ZENO - THE AI ASSISTANT

A PROJECT REPORT

Submitted to

ASSAM DON BOSCO UNIVERSITY

By

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in partial fulfillment for the award of the

degree of

BACHELOR OF COMPUTER APPLICATIONS

DEPARTMENT OF COMPUTER APPLICATIONS

SCHOOL OF TECHNOLOGY, ASSAM DON BOSCO UNIVERSITY

AZARA, GUWAHATI 781 017,

ASSAM, INDIA.

BATCH (2020-2023)

CERTIFICATE

This is to certify that the Project Report entitled **ZENO - The AI Assistant** submitted by **Nilabh Choudhury (DC2020BCA0022), Sawan Sunar (DC2020BCA0024) and Mortaza Behesti Al Saeed (DC2020BCA0059)** to the Assam Don Bosco University, Guwahati, Assam, in partial fulfillment of the requirement for the award of Degree of Bachelor of Computer Applications is a bonafide record of the project work carried out by them under my supervision during the semester January 2023 to June 2023.

Internal Guide:
Dr. Gypsy Nandi
Assistant Professor
Department of Computer Applications
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CERTIFICATE

This is to certify that the Project Report entitled **ZENO-The AI Assistant** submitted by **Nilabh Choudhury (DC2020BCA0022), Sawan Sunar (DC2020BCA0024) and Mortaza Behesti Al Saeed (DC2020BCA0059)** to the Assam Don Bosco University, Guwahati, Assam, in partial fulfillment of the requirement for the award of Degree of Bachelor of Computer Applications is a bonafide record of the project work carried out by him/them during the semester January 2023 to June 2023.

Dr.Uzzal Sharma

Head of the Department,
Department of Computer Applications

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Date :……

Prof. Manoranjan Kalita

Director, School of Technology
Assam Don Bosco University

Date:……

EXAMINATION CERTIFICATE

This is to certify that **Nilabh Choudhury, Sawan Sunar and Mortaza Behesti Al Saeed** bearing Roll Numbers **DC2020BCA0022, DC2020BCA0024 and DC2020BCA0059** respectively of the Department of Computer Applications has carried out the project work in a manner satisfactory to warrant its acceptance and also defended it successfully.

We wish them all the success in their future endeavours.

Examiners:

01. External Examiner:

02. Internal Examiner

DECLARATION

We hereby declare that the project work entitled **ZENO-The AI Assistant** submitted to the Assam Don Bosco University, Guwahati, Assam, in partial fulfilment of the requirement for the award of Degree of Bachelor of Computer Applications is an original work done by us under the guidance of **Dr. Gypsy Nandi** and has not been submitted for the award of any degree.

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ACKNOWLEDGEMENT

We would like to express our sincere gratitude and appreciation to all those who have contributed to the successful completion of this project.

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Secondly We extend our appreciation to **Assam Don Bosco University** for providing us with the resources and facilities necessary for conducting this research. Additionally, we would like to acknowledge the director of **Prof. Manoranjan Kalita** for their continuous support and encouragement.

Finally, we would like to thank our families and friends for their unwavering support and understanding throughout this project. Their belief in us has been a constant source of motivation.

Thank you all for being a part of this journey and for your significant contributions to the successful execution of this project.

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ABSTRACT

Zeno is an innovative AI assistant designed to cater to the needs of students in the realm of academia. With a focus on schedule management, resource recommendation, and question answering, Zeno aims to optimize the learning experience and support student success. Through its user-friendly interface and advanced NLP model, Zeno enables efficient communication and understanding between students and the assistant. The integration of voice recognition and text-to-speech modules enhances accessibility and accommodates diverse learning preferences. Zeno's technical feasibility, economic viability, and operational feasibility make it a promising tool in the educational landscape. By alleviating administrative burdens and facilitating quick access to educational materials, Zeno empowers students to prioritize their learning and intellectual growth. With its potential to improve time management and foster self-directed learning, Zeno is poised to contribute significantly to academic success. As AI continues to evolve, Zeno represents the AI assistants, providing personalized support and revolutionizing the way students engage with their educational journey. Through continuous development and feedback integration, Zeno strives to shape a more efficient and promising future for students worldwide.

Keywords: NLP (Natural Language Processing), AI (Artificial Intelligence)

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ABREVIATIONS

NLP - Natural Language Processing.

BoW - Bag of Words.

Seq-2-Seq - Sequence to Sequence.

GPT-3 - Generative Pre-Trained Transformer Version 3.

COCOMO - Constructive Cost Model.

AI - Artificial Intelligence.

CONTENTS

Zeno - The AI Assistant

Chapter 1: Introduction

1.1 Zeno - The AI Assistant

We are at the dawn of a new era of technology, where Artificial Intelligence (AI) is becoming increasingly prevalent in our daily lives. With the emergence of AI assistants such as Siri, Alexa, and Google Assistant, it is clear that these technologies are here to stay, and have the potential to revolutionize the way we live and learn.

