

**SENTIMENT BASED ANIME RECOMMENDATION SYSTEM**

**BY**

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**for the degree of**

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Thank you especially to my loved ones and close friends for their love and support throughout these challenging times. Finally, special thanks to Ng Zhen Lu, for always standing by my side.

## **ABSTRACT**

Anime has grown to be a vibrant and significant subset of the entertainment industry with its distinct fusion of narrative, artistic expression, and cultural impact. The problem identified in this report is the lack of personalization in anime recommendations by existing anime related platforms. Therefore, an innovative anime recommendation mobile application is proposed to overcome the issue. Sentiment analysis is focused on in this project to develop the recommendation system to revolutionize how users find and interact with anime content which will improve their viewing experience. An elaborate explanation regarding the problem of lack of personalization is discussed in this proposal as well. Sufficient reviews of the existing anime related platforms are presented and compared to further investigate the mentioned problem. Furthermore, the scope and objectives of this project are identified. The techniques to be used include web crawling and sentiment analysis powered by neural network. This proposal includes the system design of the mobile application to further elaborate the proposed solution too.

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## LIST OF ABBREVIATIONS

<i>MAL</i>	<i>MyAnimeList</i>
<i>OVA</i>	<i>Original Video Animation</i>
<i>APK</i>	<i>Android Application Package</i>
<i>VPN</i>	<i>Virtual Private Network</i>
<i>API</i>	<i>Application Programming Interface</i>
<i>UI</i>	<i>User Interface</i>
<i>BERT</i>	<i>Bidirectional Encoder Representations from Transformers</i>
<i>BiRNN</i>	<i>Bidirectional Recurrent Neural Network</i>
<i>URL</i>	<i>Uniform Resource Locator</i>
<i>HTML</i>	<i>Hypertext Markup Language</i>
<i>LSTM</i>	<i>Long Short-Term Memory</i>
<i>JSON</i>	<i>JavaScript Object Notation</i>

# Chapter 1

## Introduction

In this chapter, the problem statement and motivation, objectives, project scope, contributions and report organization is presented.

### 1.1 Problem Statement and Motivation

The existing anime-related platforms that recommend anime to their users rely on ranking algorithms, current trending anime and anime popularity based on user reviews which causes lack of personalization in recommending anime. This makes it time consuming to go through anime reviews and discussions to find suitable anime to watch. The worst possible outcome is when the anime fan watches the anime only to be disappointed as it did not meet their expectations. Hence, the lack of personalization in anime recommendation systems decreases users' satisfaction, wastes their time as well as disrupts them in their exploration of anime. Therefore, this project is proposed to recommended anime with a mobile application that will better suit the user's preferences according to sentiment.

The aim of the proposal is to propose an anime recommendation mobile application that is sentiment based. The way this recommendation system works is applicable to other forms of entertainment such as movies, music and books. After an entertainment is consumed by an individual, they will harbor certain feelings towards the entertainment. They are more likely to interact fully with the content of the entertainment when it aligns with the individual's interests and emotional tendencies, which increases satisfaction and enjoyment. With this type of recommendation system, the entertainment industry will be changed forever.

### 1.2 Objectives

The main objective of this project is to develop an anime recommendation mobile application that uses sentiment analysis. This system also aims to provide more personalized anime recommendations rather than just recommending the trending anime or latest releases like the current existing anime-related platforms. Next, it is one of the objectives to create a

mobile application with a user-friendly interface so that users can navigate easily and have good user experience.

To summarise, the objectives are as below:

1. To develop a sentiment analysis model with at least 50% accuracy for each sentiment label.
  - The sentiment analysis model will be trained and tested to analyse online reviews of the anime and determine the emotional context of the anime.
2. To successfully provide anime recommendations based on the user's inputs.
  - The system will be able to accurately generate a list of anime recommendations that matches the emotional context of the anime title that the user has input.
3. Create a user-friendly mobile application.
  - An easy to use mobile application with intuitive user interface is developed to enable users to easily navigate and engage with.

### **1.3 Project Scope and Direction**

The scope of the project is to deliver a mobile application that recommends anime based on the sentiment of the anime title that the user inputs. This software solution utilizes sentiment analysis to solve the previously mentioned challenge faced by the anime community which is the lack of personalization of anime recommendations by existing platforms. The recommendation method will be based on the emotional context of the anime that is retrieved through user reviews on MAL. The project will contribute to the anime community as an anime recommendation system based on sentiment has never been done before as of writing. This will help to generate more accurate recommendations to anime lovers which will improve their viewing experience and broaden their anime discovery.

### **1.4 Contributions**

This project will mainly contribute to the anime community and set an example for other recommendation systems. This is because as this is being written and based on previous research, not a single anime recommendation system that is based on sentiment has been found. Many existing issues such as failure of recommended anime to meet expectations and wastage of time to find suitable anime can be solved with the introduction of a personalized

recommendation system. The novelty of this project will be revolutionizing the way anime lovers discover their potential new favourite anime. Aside from greatly improving the approach of anime recommendations, anime viewers' experiences are surely boosted too. Lastly, a recommendation system based on sentiment is surely to impact the entertainment industry.

## **1.5 Report Organization**

This report is organised into 6 chapters which are introduction, literature review, system methodology and design, system implementation, system evaluation and discussion as well as conclusion and recommendation. The problem statement and motivation, objectives, project scope and direction, contributions and report organization are included in the first chapter. The second chapter is the literature review carried out on several existing anime related platforms to evaluate the strengths and weaknesses of each platform. The third chapter is discussing the overall approach of this project and the design. The fourth chapter is regarding the system implementation of this project. System evaluation and discussion is reported in the fifth chapter whereas the last chapter concludes the project and includes recommendations.

# Chapter 2

## Literature Review

### 2.1 Existing Anime Recommendation Platforms

#### 2.1.1 MyAnimeList (MAL)

MyAnimeList (MAL) is a very well-known and widely used anime and manga tracking platform amongst the anime and manga community. It is a platform available as both website [4] and mobile application with a huge database of anime titles with data such as images, descriptions, voice actors, characters and user reviews. This is a very helpful platform for anime watchers who have difficulty keeping track of their watchlist. MAL allows its registered users to create anime and manga lists. The anime watchlist is split into 5 categories which are plan to watch, watching, completed, on hold and dropped. The lists are made public as default so that other MAL users can use it as suggestions. Users can also give ratings and leave reviews so that other users may read them and decide whether to watch the anime or not. Based on user's ratings and reviews, rankings of anime will be automatically updated to show the most popular anime of all time or of the season [4].

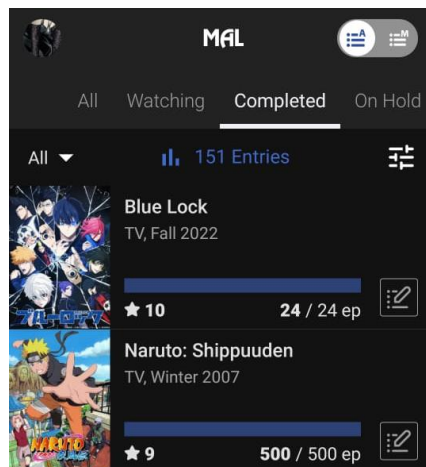


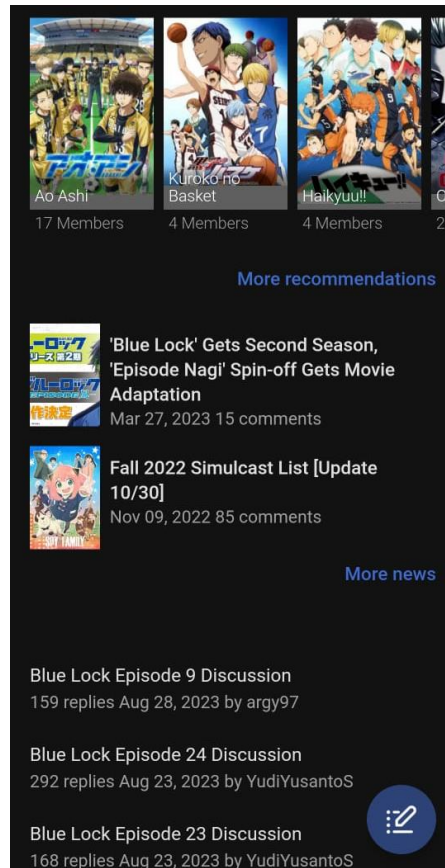
Figure 2.1.1 An example of an anime list in MAL.

Notifications for the anime and news related to the anime that is added to the user's list is available for view at the homepage. At the discussion page, there are many clubs for the user to join to discuss specific topics or give personal recommendations to each other. If the user wishes to join a discussion that is for a specific anime, they can do so by looking up the anime



then interacting with the existing posts from other users. In the page of the anime, the users will be shown anime that is related too.

For example, user is looking at a sports anime titled 'Blue Lock' so they will be recommended other sports anime such as 'Kuroko no Basket' and 'Haikyuu!!' as seen in *Figure 2.1.2*.



*Figure 2.1.2 An anime page from MAL.*

MAL also constantly notifies its users about updates on the latest and most popular anime of the season. The user can choose to view the types of anime and which year as well as the specific season. For instance, Original Video Animation (OVA) from Summer 2020. With this, anime fans can refer to when an anime was released and are also kept up to date with the current trendy anime. This serves as a recommendation feature in a way. Furthermore, users can anticipate what new anime might be released as there are also information on future anime that are posted on the same seasonal page but in a different tab. MAL monetizes itself by offering paid subscription to users which allows them to mainly customize the designs of their profile as well as remove advertisements. Social sign-in with Google, Facebook, Twitter and Apple ID are offered as alternatives in case user forgets their username provided that the users have linked their account beforehand.

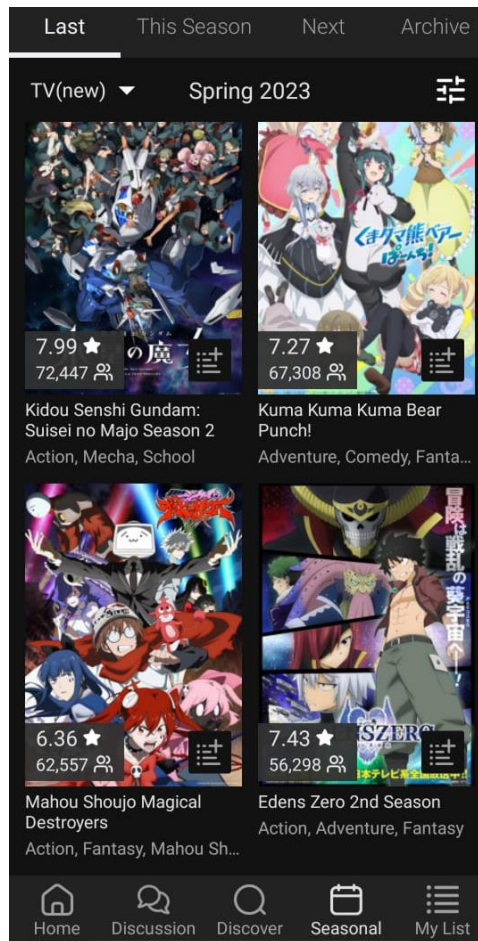
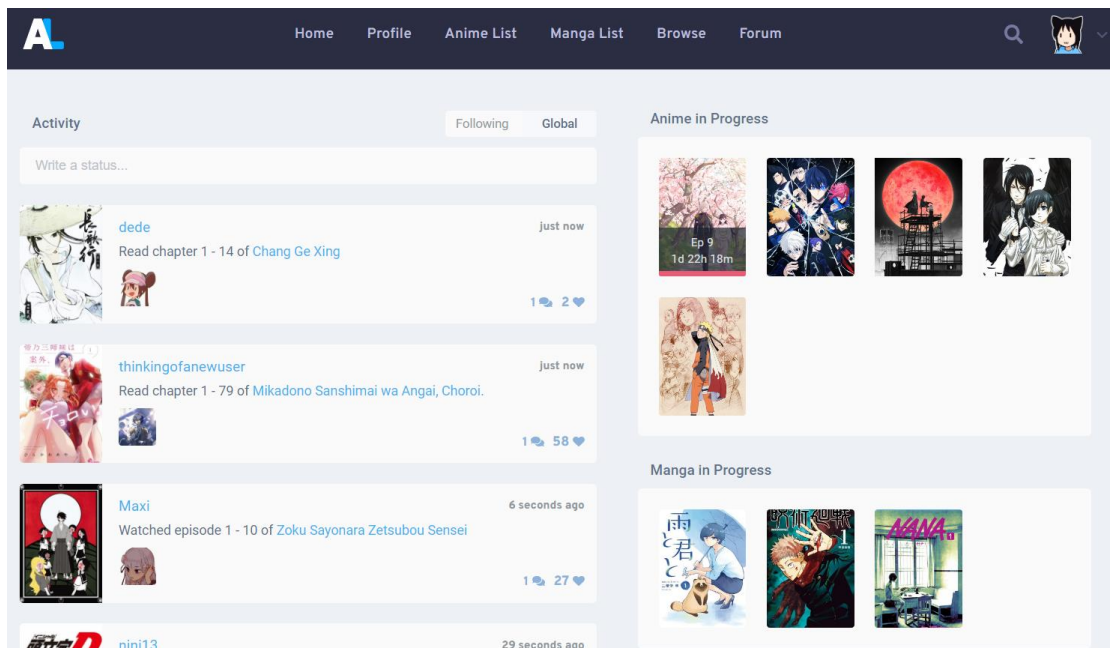


Figure 2.1.3 Anime from last season in the seasonal anime page.

