TUPLES: A STUDENT COMMUNITY APPLICATION

MINI PROJECT REPORT

Submitted in partial fulfilment of the
Requirements for the award of Bachelor of Technology Degree

In Computer Science and Engineering

Of APJ Abdul Kalam Technological University

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CERTIFICATE

This is to certify that the Mini Project Report entitled **"Tuples: A Student Community Application"** submitted by **Adithya Krishnan (B21CS1108)**, **Ferwin Lopez (B21CS1124)**, **Nevia Sebastian (B21CS1144)** and **Nikita Nair (B21CS1147)** to the APJ Abdul Kalam Technological University in partial fulfilment of the requirements for the award of the Degree of Bachelor of Technology in Computer Science and Engineering is a bonafide record of the project work carried out under our guidance and supervision. This report has not been submitted to any other university or institute for any purpose.

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ABSTRACT

A tailored community application to revolutionise the student experience by fostering meaningful connections, facilitating the development of friendships, and cultivating a supportive and inclusive environment.

Leveraging the power of advanced Artificial Intelligence (AI) algorithms, the platform intelligently groups students with similar academic pursuits and shared interests. This fosters the creation of vibrant virtual communities within the college ecosystem. A dedicated forum within each community facilitates peer-to-peer communication, allowing students to connect with like-minded individuals who share similar experiences and goals. By fostering a sense of belonging, support, and understanding, the platform encourages open communication. Students are empowered to share challenges, seek valuable advice, and offer encouragement to their peers, fostering a collaborative learning environment.

Beyond community building, the platform offers a comprehensive and user-friendly chat interface. This intuitive interface caters specifically to student needs, facilitating seamless communication and collaboration. Students can leverage the platform to engage in in-depth project collaboration by seeking help in various aspects needed for the project.

This innovative platform has the potential to significantly enhance student engagement throughout their college journey. By promoting a supportive network, fostering academic success, and enriching student life through a sense of community, this platform can empower students to thrive in their academic pursuits and personal development.

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LIST OF ABBREVIATIONS

AI	Artificial Intelligence
API	Application Programming Interface
CI	Continuous Integration
CD	Continuous Development
AWS	Amazon Web Services

CHAPTER 1

INTRODUCTION

1.1 General Background

While surrounded by peers, a significant number of students struggle to form deep bonds, experiencing a phenomenon known as "student isolation." This isn't simply a matter of feeling lonely; it has wide-ranging consequences. Strong friendships offer a vital support system, a space for vulnerability, shared experiences, and fostering genuine connections – all crucial for personal growth during these formative college years. However, the current landscape of college life, often characterised by siloed social circles and a heavy academic workload, can hinder the formation of these essential bonds.

Furthermore, student isolation hinders the potential for professional networking. College lays the groundwork for future careers, and building a network of peers with shared interests can be invaluable. Early exposure to various fields of study and professional aspirations through classmates can help students navigate career paths and identify potential mentors. Unfortunately, the lack of connection between students restricts these valuable networking opportunities.

Perhaps the most detrimental consequence of student isolation lies in its impact on knowledge exchange. The collegiate environment thrives on collaboration and the cross-pollination of ideas. However, when students remain within their existing social and academic circles, the sharing of knowledge becomes siloed. This limits exposure to diverse perspectives and hinders the development of interdisciplinary learning, crucial for success in today's interconnected world. The rise of online learning exacerbates this issue further. While technological advancements offer flexibility and accessibility to education, they can also contribute to a sense of detachment from the physical campus community. Students participating in online courses may miss out on the informal interactions that spark friendships, network building, and collaborative learning opportunities.

1.2 Objectives

Overcome Student Isolation: Even in large crowds, college can seem challenging. Our app, tuples, intends to support students in creating deep connections and friendships that go beyond casual encounters. It connects you with people who share your passions, creating a support system you can rely on during your college journey.

Boost Social Support: During college, close friendships serve as an essential network of guidance. Tuples aims to provide a community where students may go to, for assistance, confidence, and experience sharing among peers.

Enhance Networking Potential: College serves as a foundation for future employment. Through connecting students with peers who have similar interests, Tuples facilitates important early networking opportunities and exposes them to a variety of future choices.

Unlock Knowledge Exchange: Collaboration frequently produces the most innovative ideas. With Tuples, students may interact across disciplines and learn from a variety of perspectives by removing social and academic obstacles.

1.3 Scope

We aim to design, develop, and implement a user-friendly platform that caters to the academic and social needs of college students.

The project scope focuses on:

- **Intuitive UI Design:** Creating a user-friendly interface for seamless navigation within Tuples.
- **Interest-Based Matching:** Implementing robust algorithms to connect students with shared interests, fostering a collaborative environment.
- **Communication Tools:** Integrating features like messaging, video conferencing, and potentially group chat functionalities.
- **Project Management Features:** Incorporating functionalities for task creation, assignment, tracking, and collaborative editing.

CHAPTER 2

LITERATURE REVIEW

This literature review explores the potential of online platforms to foster a collaborative learning ecosystem for college students. The focus lies on functionalities that encourage meaningful connections, friendships, and a supportive learning environment while empowering collaborative project work.

Exploring The Impact of Virtual Learning Environments on Student Engagement and Academic Achievement [7]

Several studies highlight the importance of online communities in enhancing student engagement and academic success (Kuh & Hu, 2001; Chen et al., 2010). Platforms that facilitate peer-to-peer communication through forums and discussions can cultivate a sense of belonging and support These discussions can encourage students to share challenges, seek advice, and offer encouragement, fostering a collaborative learning environment where students learn from and support each other (Rogers & Stone, 2007).

