VOICE FEEDBACK SYSTEM WITH SENTIMENT ANALYSIS AT A UNIVERSITY

By

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FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

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ACKNOWLEDGEMENTS

ABSTRACT

This project entails the development of an Android mobile application that leverages Natural Language Processing (NLP), Sentiment Analysis, and integrated voice recognition technology. The primary objective of this application is to address the challenge of inefficient feedback collection and analysis methods, which often involve lengthy surveys, limited feedback scope, and difficulties in handling substantial data volumes.

The proposed application introduces an enhanced approach to submitting, gathering, and analyzing feedback. It empowers users to submit feedback through voice recognition technology, which is subsequently converted into text and subjected to sentiment analysis techniques. The feedback is then categorized based on polarity (ranging from slightly positive to slightly negative, positive, negative, or neutral) and emotion (such as anger, happiness, sadness, disappointment, fear, etc.).

Within the application, users are granted access to a history of their previous feedback submissions. This feature not only allows them to review the feedback content but also provides insights into the sentiment analysis results for each entry. Furthermore, users retain the option to selectively remove specific feedback entries, ensuring transparency and granting them control over their submitted feedback.

Additionally, the application includes administrative functionalities for management or system administrators. These features enable them to organize and categorize the collected feedback in an organized manner, primarily based on the sentiments expressed. Furthermore, categorization is facilitated according to the type of user who submitted the feedback, aiding management in customizing responses and actions based on specific user groups and their feedback. To mitigate the impact of potentially malicious anonymous feedback, the system allows management to reduce the weightage of such submissions.

In summary, this application offers a streamlined approach to feedback collection and analysis, enhancing the user experience while empowering organizations to make data-driven decisions for future enhancements.

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LIST OF ABBRIEVATION

NLP	Natural Language Processing
AI	Artificial Intelligence
ML	Machine Learning
VoC	Voice of Customers
STT	Speech-To-Text
IDE	Integrated Development Environment
ICT	Information and Communication Technology

Chapter 1 Project Background

1.1   Introduction

Artificial Intelligence (AI) is a field in engineering and also computer science where generally means implementing human intelligence in machine for them to perform tasks that would typically require human intelligence. AI is usually related to Machine Learning (ML) which human programmed and train the machine with sets and sets of data for machines to capable to think and act like human with rational and humane thoughts. In the recent years, Machine Learning along with the subfield Deep Learning have seen impressive advances.

Natural Language Processing (NLP) is a subfield of semantics study, software engineering and AI which focuses on the communication between computer and human language, mainly on programming the computer to interpret and understand human language either by written text, or speech. (R. Kumar and V. Sahula. 2021). The automated NLP is aimed to perform the job with efficiency and accuracy, just like things that human do. Once computer is programmed to understand human language it can used for automated processes of analyzing linguistic structure and to develop systems like machine translation, speech recognition and speech synthesis.

Sentiment analysis is also a process which uses NLP technology, it can interpret and analyze the ambiguousness and emotion of human language and categorize them effectively. It usually works by detecting, extracting, quantifying, and investigating the emotional tone of textual data provided. The result of sentiment analysis can generally include three polarity which is positive, negative, and neutral and can be further analyze the emotions like angry, happy, sad, etc. Sentiment analysis is important in various field such as analyzing overall mood of the user towards certain environments. These sentiments become beneficial for business, services and universities.

Sentiment analysis plays a crucial role in organizational settings, especially in universities, by aiding in the comprehension of stakeholders' feelings and opinions. It enables universities to gain insights into the opinions of their students, faculty, and staff towards various aspects of the institution, such as academic programs, campus services, and student life. This information can be utilized to identify areas that need improvement and make informed decisions based on data to enhance stakeholder satisfaction.

Moreover, sentiment analysis can aid universities in managing and monitoring their reputation online. By examining sentiment on social media and other online platforms, universities can monitor their brand reputation and address negative feedback or criticism in a timely manner. This, in turn, can help universities maintain a positive image and enhance their overall perception among their stakeholders. With advanced computing capabilities, machines can be trained to convert Voice of Customers (VoC) into text format which is commonly referred to as Speech-to-Text (STT) or Automatic Speech Recognition (ASR). This technology can be utilized in various data analytics processes such as analyzing customer reviews, evaluating product and service satisfaction, and performing business analytics. Currently, most data are collected through surveys and interviews, but using voice feedback services would provide a more convenient and efficient means of gathering reviews and feedback.

Despite its potential, the development of current NLP faces several challenges. One of these challenges is dealing with phrasing ambiguities, which can make it difficult even for humans to understand each other when using deliberate or sarcastic language. Unlike factual data, sentiment and feedbacks have a crucial characteristic which they are subjective. Another challenge is obtaining and processing the large amounts of training data required to create a new NLP system, unless an existing one is used. Additionally, NLP struggles with recognizing and processing different languages and dialects, which can limit its effectiveness in certain contexts.

1.2   Problem Statement and Motivation

Data gathering and analysis are crucial processes in our daily lives in the modern world. Due to the enormous amount of data at our disposal, data gathering and analysis are now fundamental to daily life. We may make wise judgments, spot patterns, and learn important lessons with the aid of data collection and analysis, which can have an impact on many different areas of our lives. Data collection and analysis are essential in organizations for data-driven decision-making, process improvement, consumer preference identification, and trend forecasting.

The use of data analytics in business can have a number of advantages, including raising operational effectiveness, locating cost-saving opportunities, and boosting customer satisfaction. Businesses may learn customer preferences, spot trends, and create focused marketing tactics that boost client loyalty and engagement by analyzing customer data.

Automation of the data gathering process, increased data accuracy, and real-time data analysis are just a few advantages that can come from using AI into data collection and analytics. Businesses can gain a competitive edge by using AI-powered analytics to discover patterns and forecast outcomes more quickly. People's voices should also be recorded and analyzed in addition to written or typed data on paper or electronic devices. However, integrating voice input with sentiment analysis presents certain difficulties. The following are typical issues that organizations, including colleges, go across.

Existing Feedback collection methods are with many limitations

Currently, surveys and interviews are the two most popular ways to obtain feedback. Even though these are the most common approaches, they take a lot of time and work. Most surveys have a collection of questions that can take a few minutes or even hours to answer. Conversely, interviews demand that you prepare interview questions and conduct them with the interviewee and location of your choice, whether face-to-face or via online meetings. These procedures are ineffective because they have time and space restrictions and are labor-intensive. Low response rates in surveys and interviews indicate that a representative sample of the population is frequently not provided. The ability of universities to make data-driven decisions and changes may be hampered as a result of limited data and insufficient insights. Additionally, Traditional approaches might also be subject to response bias since some people might be more inclined to react than others, which could skew the representation of stakeholders' perspectives. Universities want a better and faster response rate from those who offer comments in order to acquire more insights with larger samples.

Scope limitations of feedbacks

An initial set of questions is typically provided, consisting primarily of closed-ended questions, to streamline the feedback collection process. This may limit the amount of feedback that individuals may provide because their further opinions may not be covered by the questions. Traditional approaches have trouble gathering all kinds of feedback from people. For example, some surveys only feature five or ten questions, which restricts the scope of feedback to those items and excludes opinion on other topics. The surveys' foci are relatively narrow and frequently leave out the key elements of what respondents wish to report.

The unavailability of feedback collection techniques like surveys and interviews to capture real-time feedback limits their usefulness. The input gathered could not exactly

reflect the situation or emotion at hand because these methods take time to plan and execute. For some events, questionnaires may become old and irrelevant, or they may not keep up with organizational changes. A university might have a questionnaire about a particular activity or program that is no longer available, or one about a certain department that has experienced significant organizational and responsibility changes. The questionnaire would not offer precise or helpful information in such circumstances.

When we utilize a sampling technique like questionnaires, sampling bias could also happen. For instance, the university provided students with a set of surveys regarding its facilities. The questionnaires might not have reached all students, and those who are now utilizing the facilities might not have gotten them. Some students might not have used the services indicated in the questionnaire.

<u>Difficulties in handling large data</u>

Some feedback gathering techniques involve open-ended questions or opinion gathering techniques in addition to answering closed-ended questions. These techniques are ineffective because it takes a lot of time and labor to process each one individually. Imagine, for the sake of illustration, that a university seeks student input regarding the caliber of its academic offerings. It may take a lot of time and resources to manually examine the data if the feedback has open-ended questions or calls for qualitative analysis.

Additionally, if there are many responses to the input, the manual analysis may miss or neglect some crucial trends or insights. It can be difficult for institutions, especially colleges, to manage vast amounts of data. For instance, manually assessing the data can be time-consuming and prone to mistakes if a university gathers input from a big number of students. This is especially true if the method used to gather input involves asking open-ended questions or gathering opinions. It takes a lot of time and effort to manually analyze huge data sets, and human mistake can lead to the omission or disregard of crucial information.

To successfully assess and process a sizable amount of feedback data gathered, an efficient methodology is required. As AI technologies can manage and analyze data more precisely and quickly than human analysts, using AI technologies can be a viable solution to this problem. For instance, artificial intelligence-powered sentiment analysis algorithms can automatically classify feedback based on positive, negative, or neutral tones, giving a brief summary of the input's overall sentiment.

Due to the aforementioned issues, this project intends to develop a mobile application that makes use of a voice feedback system and sentiment analysis to quickly and easily gather and evaluate comments.

1.3   Project Objectives

The purpose of the project is to create an Android mobile application that can efficiently gather and analyze student feedback for a university. The system will turn spoken feedback into text using voice recognition technology, which will then be analyzed using sentiment analysis techniques to determine if the input is generally favorable, negative, or neutral. Ideally, the system will also convey the emotion associated with the feedback. The institution will use the sentiment analysis results to identify areas for improvement to boost client satisfaction through data analytics. Additionally, the app will enable users to provide feedback and complaints directly to the university, making it simpler for the latter to handle user issues and enhance services.

• Offering an alternative method for feedback collection

The suggested feedback system attempts to give people a more practical and approachable manner to offer their thoughts. Users can simply submit feedback by speaking into the system using voice recognition technology rather than having to type it down, which can be tiresome and time-consuming. The planned feedback system will allow users to submit input by voice, which will be understood and converted to text, much like Google's "Hey Google" voice searches and actions or Apple's Siri. Users will find it simpler to submit feedback with this feature because they can speak it aloud instead of typing it, making it a hands-free and multitasking alternative.

Additionally, those with limited literacy skills or communication obstacles may find it simpler to submit comments thanks to the speech recognition tool. They only need to speak their feedback in their local tongue, and speech recognition technology will understand it, translate it to text, and then process it further using NLP and machine learning algorithms. Through automation, the feedback analysis process might be sped up and made more effective.

• Accepting feedbacks without a limited scope

Users can provide comments on any topic using the proposed system's open-ended feedback gathering technique. With this strategy, institutions are certain to get input on all facets of their operations and can utilize it to better going forward.

Users are free to submit feedback on any subject they deem significant when using an open-ended feedback collection approach, which provides colleges with a more thorough

understanding of their operations and possible areas for development. For instance, a student could want to share input on the cafeteria's food quality, which might not have been covered in a conventional survey that solely asked for opinions on academic programs or campus infrastructure. Universities can gain insightful information on all facets of their operations by accepting open-ended input, which they can then utilize to make data-driven decisions.

• Providing a more efficient way to process large amounts of data

The conventional approach to handling massive amounts of data needs a lot of time, money, and labor. Data processing is frequently done manually, which makes it challenging to evaluate or enhance university operations. The suggested method makes use of technology that enables automatic data collecting and processing, saving universities time and resources that they may devote to other tasks, including handling feedback or business analytics.

