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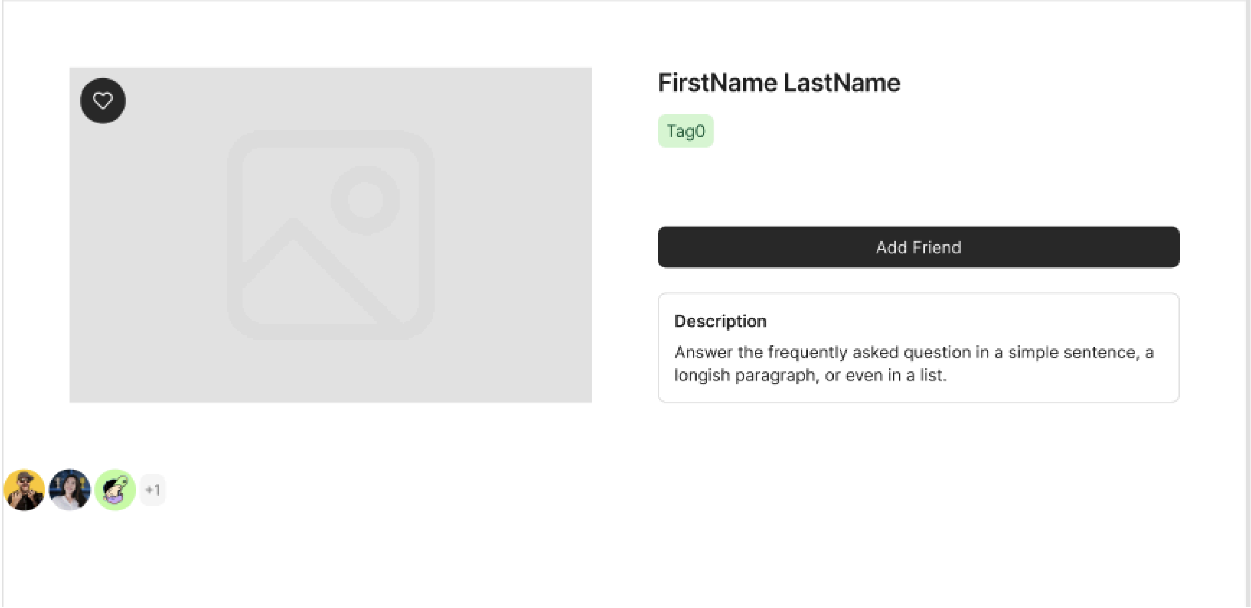
Professor Xiangyu Zhang

CS 30700

February 14, 2025

Grapevine Design Document



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Description

Answer the frequently asked question in a simple sentence, a longish paragraph, or even in a list.

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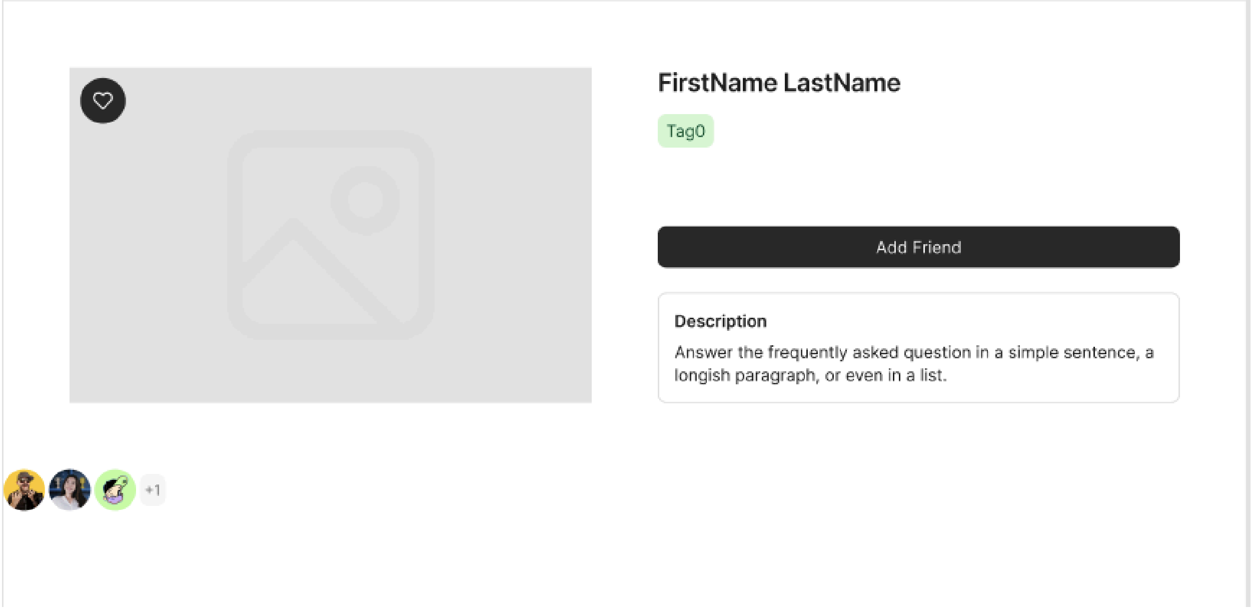
Purpose

Studying in groups can enhance learning by fostering collaboration, discussion, and knowledge sharing. However, students often struggle to find study partners who share their courses, schedules, and study preferences.

The purpose of this project is to develop a web application that helps students find and form study groups based on shared courses, availability, and study habits. While existing platforms like Discord and GroupMe allow for communication, they lack structured ways to match students for effective study sessions. Our Study Group Finder will provide an organized, intuitive system where users can create, join, and manage study groups with ease. The platform will include course-based filtering, availability matching, and communication tools to streamline the process of connecting students who want to study together.

Functional Requirements

1. User Registration & Authentication



Description

Answer the frequently asked question in a simple sentence, a longish paragraph, or even in a list.

1.1. As a user, I would like to register an account.

1.2. As a user, I would like to be able to log in to my account.

1.3. As a user, I would like to be able to enable 2-factor authentication during registration (stretch)

1.4. As a user, I would like to reset my password in case I forget it

1.5. As an instructor, I would like to be able to verify my role (TA or professor) and the class I teach using my university email during registration (move to profile)

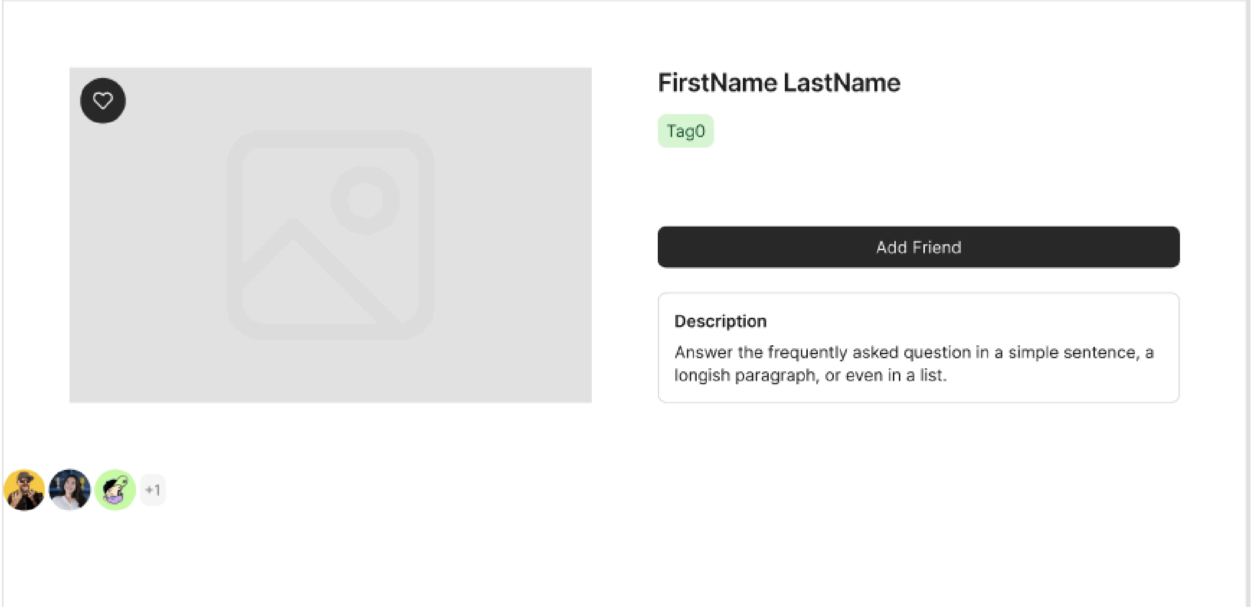
1.6. As a student, I would like to verify my enrollment in a university by sending a confirmation code to my university's email when I register an account.

1.7. As a user once I create an account I would like to be guided on account setup (courses, available times, etc…) (if time allows)

1.8. As a user I would like to be able to delete my account and all information tied to it.

2. User, Instructor, & Study Group Profiles

2.1. As a user, I would like to be able to modify my account information (password)



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2.2. As a student, I would like to be able to set and display what course I am taking, what major I am in, what year I am in, what teachers I have, and what study groups I prefer.

2.3. As a student, I would like to be able to set my current friends

2.4. As a user, I would like to be able to set what times I am available

2.5. As a user, I would like to be able to set locations I would prefer to meet at

2.6. As a user, I would like to be able to write a bio about myself

2.7. As a user, I would like to be able to connect (make friends) with other users

2.8. As an instructor I would like to be able to set what courses I am teaching

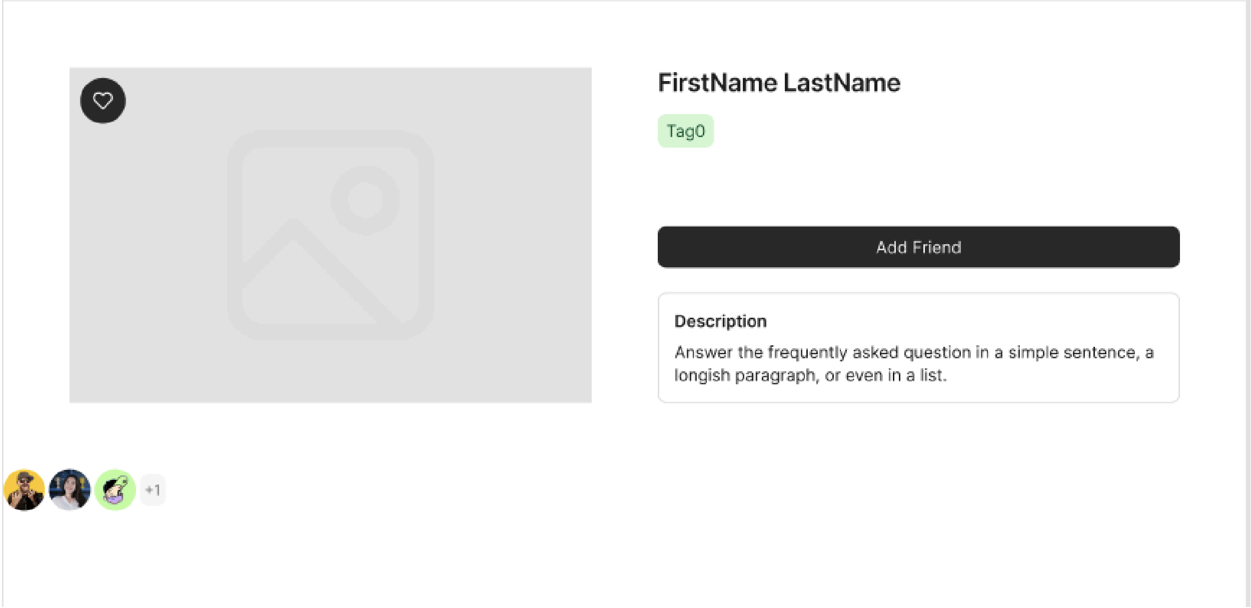
2.9. As a instructor I would like to be able to see students enrolled in my courses

2.10. As a instructor I would like to be able to set my role (UTA, GTA, professor)

2.11. As an user, I would like to be able to view my rating/reviews

2.12. As an instructor, I would like to be able to specify my group as an instructor led group

3. Messaging & Notifications



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3.1. As a user I would like to message other users

3.2. As a user I would like to be able to view my message history

3.3. As a user, I would to receive notifications (emails, browser alerts) about messages

3.4. As a user, I would like to be able to message one of my friends from their profile

3.5. As a user, I would like to be able to navigate to a user's profile from my message channel with them

3.6. As a user I would like to be able to search my message threads for a user and if I do not already have one to create a message thread with them through the search feature.

4. **Discussion Forum**

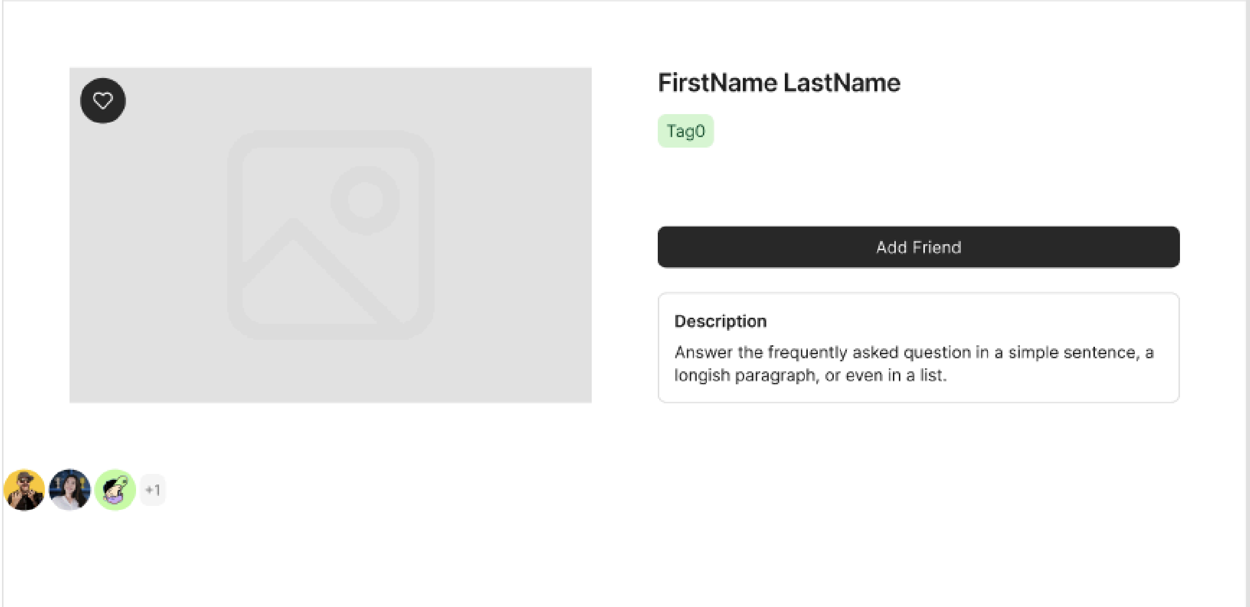
4.1. As a user, I would like to be able to view a list of discussion forum threads

4.2. As a user, I would like to be able to filter discussion forum threads

4.3. As a user I would like to be able to start a discussion forum

4.4. As a user I would like to be able to reply to discussion forums

4.5. As a user I would like to be able to upvote or downvote a discussion forum



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4.6. As a user I would like to receive notifications about replies to my forum posts

5. **Study Group Discovery & Scheduling**

5.1. As a user I would like to be able to search for other users (potential connects/friends) based on my profile

5.2. As a user I would to be able to search for other users by filters

5.3. As a user I would like to schedule events

5.4. As a user I would like to see a collection of upcoming events on the events page

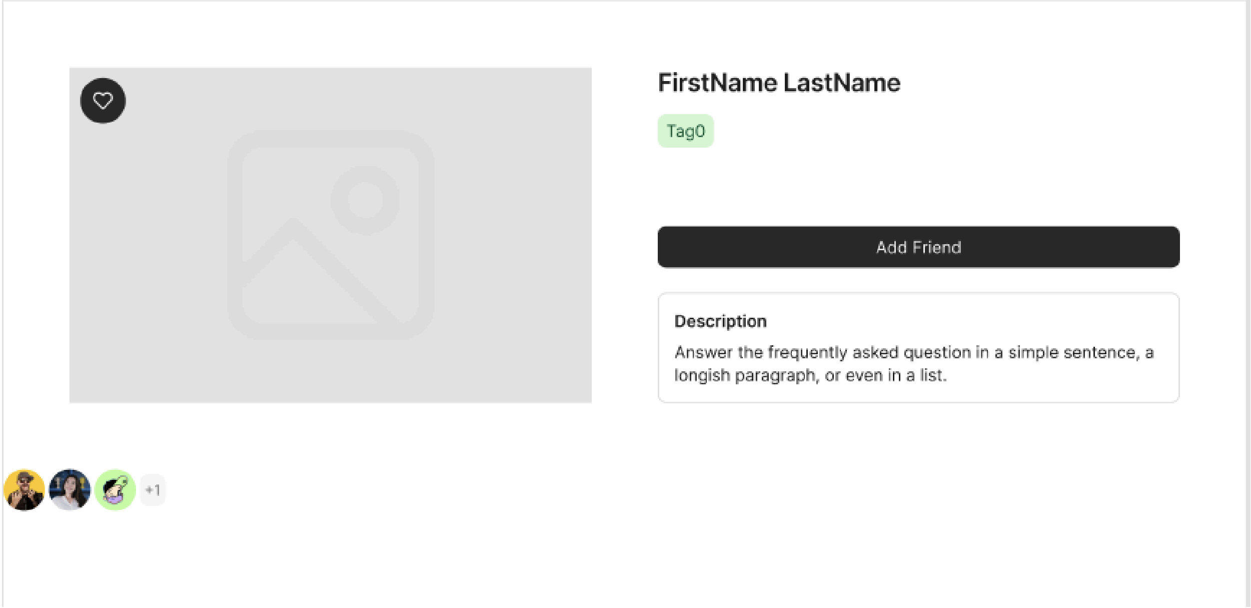
5.5. As a user I would like to register for an upcoming event

5.6. As a user, I would like be filter through upcoming events by date, location, and classes

5.7. As a user I would like to be able to set reminders about my upcoming events

5.8. As a student, I would like to rate other students or instructors in my study group (like Uber)

5.9. As a student I would like to provide a written review for other students and instructors



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5.10. As a user, I would like to create study group profiles

5.11. As a student, I would like to see public study groups

5.12. As a user I would like to see private study groups. If they are private I would like to be able to send a request to the host to join the study group.