Matching Scientific Article Titles using Cosine Similarity and Jaccard Similarity Algorithm [2]

This report explores the effectiveness of two quantitative techniques for evaluating the similarity between scientific article titles: cosine similarity and Jaccard similarity. These methods hold promise for researchers by enabling them to efficiently identify articles relevant to their specific area of inquiry. The core principle lies in analysing the titles of existing research and identifying those with a high degree of similarity to a researcher's current topic. This report delves into the strengths and weaknesses of each approach, aiming to determine which method offers the most accurate and efficient way to match researchers with relevant scientific articles based solely on title analysis.

RecBERT: Semantic Recommendation Engine with Large Language Model Enhanced Query Segmentation for k-Nearest Neighbors Ranking Retrieval [3]

The research paper introduces RecBERT, a novel semantic recommendation engine. RecBERT utilises a large language model (LLM) to segment user queries for enhanced understanding. This segmentation allows for individual k-nearest neighbours (KNN) searches, leading to more accurate retrieval compared to traditional methods. The paper highlights RecBERT's superior performance in comment classification across various categories, positioning it as a promising advancement in recommendation system technology.

Small-world: Secure friend matching over physical world and social networks [4]

The research paper, "Small-world," proposes a new system for making friends that combines the strengths of social media and real-world interactions. It addresses the limitations of both. Social networks can be great for finding people with similar interests, but they lack the physical connection that often sparks friendships. Just because you like the same movies on Facebook doesn't mean you'll hit it off in person. On the other hand, meeting people randomly in the real world can be inefficient. "Small-world" tackles this by using location data and social network information to find people who are both geographically close and share common interests. This increases the chances of finding compatible friends while keeping your privacy protected.

CHAPTER 3
METHODOLOGY

3.1 Requirements Gathering

Key Features:

- **User Profiles**:
  - Allow users to create and manage personal profiles.
  - Profiles should include basic information (name, age, location), profile picture, and a bio.
  - Users can list their interests using both predefined categories and open-ended fields.
- **Interest Matching**:
  - Develop an algorithm to match users based on shared interests.
  - Use both predefined categories and open-ended fields to capture a wide range of interests.
  - Allow users to prioritize interests to improve matching accuracy.
- **Chat Functionality**:
  - Implement real-time messaging between users.
  - Include features such as read receipts, typing indicators, and message notifications.
  - Support group chats and file sharing.
- **Notifications**:
  - Send alerts for new messages, project updates, and new matches.
  - Allow users to customise notification preferences.

3.2 Data Collection

User Registration and Profiles:

- **Predefined Categories:**
  - ➢ Compile lists of common hobbies, subjects, and activities (e.g., sports, music, coding, reading).
  - ➢ Allow users to select from these categories during profile creation.
- **Open-ended Fields:**
  - ➢ Provide fields for users to add interests not covered by predefined categories.
  - ➢ Encourage users to be specific to improve matching.

3.3 Data Preprocessing

Interest Vectorization:

- **Create Interest List:**
  - ➢ Compile a comprehensive list of all possible interests gathered from predefined categories and user input.
  - ➢ Regularly update this list based on new user inputs.
- **Numerical Vectors:**
  - ➢ **Binary Vector:** Create vectors where each interest is represented as a binary value (1 for presence, 0 for absence).
  - ➢ **Weighted Vector:** Allow users to assign weights to interests based on their importance, creating a weighted vector.

3.4 Interest Matching Algorithm

Cosine Similarity Function:

- **Formula**: **cosine similarity=A.B / (||A||.||B||)**
  - ➢ **Vector Dot Product**: Calculate the dot product of user interest vectors **A** and **B**.
  - ➢ **Magnitude Calculation**: Compute the magnitudes **||A||** and **||B||**
- **Implementation(Match Users)**:

- ➢ Similarity Calculation: Calculate the cosine similarity between each pair of users based on their interest vectors.
- ➢ Ranking: Rank users by similarity scores to determine the most compatible matches.
- ➢ Threshold: Define a minimum similarity score for matches or limit to top N matches.

	John	Alice	Bob	Emma
John	1.000000	0.122513	0.457604	0.941742
Alice	0.122513	1.000000	0.937043	0.321403
Bob	0.457604	0.937043	1.000000	0.628828
Emma	0.941742	0.321403	0.628828	1.000000

Fig 3.1 Similarity matrix of users

3.5 Backend Development

Database Design:

- ❖ **Tables**:
  - ➢ **Users**: Store user information, including profiles and interests.
  - ➢ **Interests**: List all predefined and user-added interests.
  - ➢ **Chat Messages**: Store chat history between users.
  - ➢ **Projects**: Manage project details, including members and tasks.
  - ➢ **User-Project Associations**: Track user involvement in projects.
- ❖ **Optimization**:
  - ➢ Implement indexes on frequently queried fields (e.g., user IDs, interest IDs).
  - ➢ Optimise database schema for quick retrieval of matches and chat histories.

3.6 Frontend Development

User Interface:

- **Design**:
  - Develop intuitive and user-friendly interfaces for all features.
  - Ensure consistency in design and usability across the application.
- **Frameworks**:
  - Use Next.js to build responsive and dynamic user interfaces.
  - Leverage its server-side rendering capabilities for improved performance and SEO.

