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1. User Investigation

1.1. PACT Analysis

People

People involved in this Messaging App is focused on several groups. **Undergraduate student** is the primary user of this messaging app who is able to perform different actions. **Academics** is the facilitator, while **Administrative staff** provides support and **Admin** oversees the overall operations. Below explains their corresponding goals:

Undergraduate student

- Interact with peers to seek academic help
- Access to knowledge repository for useful learning materials, and access to discussion forums
- Send and receive message, create or join chatrooms for group chat
- Manage friend list with friend requests

Academic staff

- Provide academic support to students
- Share content on knowledge repository
- Authorized to facilitate knowledge repository such as modify articles
- Access to chatrooms alongside with send or receive message

Administrative staff

- Manage user accounts such as mute or unmute users if required
- Make any announcements on knowledge repository

Admin

- Manage overall user accounts
- Access to user profile and assign roles, remove users
- Manage high-level knowledge repository system such as have the right to perform all actions

Activities

Sending/Receiving Messages

Two main types of messaging methods are supported, one-to-one and group messaging. The system supports the functionality regardless of the users are online or offline. When users are online, they receive real-time updated messages, while offline users receive and store messages as message history. If there are unread messages, the users receive notifications from either both direct message or group message.

Managing Friends

Users are able to manage their friend list with three main basic functionalities. Friends can be added by searching their username in order to send friend requests. Users are also able to approve or reject to the requests accordingly. Conversely, added friends can be removed. Status of the approved friends can be viewed.

Sharing on Knowledge Repository

The users are able to share any relevant experiences or resources on the repository platform that is accessible to everyone. The users can create and modify own articles, along with comment on articles. However, only unmuted users are allowed to do so. Unique functionality is also designed for users to post privately such that created content are only visible to staff team and self whenever needed.

Managing Knowledge Repository

The staffs are authorized to perform moderation if needed. For instance, authorized user level is able to perform actions such as articles or users removal, roles assignations and more.

Context

The system acts as a helpful communication and collaboration tool that serves different purposes for the users whenever needed in academic settings. The system can be accessed anytime (before, during, or after semester) and anywhere (in-campus or off-campus) as long as there is internet access. Based on users' own preferences, the time spent on the system can vary, ranging from just a couple minutes to even longer periods. This depends on the users' requirements.

Technologies

The web-based application can be accessed as long as there is stable internet connection. It can be easily accessed via different types of devices such as desktops, laptops, tablets, or mobile phones. Desktops or laptops are for users who prefer to perform tasks such as creating articles, while mobile devices can be used when users prefer to engage in casual chats, or access information from the knowledge repository easily. In terms of the back-end development (server-side), Python with Flask framework is utilized, alongside with database for storing any required data securely. Security measures are also implemented to ensure the security of user's private information and data transmission.

1.2. User Investigation Process

PACT analysis and surveys are conducted for better understanding the target users. This is also aimed to gain insights on the users' requirements and expectations from the application. A few undergraduate Computer Science students within 18 to 24 age group filled out the online survey. One-to-one interview was also involved with a sample of 2 students for getting more reliable qualitative data. Though the design focuses on Student as target user, certain features are covered to support Staff roles.

1.3. Research Materials

The users survey created using Google Form was attached on Edstem platform of this unit. The interview was conducted via physical conversation. Main points from the interview were taken down in note forms, and converted into the users survey responds, so that this helps to provide data in terms of the target group's expectations as in desirable features, challenges with existing application and operational limitations. The list below shows the result of the users survey and interview.

- What is your role within USYD?

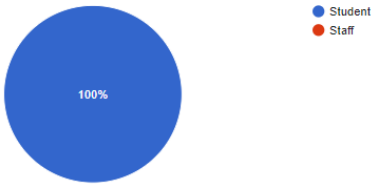


Figure 1: All the participants are considered "Student"

- What is your age?

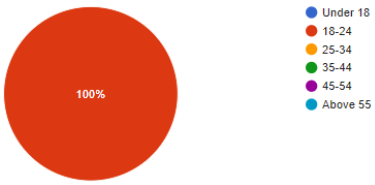


Figure 2: All the participants are aged between 18 and 24

- How often do you use Ed?

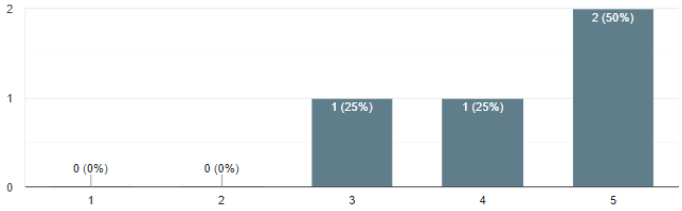


Figure 3: Most participants uses daily, some people use often and occasionally

- What devices do you typically use to access Ed?

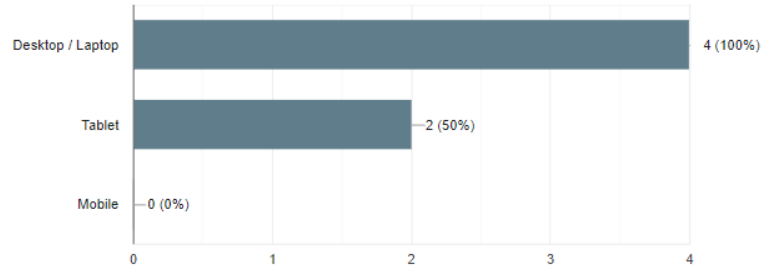


Figure 4: "Desktop/Laptop" and "Tablet" are the most used devices to access Ed

- What are your primary goals when using Ed?

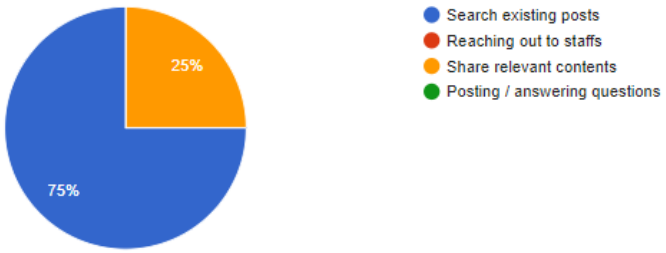


Figure 5: Most testers aimed to search existing posts, some to share relevant contents

- What features would you like / wish on Ed to better serve your needs?