6. Navigation and Usability

6.1. As a user, I would like to be able to view a homepage that summarizes my upcoming events and account info

6.2. As a user, I would like to be able to access some info about the creators of the app

6.3. As a user, I would like to generate a QR code for my study group

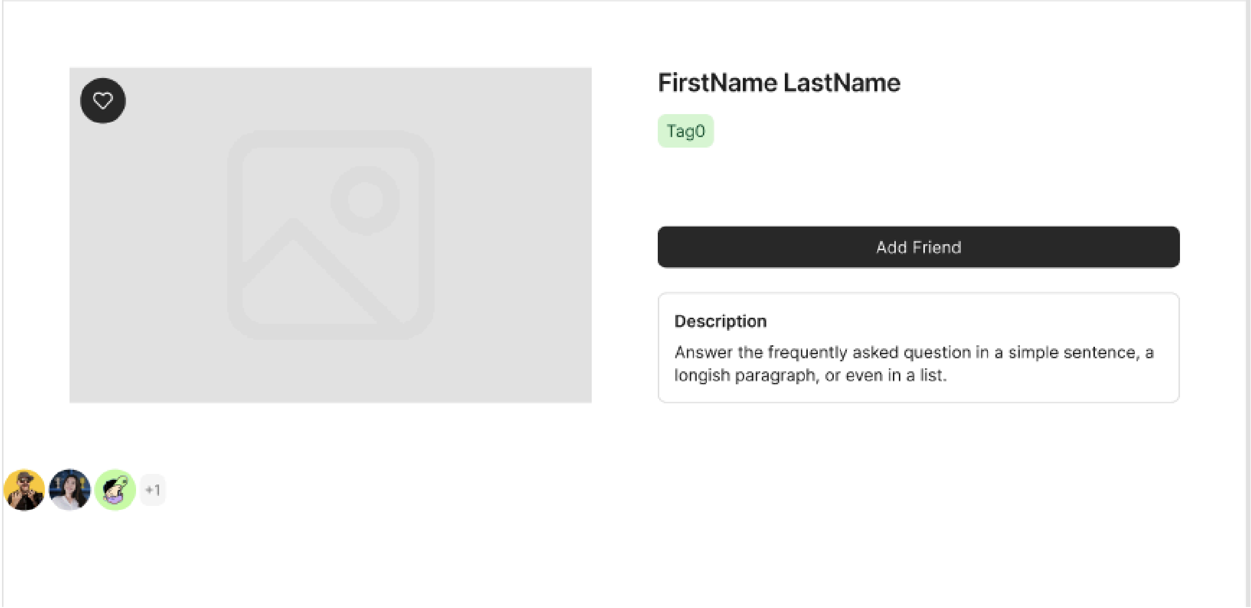
6.4. As a user I would like to be able to scan a QR code and join a study group

Non-Functional Requirements

1. Performance

1.1. I would like to application to run smoothly with minimal latency

1.2. When dynamically updating pages I would like the page to update in ~2 seconds



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1.3. When a new page loads I would like the page to load in ~2 seconds

1.4. I want the application to support ~50,000 users (Purdue population)

2. Server

2.1. I would like the server to facilitate real time client server communication

2.2. I would like the server to be able to persistently store data in a database

3. Appearance

3.1. I would like the application to look aesthetically pleasing

3.2. I would like the application to be simple to navigate

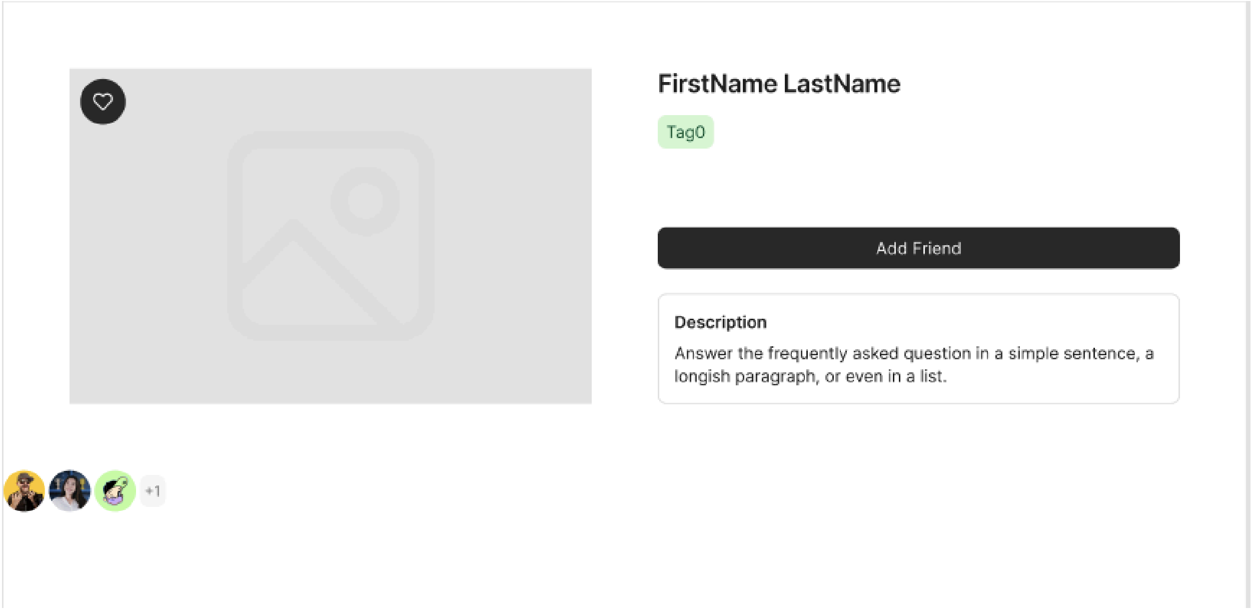
4. Security

4.1. I would like all personal data such as emails and passwords to be safely stored in our database

4.2. I would like only one account per person (achieved through using Purdue emails)

5. Usability

5.1. I would like our application to run on a web browser



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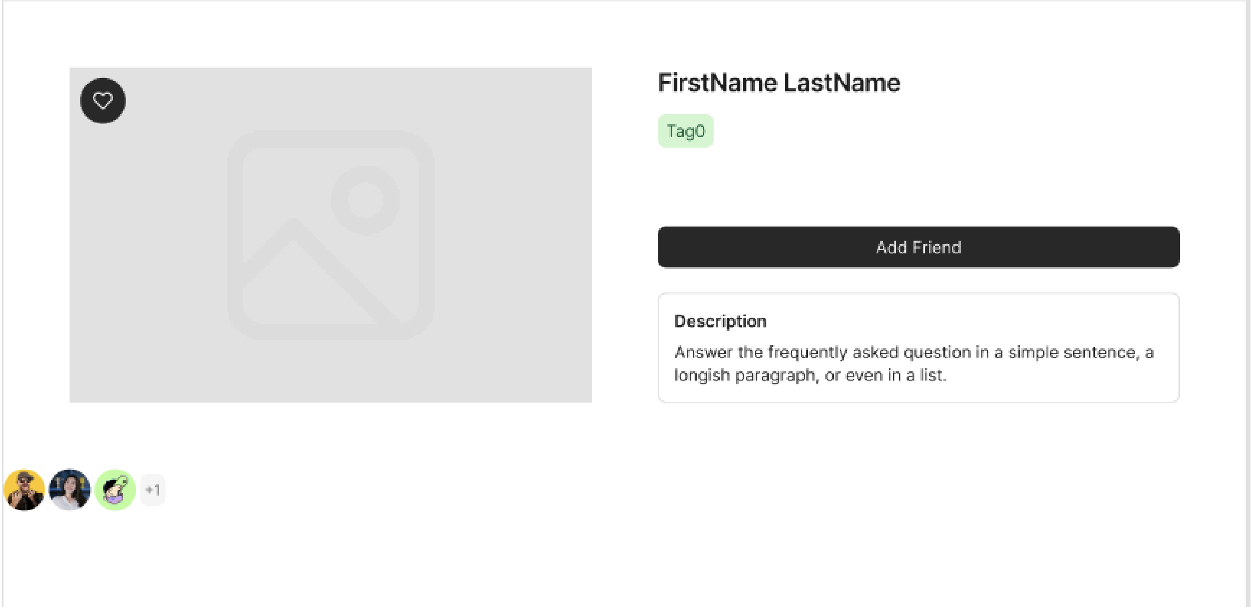

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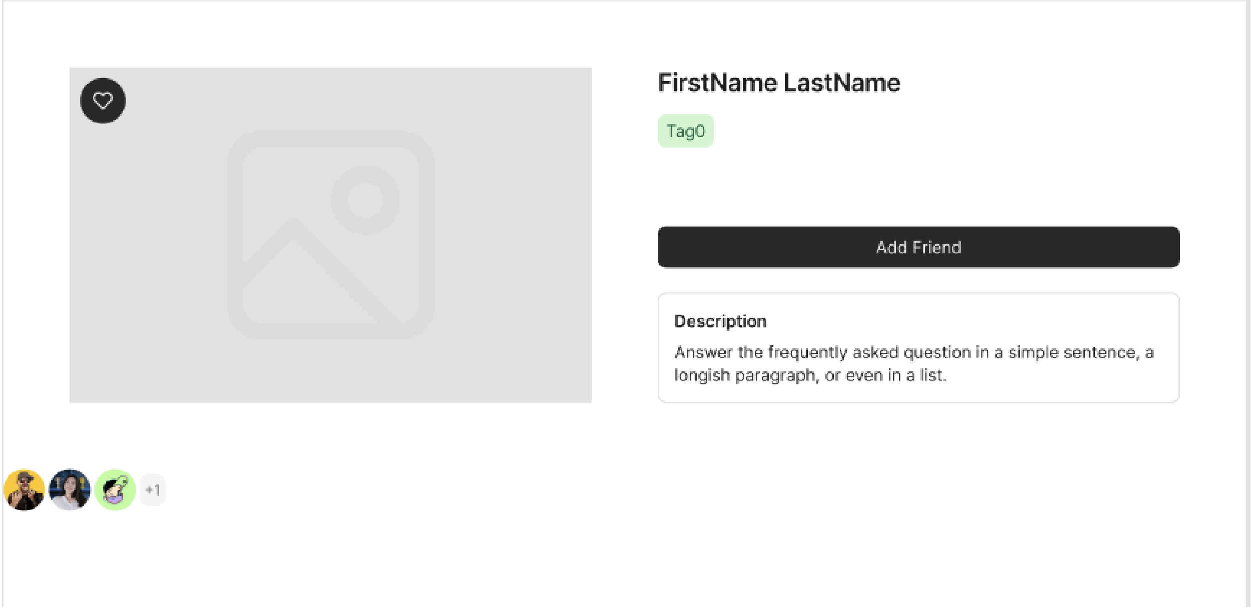
Design Outline

High-Level Overview

This project will be a social media application that allows tens of thousands of students, professors, and faculty to create study groups and schedule events with other users to work together on an academic subject. The application will follow a client-server database model where a single server will receive and handle HTTP requests from all active clients. The HTTP requests will be made using JSON representation. Interactions between the server and the database will be made via SQL queries and responses to and from Postgres. Query responses will pass through the server and feed data back to the client via JSON, where the client will update relevant data for the user.



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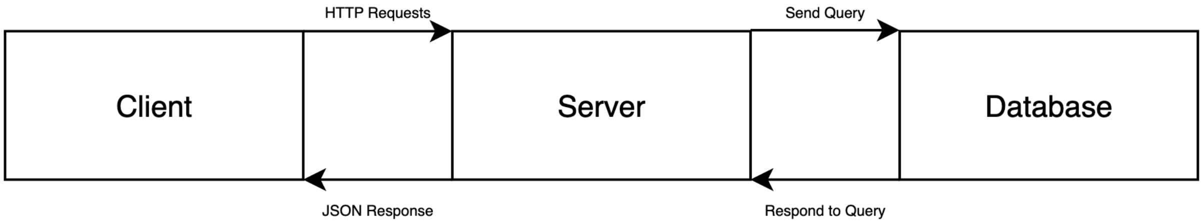
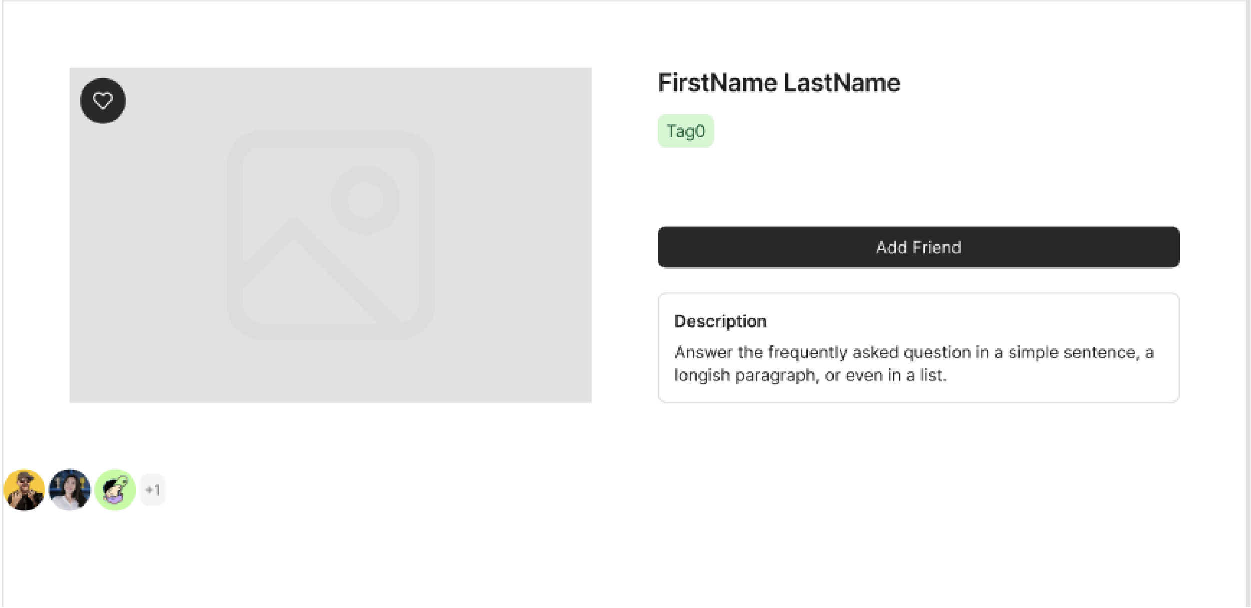


Sequence of Events Overview

The sequence diagram below enumerates the usual interactions between client, server, and database. Any given use of the app may begin with a user logging in. This will request the user profile data with their login credentials from the server, retrieve it from the database, and return it if the credentials are valid. After logging in, users may send requests to view events, create events, update their profile information, view and post forums and comments, give ratings, and any other facets of user and group data. The client will query the server which can either query the database or update the information in the database. The database will respond with the



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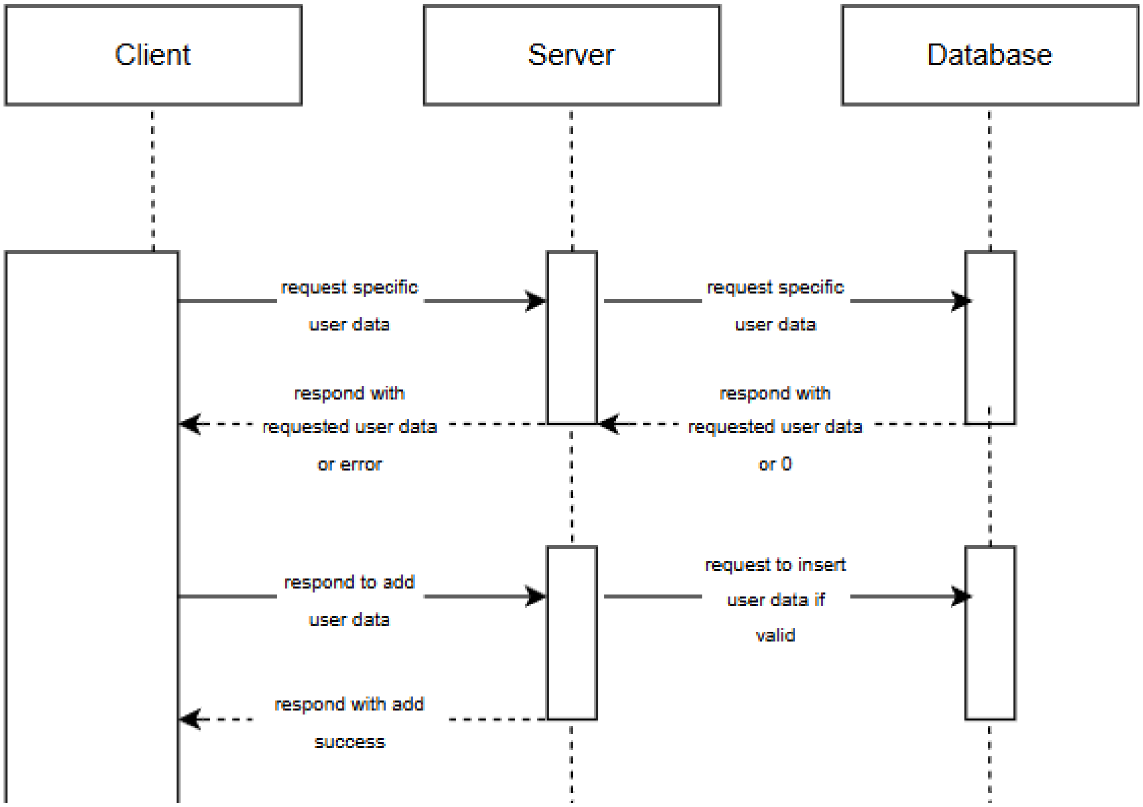
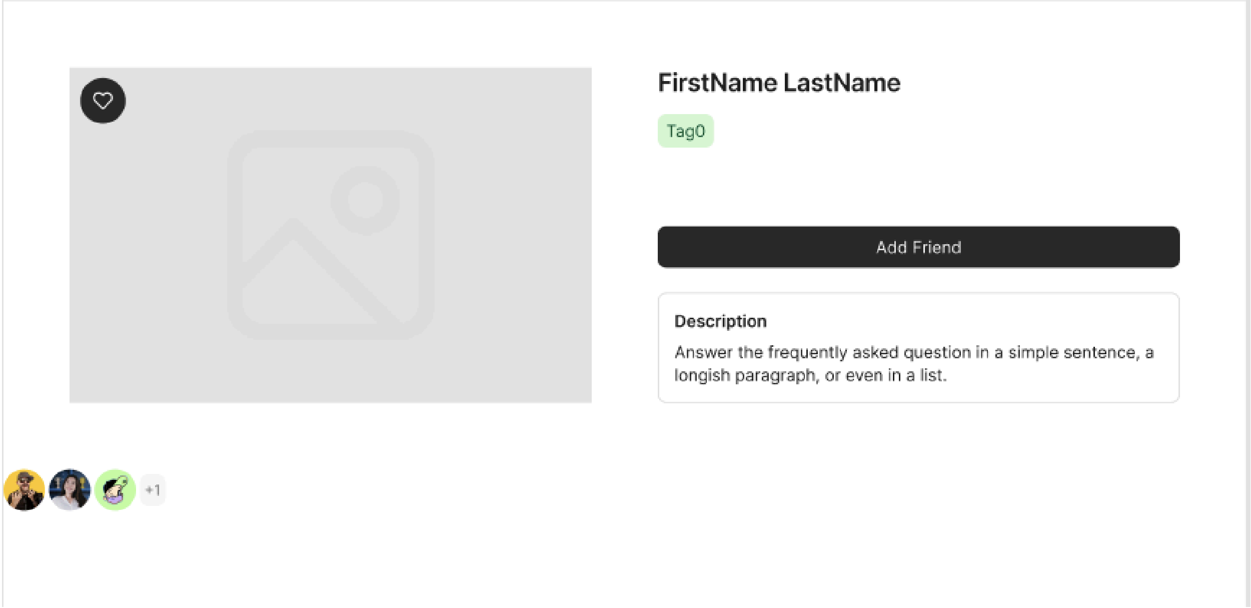
appropriate data which will then be sent from server to client.