3.7 Chat and Collaboration Features

Real-time Chat:

- **Integration**:
  - Use Firebase Snapshot (Web Sockets) for real-time messaging.
  - Ensure low latency and high reliability for message delivery.
- **Features**:
  - Implement notifications, group chats, and file sharing capabilities.
  - Include additional functionalities like emojis, message reactions, and search within chats.

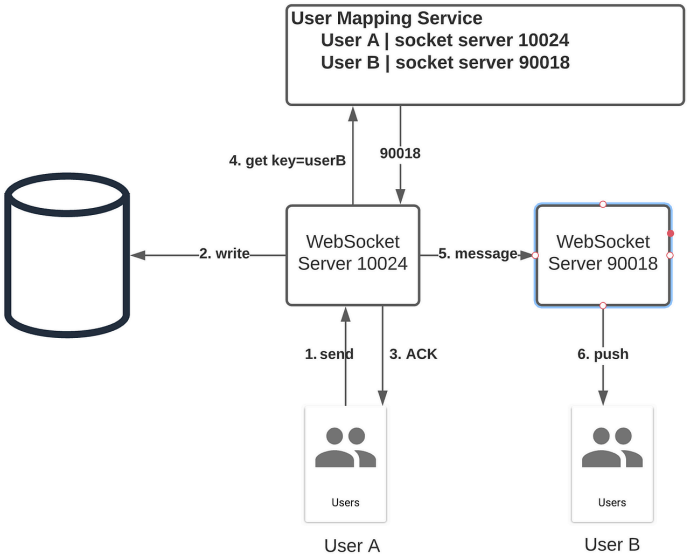


Fig 3.2 Chat Interface Architecture using Web Sockets

Project Collaboration:

- **Project Tools**:
  - Allow users to create and join projects.
  - Provide task management features (e.g., to-do lists, deadlines).
  - Enable document sharing and collaborative editing.
- **Version Control**:
  - Integrate with GitHub or similar version control systems.
  - Provide tools for code versioning and collaborative coding.

3.8 Testing

- **Unit Testing**:
  - Test individual functions such as cosine similarity calculations and API endpoints.
  - Ensure all functions perform as expected under various conditions.

- **Integration Testing**:
  - Verify smooth interaction between different components (e.g., user registration and interest matching).
  - Test end-to-end workflows to ensure system-wide functionality.
- **User Acceptance Testing (UAT)**:
  - Conduct testing with real users to gather feedback on usability and performance.
  - Make necessary adjustments based on user feedback.

3.9 Deployment

Deployment Strategy:

- **Cloud Platform**:
  - Use AWS for scalable infrastructure.
  - Leverage services like EC2, RDS, and S3 for hosting, databases, and storage.
- **CI/CD Pipelines**:
  - Set up continuous integration and continuous deployment pipelines.
  - Automate testing and deployment processes to ensure seamless updates and quick releases.