The proposed feedback system may automatically classify and categorize input according to its relevance and importance with the use of AI algorithms, doing away with the necessity for manual processing. Additionally, the system can spot patterns and trends in comments, giving colleges important information about areas that require development or those that are already working effectively.

As a result, universities can modify their operations and make educated decisions based on real-time data, which increases productivity and efficiency. To pre-categorize input into groups including facilities, academics, and student services, the suggested method will use AI. Universities can then take the necessary measures after categorizing feedback to swiftly discover problems. For instance, the institution can easily identify this issue under the facilities category and take action to give students more study spaces if many students are complaining about the lack of study spaces.

1.4   Project Scope and Direction

The main goal of this project is to develop an Android mobile application that improves the user experience by offering a quicker way to submit, gather, and analyze comments on the university. Voice recognition technology will be used to achieve this, making it simple for consumers to provide feedback. Additionally, the system will make use of AI tools like sentiment analysis to aid in the interpretation of the gathered feedback. The following elements will be included to make the feedback system easier to use:

I.   **Users' opinion of the university will be gathered by the feedback system.**

II. **The feedback system will feature recording modules and accept feedback using voice recognition technology.**

III. **The input that has been gathered will be examined using a sentiment analysis software.**

IV. **Based on polarity, feedback will be divided into five categories: positive, slightly positive, neutral, slightly negative, or negative.**

V. **The feedback systems will store data on cloud database.**

VI. **Querying can be done automatically on cloud database.**

VII. **Login module which identifies admin and users.**

VIII. **In the data analytics module, the management team will be able to access more detailed analytics with graphs.**

IX. **Users of the feedback system will have access to a user-friendly interface with simple navigation.**

X. **Users will be able to send recommendations or grievances to the university directly through the feedback system for quick resolution.**

1.5   Contributions

The importance of this voice feedback application rests in its capacity to overcome the difficulties that colleges encounter when trying to gather and analyze client input. The app can increase the efficacy of the feedback collection process by offering a mobile application that enables users to provide feedback in a more comfortable and accessible manner.

The program can also assist institutions in conducting a more precise and insightful examination of the input they receive by using voice recognition technology and sentiment analysis. This is helpful for determining the areas in which their services need to be improved, which will ultimately improve the overall client experience.

The app's capability to give institutions real-time feedback is another important feature that can aid them in quickly responding to student issues and complaints. Universities can respond to client input quickly and take necessary action to improve their services by enabling customers to send their comments directly to the university through the mobile application.

The app may also aid in bridging the communication gap between clients and colleges. Universities can gather valuable information about their customers' needs and preferences by

giving them a place to voice their ideas and grievances. This will help them to better tailor their services to match their customers' expectations.

It's also important that the app can gather feedback from users who have little education or experience with the internet. Even people with little expertise using digital devices can offer feedback and suggestions through the app thanks to speech recognition technology. For instance, parents of students who are not comfortable using technology can easily utilize the app to complain to the institution or offer ideas. As a result, the feedback system may now reach a larger audience, enabling the institution to gather feedback from its stakeholders that is more varied and representative.

The system provides valuable business insights that empower the university to drive improvements effectively. These insights are derived from user feedback, sentiment analysis, and data visualization, enabling informed decision-making and strategic enhancements across various university aspects.

Overall, this voice feedback app has the potential to dramatically enhance the way institutions gather and analyze student data, which would ultimately result in better services and a better customer experience.

1.6 Report Organization

In Chapter 1, the introduction of the project, an overview of the project is provided. This chapter contains the problem statement and motivation, outlining the issues that spurred my project. It also outlines the objectives, defining what the project aims to achieve, and delves into the project's scope and direction. Additionally, it also highlights the contributions to the field and provide an outline of the report's organization, giving readers a roadmap of what to expect.

Chapter 2, the literature review, is where existing system related to this project is reviewed. The comparison of this project and the existing project is shown.

Chapter 3, the system methodology, which outline the approach for development-based projects. This chapter includes a system design diagram, system architecture diagram, use case diagram, and activity diagram, providing a visual representation of the project's structure and workflow.

Chapter 4, system design provides detailed information about the system's design aspects. It includes the system block diagram, system component specifications, and system component interaction operations.

Chapter 5, system implementation will be discussing the practical aspects of implementing the project. This includes device setup, system operation with screenshots, any implementation challenges encountered, and concluding remarks on the implementation process.

Chapter 6, the system evaluation and discussion chapter, where system evaluation report take place. It covers system testing and performance metrics, testing setups and results, project challenges faced, an evaluation of project objectives, and concluding remarks on the evaluation process.

Chapter 7, the conclusion and recommendation chapter, is dedicated to summarizing the findings and conclusions. It also concludes the project and offer recommendations for future work or improvements, ensuring a comprehensive understanding of our project's objectives, processes, and contributions.

Chapter 2 Literature Review

2.1 Existing feedback methods at universities

2.1.1 Universiti Malaya (UM) Helpdesk

Figure 1: UM Helpdesk

The University Malaya has a built-in system for receiving feedback. It enables users to provide comments in a variety of areas, including academic services, campus facilities, and ICT services. Users can provide detailed feedback and even add images as supplementary materials.

<u>Strengths</u>

• **Feedback Status Confirmation**

Users can readily check the progress of their complaints or feedback via the feedback system, which promotes transparency in the way that input is handled. It can also let others know that the university is paying attention to their feedback.

• **Pre-categorizing**

Users can enter the feedback category for simpler feedback documentation. Universities can more effectively discover areas for improvement by using this feature, which enables them to

examine feedback data based on several categories. Users can offer specific feedback under categories such ICT services, campus amenities, and academic services.

• **Open-end Feedbacks**

Users can freely offer comments through the system, which enables them to share ideas and proposals that the institution had not previously taken into account.

Weaknesses

• **No Mobile Application Available**

There is no mobile application for the feedback system, which makes it difficult for people to utilize on mobile devices.

• **Private Feedbacks**

Users cannot access each other's feedback since it is only visible to them and system administrators when it is posted by users. Users may find it difficult to get a full picture of the university's feedback history due to this limitation, which could undermine their confidence in the feedback system.

2.1.2 Hot Courses Abroad

WRITE A REVIEW TO HELP OTHER STUDENTS

Universiti Tunku Abdul Rahman (UTAR)

Your rating

Rate from 1 (poor) - 5 (excellent). You can give your reasons why in the comment box

★★★★★ Overall experience *

★★★★★ Admission process*

★★★★★ Funding and scholarships

★★★★★ Your study experience*

★★★★★ Your life experience*

★★★★★ Job prospects*

Your review

Review title*

HOW ARE YOU FINDING THE UNIVERSITY?*   Guidelines

Tell us about your university experience in English

Figure 2: Hot Course Abroad

Users of Hot Course Abroad can post and review feedback for other colleges, allowing them to compare the institutions and draw comparisons.

Strengths

• Rating System with Stars for Each Category

Users can rate how satisfied they are with each category that is offered, including overall experience, the application process, receiving financial aid, and more.

• Detailed Text Feedbacks

Users can elaborate and defend their opinions by adding additional remarks to their feedbacks.

• Precise Figures

The site displays the percentage of recommended reviewers, providing users with a general idea of the overall satisfaction of other users.

• Contact Information Collection for Notifications

Users can get a broad notion of how satisfied other users are with the site by looking at the percentage of recommended reviewers that it displays.

<u>Weaknesses</u>

• Unprocessed Written Reviews

Because reviews must be at least 200 characters long and cannot be processed for easy understanding, the information in written comments may be overwhelming and difficult to browse.

• Only Text Feedbacks

Users are only able to offer their feedback verbally through text entry; speech recognition is not an option. Compared to speech-to-text tools, which are now commonly available on the internet, typing words one at a time can be time-consuming.

2.1.3 Easyuni

Figure 3: easyuni.my

Easyuni.my is a website where users can provide feedback for universities, but in order to do so, users must first confirm their email address. The platform's advantages and disadvantages are listed below:

Strengths

• Verification Process

The platform requires users to confirm their email address, ensuring that the reviews are accurate and reliable.

• Multiple Universities

The portal offers evaluations and comments for universities all across the world.

Weaknesses

• Limited Feedback Categories

Users can only rate a small number of areas on the portal, including campus amenities, academic staff, and course design.

• No Sorting Options

Finding pertinent feedbacks is difficult because users cannot arrange reviews by ratings or date.

2.2 Comparison Table

	UM Helpdesk	Hot Courses Abroad	Easyuni	Proposed System
Speech To Text	**NO**	**NO**	**NO**	**YES**
Feedbacks Transparency	**NO**	**YES**	**YES**	**YES**
Rating	**YES**	**YES**	**NO**	**YES**
Open-ended Feedbacks	**YES**	**YES**	**YES**	**YES**
Automated Feedbacks Analysis	**NO**	**NO**	**NO**	**YES**
Application Readiness	**NO**	**NO**	**YES**	**YES**
Data Visualization	**NO**	**NO**	**NO**	**YES**

Table 1: Comparison Table

Chapter 3 System Methodology

3.1 Methodology

The project development methodology employed is the Prototyping method. Prototyping is a development approach that entails constructing a functional model of the final product. This model serves to unveil both its strengths and weaknesses while offering stakeholders a tangible visualization of the project. Prototyping manifests through the creation of an initial version of the mobile application, showcasing its fundamental features and user interface. This can be achieved using various techniques, including sketching, wireframing, or specialized prototyping software. Following the prototype's creation, it undergoes user testing to collect feedback and enhance the application's quality before proceeding to the final development phase.

The utilization of prototyping as a mobile app development methodology offers numerous advantages. Foremost among these is its capacity to provide a visual representation of the app, simplifying the process for stakeholders to conceptualize its appearance and functionality. This visualization aids in the early identification of potential issues and shortcomings, enabling necessary adjustments to be made prior to the application's release.

Furthermore, prototyping allows developers to meticulously evaluate the app's strengths and weaknesses. Through the creation of a prototype, developers gain firsthand insight into the app's operation, enabling them to pinpoint areas requiring enhancement or optimization. This iterative process contributes to streamlining the development cycle and ensures the ultimate product attains the highest standard.

Additionally, prototyping provides a comprehensive overview of the application, which proves invaluable for future development and updates. Developers can glean insights into the application's overarching structure and functionality, thereby facilitating informed planning for subsequent features and enhancements.

Lastly, prototyping facilitates more effective project presentations to stakeholders and investors. Through the provision of a visual representation of the app, stakeholders gain a deeper comprehension of the project, enabling them to offer constructive feedback that contributes to refining the final product.

