Kathmandu University

Department of Computer Science and Engineering

Dhulikhel, Kavre

A Project Report
on
"KUPals"

COMP 206

(For partial fulfillment of II Year/I Semester in Computer Science/Engineering)

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Submission Date:2025-08-05

Bona fide Certificate

This project work on

“KUPals”

is the bona fide work of

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Acknowledgement

We would like to express our heartfelt gratitude to the Department of Computer Science and Engineering (DOCSE) for providing us with the incredible opportunity to work on this project, “KUPals." This project has expanded our technological horizons, improved our teamwork skills, and helped us better comprehend the tools and technology needed to create a fully effective recommendation website.

We would like to express our deepest gratitude to our supervisor, Mrs. Subhadra Joshi, for her invaluable guidance, unwavering support, and insightful feedback throughout the development of this project. Her insights played a vital role in shaping our ideas and translating them into a practical solution.

This project has greatly helped improve our understanding of the tools and technologies required to develop a fully functional website, broadened our technical horizons, and helped us develop teamwork skills.

We are also deeply thankful to our Project coordinator and supervisor, Mr. Suman Shrestha, for his unwavering support and valuable insights he has provided us with. His efforts have not been short of a guiding light for us.

Additionally, we extend our appreciation to our fellow students and peers for their constant encouragement, support, and expert advice throughout the development process of “KUPals” app. Their input and suggestions greatly helped us understand the real needs and expectations of KU students, enabling us to tailor the platform accordingly.

Abstract

In the context of university life, students often face difficulties in finding a dedicated platform that supports both academic collaboration and social interaction. The KUPals project addresses this gap by creating a lightweight, web-based social platform tailored for students of Kathmandu University. KUPals enables users to join public groups based on shared interests—such as music, hiking, art, and gaming—as well as form private, invite-only groups for academic discussions or club coordination. The platform is developed using React for a responsive frontend and Firebase for backend services, including user authentication, real-time database operations, file storage, and hosting. This technology stack ensures low maintenance, scalability, and seamless real-time communication while maintaining data privacy through Firebase's robust security rules. Through its intuitive interface and real-time features, KUPals is designed to promote group-based learning, simplify student networking, and enhance campus engagement. The platform not only fills the current void in student communication tools but also lays a foundation for future expansion into mobile applications or integration with university systems.

Keywords: University platform, student collaboration, real-time chat, social networking.

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Acronyms/Abbreviations

API	Application Programming Interface
CPU	Central Processing Unit
CSS	Cascading Style Sheets
DB	Database
HTML	Hypertext Markup Language
JS	JavaScript
JSON	JavaScript Object Notation
OS	Operating System
RAM	Random Access Memory
REST	Representational State Transfer
SQL	Structure Query Language
UI	User Interface
UX	User Experience

1. Introduction

1.1 Background

In recent years, universities have increasingly recognized the importance of digital platforms in fostering student engagement and collaboration. While mainstream social networks like Facebook, Instagram, and Discord offer general communication tools, they fail to meet the specific needs of university students. These platforms lack dedicated academic features, proper privacy controls, and the ability to seamlessly blend social and academic interactions within a secure, university-focused environment.

At Kathmandu University (KU), students face similar challenges. Despite having diverse academic and social interests, there is no centralized platform that allows them to easily connect for both collaborative learning and extracurricular activities. Existing solutions—whether general social media or basic university forums—are inadequate because they:

- Don't support real-time communication effectively
- Offer limited tools for group management
- Fail to balance academic and social needs
- Often compromise student privacy

Recent Developments in Student Platforms

1. **University-Specific Networks:** Some institutions have created their own platform, but these tend to focus only on academics, missing opportunities for social engagement and real-time interaction.

2. **Privacy-Centric Solutions:** With growing concerns about data security, there's increasing demand for platforms that prioritize student privacy without sacrificing functionality.

Why Current Platforms Fall Short

Social-Academic Imbalance: Most tools cater exclusively to either socializing or academics, forcing students to juggle multiple platforms.

Privacy Risks: Third-party platforms often collect excessive user data, making students vulnerable to breaches.

Limited Customization: Generic social media can't support university-specific needs like study groups, event planning, or club management.

1.2 Objectives

The main objectives of this project are:

- Public and private groups for both academic and social purposes
- To develop a React/Firebase platform for KU students to join interest groups
- To enable creation of private groups for academic or social collaboration
- To implement real-time chat functionality using Firebase's real-time database
- To ensure user data privacy with Firebase Auth and Firestore security rules
- To design a maintainable and scalable platform

1.3 Motivation and Significance

As students at Kathmandu University, we recognized a critical gap in existing digital platforms. While tools like Facebook and Discord offer general communication features, they fail to provide the focused, secure environment university students need for both academic collaboration and social engagement. These mainstream platforms

are either too broad (losing academic relevance) or too narrow (focusing only on studies), leaving KU students without a proper space to balance their campus life.

KUPals addresses these issues by:

• Providing a university-specific design tailored for KU's community

• Implementing a privacy-first approach using Firebase's secure infrastructure

• Utilizing practical technology (React and Firebase) for robust functionality

• Bridging the gap between academic and social need

2. Related Works

Several platforms attempt to address university communication needs, but each falls short in key area related to KU students.