Zeno is one such AI assistant designed specifically for the education sector. Zeno is a student-centric AI assistant that can help students manage their schedules, find important notes, and answer academic questions. With Zeno, students can easily keep track of their assignments, deadlines, and appointments, allowing them to focus on their studies and achieve better academic outcomes.

1.2 Objective

Zeno is an AI assistant designed to help students succeed academically by providing support that caters to their individual needs and preferences. The objective of Zeno is to assist students in managing their schedules, recommending resources, and answering academic questions.

Zeno is designed to simplify the lives of students by providing them with real-time assistance. By leveraging AI technology, Zeno can help students keep track of their schedules, assignments, and deadlines. With Zeno, students can quickly access their notes, receive reminders, and stay on top of their academic responsibilities.

Zeno can also recommend resources to students that can help them improve their academic performance. By suggesting resources, including articles, videos, and other materials to their aid. This can help students stay engaged and motivated, and ultimately lead to improved academic outcomes.

Zeno can also answer academic questions. This includes questions related to specific topics, assignments, or even test preparation. Zeno's ability to provide quick and accurate answers can help students save time and stay focused on their studies.

The ultimate objective of Zeno is to enhance academic performance and improve learning outcomes for students. Zeno can help students achieve their academic goals. Through real-time feedback and recommendations, Zeno can help students to self improvement and help them succeed.

1.3 Existing Systems

Prior to the development of Zeno, there were several existing systems that offered similar functionality and services. These systems aimed to provide students with academic support, scheduling management, and resource recommendations. Some of the existing systems similar to Zeno are:

1.3.1 MyStudyLife: This is an online platform that allows students to manage their schedules, assignments, and exams. It also provides personalized to-do lists and reminders to help students stay on track.

1.3.2 Chegg Study: Chegg Study is an educational app that provides students with access to millions of textbooks, expert answers, and solutions to homework problems. The app also includes a scheduling management tool to help students stay organized.

1.3.3 Brainly: Brainly is a community-based learning platform that allows students to ask and answer academic questions in a collaborative environment. It also provides resources such as study materials and video tutorials.

1.4 Problem Statement

The traditional education system has long relied on a one-size-fits-all approach, which can be ineffective for many students. Students often struggle to manage their schedules, find important notes, and receive support for their needs and preferences. This can lead to frustration, low academic performance, and ultimately, a lack of engagement and motivation in their studies.

The problem is that students need a more personalized and efficient approach to education that can help them succeed academically. Zeno can aid in that by providing real-time assistance, recommend resources and answer academic questions. Students often have to rely on external resources, which can be time-consuming and ineffective.

Zeno aims to solve this problem by helping students manage their schedules, recommend resources, and answer academic questions. By leveraging AI technology, Zeno can provide personalized support that caters to the students needs and preferences. This can enhance academic performance and improve learning outcomes for students.

Therefore, the problem that Zeno seeks to address is the lack of personalized and efficient support in the traditional education system, which can lead to frustration, low academic performance, and a lack of engagement and motivation in students.

1.5 Proposed Plan

1.5.1 Development:

The Development Zeno using the latest technologies to ensure that it offers high-quality service. The development process involves the following stages:

Back-end: Zeno's back-end consists of the following modules:

I. **NLP Model:** Zeno will use a Natural Language Processing (NLP) model to understand user inputs and questions accurately. This model will enable Zeno to recognize and process complex inputs from students, making it easier for them to interact with the assistant.

II. **Voice Recognition Module:** To enable voice inputs from students, Zeno will have a voice recognition module that converts speech to text for input into the system. This module will be integrated with the NLP model to ensure that it recognizes voice inputs accurately.

III. **Text-to-Speech Module:** To provide voiced outputs to students, Zeno will have a text-to-speech module that converts text to speech. This module will be integrated with the NLP model and recommendation module to enable Zeno to provide personalized and comprehensive responses to student queries.

IV. **Scheduling Module:** Zeno will have a scheduling module that helps students manage their academic schedules, deadlines, and appointments. This module will enable students to input their schedules using commands.

Front-end: Zeno's front-end will be developed as an Android app, providing a user-friendly interface for students to interact with the assistant. The app will enable students to input queries using voice or text commands, view personalized recommendations, and manage their academic schedules.

1.5.2 Testing:

After the development of Zeno, rigorous testing will be conducted to ensure that the system is functional and meets the needs of students. Testing will include functional testing, usability testing, and performance testing.

1.5.3 Deployment and Maintenance:

Once Zeno has been developed and tested, it will be deployed to students through various channels such as app stores and online platforms. And maintained by implementing the feedbacks and adding new functionalities.

Chapter 2: Feasibility Study

2.1 Technical feasibility

Technical feasibility is assessing whether a proposed system can be implemented with available resources and technology. Following are the hardware and software requirements for the proposed AI system.