3.2 System Design Diagram

3.2.1 System Architecture Diagram
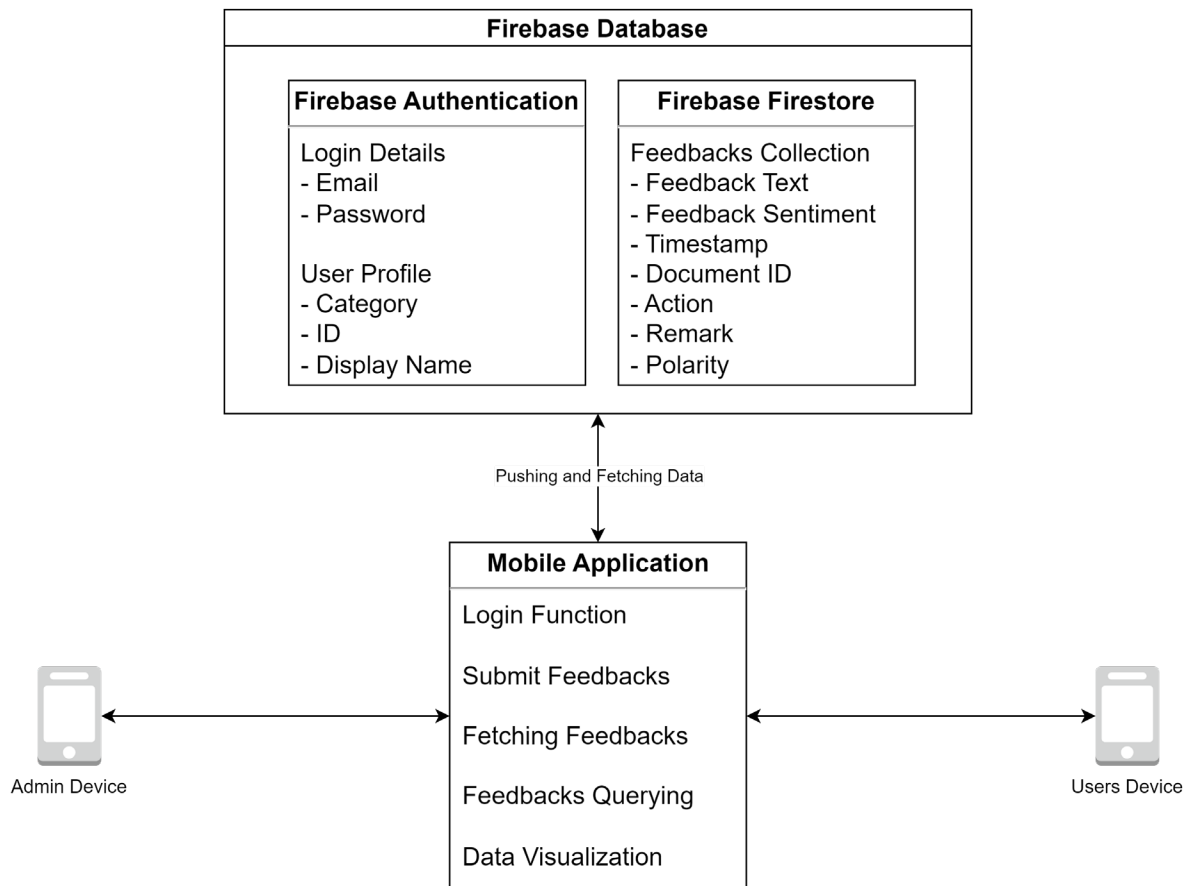
Figure 4: System Architecture Diagram

The provided figure outlines the interaction between users' and administrators' devices and the Sentimental Feedback Application, which relies on Firebase, a cloud database. Within this architecture, various functions of the mobile application are utilized.

The mobile application includes functions such as login, feedback submission, feedback retrieval, feedback querying, and data visualization. Firebase Authentication is employed to securely store user data, encompassing login credentials and user profiles. Additionally, Firestore is utilized to organize feedback-related data into collections and documents. These feedback documents contain fields such as feedback text, feedback sentiment, timestamp, document ID, and more.

For functions requiring querying capabilities, Firebase incorporates query rules and indexes, ensuring efficient and accessible queries for the mobile application. When users engage in these functions within the mobile application, the application establishes

communication with Firebase to perform actions such as data submission, retrieval, and querying as intended.

3.2.2 Use Case Diagram

Figure 5: Use Case Diagram

The provided diagram represents the use case diagram of the mobile app, illustrating the interactions between two primary actors and the system: the admin and the users.

Users have access to several modules, including the registration module, login module, record feedback module, and feedback history module. On the other hand, the admin can access the login module and the data visualization module.

The register module is solely for user where they can register an account for the app in different category: student, staff and guest. The login module serves both users and admins with the same functionality. It retrieves account details from the database and determines whether the logged-in account is an admin or a user, displaying the appropriate view accordingly. User can also choose to login anonymously with some limitations

Within the admin view of the application, two main modules are present: the data visualization module and the feedback history module. In the data visualization module, admins can retrieve feedback data from the database and generate graphs and pie charts based on their preferences. In the feedback history module, admins can view all feedback from users and apply filters for a more concise view. Admins also have the ability to add remarks to feedback entries, indicating actions taken in response to received feedback.

Conversely, in the user view of the application, the primary modules are the record feedback module and the feedback history module. In the record feedback module, users can verbally provide feedback using the microphone, receive text output, and perform sentiment analysis. If users are satisfied with the feedback input, they can submit it to the database. In the user feedback history module, which differs slightly from the admin's, users can view only their own feedback entries, while any remarks made by the admin are displayed alongside each respective feedback entry.

In summary, the use case diagram describes the various features of the feedback system and how the actors interact with these features. The diagram provides a clear visualization of the system's functionalities, which can help in the development and testing process.

3.2.3 Activity Diagram
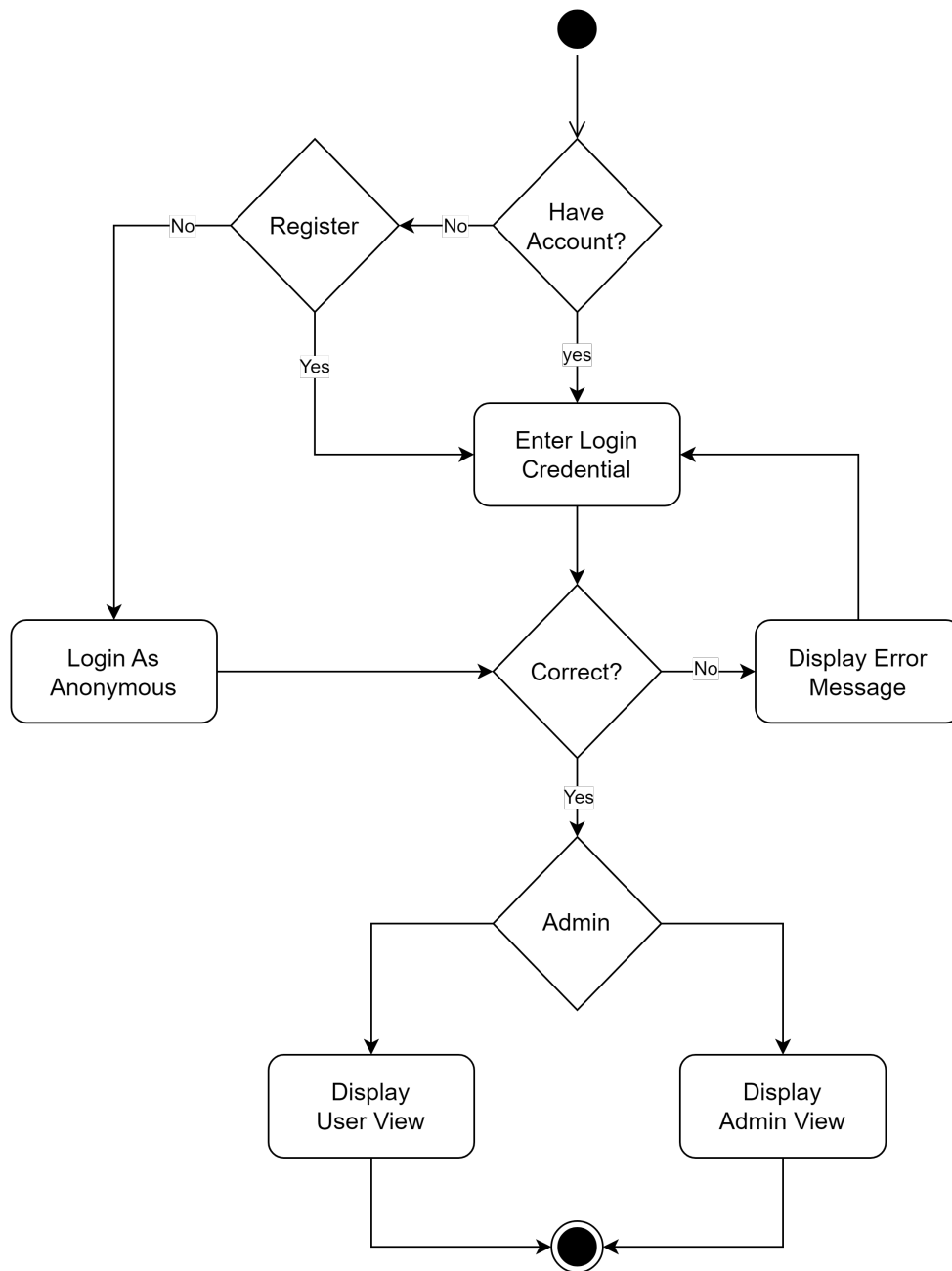
Figure 6: Activity Diagram Login

The Login module activity diagram presented above depicts the process flow for users who already have an account. These users can enter their login credentials to access their account. However, for those who do not have an account, the diagram illustrates the process flow for registering as a new user or login as anonymous. In case a user enters incorrect credentials, an error message will be displayed on the screen until the user enters the correct login information. After correct credentials is entered, the system will identify whether the account is user account or admin account then show the correct home page accordingly.
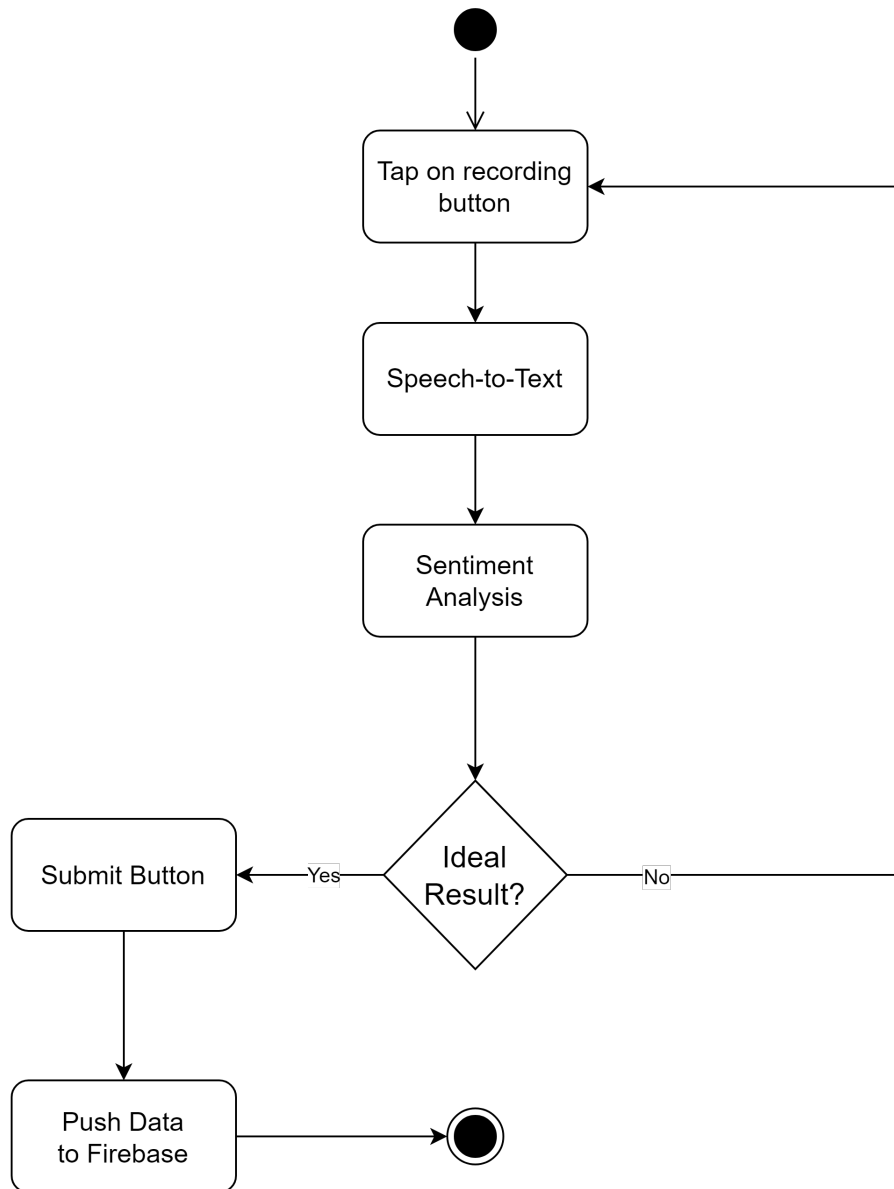
Figure 7: Activity Diagram Record