Mainstream platform

1. Facebook Groups

Facebook Groups are a feature of the social media platform Facebook that allows users to create private or public communities centered around a common interest, goal, or location. These groups serve as a forum for members to have discussions, ask questions, share content, and organize events. They are a familiar and widely used tool for building communities online, from local book clubs to global fan bases. The ease of use and integration with the broader Facebook ecosystem makes them a popular choice for fostering interaction among people who share a specific connection or passion. (Meta, n.d.)

2. Discord

Discord is a communication platform initially designed for video gamers but has since expanded to serve a wide range of communities. It allows users to create "servers" which are essentially virtual communities with various text and voice channels. Its key features include real-time voice chat, rich media support, and the ability to customize user roles and permissions. Discord's structure is highly organized, with channels dedicated to specific topics, making it easy for members to engage in focused conversations. Its gaming-centric roots are still evident in its design, but it is now widely used for everything from academic study groups to professional networking. (Discord, n.d.)

3. Slack

Slack is a cloud-based communication and collaboration platform primarily used in professional and academic settings. It organizes conversations into "channels" which can be created for specific projects, teams, or topics, reducing the clutter of traditional email chains. Slack offers a variety of integrations with third-party apps, allowing users to centralize their workflows and access information from different services without leaving the platform. While it has a free tier, many of its most powerful features are reserved for paid plans, which can limit its accessibility for some users. (Technologies, n.d.)

4. Piazza/Yammer

Piazza/Yammer represents a category of platforms designed for specific institutional or corporate communication. Piazza, for example, is a free platform often used in educational settings to facilitate Q&A between students and instructors, offering a rigid, forum-like structure. Yammer, on the other hand, is an enterprise social networking service from Microsoft that is used for internal communication within an organization. It functions much like a corporate version of Facebook, allowing employees to connect, share knowledge, and engage in discussions across departments. Both platforms prioritize structured, purpose-driven communication over casual, social interaction. (Microsoft, n.d.)

3. Design and Implementation

System Architecture Overview

KUPals adopts a serverless architecture using React for the frontend and Firebase for all backend services. This model supports faster development, simplified maintenance, and automatic scalability—ideal for university-level platforms with limited IT resources.

Main Components:

Frontend: React.js (UI), Tailwind CSS (Styling), Context API (State management)

Backend: Firebase Authentication, Firestore, Realtime Database, Cloud Storage

Deployment: Firebase Hosting

Frontend Design

Framework: React.js with functional components and JSX.

Styling: Tailwind CSS provides a mobile-first, utility-based design system.

Routing: Implemented using next-router for smooth navigation.

State Management: Context API handles global states for user sessions, group memberships, and chat updates.

Responsiveness: Optimized for desktops, tablets, and smartphones.

Backend Design (Firebase Services)

Firebase offers a scalable, real-time backend without requiring traditional server maintenance.

- **Authentication:**
    - Email/password and Google sign-in via Firebase Auth.
    - Secure session handling with Firebase tokens.
- **Database:**
    - Firestore: Stores user profiles, group details, and notifications.
    - Realtime Database: Optimized for real-time messaging and chat updates.
- **Storage:**
    - Firebase Storage allows users to upload profile pictures, group images, and shared documents.
- **Security:**
    - Firebase security rules protect access to data based on user roles and group membership.
    - Data access is scoped to authenticated sessions.

Core Modules Implementation

User Module

- Register/login with email and Google
- Edit profile (name, avatar, bio, interests)
- View other students' public profiles

Group Management

- Public group browsing and joining
- Private group creation with invite-only links
- Role-based group member management

Chat System

- Group-specific real-time chat via Realtime Database
- Scrollable chat history
- Emoji and file sharing support (future scope)

Notifications

- Real-time updates for group invites, messages, and announcements
- Firebase Firestore triggers for serverless notification logic

3.1 System Requirement Specifications

Software Requirements

Category	Specification
Operating System	Windows 7+, macOS 10.12+, Ubuntu 16.04+
Web Browsers	Chrome (latest), Firefox, Edge, Safari 13+
Mobile Access	Android 8+, iOS 13+ (via responsive frontend)

Hardware Requirements

Requirement Type	Minimum	Recommended
CPU	Intel Core i3 / AMD Ryzen 3	Intel Core i5 / AMD Ryzen 5
RAM	2 GB	4 GB+
Storage	300 MB free space	500 MB SSD
Graphics	Integrated (Intel HD Graphics)	Integrated or better

Software Stack

Layer	Technology Used
Frontend	React.js, Next.js, Tailwind CSS, Context API
Authentication	Firebase Authentication (Email/Google)
Database	Firestore (for structured data), Realtime DB (chat)
File Storage	Firebase Storage
Hosting	Firebase Hosting

3.2 Development Phases

Phase	Duration	Activities
Phase 1	1.5 weeks	Research, requirements gathering, wireframes
Phase 2	6 weeks	Core development: auth, profiles, groups, chat
Phase 3	2.5 weeks	UI refinements
Phase 4	2 weeks	Final touch, documentation