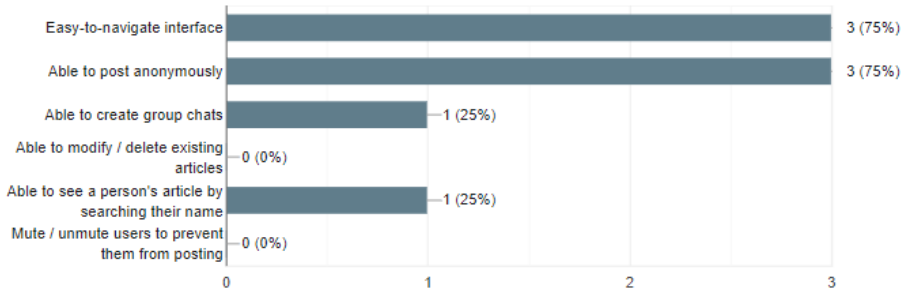


Figure 6: Participants' top preferences features are simple UI, anonymous posting

- What features of Ed do you dislike, or feel could be improved?

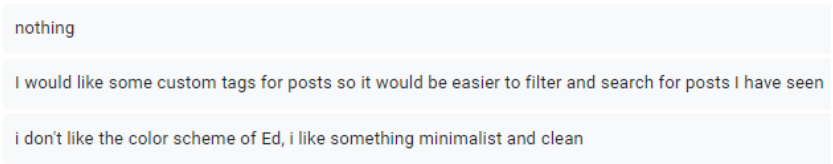


Figure 7: Suggestions on existing tools features

1.4. Persona Document

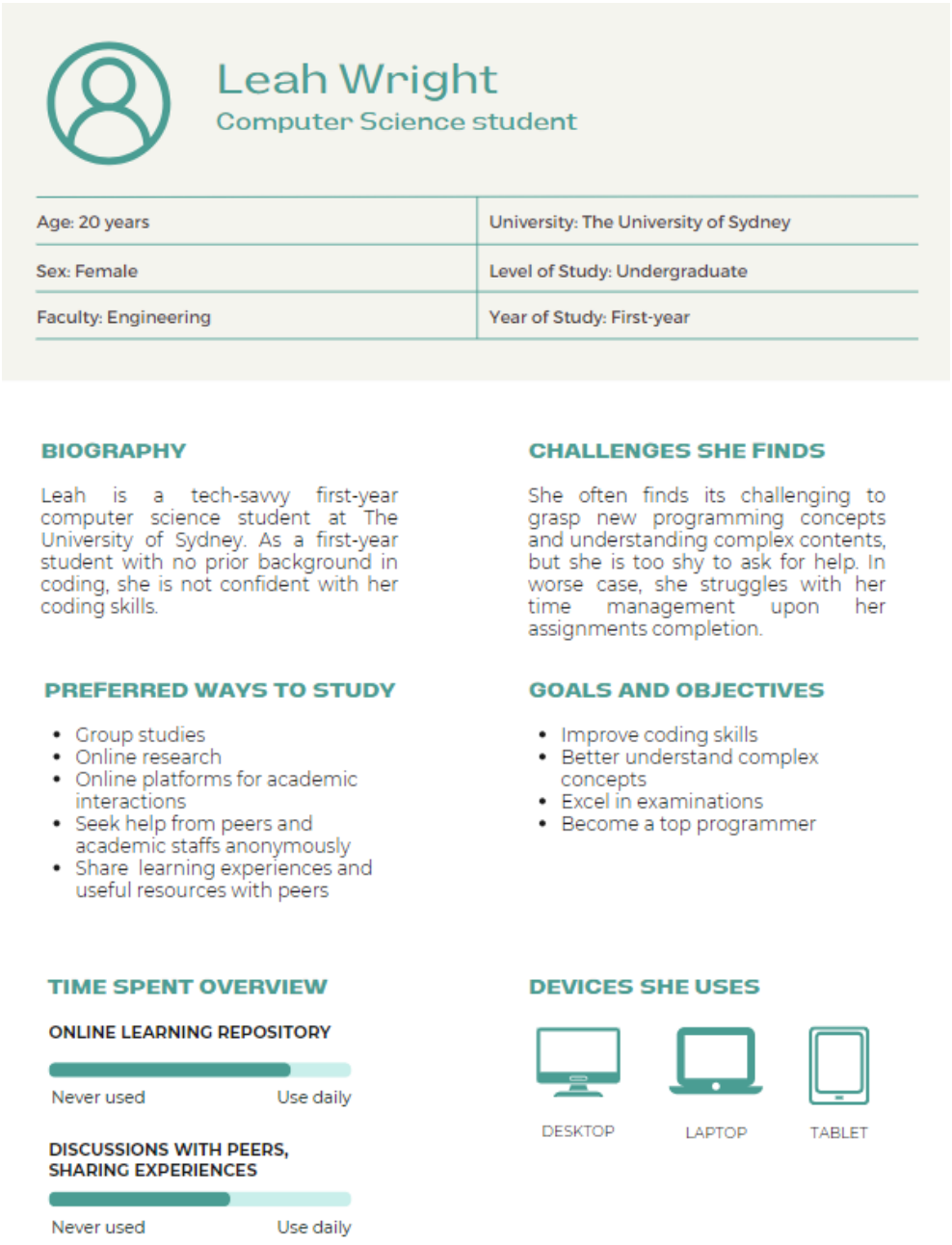


Figure 8: Persona Documentation on a first-year CS student

The analysis highlights the importance of the persona's preferences of an interactive learning opportunity to learn and seek help from peers and academic parties. It is also revealed that asking questions unidentified would be beneficial.

1.5. Content Collection

Based on my findings when researching about the target persona and as introduced by (Alshammary and Alhalafawy, 2023) [1], it is interesting to understand that digital platforms that are equipped with interactive tools such as Canvas and Edstem actually encourage cooperative learning. In which, this motivates the implementation of similar features and functionalities in the application.

The current messaging features could potentially be enhanced to reference these interactions, such that supporting active engagements and interactions. It can also act as a handy tool for live chat and group chat that provide a cooperative learning mechanism for supporting the users academically. On the other hand, the knowledge repository focused on being an interactive platforms for different parties such as the students and the mainly the academics to support engagements.