To utilize the feedback system, users initiate the process by tapping the recording button on the app interface. Subsequently, the speech recognition technology transforms the recorded audio into text, facilitating analysis through sentiment analysis techniques. In the event that users are dissatisfied with the obtained results, they have the option to repeat the process until achieving the desired outcome. Once the user is satisfied with the feedback, they can submit it to the app, which will send the feedback and result of the sentiment to Firebase.
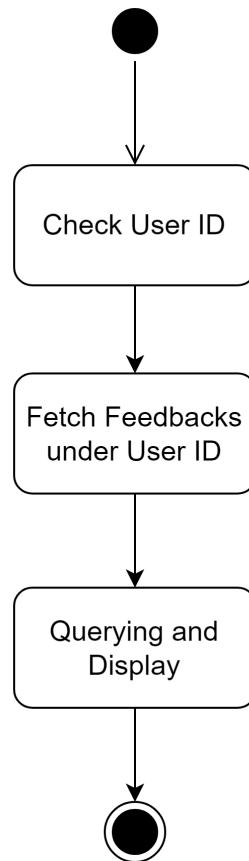
Figure 8: Activity Diagram User History

Whenever a user accesses the feedback history module, the application performs a check of the current user ID. It then proceeds to retrieve the feedback submissions associated with that user ID, including any remarks provided by the admin. Subsequently, the retrieved data undergoes a query and sorting process based on timestamps before being presented on the layout for display.
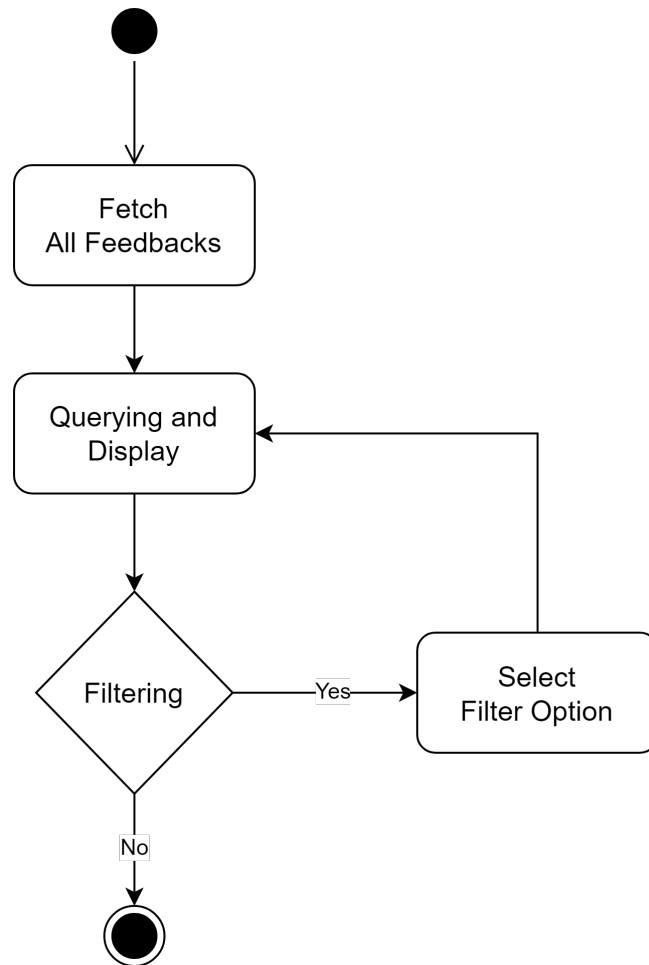
Figure 9: Activity Diagram Admin History

In the admin history module, the application initiates by retrieving all feedback entries from Firebase. Afterward, it performs a query operation to organize and display these feedbacks. Admins have the flexibility to apply filters, enabling them to showcase specific categories of feedback. The app then presents the filtered feedback entries accordingly.
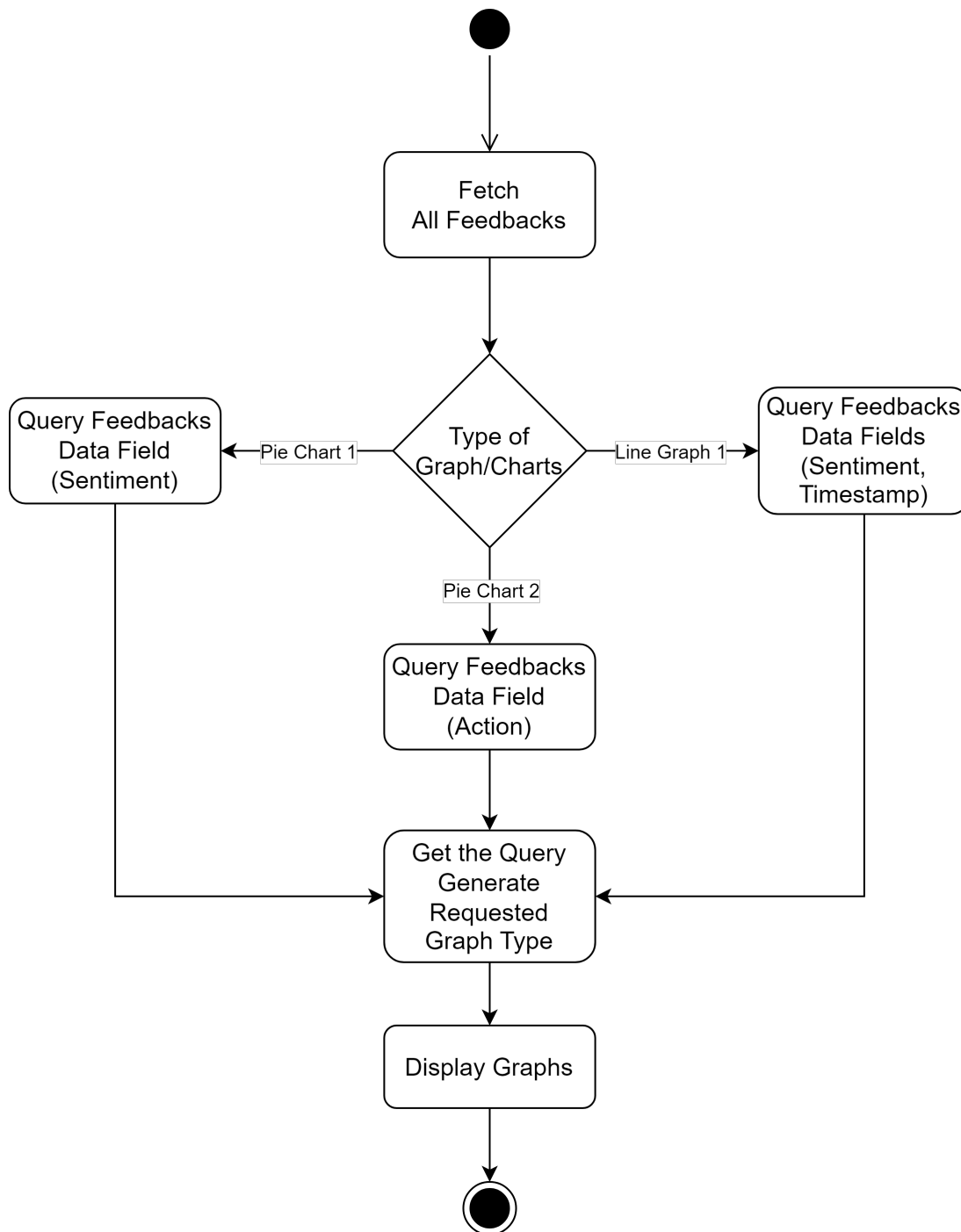
Figure 10: Activity Diagram Data Visual

At the beginning of the data visualization module, the app initiates by retrieving all feedback data from Firebase. The admin is presented with a choice of three available graph types. Once a specific graph type is selected, the app proceeds to query the feedback data according to the specified criteria. Subsequently, it utilizes this data to generate the chosen graph or pie chart. Finally, the graphical representation is displayed on the layout for the admin's review and analysis.

Chapter 4 System Interaction

4.1 System Components Specifications

Within the project, various components serve distinct functions. To facilitate navigation, a bottom navigation bar has been implemented, featuring separate menus for both users and admins. For user interactions and the initiation of functions, the project employs components such as image buttons, standard buttons, and spinners. For prompting users, alert dialogs are primarily used. Additionally, for displaying information, components like text views and loading circles come into play. In terms of layout design, the project makes use of different layout types, including constraint layouts, frame layouts, and linear layouts. These components collectively contribute to the functionality and user experience of the application.

4.2 System Components Interaction Operation

Navigation Component

The mobile app employs a bottom navigation bar for navigation, utilizing the view pager adapter. This navigation bar is tailored to different user roles, offering different menu items. Users are presented with "Home," "Record," and "History," while admins have access to "Home," "History," and "Data Visual." When a user or admin clicks on a menu item, the app seamlessly guides them to the corresponding fragment, presenting the relevant content.

Function Component

To facilitate the recording process, an image button featuring a microphone icon has been incorporated, making its functionality clear to users. Upon tapping this image button, audio recording initiates, provided that the necessary permissions have been granted.

When presenting users with choices, as seen in the admin's data visualization view for selecting the type of graphical representation to generate, a spinner is utilized. This spinner displays a dropdown menu with multiple options to choose from. Adjacent to the spinner, a standard button is positioned to allow users to commit or confirm their selection.

Prompting Component

The alert dialog component plays a crucial role in the application. It is utilized in various scenarios, such as during the filtering process where it prompts checkboxes to refine results. Additionally, it serves as a valuable tool during the login process when a user opts to remain anonymous, providing a warning or confirmation when necessary.

Display Component

Within the application, display components are pivotal for conveying information to users effectively. They are used, for instance, to showcase the text converted from speech-to-text (STT) and to present sentiment analysis results in a comprehensible manner.

Layout Component

The layout component selection is tailored to specific needs within the project. For precise positioning, the constraint layout is employed, ensuring elements are precisely situated. On the other hand, the frame layout offers more flexibility in arranging components in a freeform manner. Lastly, the linear layout is chosen to maintain a consistent alignment of multiple components, promoting a structured and organized user interface.

Chapter 5 System Implementation

5.1 Device Setup

5.1.1 Hardware Setup

Hardware used for this project development is a laptop and android mobile device. The usage of the laptop is to perform the coding for developing the mobile application, python coding for sentiment analysis library. The android mobile device act as a testing and deploying device to test the application developed.