Client
Server
Database
request specific user data
request specific user data
respond with requested user data or error
respond with requested user data or 0
respond to add user data
request to insert user data if valid
respond with add success



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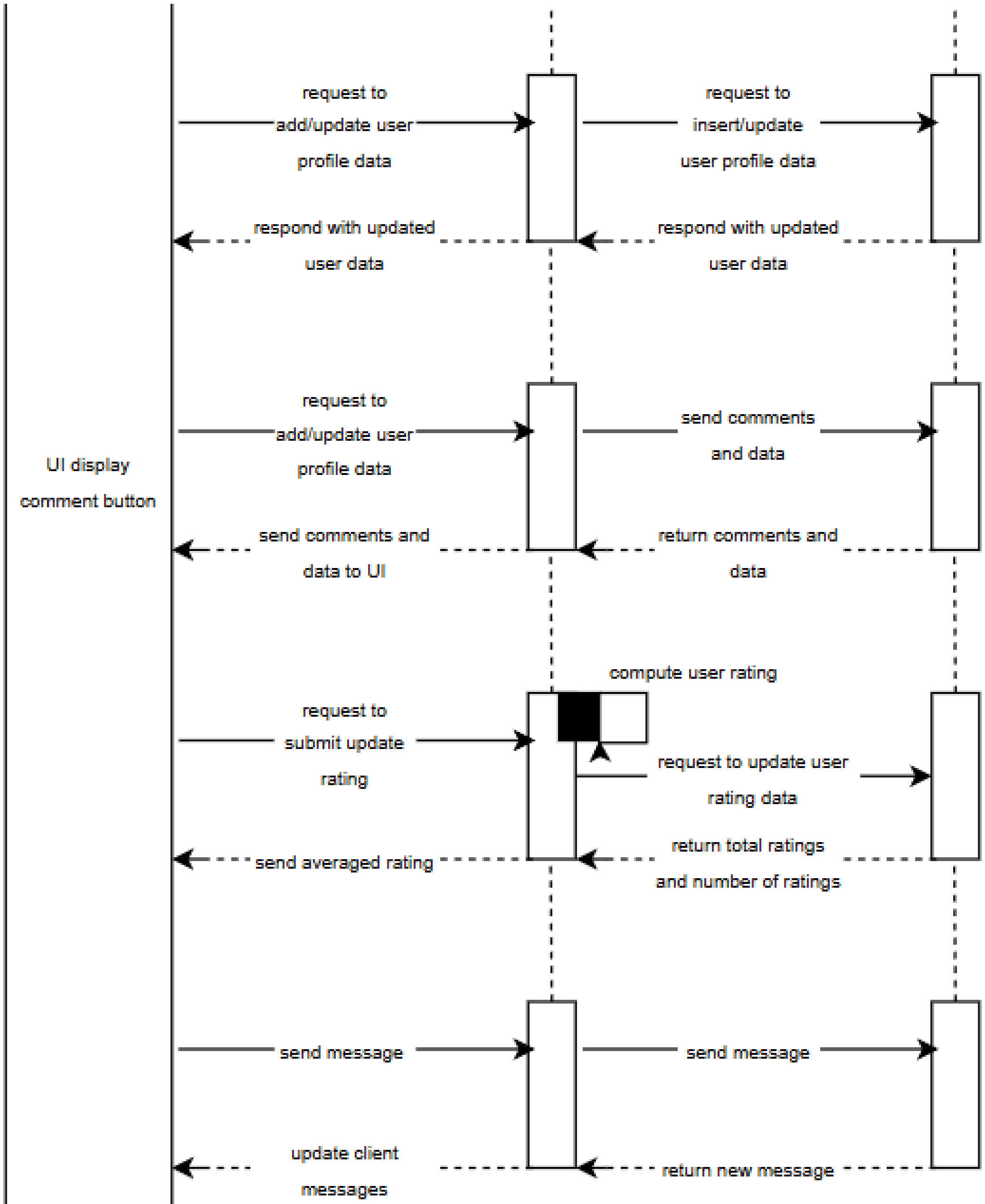
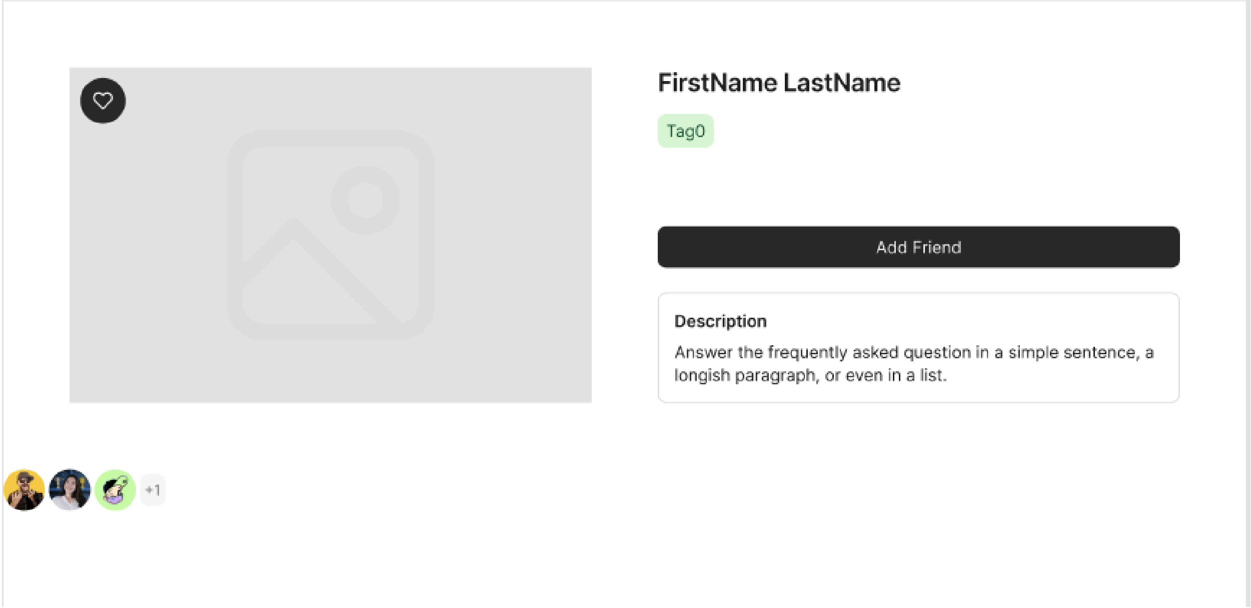

UI display
comment button
request to add/update user profile data
request to insert/update user profile data
respond with updated user data
respond with updated user data
request to add/update user profile data
send comments and data
send comments and data to UI
return comments and data
compute user rating
request to submit update rating
request to update user rating data
send averaged rating
return total ratings and number of ratings
send message
send message
update client messages
return new message



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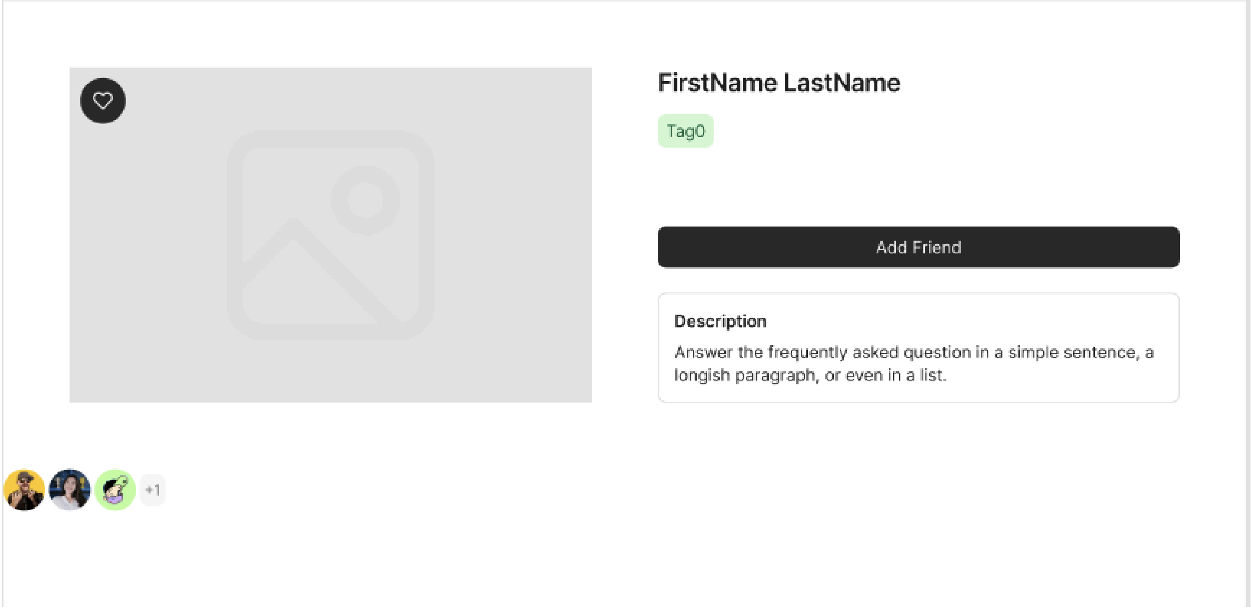
Design Issues

Design Issues (Functional)

1. **What information will users have to enter when signing up?**

    - **Option 1: Username, Password, and Email**
    - **Option 2: Email, Password**
    - **Option 3: Email, Password, Name**
    - **Option 4: Email, Password, Name, Birthday**

    Choice: Option 4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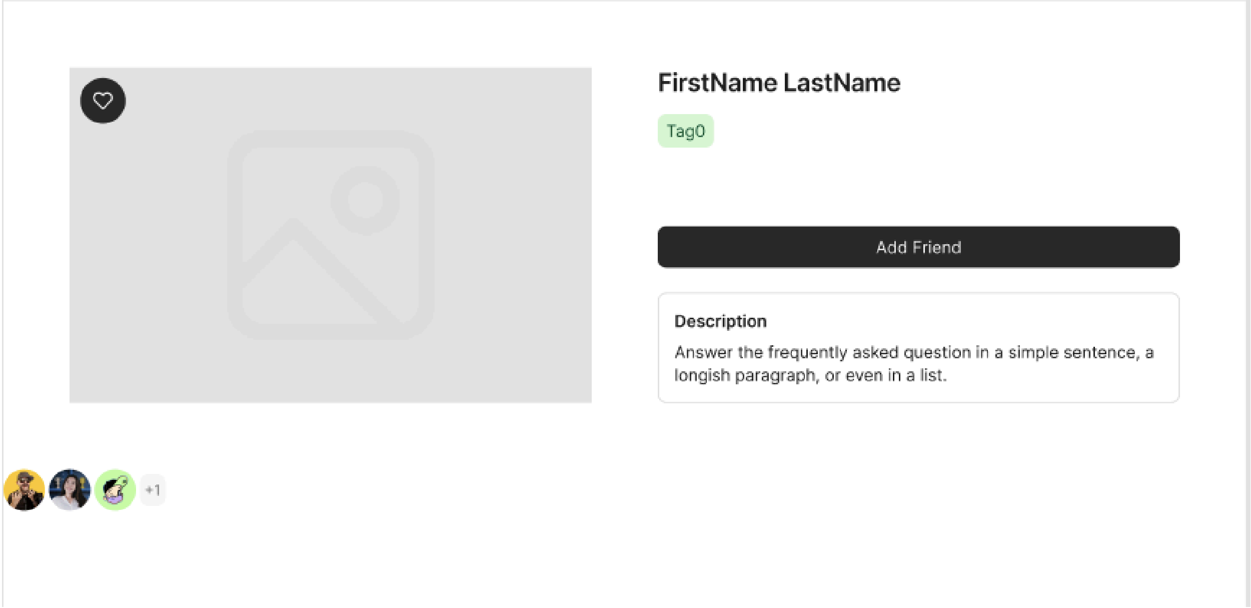
Justification: We decided that a unique username would be unnecessary since your email should already be unique as a Purdue student email. We do, however, need that Purdue email for a unique identifier and a way to potentially enforce two factor authentication. A password is necessary to protect your account. We take a name that does not require uniqueness but still provides a personal identifier to be displayed for the user on their profile and in the groups/events they join. We also have decided that inputting a birthday would be helpful for age group preferences as well as ensuring that people signing up are both college students and over 18.

2. **How will users communicate?**
    - **Option 1: Real-time messaging**
    - **Option 2: Emails**
    - **Option 3: Group discussion boards**
    - **Option 4: Forum threads**

Choice: Options 1 and 4



Description

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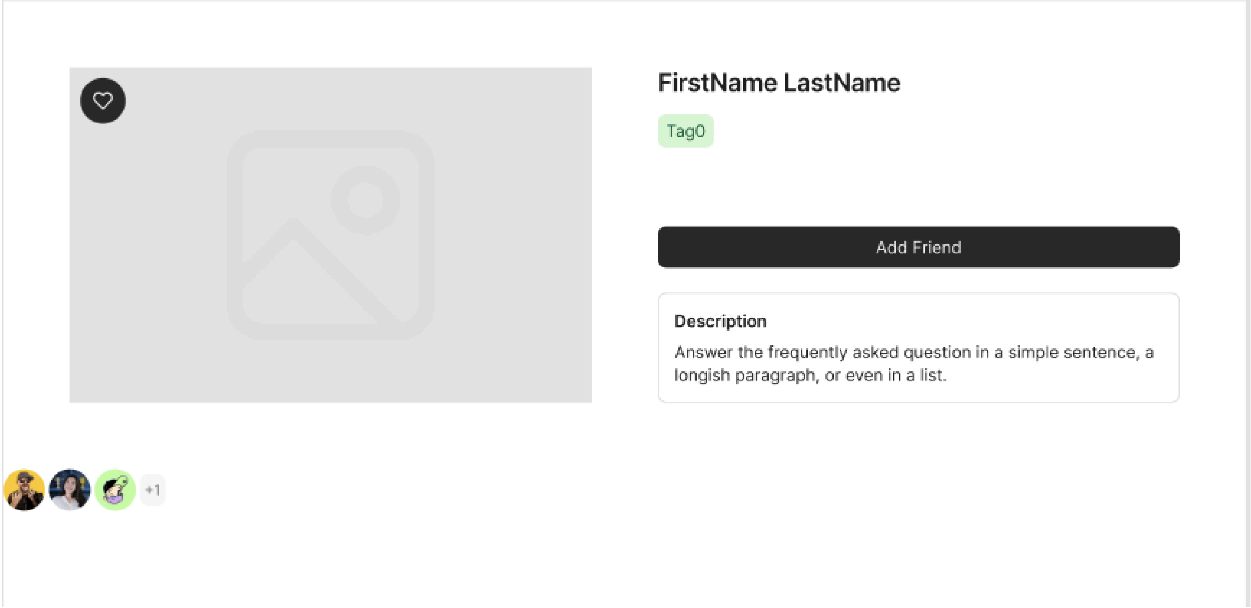
Justification: We decided it would be most effective for communication to allow students to both send simple messages directly to one another and have communal threads discussing classes. Requiring students to open their email and an email app outside of ours would defeat the purpose of providing a messaging service. Groups are primarily for physical meetings, so group messaging for events may be redundant and not required. Forum threads will fill in the need for discussion across multiple students and allow group deliberation for specific subjects and issues. The combination of individual messages and forums facilitates the cooperation the app is designed for.

3. **How will we allow users to specify classes and general tags of interest?**
    - **Option 1: Allow users to create any class or interest tag**
    - **Option 2: Limit classes to existing ones and let users create tags for further specification**

Choice: Option 2



FirstName LastName

Description

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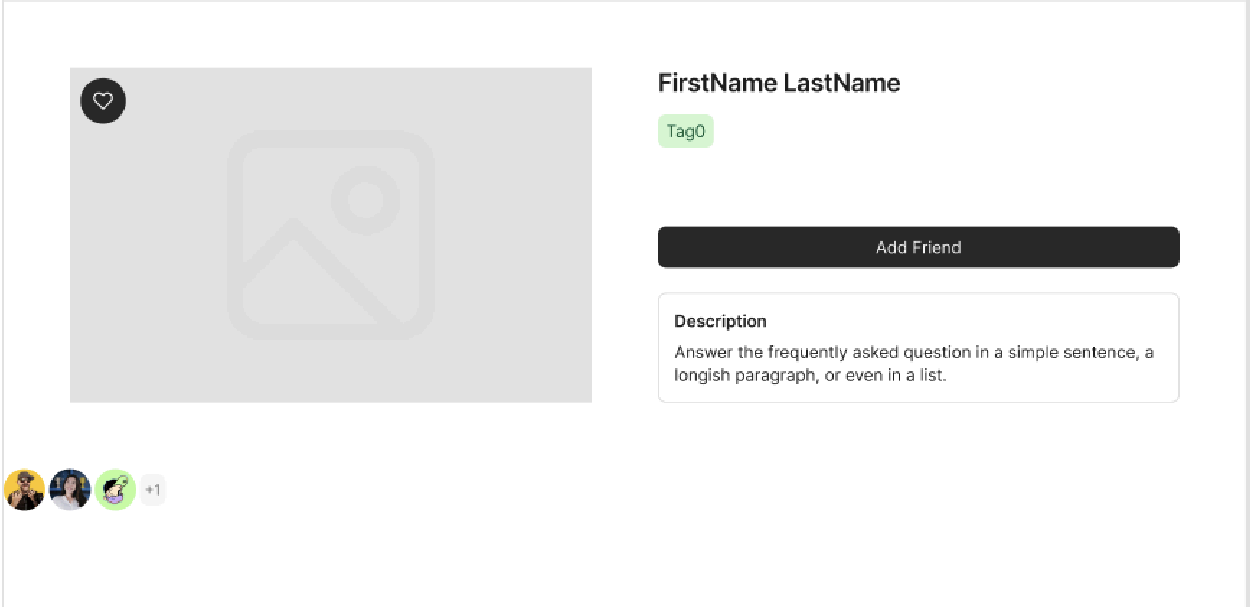
Justification: We want users to be able to create at least somewhat personalized tags for groups to indicate more specific goals, interests, formats, etc. However, we also think there needs to be a set list of classes to standardize description of material covered in groups or forums as well as indicate the coursework of individual users.