Through this platform, the users are able to share any relevant academic experiences or struggles. For instances, students can post what they find challenging on certain topics. This can help them to seek help via the platform, or conversely, some useful tips can be shared to the others. Whenever the students seek help or clarification on academic needs, say understanding confusing concepts, this knowledge repository provides the students the platform to do so. Moreover, The availability of chatrooms offers the users to have discussions with peers or academic staffs.

As being mentioned by (Sulissusiawan and Salam, 2017) [2] in regards of learners requiring an active and interactive environment, in which students interacting through resources and with other people. It is also mentioned that students are able to build their knowledge, potentially through online communication participation with the help of online tools. As such, this could refers to the application will potentially help supporting the students in the academic settings by enabling online communication and knowledge-based platforms.

Security is one of the keys in an application development. I understand that this is crucial for user account permissions system to ensure security and compliance. To achieve this, user access are controlled by defining levels of users hierarchically. In our case, the top-level is Admin, followed by the Administrative staff, coming down to Academics, and finally the students. Some key elements should be implemented for enhancing the overall security, through user authentication, access control and user management (Soni, n.d.) [3].

2. Navigation design

2.1. Sitemap

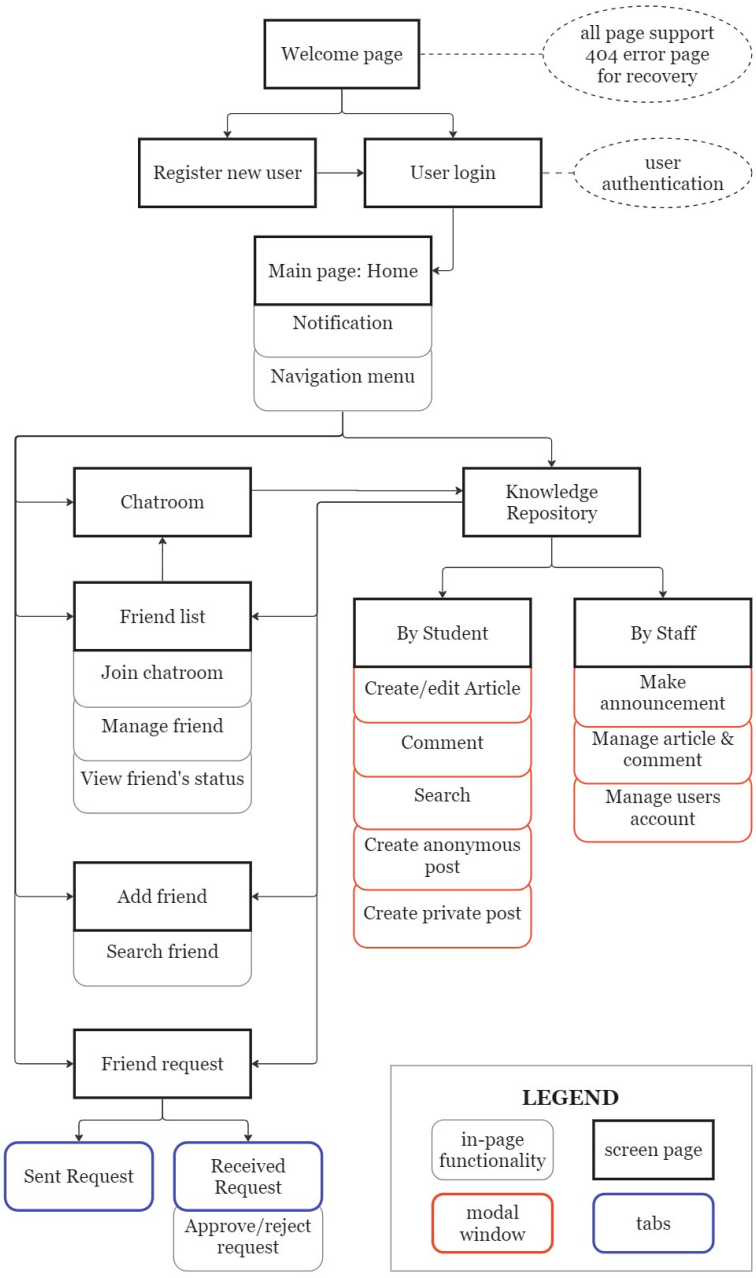


Figure 9: Sitemap of the messaging app

2.2. Card sorting session

Open Card Sorting

Figure 10: Open card sorting

Closed Card Sorting

Figure 11: Closed card sorting

By comparing both open and closed card sorting, we can see a "Security Features" category was defined by the group A. However, the cards contained are actually defined under "Functionality" section in closed card sorting. Besides, group B categorized "AI help desk" under "User Experience" in open card but Group A put it under "Bach-end processes" in closed card. This suggested that they might see it as an advantage over technical part. There is also inconsistency where "Data validation" is put under "Features" in open card, while it was categorized as "Back-end processes" in closed card. This suggested that different ways of interpretations would be made, and this will need to be analyzed closely for aligning the user's understanding.

2.3. Information architecture of website

The application's structure is designed as simple as possible to enhance learnability. Utilizing an easy-understandable navigation menu, users can understand the overall layout and how it is structured without difficulties. A sitemap was generated for users to better understand the structure of the messaging app.

Specific features and functionalities are designed for ensuring the users' objectives are met. For instance, features such as search, posting privately or anonymously were planned to be designed. These were intended to enhance the overall efficiency, whereby the users are able to safe time looking for information they need.

The messaging app was also designed to ensure memorability. Simple user interface design with no complicated context of usability, this is to ensure the users are able to remember the way to use or navigate through the website even when they return after a long period. Besides, it was also designed with consistent layout and aesthetic color scheme, alongside with a navigation menu to improve memorability.

Throughout the entire development, meaningful error messages were used in order to handle error recovery. 404 error page was also implemented in case of any unexpected errors prompted, whereby the users are able to recover from an invalid URL link.

User satisfaction was prioritized by improving the overall design. By focusing on the expected functionalities and features, they were focused to meet the users' satisfaction. Furthermore, data security was prioritized and specific features such as the availability to post privately or without revealing identity were to ensure security. User satisfaction was also aimed by designing an appealing user interface and simple navigation. Conversely, user testings were conducted iteratively to gather feedback to pin point any improvements and errors. This was also aimed to develop an application that is able to fulfil the users' expectations and objectives.

Information Architecture diagram was created for enabling better understanding of the overall design in terms of the concepts of usability.