Description	Specifications
Model	ASUS TUF A15
Processor	Ryzen 4900H
Operating System	Windows 11
Graphic	NVIDIA GeForce RTX 2060
Memory	16GB DDR4 3200MHz
Storage	1TB PCIe NVME SSD, 1TB SATA SSD

Table 2: Laptop Specification

Description	Specifications
Model	Redmi Note 9S
Operating System	Android 12
Chipset	Qualcomm Snapdragon 720G (8nm)
Memory	6GB
Storage	128GB

Table 3: Smartphone Specification

5.1.2 Software Setup

Before starting the development process, it is necessary to install a few software and plugins on the laptop.

1. Android Studio - version 2022.3.1

   This is the primary IDE for coding in Java and designing the user interface of mobile apps for the Android operating system.

2. Python – version 3.8

   This is the programming language used for coding in NLP technology and semantic analysis.

3. Pycharm – version 2022.3.

   This is the IDE used for coding in the Python language.

4. Chaquopy – version 14.0

   This is an Android Studio plugin that enables the integration of Python code into mobile apps.

5.2 Library and External Services

5.2.1 Vader Sentiment (Sentiment Analysis Library)

Vader Sentiment was selected as the sentiment analysis library for its maturity and extensive dictionary compared to other options. Additionally, its integration into Android Studio proved to be the most straightforward.

Vader Sentiment employs a lexicon-based approach to determine the sentiment of text. This lexicon contains a collection of words and phrases, each assigned a polarity score within a range of -4 to +4, indicating the nature of the word. The creation of this lexicon is accomplished by analyzing social media text.

The sentiment analysis process involves several steps. First, it tokenizes the input sentence by breaking it down into individual words or phrases, allowing for independent analysis of each token. Following tokenization, the intensity score is calculated from the polarity score, resulting in a score that falls within the range of -1 (most negative) to 1 (most positive).

Subsequently, developers can utilize this intensity score to classify the nature of feedback. After analyzing the intensity score gain by different feedbacks, this project set the optimal classification for the feedback to use in university as below:

Intensity Score	Sentiment Result
<-0.45	Negative
<0 and >-0.45	Slightly Negative
0	Neutral
>0 and <0.45	Slightly Positive
>0.45	Positive

Table 4: Sentiment Classification

To improve the accuracy of the Vader Sentiment lexicon, additional words without assigned polarity were added using Python. For instance, the feedback "Student drives recklessly" initially returned a neutral sentiment. However, the word "recklessly," which is clearly negative, was given an appropriate negative polarity score through experimentation. This adjustment to the lexicon file significantly enhanced the accuracy of the sentiment analysis results.

5.2.2 Firebase (Cloud Database)

Firebase was selected as the cloud database for this project for several compelling reasons. One of its notable strengths is its compatibility with both Android and iOS platforms, ensuring adaptability to future operating system changes. Firebase's user-friendly dashboard is particularly advantageous, as it allows developers to dive straight into building features without the burden of deciphering complex structures.

Firebase offers valuable functionalities for project development. Its Firebase Authentication feature simplifies user login and registration while prioritizing user privacy and security. Additionally, Firebase Firestore, a NoSQL cloud-based database, eliminates the need for developers to format data in JavaScript or deal with SQL queries. Notably, Firebase includes powerful querying and indexing capabilities, enabling data sorting, filtering, and limiting. Automatic indexing is a standout feature, enhancing query performance by creating indexes for frequently queried fields. Custom indexing further optimizes data retrieval, improving response times significantly.

In short, Firebase Authentication stores user account details securely, while Firebase Firestore serves as the repository for feedback information. The availability of custom indexing ensures efficient and speedy data fetching when needed for the application.

5.3 System Operation
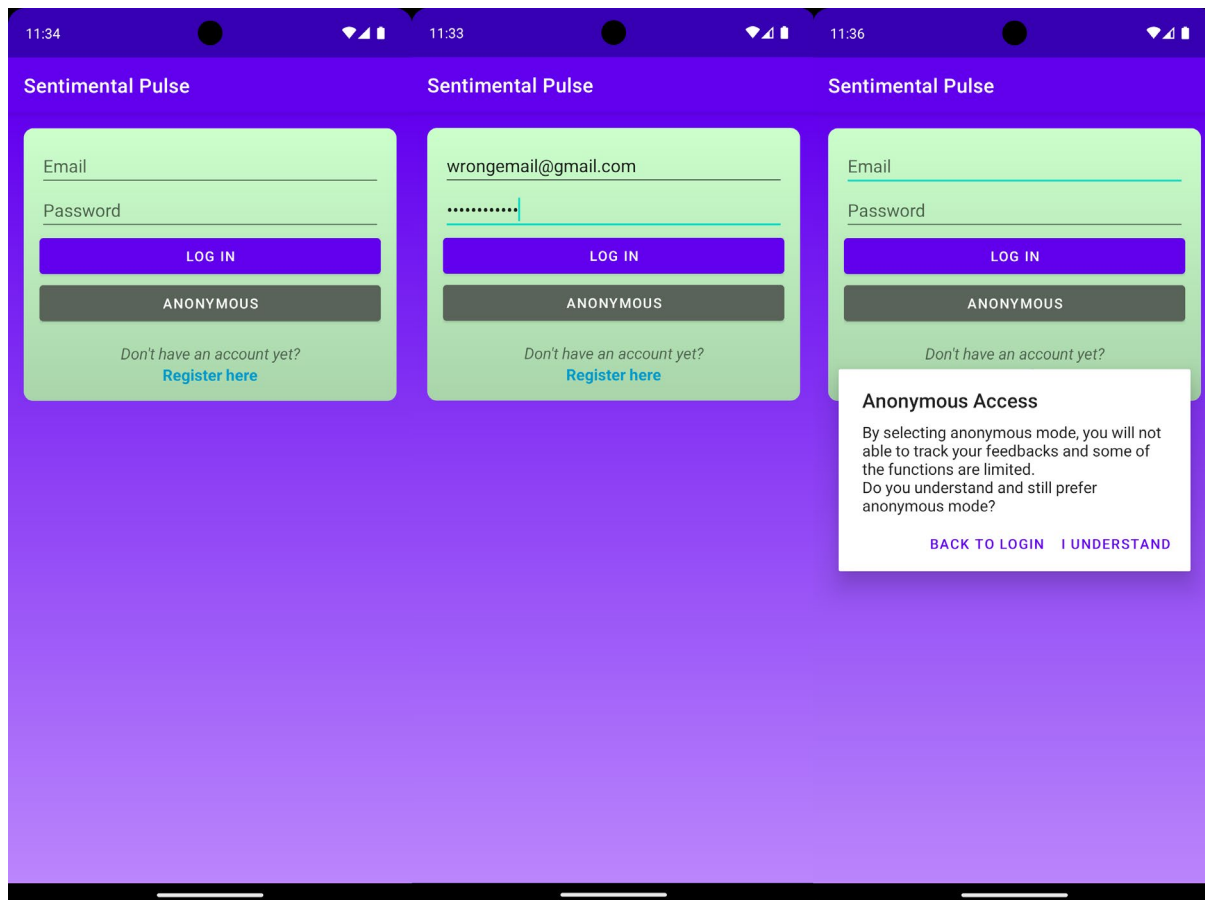
Figure 11: Demo Login

When users open the app for the first time, they'll see the login page. Both regular users and administrators use the same login. If the credentials entered match those of an administrator, the app switches to admin view. If they match those of a registered user, it goes to the user view. If the credential entered match neither of them, it will toast an error message.

User can also click on the "ANONYMOUS" button to login anonymously into user view but anonymous user will not able to login to the same session or check the remark of admin if logged out. Before user can login anonymously, it will prompt a warning to remind user. When user click the "Register here" word, it will navigate user to register page.
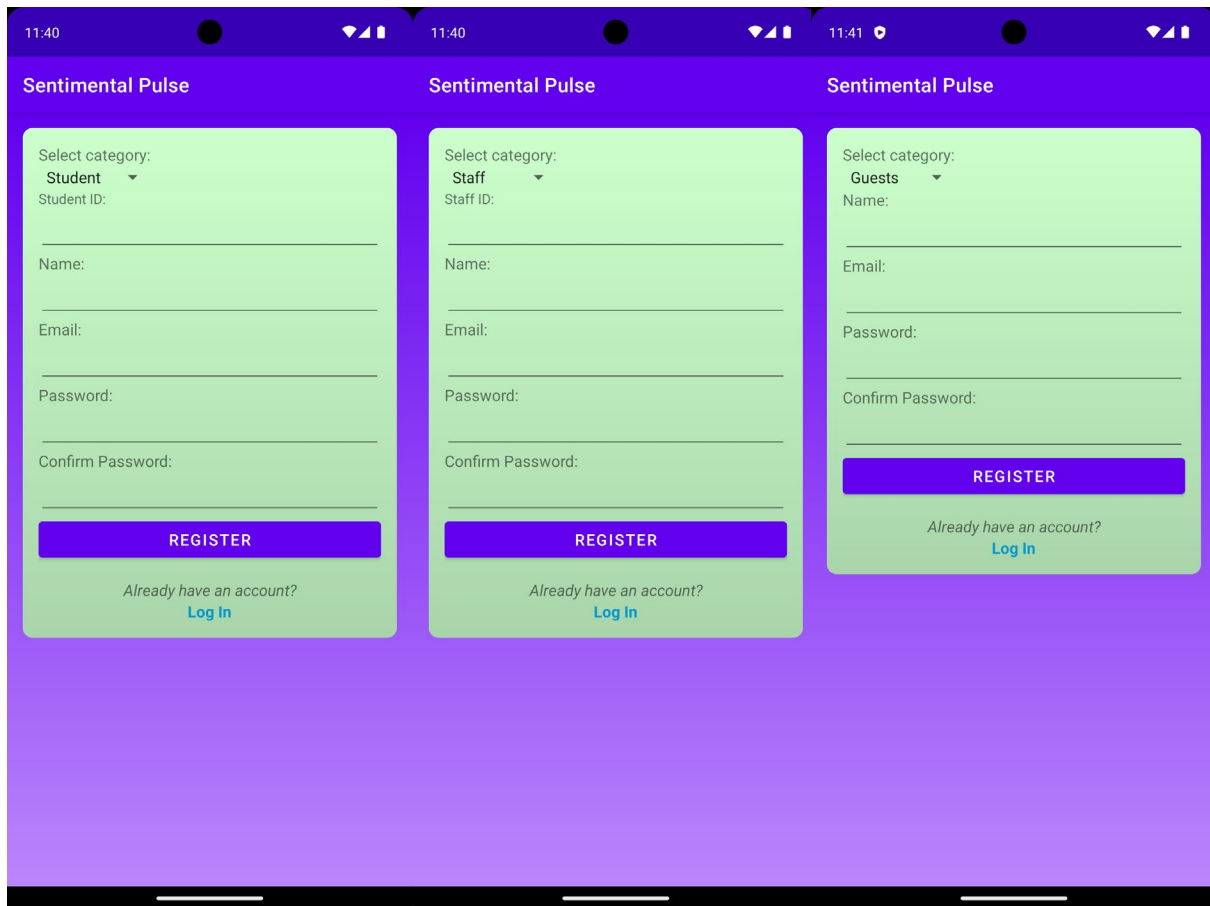
Figure 12: Demo Register

In register page, user can choose their category and register their account by filling up the form. After that, an account will be created and stored inside Firebase Authentication. After that, user will be navigated back to login page to login.