2.1.1 Hardware Requirements(Development Environment)

Table.2.1.1 Hardware Requirements(Development Environment)

Type	Requirements
Device	Personal Computer
Processor	Intel i3 processor or above
RAM	4GB or more
HDD	500GB

2.1.2 Hardware Requirements(Users Environment)

Table.2.1.2 Hardware Requirement (User Environment)

Type	Requirements
Device	Smart Phone
Processor	Qualcomm Snapdragon 782G or above
RAM	1.5 GB or more
ROM	16 GB or more

2.1.3 Software Requirements(Development Environment)

Table.2.1.3 Soft Requirement (Development Environment)

Type	Requirements
Operating System	Windows 7 64bit or above
Natural Language Processing	Python, tensorflow, pickle, nltk, random, json, numpy
Voice Recognition (Speech to text)	Google Voice Recognition API
Text to Speech	Elevenlabs API
Android Development	FLutter SDK, Android Studio

2.1.4 Software Requirements(User Environment)

Table.2.1.4 Soft Requirement (User Environment)

Type	Requirements
Operating System	6.0 Marshmallow or more

2.2 Operational feasibility

Operational feasibility evaluates how effectively a proposed system addresses identified problems and opportunities and meets the requirements identified during the development process. In the case of Zeno, the proposed system has been found to be operationally feasible as it is designed to be user-friendly and easily accessible without requiring any special training. Additionally, the mobile application can be used to fulfill the needs of users in various situations.

2.3 Economic Feasibility

Economic feasibility is an analysis of the financial viability of a proposed system or project taking into account its expected costs and benefits. This includes identifying potential costs associated with the development, deployment, and maintenance of the system, as well as the potential benefits of implementing it. Following is the economic feasibility analysis of the proposed AI system using COCOMO.

2.3.1 COCOMO

The Basic COCOMO is a static, single-valued model that computes software development effort (and cost) as a function of program size expressed in estimated lines of code (LOC).

The basic COCOMO equations take the form:

Effort Applied (E) = $Ab(KLOC)^{Bb}$, [person-months]
Development Time (D) - $Cb(\text{Effort Applied})^{Db}$[months]
People Required (P) = Effort Applied/Development Time [Count].

Where KLOC is the estimated number of delivered lines (expressed in thousands) of code.The coefficients Ab, Bb, Cb, and Db are given in the following table:

Table 2.3.1 Coefficients for COCOMO

Software Project	**Ab**	**Bb**	**Cb**	**Db**
Organic	2.4	1.05	2.5	0.38
Semi-detached	3.0	1.12	2.5	0.35
Embedded	3.6	1.20	2.5	0.32

Our Project type is Organic project, Estimate LOC = 2500 Now the basic COCOMO equation of our project is

Effort Applied (E) = $Ab(KLOC)^{Bb}$ [person-months]

= $2.4(2.5K)^{1.05}$ [person-months]

= 6.3 [person-months]

Development Time (D) =$Cb(\text{Effort Applied})^{Db}$ [months]

= $2.5\ (6.3)^{0.38}$ [months]

= 5.03[months]

People Required (P) = Effort Applied/Development Time [count]

= 6.3 /5.03 [count]

= 1.25 [count] = 1 (approximately)

The project development time for this project is 6.3 months which will require 1 person. As we have a limited time of approximately 5 months to complete this project we will require more people to develop this project.

Since we have 3 members in our group the project development time is justified.

2.4 Schedule Feasibility

Scheduled Feasibility is the measure of how reasonable the project timetable is. It is the determination of whether a project can be implemented in the allotted time frame. This is illustrated with the help of the Work Breakdown Structure and Gantt chart provided below

2.4.1 Work Breakdown Structure

Work Breakdown Structure (WBS) is a hierarchical breakdown of tasks required to complete a project into manageable sections. Following is the work Breakdown structure for the proposed project.