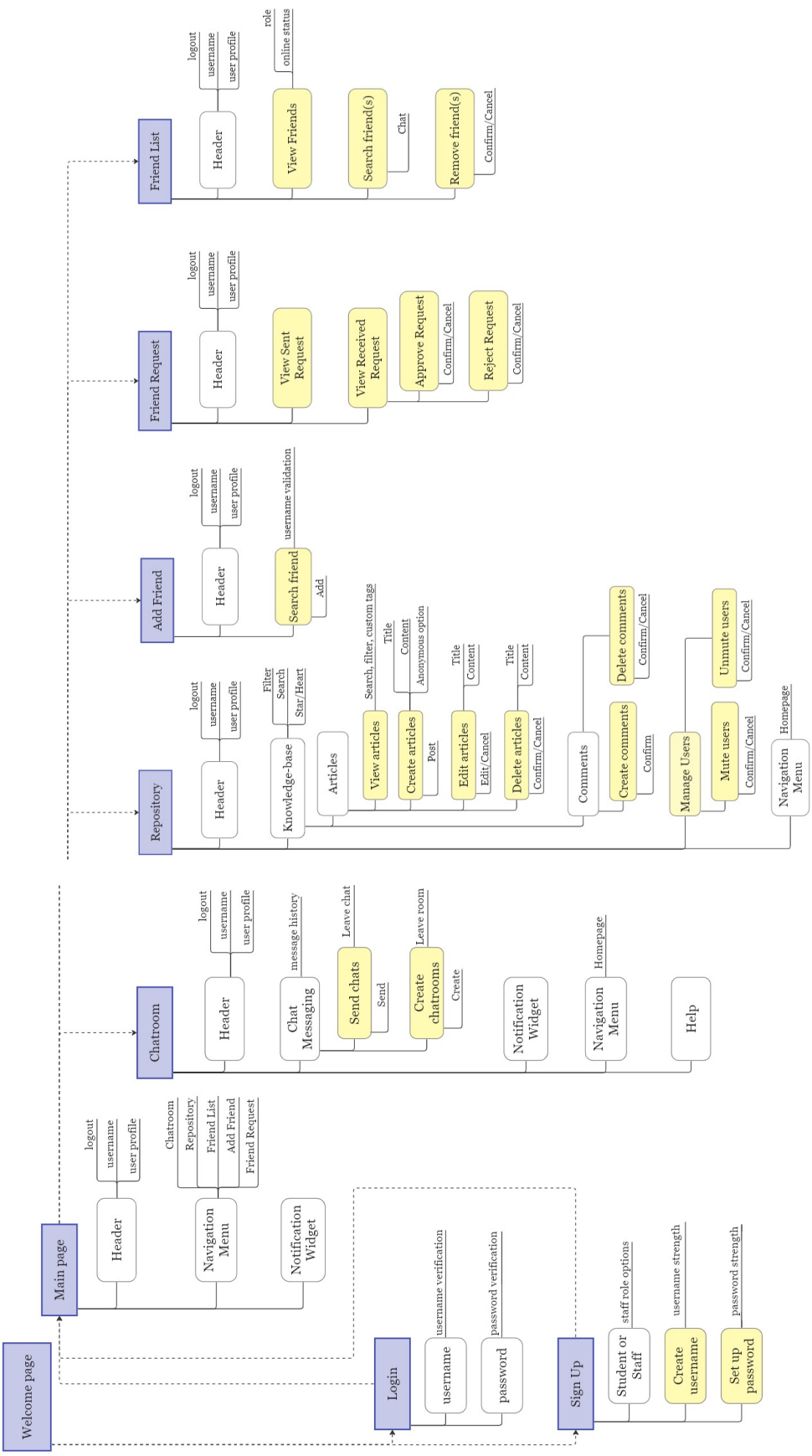


Figure 12: Information Architecture

3. Low Fidelity Prototype

3.1. Prioritized list of features

- Data Storage and Transmission
  - Secure data storage and transmission
  - Data and messages synchronize with cloud and backup

- Messaging Functionalities
  - Real-time notifications
  - Able to view message history
  - Able to edit or delete/recall message
  - Able to share files
  - Able to search with keywords, tags or filters
  - Targeted messages or users during chats with the use of @ or #
  - Interactive and real-time chat feature for smooth communication

- Knowledge Repository Functionalities
  - Easy to create content
  - Posting anonymously or privately
  - Text editor that is user-friendly and support different formats (e.g. LaTeX, code)

- UI Elements
  - Aesthetic color scheme and user interface
  - AI helpdesk/chatbots to facilitate performance
  - Seamless integration that support different devices
  - Smooth and transparent UI design and navigation

- Accessibility
  - Support keyboard-accessibility
  - Adjustable user interface features
  - Support different language options
  - Integrate adjustable color or font adjustment

3.2. Steps taken for "best" design

In order to develop the "best" design, a few key steps were taken. The first key step was to identify the target user and to understand their requirements. This step is vital for gaining insights about the users' expectations and preferences, in which this can be done through extensive user research. Several methods were done or conducted to investigate the users' needs. One of the example in our case, which discussed in section 1.2, was survey. Apart from survey, interviews or observation were done too. These enable us to better understand what they really want and help to develop the design that best suited them.

Once the target user was decided along with understanding their needs, the purpose of the development was defined by clear goals. This step was to outline the requirements, which were specifying problems or challenges need to be solved. These requirements can be functional or non-functional. For instance, functional requirements cover the basic functionalities the design should have such as user login and registration, messaging features and knowledge-based repository. Non-functional requirements covers the overall usability such as the UI elements, inclusivity or accessibility.

Onto the next stage, ideas were transformed by reflecting how to solve the defined problems. User persona was created to represent the target user to help better understanding the goals, challenges and behaviours. With all these, designs were crafted and improved over time through wireframing and prototyping. Wireframe diagrams were created to outline the structure of the application, showing each screen's functionality and layout. This was an important step as it allows us to assess and enhance the user experience by redefining the prototypes. Then, guerrilla test was conducted to identify problems and improve the design from the participants' feedback.

Next, prototype was constantly improved and converted to real application, while evaluations were preformed gradually. Here, think aloud test was conducted by observing and examining the how the participants reacted and responded. With these useful feedback and observations, the prototype was refined for improvements iteratively. Tests were conducted until satisfied, followed by a final user testing to ensure all the requirements were met and the application was effective enough. By following these steps, the "best" design was able to be developed, and ended with self-evaluation on any improvements can be made in the future.