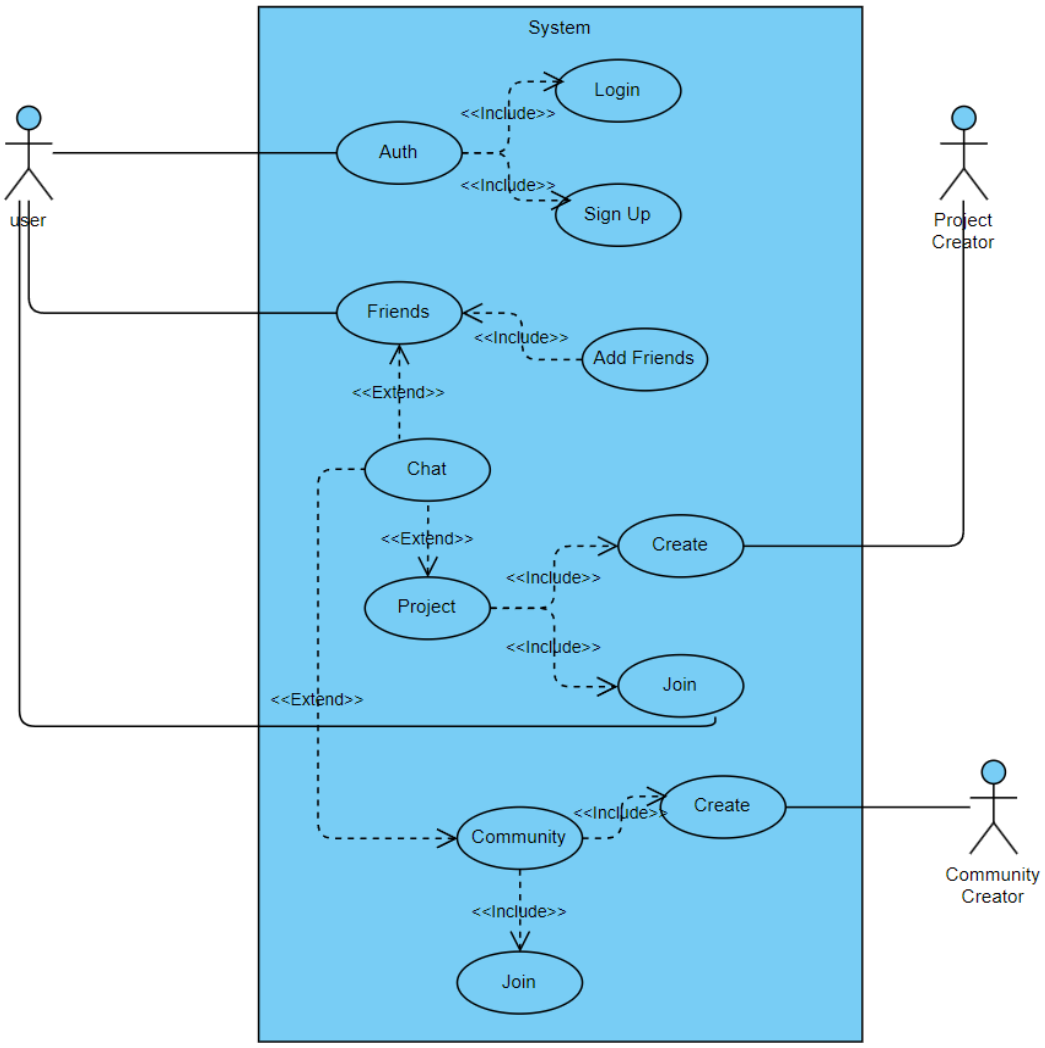
3.10 Maintenance and Updates

- **Regular Updates**:
  - Plan for regular updates to add new features and improve existing ones.
  - Ensure backward compatibility and minimal downtime during updates.
- **Monitoring and Support**:
  - Implement monitoring tools to track system performance and user activity.
  - Provide support channels for users to report issues and request features.
- **Security**:
  - Ensure data security and privacy by implementing robust security measures.
  - Regularly update the system to address security vulnerabilities and threats.

CHAPTER 4

SYSTEM DESIGN

4.1 Use Case Diagram



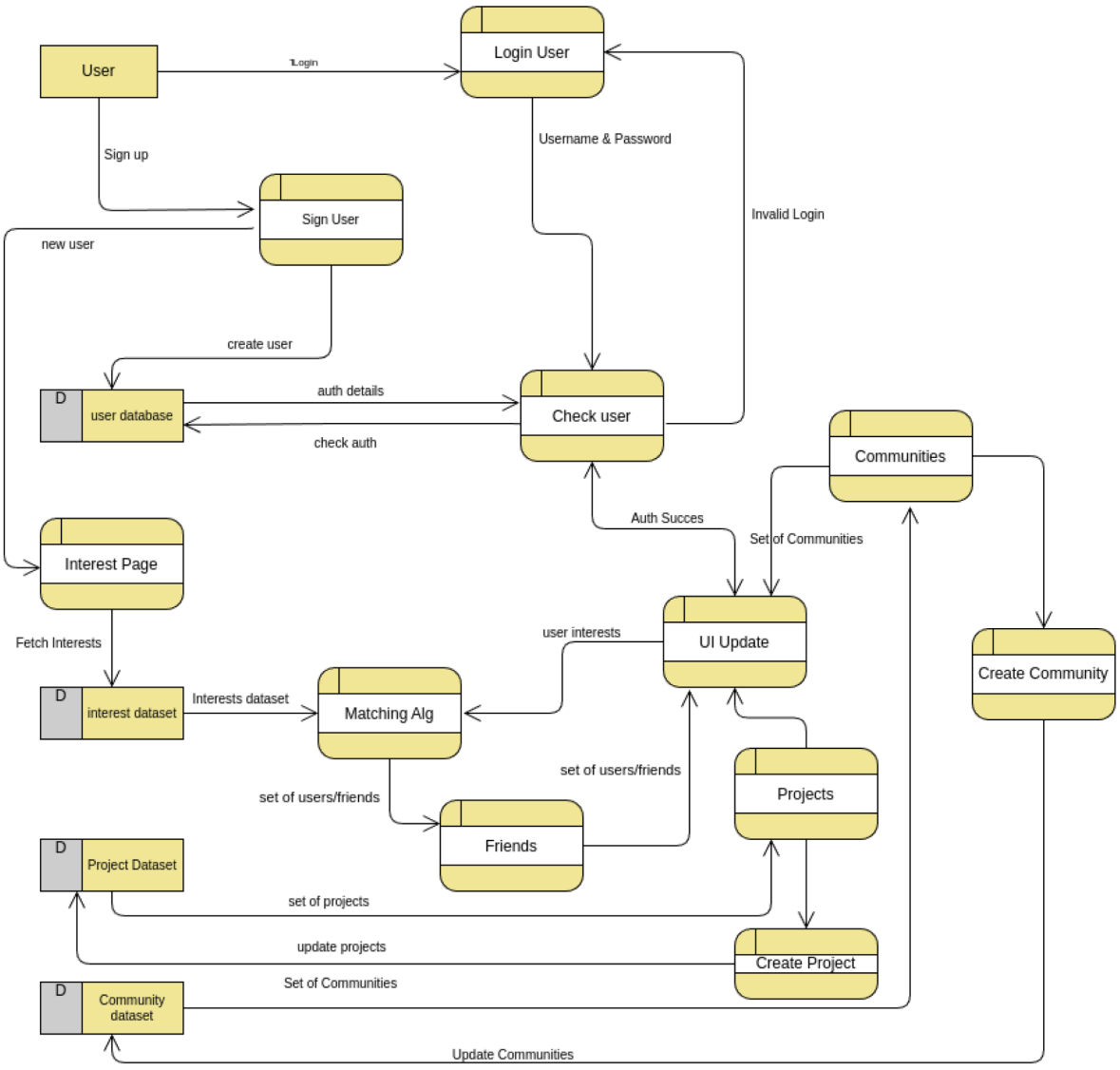
Actors:

- **Student:** The primary user of the system. Students can create and join projects, add friends, and participate in chats.
- **Community Creator:** This actor can potentially be a student or a group of students who create online communities around specific interests or academic subjects. They can invite members and manage the community.