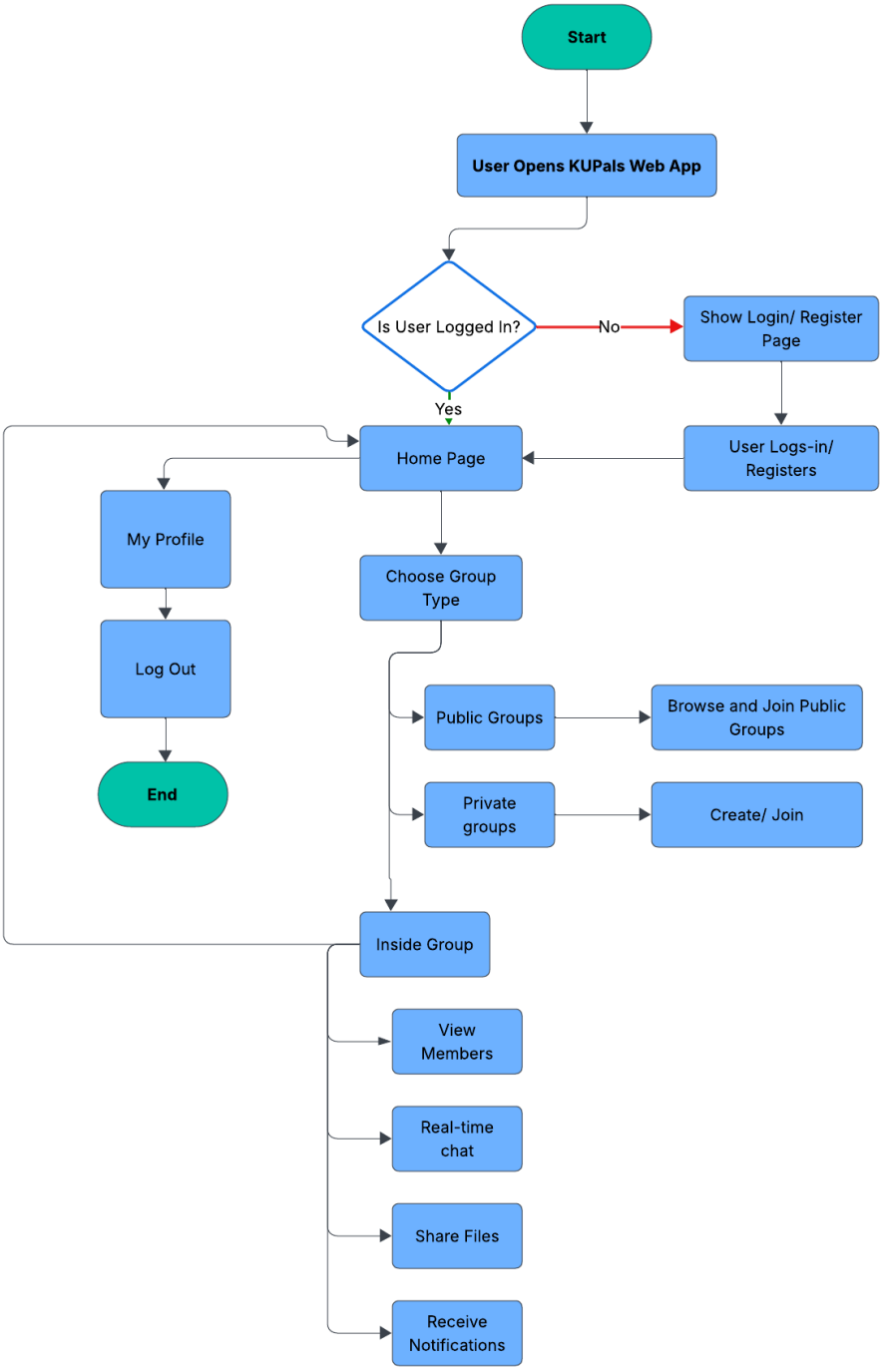

Fig. 3.2.1

Flowchart: Basic Working of the Web App

4. Discussion on the achievements

The development and partial deployment of the **KUPals** platform has resulted in significant progress toward the project's objectives. Designed with simplicity, scalability, and student engagement in mind, the web application successfully meets many of the functional requirements laid out during the proposal phase.

Functional Milestones Achieved

- **User Authentication System**
  A fully operational login and registration system using **Firebase Authentication** was implemented. Users can log in using email/password or Google accounts securely.
- **Group Creation and Membership**
  Students can create **public** and **private groups**, aligning with our goal of supporting both open communities and focused academic collaboration.
- **Real-Time Messaging**
  The integration of **Firebase Realtime Database** allowed for fast and responsive group chat, fulfilling the requirement of instant communication.
- **Responsive and Clean UI**
  The frontend, built with **React** and styled using **Tailwind CSS**, offers a smooth and responsive experience across different screen sizes.
- **Basic Profile System**
  Users are able to edit and manage basic profile information including name, profile photo, and interests, enabling identity in the community.

Performance and Technical Highlights

- **Real-Time Data Sync**
  Firebase services enabled instant data updates, especially in group chat and user actions—demonstrating successful use of serverless technology.
- **Low Hosting Cost**
  By using **Firebase's free tier**, we were able to deploy and host the application without incurring additional infrastructure costs.

