HCI - Final Report

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Abstract

This report details the development of a web application for managing friends, groups, and loans, created for a Human-Computer Interaction course project. The development process included user interviews, prototyping, A/B testing, and preference testing. Testing showed a preference for Prototype A, leading to design adjustments such as resizing buttons, modifying loan amount fields, and improving modal navigation. The final app is a mobile-friendly web application focusing on simple navigation and core features to meet the outlined requirements.

Keywords

HCI, Loan management, Application, Prototype, Low-fidelity, High-fidelity, A/B testing, Preference testing, Usability testing

1 Introduction

This report details the iterative development and testing process for our Human-Computer Interaction course project, a loan management application. We designed the app to simplify the management of shared expenses, the app allows users to add and remove friends, create groups, issue and track loans, and confirm repayments.

We based our development process on the principles of user-centered design and iterative improvement. Starting with a project proposal and pre-planning interviews, we set out to understand user needs and expectations. This feedback was used during the creation of low- and high-fidelity prototypes, which we evaluated through A/B testing and preference testing. Each stage of the project contributed to the evolution of the app, resulting in a minimum viable product (MVP) evaluated by user feedback and usability findings.

2 Methods

Our project followed an iterative development and testing process based on user-centered design principles. Each phase was planned to gather information from potential users, refine our designs, and ensure the final product met their needs. Below, we outline the methods used at each stage of the project.

2.1 Project Proposal and Planning

At the beginning of the project, we wrote a proposal outlining the goals and scope of a loan management application. The app was intended to help users efficiently manage shared expenses and loans with friends and groups. To ensure our design satisfied user needs, we performed pre-planning interviews with eleven participants from our target demographic. These interviews helped us establish functional and non-functional requirements, which guided the development of the initial prototypes.

2.1.1 Pre-Planning Intreviews. The interviews were semi-structured, allowing participants to provide detailed feedback while focusing on key areas of functionality and usability. Below, we summarize the main areas:

Functional Requirements:

- **Managing Friends and Groups:** Participants were asked how they would prefer to add friends, with options such as username, email, or phone number. They also shared their expectations for managing groups, such as adding/removing members and setting group names.
- **Loan Issuing and Tracking:** Questions focused on what details users found necessary when issuing loans, including amount, reason, and due date.
- **User Account and Profile:** Participants were asked what information they would like displayed in their profiles and if a summary of loans and debts on the dashboard would be beneficial.

Non-Functional Requirements:

- **Usability:** Participants were asked about their preferences for the visual design and navigation. We inquired about the types of visual elements or layouts they found intuitive and whether they would prefer minimalist designs, colorful interfaces, or icon-based navigation. Additionally, we asked if they would find in-app tips or tutorials helpful or if they preferred to explore features on their own.
- **Performance:** We asked the participants about the importance of app performance, particularly the responsiveness of actions such as loading groups or processing loans.
- **Reliability and Data Accuracy:** We asked participants about their concerns regarding data accuracy and reliability when managing loans and shared expenses. We also questioned how frequently they would expect their data to sync or update (e.g. daily, real-time).
- **Security and Privacy:** Participants were questioned about their comfort level with sharing personal information such as email addresses or phone numbers with other group members. We also talked about their expectations for various security features.

2.2 Prototyping

The prototyping phase was very important for visualizing the app's design. We adopted an iterative approach, starting with simple low-fidelity wireframes and advancing to high-fidelity prototypes that closely resembled the final product. The images of our prototypes are present in our portfolio [1].

2.2.1 Low-Fidelity Prototype. The low-fidelity prototype was developed during laboratory sessions, where we sketched the app's basic structure and layout on paper. This wireframe served as a blueprint for the app, focusing on:

- **Key Features:** Representing essential functionalities such as adding friends, creating groups, issuing loans, and tracking repayments.
- **Navigation Flow:** Mapping out how users would move between screens (e.g., dashboard, group view, loan details).
- **User Interface Elements:** Identifying core components like buttons and input fields.