## 2.1.2 AniList

AniList is a website [5] where users can create their anime and manga list to keep track of whatever they are watching or reading. This platform has extensive anime records which include trailers of the anime. The anime featured on this platform does not only include mainstream anime but also assists anime enthusiasts in exploring their preferred niche anime. This leads to users being exposed to a plethora of anime outside of their usual comfort zone. There is an interactive list featured so that users can record and rate those anime from their watchlist. Additionally, users are given the option to import their anime list from elsewhere such as from MAL. Once the user has uploaded their list, they will be able to check out statistics based on their anime list. The statistics include genre overview and total watch time. The homepage of AniList imitates social media platforms where posts from people whom the user is following are shown. Interaction among AniList users is also encouraged as global posts from random users are also featured on the feed. These posts can be interacted with by liking

and commenting anything from opinions of the discussed anime to asking for anime that is similar to the discussed anime. The feature that stood out the most was the constantly automatically refreshing homepage. It refreshes itself after 3 minutes to keep the posts recent and relevant. Moreover, the homepage also displays anime and manga that is in progress for the user that is logged in. Another notable feature is there is a countdown for the next episode of the anime that the user is watching that is still on air as seen below in *Figure 2.1.4*.



*Figure 2.1.4 AniList homepage with posts as well as anime and manga in progress.*

Every anime in this platform has multiple tags for categorization purposes. Then, there is customization offered to users for anime ranking and charts with the use of filters. Based on *Figure 2.1.5*, these filters are genres, year, season, format and airing status. The anime recommendations from this platform are done by recommending individual anime based on titles that the user has saved into their anime list. Not only that, for every recommendation, there will be a rating so that the recommendations can be fine-tuned for others based on the user's input. Users will also be introduced to new anime based on their viewing history that is done by the algorithm of this platform.

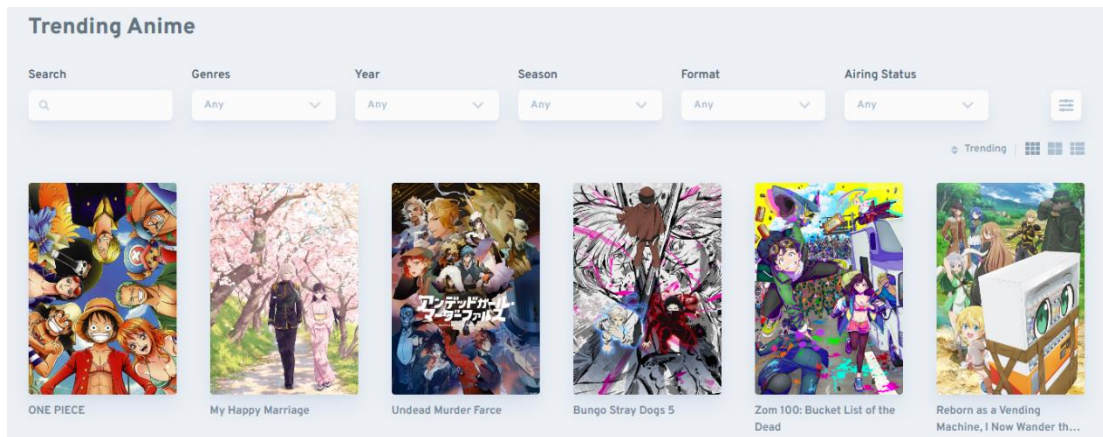


Figure 2.1.5 Anime ranking chart with filters from AniList.

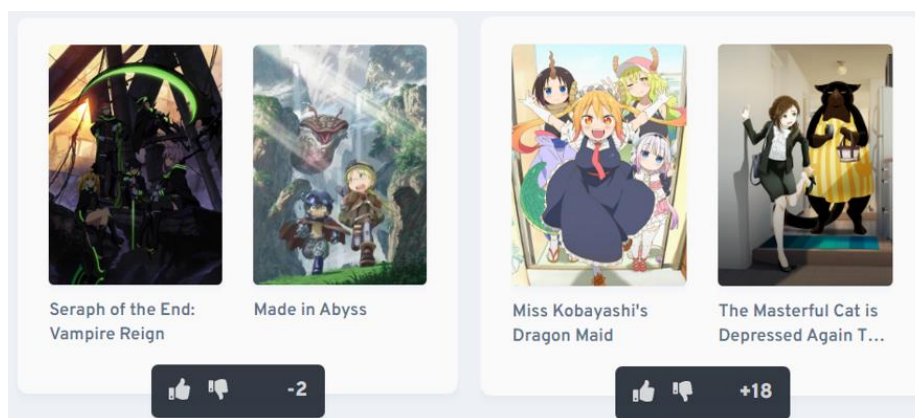
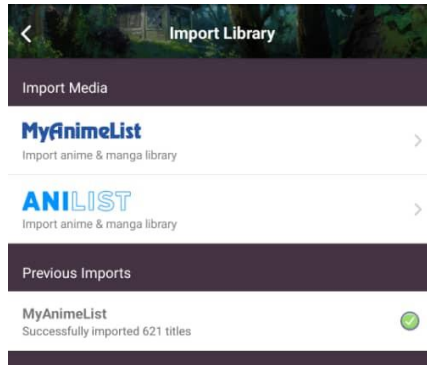


Figure 2.1.6 Recommendations with positive and negative ratings from Anilist.

### 2.1.3 Kitsu

Kitsu is another platform that is available as both a website [6] and mobile application. This platform has a huge anime data record as well as a social media feed that is comparable to the homepage from Anilist. The feed features posts from both the users that are followed and random global posts that can be liked and commented on. Kitsu also allows its users to import anime and manga library from MAL and AniList. A useful feature for users is the display of the users' import history as well as the status. Users are also given the option to link their MAL account to import information from there. The import of the list will be done in the background which allows users to continue using the platform. Once the list import is done, users will be notified by Kitsu. Unlike other platforms, Kitsu allows two-way migration. Users can download their anime and manga library to be imported to MAL.



*Figure 2.1.7 Import user interface in Kitsu.*

Additionally, Kitsu allows users to censor content from their posts. This is to prevent other users from viewing spoilers when coming across those posts on their feed. This in turn also prevents ruining the viewing experience for other users who have not watch the anime. There are different censorship settings available for users to set. These settings are allow inappropriate content, hide all inappropriate content and limited to following feed.

Not only that, Kitsu takes user feedback seriously. There are five categories for users to report to which are bugs, feature requests, database requests, mobile bugs and mobile features. When users report, there will be review statuses visible to those users so they know that action is being taken by the Kitsu staff. The statuses include planned, under review and in progress. The reports by users are public for other users to read and if they agree, they can ‘upvote’ the report. There is a counter for the number of users who upvoted the report so that the staff can prioritise the issues to be handled first. Users can also comment on the other users’ reports to try to help them with the addressed issues.

Kitsu produces anime recommendations based on its users’ preferred genre or favoured categories rather than a specific liked anime. When browsing categories of anime, there will be many related subcategories displayed as suggestions to allow users to discover the anime they like more accurately. Based on anime categories, user viewing statistics are analysed by Kitsu too to give the user a better understanding of their preferences.

## Trending Angst Anime Remove from Favorites

A feeling of general discomfort and uneasiness is present due to either trivial or more serious reasons, often accompanied by depression. Warning: may contain copious amounts of brooding and sighing. Etymology: "Angst" is a German word meaning fear or anxiety.

Or, browse with the [advanced search](#)

Figure 2.1.8 Recommended anime based on genre in Kitsu.

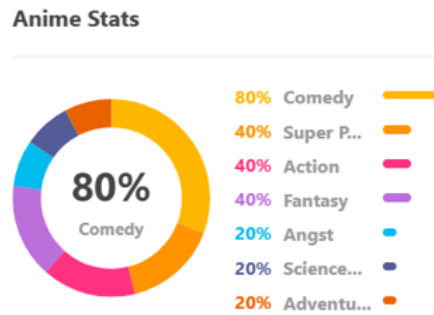


Figure 2.1.9 User anime statistics in Kitsu.

This platform stands out from others by having a very detailed advanced search based on many categories including but not limited to number of episodes, streaming platforms and seasons of release.

Figure 2.1.10 The advanced search categories of Kitsu.

## 2.1.4 Crunchyroll

Crunchyroll is a well-known legal streaming platform [7] for anime that allows users to stream high quality anime. Because it is legal, shortly after an anime is released in Japan, Crunchyroll users are able to stream that anime. Thus, allowing users to stay up to date with the latest anime releases. At the mobile application homepage, there are some anime featured including popular anime and new anime of the season. For the website version, there are anime news and articles available for readers to read. Not only that, there is also a broadcast schedule for new anime episodes so that the fans of those anime are aware of when the next episode of their favourite anime is released.

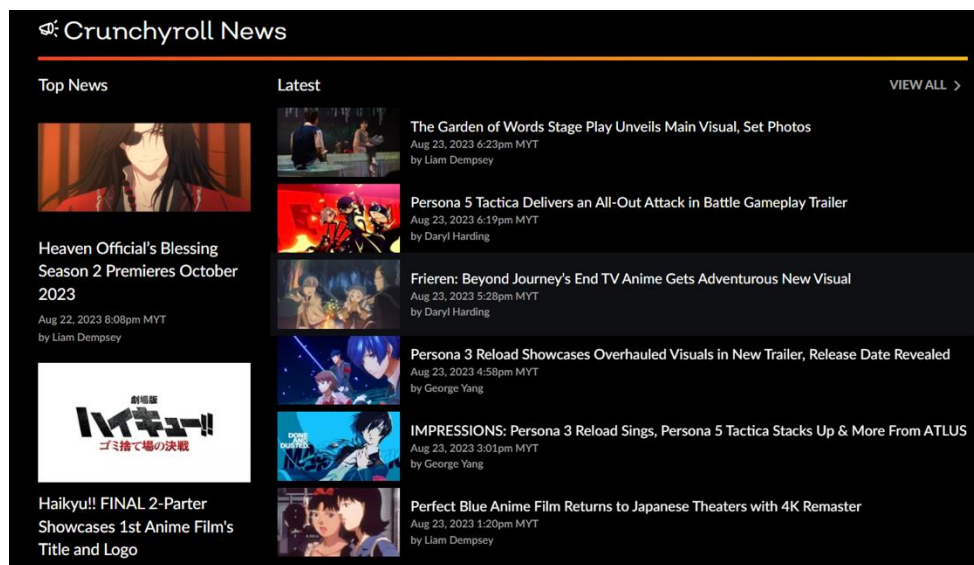


Figure 2.1.11 Anime news and articles on Crunchyroll.