4. **How do we apply the rating system?**
   - **Option 1: Allow everyone to rate anyone**
   - **Option 2: Limit ratings to rating people in instructive roles only**

Choice: Option 1

Justification: In a traditional context, apps usually only provide a way to rate instructors. This of course is because they are supposed to bring value to the educational environment as a teacher. However, in the context of study groups, everyone contributes. Furthermore, groups will not always include someone in the instructor role. We want the rating to demonstrate every participant's behavior and willingness to contribute to a group.



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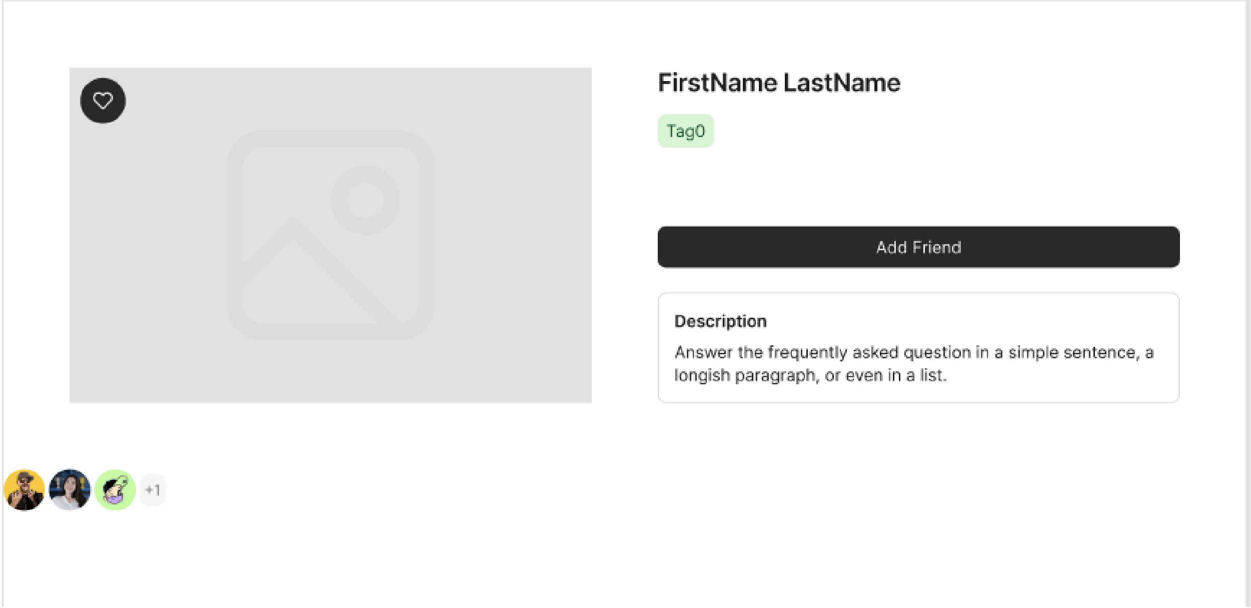
5. **How will we utilize user location for group gathering?**

   - **Option 1: Allow users to set preferred locations**
   - **Option 2: Use GPS mapping to display and filter distances to group gatherings**
   - **Option 3: Allow users to set a radius for potential groups**

Choice: Options 1 and 2

Justification: This application is meant to make meeting up with study groups and forming events easier, quicker, and more convenient. For that, we think having both preferred locations and actual live mapped distances will combine well to create that quick convenience. It will allow users to both see the closest events and groups as well as simplify it by setting locations that they prefer and leaving it at that. Setting a radius would be mildly redundant considering the already versatile combination of live distance and location preference.



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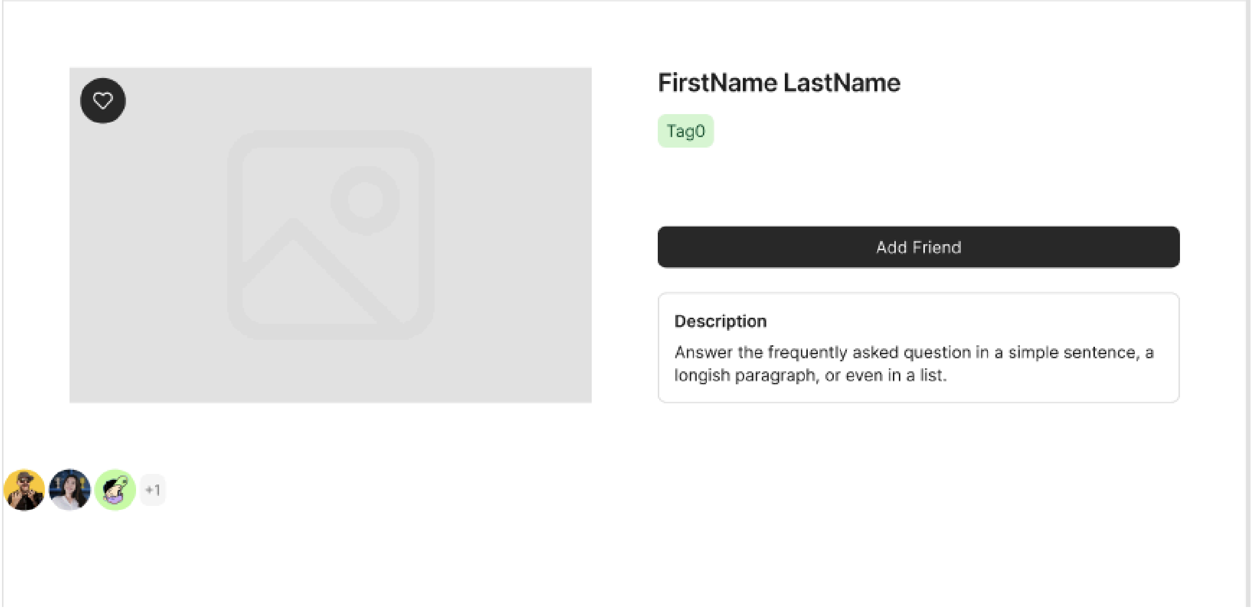
Design Issues (Non-Functional)

1. **What development languages will we use for the application?**
    - Five of our group members have intermediate experience in Java, but none of our group members have development experience with web applications or specific frontend or backend frameworks. Due to our prior experience in Java, we should utilize it by picking technologies and frameworks that have Java support or support Object Oriented Programming languages similar to Java. Since all of our members have no prior experience with frontend development, we will use Javascript for our frontend as it is easier to pick up and there are extensive resources online to help us learn.
2. **What database management system will we use to store our users' data?**
    - **Option 1: NoSQL database**
    - **Option 2: Relational database**

    Choice: Option 2



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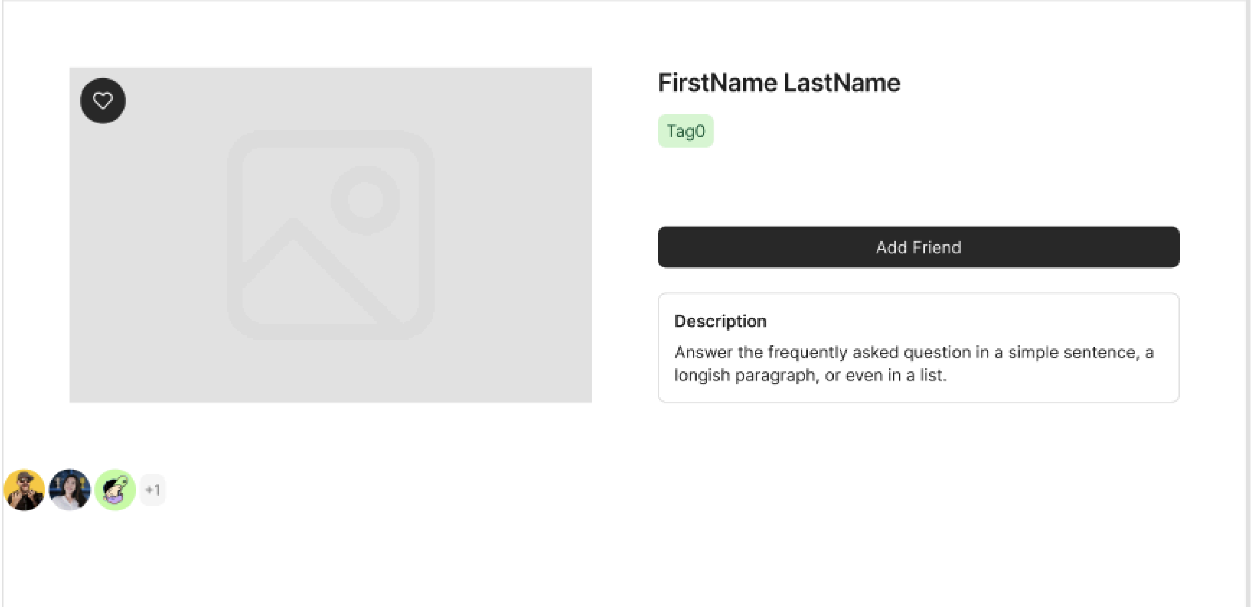
We will not use a NoSQL database as none of our members have experience with NoSQL database management tools such as MongoDB. We will use a relational database as the key-value nature of tuples is a fairly straightforward concept and a few of our members have some experience with SQL queries. We will use PostgreSQL since it is highly scalable and reliable and it is widely used with plenty of resources to help us pick it up for the first time and troubleshoot any potential roadblocks.

3. **What back-end framework will we use for the application?**
    - **Option 1: Node.js**
    - **Option 2: Spring Boot**
    - **Option 3: Flask**

Choice: Option 2

Although there are extensive tutorials for Node.js, which will allow us to develop a server-side application and seamlessly integrate it with our front end, we felt that the time needed



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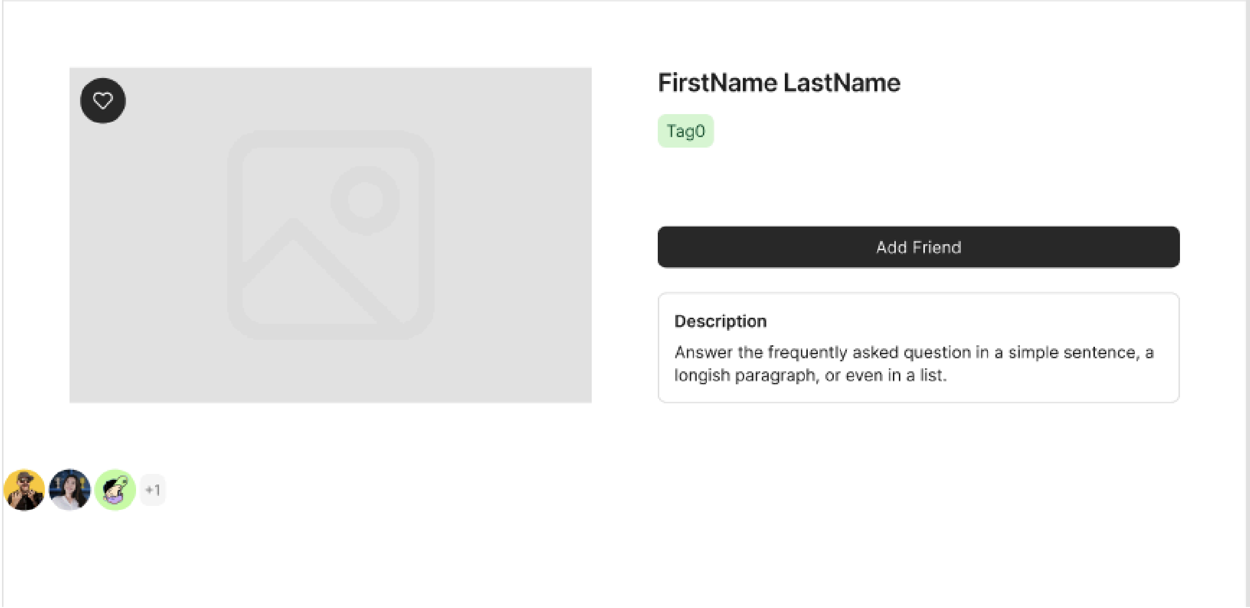
to work through learning the framework would slow us down unnecessarily. We also did not choose to use Flask, as our group's experience with it or Python development in general is varied. Therefore, Spring Boot is a natural choice, as it allows any of our members to utilize our prior experience with Java and build out our server logic quickly.

4. **What front-end framework will we use for the application?**
   - **Option 1: React**
   - **Option 2: Angular**
   - **Option 3: HTML/CSS with Javascript**

Choice: Option 1

While Angular provides more structure and built-in features as a framework, it takes much more time to learn and fully utilize its extensive functionality to the fullest degree. As for pure HTML and CSS, it would simply take too much time to write when our team's workload is already divided between front-end and back-end development, and using an existing library or



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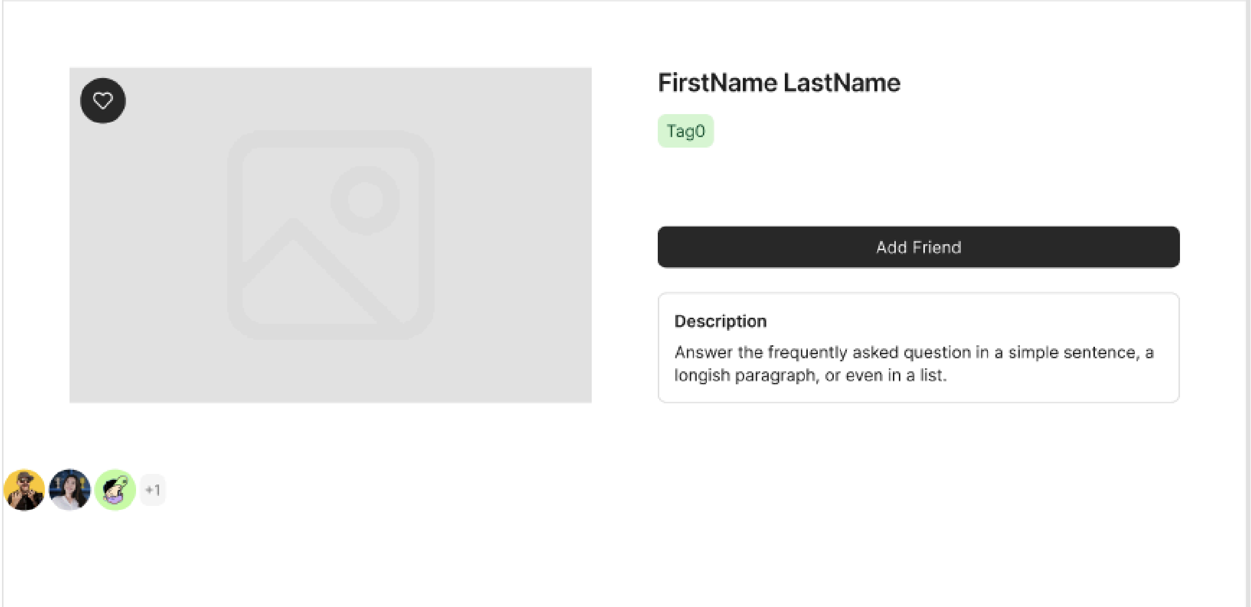
framework would allow us to ramp up much quicker. Therefore, React is the logical choice as its learning curve is much more forgiving and it abstracts much of the work needed to manage UI components and states properly.

5. **How should users access the app?**
   - **Option 1: Browse through events and groups without an account**
   - **Option 2: Access all features after creating an account with just a username and password**
   - **Option 3: Only be able to access the app after verifying their enrollment during registration**

Choice: Option 3

We wanted users to go through some form of authentication process when creating an account since all users needed to be associated with Purdue University. Therefore, only requiring users to create a username and password to access all features was not secure enough; we



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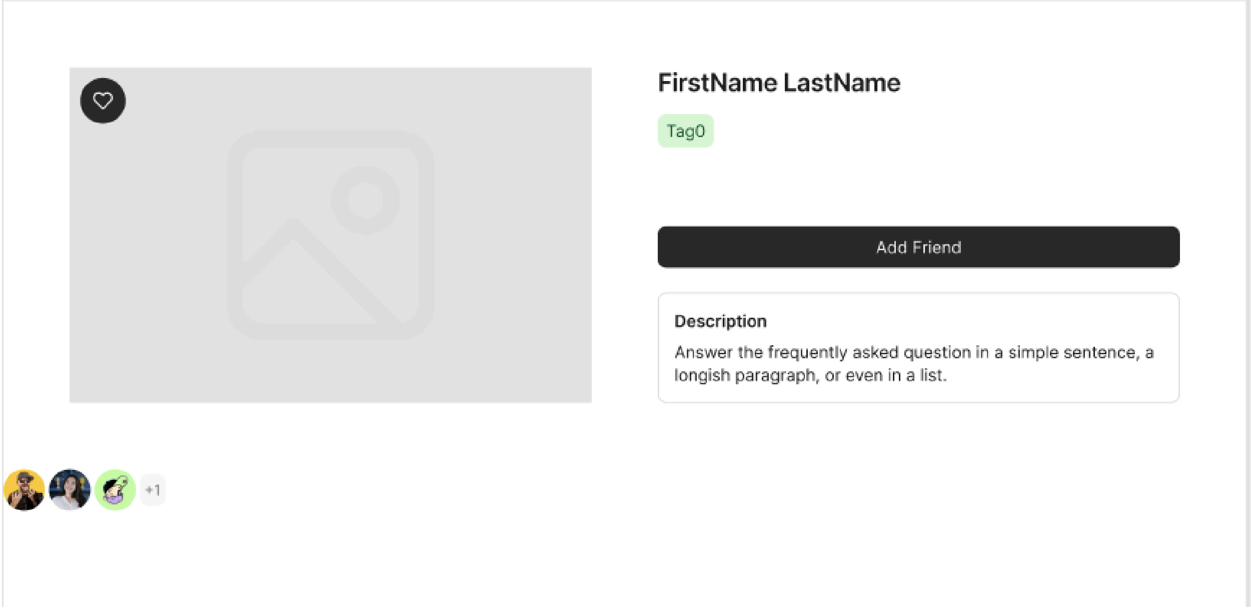
decided to require that users verify their affiliation with Purdue using their university email. We also chose not to allow any user to see the application without an account, as it seemed counterintuitive if a user could browse through potential study groups without being able to participate in one. Additionally, the challenge of handling user roles and permissions between users with an account and users without one would have taken away time that we could use to improve other features of the application.

