

SOFTWARE ENGINEERING CONCEPTS

(LAB MANUAL)

Software Concepts & Engineering - Lab Manual

Overview of the Project

Business Architecture Diagram

Requirements as User Stories

Architecture Diagram

Test Strategy

Deployment Architecture of the application

ALUMNI NETWORK PLATFORM

OVERVIEW :

The alumni network platform strives to build a vibrant community where former students, current students, and faculty members can connect and collaborate. By addressing challenges such as low user retention and decreasing reachability, the platform aims to foster meaningful connections among its members. It provides personalized content, mentorship opportunities, job boards, and internship listings to facilitate professional growth and networking.

Through regular events, webinars, and newsletters, the platform ensures ongoing engagement, keeping alumni, students, and faculty actively involved. By nurturing this sense of community and loyalty, the platform strengthens the bond between its members and the institution, creating a lifelong support network for personal and professional development.

FEATURES :

ALUMNI

1. Networking and Connections:

- Interest in reconnecting with former classmates, mentors, and alumni in their industry or region.
- Desire to expand their professional network for career opportunities, mentorship, and collaboration.

2. Professional Development:

- Access to career resources, job postings, and continuing education opportunities.
- Interest in attending alumni-led workshops, webinars, and industry events to enhance skills and knowledge.

3. Giving Back:

- Desire to contribute to their alma mater through donations, mentorship, or volunteering.
- Interest in supporting current students by sharing insights, offering internships, or participating in alumni panels.

STUDENTS :

1. Networking and Mentorship:

- Seeking mentorship opportunities and guidance from alumni in their field of study or career interest.
- Interest in connecting with alumni for internship opportunities, job shadowing, and career advice.

2. Career Services:

- Access to job postings, internship opportunities, and career resources tailored to their academic background and career goals.
- Desire for resume workshops, interview preparation sessions, and networking events to enhance their employability.

3. Engagement and Events:

- Participation in alumni-led events, workshops, and panel discussions to learn from industry professionals and alumni.
- Interest in attending reunions, networking mixers, and career fairs to build connections and explore career paths.

FACULTY :

1. Alumni Relations:

- Interest in maintaining relationships with alumni for guest lectures, collaborative research projects, and industry partnerships.
- Desire to engage alumni in mentorship programs, career development initiatives, and student support activities.

2. Professional Development:

- Access to alumni-led workshops, seminars, and conferences to stay updated on industry trends and best practices.
 - Opportunity to network with alumni for research collaborations, funding opportunities, and academic partnerships.
3. Student Support:
- Collaborating with alumni to provide mentorship, internship opportunities, and career guidance to students.
 - Leveraging alumni connections to enhance student recruitment, retention, and career placement outcomes.

PLATFORM FEATURES :

- Alumni Directory: Searchable directory with detailed alumni profiles and networking capabilities.
- Mentorship Programs: Tools for facilitating mentorship connections between alumni and students.
- Job Board: Platform for posting job opportunities, internships, and career resources.
- Events Calendar: Schedule of alumni events, reunions, workshops, and networking mixers.
- Content Sharing: Space for sharing articles, industry insights, and alumni success stories.
- Donation Portal: Online portal for alumni to contribute financially to their alma mater.
- Analytics Dashboard: Insights into user engagement, event attendance, and platform usage for administrators.

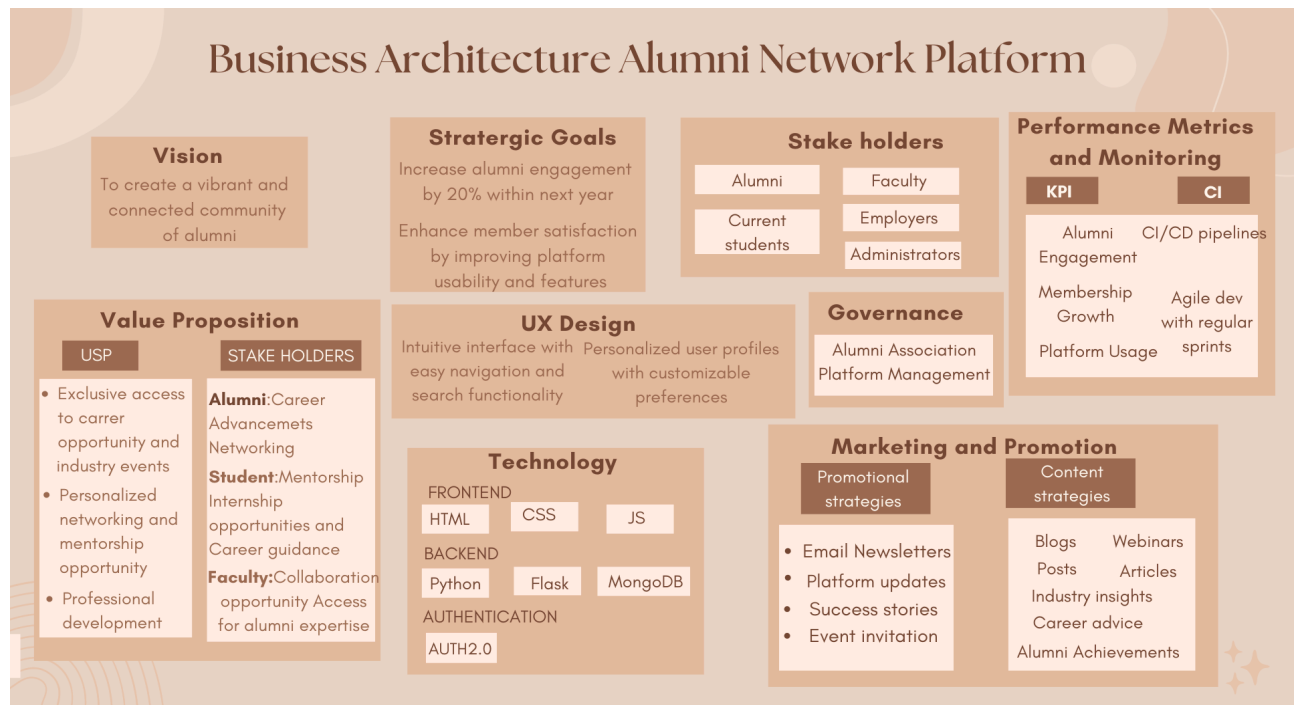
PROBLEMS FACED BY CURRENT SYSTEMS:

According to recent data, similar systems face challenges such as low user retention rates as low as 15% and a concerning 77% decrease in alumni reachability over 1-2 years. In contrast, our platform prioritizes meaningful connections among members, addressing these challenges effectively. By offering personalized content, mentorship opportunities, job boards, and internship listings, we facilitate professional growth and networking, significantly enhancing user engagement. Through a diverse range of initiatives including regular events, webinars, and newsletters, our platform ensures ongoing engagement, actively involving alumni, students, and faculty members. In comparison to other platforms, which struggle to maintain long-term engagement, our platform's initiatives have shown a substantial increase in user participation and interaction. By nurturing this strong sense of community and loyalty, we reinforce the bond between members and the institution, creating a lifelong support network that fuels personal and professional development.