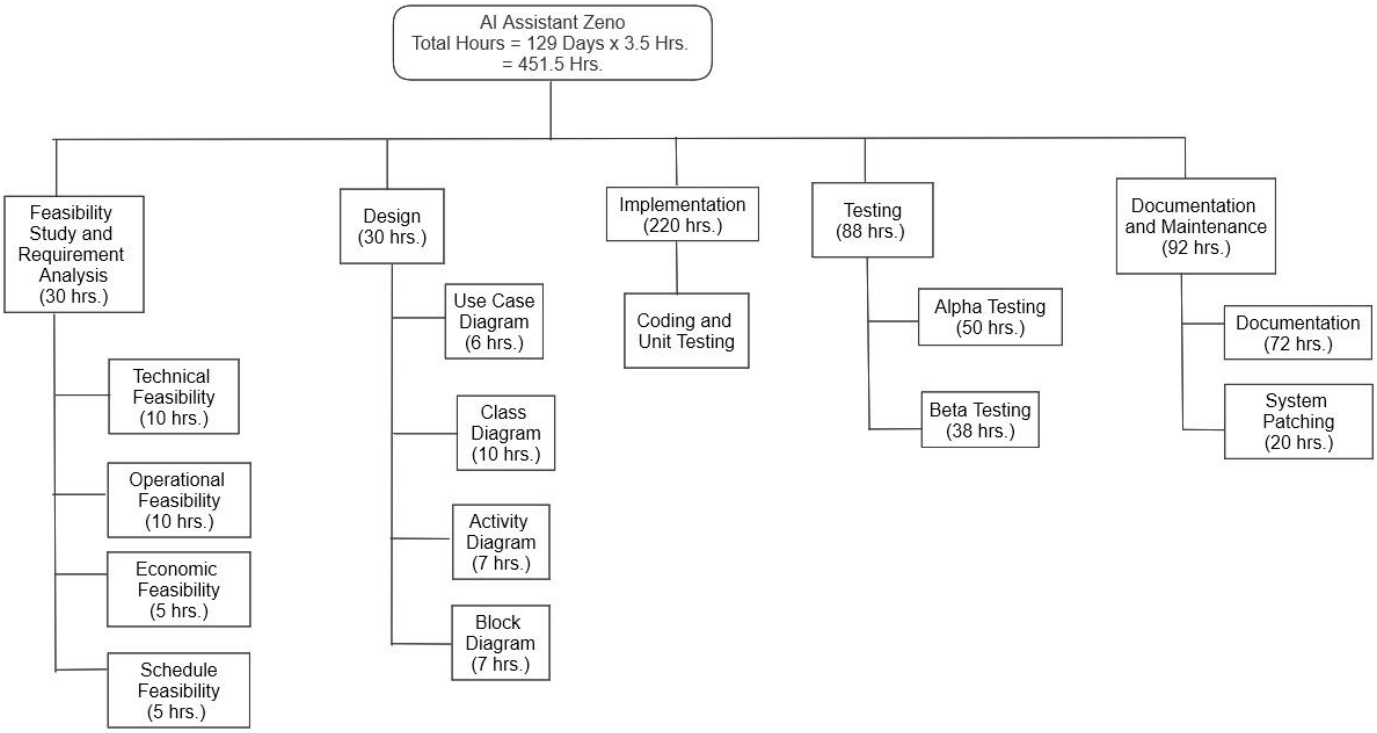

Fig. 2.4.1 Work Breakdown Structure

2.4.2 Gantt Chart

A Gantt chart is a visual representation of a project schedule that shows tasks, their durations, dependencies and milestones. Following is the Gantt for the proposed project.

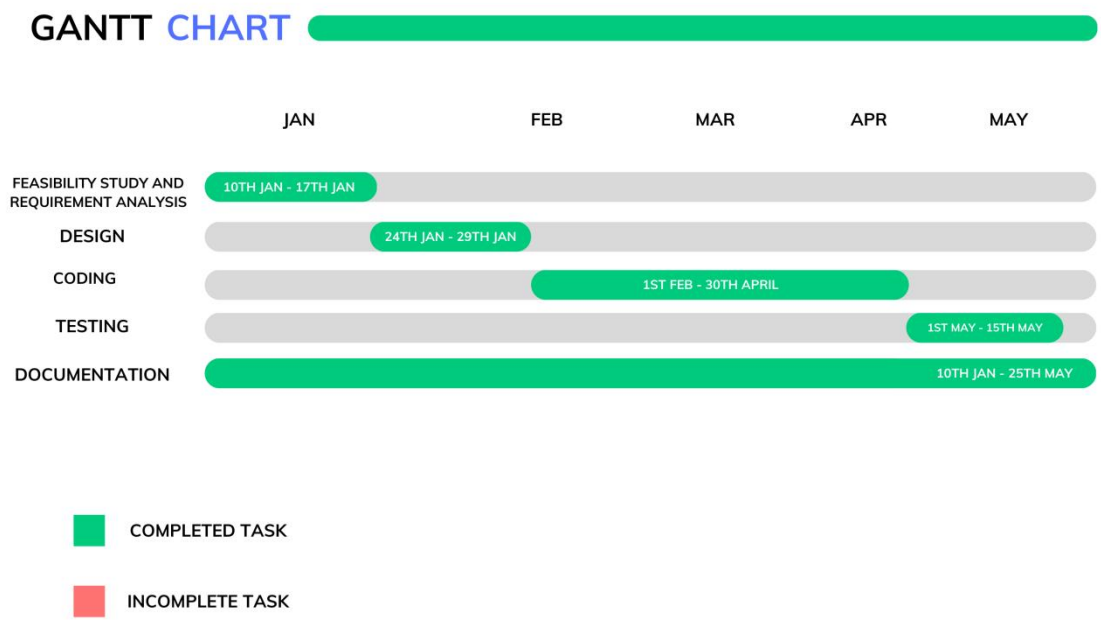

Fig. 2.4.2 Gantt Chart

Chapter 3: Design Diagrams

3.1 Use Case Diagram

A use case diagram is a graphical representation that depicts the interactions between users and a system. Following is the Use Case Diagram for the proposed system.