6. **How will we host our web-application?**
    - **Option 1: Vercel, Heroku, Supabase**
    - **Option 2: AWS (Cloudfront, EC2 Instance, RDS)**
    - **Option 3: DigitalOcean**

Choice: Option 2

We considered several hosting options, including **Vercel, Heroku, Supabase** (Option 1) for their ease of use, and a DigitalOcean that was reliable but not industry standard. While these



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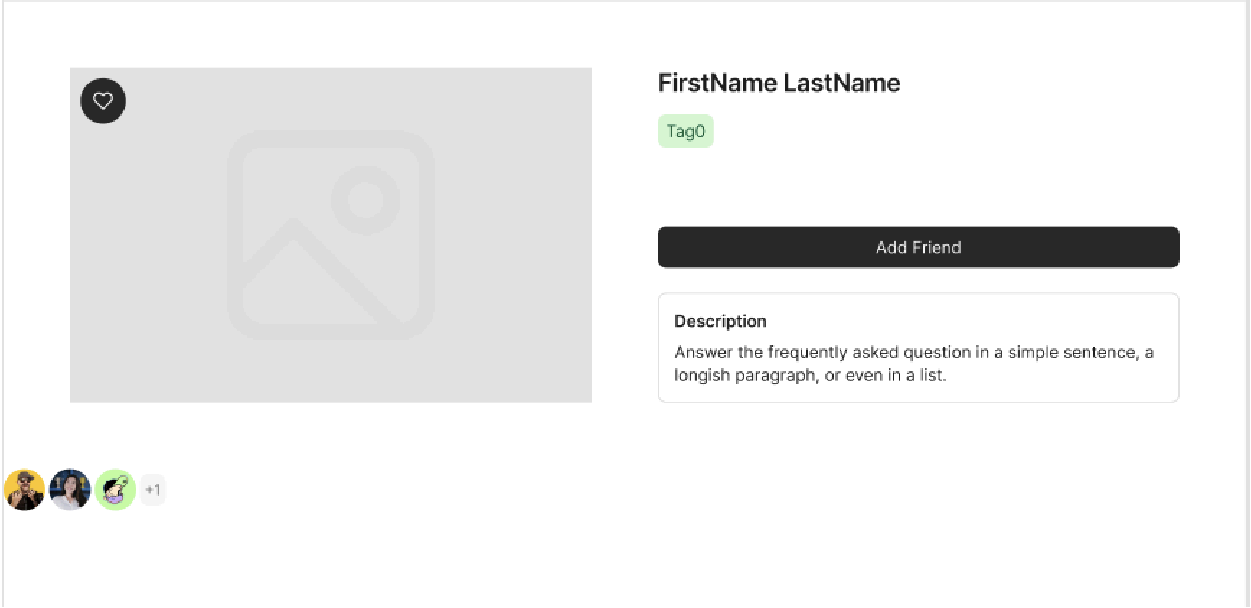
alternatives offer quick setups, they lack the flexibility and scalability we need as the application grows, especially because of the number of users we want to service (~50,000). AWS, although slightly more complex to configure, is the industry standard for hosting scalable web applications. With services like **CloudFront**, **EC2**, and **RDS**, AWS provides the control, reliability, and scalability we require for both current and future needs. The trade-off in complexity is justified by the long-term benefits it offers. Additionally, AWS is industry standard and utilizing it in our project will help us learn a technology for the future.



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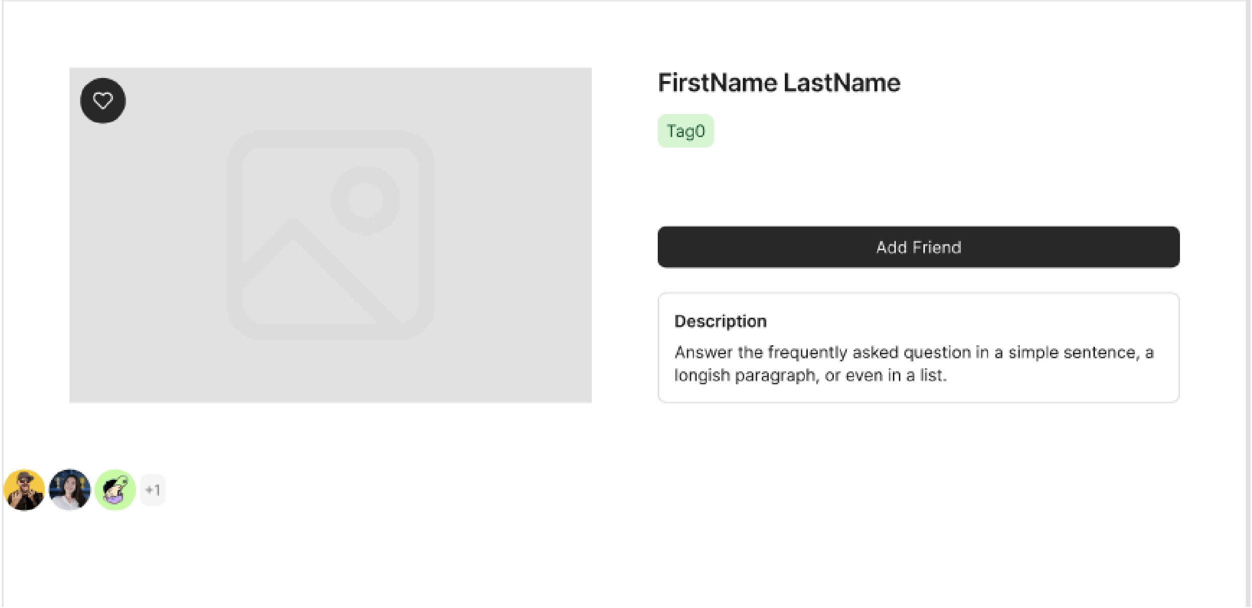
Design Details

Class Descriptions and Interactions Between Classes



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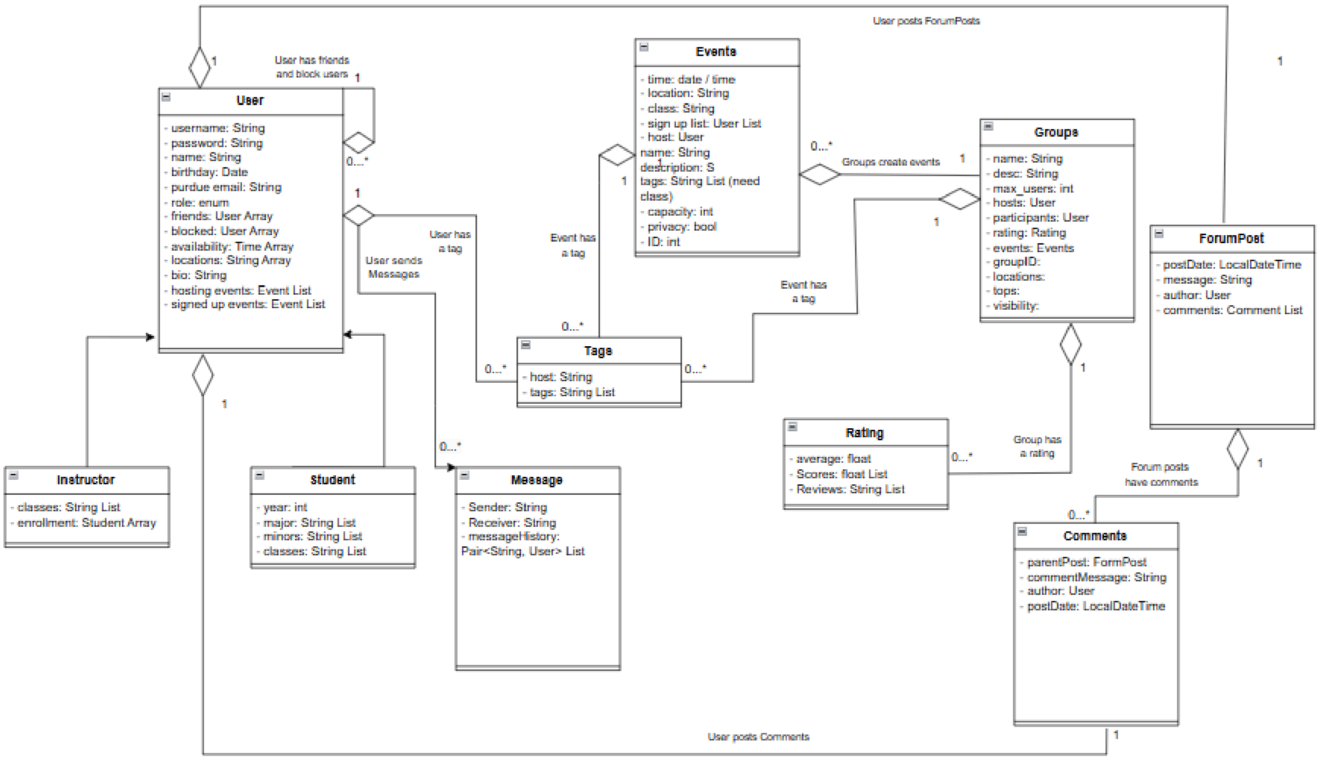

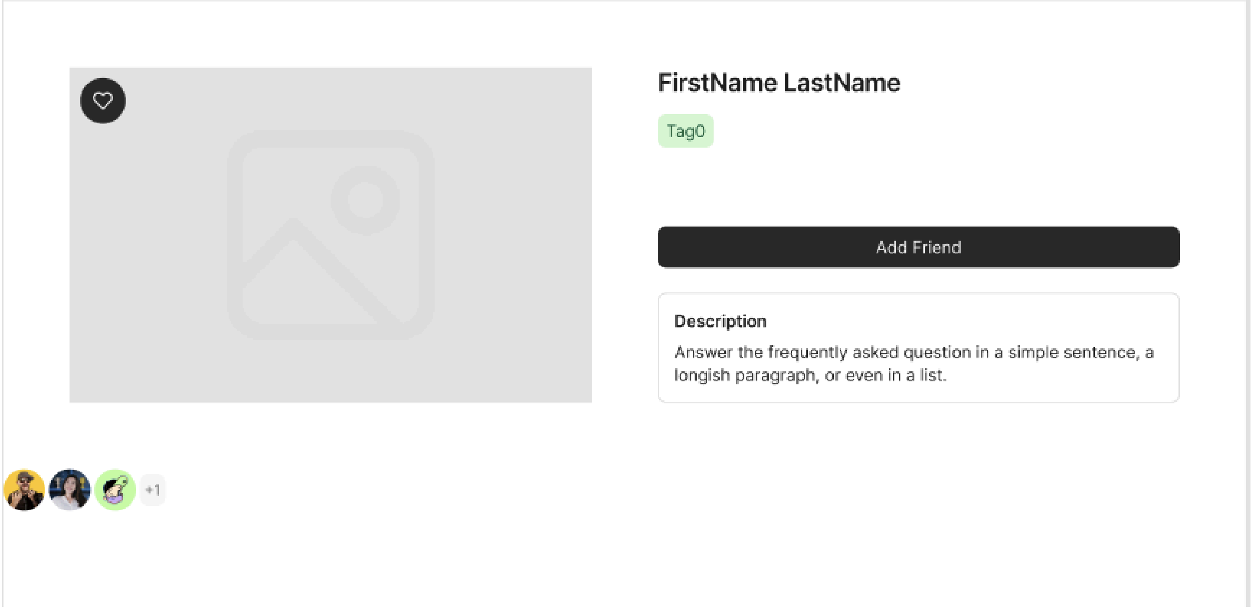

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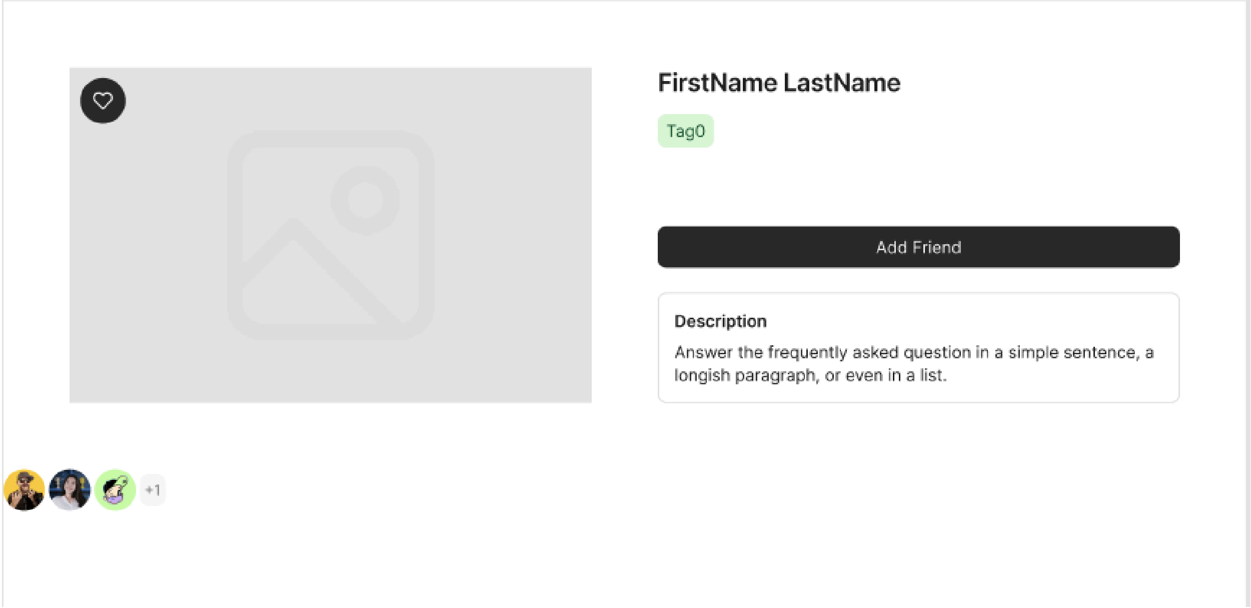
User:

- Created when a new user is registered
- Users must have a unique username, unique Purdue email, secure password and birthday, and role to confirm they are attending Purdue.
- Users can choose to add a bio, friends, and/or blocked users to personalize their profile
- Users can state their preferences as tags such as preferred locations or times they are available to assist in finding study groups to join
- Each user will have a list of events that they are attending and events they are hosting. These events will show up in the home page.
- Each user will either be an instructor or a student,

Instructor:

- Created when user specifies their role as an instructor on registration
- Instructors have a list of classes they are instructing



Description

Answer the frequently asked question in a simple sentence, a longish paragraph, or even in a list.

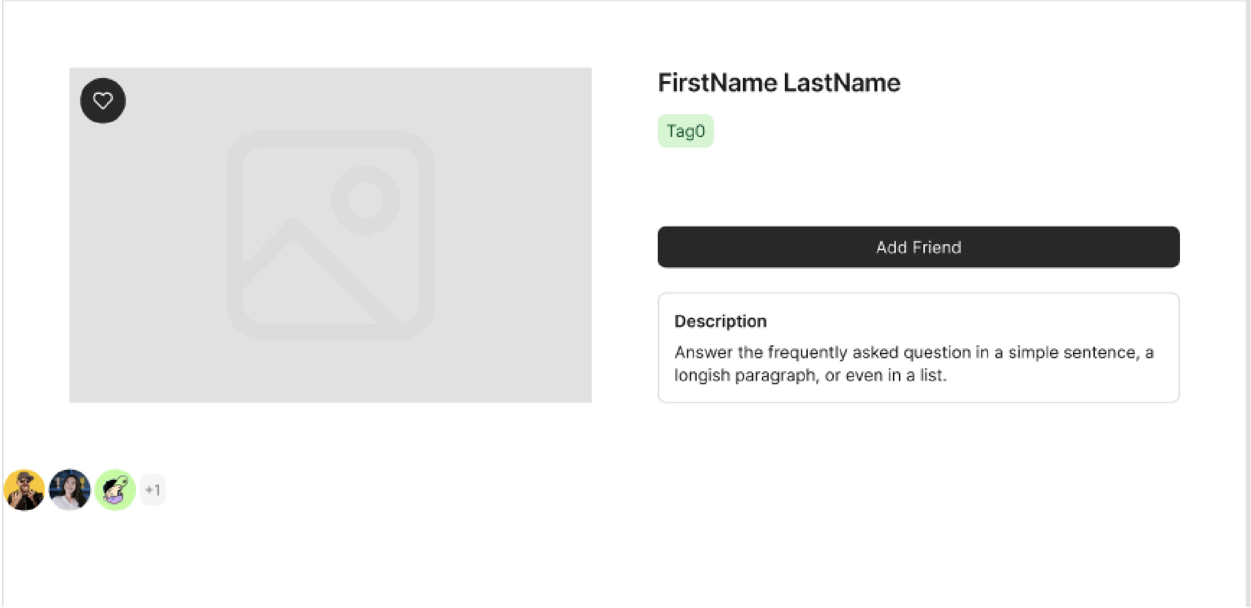
- Instructors should be able to see a list of students enrolled in their classes

Student:

- Created when user specifies their role as a student on registration
- Students will enter the year they are graduating, their majors and minors, and any classes they are taking.

Tag:

- Tags are created when a user adds a tag to their profile, group, event, or post.
- Tags are used to search and filter for groups, events, users, and forum posts
- Host will be what object is being tagged.
- The object will have a list of strings of possible tags, created by web scraping for all purdue courses and departments



Description

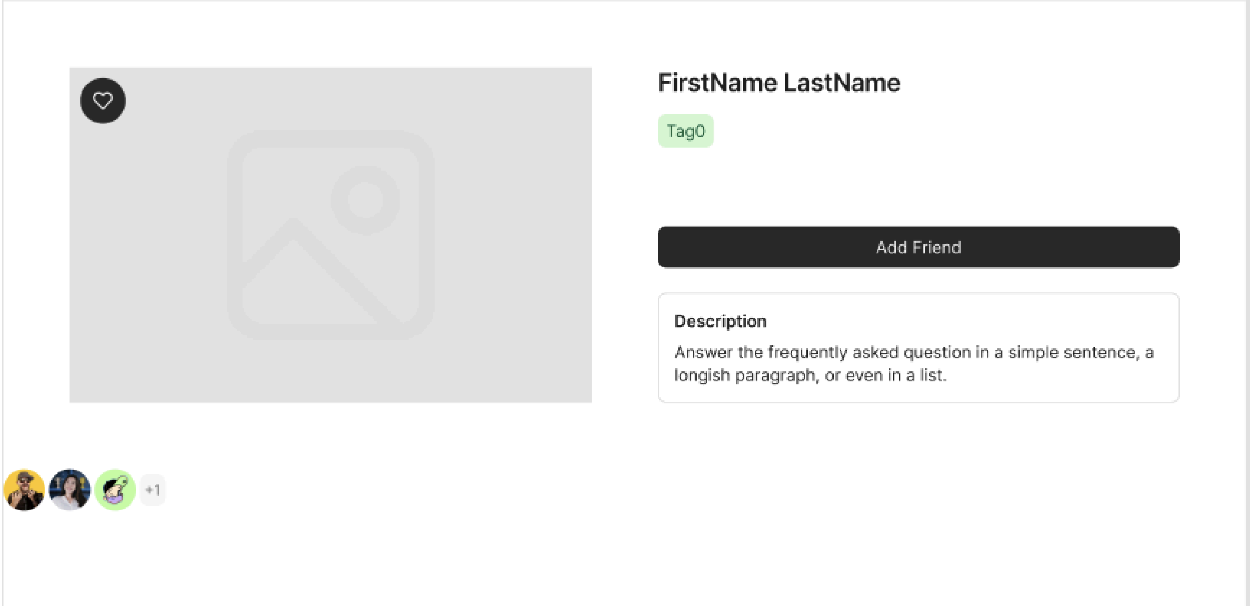
Answer the frequently asked question in a simple sentence, a longish paragraph, or even in a list.