3.3. Wireframe diagrams

Figure 13: Wireframe design

These designs shows the prototype of the messaging app. With mainly 6 user interfaces focused on supporting the functionalities for students. The two left-most frames visualize Chatroom page and Friend List page, enabling the student to perform interactions such as messaging, joining chatroom or managing friends. The middle two frames visualized the Homepage as the main navigation menu, alongside with the Knowledge Repository where the students can post or edit articles and have discussions with peers. The two right-most frames showed the how a friend can be added and the user actions allowed after sending a friend request.

3.4. Messaging App Guerrilla Usability Test Report

Date: 15 May, 2024 | Conducted by: Lyvia

Introduction

- **Objective**: To identify pain points in messaging and posting article processes.
- **Scope**: To test new user's experience on navigation system of main features.

Method Used

- **Participant**: Test was conducted at the Learning Hub with two tech-savvy first-year USYD students aged between 18-24.
- **Process and Material Used**: Participants were given a laptop with the prototype of Messaging App ready and asked to perform specific actions and provide feedback.
- **Tasks**: Participants were asked to perform 3 main tasks, involving register as a new student, navigate to Chatroom and send a message to a friend, along with create an article on Knowledge Repository.

Raw Results

- **Signing Up**
  - All 3 participants signed up successfully
  - *Feedback*: Simple steps and process to sign up
- **Sending Message**
  - 2 out of 3 participants navigated to Chatroom and sent a message
  - *Feedback*: Confusion over the "Chat with" label in Add Friend, is this similar to "Search friend"?, asked Tester1
- **Creating Article**
  - 2 out of 3 participants created articles successfully
  - *Feedback*: Confusion over the "Create Article" button, "I would have to scroll down to the page if the article is long or having many comments, it would be better if the button is located somewhere obvious.", responded Tester3

Findings

- All participants found no difficulty to sign up and suggested that the navigation is easy, indicating design is user-friendly.
- All participants found the overall design and color scheme appealing with retro and aesthetic vibe.
- Some participants found some confusion over certain terms used and minor UI elements confusion, suggesting changing terms and relocate buttons.

4. Initial Implementation of Prototype

4.1. Incremental development plan

The development plan is divided into two iterations incrementally, with each iteration covers two weeks period, followed by a final iteration.

First Iteration: Weeks 9-10

The first iteration prioritizes on improving the user interaction on the application. Evaluation are conducted by gaining feedback on confusions or improvements on user roles and multi-user system.

- **Role-based system**: Update the system to support different user roles so that it covers the students and different types of staffs. Develop different user sign up options to support different roles.
- **Chatroom with multi-user**: Upgrade the chatroom to enable multiple users to join chatroom and communicate. Along with focus to improve efficient of group chatting features.
- **Friend List and Messaging**: Imporve the messaging features for smoother real-time messaging features. Update friend list to enable users to select multi-user to join chatroom.

User Acceptance Test: Prototypes are used and tested for gaining feedback and suggestions on enhancing user interactions. It was suggested to redesign the Homepage for consistency and to simplify navigation and better user interface.

Second Iteration: Weeks 11-12

The second iteration is to focus on enhancing and further building the functionalities for usability from the first iteration evaluation, as well as prioritizing on the knowledge repository and user function.

- **User Account system**: Set up permissions system to restrict system access based on each user's role. Define allowed user actions.
- **Knowledge Repository**: Design and implement a knowledge base for the users following the role-based system. This is aim to allow the users to share reading or learning materials.
- **User Function**: Develop specific "Posting Anonymously/Private" functionality based on user investigation by introducing the user to post without revealing their identities or only to the staff. This is to help the users that are shy and hesitant to share on a public platform.

Evaluations Conducted: Think aloud tests are conducted on every functionalities and features to get the participants' immediate feedback and responses while navigating and interacting with the system. This is aimed to better understand the user experience and identify potential usability issues.

Final Iteration: Week 13

The final iteration focuses on improving and addressing issues identified during user testing and previous iteration. It is also aimed to enhancing the user interfaces to be more appealing and taking in all the feedback obtained to further refine the functionalities.

4.2. Outline of evaluations conducted

As discussed briefly above, the prototype is tested with think aloud test to collect participants' responses and interactions. Apart from taking notes of the participants reactions, **user acceptance tests** were also conducted via questionnaire during post-iteration evaluation. The survey was focused on the main topics prioritized at each iteration. Based on their feedback and ratings, it was suggested that enhancements should be made focusing on the user interfaces and labels, along with indications of well-defined functionalities and user account permissions system. The evidences of the survey conducted can be seen in the next section.

Furthermore, **Lighthouse tests** are conducted on each screen page to improve the quality of the application. For Homepage (as /table in URL), it scores relatively high scores on performance 100%, accessibility 91% and best practices 100%, but 78% on SEO as this application focuses on web pages only. Moving onto the Chatroom page, it scores higher similar scores with only 1% lower on accessibility.

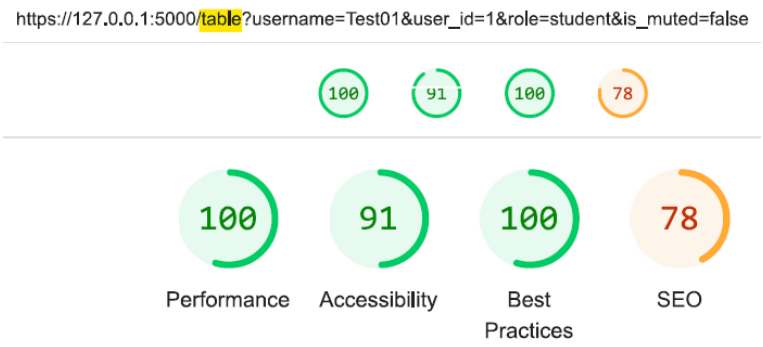


Figure 14: Homepage scoring highest among Lighthouse test results

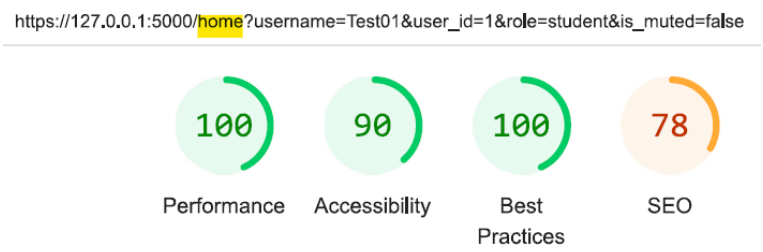


Figure 15: Chatroom page scoring second highest with Add Friend

On the other screen, Knowledge Repository scores slightly lower with only 73% on accessibility due to the fact that the HTML structure when designing this screen is slightly different and much complicated than the other screens. While Friend List page, scores 100% for both performance, and best practices similarly, accessibility has an overall score of 84%.