Limitations and Areas for Future Improvement

While the core features were implemented successfully, some features were either simplified or left for future iterations:

- **File sharing within groups** was partially implemented but not fully tested.

- **Push notifications** and **event reminders** are in the backlog for next versions.

Conclusion

The KUPals project successfully achieved its primary objective: creating a lightweight, scalable, and user-friendly platform that enhances student collaboration and community engagement. The development team's choice of a React and Firebase tech stack proved to be a highly effective strategy, enabling the creation of a modern web application that is both efficient and responsive. A key achievement of the project was the creation of a modular architecture that allows core features, such as interest-based community forums and collaborative spaces, to function independently while seamlessly integrating into the overall platform. This design provides a strong foundation for future development and makes it easy to add new features without disrupting the existing user experience.

While KUPals has laid a strong foundation for a vibrant student community, the project encountered certain limitations, primarily due to time constraints. More advanced features, such as real-time event calendars and deeper integration with university-specific resources, were not implemented. Despite these limitations, the application offers a robust and intuitive experience for students to connect, share resources, and engage in interest-based activities. Overall, the project effectively accomplished its core goals, delivering a reliable and engaging platform that significantly improves the student experience and lays the groundwork for a scalable and feature-rich future.

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APPENDIX

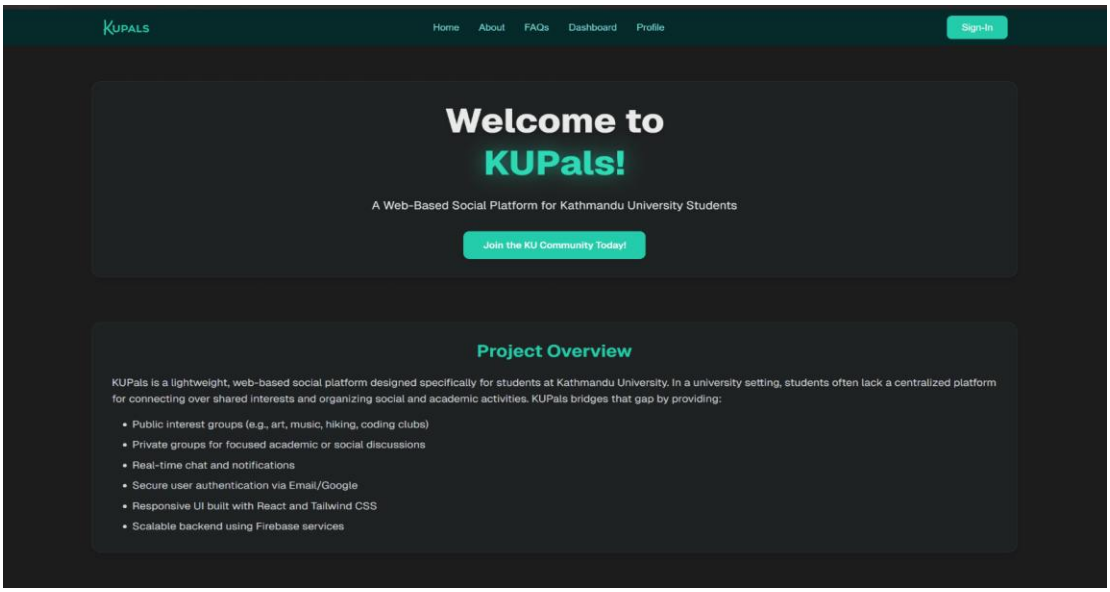

Fig. 2 Landing Page