After creating the initial prototype, we engaged in discussions with fellow students during the lab sessions. These discussions provided feedback on potential pain points, usability challenges, and areas for improvement. Based on the feedback, we revised the wireframe to better address user expectations.

This stage helped us identify key design considerations and influenced the creation of the high-fidelity prototypes.

2.2.2 High-Fidelity Prototype. Building on the insights from the low-fidelity prototype, we created two high-fidelity prototypes using Figma. These prototypes were designed to closely resemble the final product in terms of layout, aesthetics, and interactive elements.

Design process: Each prototype included the app's core screens, such as the dashboard, friend list, group management interface, loan details, and notifications. We focused on maintaining a clean and user-friendly interface, incorporating feedback from the earlier phase.

Prototypes A and B: To test specific design elements, we developed two versions of the prototype with minor differences. For example, Prototype A employed an icon-based navigation bar for enhanced simplicity while Prototype B featured a more traditional "burger menu" for navigation.

The high-fidelity prototypes were very important for performing A/B testing and preference testing. Prototype A and Prototype B allowed us to compare user performance and preferences for different navigation styles and layouts. This testing phase provided important information which influenced the development of the minimum viable product (MVP) [2].

2.3 User Testing

User testing was an important phase in evaluating the usability and intuitiveness of our high-fidelity prototypes. We employed A/B testing and preference testing to gather both quantitative and qualitative data from users, whith the goal of identification the best design choices and ensure our app met user expectations. To avoid bias, there was no overlap between participants in A/B testing and preference testing. Testing was conducted in both controlled environments (laboratory sessions) and external settings to ensure a mix of perspectives. Below, we outline the methods used for each type of testing.

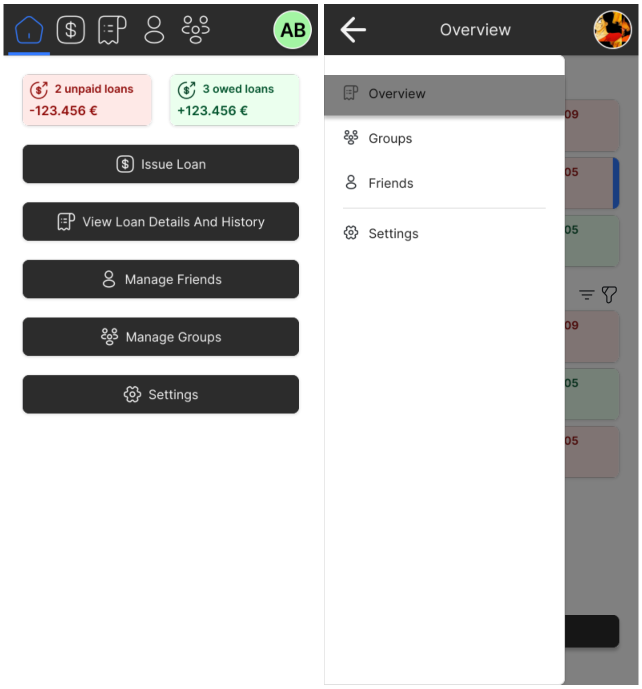

Figure 1: Example of differences in navigation in Prototype A (left) and Prototype B (right).

2.3.1 A/B Testing. A/B testing was performed to compare two versions of specific screens (Prototypes A and B) and evaluate their usability, intuitiveness, and overall effectiveness. This testing was performed with 14 participants, split equally between Prototype A and Prototype B. The participants were from both university laboratory sessions and external settings, ensuring diverse feedback.

Testing procedure: Participants were randomly assigned to interact with either Prototype A or Prototype B. Each participant completed tasks associated with the following key screens:

- Dashboard
- Friend List
- Add Friend
- Issue Loan

For each screen, participants answered the following questions:

1. **Rank Question:** Participants rated the intuitiveness of the screen design on a scale from 1 to 5.
2. **Navigation Success Question:** Participants were asked how they would navigate to specific sections or perform certain actions, where we took note of their ability to complete the tasks successfully.
3. **Open Question:** Participants were asked to give additional feedback about the design, focusing on areas for improvement or specific pain points.