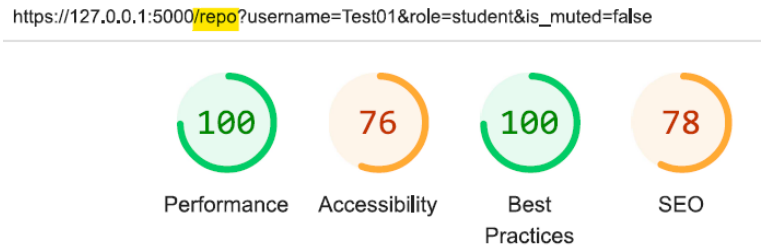


Figure 16: Knowledge Repository page scoring lowest among other results

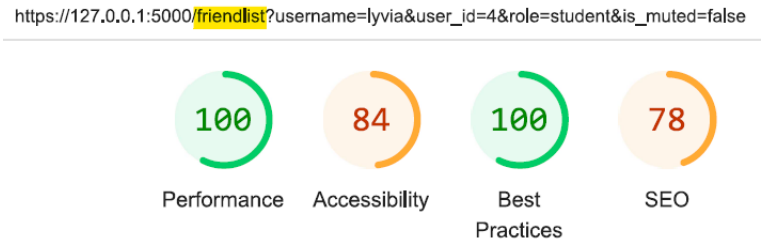


Figure 17: Friend List page scoring second lowest

As for the Add Friend screen, it has overall high scores in terms of all the checks except for SEO, similar to the other screen pages. Similar to Homepage, the screen page of Friend Request scores relatively high with 91% in accessibility and full scores for performance and best practices. In summary, all of the screen pages score the perfect scores for both performance and best practices categories, with around 13% difference in accessibility and surprisingly similar 78% for SEO due to this application only supports web services.

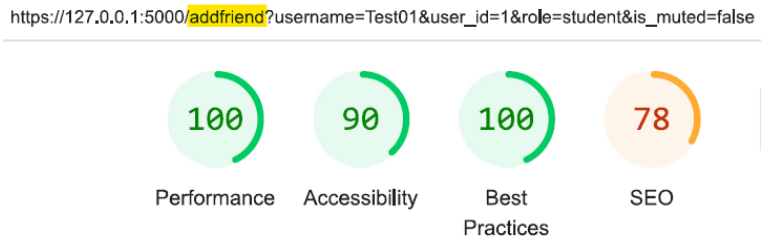


Figure 18: Add Friend page scoring high test scores

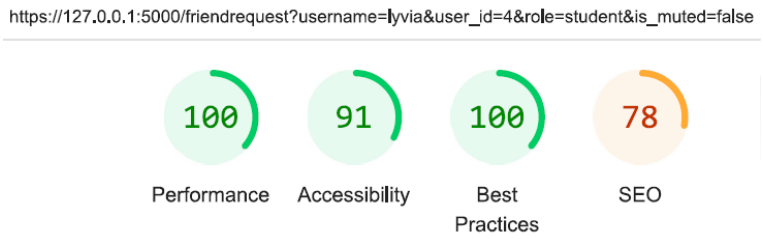


Figure 19: Friend Request page scoring top score along with Homepage

4.3. User Acceptance Test Responses

Friend List and Messaging

Figure 20: Easiness to navigate through message sending and chat

From the test responses and ratings above, it is clear that the navigation through Friend List and Messaging is intuitive. However, there are improvements need to be done in terms of color scheme used and text used in the features tested based on the feedback.