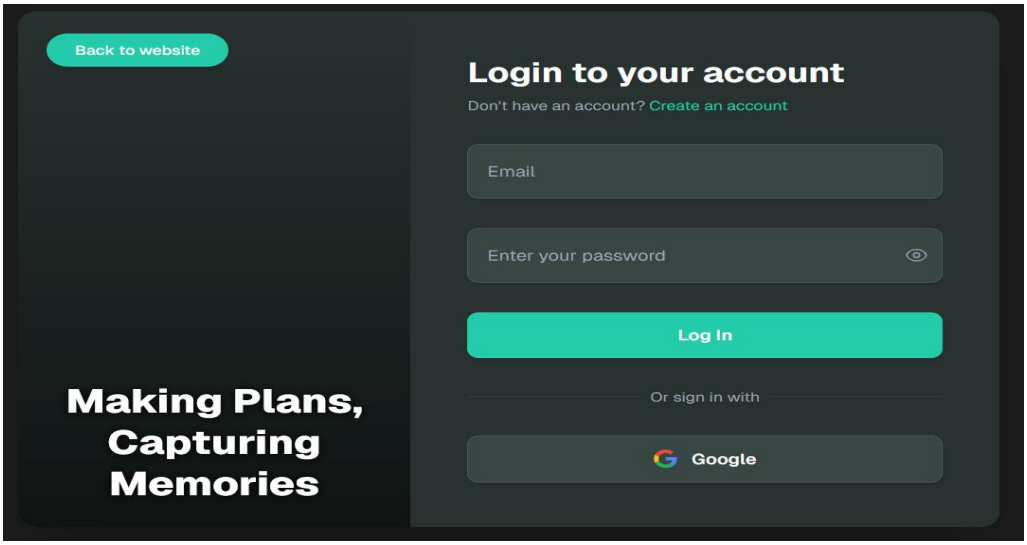

Fig. 3 Login Page

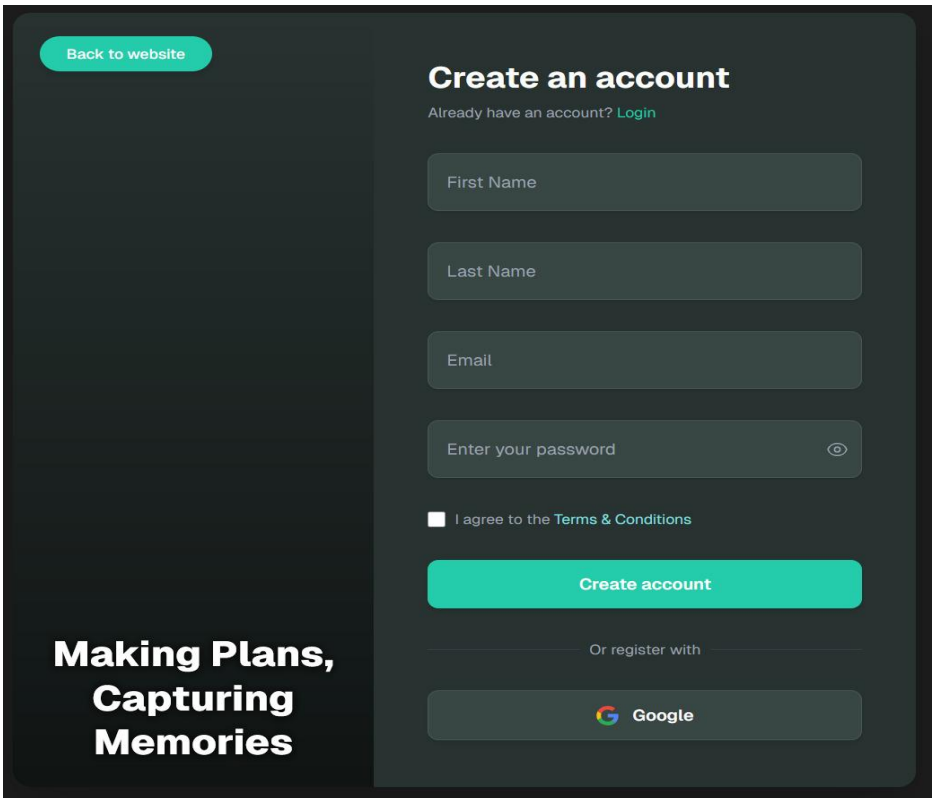

Fig. 4 Sign up Page

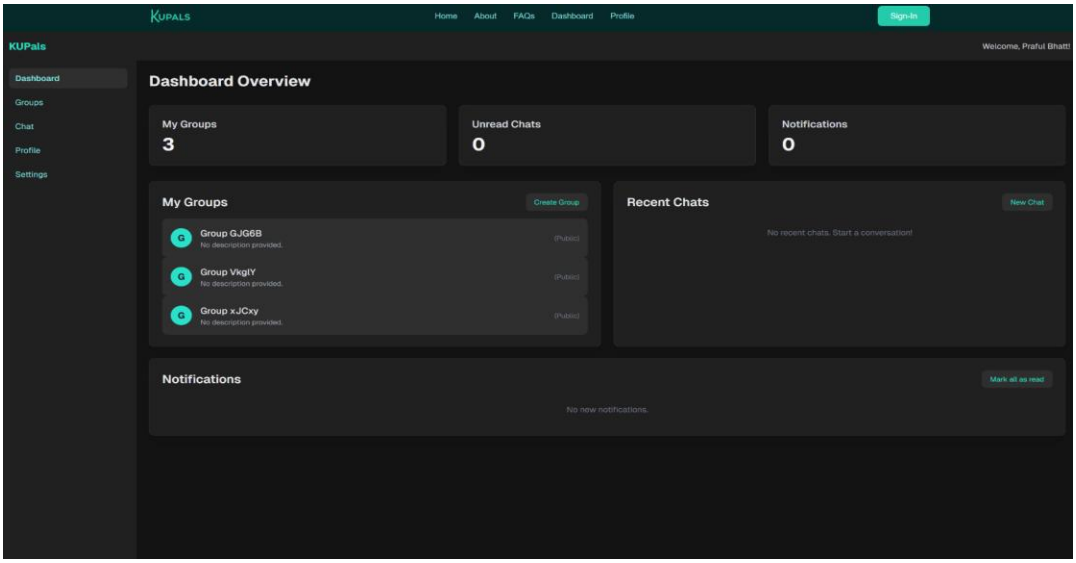

Fig. 5 Dashboard

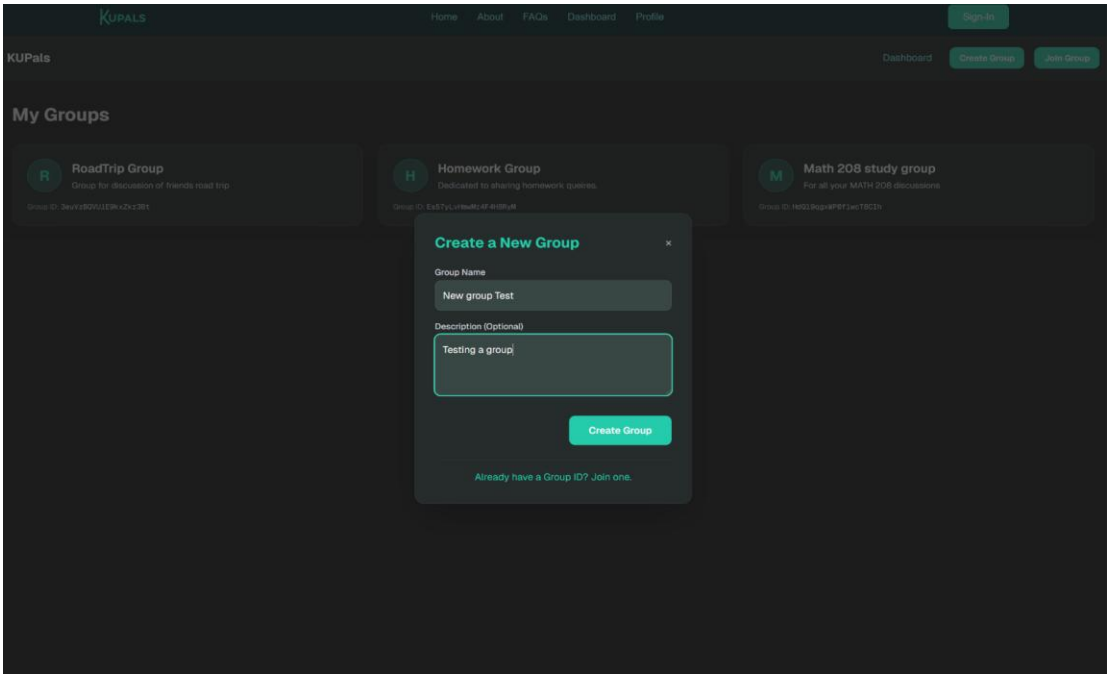

Fig. 6 Create a group

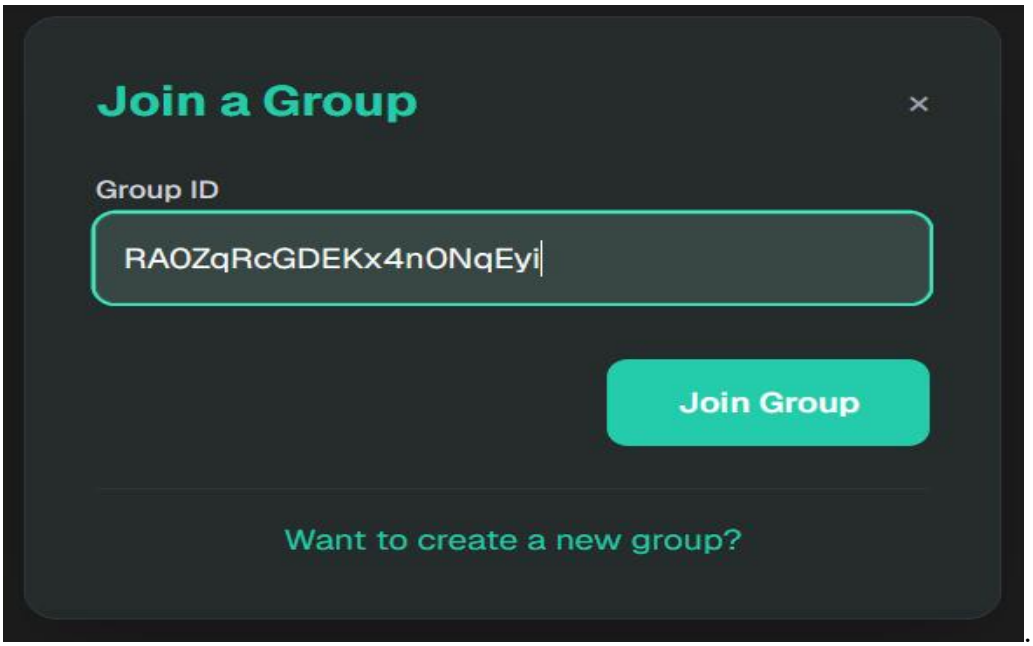

Fig. 7 Join a group

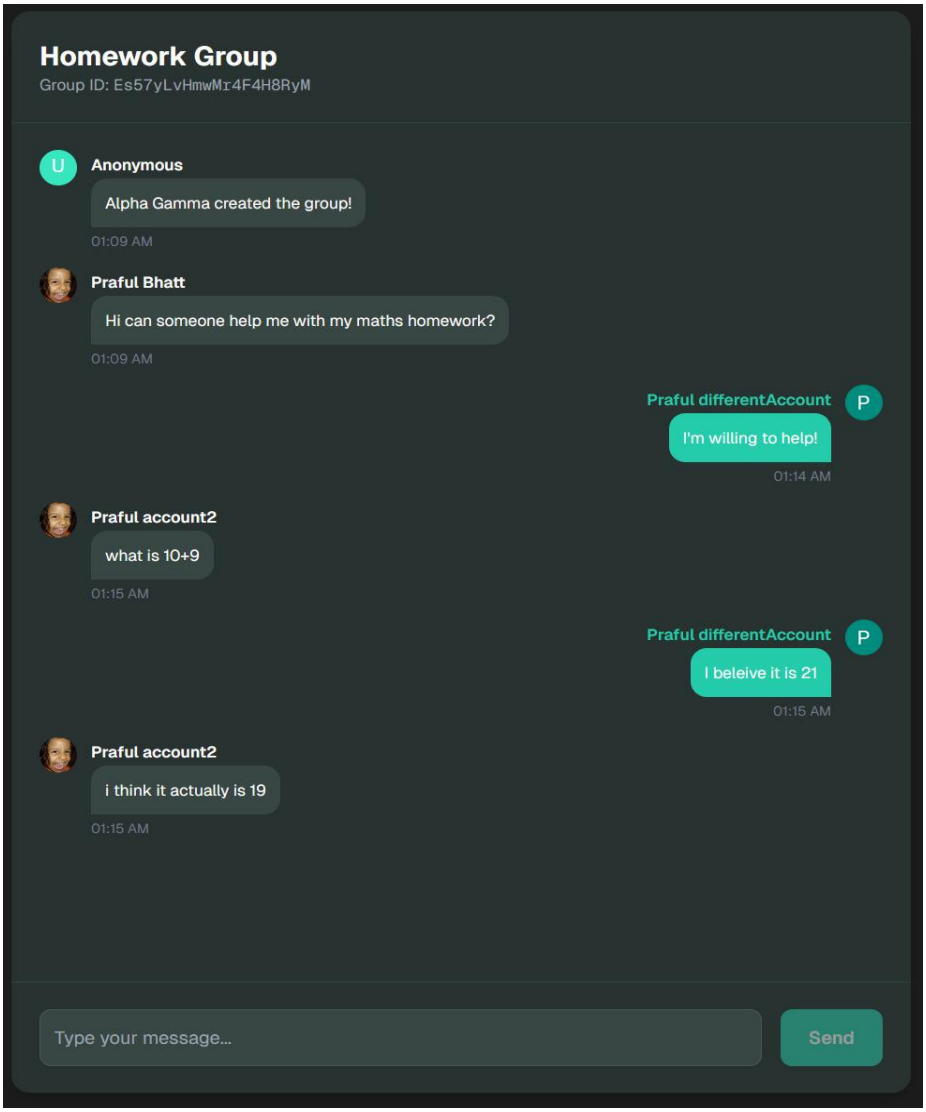

Fig. 8 Real-time chat

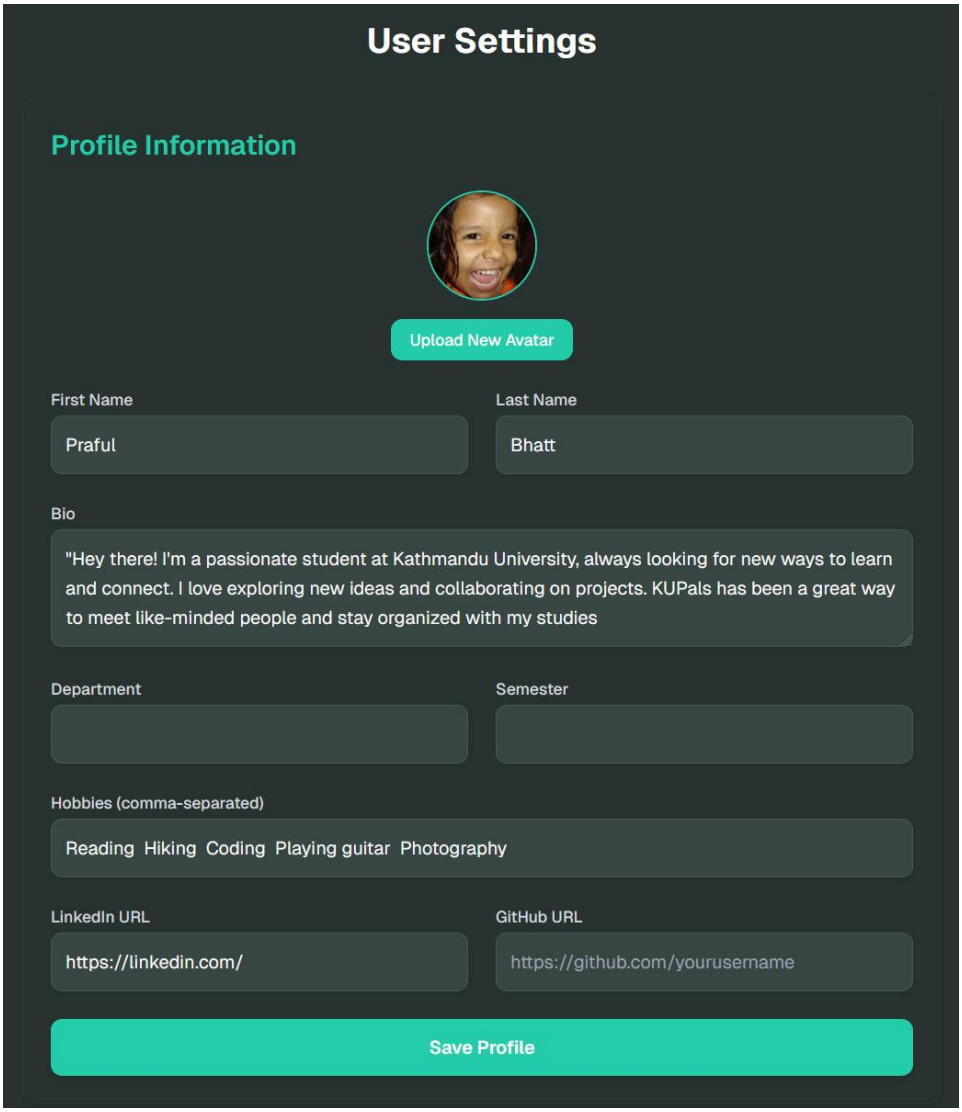

Fig. 9 User settings

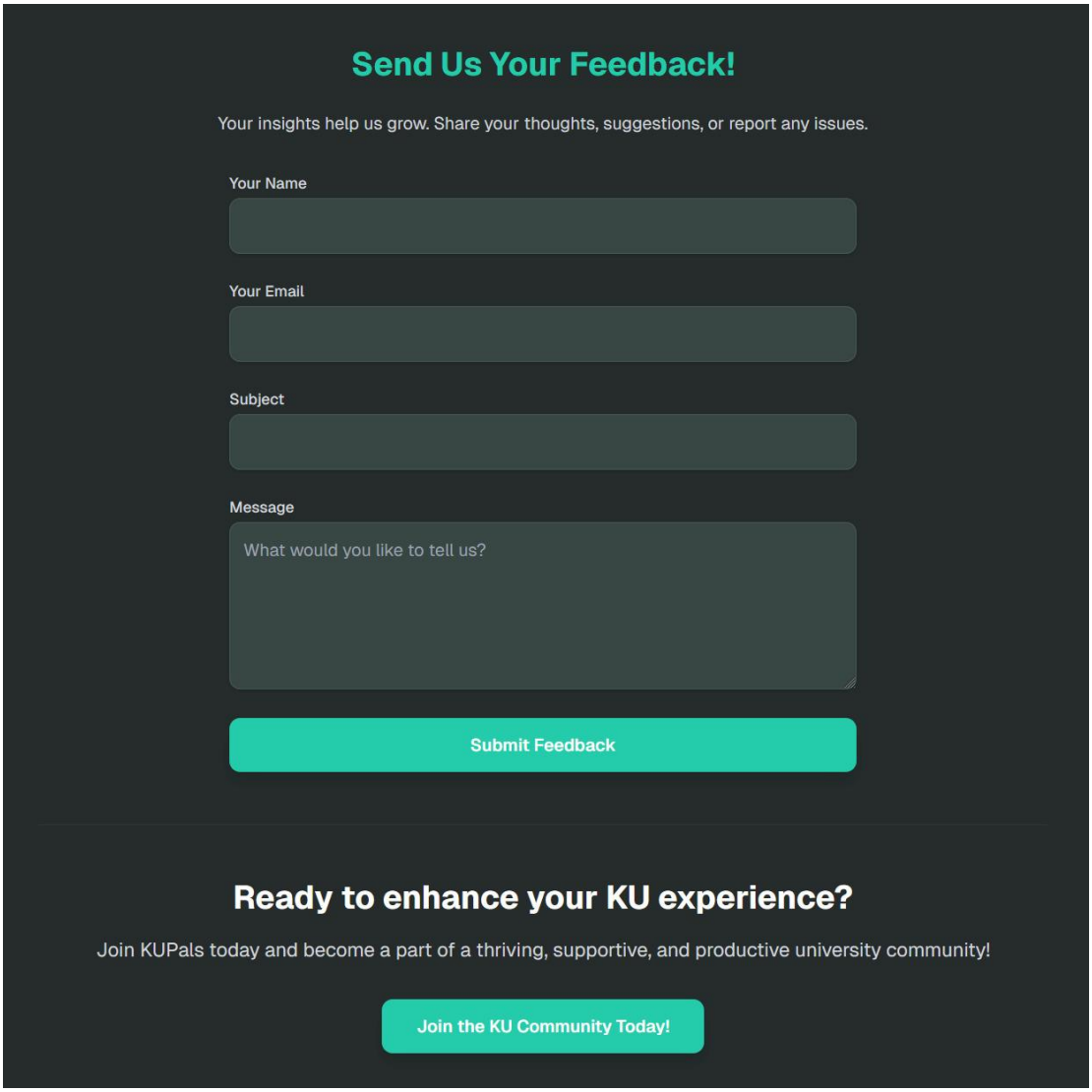

Fig. 10 Feedback section