We collected both quantitative and qualitative data. Quantitative data was represented by rankings from the first question and success rates from the various tasks, while qualitative data was represented by the open-ended feedback, which provided further insights into user preferences and frustrations.

2.3.2 *Preference Testing.* Preference testing focused on gathering quantitative data to evaluate user preferences between the two prototype versions. This testing was conducted with 5 participants, separate from the A/B testing group to ensure unbiased results.

Testing procedure: This time, participants were presented with both Prototype A and Prototype B for the following screens:

- Dashboard
- Friend List
- Navigation
- Issue Loan

For each screen, participants answered the following questions:

(1) Which design do you prefer?
(2) Which design feels more intuitive?
(3) Which design is more visually appealing?

The data collected during preference testing was purely quantitative, with responses tallied to determine overall user preferences for each design aspect.

2.4 Implementation

The final stage of our project involved implementing a Minimum Viable Product (MVP) [2] based on the information gathered from user testing and prototype evaluations. The MVP was designed as a Progressive Web Application (PWA) with a focus on mobile use.

The MVP was built using Svelte as the front-end framewok, and using Node.js for the back-end. We used SQLite for data storage, leveraging it's simplicity which aligned with the MVP's scope.

The MVP includes core functionalities identified as essential through user research and testing:

- **Friend Management:** Users can add and remove friends.
- **Group Management:** Users can create groups, add/remove members, and assign group names.
- **Loan Issuance and Tracking:** Users can issue loans, track repayments, and manage shared expenses within groups.

As a minimum viable product, the implementation focused on delivering functionality rather than refining all aspects of the application. Key limitations include:

- **Quality Control:** The MVP lacks comprehensive error handling and quality assurance measures.
- **Validation:** Input validation for user actions, such as adding friends or creating loans, is minimal and may require refinement in future iterations.
- **Performance Optimization:** While the app is functional, further optimization is required for scalability and high traffic loads.
- **Missing features:** The prototype is missing some features which were omitted due to time constraints, such as notifications and registration.

Despite these limitations, the MVP proves to be as a strong foundation for further development and provides a product for evaluating the app's potential and receiving user feedback.

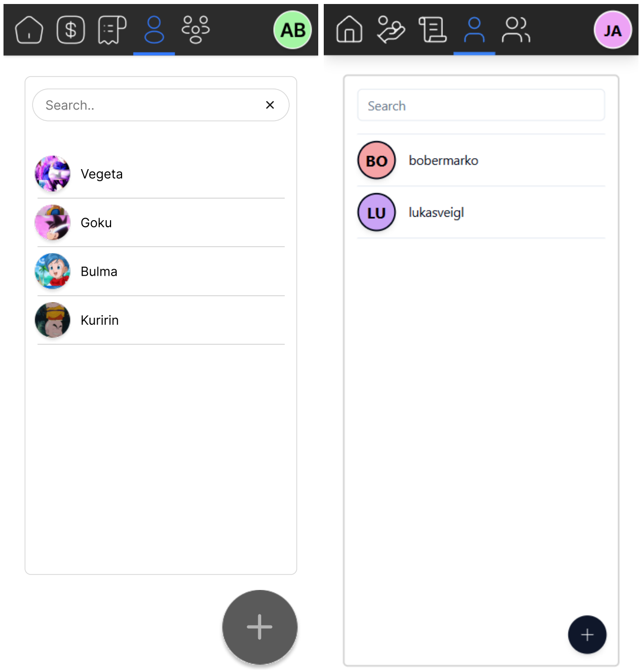

Figure 2: Example of user feedback taken into consideration. High-fidelity prototype is on the right, and the MVP screen with an adjusted button is on the left.