EMPOWERING USERS : HOW IMPLEMENTATION ENHANCES USER EXPERIENCE

- **Interactive Features:** New additions such as real-time chat, virtual events, and personalized content feeds will make the platform more dynamic and relevant to users' individual interests and needs.
- **Improved Networking Opportunities:** Enhanced networking tools, including alumni directories, interest groups, and mentorship programs, will facilitate meaningful connections and professional development.
- **Regular Engagement Activities:** Implementation of webinars, newsletters, and alumni success stories will keep the community active and involved, ensuring ongoing interaction.
- **Data-Driven Personalization:** Leveraging data analytics, we will personalize the user experience, delivering relevant content and recommendations based on individual behavior and preferences.

BUSINESS ARCHITECTURE



BUSINESS NEED :

The business need revolves around transforming the current state of alumni engagement, which is often characterized by fragmented processes and limited digital platforms. Key aspects of the business need include:

- Enhanced Alumni Engagement:** There's a pressing need to significantly increase alumni engagement rates, aiming for a 20% improvement within the next year. The current level of engagement is insufficient, with alumni interactions often sporadic and lacking depth.
- Improved Member Satisfaction:** Member satisfaction with the existing platform is suboptimal due to usability issues and a lack of personalized features. By enhancing

platform usability and introducing new features, member satisfaction can be substantially improved.

3. **Creating a Vibrant Community:** The goal is to create a vibrant and connected community of alumni, students, and faculty members. This involves fostering meaningful connections, providing personalized networking opportunities, and facilitating ongoing engagement through various initiatives.
4. **Exclusive Access to Opportunities:** Alumni, students, and faculty members seek exclusive access to career opportunities, industry events, and mentorship programs. The platform should serve as a centralized hub for accessing these opportunities, thereby enriching the overall user experience.
5. **Professional Development:** Facilitating professional development is essential for alumni and students. The platform should offer resources such as career advice, job search assistance, and skill-building opportunities to support users in their professional growth.

BUSINESS PROCESSSS MANAGEMENT:

In accordance with modern workflow management practices, our platform utilizes automated processes to streamline operations and enhance efficiency. By leveraging automation, tasks such as communication, data processing, and event management are executed seamlessly, reducing manual intervention and optimizing resource utilization.

The alumni network platform operates seamlessly through a variety of automatic processes designed to enhance user experience and streamline operations. With automated event reminders, alumni stay informed about upcoming events without manual effort, ensuring they never miss out on important gatherings. Intelligent content recommendation algorithms deliver personalized content to alumni based on their interests and engagement history, offering a curated experience tailored to each user. Feedback collection is automated, with surveys and feedback forms sent automatically after events, enabling continuous improvement based on user input. Smart event registration simplifies the registration process, allowing alumni to sign up for events effortlessly with pre-filled forms or single-click registration buttons.

Mentor-matching algorithms connect alumni mentors with mentees based on shared criteria, fostering mentorship connections without manual intervention.

Auto-generated reports provide administrators with real-time insights into platform usage and effectiveness, enabling data-driven decision-making. Networking suggestions are automated, with machine learning algorithms suggesting potential connections based on shared interests and affiliations, facilitating networking opportunities with ease. Seamless integration with social media platforms allows for automatic syncing of alumni profiles, enabling effortless sharing of platform content and events, thereby expanding reach and engagement across various channels. These automatic features collectively ensure that the alumni network platform operates efficiently, providing a personalized and streamlined experience for users while minimizing manual effort from administrators.

DIFFERENT PERSONAS :

1. **Alumni:** Alumni primarily interact with the platform or newsletters to stay informed about events, job opportunities, and news from their alma mater. However, the lack of personalized features or interactive tools may limit their engagement, as they may not find the content relevant to their interests or needs.
2. **Students:** Students may use the platform to connect with alumni for career advice, mentorship, or networking opportunities. However, the passive nature of email newsletters and the limited functionality of digital platforms may hinder their ability to engage actively with alumni or access exclusive resources.
3. **Faculty/Staff:** Faculty and staff members play a crucial role in organizing alumni events, managing mentorship programs, and tracking engagement metrics. However, the reliance on automatic processes may limit their ability to facilitate meaningful interactions and engagement among alumni, students, and faculty.

BUSINESS PROBLEMS :

1. **Low Alumni Engagement:** The current automatic processes fail to effectively engage alumni, resulting in low participation rates in events, mentorship programs,

and other engagement initiatives. Automated platforms and newsletters may lack the interactivity and personalization needed to foster meaningful connections.

2. **Limited Member Satisfaction:** Alumni, students, and faculty may express dissatisfaction with the existing automatic platforms due to the passive nature of communication and the lack of personalized features. Without opportunities for active participation or exclusive access to resources, members may feel disconnected from the community.
3. **Fragmented Community:** The reliance on automatic processes may contribute to a fragmented community, where alumni, students, and faculty struggle to connect and collaborate effectively. Without opportunities for real-time interaction and engagement, the community may lack cohesion and a sense of belonging.

USER STORY

1. User Registration and Authentication

Description: As an alumnus, I want to register and create a profile so that I can join the network and access its features. This will enable me to connect with other alumni and participate in the community.

Acceptance Criteria:

- The registration form includes fields for name, email, graduation year, degree, and major.
- The system sends a verification email upon registration to confirm the user's email address.
- Users can log in securely using their email and password.
- Users can reset their password through a "Forgot Password" link, which sends a reset email.

2. Profile Management

Description: As an alumnus, I want to update my profile with personal and professional information so that I can keep my information current and relevant. This helps other alumni find and connect with me based on my updated profile.

Acceptance Criteria:

- Users can edit profile fields such as name, contact information, biography, professional experience, skills, and interests.
- Users can upload and change their profile picture.
- Privacy settings allow users to control who can see different parts of their profile.

3. Networking and Connections

Description: As an alumnus, I want to connect with other alumni so that I can build my professional network and stay in touch with peers. Networking is essential for career growth and maintaining relationships.