5.3.1 User Operation
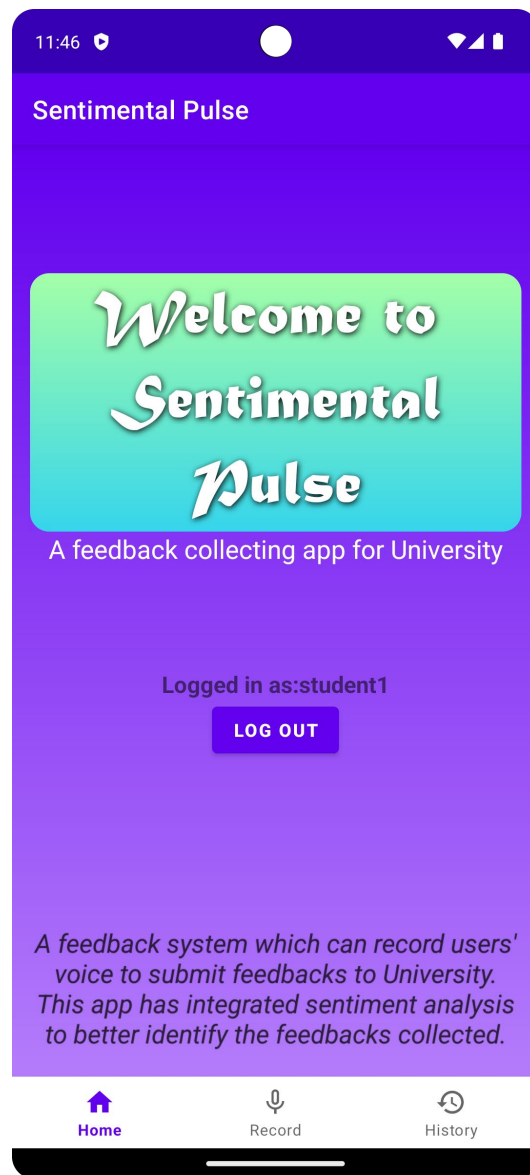
Figure 13: Demo Home Page

In user view, user will first view the home fragment which briefly tells the function of this feedback system application. The display name of the user will be shown at the center along with logout button. Bottom of the application is the bottom navigation menu for user to navigate.
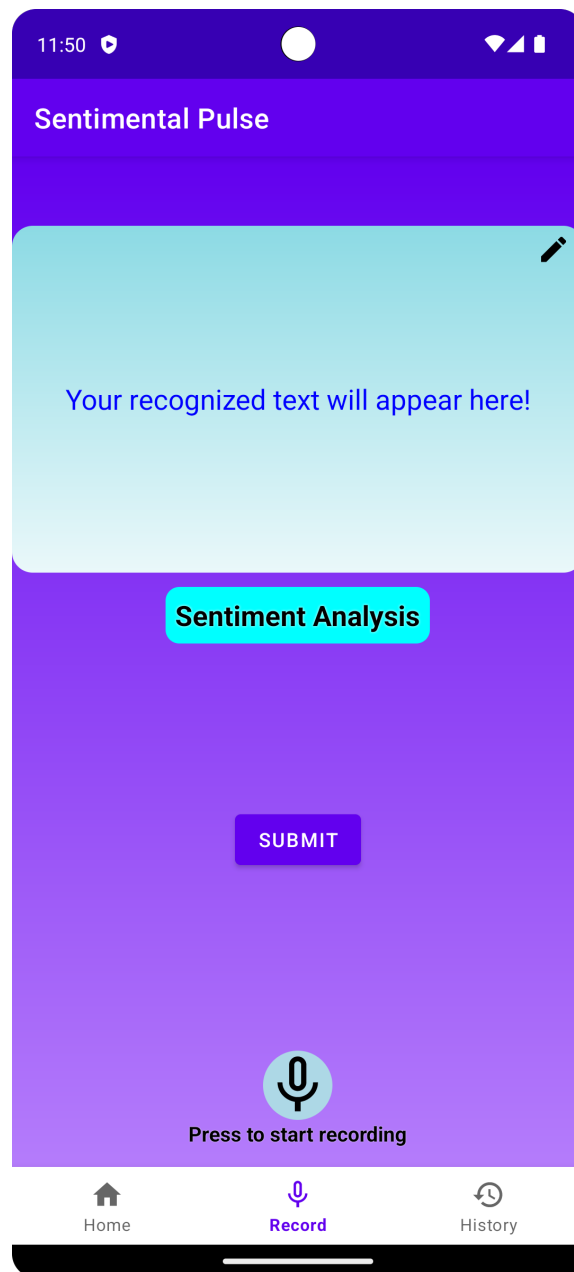
Figure 14: Demo Navigate Record

After user swipe to the next fragment or click on the record navigation menu on the bottom, the application will show the record fragment. The record fragment consists of a text view displaying the hints, a text box showing the sentiment analysis, a submit button and a recording image button.
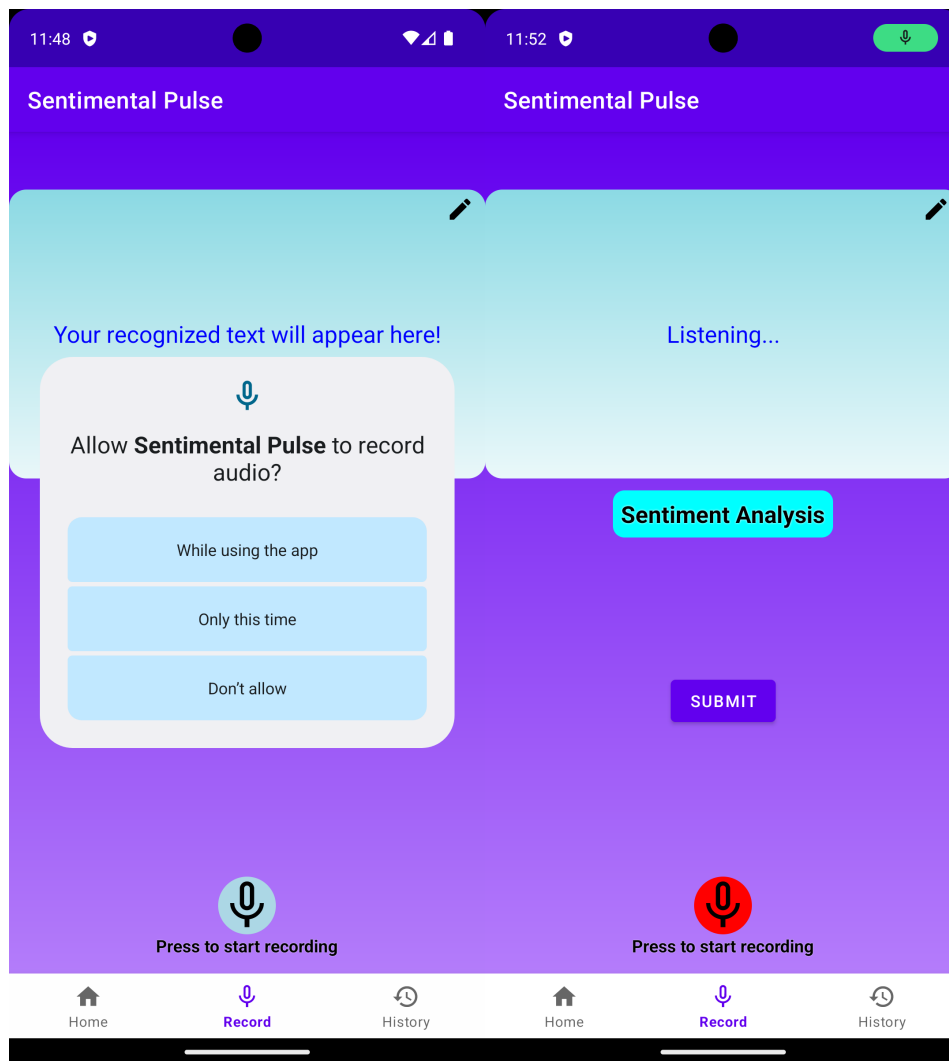
Figure 15: Demo Record

If the application did not get the permission to use the mic, then it will prompt user to give the permission. When the audio is recording, the microphone button will change to red color and the text view above will show "Listening…"
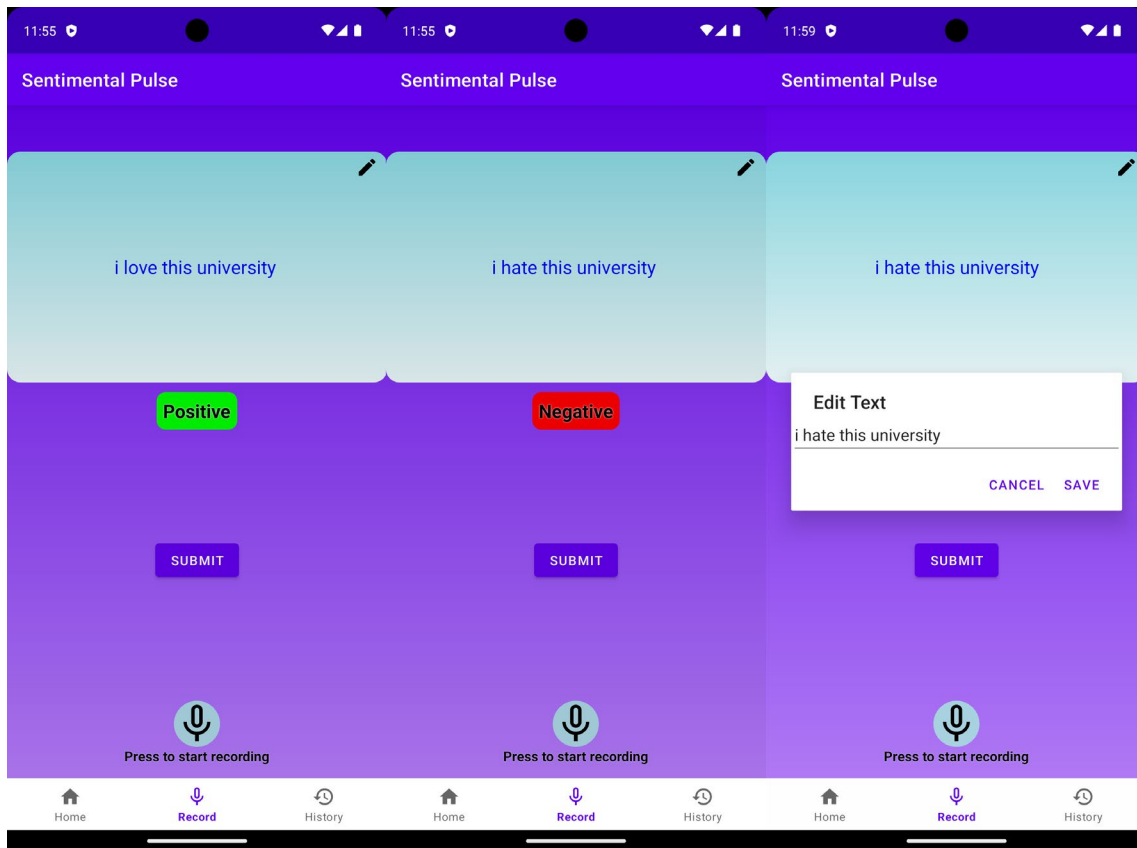
Figure 16: Demo Sentiment Result

After the recording is ended, the recognized text will be shown in the text box, and the sentiment analysis result will be shown in the text box below it. User can also click on the edit icon on the upper right corner on the text box to edit it using keyboard.
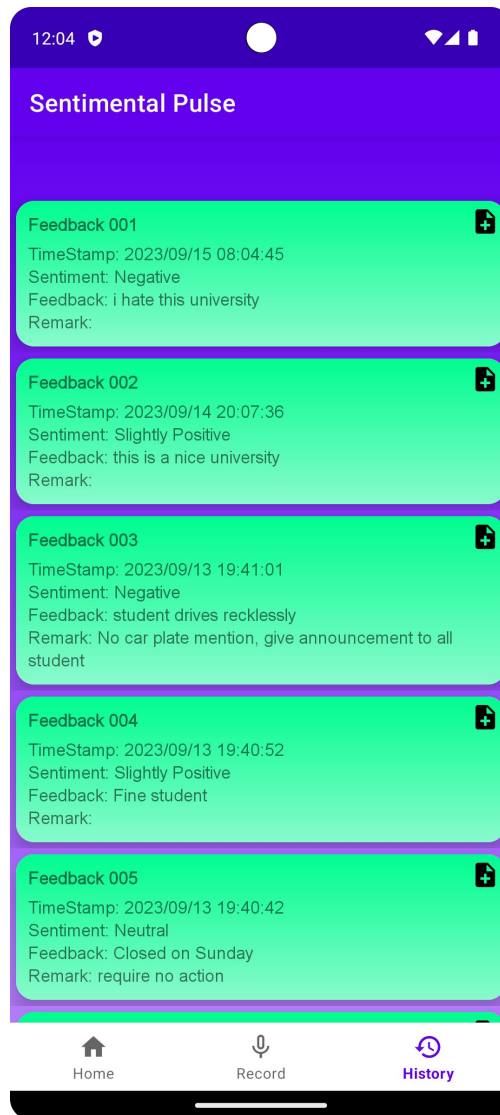
Figure 17: Demo User History

After user submit the feedback, they can proceed to history where all their previous feedbacks were fetched and displayed, they can also check for the remake from admin.

