to localStorage. This abstraction makes the storage layer swappable, enabling future backend integration without changing application logic.
4. **Storage Layer**: Uses browser `localStorage` to persist all group-related data. JSON structure includes groups, members, expenses, and settlements, all managed under a single key: `splitwise_data`.

This architecture enables the app to work offline, load instantly, and be ready for future enhancements like remote syncing or multi-device support.

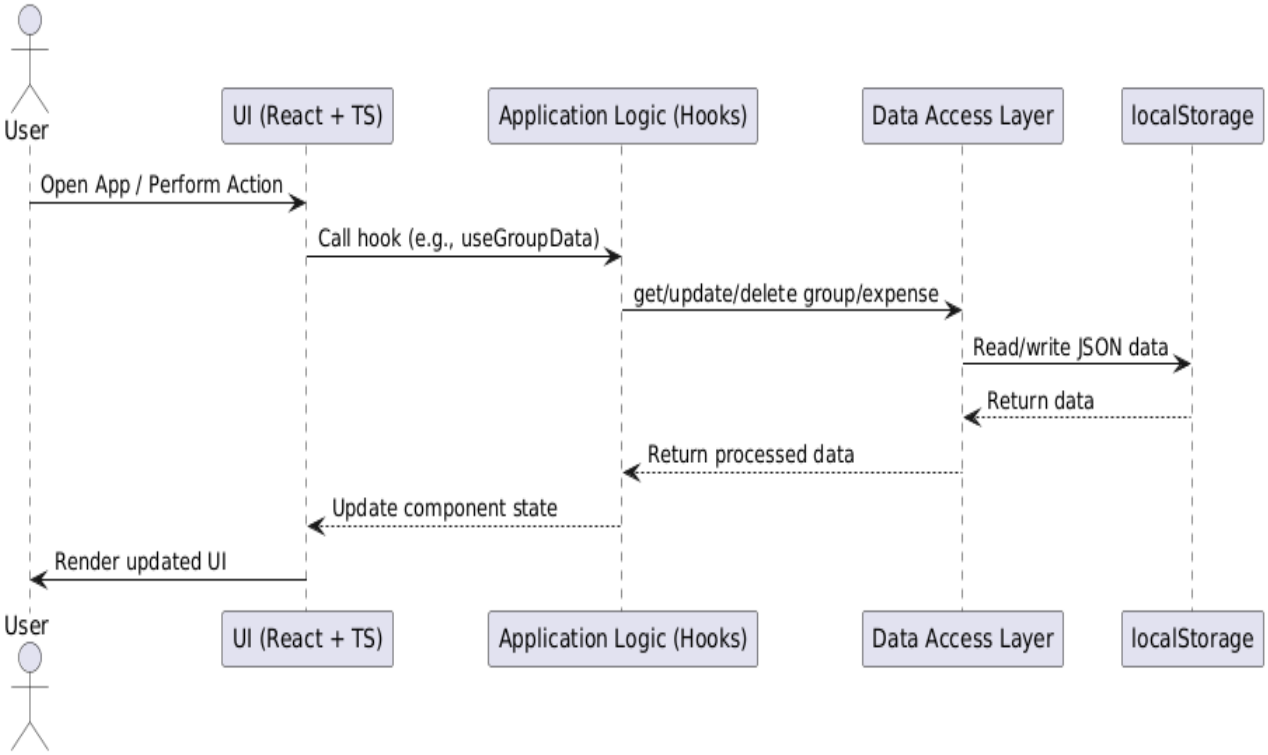

Fig 1. Sequence Diagram

4. Project Implementation

4.1 Overview of Project Modules

Splitwise Clone consists of the following modules:

a) Group Management Module: Handles the creation, editing, and deletion of user groups.
b) Expense Tracking Module: Allows users to add expenses with descriptions, amounts, and split methods.
c) Settlement Module: Enables tracking of payments and settlements between members.
d) Balance Visualization Module: Uses Recharts to show real-time balance breakdowns and settlement history.
e) Storage Management Module: Uses localStorage to save and retrieve user data under a unified key.