Message:

- Created when a user first messages another user
- The sender will be the user who sends the first message and the receiver will be who they message
- MessageHistory will contain all the messages sent between the two users

Groups:

- A group object is created when a user creates a new group
- When creating a group, users will specify a name, description of the group, max number of members, location, and whether the group is public or private
- Each group object will be assigned a unique group_id
- Host will contain all the users who are hosting the group, while participants will contain those who have joined the group.
- Events contains a list of events created by the group



FirstName LastName

Tag0

Description

Answer the frequently asked question in a simple sentence, a longish paragraph, or even in a list.

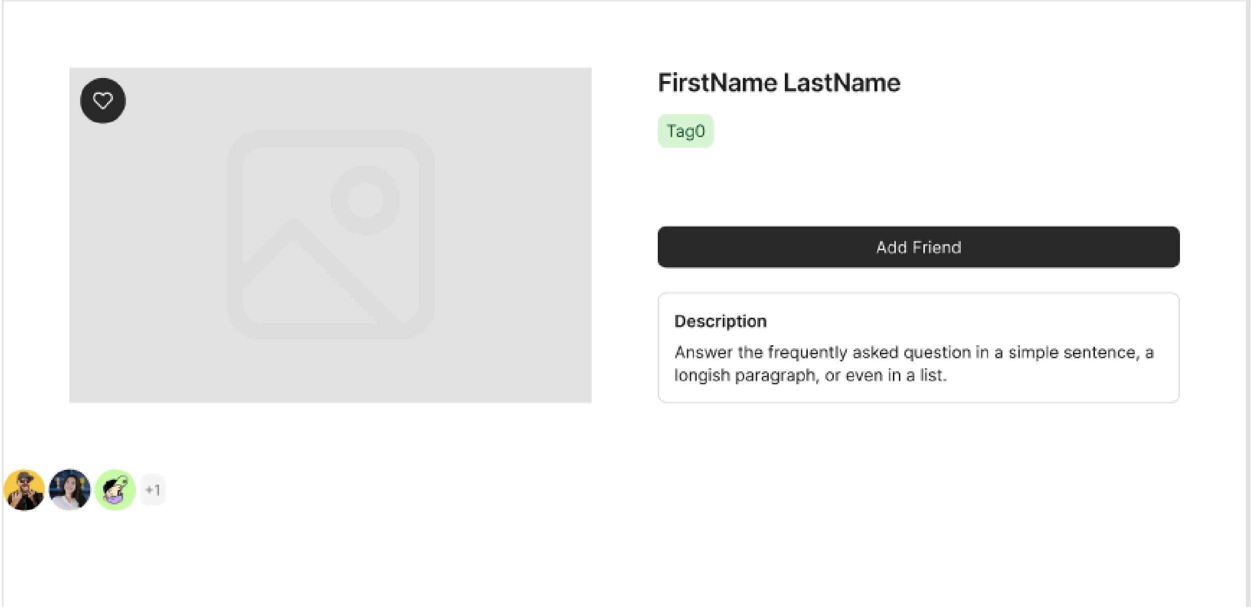
- The group will have a rating object to display participants' rating of the group

Rating:

- Created with the creation of a group object
- Scores will contain a list of participants' rating of the group and avg will calculate the avg rating based on the list
- Reviews will be an optional written review of a group by a participant

Events:

- Created when a group creates a new event
- Every event must have a specified date/time, location, class tag(s), name , description, privacy, and capacity
- Every event will be assigned a unique event_id
- When users sign up for an event they will be added to the sign up list of the object



FirstName LastName

Tag0

Add Friend

Description

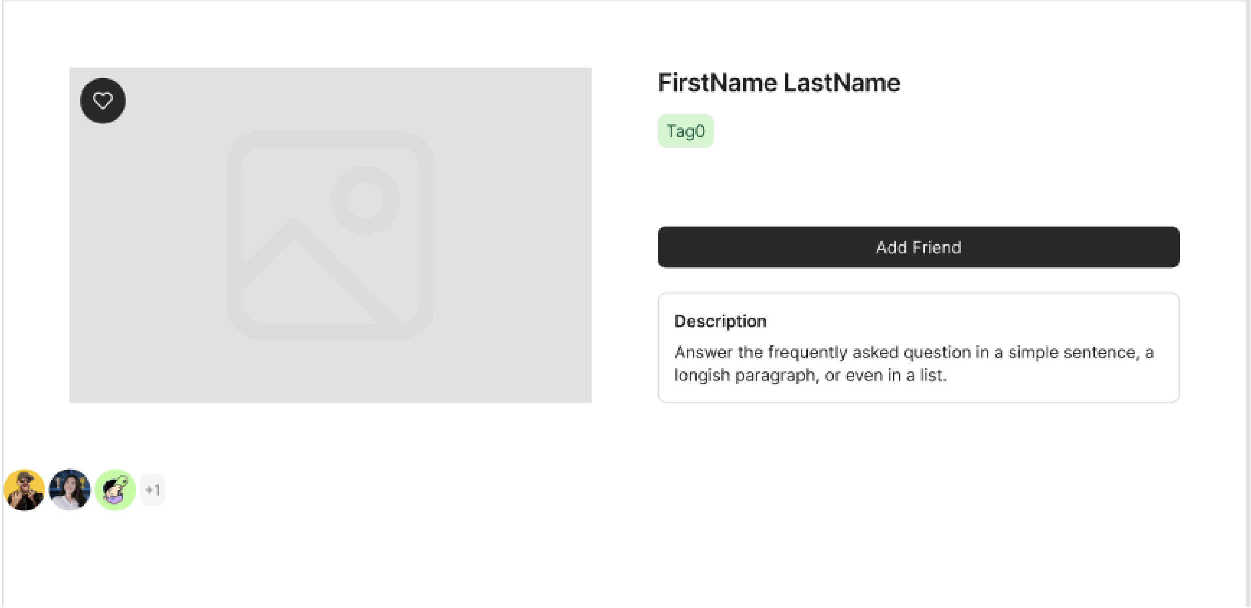
Answer the frequently asked question in a simple sentence, a longish paragraph, or even in a list.

ForumPost:

- Created when the user makes a new post on the forum
- Author will be the user who makes the forum post
- Message will contain the message of the user's forum post
- postDate will be the date and time at which the message is created; will not be changed
- Contains a list of comments made to the forum post

Comments:

- Created when a user comments under a forum post for the first time
- parentPost will be the original post the comment is responding to to
- Contains the user who sent the comment and the message of their comment
- postDate will be the date and time at which the comment is created; will not be changed

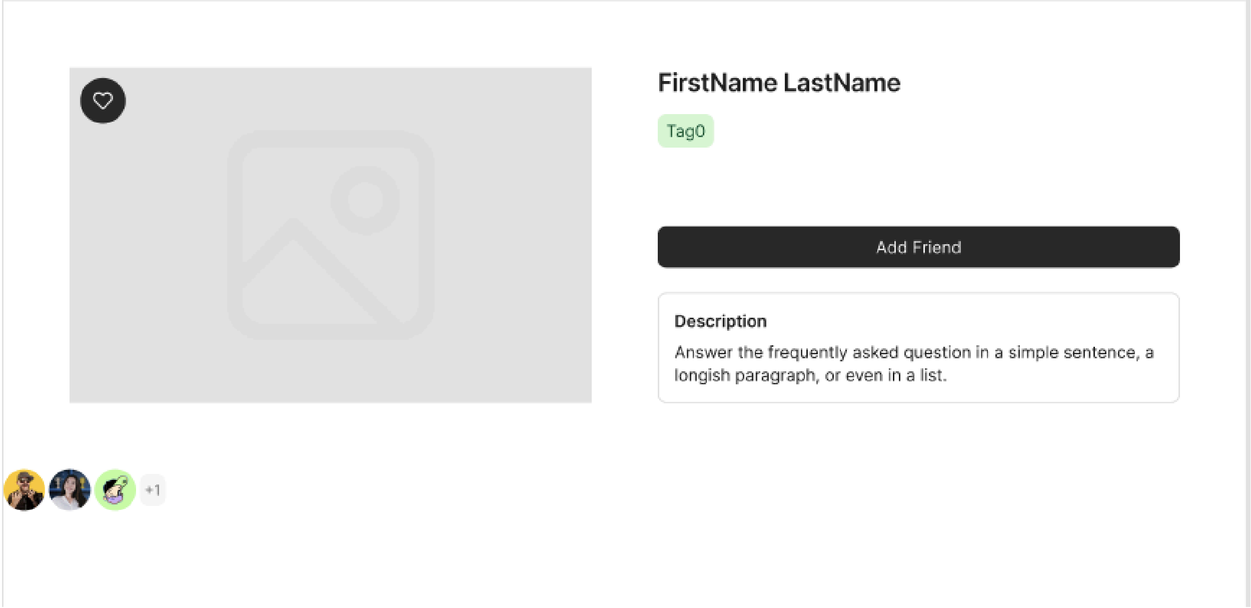


Description

Answer the frequently asked question in a simple sentence, a longish paragraph, or even in a list.

Navigation Flow Map Description

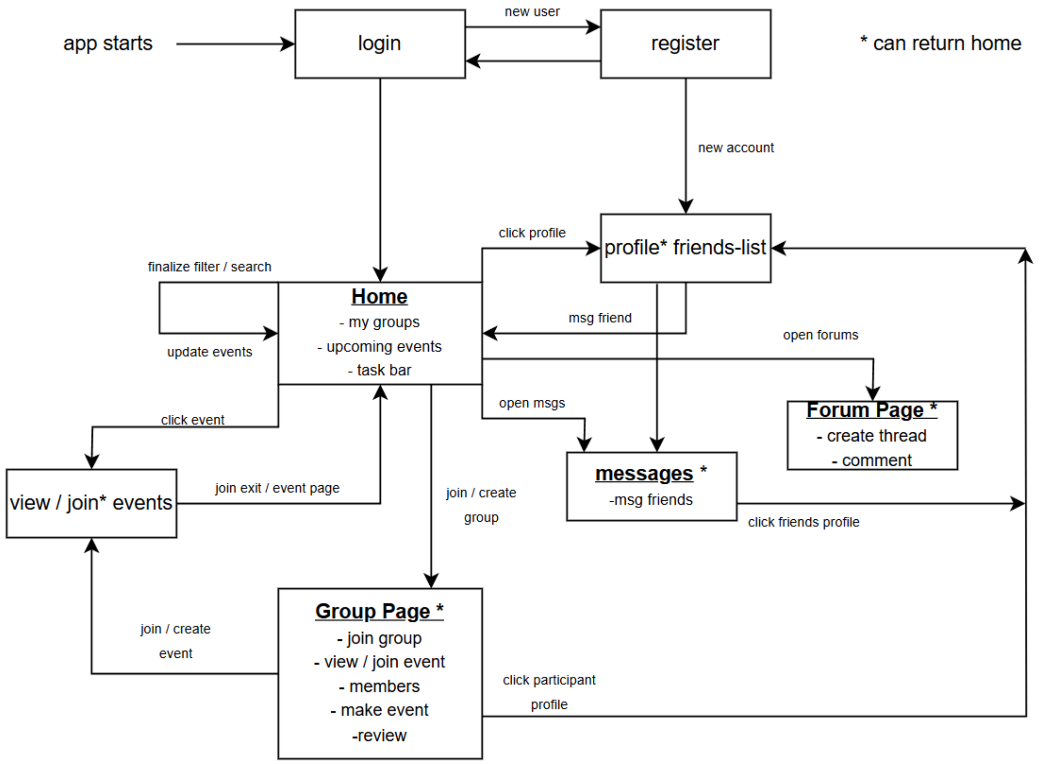
This flowchart represents the user navigation of our study group finder application. The user upon launching the app, begins at the Login screen. If the user is new, they can proceed to the Register page to create an account. After logging in, the user is brought to the Home screen, which displays: My groups (groups the user has joined), Upcoming events (events related to the user's groups), Task bar (navigation options). From the task bar the user can navigate to the other pages that allow the user to view their profile, message other users, join events and groups, and access the forum page. The Home page also allows the user to search/select filters to find a suitable group or event that matches their interests. The * symbol next to certain pages (Profile, Messages, Forum Page, etc.) indicates that the user can return to Home from these pages.

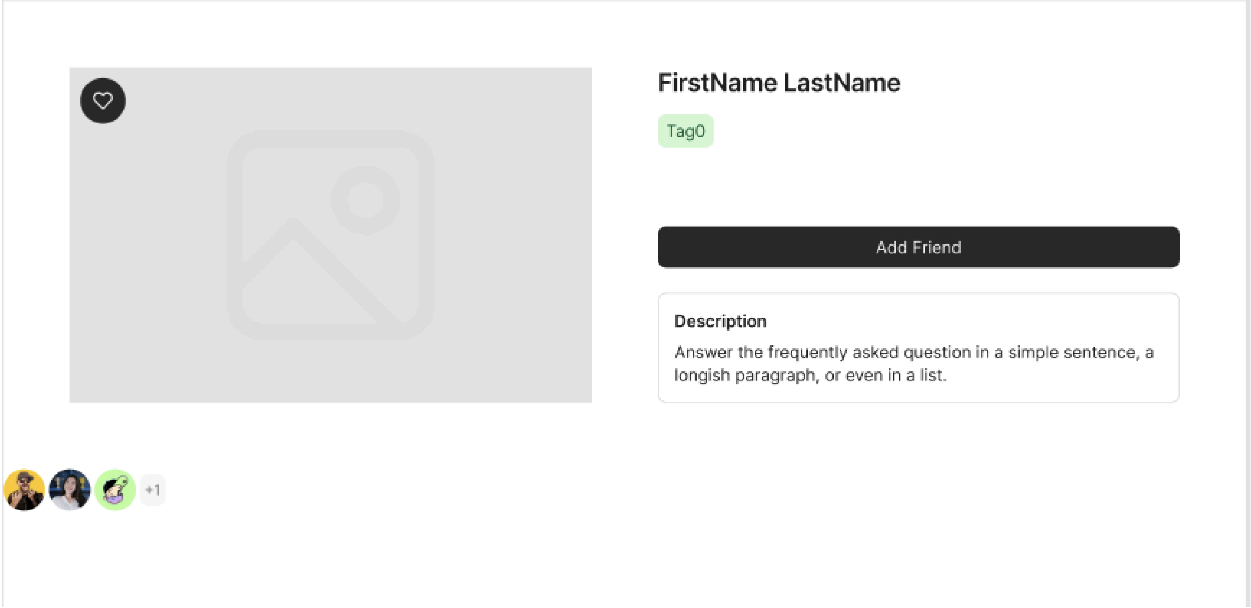


FirstName LastName

Description

Answer the frequently asked question in a simple sentence, a longish paragraph, or even in a list.





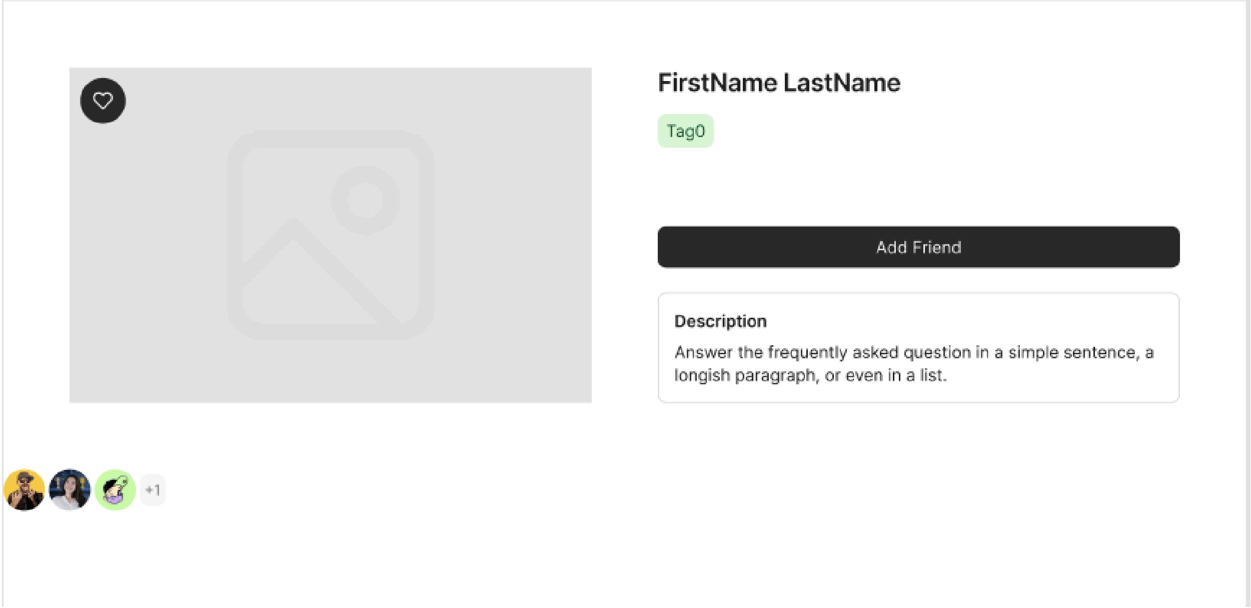
Description

Answer the frequently asked question in a simple sentence, a longish paragraph, or even in a list.

User Interface Mockup Description

We’ve designed a function bar that will appear at the top of each page after the user logs in. The bar gives quick access to other pages including the groups page, events page, forum page, and friends page. The UI is very intuitive and organized well, with similar functions on the same page.