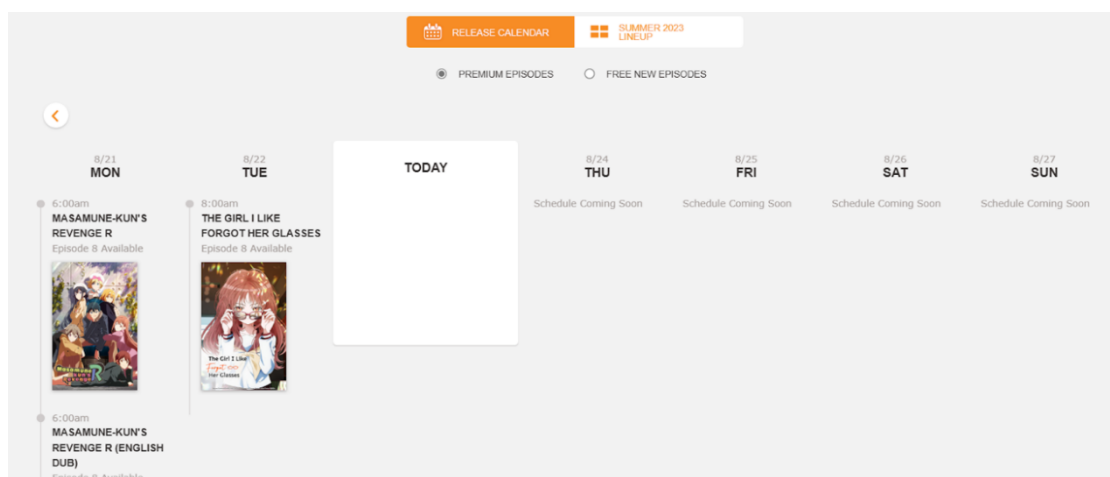


Figure 2.1.12 New episode schedule on Crunchyroll.

If the user wants to browse all anime instead, they can do so with the browse page which can be displayed and sorted by popularity, newest and alphabetical order. There are also filters to show series or movie type anime as well as the language it is available in (subtitled and dubbed).

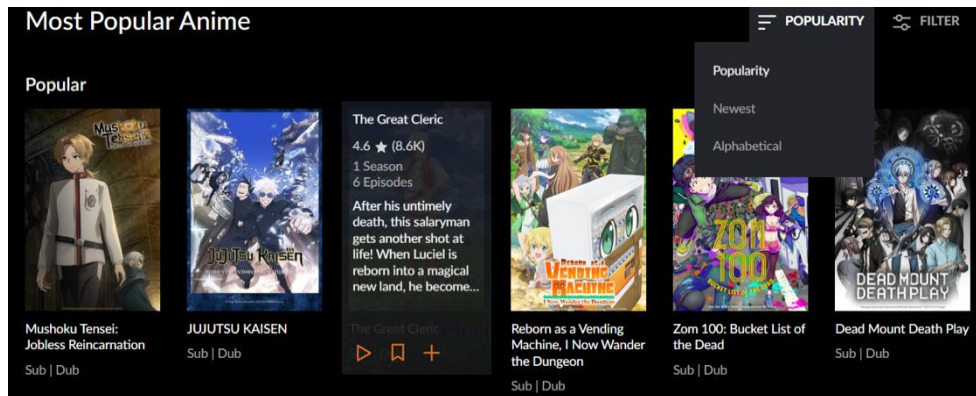


Figure 2.1.13 Anime browsing page on Crunchyroll.

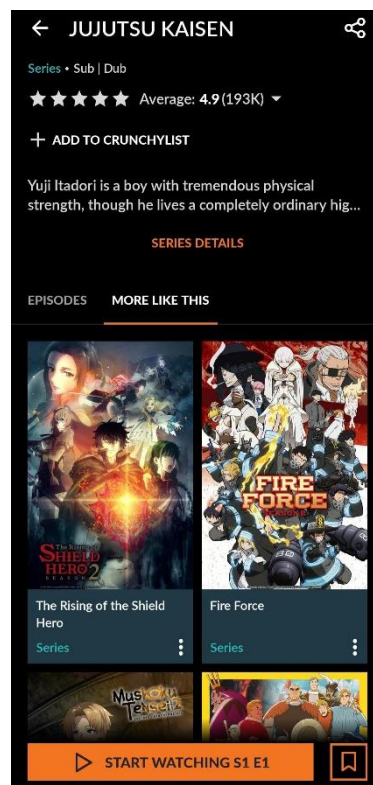
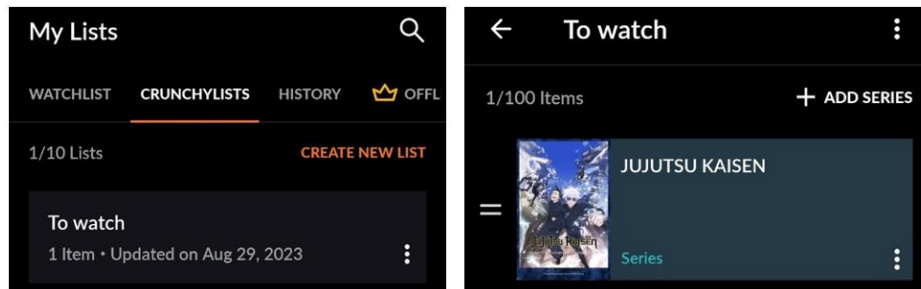


Figure 2.1.14 Anime similar to Jujutsu Kaisen on Crunchyroll.



Besides, users can browse according to genre too. When a user is browsing an anime, there is a 'more like this' tab which recommends similar anime. Since Crunchyroll is an independent platform, it creates its own lists called Crunchylists. Users have the freedom to name their lists whatever they wish and have as many as ten lists with a maximum of 100 different anime each.



*Figure 2.1.15 Crunchylist and the anime in the list.*

Crunchyroll is available to stream worldwide which means that it is accessible to many international anime viewers. Due to this, this platform provides subtitles in a variety of languages to improve their viewers watching experience. This is to ensure that the viewers who are not fluent in Japanese can still enjoy anime with accurate translations without losing the meaning through misinterpretation. Additionally, users are able to use Crunchyroll on many different devices other than mobile phones and laptops. These devices include but are not limited to smart televisions and gaming consoles.

### **2.1.5 Anime-Planet**

Anime-Planet [8] is a platform with a big database of anime information that allows its users to track anime, manga characters and people (artists, authors and producers of anime) compared to the other platforms where users do not have the option to track the people that they want to. As soon as the user loads into the homepage, they are greeted with popular anime and manga this week, some anime recommendations and latest anime from the current season.

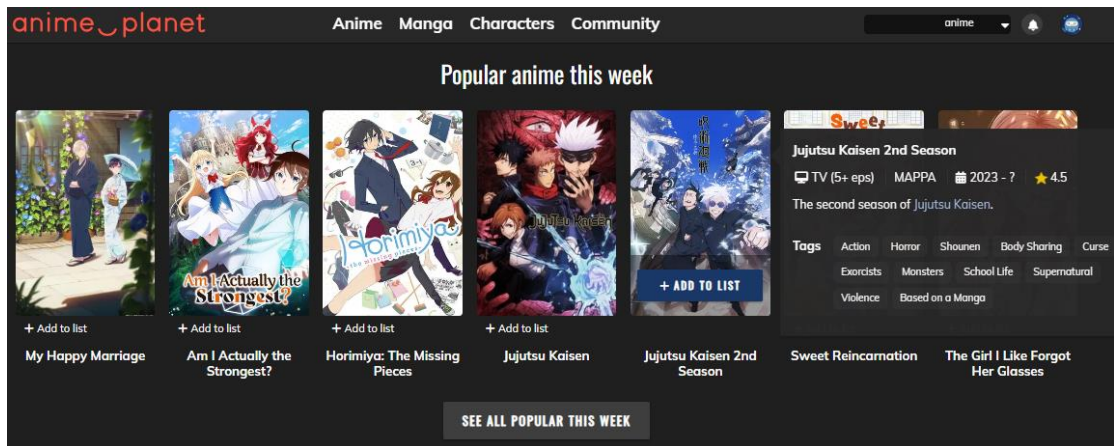


Figure 2.1.16 Homepage of Anime-Planet.

Users can upload their anime and manga list from MAL and AniDB. This platform gives its user options on whether the website should help automatically update the list as users watch anime on the site. This is helpful as not a lot of platforms offer this useful feature. After that, based on that imported list, recommendations are generated. The recommendations are generated based on the overall types of anime that the user has saved into their list.

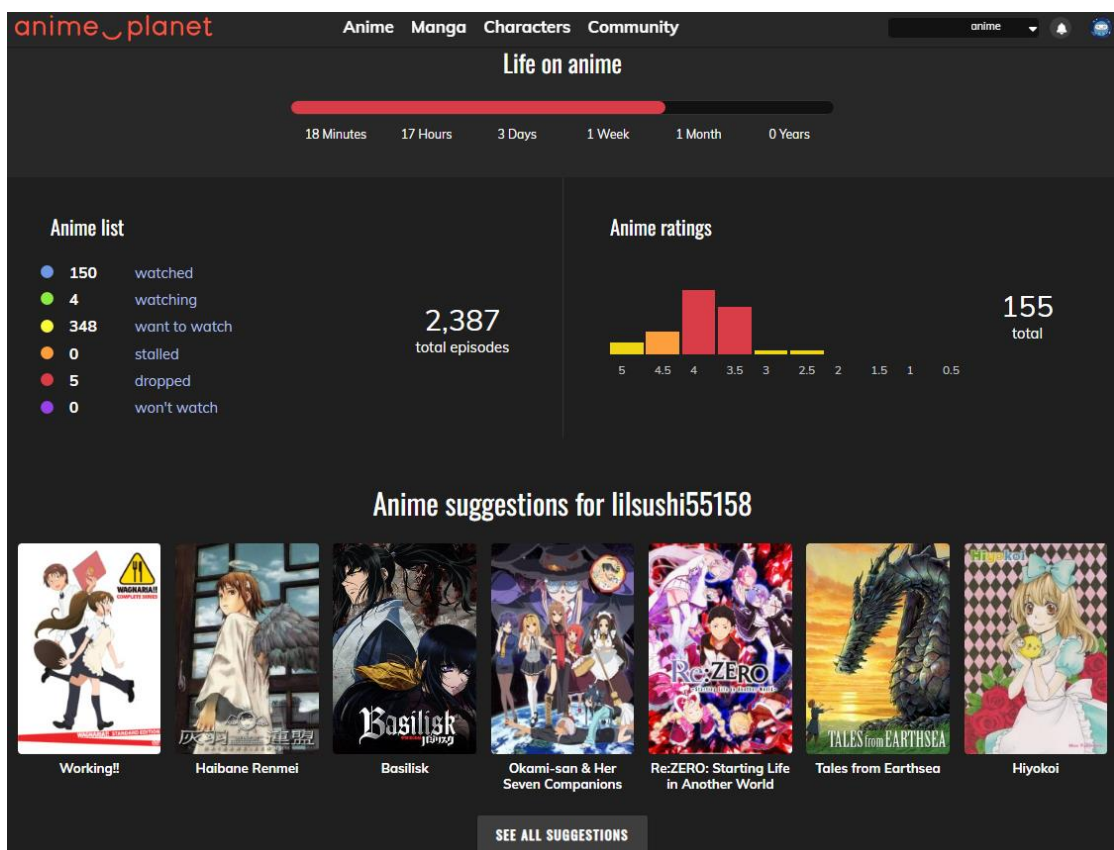


Figure 2.1.17 Anime recommended based on user's list.

Additionally, recommendations based on individual anime can be generated by users for the public as well. These recommendations can be given feedback by users if they agree and they can view the reason the anime is recommended.

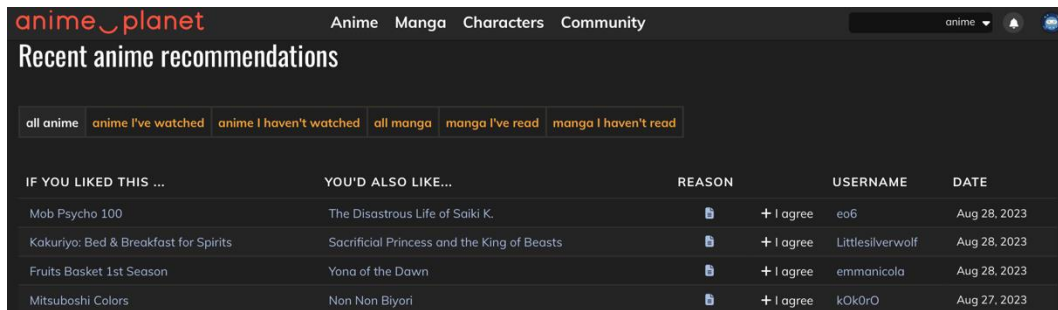


Figure 2.1.18 Anime recommended by other users on Anime-Planet.