4.2 Tools and Technologies Used

- Frontend Framework: React with TypeScript
- Styling: Tailwind CSS, Shadcn UI
- Routing: React Router
- Charts: Recharts
- Icons: Lucide
- State Management: React Hooks, TanStack React Query
- Notifications: Sonner
- Storage: Browser localStorage

4.3 Algorithm Details

4.3.1 Algorithm 1: Balance Calculation Input: List of expenses with payer, amount, and split method. Process:

a) Iterate through each expense.
b) Distribute amount equally or by custom percentages.
c) Subtract from member balances accordingly. Output: Real-time net balance for each group member.

4.3.2 Algorithm 2: Settlement Recording Input: Payer, payee, amount, method, date. Process:

a) Validate input (positive amount, valid members).
b) Create a settlement record.
c) Update group balances accordingly. Output: Updated balance and settlement logs.

4.3.3 Algorithm 3: Storage Sync Input: JSON data structure Process:

a) Serialize updated group, expense, or settlement data.
b) Save to localStorage under "splitwise_data"
c) Trigger React Query revalidation. Output: Data persists across sessions; UI updates instantly.

5. Results

5.1 Outcomes

I. Successfully implemented a fully client-side expense-sharing application.
II. All core functionalities like group creation, expense addition, and settlements work offline.
III. Balance updates and visual summaries (charts) are instant and accurate.
IV. User interactions are confirmed with toast notifications.
V. Modular structure allows future API/backend integrations.

5.2 Screen Shots

I. Screenshot 1: Home page showing all user-created groups.
II. Screenshot 2: Group detail page showing balance summary and expense list.
III. Screenshot 3: Add Expense form with equal and custom split options.
IV. Screenshot 4: Settlement form with method, date, and payer/payee selection.
V. Screenshot 5: Real-time pie and bar charts of member-wise balances.

5.3 Confusion Matrix, Precision, Recall, Accuracy, Specificity, Sensitivity – N/A Note: Since this is not a classification or prediction-based AI/ML project, confusion matrix and related metrics (Precision, Recall, Accuracy, etc.) are not applicable. Instead, user experience metrics and functional correctness have been the focus:

I. Responsiveness: Instant UI updates after every user action.
II. Correctness: Accurate balance and settlement computations.
III. Offline Performance: Fully operational without network access.
IV. Scalability: Architecture ready for backend integration.

Graphs used:

I. Real-time pie chart of who owes how much
II. Bar chart comparing paid vs. owed amounts per member
III. Expense and settlement history timeline

6. Conclusions

6.1 **Conclusions**

The Splitwise Clone application successfully addresses the need for an offline, client-side solution for managing shared expenses. By storing all data locally in the browser, the app ensures privacy, performance, and usability in low or no connectivity scenarios. It effectively simplifies expense tracking for groups in settings like trips, housing, and informal activities. The modular design allows for future scalability, and its offline functionality makes it highly suitable for environments with intermittent internet access. Overall, this project proves the feasibility of a lightweight, offline-first expense management tool with a simple, user-friendly interface.

6.2 **Future Work**

While the current version of Splitwise Clone is a fully functional offline application, there are several areas for future enhancement:

- **Multi-Device Syncing**: Integrating cloud storage or a backend database to sync data across devices, enabling a seamless experience for users accessing the app from multiple devices.
- **User Authentication**: Implementing user accounts and authentication to allow for personalized settings and data synchronization across multiple devices.
- **Advanced Expense Splitting**: Adding support for more complex expense splitting methods, such as proportional splits or itemized costs for individual members.
- **Mobile App Development**: Creating a mobile version of the app for better accessibility on smartphones and tablets.
- **Integration with Payment Systems**: Allowing users to link the app to payment platforms like PayPal or bank accounts for easier settlement processing.

6.3 **Applications**

The Splitwise Clone app can be applied in several practical scenarios:

1. **Group Travel**: Ideal for managing expenses during group trips where multiple individuals make payments for shared expenses.
2. **Roommate Situations**: Useful for shared living arrangements to track utility bills, rent, and other common expenses.
3. **Team Outings or Events**: Helpful for managing expenses in team-building activities, company outings, or social gatherings.
4. **Student Housing**: Students living together can use the app to efficiently track their shared costs and maintain transparency in financial matters.

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