Groups
Events
Threads
Friends

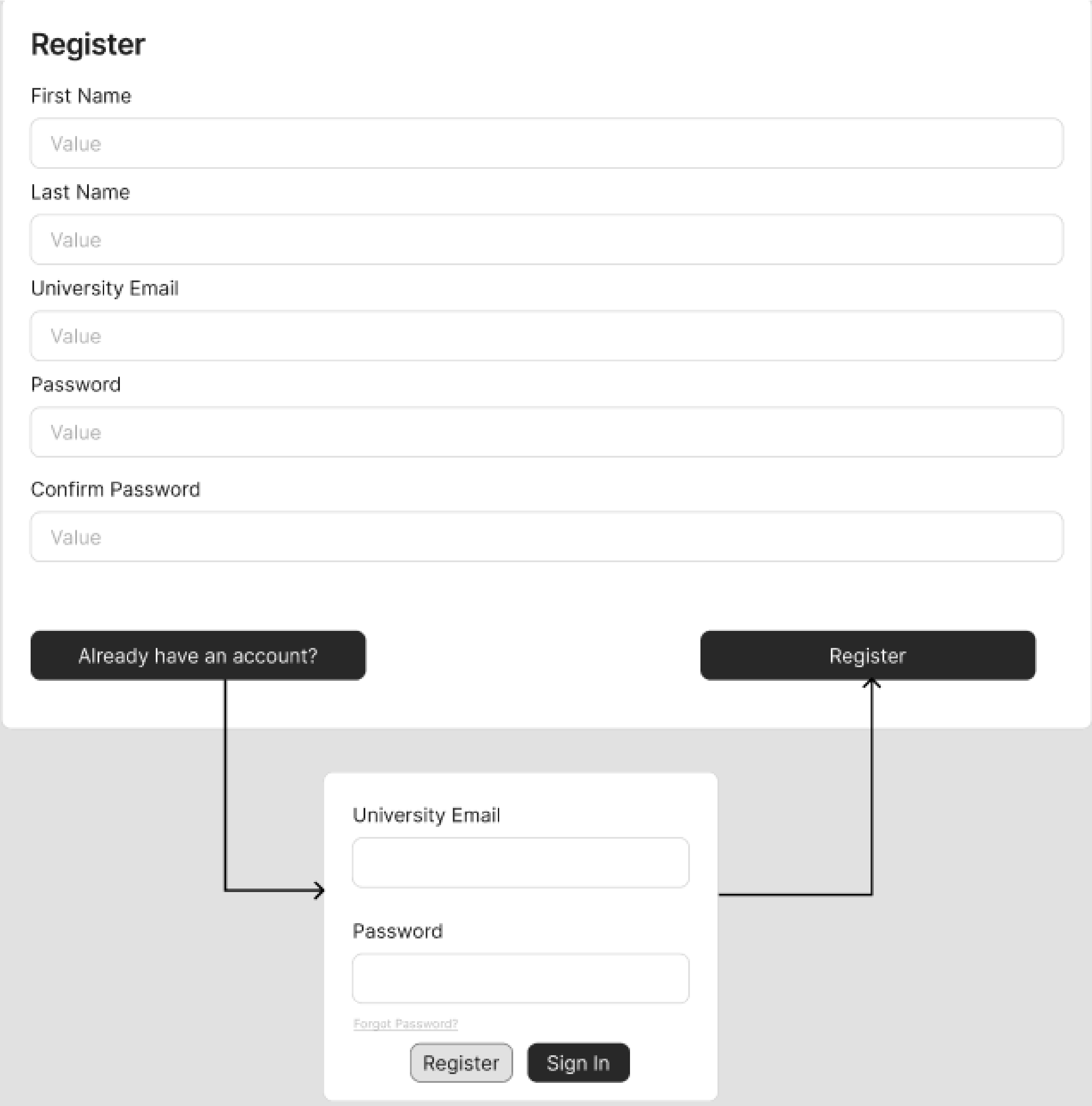


FirstName LastName

Tag0

Description

Answer the frequently asked question in a simple sentence, a longish paragraph, or even in a list.



Register

First Name: Value

Last Name: Value

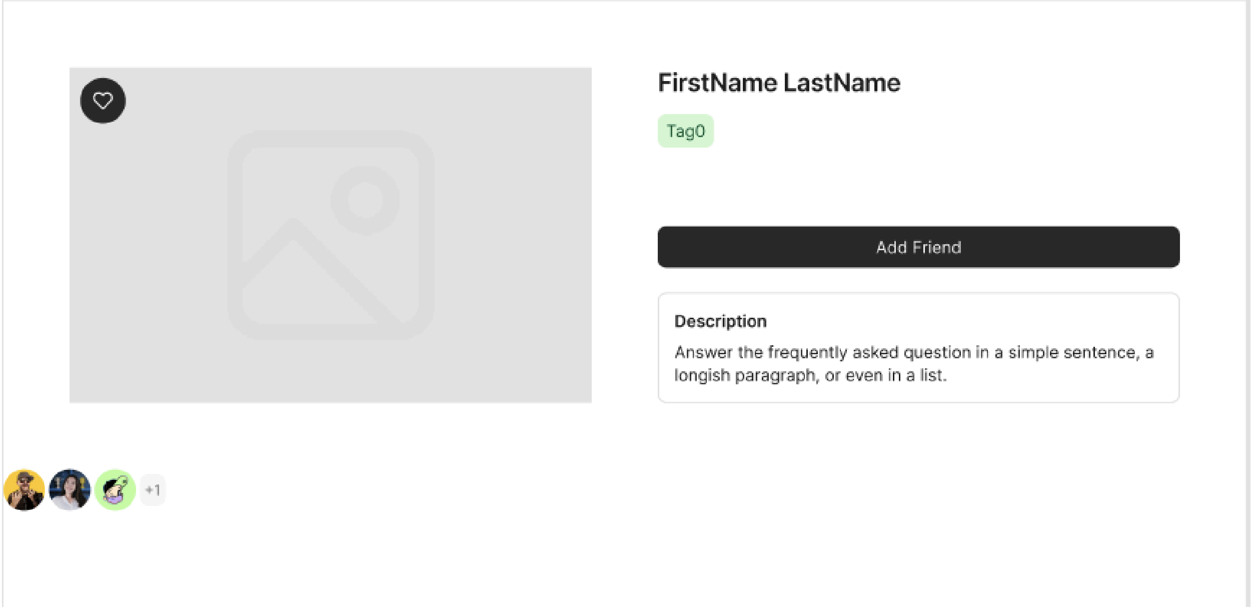
University Email: Value

Password: Value

Confirm Password: Value

University Email

Password

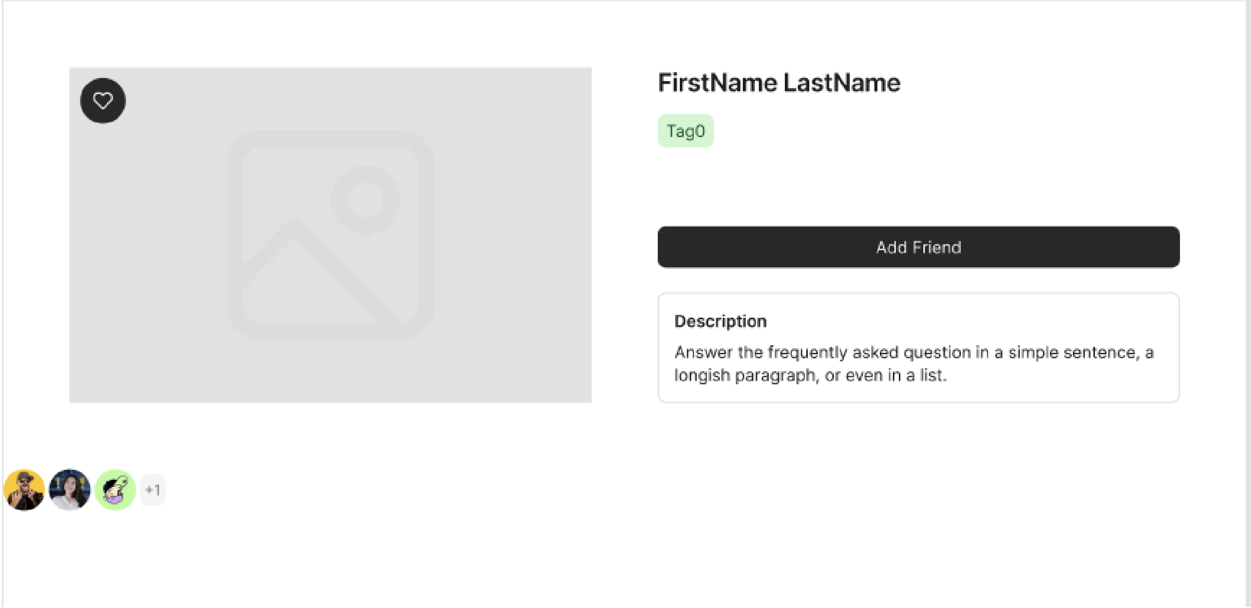


Description

Answer the frequently asked question in a simple sentence, a longish paragraph, or even in a list.

This is the registration page which is required to access our site. Required information includes first name, last name, a Purdue email and secure password. In the case they already have an account they can redirect to the login page which itself can also redirect to the registration page. Information will be checked for uniqueness and password must be minimally secure.

This is the profile page that will start blank after a user signs up on our site. Information that can be added includes birthday, classes, major, a short bio, and any amount of tags. The profile page will have slight differences depending on if it is the logged in user or another user viewing the page. Other users will be able to see the groups that you are in and other more personal info may have limited visibility. On a user's profile page is also where they can choose to add friends which is the basis of our messaging system.

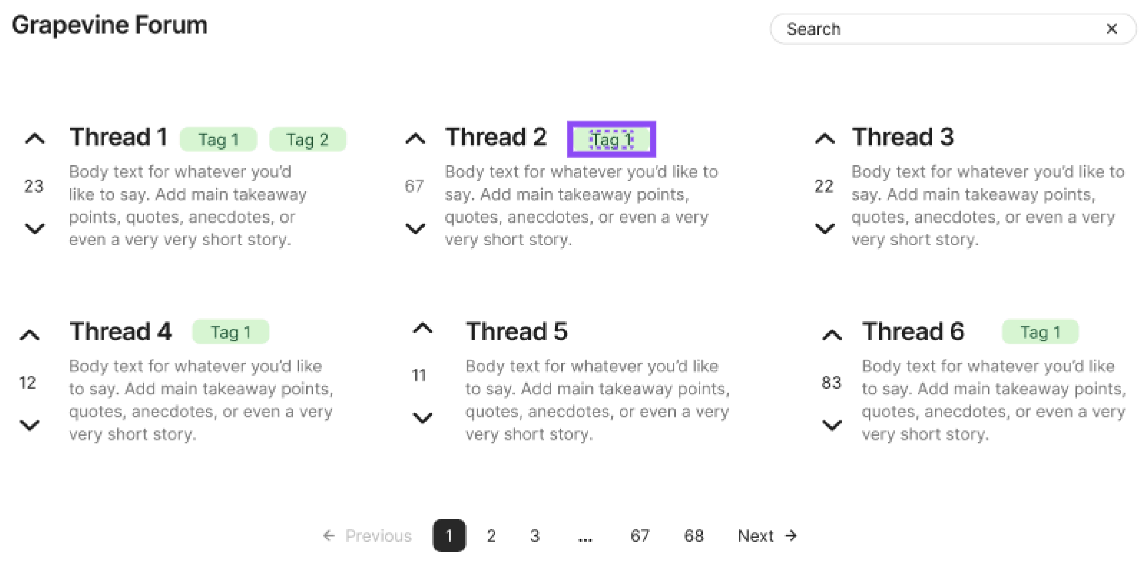


FirstName LastName

Tag0

Description

Answer the frequently asked question in a simple sentence, a longish paragraph, or even in a list.



Grapevine Forum

23 Thread 1 Tag 1 Tag 2

Body text for whatever you'd like to say. Add main takeaway points, quotes, anecdotes, or even a very very short story.

67 Thread 2 Tag 1

Body text for whatever you'd like to say. Add main takeaway points, quotes, anecdotes, or even a very very short story.

22 Thread 3

Body text for whatever you'd like to say. Add main takeaway points, quotes, anecdotes, or even a very very short story.

12 Thread 4 Tag 1

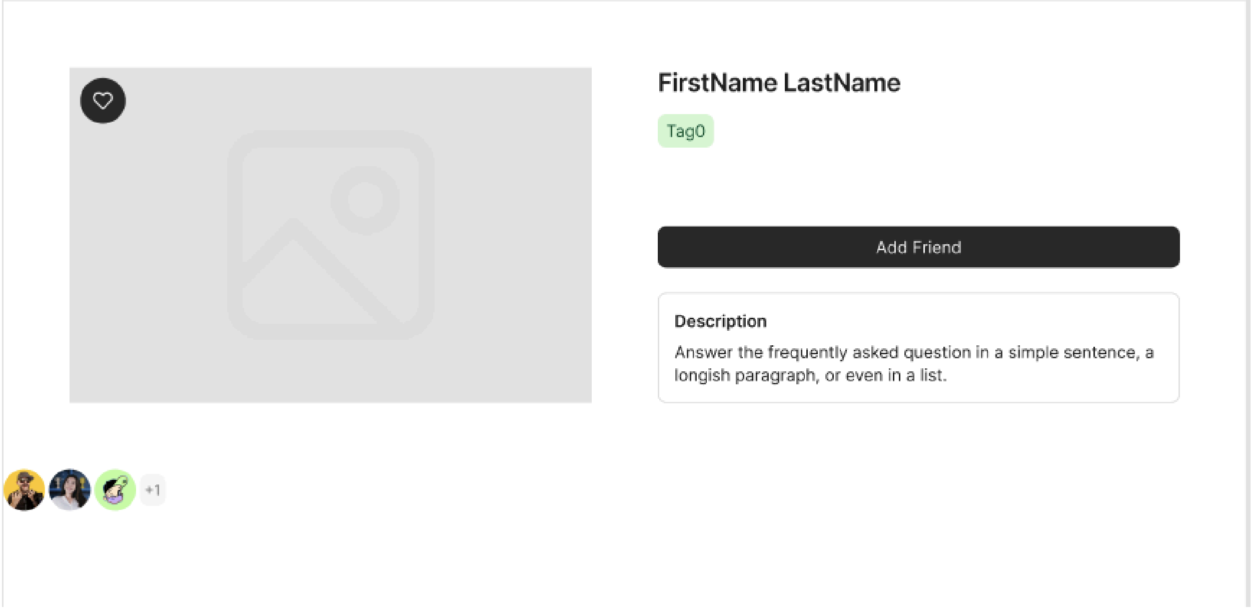
Body text for whatever you'd like to say. Add main takeaway points, quotes, anecdotes, or even a very very short story.

11 Thread 5

Body text for whatever you'd like to say. Add main takeaway points, quotes, anecdotes, or even a very very short story.

83 Thread 6 Tag 1

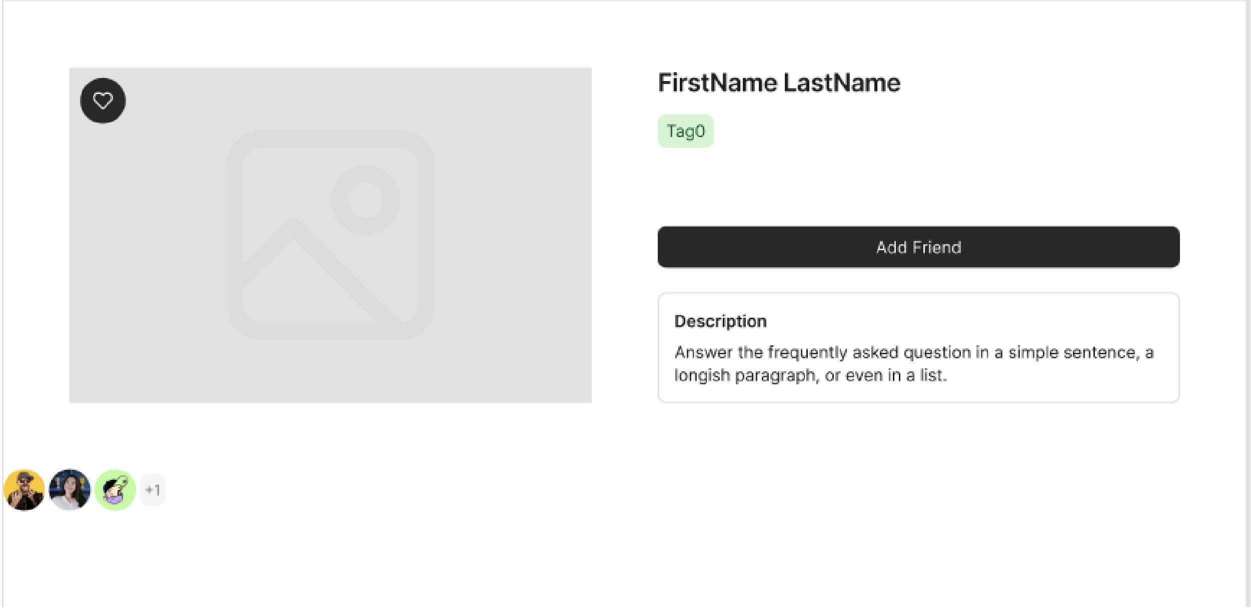
Body text for whatever you'd like to say. Add main takeaway points, quotes, anecdotes, or even a very very short story.



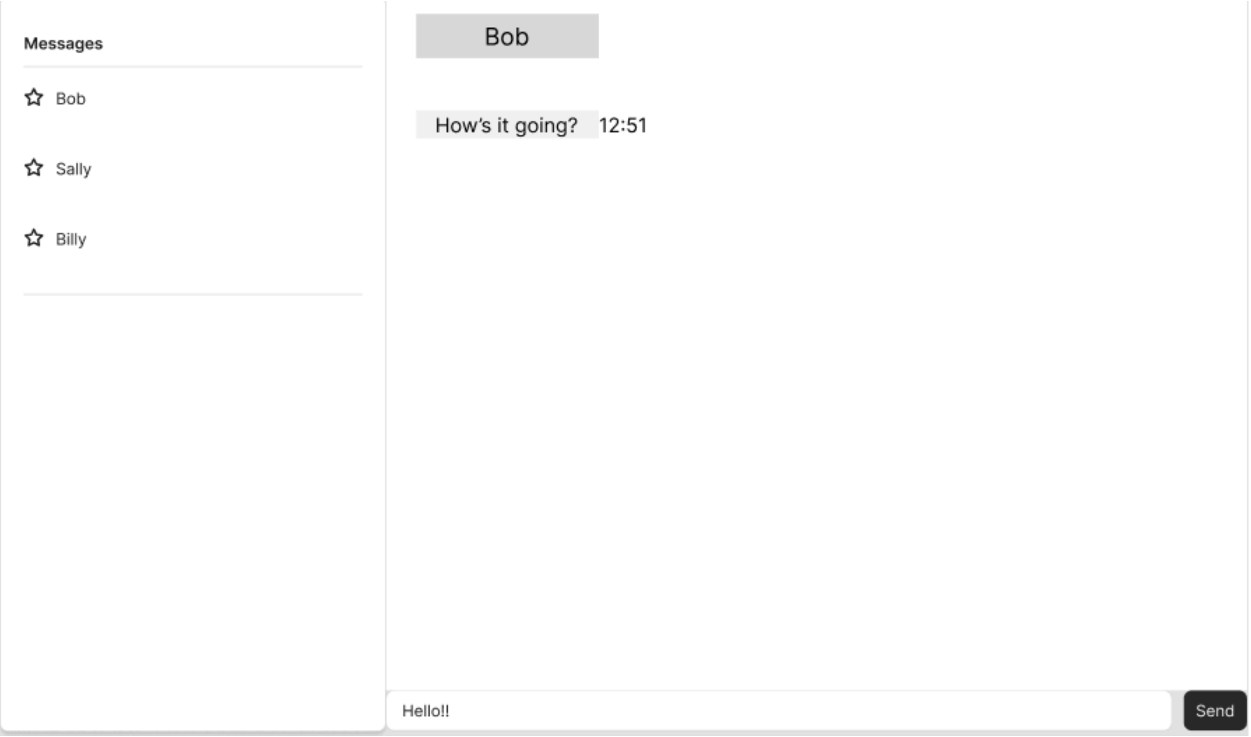
Description

Answer the frequently asked question in a simple sentence, a longish paragraph, or even in a list.