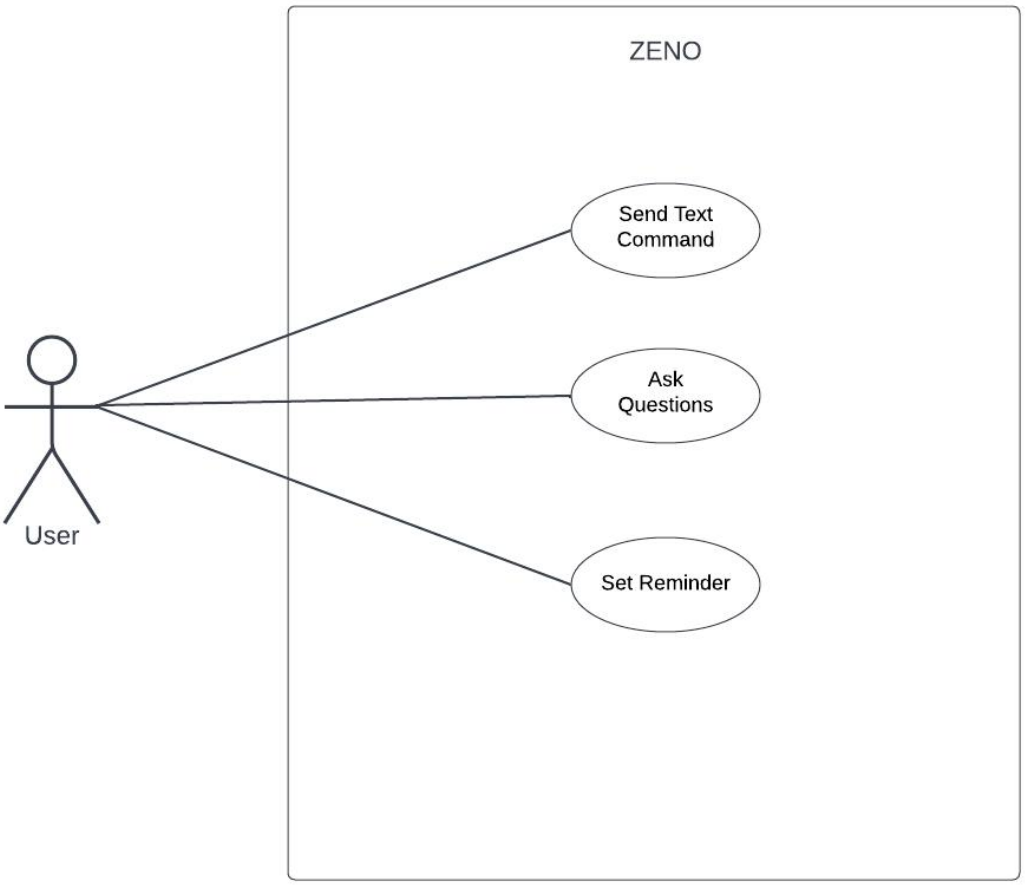

Fig. 3.1 Use Case Diagram

3.2 Block Diagram

A Block Diagram is a visual representation of a system or process that uses blocks to represent components and their connections. Following is the Block diagram for the proposed system.

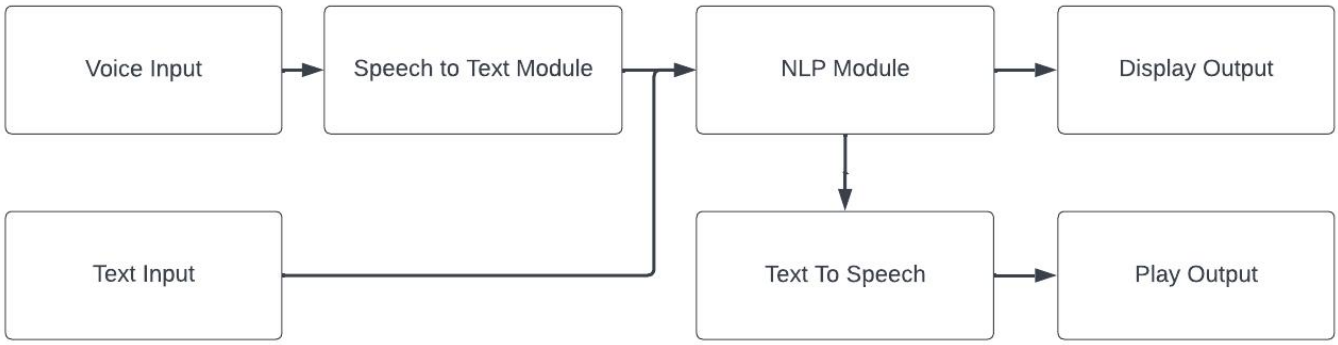

Fig. 3.2 Block Diagram

3.3 State Machine Diagram

State Machine diagram is a visual representation of the states and transitions of an object or system. Following is the State Machine diagram for the proposed system.