2.5 Usability testing

Usability testing was conducted to evaluate the effectiveness, efficiency, and user satisfaction with our interactive prototype. To gain deeper information into user interactions and thought processes, we incorporated the Think-Aloud Protocol during the testing sessions. This allowed us to observe and analyze user behavior while identifying areas for improvement.

Testing procedure: Participants were presented with our interactive prototype and asked to complete a series of predefined tasks reflecting the app's main functionalities. For each task, participants were asked questions before and after the task to assess their expectations and experiences. During the task, participants were encouraged to verbalize their thoughts and decisions, and reactions, while questioners observed and recorded their actions and comments.

The tasks included:

- Adding a friend
- Creating a group
- Issuing a loan
- Confirming a loan

Each task was divided into three stages:

- **Before Task:** Participants were asked about their expectations regarding the location or method to complete the task. For example, "Where do you expect to find the 'Add Friend' button?" or "How do you expect to issue a loan?"
- **During Task:** Participants performed the task while verbalizing their thoughts. Questioners recorded the screens

visited, buttons clicked, and any observed confusion or hesitation.

- **After Task:** Participants rated the ease or difficulty of the task on a 5-point scale, with 3 representing the task being as expected. This helped quantify user perceptions of task complexity.

3 Results

The results section outlines the key findings from the pre-planning stage, user testing phases, including both A/B testing, preference testing, and usability testing. The data collected helps to evaluate whether the goals of the project were achieved.

3.1 Pre-Planning Interview Findings

3.1.1 Functional Requirements. **Managing Friends And Groups:**

(1) **Adding Friends:** Preferences were varied — some users want to add friends via email, phone number, or username, while others are open to any method.
(2) **Managing Groups:** Users need to create, rename, or remove groups, track payment timelines, and manage debt. Some also desire recurring costs and the option to add images or notes.
(3) **Notifications:** Phone notifications are favored, with a few users open to email alerts. The notification types and frequency vary, with many preferring only essential updates.

Loan Issuing and Tracking:

(1) **Loan Details:** Essential fields include loan amount, reason, and optionally, the due date.
(2) **Splitting Loans:** Users want options for both custom amounts and automatic loan splitting.
(3) **Debt Tracking:** Users need to track debt statuses and set reminders for repayment, with preferences for customizable repayment frequencies.

User Account & Profile:

(1) **Profile Information:** Most users are comfortable sharing their name and email or phone number. Some are open to including profile pictures.
(2) **Loan Tracking in Profiles:** Users prefer to see how much they owe or are owed within their profile.

3.1.2 Non-Functional Requirements. **Usability:**

(1) **Simple Navigation:** Users prefer simple, intuitive navigation, where features are accessible with minimal effort.
(2) **Design Preferences:** A minimalist design with fewer buttons and visual elements like icons and images is favored.
(3) **Tutorials:** While some users like tutorials or tips, most prefer an app that's intuitive enough to use without extra guidance.

Performance:

(1) **Speed:** Users expect the app to be fast and responsive, with quick load times and actions.

Reliability and Data Accuracy:

(1) **Accuracy:** Financial data must be accurate, and users want the ability to correct any errors easily.
(2) **Real-Time Updates:** Users want real-time updates for accurate debt tracking and to avoid discrepancies.

Security and Privacy:

(1) **Privacy Concerns:** Users prefer to share only necessary details like email or phone numbers but are generally hesitant to provide phone numbers.
(2) **Security Features:** Some users prefer basic password protection, while others want additional security features like two-factor authentication or the ability to lock the app with a PIN or fingerprint.

Notifications and Alerts:

(1) **Notification Preferences:** Push notifications are most preferred, with some users open to email alerts for key updates.
(2) **Notification Frequency:** Users prefer receiving functional, non-intrusive notifications without excessive reminders.

Based on these findings, our plan was to develop a mobile-first web application that simplifies the user experience by focusing on the most common use cases. We decided the app will require mandatory login with usernames, minimizing the amount of personal information needed from users. To ensure ease of use, navigation will be streamlined with intuitive shortcuts, making it quick and easy to perform essential tasks. The app will prioritize essential features like managing friends, groups, loans, and debt tracking, and it will be designed to be as simple and accessible as possible.