This is the forum page where a user can browse threads which can be sorted through various different tags. A user can create a thread, set appropriate tags, and comment on existing threads. Given instructors and TA roles, there is also room for moderation when tags specify certain classes or subjects. From threads and comments one can redirect to other user’s profiles where they can send a friend request.

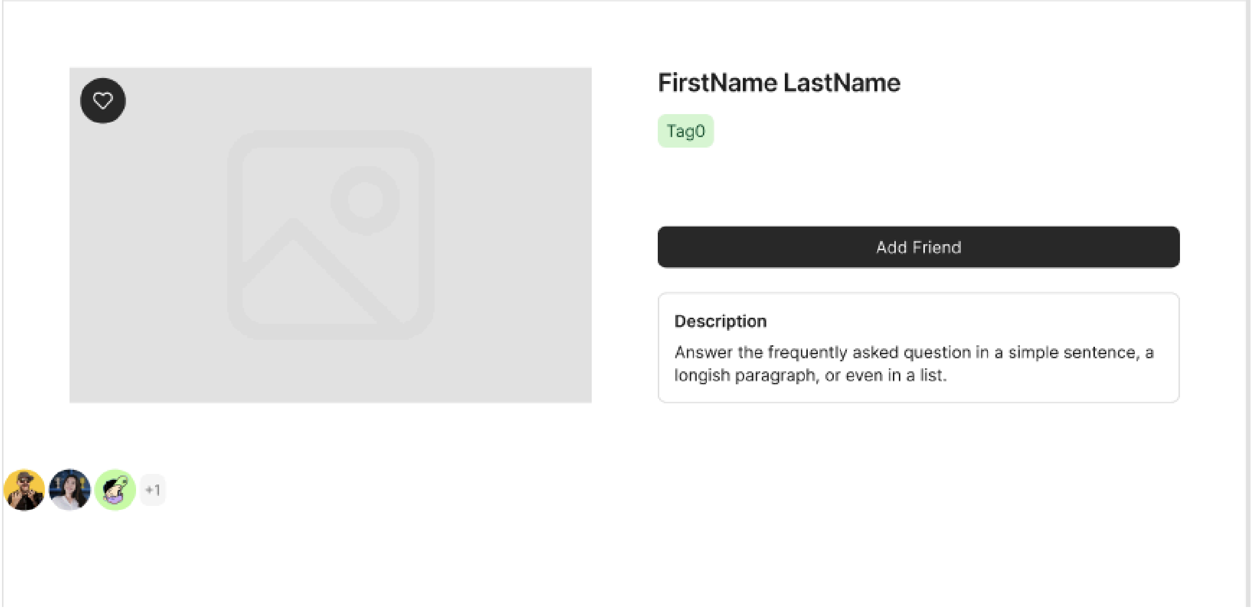


Answer the frequently asked question in a simple sentence, a longish paragraph, or even in a list.



How’s it going? 12:51

Hello!!

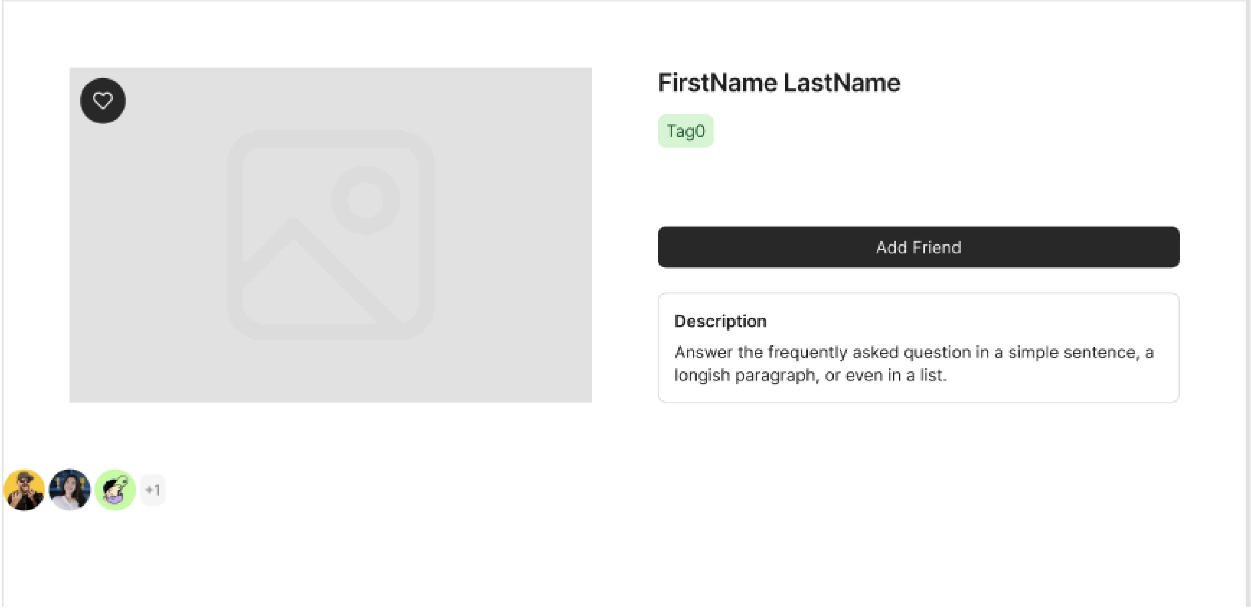


FirstName LastName

Description

Answer the frequently asked question in a simple sentence, a longish paragraph, or even in a list.

This is the messaging page which can be redirected to via the friends list. On the left hand side the user can select which other user they want to message, then draft out a message and send it. Each message is marked with the time/date sent and colors will differentiate which person sent which message. This messaging system expands with groups.



Description

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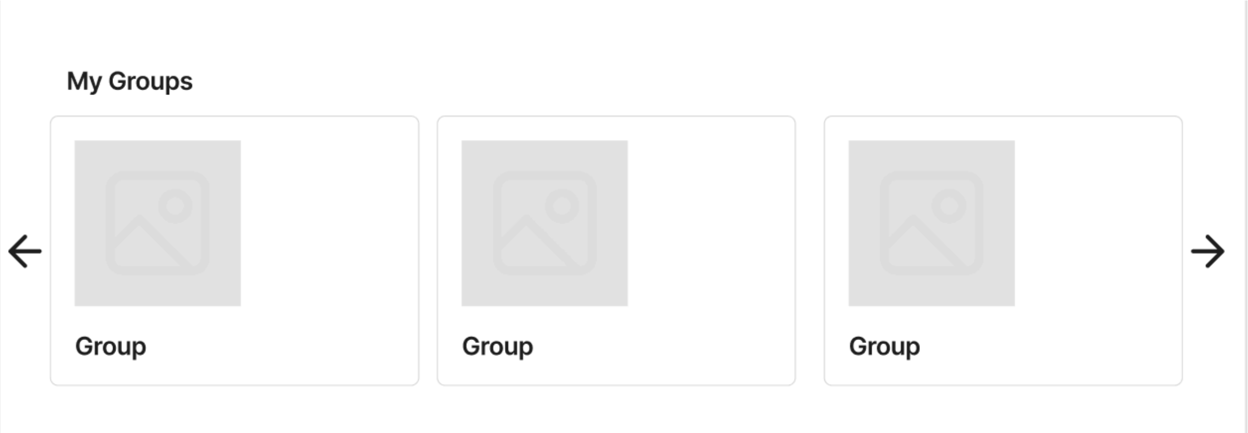
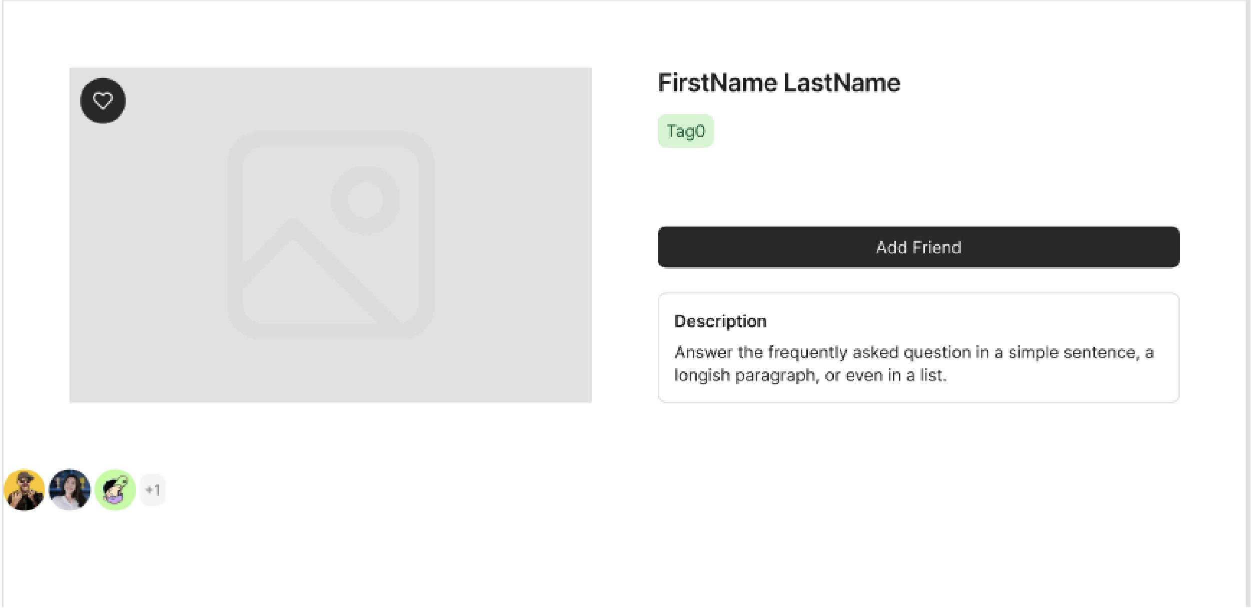


This is the groups page which also will double as the homepage after logging in. My groups are displayed for the user to scroll through while all groups would be displayed under allowing the user to sort using tags and other parameters to find specific groups they are wanting to join. These groups can be separated into study groups, instructor lead, etc. The group page is also where the user can decide to create a group, which he then becomes the admin of.



FirstName LastName

Description

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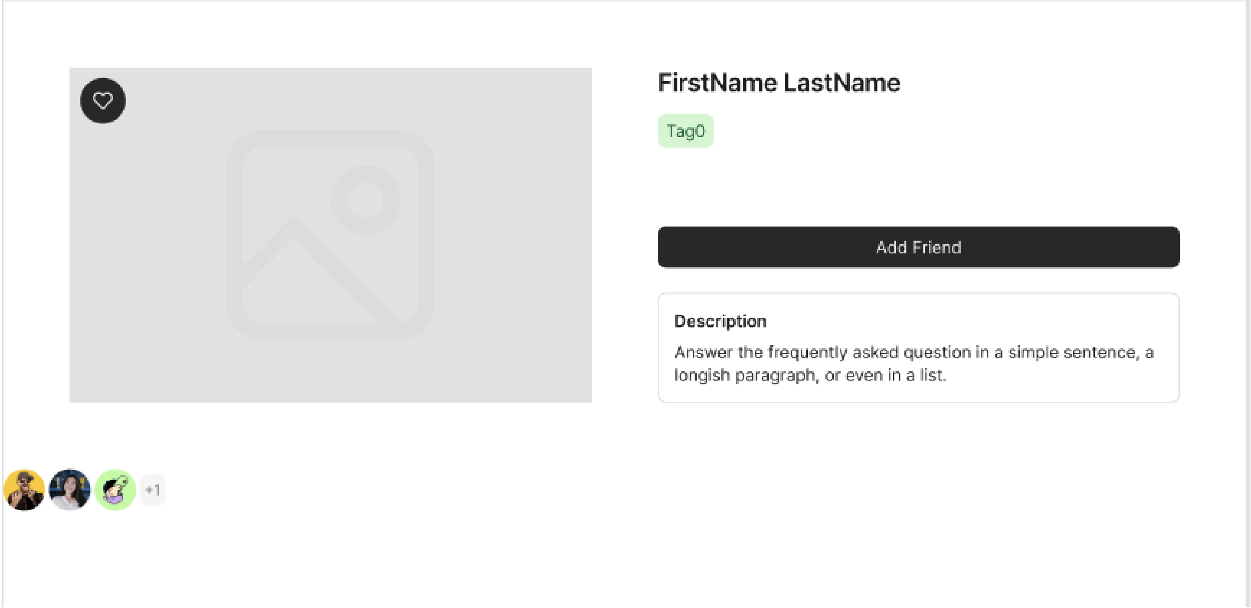

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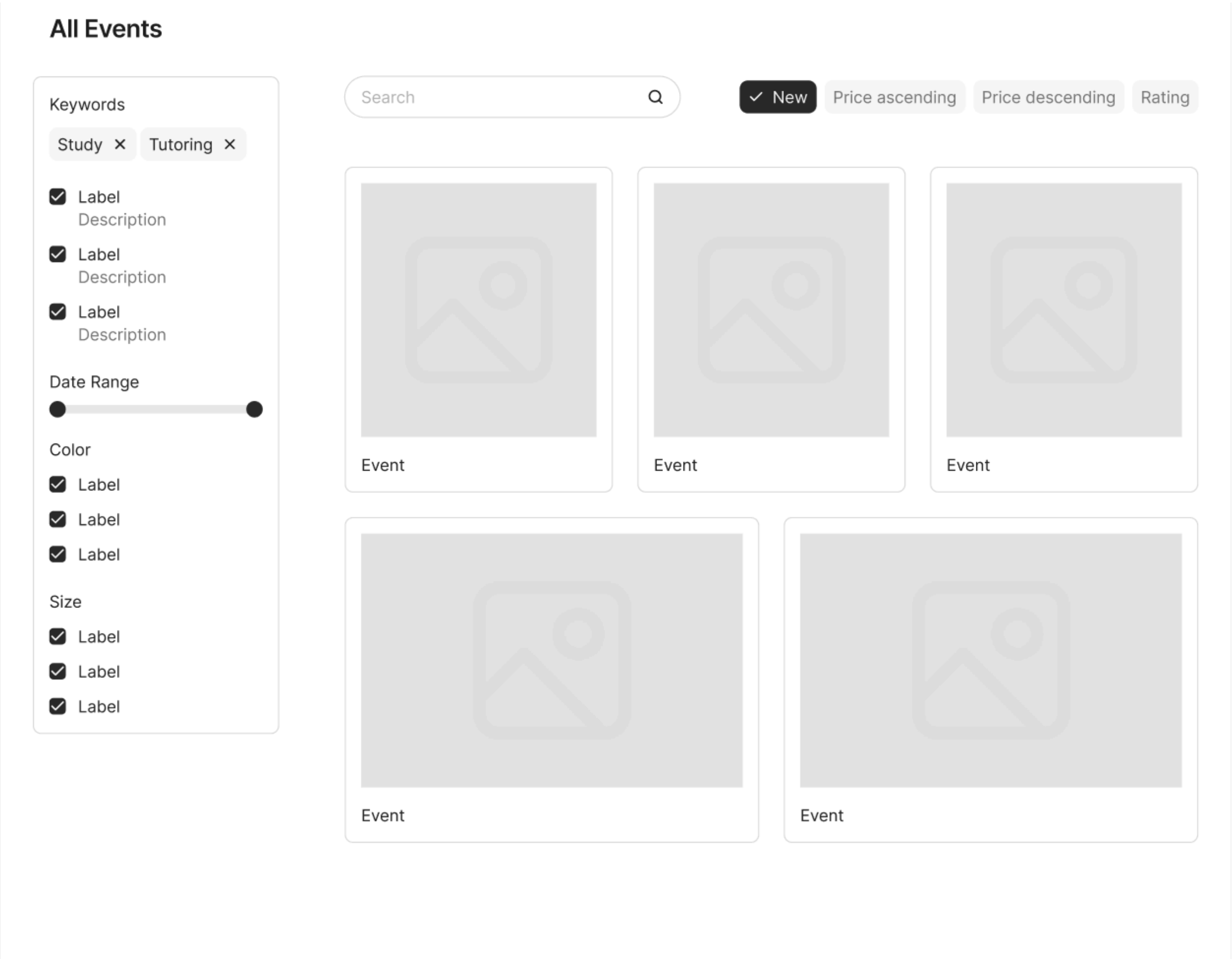

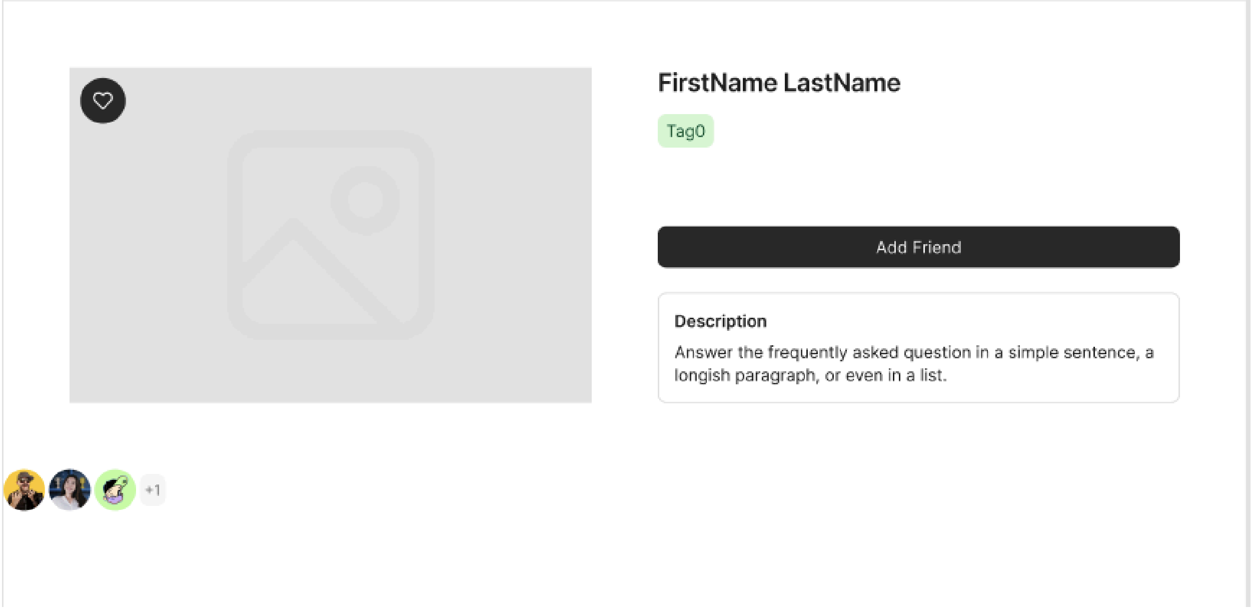

FirstName LastName

Tag0

Add Friend

Description

Answer the frequently asked question in a simple sentence, a longish paragraph, or even in a list.

This is the events page which will display both the events the user has registered for and a sortable all events section. Events will be centered around groups, a requirement for hosting, and can be study meetups, supplementary lectures, tutoring, or more. The search bar can be used to find specific events and hovering over each tile will show a little extra info about each event. The events page is also where a user can decide to host an event through his group, setting the parameters.