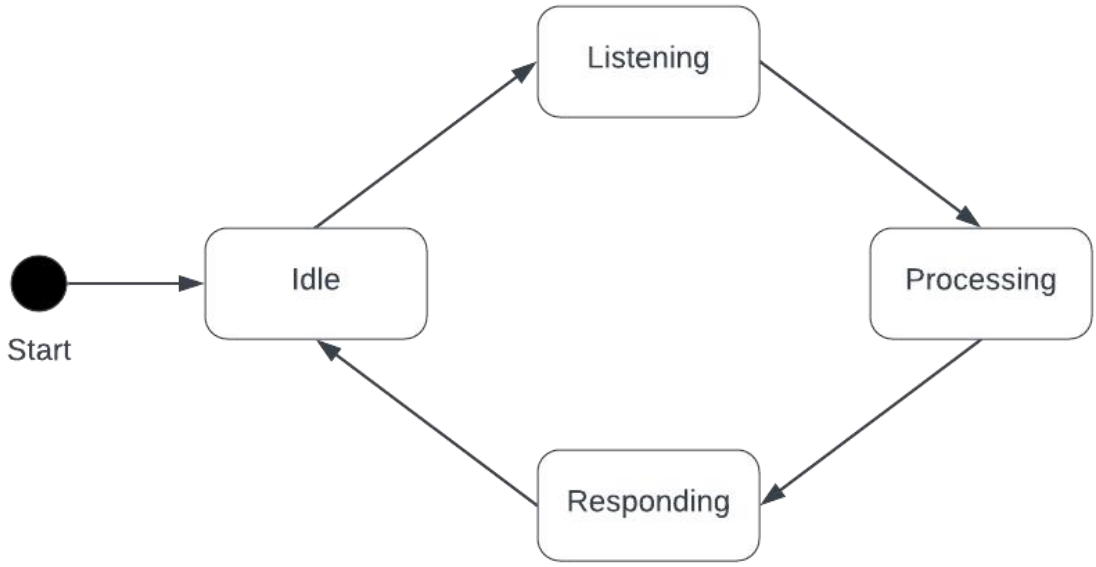

Fig. 3.3 State Machine Diagram

3.4 Sequence Diagram

Sequence diagram is a UML modeling tool used to represent interactions between objects or components in a system. Following is the Sequence diagram for the proposed system.