Acceptance Criteria:

- The platform provides a search functionality to find other alumni by name, graduation year, degree, industry, and location.
- Users can send and accept connection requests.
- A direct messaging system allows users to communicate with their connections.
- Users receive notifications for new connection requests and messages.

4. Groups and Events

Description: As an alumnus, I want to join interest-based groups and participate in events so that I can engage with alumni who share similar interests. This fosters community engagement and provides opportunities for networking and learning.

Acceptance Criteria:

- Users can create and join groups based on common interests, industries, or locations.
- The platform supports event creation and management, including RSVP functionality.
- Calendar integration provides event reminders.
- Groups have discussion forums for ongoing conversations among members.

5. Job Board and Career Support

Description: As an alumnus, I want to access job postings and career resources so that I can advance my career and help others do the same. A dedicated job board and resources enhance career development and networking opportunities.

Acceptance Criteria:

- A job board is available for posting and searching for job opportunities.
- Users can access career resources such as articles, webinars, and mentorship programs.
- Users can opt to receive job alerts based on their profile preferences.
- Tools for building resumes and cover letters are available.

6. Content Sharing and Updates

Description: As an alumnus, I want to share news, updates, and content with the community so that I can stay engaged and informed. Sharing content helps maintain active participation and keeps the community vibrant.

Acceptance Criteria:

- A newsfeed feature allows users to share articles, updates, and personal achievements.
- Users can comment on and like posts.
- An admin approval process ensures that official updates are moderated.
- Users can subscribe to newsletters for regular updates.

7. Analytics and Reporting

Description: As an admin, I want to access analytics and reports so that I can understand user engagement and improve the platform. Analytics help in making informed decisions to enhance user experience.

Acceptance Criteria:

- An admin dashboard provides metrics on user registration, activity, and engagement.
- Reports highlight popular groups, events, and job postings.
- Tools are available for collecting and analyzing user feedback.

8. Mobile Accessibility

Description: As an alumnus, I want to access the platform from my mobile device so that I can stay connected on the go. Mobile accessibility ensures that users can engage with the platform anytime, anywhere.

Acceptance Criteria:

- The platform is designed to be responsive for mobile browsers.
- A native mobile app is available for iOS and Android.
- Users receive push notifications for important updates and messages.

9. Security and Privacy

Description: As an alumnus, I want to ensure my data is secure and my privacy is respected so that I feel safe using the platform. Security and privacy are critical for user trust and engagement.

Acceptance Criteria:

- Data encryption is implemented for protecting sensitive information.
- The platform complies with GDPR and other relevant privacy regulations.
- Regular security audits and updates are conducted.
- Users have control over data sharing and privacy settings.

NON FUNCTIONALITY REQUIREMENTS :

1. Scalability

- **Description:** The platform must be able to handle an increasing number of users and data volume without performance degradation.
- **Requirement:** The system should support at least 10,000 concurrent users and handle up to 1 million registered users without noticeable performance issues.

2. Security

- **Description:** The platform must ensure that user data is protected against unauthorized access and breaches.
- **Requirement:** Implement end-to-end encryption for all data transmission and storage. Regularly update and patch the system to address security vulnerabilities. Ensure compliance with GDPR and other relevant data protection regulations.

3. Availability

- **Description:** The platform should be reliably available to users with minimal downtime.
- **Requirement:** Achieve at least 99.9% uptime, ensuring the platform is accessible 24/7. Implement failover mechanisms and redundant systems to handle server failures.

4. Performance

- **Description:** The platform must provide fast and responsive interactions to ensure a positive user experience.
- **Requirement:** Page load times should be under 3 seconds for 95% of user requests. The system should process search queries and user actions within 2 seconds on average.

5. Usability

- **Description:** The platform must be user-friendly and intuitive to encourage regular use and engagement.
- **Requirement:** Conduct usability testing with a target of achieving a System Usability Scale (SUS) score of at least 80. Ensure the user interface is accessible, with compliance to WCAG 2.1 standards for accessibility.

POKER PLANNING ESTIMATION

User Registration and Authentication

- **Effort Estimate:** 8 story points
- **Reasoning:** Includes form creation, email verification, secure login, and password reset functionality.

Profile Management

- **Effort Estimate:** 5 story points
- **Reasoning:** Covers editing profile fields, uploading profile pictures, and setting privacy controls.

Networking and Connections

- **Effort Estimate:** 13 story points
- **Reasoning:** Involves search functionality, connection requests, direct messaging, and notifications.

Groups and Events

- **Effort Estimate:** 8 story points
- **Reasoning:** Requires group creation, event management, calendar integration, and discussion forums.

Job Board and Career Support

- **Effort Estimate:** 13 story points
- **Reasoning:** Includes job postings, career resources, job alerts, and resume building tools.

Content Sharing and Updates

- **Effort Estimate:** 8 story points
- **Reasoning:** Entails newsfeed, sharing articles, commenting, liking posts, and admin moderation.

Analytics and Reporting

- **Effort Estimate:** 5 story points
- **Reasoning:** Provides admin dashboard, user engagement metrics, popular content reports, and feedback tools.

Mobile Accessibility

- **Effort Estimate:** 13 story points
- **Reasoning:** Ensures platform responsiveness, native mobile apps, and push notifications.