Users can leave reviews on the pages of anime by rating the story, animation (graphics), sound and characters. This way, users who plan to watch the anime and come across the reviews can get a better understanding of the anime that they want to watch. Not only that, these users will be able to form a more accurate first impression of the anime and know what to expect from it. This will prevent users from being let down by an anime that did not meet their expectations.



Figure 2.1.19 Anime review on Anime-Planet.

Anime-Planet does provide links for their users to stream anime legally. With this platform, users can favourite characters that they like instead of just anime titles. The characters that appear in several anime can help improve the accuracy of the anime recommendation. In Anime-Planet, ranking of anime is done by season or category.

A special feature from Anime-Planet is challenges. To encourage users to watch more anime or read more manga, there are often challenges held. As this is being written, there is the 2023 Anime Watching Challenge where there are three different achievements. Level 1 is for users who have watched 12 anime, level 2 is for users who have watched 24 anime and users who have watched 36 anime will be awarded level 3. The time left for the challenge as well as the number of users participating are displayed to make the user feel more competitive.

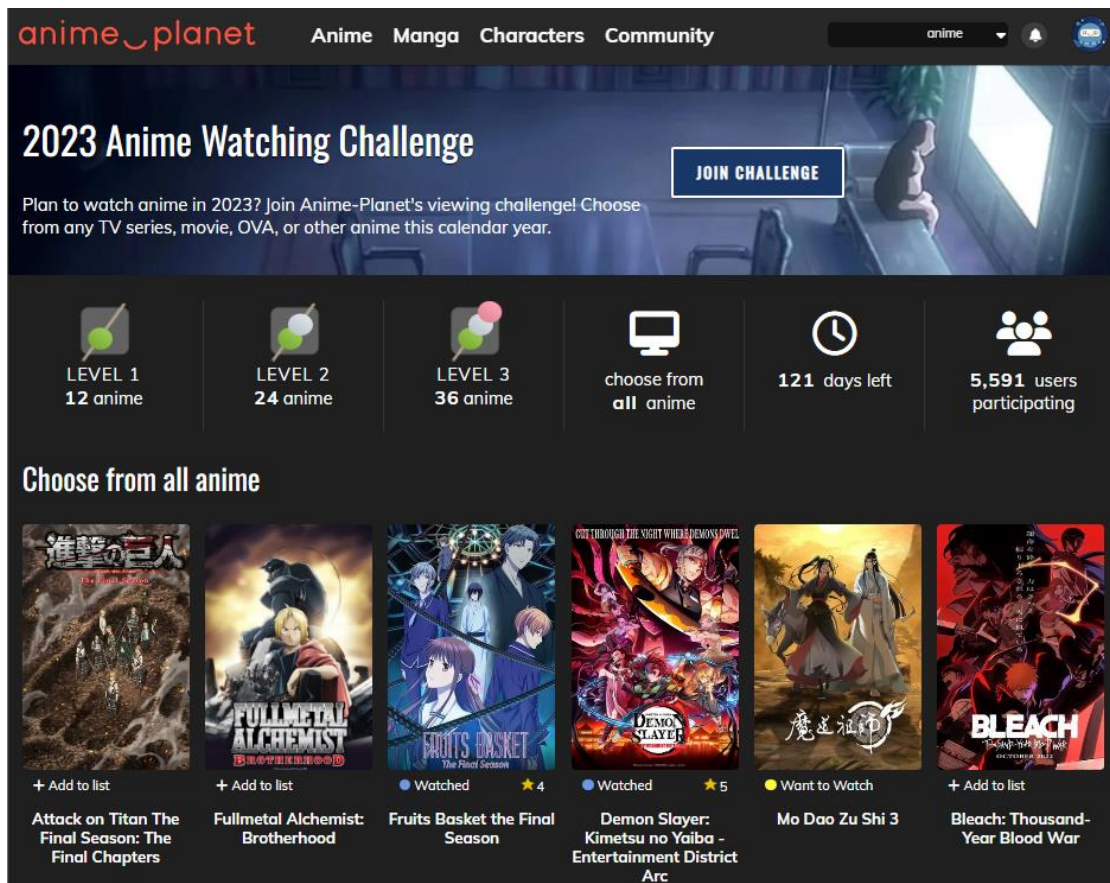


Figure 2.1.20 Anime Watching Challenge on Anime-Planet.

## 2.2 Summary of Existing Systems

For the first reviewed anime recommendation mobile application which is MyAnimeList, it lacks personal anime recommendations. The platform admits to recommending anime based on its rankings. Not only that, but the platform also frequently shows current popular anime or latest releases as a form of recommendation. Therefore, this makes the anime that is recommended to the users too general and based on the rankings of others. Every anime enthusiast has their own preferences so their likings should not be generalized like so. The public recommendation is based on the assumption of “if you like this you might like that”. However, the lists are random and highly possible to not be related to the actual anime liked by the user. Another limitation of this platform is it does not have integrated streaming despite being widely known and heavily used by the anime community. In addition, the user interface can be confusing and overwhelming especially for first time users.

The second reviewed application was AniList. The anime recommendation system from this platform system recommends anime based on each individual anime the user saved rather than based on their overall preference which may not be helpful as some of the recommendations could be irrelevant. Since users have to manually import their anime list to the platform, the data in AniList may not be up to date when compared to the source of the data unless the user constantly updates their watch list and frequently conducts cross checks to ensure validity. A huge disadvantage of using AniList is it has no official mobile application. This can be inconvenient for users who prefer to manage their anime lists from their smartphone. There are users who have unofficially created a mobile application for this platform but AniList has explicitly stated that the applications are not maintained by or affiliated with the staff of AniList.

Thirdly, Kitsu has many limitations. The mobile application version of it when searched on Google was in the Google Play Store. However, it is said to be last updated in 2019. Therefore, it is very outdated and was made for older operating systems. Not only that, users can forcefully download the Android Package Kit (APK) from other websites but there will definitely be security risks. There are users who have complained on forums that the mobile version of Kitsu is not accessible in certain regions like India. application is also known to be buggy when tested. An example is when user wants to edit anime progress, there will be two of the same popups to do so. However, when the user updates the progress in only one of the popups, the progress will be lost. This is considered redundant or counterproductive. A huge issue with this

platform is that there are certain segments of missing data such as characters in the anime or the voice actors, even for popular anime. This may discourage users from using Kitsu since many anime enthusiasts like looking for information about anime including but not limited to voice actors of the anime. The platform also mainly focuses on being a community platform rather than recommending anime unless recommendations are being discussed. Next, the different seasons of the same anime are posted in different pages. To add on, the prequels, sequels or alternate storyline of an anime is not directly linked to the original anime. This means that users need to put in extra effort to search for anime which is not user friendly.

Crunchyroll does not have a customized recommendation system. This can be quite disappointing especially if an anime fan looks forward to using a well-known platform. Options are limited when it comes to customizing an anime list. Furthermore, since Crunchyroll is a streaming platform, it does not have any data at all for anime that is not being streamed on itself. Hence, there is limited anime to be offered to the users which leads to lesser anime being discovered from the user's point of view. The features for the watch list management are very basic when compared to other platforms as well. As mentioned before, Crunchyroll is a legally operating streaming platform which means it needs funds to continue operating. Users must pay for a membership to fully access the whole anime catalogue that it offers, the premium features and for an advertisement free experience. There are also geographical restrictions that have been set which makes certain anime not accessible by users in different regions which can be deemed unfair.

Finally, there is Anime-Planet which has a simplistic forum as opposed to the modern feed-based discussions in Kitsu. Users have also reported that anime information may be incomplete which can be a deal-breaker for some users. This is because missing information makes the platform unreliable. Additionally, Anime-Planet may not be working in certain countries such as India so users might need to use a Virtual Private Network (VPN) to access this platform. Another downside of Anime-Planet is the frequency of news and updates. Official announcements are made months apart from each other which could be an indicator that the platform is hardly maintained or updated. This could negatively impact the users' experience especially when reporting a bug in the platform. There is lack of industry news or insights as well which users may not like as many anime enthusiasts like to be kept up to date with the trends. There are some users who have mentioned that the mobile application version is limited

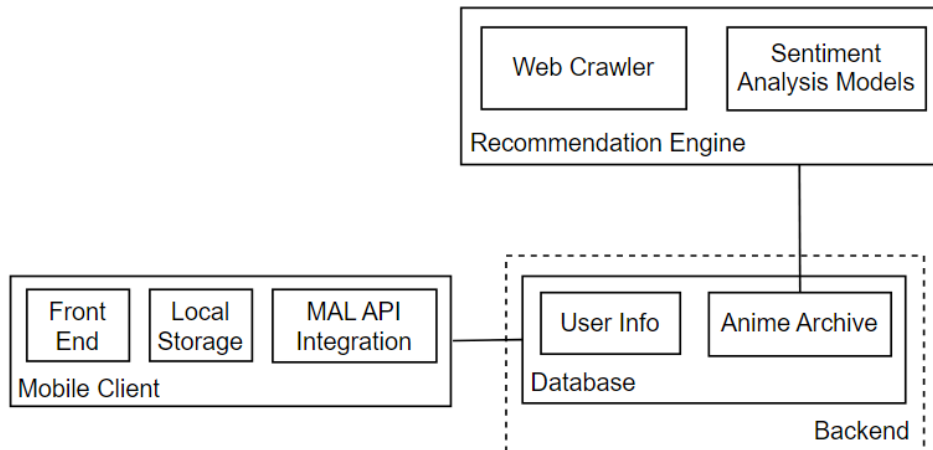
in features compared to the website version which discourages the use of this platform amongst those who prefer to use anime recommendation systems on their mobile phone.

When these five platforms are compared with the proposed solution, there is a big difference with how the recommendations are generated. This is because these platforms mostly recommend anime based on ranking algorithms, current trending anime and anime popularity based on user reviews. Meanwhile, the proposed solution recommends anime based on the sentiment that the user wants to feel while watching the anime. This will result in high user satisfaction because the watchers roughly know what to expect in the anime recommended. For example, user searches for anime that is exciting and has suspense elements to it so the list of recommended anime will have those sentiment tags.

# Chapter 3

## System Methodology and Design

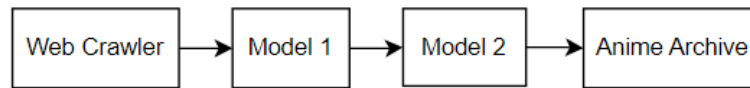
### 3.1 System Block Diagram



*Figure 3.1.1 Block diagram of the proposed mobile application.*

The mobile application (mobile client) comprises of the front end, local storage and MyAnimeList (MAL) Application Programming Interface (API) integration. The front end is done with Java language on Android Studio to achieve the sub-objective of creating a user-friendly mobile application. Users interact with the user interface (UI) to navigate around the mobile application and access the features such as the recommendation feature which is the main function. When the user first launches the mobile application, if the user has an account, they are required to login. The user can login with their email, Gmail or MAL account. If the user does not have an account, they can register for an account with the methods previously mentioned. The user data is to be stored in the user info database which is in Firebase. Once the user has moved past the login or account registration, the user can then generate anime recommendation lists. This is done by inputting an anime title in the search text field. The user has options to save the recommendation list locally in their device or update their anime list in MAL. The update can be done with the MAL API [11].





*Figure 3.1.2 Processing flow for generating sentiment labels for anime.*

The anime archive used is an excerpt of a publicly available dataset [12]. Based on *Figure 3.1.2*, the process of generating labels for the anime in the Firebase database begins with the web crawler where the input is the anime title. The web crawler is an API that is available online at [13] and has been modified to suit the needs of this project. The web crawler will save the reviews in a csv file as output. Next, the reviews of the anime are used as input for the first sentiment analysis model which is a pre-trained Bidirectional Encoder Representations from Transformers (BERT) model which is used to filter out negative reviews. After that, the output which are the positive reviews, go through the second model which is a Bidirectional Recurrent Neural Network (BiRNN) model to determine the emotional context of the anime. Both the models are developed and trained before they are released. This should achieve the first sub-objective of this project which is to develop a sentiment analysis model. The sentiment label(s) are generated and saved in the database before the mobile application deployment. Then, when a user wishes to get recommendations, they input the anime title that they want to get recommendations based on in the search text field of the mobile application. A list of anime with at least one of the same labels as the input anime is returned to the user. This will achieve the second sub-objective which is to successfully provide anime recommendations based on the user's inputs.