3.2 Prototyping Feedback

In the prototyping phase, we created two distinct versions of the application to gather feedback on their usability and design. The prototypes were developed based on insights gained from the pre-planning interviews and aimed to test different approaches to key features like navigation, layout, and user interactions. Users were given tasks to complete using both prototypes, and their feedback was collected through both quantitative and qualitative methods to identify which version better met their needs.

3.2.1 A/B Testing. In the A/B testing phase, users were asked to rate their experience with both Prototype A and Prototype B. Quantitative data collected from these ratings indicated a preference for Prototype A. While both prototypes allowed users to successfully complete all assigned tasks, Prototype A received higher ratings in terms of user satisfaction.

Open-ended feedback was also considered and used to refine the design further. Based on user suggestions, we made several adjustments, including making the "Add Friend/Group" button smaller and positioning it within the borders to reduce visual clutter. Additionally, users found the inclusion of the "+" and "-" signs in the loan amounts confusing, so these were removed for greater clarity. To improve the user experience when closing modals, "X" buttons were added to allow users to easily exit the modal interface.

For detailed data and visual comparisons between the prototypes, please refer to our portfolio [1], which will be submitted alongside this report.

3.2.2 Preference Testing. The findings from the preference testing phase confirmed our conclusions from the A/B testing. Users preferred Prototype A over Prototype B, echoing the quantitative ratings collected earlier. While both prototypes met the functional requirements, Prototype A's design elements were better aligned with user preferences, as indicated by their feedback. For precise data and information from this phase, please refer to our portfolio [1], which contains detailed breakdowns of user preferences and task completion success rates.

3.3 MVP Evaluation

The MVP evaluation was conducted using a combination of usability testing and the think-aloud protocol, producing both quantitative and qualitative data. Our results show that the general difficulty of the tasks was rated positively by users, with the average quantitative score always at or above 3 (meaning as expected). This suggests that users generally found the tasks to be of an expected or slightly easier difficulty level. Additionally, qualitative feedback supports this trend, with users expressing satisfaction overall.

Despite this, some users experienced minor confusion during specific tasks. For example, one user encountered difficulties while trying to add friends through the "Manage Friends" page. They first tried using the search function, but quickly realized that it wasn't possible to find new friends that way. After noticing the "Add Friend" button, they were able to continue without further issues.

Similarly, another user faced challenges while confirming a loan. They navigated to the "Loan History" window via the navigation bar and found the correct loan, but initially had trouble understanding the confirmation process. They mistakenly thought they needed to manually enter the amount repaid. However, they quickly discovered that the loan could be confirmed with a single click on the total amount owed.

These moments of confusion were generally resolved quickly, indicating that the users were able to figure out the interface with minimal guidance. Overall, the usability of the app aligns with the goals of the MVP, and the feedback gathered could be used to improve the user experience moving forward.

A more detailed breakdown of the usability testing phase can be found in our submitted portfolio [1].

4 Discussion

The development and testing phases of this project provided valuable information about user preferences and behaviors. Through user interviews, we identified functional requirements such as the importance of simplicity and flexibility in managing friends, groups, and loans. A/B testing revealed that users preferred Prototype A, leading to refinements based on open-ended feedback. These adjustments, such as resizing buttons and removing confusing elements, improved the user experience. The decision to develop a web app ensures accessibility across devices, and by focusing on core use cases, our MVP reaches the goals of this project, despite some missing features. Future improvements could involve adding more advanced features based on user feedback or implementing missing features.

References

[1] Group 14. 2025. Group 14 - portfolio. https://github.com/mpopovic4116/fri-hci-2024-g14/tree/main. (Jan. 2025).

[2] Group 14. 2025. Minimum viable product. https://hci.mywire.org/. (Jan. 2025).