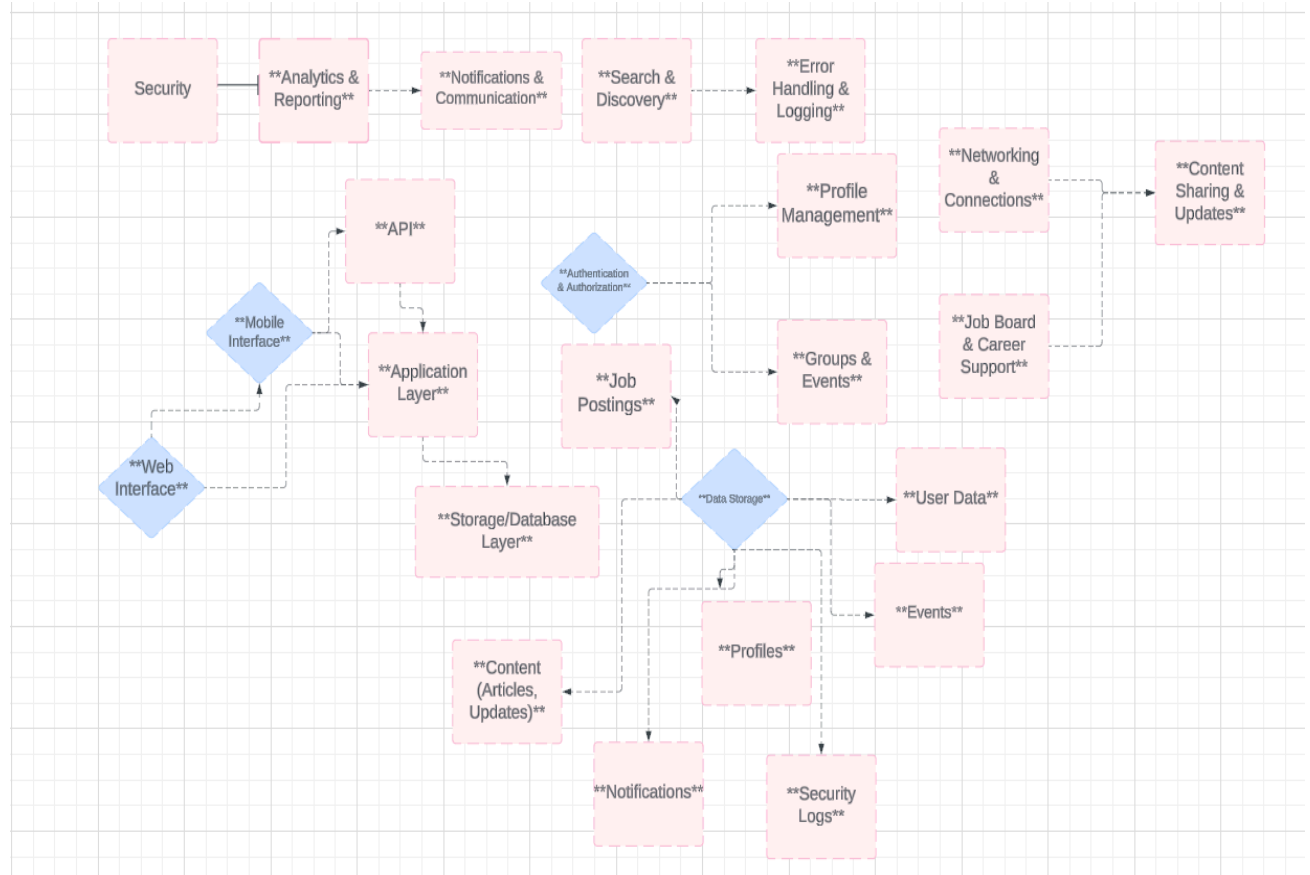
Security and Privacy

- **Effort Estimate:** 8 story points
- **Reasoning:** Implements data encryption, GDPR compliance, security audits, and user privacy settings.

Scalability and Performance

- **Effort Estimate:** 8 story points
- **Reasoning:** Ensures the platform handles high user loads, maintains performance, and includes failover mechanisms.

ARCHITECTURE DIAGRAM



ARCHITECTURE PATTERN USED AND WHY:

Architecture Pattern: Microservices Architecture

Description: The Alumni Network Platform employs a Microservices Architecture, which structures the application as a collection of loosely coupled services. Each service corresponds to a specific module or functionality, such as user authentication, profile management, job board, and analytics. These services communicate with each other via well-defined APIs.

Reasons for Using Microservices Architecture:

1. Scalability:

- Microservices can be scaled independently based on demand. For example, the job board service can be scaled separately if job postings and searches experience high traffic, without affecting the performance of other services like user authentication or profile management.

2. Flexibility:

- Different services can be developed, deployed, and maintained independently. This flexibility allows for continuous deployment and integration, facilitating frequent updates and improvements without causing system-wide disruptions.

3. Resilience:

- The isolation of services ensures that the failure of one service does not impact the entire system. This enhances the overall reliability and availability of the platform.

4. Technology Diversity:

- Each microservice can be developed using the most appropriate technology stack for its specific requirements. For instance, the analytics service might use a different database or programming language compared to the content sharing service.

5. Organizational Alignment:

- Development teams can be organized around different microservices, enabling more focused and efficient workflows. Teams can work on specific services, enhancing expertise and speeding up development cycles.

DESIGN PRINCIPLE USED AND WHY :

1. Single Responsibility Principle (SRP):

Description: Each microservice or module in the platform is designed to handle a specific responsibility or functionality. For instance, the authentication service only manages user authentication and authorization, while the profile management service handles user profiles.

Why:

- **Maintainability:** Having a single responsibility per service simplifies code management and reduces complexity.
- **Testability:** Services with a single responsibility are easier to test and debug, ensuring higher quality and reliability.

2. Open/Closed Principle (OCP):

Description: Services are designed to be open for extension but closed for modification. New functionalities can be added by extending existing services or creating new ones without modifying the existing codebase.

Why:

- **Extensibility:** The platform can easily adapt to changing requirements and new features without risking existing functionalities.
- **Stability:** Minimizes the risk of introducing bugs or issues when new features are added.

3. Separation of Concerns (SoC):

Description: Different functionalities and concerns are separated into distinct services. For example, user interface concerns are handled by the UI layer, while business logic is managed by the application layer, and data storage concerns are addressed in the database layer.

Why:

- **Clarity:** Clear separation makes the system easier to understand and manage.

- **Reusability:** Services can be reused across different parts of the application, enhancing efficiency and reducing duplication.

4. Dependency Injection:

Description: Services depend on abstractions (interfaces) rather than concrete implementations. Dependencies are injected at runtime, allowing for greater flexibility and easier testing.

Why:

- **Testability:** Simplifies unit testing by allowing mock dependencies to be injected.
- **Flexibility:** Enables the platform to switch between different implementations of a service without changing the consuming code.