## **3.2 System Components Specifications**

### **3.2.1 Recommendation Engine**

The recommendation engine consists of the web crawler and two sentiment analysis models. The web crawler from [13] was modified to fit the needs of this project by adapting the code to the Hypertext Markup Language (HTML) of the MAL website to scrap reviews from. Not only that, the reviews scrapped are then coded to be output into a csv file for easier data handling. In the web crawler script, imports for scrapy, re, csv, os, unicodedata and detect from langdetect are done. The code of the web crawler starts off with a method definition for checking if a review is in English. Then, variables such as anime title, review counter, English review counter and non-English review counter are initialized to zero. The anime title input passed to the script is then used to build the MAL URL for anime searching. Once that is done,

the web crawler is coded to go through the HTML elements of the website and look for the anime title that matches the input given to it. Next, the link for the anime to be found is extracted from the website and surfed for its reviews. Every review is checked if it is in English and if it is, it will be saved in a csv in the review column and a sentiment column is created and left empty. Once all the reviews are scraped, the file is saved as '(anime title)\_reviews.csv'.

The first sentiment analysis model is created for the purposes of removing negative reviews from the file by doing binary classification. The dataset used to train this model is from [9]. Only one fifth of the whole dataset is used due to limited computation resources so there are 10000 samples. The dataset is loaded and split into 80% training set and 20% testing set. Then, both sets are tokenized with the BertTokenizer and padded. The positive label is mapped as one and negative label as zero. The training and testing labels are converted into integers with the label mapping defined. Then, the tokenized train and test dataset are used to create Pytorch tensors. Dataloaders for both training and testing are created with batch size of 16 and 32 respectively. The optimizer is set as Adam with a learning rate of 0.00002 and used in the scheduler. Then, training is done for 3 epochs. After that, evaluation is done and an accuracy of 94% is achieved so the model is saved. To predict the sentiments of reviews, the model is loaded and set to evaluation mode.

The dataset for the second sentiment analysis model is self-made. The reviews are crawled from MAL then classified by prompting ChatGPT together with explanations as reasoning. Then, the labels are manually verified one by one to ensure the quality of the dataset. There are 3726 samples in the dataset with four labels which are wholesome (1619 labels), funny (1571 labels), sad (1437 labels) and exciting (1350 labels). The dataset is loaded and preprocessed by removing stop words, ensuring all letters are lowercase and augmenting the dataset by replacing some words with synonyms. Next, the data is split into 80% training set and 20% testing set. Labels are transformed with MultiLabelBinarizer and the class weights are calculated due to slight class imbalance in the dataset. The reviews are then tokenized and padded. Additionally, GloVe embedding is used to get the vector representations for words. Learning rate scheduler implemented with ReduceLROnPlateau and early stopping is used to prevent overfitting of the model during training. The model is built using Keras Sequential where the first layer is an embedding layer which was defined by the GloVe embeddings earlier. The input dimensions is the vocabulary size and output dimensions is the dimension of the GloVe embeddings used. The next layer is a Bidirectional Long Short Term Memory (LSTM) layer with 64 neurons with dropout and recurrent dropout set to 0.2. The last layer is

a dense layer with the number of classes which is four and sigmoid activation. After that, the model is compiled using Adam optimizer with 0.0005 learning rate and binary cross-entropy loss. The evaluation metrics to monitor the training is set to accuracy. The model is trained using the class weights, 20 epochs, batch size of 16 as well as implementing the earlier defined ReduceLROnPlateau and early stopping. Once training is completed, the model was evaluated and has an overall accuracy of 27.48%. Despite having low overall accuracy, the accuracy for each label was more than 50% which is 71% for exciting, 68% for funny, 75% for sad and 68% for wholesome. Therefore, the model and MultiLabelBinarizer classes were saved to be used for generating labels. During label generation, anime titles were put as strings into an array to be passed to the web crawler. Then the reviews are passed to the first and second sentiment analysis models. The generated labels are saved into the Firebase database.

### **3.2.1 Backend**

Firebase is used for backend processing such as Realtime Database and Authentication. Anime data and user information is stored safely with rules set to only allow specific access such as users are only able to access their own user information and anime data. When a user registers for an account with the mobile application, Firebase automatically handles all the user information and authentication process with the Authentication feature.

### **3.2.1 Mobile application**

The mobile application, AniRex functions as UI for the users to interact with the database to get anime recommendations. When the mobile application is first opened, user encounters a splash screen. This is where the logo is animated and in the background, Firebase connection is initialized and checking is done to confirm if user needs to log in or not. If no user is logged in, the user will be prompted to log in with either email, Google or MAL. Users can directly proceed as a guest user or register for an account if they are not an existing user. User class is defined to store or update user information within the whole application. When users want to register for an account, they can do so with their email, Google account or MAL account. After that, the user will encounter the homepage where they can search for anime to get recommendations based on. The homepage activity hosts the recommendation list fragment, profile fragment and search results fragment. After anime recommendations are displayed, users can click on the anime titles and they will be redirected to MAL website of the anime if they wish to read more information regarding the anime. User can also add the anime to their

list. When users want to view the saved anime recommendations, they can navigate to the list fragment with the bottom navigation bar. Again, users can click on the anime titles and they will be redirected to MAL website of the anime if they wish to read more information regarding the anime. Not only that, if users want to export their list to MAL, they can do so too. If users wish to logout of their account in the mobile application, they can navigate to the profile fragment and simply click the logout button. The mobile application can be deployed to mobile phones with Android operating systems by compiling it as an APK.

### 3.3 Use Case Diagram and Description

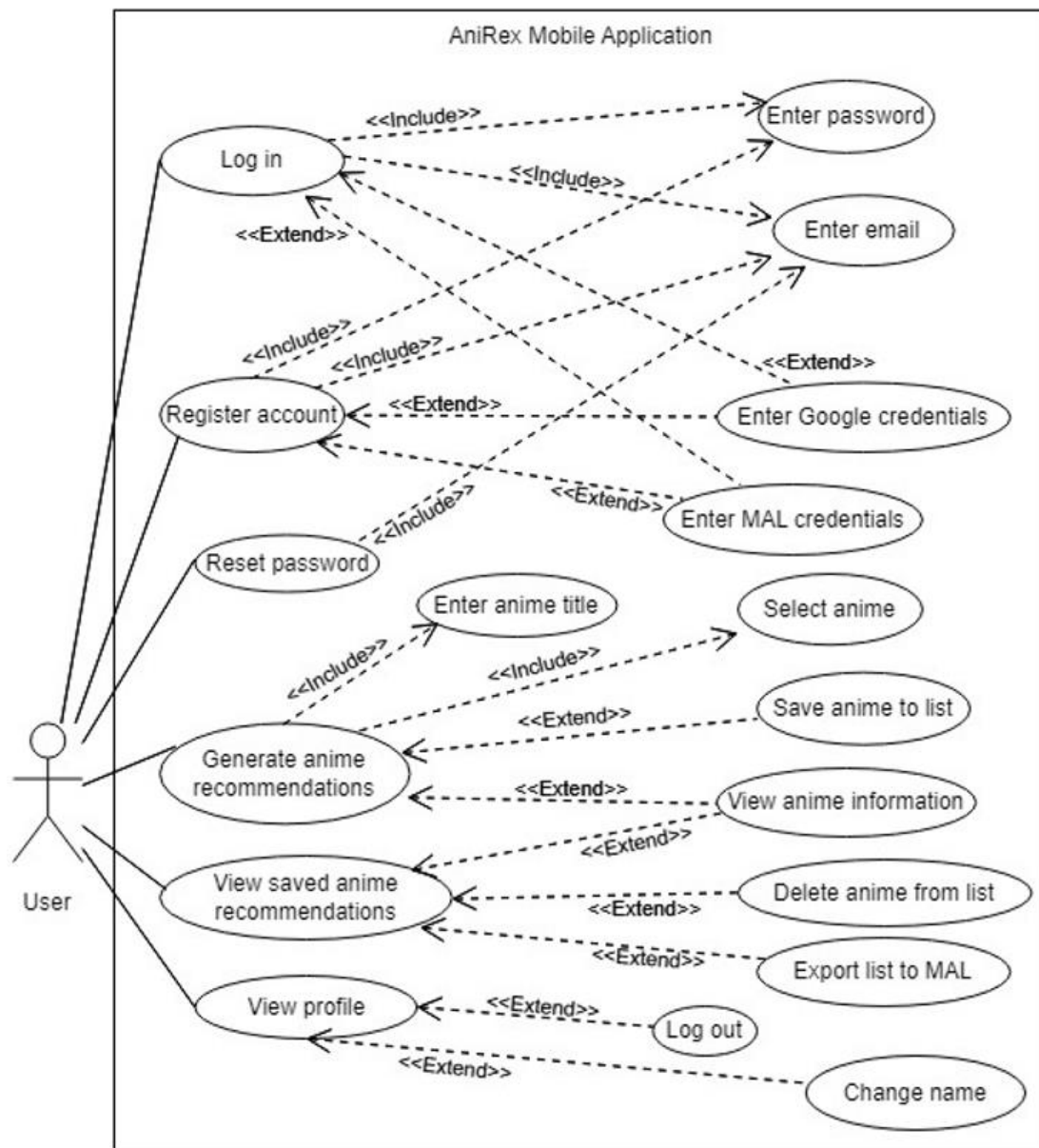


Figure 3.3.1 Use Case Diagram of the mobile application AniRex.

Table 3.3.1: Use Case of Login.

Use Case Name	Login
ID	1
Importance level	High
Primary Actor	User
Use Case Type	Essential, Detail
Brief Description	This use case illustrates how a user logs into their account in the mobile application, AniRex.
Trigger	User wants to log in to their account in AniRex.
Relationships	Association: User Include: Enter email, Enter password Extend: Enter Google credentials, Enter MAL credentials
Normal Flow of Events	<ol style="list-style-type: none"> <li>1. System displays Login page with required email and password text fields.</li> <li>2. User enters email.</li> <li>3. User enters password.</li> <li>4. User clicks “Log In” button to submit the email and password to the system.</li> <li>5. System validates user’s credentials.</li> <li>6. System displays message “Logged in successfully” and redirects the user to the homepage of AniRex.</li> </ol>
Alternate/Exceptional Flows	<p>3a. User chooses to log in with Google account.</p> <p>3b. User chooses to log in with MAL account.</p> <p>7a. System displays error message “Please enter your credentials” if the email and password field is empty and the login button is clicked.</p> <p>7b. System displays error message “User does not exist” if credentials are invalid.</p>

Table 3.3.2: Use Case of Sign Up.

Use Case Name	Sign Up
ID	2
Importance level	High
Primary Actor	User
Use Case Type	Essential, Detail
Brief Description	This use case illustrates how a user registers for an account with the mobile application, AniRex.
Trigger	User does not have an existing account and wants to register an account with Anirex.
Relationships	Association: User Include: Enter email, Enter password Extend: Enter Google credentials, Enter MAL credentials
Normal Flow of Events	<ol style="list-style-type: none"> <li>1. User wants to register for a new account in AniRex.</li> <li>2. The “Sign up” button at the Login page is clicked by user.</li> <li>3. System redirects user to the Sign Up page of Anirex.</li> <li>4. System displays Sign up page.</li> <li>5. User enters their email.</li> <li>6. User enters password.</li> <li>7. User confirms password.</li> <li>8. User clicks “Sign Up” button.</li> <li>9. System displays message “Registered successfully”.</li> <li>10. System redirects user to Login page.</li> </ol>
Alternate/Exceptional Flows	<p>5a. User chooses to sign up with Google.</p> <p>5b. User chooses to sign up with MAL.</p> <p>9a. If both password inputs do not match, system will display error message “Both passwords are not same”.</p> <p>9b. If email field, password field and confirm password field are empty, system displays error message “Please add your credentials”.</p>

*Table 3.3.3: Use Case of Reset Password.*

Use Case Name	Reset password
ID	3
Importance level	High
Primary Actor	User
Use Case Type	Essential, Detail
Brief Description	This use case illustrates how a user resets their forgotten password for their account with the mobile application, AniRex.
Trigger	User forgets password of their AniRex account and wants to reset the password.
Relationships	Association: User Include: Enter email
Normal Flow of Events	<ol style="list-style-type: none"> <li>1. User wants to reset their account password in AniRex.</li> <li>2. User clicks on the “Forgot Password” button at the Login page.</li> <li>3. User enters their email.</li> <li>4. User clicks “Submit” button.</li> <li>5. System displays message “Password reset email has been sent.”.</li> </ol>
Alternate/Exceptional Flows	5a. System displays message “Failed to sent password reset email.”.