Use Cases:

- **Create Project:** A student can initiate a new project by providing details and descriptions.
- **Join Project:** Students can browse existing projects and choose to join those that align with their interests.
- **Add Friends:** Students can connect with other users and build their network.
- **Chat:** Students can interact with each other and collaborate on projects through text-based chat functionalities.
- **Create Community (Optional):** Community creators can establish online communities focused on particular interests or subjects. They can invite members and potentially manage the community space.
- **Join Community (Optional):** Students can discover and join communities that suit their academic or extracurricular interests.

4.2 Data Flow Diagram



User Inputs:

- **Login/Signup:** Users can either create new accounts or log in to existing ones. During signup, users provide their email address and password to establish a user profile.
- **User Interests:** This stage involves users specifying their interests. This might involve selecting from predefined categories, entering keywords, or a combination of both. The chosen interests are stored in the user database.

2. **Data Processing:**
    - **Matching Algorithm:** An unspecified matching algorithm (represented by the matching box) analyses user interests stored in the database. Techniques like cosine similarity are likely employed to identify users with the most compatible interests.
    - **Matching Results:** The matching algorithm generates a list of users with interests that closely align with the current user's interests.
3. **Data Flow and User Interactions:**
    - **User Interface Update:** The application updates the user interface (UI) to display the list of matched user profiles. This allows users to see potential connections based on shared interests.
    - **User Initiates Interaction:** Upon seeing profiles of interest, users can leverage features not shown in the diagram (e.g., sending friend requests, starting a chat, or browsing detailed profiles). This initiates interaction with potential connections.

Data Storage:

- **User Database:** This central storage unit houses user profiles, including login credentials (email and password) and user-specified interests.
- **Interests Dataset :** This component represents a broader database of pre-defined interests that users can select from during profile creation, enriching the user experience.