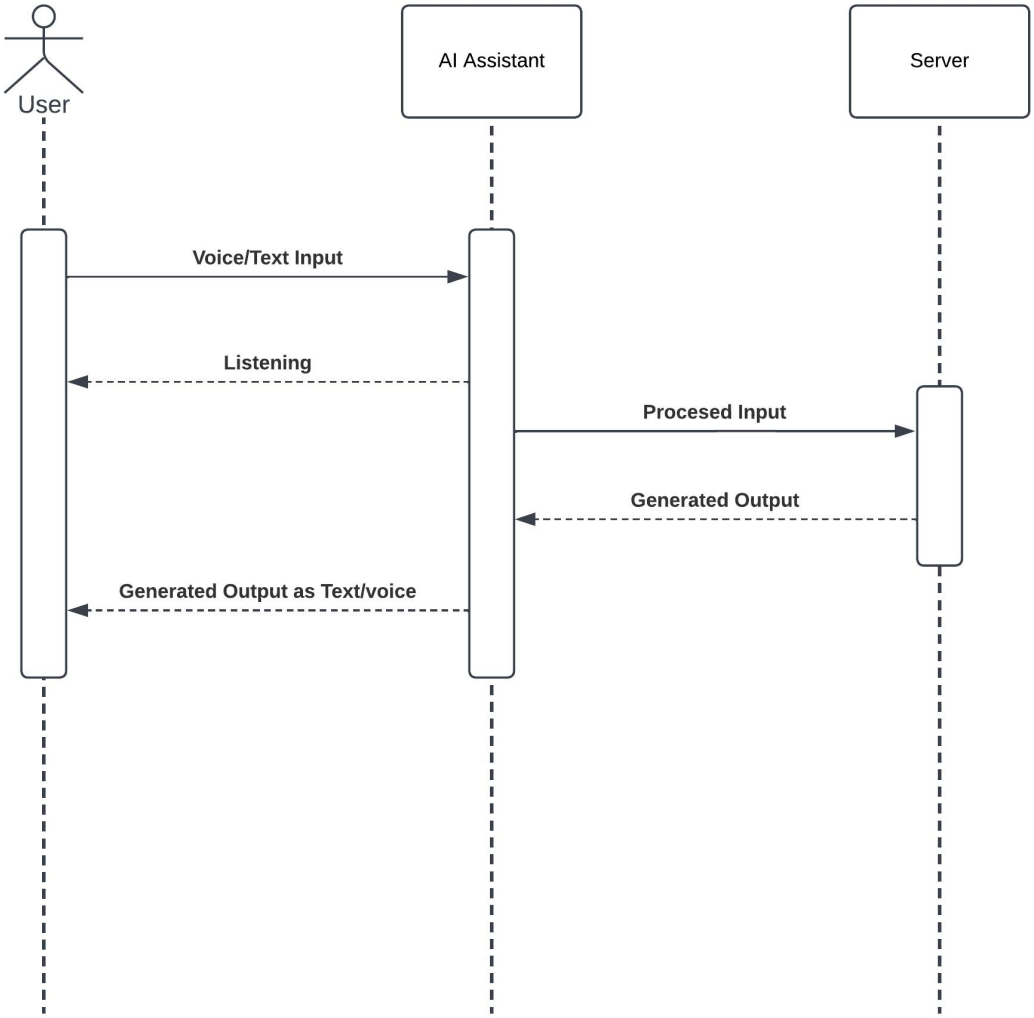

Fig. 3.4 Sequence Diagram

3.5 Activity Diagram

An activity diagram is a graphical representation in UML that depicts the flow of activities, actions, and transitions within a system or process, illustrating the sequential and parallel flow of events.

3.5.1 Activity Diagram Level - 1 (Main Activities)

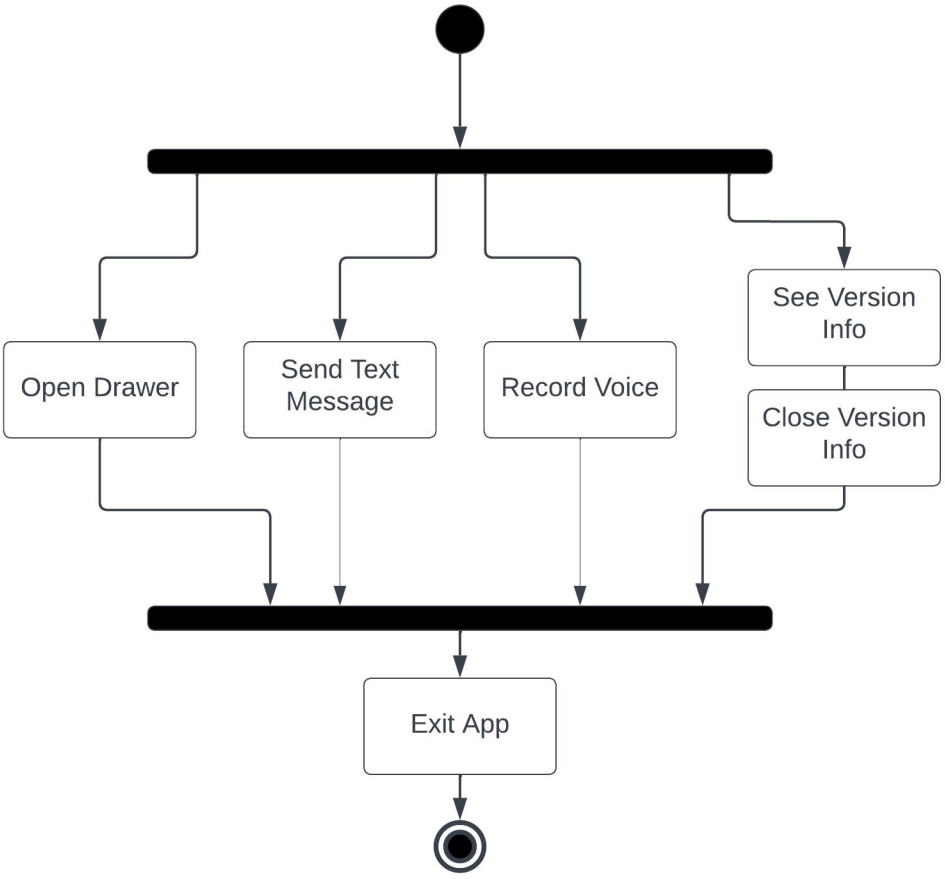

Fig. 3.5.1 Activity Diagram(LVL 1)