*Table 3.3.4: Use Case of Generate Anime Recommendations.*

Use Case Name	Generate Anime Recommendations
ID	4
Importance level	High
Primary Actor	User
Use Case Type	Essential, Detail
Brief Description	This use case illustrates how a user generates anime recommendations with the mobile application, AniRex.
Trigger	User wants to generate anime recommendations.
Relationships	Association: User

	<p>Include: Enter anime title, Select anime</p> <p>Extend: Save anime to list, View anime information</p>
Normal Flow of Events	<ol style="list-style-type: none"> <li>1. User wants to generate anime recommendations.</li> <li>2. User clicks on the “Search Anime” text input field at the Homepage.</li> <li>3. User enters the anime title.</li> <li>4. User clicks search icon.</li> <li>5. System displays anime that match the input anime title.</li> <li>6. User selects one anime that they want to get recommendations based on.</li> <li>7. System displays all anime with at least one matching sentiment label with the selected anime.</li> <li>8. User scrolls through displayed anime list.</li> </ol>
Alternate/Exceptional Flows	<p>8a. User clicks “Add” button to save anime to their list.</p> <p>8b. User clicks underlined anime title to view more information about the recommended anime.</p>

*Table 3.3.5: Use Case of View Saved Anime Recommendations.*

Use Case Name	View saved anime recommendations
ID	5
Importance level	High
Primary Actor	User
Use Case Type	Essential, Detail
Brief Description	This use case illustrates how a user views their saved anime recommendation list the mobile application, AniRex.
Trigger	User wants to view saved anime in their AniRex account.
Relationships	<p>Association: User</p> <p>Extend: View anime information, Delete anime from list, Export list to MAL</p>
Normal Flow of Events	<ol style="list-style-type: none"> <li>1. User navigates to List page from Homepage by clicking list icon in the bottom navigation bar of Anirex.</li> </ol>



	<ol style="list-style-type: none"> <li>2. System displays anime that have been saved in the user's list.</li> <li>3. User scrolls through list.</li> </ol>
Alternate/Exceptional Flows	<ol style="list-style-type: none"> <li>2a. System displays blank list if user has no saved anime.</li> <li>3a. User deletes anime from their list.</li> <li>3b. User exports the saved anime recommendations to MAL by clicking "Export to MAL" button.</li> </ol>

*Table 3.3.6: Use Case of View Profile.*

Use Case Name	View profile
ID	6
Importance level	High
Primary Actor	User
Use Case Type	Essential, Detail
Brief Description	This use case illustrates how a user views their profile with the mobile application, AniRex.
Trigger	User want to view the profile of their AniRex account.
Relationships	Association: User Extend: Change name, Log out
Normal Flow of Events	<ol style="list-style-type: none"> <li>1. User navigates to Profile page from Homepage by clicking profile icon in the bottom navigation bar of Anirex.</li> <li>2. System displays information of user's profile.</li> <li>3. User views profile information.</li> </ol>
Alternate/Exceptional Flows	<ol style="list-style-type: none"> <li>3a. User clicks pencil icon next to name to change their name.</li> <li>3b. User clicks "Sign out" button at top right corner to log out of their Anirex account.</li> </ol>

# Chapter 4

## System Implementation

### 4.1 Hardware Setup

The hardware used in this project is a laptop and android mobile device. The laptop was used to code the mobile application and create sentiment analysis models that are needed for this project. The mobile device will be used for testing and deploying this mobile application to recommend anime to the user.

Table 4.1.1 Specifications of laptop

Description	Specifications
Model	Acer Nitro 5 AN515-57
Processor	11th Gen Intel(R) Core (TM) i5-11400H @ 2.70GHz 2.69 GHz
Operating System	Windows 11
Graphic	NVIDIA GeForce RTX3060
Memory	16GB DDR4 RAM
Storage	512 HDD + 1TB SSD

Table 4.1.2 Specifications of android mobile device

Description	Specifications
Model	Oppo Reno 3
Processor	Octa-core (2x2.2 GHz Cortex-A75 & 6x2.0 GHz Cortex-A55)
Operating System	Android Version 12.1
Graphic	PowerVR GM9446
Memory	8GB RAM
Storage	128GB

## 4.2 Software Setup

The software used for development:

1. Android Studio (Version: Arctic Fox, 2020.3.1)
2. Jupyter Notebook (Version 6.4.8 with Python 3.12.0rc1)
3. Firebase

## 4.3 Setting and Configuration

In the module version of build.gradle file of the Android Studio project, dependencies are implemented as below:

1. Firebase Dependencies
  - Firebase Authentication (com.google.firebase:firebase-auth:21.0.1)
  - Firebase Realtime Database (com.google.firebase:firebase-database:20.0.3)
2. Google Play Services Authentication Dependency
  - Google Sign-In (com.google.android.gms:play-services-auth:20.6.0)
3. Picasso Dependency
  - Picasso, a powerful image downloading and caching library for Android (com.squareup.picasso:picasso:2.71828)
4. Retrofit Dependencies for MAL API
  - Retrofit, to make network requests (com.squareup.retrofit2:retrofit:2.9.0)
  - Gson Converter, parsing JavaScript Object Notation (JSON) responses when interacting with the MAL API (com.squareup.retrofit2:converter-gson:2.9.0)

In the manifest.xml file of the project, Internet access needs to be granted by including ‘<uses-permission android:name="android.permission.INTERNET" />’.

#### 4.4 System Operation



*Figure 4.4.1 Deployed AniRex APK.*



*Figure 4.4.2 Splash screen of AniRex when launching the mobile application.*

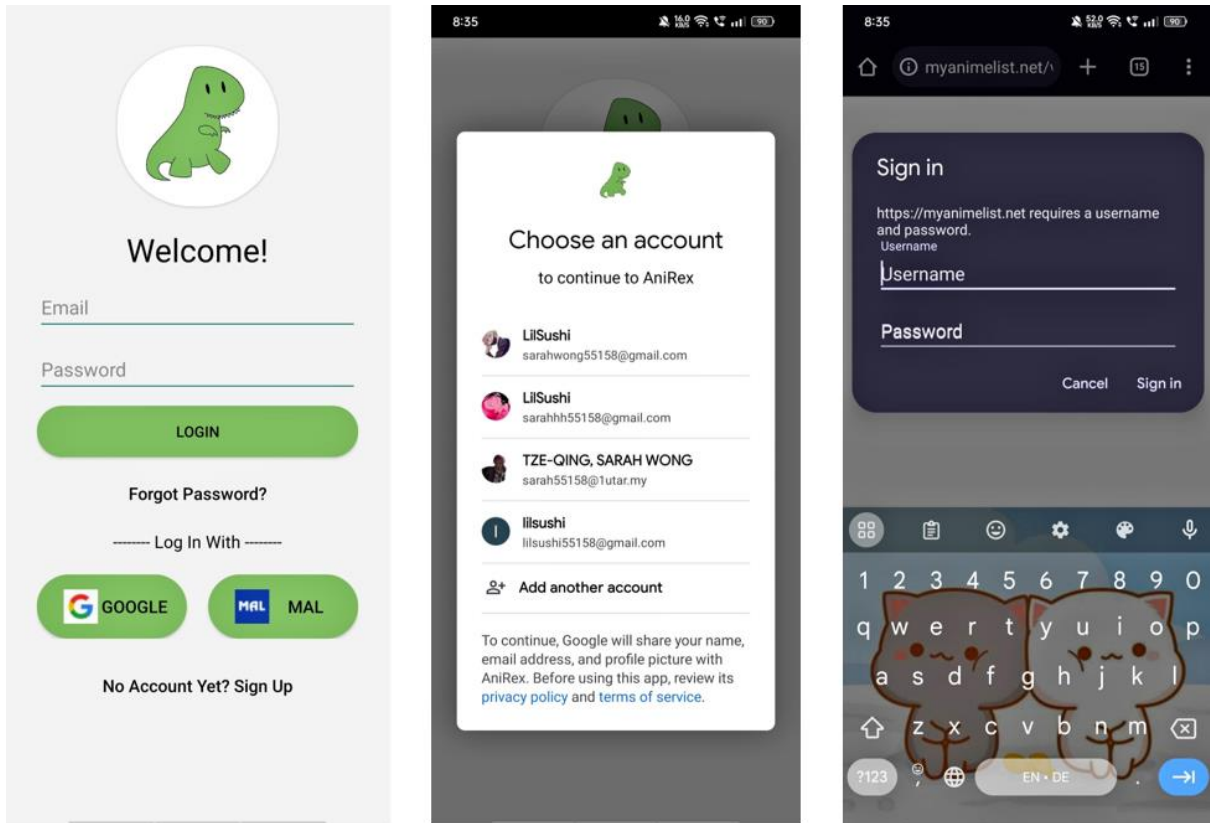


Figure 4.4.3 Default login page, login with Google page and login with MAL page.

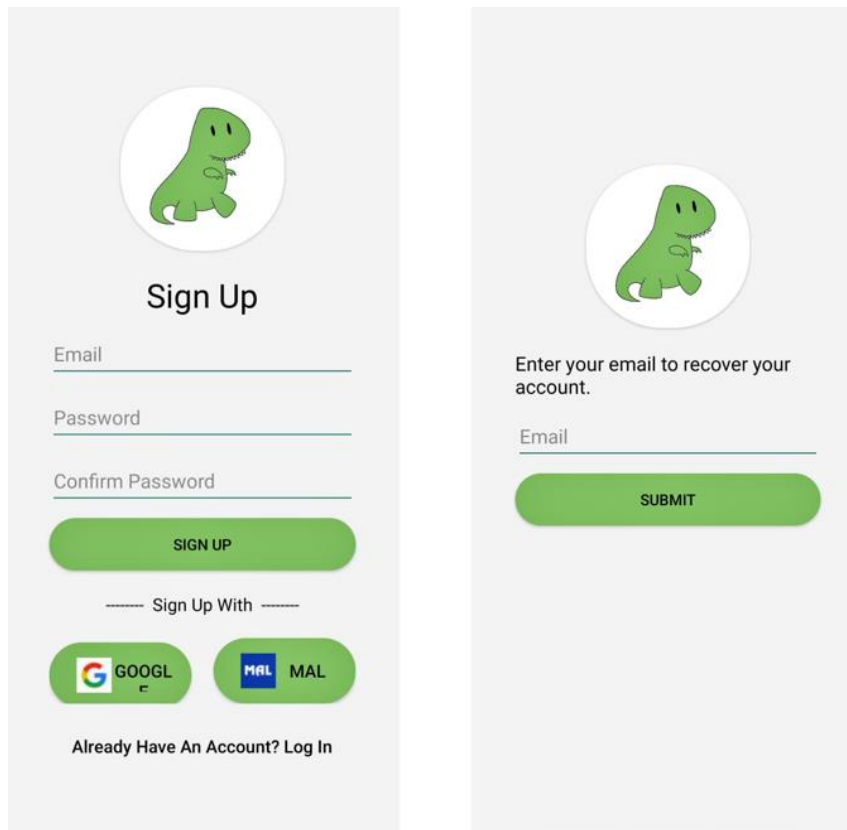


Figure 4.4.4 Sign up page and forgot password page.