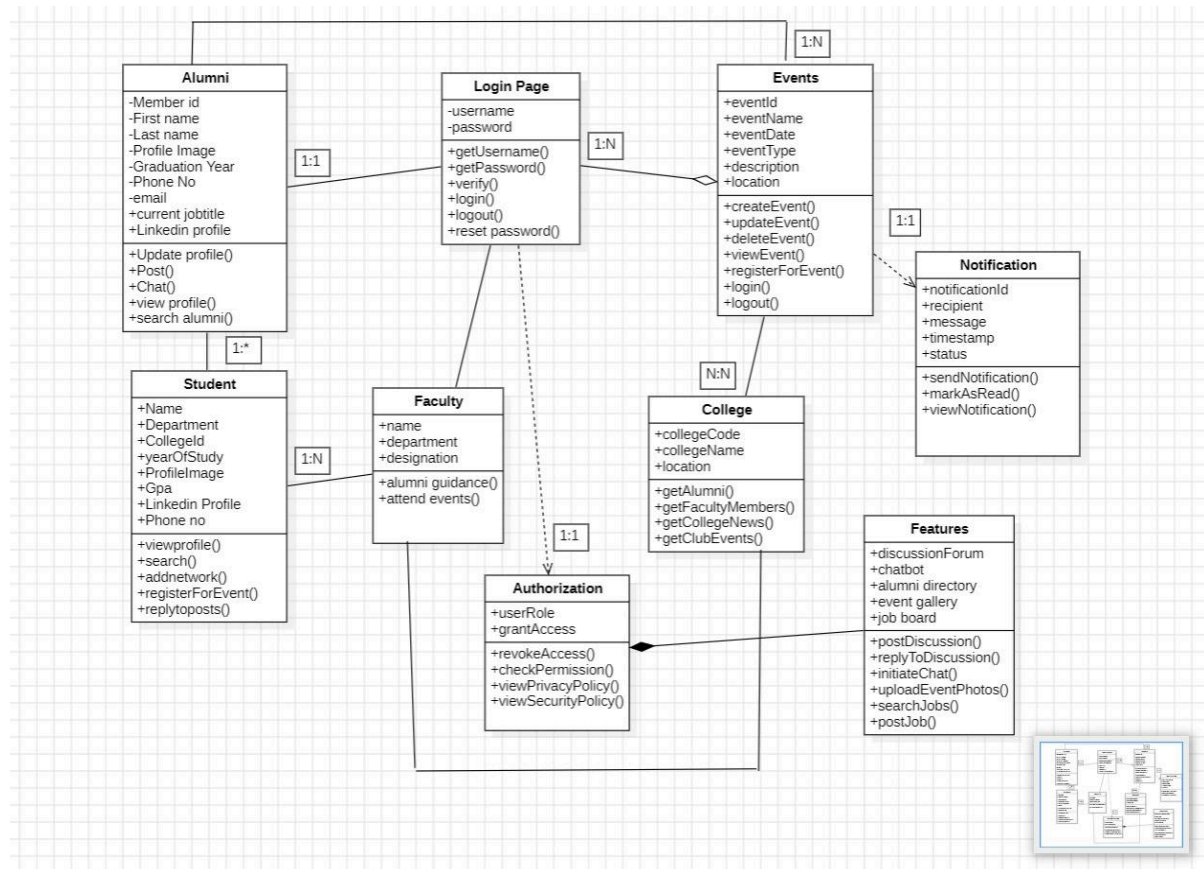
5. Encapsulation:

Description: Each service encapsulates its own data and functionality, exposing only necessary operations via APIs.

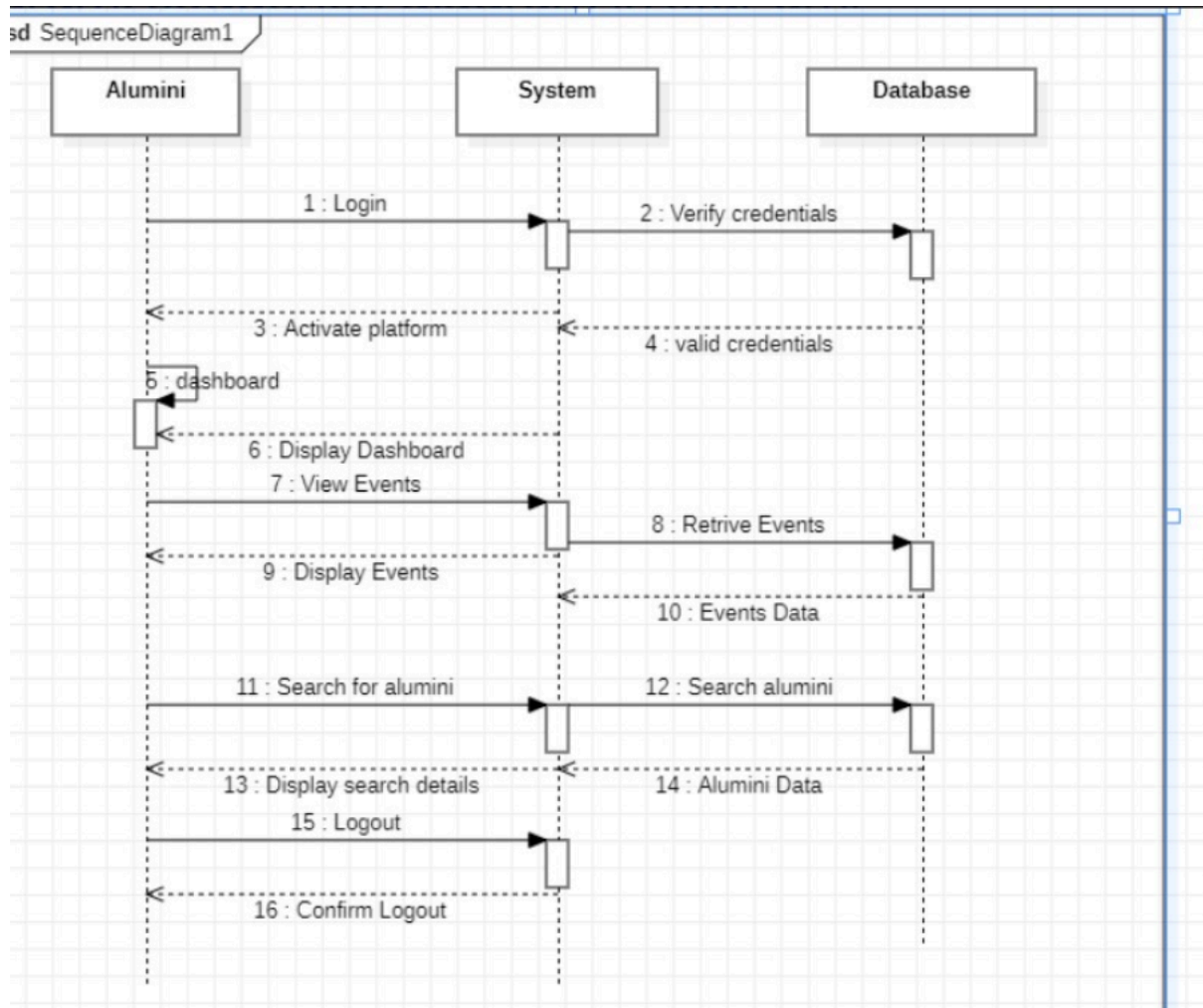
Why:

- **Security:** Encapsulation ensures that internal data and operations are hidden from external access, reducing security risks.
- **Modularity:** Promotes modular design, where each service operates independently, enhancing maintainability and scalability.