5.3.2 Admin Operation

The application admin shares the same home page with user, but the bottom navigation menu is differed from the user which has home, history and data visual.
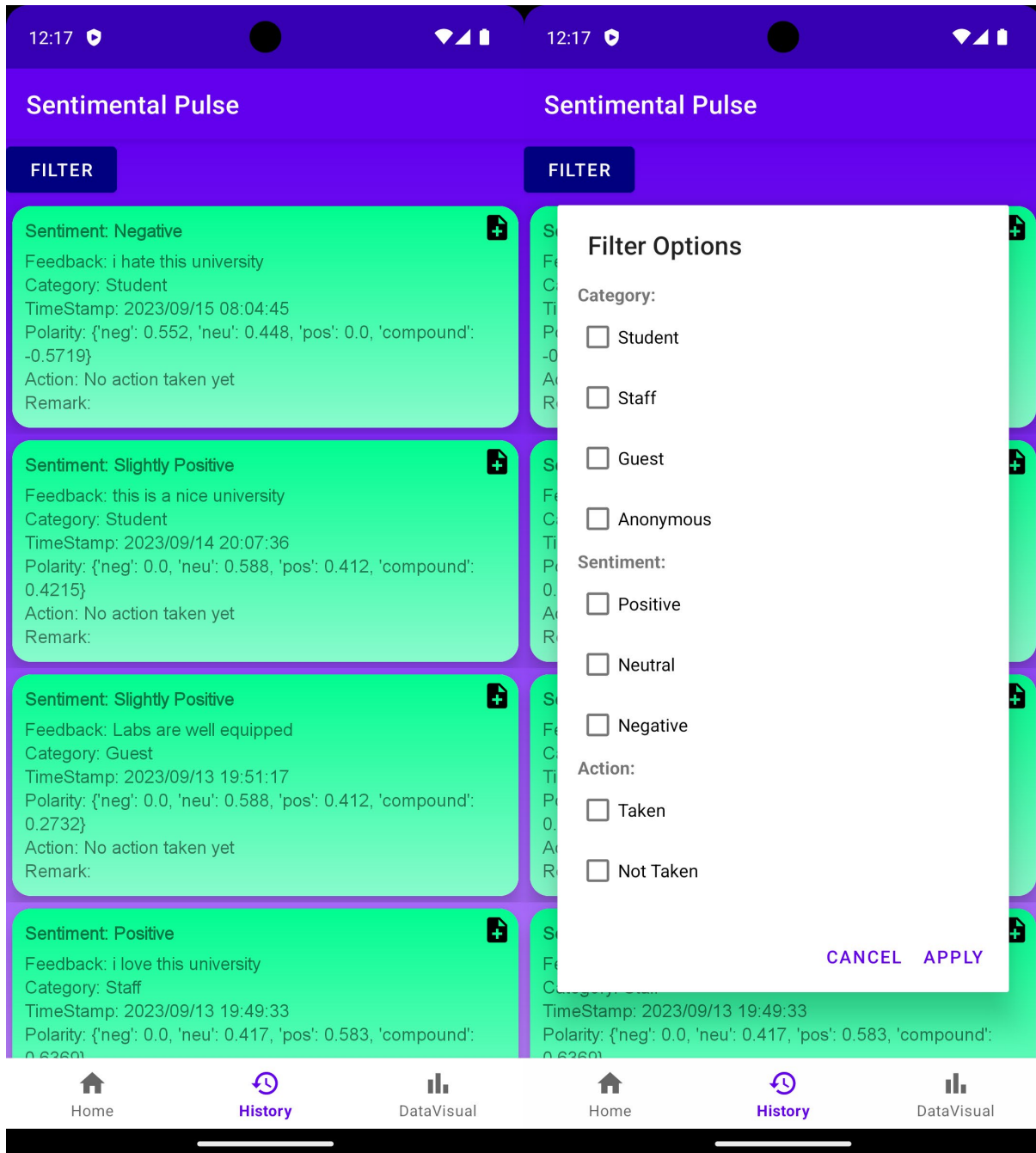
Figure 18: Demo Admin History

In the history fragment of admin, it fetches all feedbacks from all user and display it sorted by timestamp. Admin can choose to filter the data for category, sentiment result, or whether the feedback has been taken action or not.
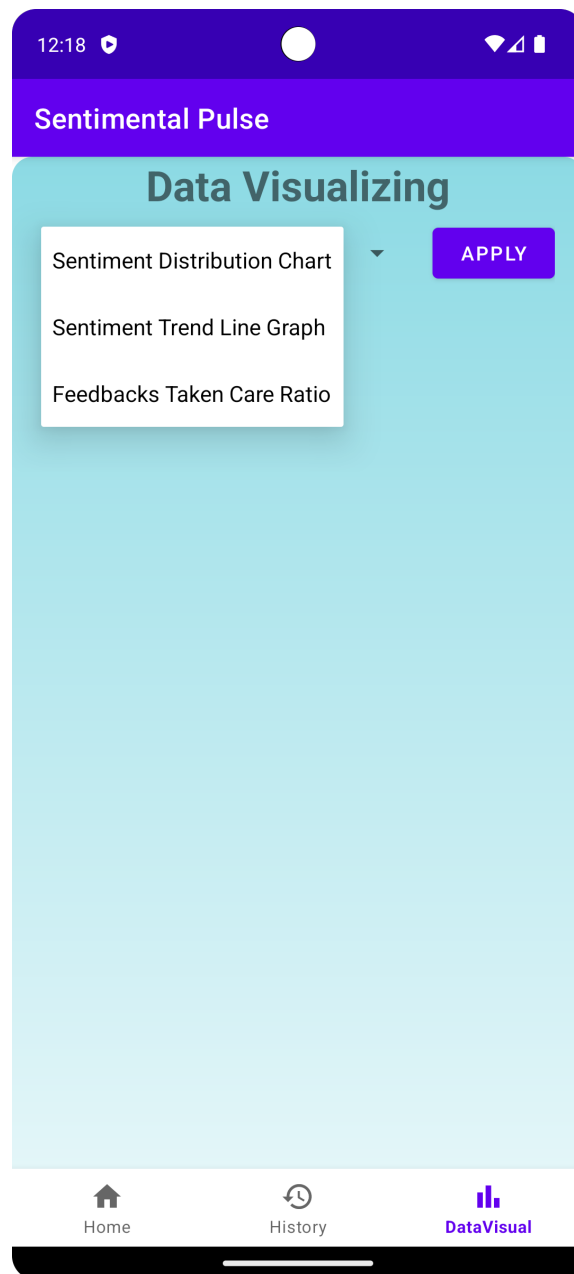
Figure 19: Demo Data Visual 1

In data visual fragment, user will have a spinner button to choose which kind of graph or chart they want to generate.

Figure 20: Demo Data Visual 2

The graphic representation of the data is shown as above where the first one is the percentage of each type of feedback sentiment received, the second one is the type of feedback sentiment received on each day, the last one is to show the percentage of the feedbacks that has been taken action or not.

Chapter 6 System Evaluation and Discussion

6.1 Application Test Case and Result

6.1.1 Speech Recognition Test Case

Test Sentence	Test Count	Pass Count	Accuracy
The environment is nice	5	4	80%
The student drive recklessly	5	5	100%
This staff here is outrageous	5	5	100%
The meal in the canteen is nice	5	3	60%
The staff is helpful	5	4	80%
I hate this university	5	2	40%
The restaurant nearby is good	5	3	60%
The office is far away	5	4	80%
The campus is dirty	5	4	80%
Today's weather is fine	5	5	100%
Total Accuracy			78%

Table 5: Speech Recognition Test Case

The above is the test case result for the speech recognition of the application. The test case is carried out by speaking the test sentence clearly for 5 times and measure the pass count then calculate the percentage of accurate outcome. The recording device used here is Redmi Note 9 smart phone. The result is considered pass if the result is exactly as the test sentence or the keyword which is the adjectives is still there because this feedback system focuses on adjectives than other type of words.

The result of 10 test sentences gains the outcome of 78% accuracy which is still acceptable but can be improved through hardware and further coding.

6.1.2 Sentiment Result Test Case

Test sentence	Expected sentiment	Actual Sentiment	Pass/Fail
The student drives recklessly	Positive	Negative	Pass
The lecturers take the job seriously	Positive	Slightly Negative	Fail
The meal in the canteen is delicious	Positive	Positive	Pass
The classroom is well-tidied	Positive	Slightly Positive	Pass
The drain is stinky	Negative	Slightly Negative	Pass
The student here is rude and impolite	Negative	Negative	Pass
The staff here is lazy	Negative	Slightly Negative	Pass
The office staff is slow	Negative	Neutral	Fail
The campus here is standard	Neutral	Neutral	Pass
There are many students here	Neutral	Neutral	Pass
Accuracy			80%

Table 6: Sentiment Result Test Case

These are the results of the sentiment analysis test. The test is conducted by inputting sentences and comparing the actual sentiment results to the expected ones. The test achieved an 80% accuracy rate, which is quite high and indicates readiness for use.

6.2 Objectives Evaluation

Objective 1: Offering an Alternative Method for Feedback Collection

In pursuing this objective, the project's focus has been on innovation. It has led to the development of a mobile application that embraces voice recognition technology. This technology permits users to express their feedback verbally, departing from conventional text-based approaches. The outcome is an alternative and highly engaging method for feedback collection, which has been successfully implemented.

Objective 2: Accepting Feedbacks Without a Limited Scope

Efforts in this direction have resulted in a substantial transformation of feedback collection. The traditional constraints and boundaries placed on feedback submission have been effectively dismantled. Users are now afforded the freedom to articulate their thoughts, opinions, and emotions openly. The project has successfully fostered an environment where

feedback is unbounded in scope, ensuring a more comprehensive and thorough evaluation process.