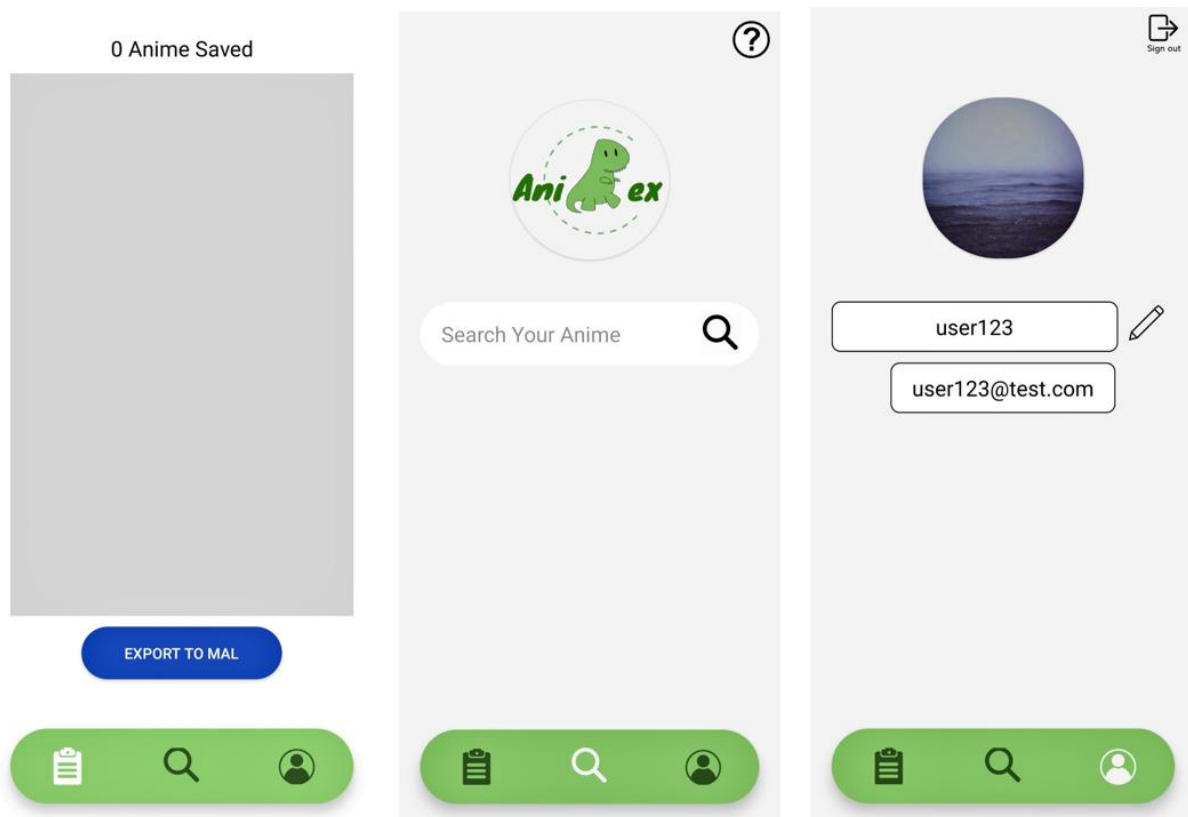


Figure 4.4.5 Saved recommendation list page, homepage and profile page.

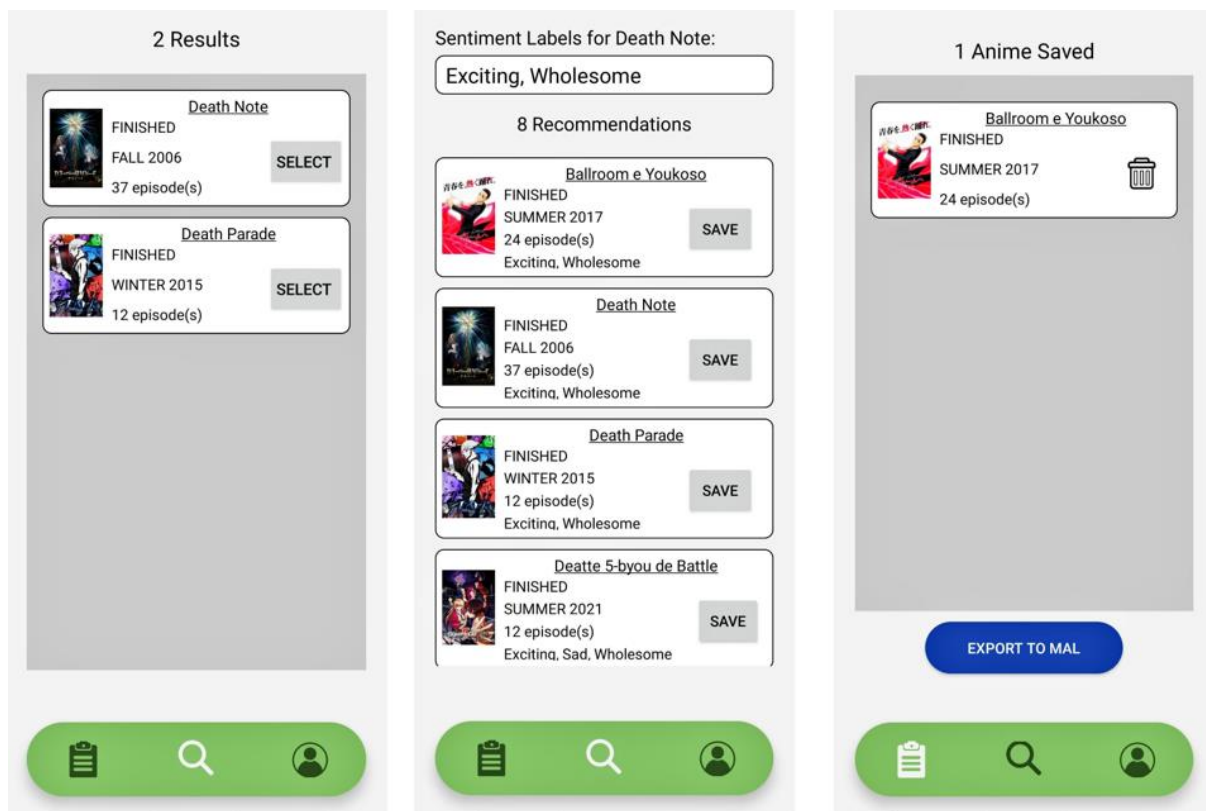


Figure 4.4.6 Results displayed when search "death", anime recommended for Death Note and saved anime in recommendation list.

#### **4.5 Implementation Issues and Challenges**

During the development stage of this project, many challenges were encountered. The main challenge is regarding computational resources and time. This is caused by the computational resources required for model training. The training of the sentiment analysis models consumed most of the time. Not only that, the dataset required to train the second sentiment analysis model is niche and had to be self-made which also proved to be challenging because emotions are subjective. Since natural language processing is complex, the overall accuracy of the second sentiment analysis model is personally unsatisfactory. Therefore, many different transformer models such as Albert, Distilbert, Convbert, LLaMa and Mistral were attempted. However, due to lack of knowledge and adequate research due to time constraints, the attempts were futile. Moreover, the anime archive dataset from [12] is too large to query or process directly on the client's side. Therefore, only a small excerpt of the dataset is used to reduce computation resources needed for querying or processing.

# Chapter 5

## System Evaluation And Discussion

### 5.1 System Testing and Performance Metrics

The features of the mobile application are tested by carrying out unit testing and integration testing. This is to ensure that the expected outcomes are achieved. On the other hand, the sentiment analysis models are evaluated with accuracy, precision, recall and f1 score metrics as seen in Figure 6.1.2.

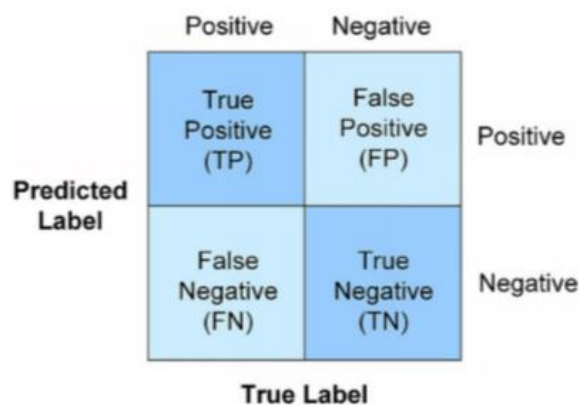


Figure 5.1.1 The truth matrix.

$$\begin{aligned}
 \textit{precision} &= \frac{TP}{TP + FP} \\
 \textit{recall} &= \frac{TP}{TP + FN} \\
 F1 &= \frac{2 \times \textit{precision} \times \textit{recall}}{\textit{precision} + \textit{recall}} \\
 \textit{accuracy} &= \frac{TP + TN}{TP + FN + TN + FP}
 \end{aligned}$$

Figure 5.1.2 Precision, recall, f1 score and accuracy formula.

## 5.2 Testing Setup and Result

### 5.2.1 Mobile Application

Table 5.2.1 Test cases for login page.

Test case	Explanation	Testing data	Expected outcome	Actual outcome	Conclusion
1	Login with valid email and password.	Email: user123@test.com Password: user123	User is redirected to homepage of	User is redirected to homepage of	Pass



			the mobile application.	the mobile application.	
2	Login with empty email and empty password.	N/A	Error message shown.	Error message shown.	Pass
3	Login with valid email and valid password but do not have a registered account.	Email: newuser@test.com Password: newuser123	Error message shown.	Error message shown.	Pass
4	Login with Google account.	Google credentials	User is redirected to sign in with Google.	User is redirected to sign in with Google.	Pass
5	Login with MAL account.	MAL credentials	User is redirected to sign in with MAL.	User is redirected to sign in with MAL.	Pass
6	User clicks “sign up” button.	N/A	System redirects user to sign up page.	System redirects user to sign up page.	Pass
7	User clicks “forgot password” button.	N/A	System redirects user to forgot password page.	System redirects user to forgot password page.	Pass

Table 5.2.2 Test cases for sign up page.

Test case	Explanation	Testing data	Expected outcome	Actual outcome	Conclusion
1	Sign up with valid email as well as password and confirm password are same.	Email: newuser@test.com Password: newuser123 Confirm password: newuser123	System redirects user to login page.	System redirects user to login page.	Pass
2	Sign up with valid email but password and confirm password are not same.	Email: newuser@test.com Password: newuser123 Confirm password: newuser	Error message shown.	Error message shown.	Pass
3	Sign up with valid email, valid password and empty confirm password.	Email: newuser@test.com Password: newuser123 Confirm password: N/A	Error message shown.	Error message shown.	Pass
4	Sign up with valid email, empty password and valid confirm password.	Email: newuser@test.com Password: N/A Confirm password: newuser123	Error message shown.	Error message shown.	Pass
5	Sign up with empty email, valid password and valid confirm password.	Email: N/A Password: newuser123 Confirm	Error message shown.	Error message shown.	Pass

		password: newuser123			
6	Sign up with MAL account.	MAL credentials	User is redirected to sign up with MAL.	User is redirected to sign up with MAL.	Pass
7	Sign up with Google account.	Google credentials	User is redirected to sign in with Google.	User is redirected to sign in with Google.	Pass

*Table 5.2.3 Test cases for forgot password page.*

Test case	Explanation	Testing data	Expected outcome	Actual outcome	Conclusion
1	Enter valid email for existing account	Email: user123@test.com	Systems sends email to reset password.	Systems sends email to reset password.	Pass
2	Enter invalid email for non-existing account.	Email: user@test.com	Error message shown	Error message shown	Pass

*Table 5.2.4 Test cases for homepage activity.*

Test case	Explanation	Testing data	Expected outcome	Actual outcome	Conclusion
1	Enter anime title to search for anime.	Input: "death"	System displays all search results containing the keyword "death".	System displays all search results containing the keyword "death".	Pass

2	Navigate to recommendation list page with bottom navigation bar.	N/A	User is redirected to recommendation list page.	User is redirected to recommendation list page.	Pass
3	Navigate to profile page with bottom navigation bar.	N/A	User is redirected to profile page.	User is redirected to profile page.	Pass

*Table 5.2.5 Test cases for recommendation list page.*

Test case	Explanation	Testing data	Expected outcome	Actual outcome	Conclusion
1	Click anime title to view more information about the anime.	N/A	System redirects user to the anime page on MAL.	System redirects user to the anime page on MAL.	Pass
2	Remove anime from saved recommendation list.	N/A	Anime is removed from the saved anime recommendation list.	Anime is removed from the saved anime recommendation list.	Pass
3	Export saved anime recommendation list to MAL.	N/A	MAL API is called to export list.	N/A	Fail
4	Navigate to profile page with bottom navigation bar.	N/A	System redirects user to profile page	System redirects user to profile page	Pass