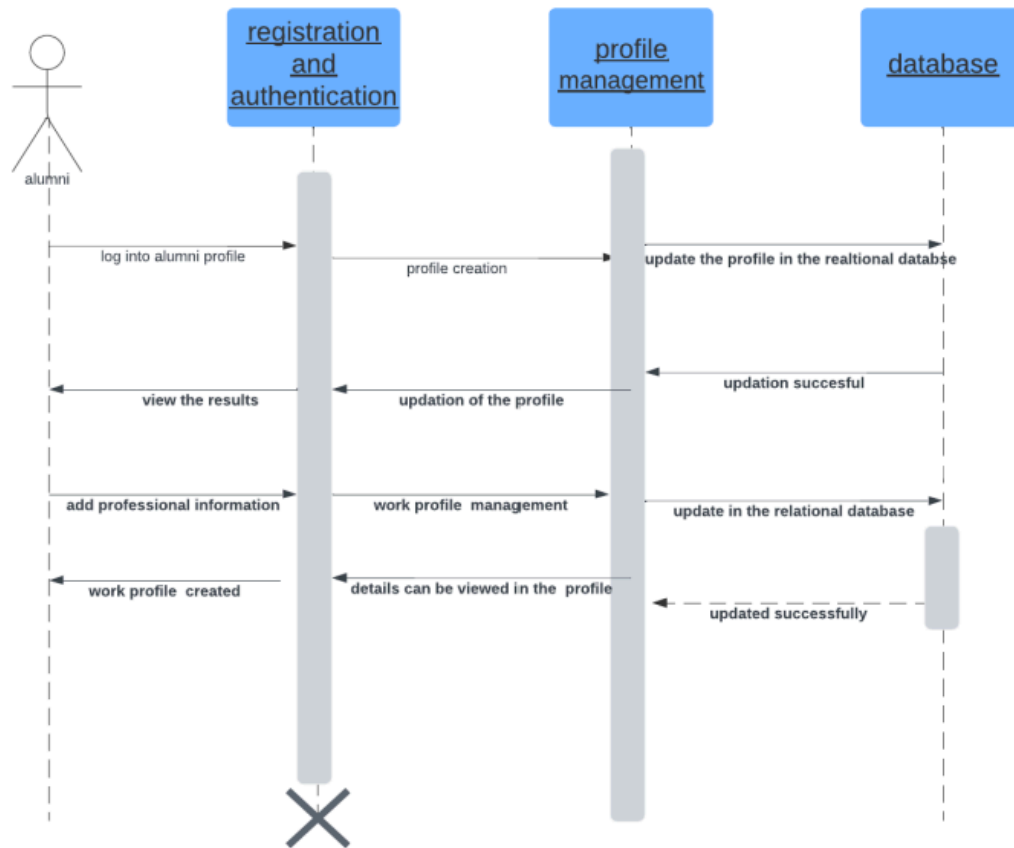
CLASS DIAGRAM

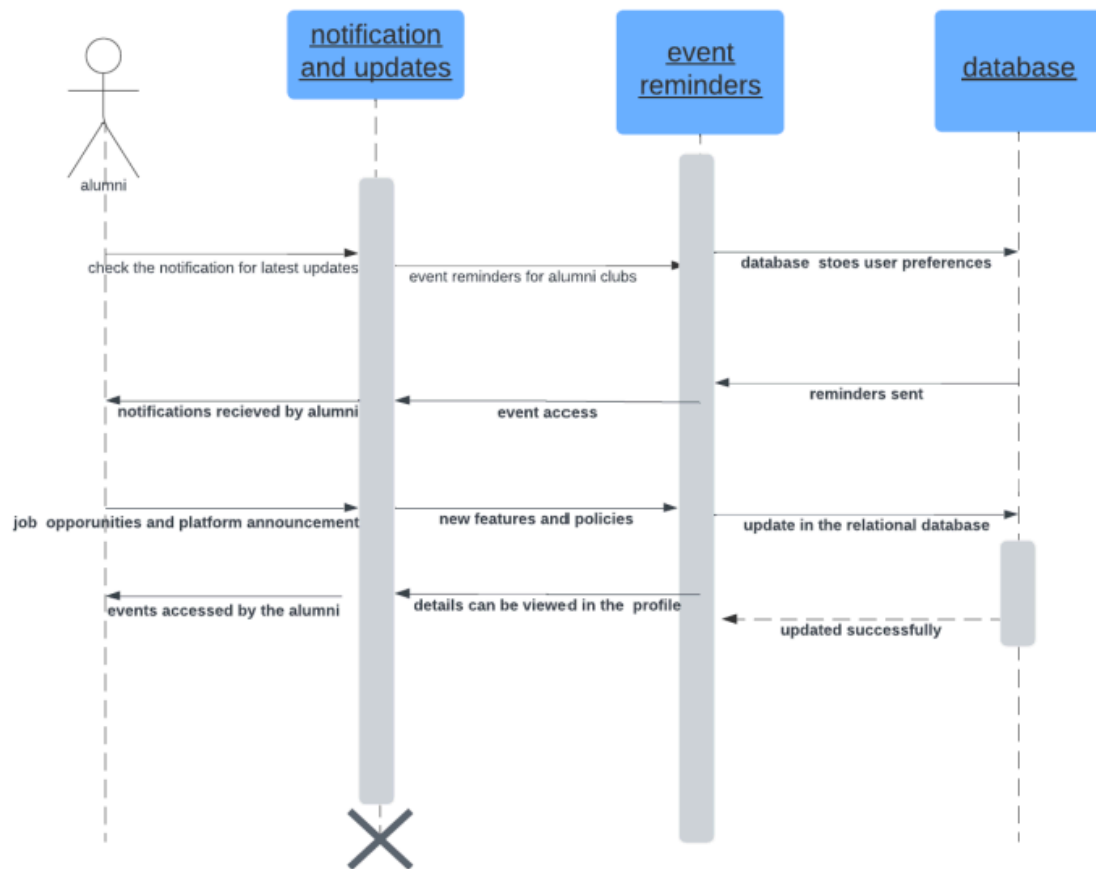


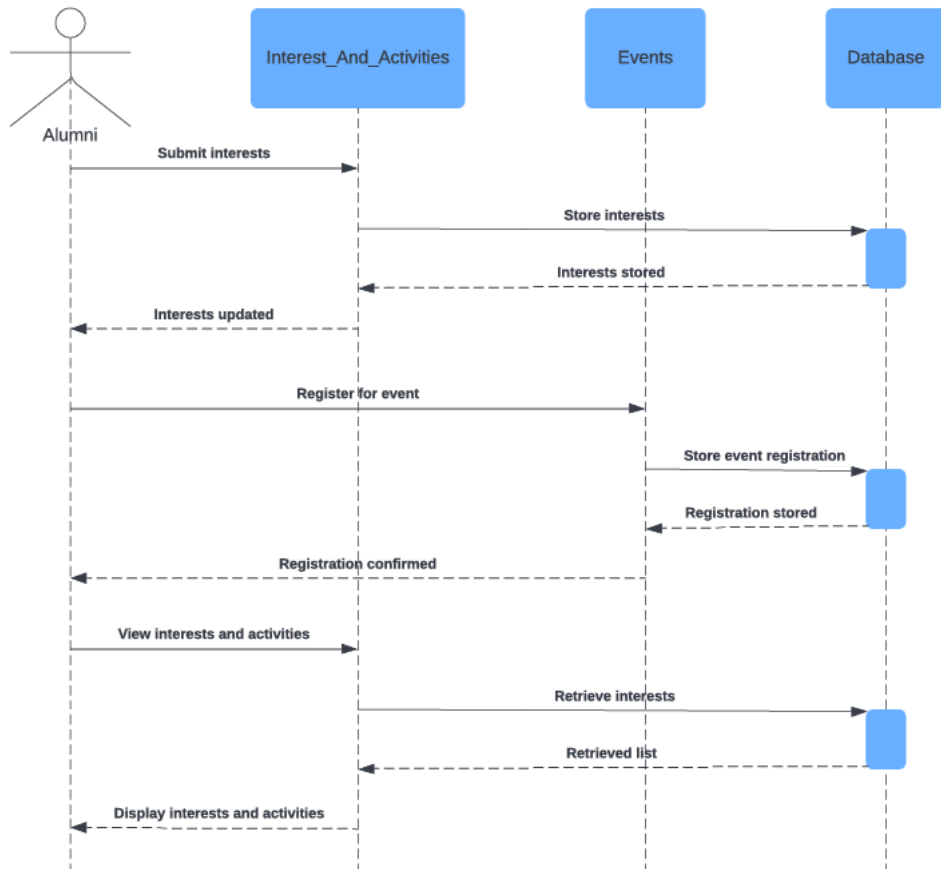
SEQUENCE DIAGRAM



SEQUENCE DIAGRAM FOR USER STORIES







TEST STRATEGY

Documenting Test Plans:

The test strategy for the Alumni Network Platform will encompass various testing types, including unit testing, integration testing, system testing, and acceptance testing. Each phase of testing will focus on ensuring the functionality, reliability, performance, and usability of the system.

Test Cases for User Stories

User Story 1: User Registration

Happy Path:

1. Navigate to the registration page.
2. Enter valid name, email, graduation year, degree, and major.
3. Click on the "Register" button.
4. Verify that the user receives a verification email.
5. Click on the verification link in the email.
6. Verify that the user is redirected to the login page.
7. Enter valid email and password to log in.

Error Scenarios:

1. Navigate to the registration page.
2. Enter an already registered email.
3. Enter other valid details.
4. Click on the "Register" button.
5. Enter a password with fewer than 6 characters.
6. Verify that the appropriate error message is displayed.

User Story 2: Profile Management

Happy Path:

1. Log in to the system.
2. Navigate to the profile management page.
3. Update the profile fields (e.g., name, contact information, biography, professional experience, skills, and interests).
4. Click on the "Save" button.
5. Verify that the profile information is updated and displayed correctly.

Error Scenario:

1. Log in to the system.
2. Navigate to the profile management page.
3. Enter invalid data in one or more fields (e.g., an extremely long biography, an invalid phone number format).
4. Click on the "Save" button.
5. Verify that appropriate error messages are displayed for the invalid fields.

User Story 3: Networking and Connections

Happy Path:

1. Log in to the system.
2. Search for an alumnus using valid criteria.
3. Click on the "Connect" button next to an alumnus profile.
4. Verify the connection request is sent.

Error Scenarios:

1. Log in to the system.
2. Navigate to the search page.