Objective 3: Providing a More Efficient Way to Process Large Amounts of Data

The project's approach to addressing this objective has been technologically driven. By integrating Natural Language Processing (NLP) and sentiment analysis, the project has significantly improved the data processing and analysis capabilities. Large volumes of feedback data can now be managed with remarkable efficiency. This achievement empowers organizations to harness data for informed decision-making, contributing to improved operational efficiency.

In sum, the project has made substantial progress in achieving its objectives. It has introduced an innovative method for feedback collection, eliminated limitations on feedback scope, and greatly enhanced data processing efficiency. These accomplishments signify a noteworthy advancement in the realm of feedback systems.

6.3 Project Challenge

The project challenges fall into three main categories: limitations within Android Studio, constraints related to Natural Language Processing (NLP), and concerns regarding the scalability of the application.

One of the significant hurdles we've encountered is navigating the limitations within Android Studio. You see, Android primarily employs Java or Kotlin for development, which differs from Python, the language often used for Natural Language Processing (NLP) tasks. To bridge this gap and ensure smooth functionality, we've explored various methods. Our current approach involves leveraging plugins like Chaquopy, but even that requires regular updates from its author to seamlessly integrate the latest Python libraries. Furthermore, discovering libraries or tools that align with our project's needs and can smoothly integrate into Android Studio has proven to be quite time-consuming and demanding.

When it comes to Natural Language Processing (NLP), our challenges revolve around the intricacies of accurately comprehending and analyzing human language. NLP models often grapple with the complexities of diverse language patterns, slang, and even sarcasm. Achieving a high level of precision in sentiment analysis, especially in the context of academic feedback with its wide range of tones and contexts, poses a formidable challenge.

Ensuring that our NLP component can adeptly decipher and classify the emotions and sentiments expressed in feedback remains a significant hurdle we're actively addressing.

The scalability challenge is all about preparing our project to gracefully grow and adapt as more users join, and the volume of feedback data expands. As our application gains popularity and garners more user submissions, maintaining top-notch performance and responsiveness becomes paramount. We must guarantee that our app can gracefully handle the increased load of data, user interactions, and real-time updates without compromising the user experience. To tackle this, we've been proactively planning for scalability from the project's outset and devising effective strategies to address these evolving challenges, which we recognize as pivotal for our project's long-term success.

Chapter 7 Conclusion

To sum up, this project has effectively addressed the problem statement at hand, which revolved around the limitations of existing feedback collection methods, including scope restrictions and difficulties in handling large volumes of data. The objectives set out for this project, namely, offering an alternative method for feedback collection, accepting feedbacks without limitations on scope, and providing a more efficient way to process large amounts of data, have been successfully achieved.

This project successfully achieved the goals set at the beginning. The feedback system developed is user-friendly, featuring voice input capabilities and powered by sophisticated technology. Within this project, users can seamlessly provide feedback, access their feedback history, and benefit from sentiment analysis. Simultaneously, administrators can efficiently manage and categorize feedback.

Although the performance of this project is currently satisfactory, it's crucial to recognize that as user numbers increase, potential performance challenges may arise. To ensure a consistently smooth user experience, continuous refinement and optimization are essential. This entails fine-tuning backend processes and optimizing data retrieval to accommodate a growing user base effectively.

Looking forward, there is substantial room for expanding the capabilities of this project. For instance, integrating a translation function could enable feedback in languages other than the default, making it more accessible to a broader audience. Furthermore, considering a customer service feature that enables direct communication between users and administrators could enhance user engagement and issue resolution.

In summary, this project serves as a testament to the transformative potential of modern technology in the realm of feedback collection and analysis. It has admirably addressed the initial problem statement while paving the way for future innovations and improvements in this domain.

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FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3, Y3	**Study week no.: 3**
Student Name & ID: Chan Jun Jie 20ACB04582	
Supervisor: Mr. Su Lee Seng	
Project Title: Voice Feedback System with Sentiment Analysis at a University	

1. WORK DONE

Implement login and register modules into the application

2. WORK TO BE DONE

Integrate cloud database into the system

3. PROBLEMS ENCOUNTERED

4. SELF EVALUATION OF THE PROGRESS

The UI of the login modules and register modules need improvement

_____
Supervisor's signature

_____
Student's signature

FINAL YEAR PROJECT WEEKLY REPORT
(Project II)

Trimester, Year: T3, Y3	Study week no.: 5
Student Name & ID: Chan Jun Jie 20ACB04582	
Supervisor: Mr. Su Lee Seng	
Project Title: Voice Feedback System with Sentiment Analysis at a University	

1. WORK DONE

Integrated Firebase Firestore Database into the app to store feedbacks data (half done)

2. WORK TO BE DONE

Continue integrating and improving cloud database

3. PROBLEMS ENCOUNTERED

Cannot create collection based on user type or user ID

4. SELF EVALUATION OF THE PROGRESS

The feedback data field that stored in Firebase need refinement

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Supervisor's signature

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Student's signature

FINAL YEAR PROJECT WEEKLY REPORT
(Project II)

Trimester, Year: T3, Y3	Study week no.: 7
Student Name & ID: Chan Jun Jie 20ACB04582	
Supervisor: Mr. Su Lee Seng	
Project Title: Voice Feedback System with Sentiment Analysis at a University	

1. WORK DONE

Done implementing Firestore will appropriate feedback fields stored

2. WORK TO BE DONE

Create an admin view and its function

3. PROBLEMS ENCOUNTERED

4. SELF EVALUATION OF THE PROGRESS

The feedback data can be pushed and fetched correctly

_____
Supervisor's signature

_____
Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3, Y3	**Study week no.: 9**
Student Name & ID: Chan Jun Jie 20ACB04582	
Supervisor: Mr. Su Lee Seng	
Project Title: Voice Feedback System with Sentiment Analysis at a University	

1. WORK DONE

Created admin view and its function.
Implement filtering by querying in Firebase

2. WORK TO BE DONE

Create the data visualization module for graphical representation

3. PROBLEMS ENCOUNTERED

4. SELF EVALUATION OF THE PROGRESS

Admin view and its components are functioning

_____
Supervisor's signature

_____
Student's signature

FINAL YEAR PROJECT WEEKLY REPORT
(Project II)

Trimester, Year: T3, Y3	Study week no.: 11
Student Name & ID: Chan Jun Jie 20ACB04582	
Supervisor: Mr. Su Lee Seng	
Project Title: Voice Feedback System with Sentiment Analysis at a University	

1. WORK DONE

Created data visualization modules

2. WORK TO BE DONE

Optimize the mobile application and continuously update the library through experimenting

3. PROBLEMS ENCOUNTERED

4. SELF EVALUATION OF THE PROGRESS

The application is ready

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Supervisor's signature

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Student's signature

POSTER

PLAGIARISM CHECK RESULT

Match Overview

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institutions gather and analyze student data, which would ultimately result in better services and a better customer experience.

1.6 Report Organization

In Chapter 1, the introduction of the project, an overview of the project is provided. This chapter contains the problem statement and motivation, outlining the issues that spurred my project. It also outlines the objectives, defining what the project aims to achieve, and delves into the project's scope and direction. Additionally, it also highlights the contributions to the field and provide an outline of the report's organization, giving readers a roadmap of what to expect.

Chapter 2, the literature review, [ ] t is reviewed. The comparison of this proj

Chapter 3, the system methodolog used projects. This chapter includes a system design diagram, system architecture diagram, use case diagram, and activity diagram, providing a visual representation of the project's structure and workflow.

Chapter 4, system design provides detailed information about the system's design aspects

123dok.com
Internet Source

guage and Integrated development environment that involving in this project will be written. Then, several similar applications will be reviewed and study. Chapter 3 consists of **system design diagram** such as **System architecture diagram, use case diagram and** description, and **activity diagram**. The overall design of the system component and end-user interaction with the system will be shown in this chapter. Chapter 4 consists of system block diagram, system

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do further review. The rest of this paper is arranged as follows. The integrated system is briefly presented in section 2. Section 3 concludes the paper. AUTOMATED DIGITAL FORENSICS SYSTEM Background **The main objective of this project is to** design and **develop an** automated **mobile** digital forensics system **that** can automatically extract data from android devices and analyze the data by using previously developed Raspberry Pi cluster

irection

The main goal of this project is to develop an Android mobile application that improves the user experience by offering a quicker way to submit, gather, and analyze comments on the university. Voice recognition technology will be used to achieve this, making it simple for consumers to provide feedback. Additionally, the system will make use of AI tools like sentiment analysis to aid in the interpretation of the gathered feedback. The following elements will be included to make the feedback system easier to use:

I.   Users' opinion of the university will be gathered by the feedback system.

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5.1 Device Setup

5.1.1 Hardware Setup

Hardware used for this project development is a laptop and android mobile device. The usage of the laptop is to perform the coding for developing the mobile application, python coding for sentiment analysis library. The android mobile device act as a testing and deploying device to test the application developed.

Description	Specifications
Model	ASUS TUF A15
	4900H
	ws 11
	IA GeForce RTX 2060
Memory	16GB DDR4 3200MHz
Storage	1TB PCIe NVME SSD, 1TB SATA SSD

Heng Zhang, Zhitao Wan, Zhiyu Zhang, Xiupin...
Publication

e implemented a DPIS system in Golang and deployed in 20 identical nodes as the test bed. The configuration of each node with: ? Processor: Intel Core i7-11700K (8 Cores, 16 Threads, up to 5.0 GHz) ? Memory: 16GB DDR4-3200MHz RAM ? Storage: 512GB PCIe NVMe SSD + 1TB 7200RPM SATA HDD ? Network: 1000Mbps Ethernet The privacy data covered is shown in Table I. The comparison with other main stream blockchain-based projects is listed in

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Final Year Project

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Full Name(s) of Candidate(s)	Chan Jun Jie
ID Number(s)	2004582
Programme / Course	IB
Title of Final Year Project	Voice Feedback System with Sentiment Analysis at a University

Similarity	**Supervisor's Comments** **(Compulsory if parameters of originality exceeds the limits approved by UTAR)**
Overall similarity index:____1_____ % **Similarity by source** Internet Sources: _____1_____ % Publications: ____0_____ % Student Papers: _____0_____ %	
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Parameters of originality required and limits approved by UTAR are as Follows:
   (i)   Overall similarity index is 20% and below, and
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Note: Parameters (i) – (ii) shall exclude quotes, bibliography and text matches which are less than 8 words.

Note Supervisor/Candidate(s) is/are required to provide softcopy of full set of the originality report to Faculty/Institute

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.

_____
Signature of Supervisor

Name: Su Lee Seng

Date: 2023/09/15

UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF INFORMATION & COMMUNICATION TECHNOLOGY
(KAMPAR CAMPUS)
CHECKLIST FOR FYP2 THESIS SUBMISSION

Student Id	20ACB04582
Student Name	Chan Jun Jie
Supervisor Name	Su Lee Seng

TICK (√)	DOCUMENT ITEMS Your report must include all the items below. Put a tick on the left column after you have checked your report with respect to the corresponding item.
	Front Plastic Cover (for hardcopy)
√	Title Page
√	Signed Report Status Declaration Form
√	Signed FYP Thesis Submission Form
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√	Acknowledgement
√	Abstract
√	Table of Contents
√	List of Figures (if applicable)
√	List of Tables (if applicable)
	List of Symbols (if applicable)
√	List of Abbreviations (if applicable)
√	Chapters / Content
√	Bibliography (or References)
√	All references in bibliography are cited in the thesis, especially in the chapter of literature review
√	Appendices (if applicable)
√	Weekly Log
√	Poster
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I, the author, have checked and confirmed all the items listed in the table are included in my report.

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