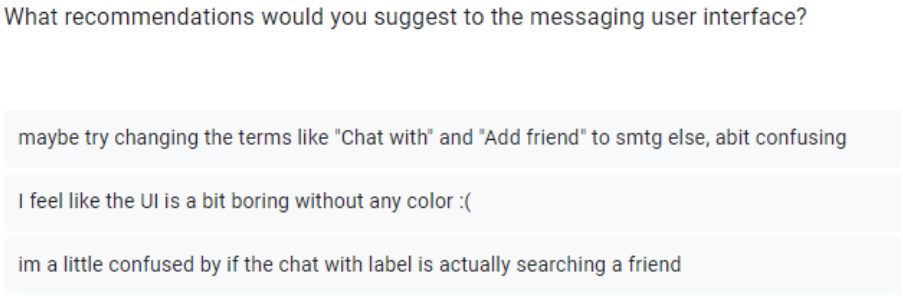


Figure 21: Feedback on messaging user interface

Multi-user Chatroom

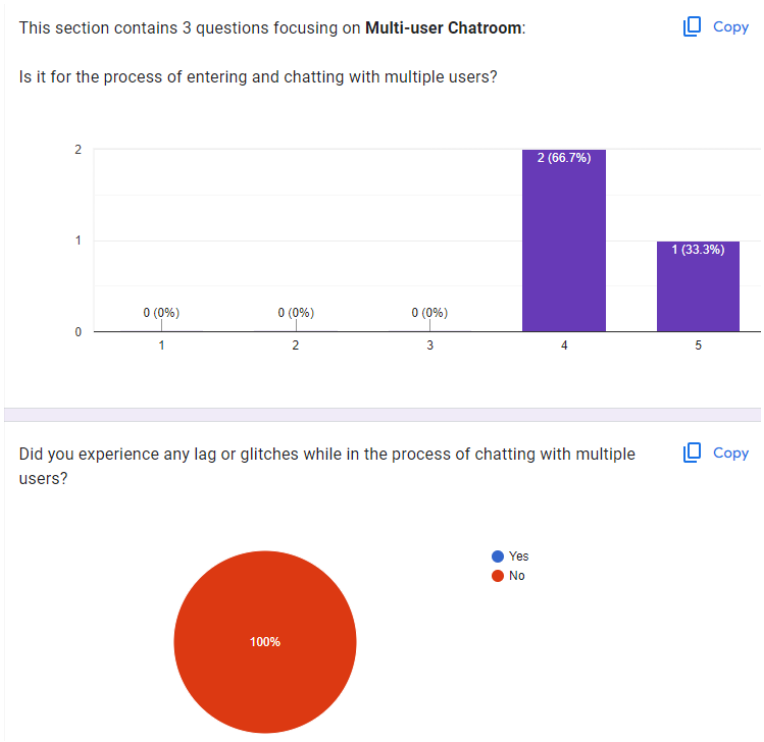


Figure 22: Ratings of participants on using multi-user chatroom

Based on the evaluation results above, we can see that the testers responded it was nearly "very easy" for the process of using the features of multi-user chatroom. Moreover, the testing was also focused on identifying if there were any errors prompted during the process, in which the result was no errors were found. However, there were suggestions in term of the UI elements that requires some minor modifications for usability enhancement.

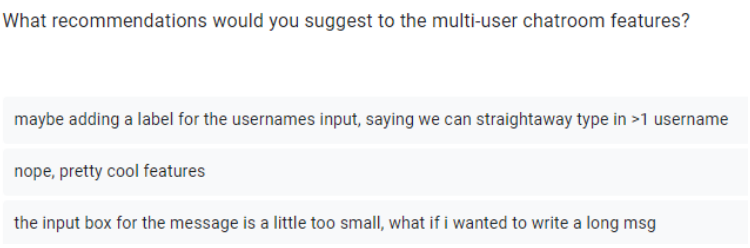


Figure 23: Feedback on multi-user chatroom features

User Account Permissions System

Based on the evaluation results, the results show that the testers feel safe with the permissions system based on different roles. On the other hand, no issue or concerns are raised in regards of the accessibility while using different role-based accounts.

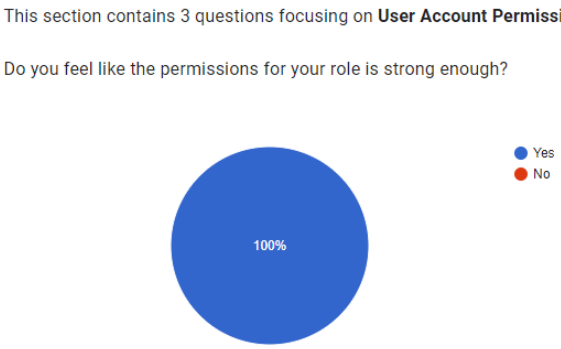


Figure 24: Responses on User Account Permissions System

Figure 25: Responses on accessibility

Knowledge Repository

Figure 26: Easiness to navigate through Knowledge Repository page and post, edit, comment articles

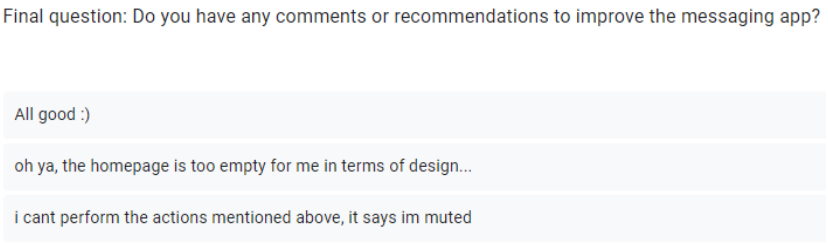


Figure 27: Overall feedback on the messaging app

This section indicates the evaluation on Knowledge Repository overall user experience. According to the outcome, testers responded they found no difficulty on navigating through the feature and performing the user actions, with majority of the results accumulated on the highest rating. The result below indicates the intuitiveness of the specific user function based on the user investigation. This is evident by all testers responded feeling comfortable with the special function. Overall, all the feedback were taken into account and suggested modifications were made accordingly.

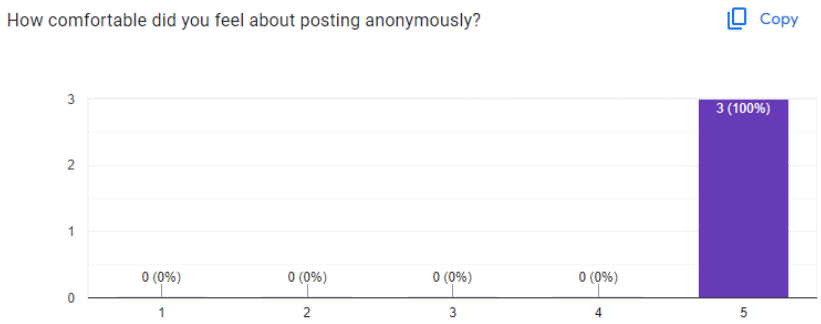
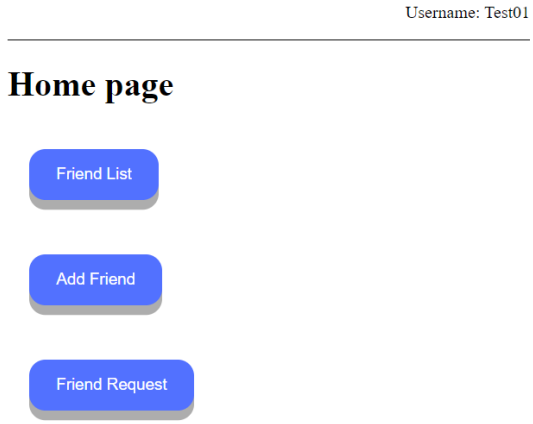


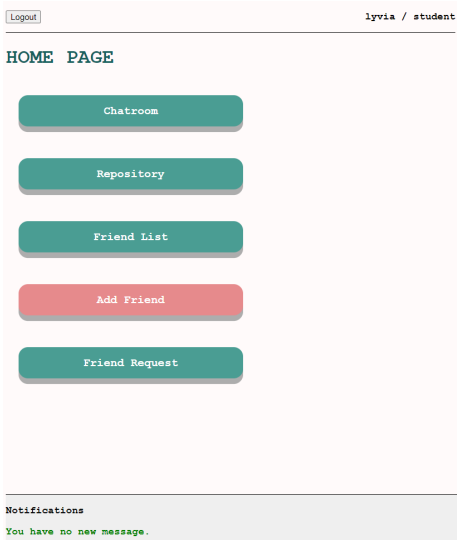
Figure 28: Evaluating unrevealing user's identity features

4.4. Improvements after each iteration

With the evaluation of the tests and feedback, improvements were made accordingly to enhance user experiences and interactions. The user interface was improved in terms of making the buttons consistent and color scheme was changed to be more appealing. Furthermore, text font was changed as well. A notification feature was also added at the bottom navigation bar to receive real-time update. Conversely, as feedback was received regarding the input label for Add Friend feature was confusing, the label was modified so that the users can understand it more easily.