5	Navigate to homepage with bottom navigation bar.	N/A	System redirects user to homepage	System redirects user to homepage	Pass
---	--	-----	-----------------------------------	-----------------------------------	------

*Table 5.2.6 Test cases for profile page.*

Test case	Explanation	Testing data	Expected outcome	Actual outcome	Conclusion
1	Click “logout” button to log out of account.	N/A	System logs out user from their account and redirects them to the login page.	System logs out user from their account and redirects them to the login page.	Pass
2	Click pencil icon to edit name.	N/A	User is prompted for new name.	User is prompted for new name.	Pass
3	Navigate to homepage with bottom navigation bar.	N/A	User is redirected to homepage.	User is redirected to homepage.	Pass
4	Navigate to recommendation list page with bottom navigation bar.	N/A	User is redirected to recommendation list page.	User is redirected to recommendation list page.	Pass

*Table 5.2.7 Test cases for search result page.*

Test case	Explanation	Testing data	Expected outcome	Actual outcome	Conclusion
-----------	-------------	--------------	------------------	----------------	------------

1	Click anime title to view more information about the anime.	N/A	System redirects user to the anime page on MAL.	System redirects user to the anime page on MAL.	Pass
2	Click “select” button to generate recommendations.	N/A	System displays anime recommendations.	System displays anime recommendations.	Pass

*Table 5.2.8 Test cases for recommendation result page.*

Test case	Explanation	Testing data	Expected outcome	Actual outcome	Conclusion
1	Click “add” button to save anime to recommendations list.	N/A	System adds anime to user’s list.	System adds anime to user’s list.	Pass
2	Click anime title to view more information about the anime.	N/A	System redirects user to the anime page on MAL.	System redirects user to the anime page on MAL.	Pass

## 5.2.2 Sentiment Analysis Models

```

Accuracy: 0.94
      precision    recall  f1-score   support

     0       0.94       0.94       0.94        996
     1       0.94       0.94       0.94       1004

 accuracy                0.94        2000
 macro avg              0.94       0.94       0.94        2000
 weighted avg          0.94       0.94       0.94        2000
  
```

Figure 5.2.1 Evaluation metrics results for first sentiment analysis model.

```

Classification Report for Exciting:
      precision    recall  f1-score   support

     0       0.78       0.69       0.73        423
     1       0.64       0.75       0.69        323

 accuracy                0.71        746
 macro avg              0.71       0.72       0.71        746
 weighted avg          0.72       0.71       0.71        746

Classification Report for Funny:
      precision    recall  f1-score   support

     0       0.70       0.79       0.74        398
     1       0.72       0.62       0.67        348

 accuracy                0.71        746
 macro avg              0.71       0.70       0.70        746
 weighted avg          0.71       0.71       0.71        746

Classification Report for Sad:
      precision    recall  f1-score   support

     0       0.77       0.87       0.82        452
     1       0.75       0.61       0.67        294

 accuracy                0.77        746
 macro avg              0.76       0.74       0.75        746
 weighted avg          0.76       0.77       0.76        746

Classification Report for Wholesome:
      precision    recall  f1-score   support

     0       0.57       0.77       0.65        375
     1       0.64       0.42       0.51        371

 accuracy                0.59        746
 macro avg              0.61       0.59       0.58        746
 weighted avg          0.61       0.59       0.58        746
  
```

Figure 5.2.2 Evaluation metrics results for second sentiment analysis model for each label.

Overall Accuracy: 27.48%  
Overall Precision: 68.12%  
Overall Recall: 64.15%  
Overall F1-score: 66.08%

*Figure 5.2.3 Overall evaluation metrics results for second sentiment analysis model.*

### **5.3 Objectives Evaluation**

The first objective of this project which is to develop a sentiment analysis model with at least 50% accuracy for each sentiment label was achieved. The accuracy of every label is more than 50% with the highest percentage being 71% and the lowest being 59%. The second objective which is to successfully provide anime recommendations based on the user's inputs has been achieved as well. The web crawler and models were deployed to process the reviews of anime in the database and generate the sentiment labels. Lastly, a user-friendly mobile application has also been managed to be developed.



# Chapter 6

## Conclusion And Recommendation

### 6.1 Conclusion

Despite being completed, the project can still and should be further improved in many aspects especially the features and functions that were not implemented due to time constraints. This is because the concept can be applied to all forms of entertainment including but not limited to books, movies and music. This can greatly improve the quality of human life by allowing humans to fully enjoy their favourite form of entertainment as they are able to feel the emotions they want to. They can also discover lesser-known entertainment in their respective industries. This leads to more diversity in genres and personal tastes instead of over creation and overconsumption which may lead to lack of creativity in the long run.

The objectives of the project have been achieved which are to develop a sentiment analysis model with at least 50% accuracy for each sentiment label, to successfully provide anime recommendations based on the user's inputs and create a user-friendly mobile application. The anime recommendations generated are more personalized than just being recommended current trending or newly released anime. The novelty of this project stands out because no sentiment analysis models have been used for this specific reason. This has contributed to the anime community.

### 6.2 Recommendation

Since the performance of the sentiment analysis models especially the second model is only subpar, it should be further improved with different transformer models. Technology is ever changing and more state-of-the-art models are being created or discovered. Not only that, finetuning models have never been easier with tons of ground breaking discoveries being made by deep learning or machine learning researchers. The potential of this project is limitless. Additionally, a web server could be implemented in the future to automate the process of generating sentiment labels for anime in the database. This will significantly reduce the time and effort needed to generate the sentiment labels. The future work also includes implementing the concept on other forms of entertainment such as reading materials.

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# FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

<b>Trimester, Year: Trimester 3, Year 3</b>	<b>Study week no.: 1 &amp; 2</b>
<b>Student Name &amp; ID: Wong Tze-Qing, Sarah (20ACB03227)</b>	
<b>Supervisor: Dr Ramesh Kumar Ayyasamy</b>	
<b>Project Title: Sentiment based Anime Recommendation System</b>	

## 1. WORK DONE

Expand dataset for second sentiment analysis model training.

## 2. WORK TO BE DONE

- Expand dataset for second sentiment analysis model training.
- Edit web crawler to fit project needs.

## 3. PROBLEMS ENCOUNTERED

- Web crawler retrieves non-English reviews.

## 4. SELF EVALUATION OF THE PROGRESS

- Satisfactory.

Supervisor's signature

Student's signature

# FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

<b>Trimester, Year: Trimester 3, Year 3</b>	<b>Study week no.: 3 &amp; 4</b>
<b>Student Name &amp; ID: Wong Tze-Qing, Sarah (20ACB03227)</b>	
<b>Supervisor: Dr Ramesh Kumar Ayyasamy</b>	
<b>Project Title: Sentiment based Anime Recommendation System</b>	

## 1. WORK DONE

- Expand dataset for second sentiment analysis model training.
- Edited web crawler to check for and discard non-English reviews.

## 2. WORK TO BE DONE

- Expand dataset for second sentiment analysis model training.
- Edited web crawler to check for and discard non-English reviews.

## 3. PROBLEMS ENCOUNTERED

- Web crawler sometimes retrieve reviews for manga instead of anime.

## 4. SELF EVALUATION OF THE PROGRESS

- Satisfactory



Supervisor's signature



Student's signature

# FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

<b>Trimester, Year: Trimester 3, Year 3</b>	<b>Study week no.: 5 &amp; 6</b>
<b>Student Name &amp; ID: Wong Tze-Qing, Sarah (20ACB03227)</b>	
<b>Supervisor: Dr Ramesh Kumar Ayyasamy</b>	
<b>Project Title: Sentiment based Anime Recommendation System</b>	

## 1. WORK DONE

- Edited web crawler to check for and discard non-English reviews.
- Expand dataset for second sentiment analysis model training.

## 2. WORK TO BE DONE

- Develop mobile application

## 3. PROBLEMS ENCOUNTERED

- None

## 4. SELF EVALUATION OF THE PROGRESS

- Satisfactory



Supervisor's signature



Student's signature

# FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

<b>Trimester, Year: Trimester 3, Year 3</b>	<b>Study week no.: 7 &amp; 8</b>
<b>Student Name &amp; ID: Wong Tze-Qing, Sarah (20ACB03227)</b>	
<b>Supervisor: Dr Ramesh Kumar Ayyasamy</b>	
<b>Project Title: Sentiment based Anime Recommendation System</b>	

## 1. WORK DONE

- Develop mobile application

## 2. WORK TO BE DONE

- Develop mobile application  
- Try transformer models for second sentiment analysis models

## 3. PROBLEMS ENCOUNTERED

- None

## 4. SELF EVALUATION OF THE PROGRESS

- Satisfactory

Supervisor's signature

Student's signature

# FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

<b>Trimester, Year: Trimester 3, Year 3</b>	<b>Study week no.: 9 &amp; 10</b>
<b>Student Name &amp; ID: Wong Tze-Qing, Sarah (20ACB03227)</b>	
<b>Supervisor: Dr Ramesh Kumar Ayyasamy</b>	
<b>Project Title: Sentiment based Anime Recommendation System</b>	

## 1. WORK DONE

- Develop mobile application.
- Try transformer models for second sentiment analysis models.

## 2. WORK TO BE DONE

- Fine tune existing second sentiment analysis model.

## 3. PROBLEMS ENCOUNTERED

- Transformer models not working as expected.

## 4. SELF EVALUATION OF THE PROGRESS

- Bad

Supervisor's signature

Student's signature



# FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

<b>Trimester, Year: Trimester 3, Year 3</b>	<b>Study week no.: 11 &amp; 12</b>
<b>Student Name &amp; ID: Wong Tze-Qing, Sarah (20ACB03227)</b>	
<b>Supervisor: Dr Ramesh Kumar Ayyasamy</b>	
<b>Project Title: Sentiment based Anime Recommendation System</b>	

## 1. WORK DONE

- Fine tune existing second sentiment analysis model.

## 2. WORK TO BE DONE

- FYP2 report writing and presentation preparation.

## 3. PROBLEMS ENCOUNTERED

- None

## 4. SELF EVALUATION OF THE PROGRESS

- Satisfactory

Supervisor's signature

Student's signature



# SENTIMENT BASED ANIME RECOMMENDATION SYSTEM

by Wong Tze-Qing, Sarah  
Supervisor: Dr Ramesh Kumar Ayyasamy



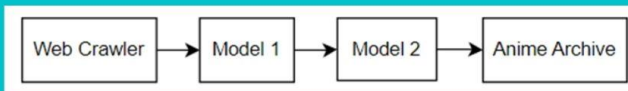
## INTRODUCTION

- Recommends anime based on sentiments
- User inputs anime title
- List of anime with the same sentiment tags are generated

## METHOD

- Developed using pre-trained BERT and BiRNN models
- Developed with Java on Android Studio to develop mobile application.

## PROCESSING FLOW



	Input	Output
Web Crawler	Anime URL	Reviews
Model 1	Reviews	Positive Reviews
Model 2	Positive Reviews	Sentiment Labels
Anime Archive	Sentiment Labels	Labelled anime

## DISCUSSION

- Anime recommendation system based on sentiment has never been done before.
- Utilizes sentiment analysis to improve the existing recommendation systems.

## RESULTS

Model 1 accuracy: 94%

Model 2 accuracy:

Wholesome: 59%

Funny: 71%

Exciting: 71%

Sad: 77%



## CONCLUSION

- Save time from having to read reviews to decide whether to watch anime or not
- Recommend based on sentiments instead of popularity and trends
- Meet expectations of users who are in the mood for specific sentiments
- Applicable to music and movies

## PLAGIARISM CHECK RESULT

Match Overview		
<b>7%</b>		
<	>	
1	Submitted to American... Student Paper	1% >
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***Based on the above results, I hereby declare that I am satisfied with the originality of the Final Year Project Report submitted by my student(s) as named above.***

\_\_\_\_\_  
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 Name: Dr Ramesh Kumar Ayyasamy  
 Date: 26/04/24

\_\_\_\_\_  
 Signature of Co-Supervisor  
 Name: \_\_\_\_\_  
 Date: \_\_\_\_\_



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