4.3 Graphical User Interface

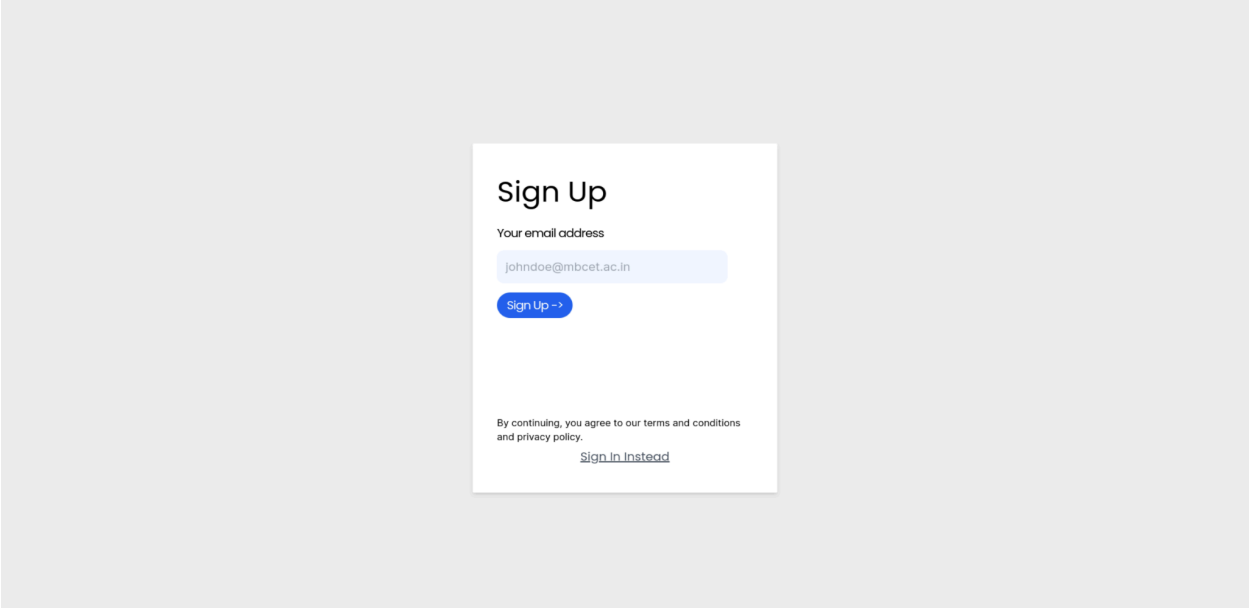


Fig 4.3.1 Sign Up Interface

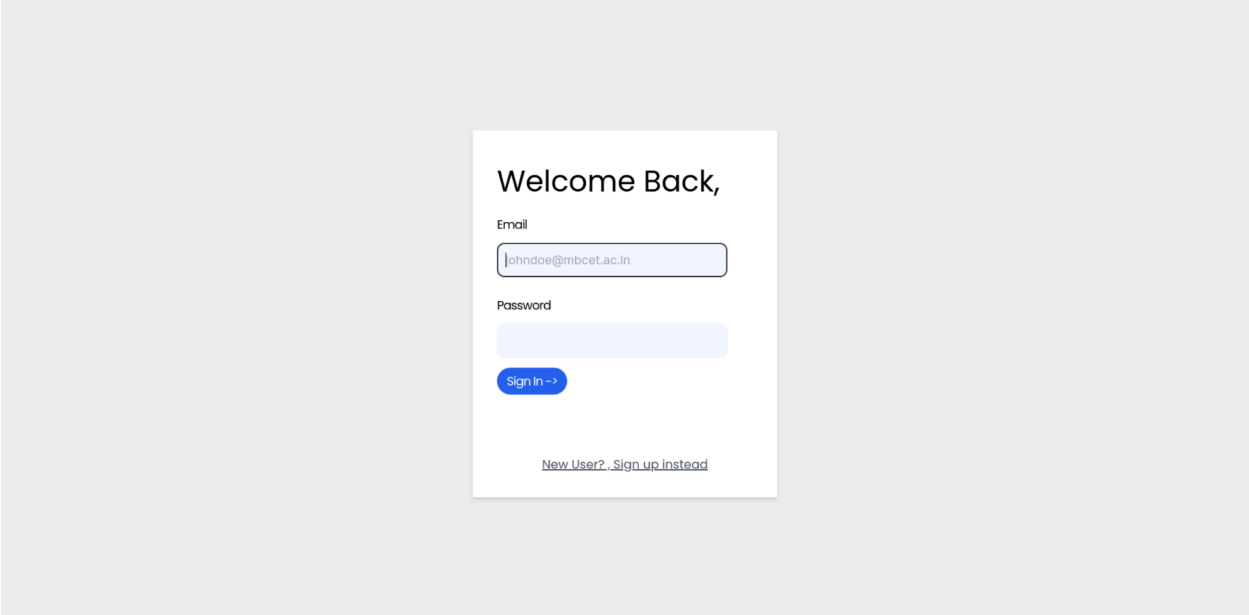


Fig 4.3.2 Login Interface

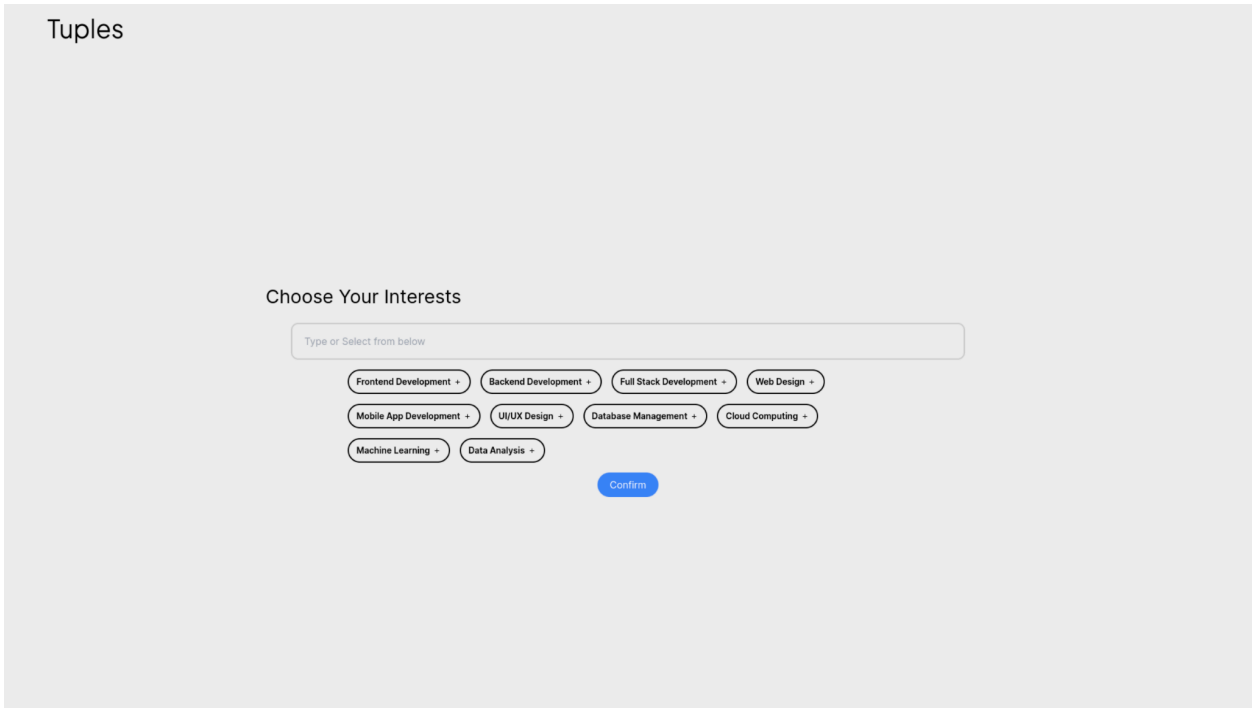


Fig 4.3.3 Interests Selection Interface

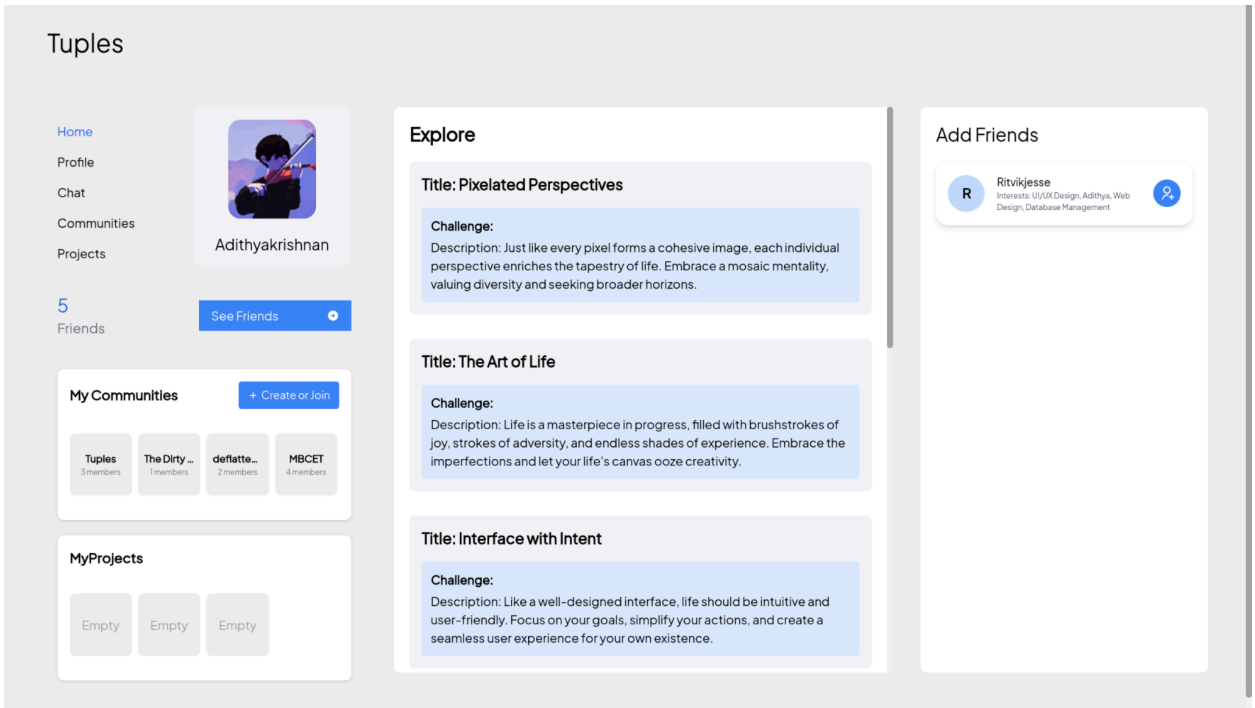


Fig 4.3.4 Home Page

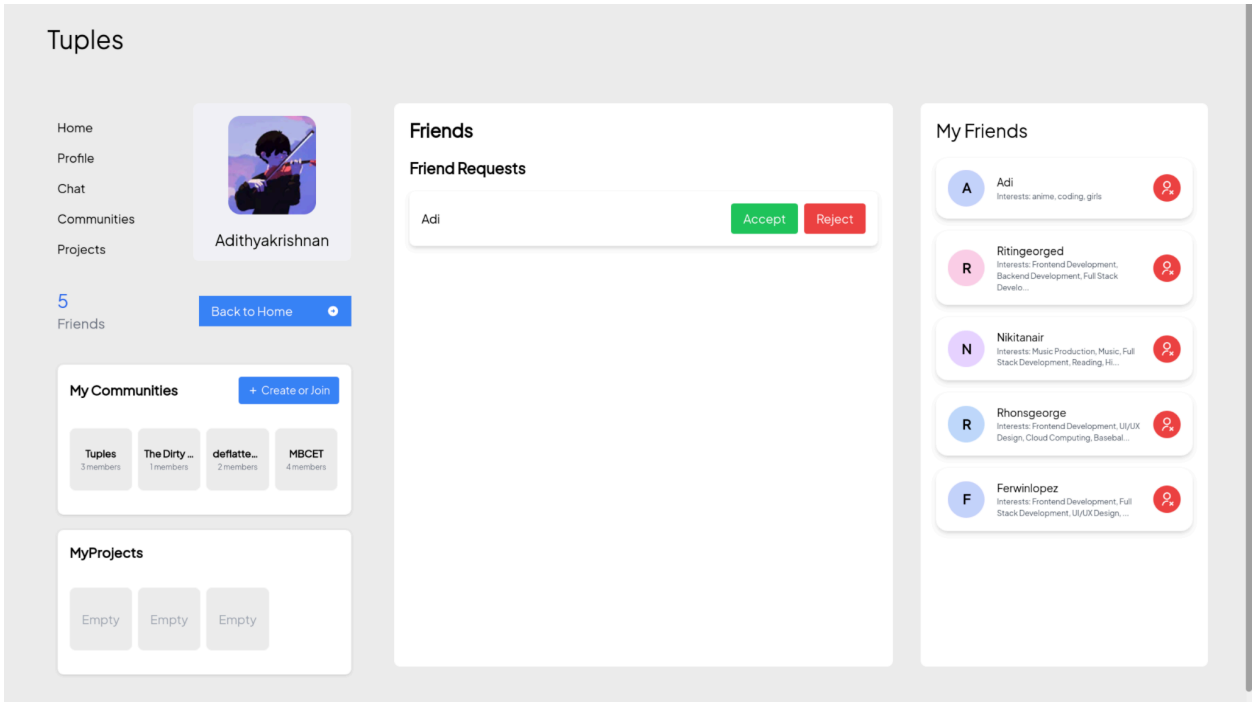


Fig 4.3.5 Friend Requests

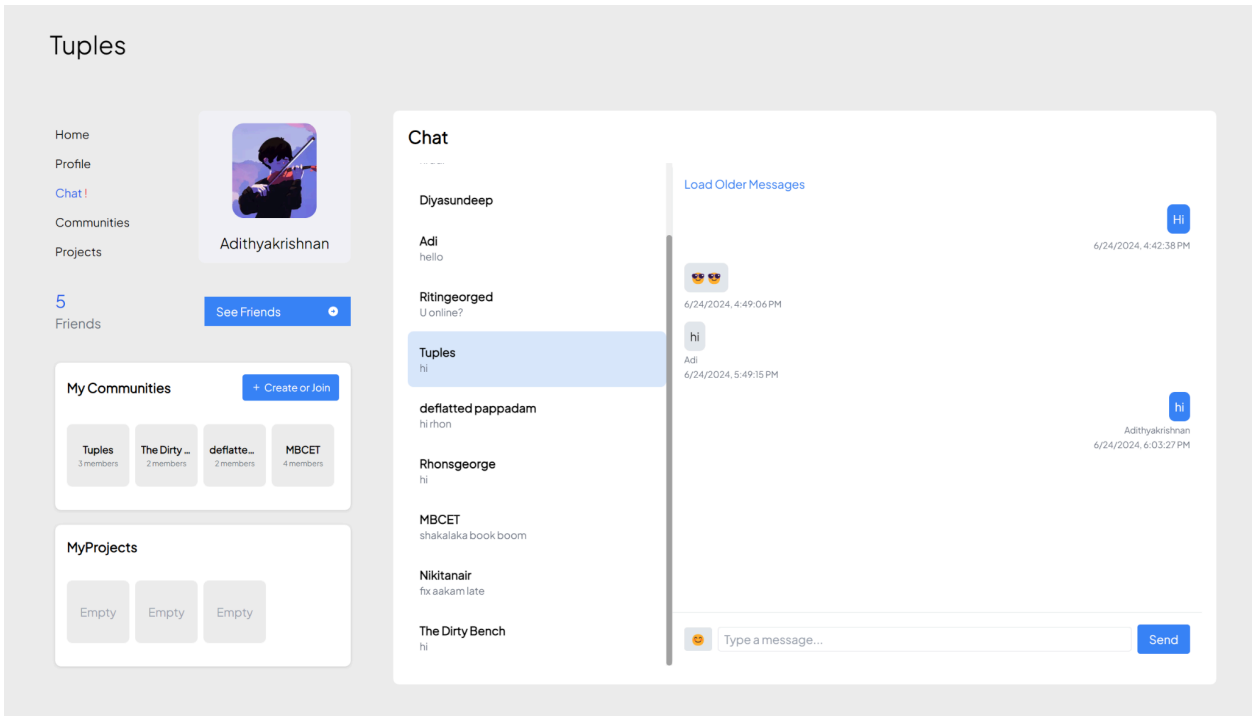


Fig 4.3.6 Chats

CHAPTER 5

RESULTS AND DISCUSSION

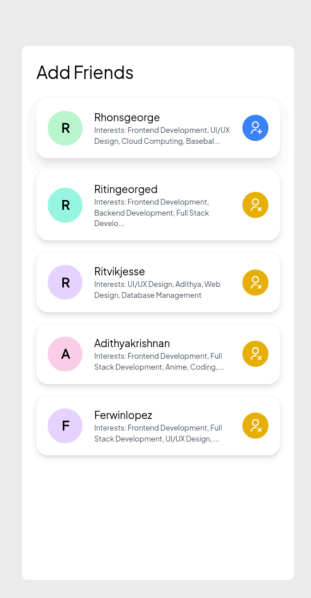


Fig 5.1 Interest Matching Model

The model presented takes user interests as input and matches them based on semantic similarity. It employs cosine similarity to measure the degree of similarity between users' interest vectors. When a user provides their interest, the model calculates the cosine similarity score between this interest and the interests of other users in the database. The output is a list of users with the highest similarity scores, indicating shared or related interests. This JSON response demonstrates the model's capability to identify and match users with similar interests effectively. The model is running smoothly on Postman, validating its functionality.

This endpoint utilises a POST request to receive user interest data (likely in JSON format) from the mobile app. The server, potentially powered by Flask API, then leverages this information to search its database for users with similar interests. The API endpoint responds by sending a list of these similar users back to the mobile app, allowing it to potentially display product