3. Leave one or more search criteria fields blank.
4. Click on the "Search" button.

User Story 4: Groups and Events

Happy Path:

1. Log in to the system.
2. Navigate to the "Groups" section.
3. Click on the "Create Group" button.
4. Enter group details (name, description, interest/industry/location).
5. Click on the "Create" button.

Error Scenarios:

1. Navigate to the "Events" section without logging in.
2. Attempt to RSVP to an event.

Additional Test Cases

User Story 5: Job Board and Career Support

Happy Path:

1. Log in to the system.
2. Navigate to the job board.
3. Search for job opportunities using valid criteria.
4. Click on a job posting to view details.
5. Apply for a job by submitting a resume and cover letter.

Error Scenarios:

1. Log in to the system.
2. Navigate to the job board.
3. Leave all search criteria fields blank.
4. Click on the "Search" button.
5. Attempt to apply for a job without uploading a resume.

User Story 6: Content Sharing and Updates

Happy Path:

1. Log in to the system.
2. Navigate to the newsfeed section.
3. Share a new article or update.
4. Verify that the content is displayed on the newsfeed.
5. Like and comment on a post.

Error Scenarios:

1. Log in to the system.
2. Navigate to the newsfeed section.
3. Share content with an invalid URL or excessively long text.
4. Verify that appropriate error messages are displayed.

User Story 7: Analytics and Reporting

Happy Path:

1. Log in to the admin dashboard.
2. View user registration and engagement metrics.
3. Generate a report for user activity.
4. Analyze popular groups, events, and job postings.

Error Scenarios:

1. Log in to the admin dashboard.
2. Attempt to generate a report with invalid date ranges.
3. Verify that the system displays appropriate error messages.

User Story 8: Mobile Accessibility

Happy Path:

1. Access the platform from a mobile device.
2. Log in to the system.

3. Navigate through different sections (profile, job board, groups, etc.).
4. Verify that the UI is responsive and functions correctly.

Error Scenarios:

1. Access the platform from a mobile device with a weak internet connection.
2. Verify that the system handles connectivity issues gracefully.