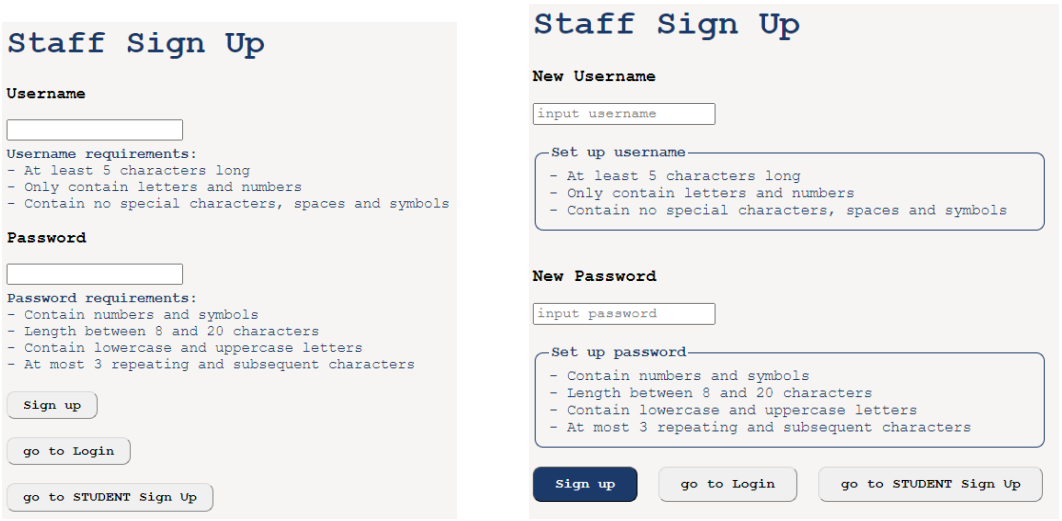
(a) Initial Homepage user interface



(b) New Homepage user interface with more consistent layout and notification bar

Figure 29: Improvement on Homepage user interface

In terms of UI specific, hierarchical design has been utilized to improve the overall layout and make specific buttons or parts on the pages stand out. This is also aimed to improve the user actions efficiency, in which enabling users to figure out the navigation system with ease.



(a) Initial Sign Up user interface without any hierarchical design

(b) Improved Sign Up user interface with fieldset and highlighted button

Figure 30: Instances of improvement made on UI elements

Moreover, the Knowledge Repository page was also restructured for enhancing user actions. Several functionalities are covered in this part, which include a top navigation bar with tabs allowing the users to navigate to other screen pages, another top navigation bar with the heading and button to create articles. Besides, the articles list which listed on the side navigation bar can be viewed, while on the right panel showing the selected article expanded.

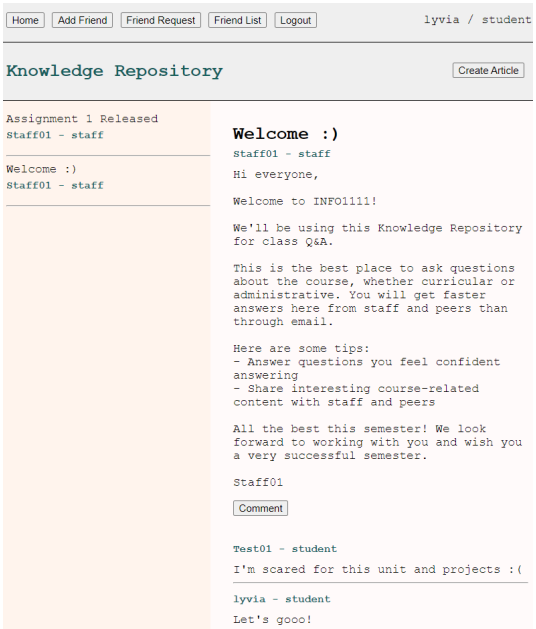


Figure 31: Knowledge Repository after modification

4.5. Final Evaluation

Iterations in summary

During the first iteration, three main enhancements were implemented. The messaging feature was improved to support multiple users and allow group chat functionality. Role-based system was also developed to satisfy different permissions system. On the contrary, knowledge repository and further building on user account permissions system were focused on the second iteration. The permissions system was refined to restrict specific actions such as only admin is allowed to assign roles, while academic staff is allowed to perform specific moderation. In addition, a platform for the users to share and seek help was implemented with different user actions allowed.

Feedback summary

Users reflected the simplicity of the functionality and navigation was well implemented. Nonetheless, there were some confusion over the labelling terms which were improved and amended after evaluation of each iteration. Feedback gathered also revealed the user functions was implemented well for allowing the users to post articles anonymously or only visible for the staff. It was also mentioned the group chat functionality and knowledge repository would be beneficial for the users in helping them throughout their academic studies.

Users Acceptance and Satisfaction

All in all, the users' satisfaction rate increased after providing introduction to each feature of the messaging app. As per required, the implementation of data encryption increased the uses' satisfaction by being able to meet their expectations. Their overall satisfaction also rose along with the improvements of the user interfaces design that enhanced the user interactions at the same time.

Future planned features

- Enable unique features for messaging, including being able to recall or delete a sent message, introduce disappearing message feature.
- Improve messaging feature to support multimedia sharing and receiving.
- Improve accessibility to include different language options, adjustable user interface features and screen reader to enable people who needed them be able to use it.
- Enhance data storage and message synchronize with cloud as data backup.
- Enable multiple devices accessibility.
- Enable search feature in knowledge repository with using special tags.

4.6. Self-evaluation

While I worked on developing the project independently, I managed all tasks effectively and further building each phase incrementally. By overseeing every aspect of the project and despite challenges faced, I was able to improve my skills and learned how a "best" design is developed by focusing on each phase of the development process, taking every details and improvements being able to be made step by step.

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