recommendations or showcase items relevant to the user's interests and those of similar users within the e-commerce app interface. This functionality can enhance the user experience by suggesting products that align with their preferences and potentially connect them with others who share similar interests.

CHAPTER 6

CONCLUSION

This project proposes a novel online platform designed specifically for college students. The platform aims to revolutionise the student experience by fostering a supportive and inclusive environment that facilitates meaningful connections, friendships, and collaborative learning.

The platform leverages AI algorithms to group students with similar interests and academic pursuits, fostering vibrant virtual communities. Dedicated forums within these communities encourage open communication, allowing students to share challenges, seek advice, and offer encouragement to their peers. A user-friendly chat interface facilitates communication and collaboration, empowering students to engage in in-depth project work.

Many online platforms lack robust features to support collaborative project work. This proposed platform addresses this gap by providing functionalities that streamline collaboration, promote teamwork, and empower students to work together effectively.

This platform has the potential to significantly enhance student engagement throughout their college journey. By promoting a supportive network, fostering academic success, and enriching student life through a sense of community, this platform can empower students to thrive in their academic pursuits and personal development.

6.1 Future Scope

The proposed platform presents a promising approach to enhance the college learning experience. Here are some areas for future exploration:

- Investigate the impact of the platform on student engagement, academic performance, and collaboration skills through user studies and platform usage data analysis.
- Explore the optimal design and functionalities for fostering teamwork and project collaboration through user testing and iterating on the platform's features.

- Integrate additional features such as resource sharing tools, task management tools, or video conferencing capabilities to further enhance collaboration and project completion.
- Investigate the possibility of integrating the platform with existing learning management systems used by colleges and universities.
- Consider the ethical considerations of using AI algorithms for student grouping and address potential biases.

By exploring these future research areas, this platform can be further refined and optimised to deliver a truly transformative learning experience for college students.

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