User Story 9: Security and Privacy

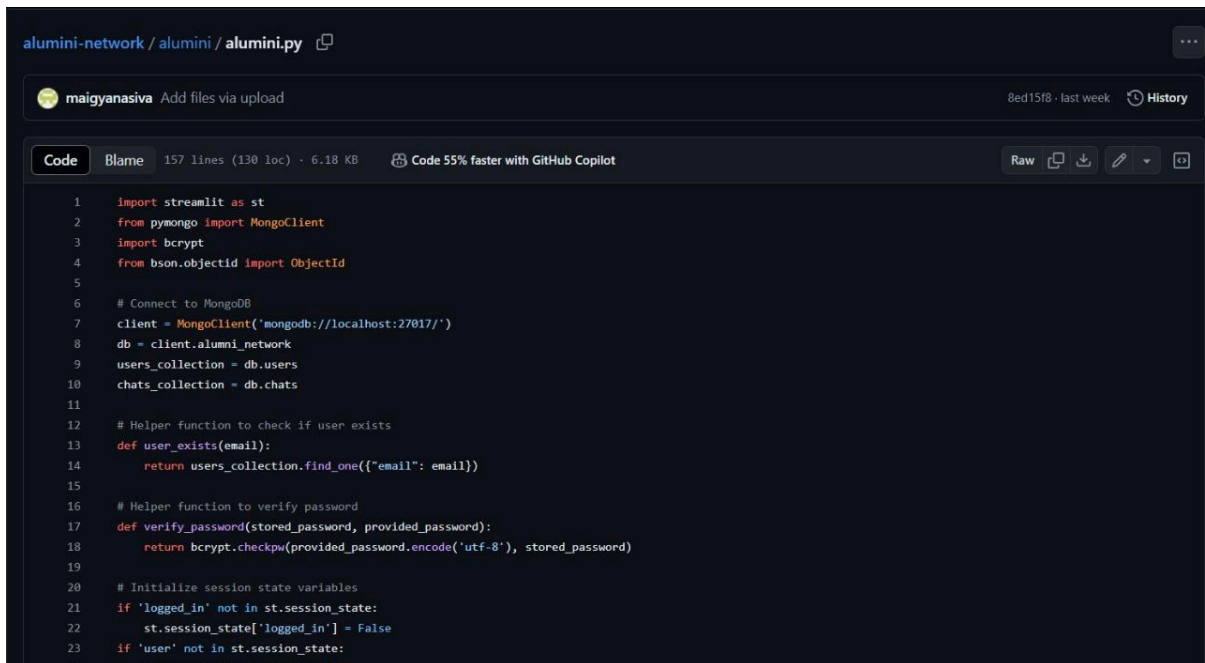
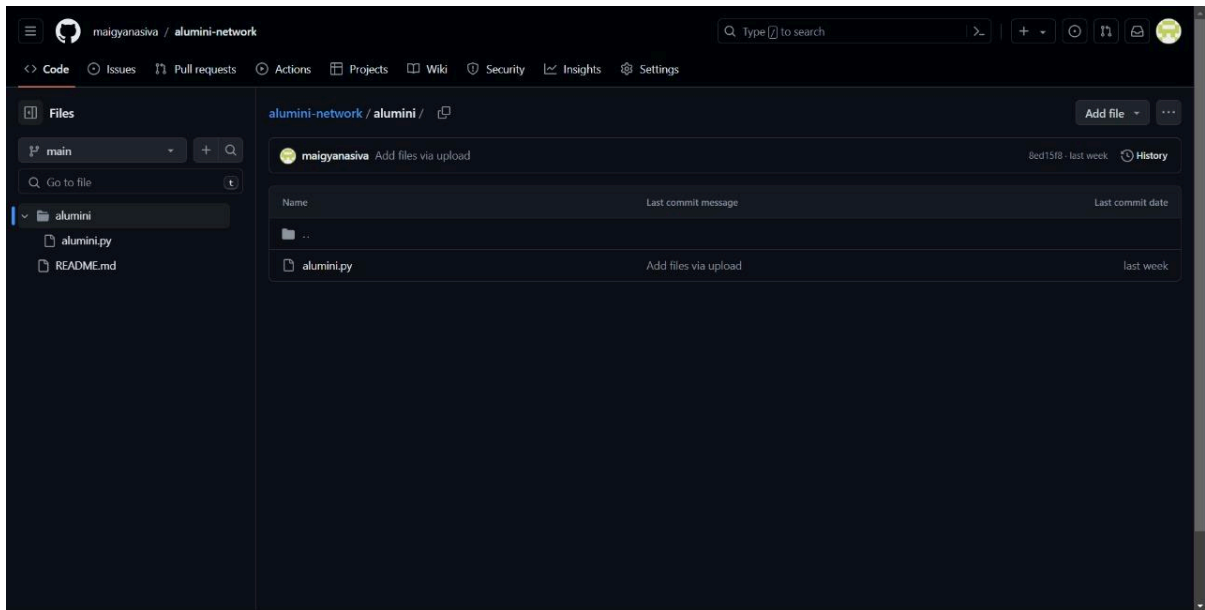
Happy Path:

1. Log in to the system.
2. Navigate to the account settings.
3. Update privacy settings to control data sharing.
4. Verify that the changes are saved and applied correctly.

Error Scenarios:

1. Log in to the system.
2. Attempt to access another user's profile or data without authorization.
3. Verify that the system denies access and displays appropriate error messages.

GITHUB REPOSITORY VIEW




```

26 # Streamlit App
27 st.title("Alumni Network Platform")
28
29 menu = ["Home", "Register", "Login", "Profile", "Search", "Chat", "Logout"]
30 choice = st.sidebar.selectbox("Menu", menu)
31
32 if choice == "Home":
33     st.subheader("Welcome to the Alumni Network Platform")
34
35 elif choice == "Register":
36     st.subheader("Register")
37
38     name = st.text_input("Full Name")
39     email = st.text_input("Email")
40     password = st.text_input("Password", type='password')
41     batch = st.text_input("Batch")
42     major = st.text_input("Major")
43
44     if st.button("Register"):
45         if user_exists(email):
46             st.error("User already exists. Please login.")
47         else:
48             hashed_password = bcrypt.hashpw(password.encode('utf-8'), bcrypt.gensalt())
49             users_collection.insert_one({"name": name, "email": email, "password": hashed_password, "batch": batch, "major": major})
50             st.success("You have successfully registered. Please login.")
51
52 elif choice == "Login":
53     st.subheader("Login")
54
55     email = st.text_input("Email")
56     password = st.text_input("Password", type='password')
57
58     if st.button("Login"):
59         user = user_exists(email)

```

DEPLOYMENT ARCHITECTURE