3.5.2 Activity Diagram Level - 2 (Detailed Activity, Drawer)

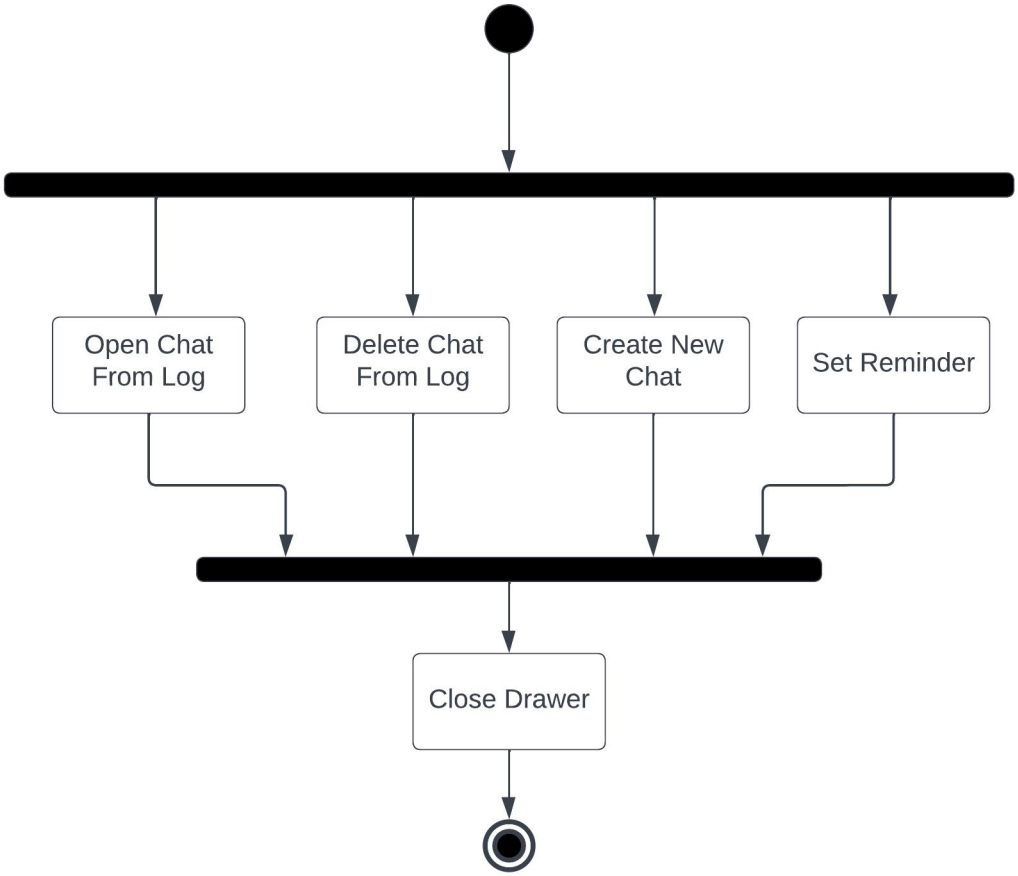

Fig. 3.5.2 Activity Diagram(LVL 2)

3.5.3 Activity Diagram Level 2 (Detailed Activity, Send Message)

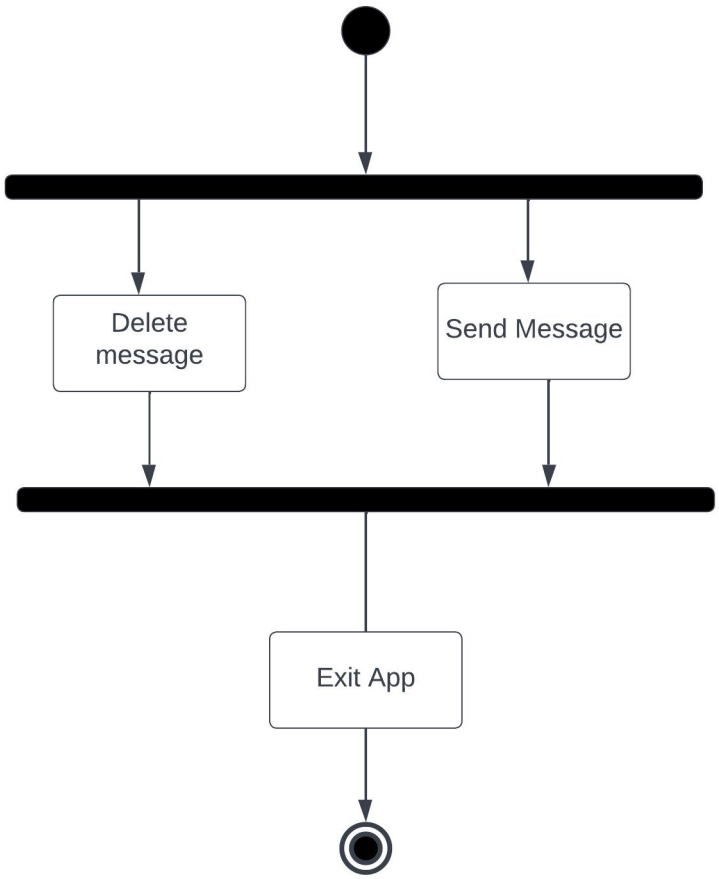

Fig. 3.5.3 Activity Diagram(LVL 2.2)

3.5.4 Activity Diagram Level - 2 (Detailed Activity, Record Voice)

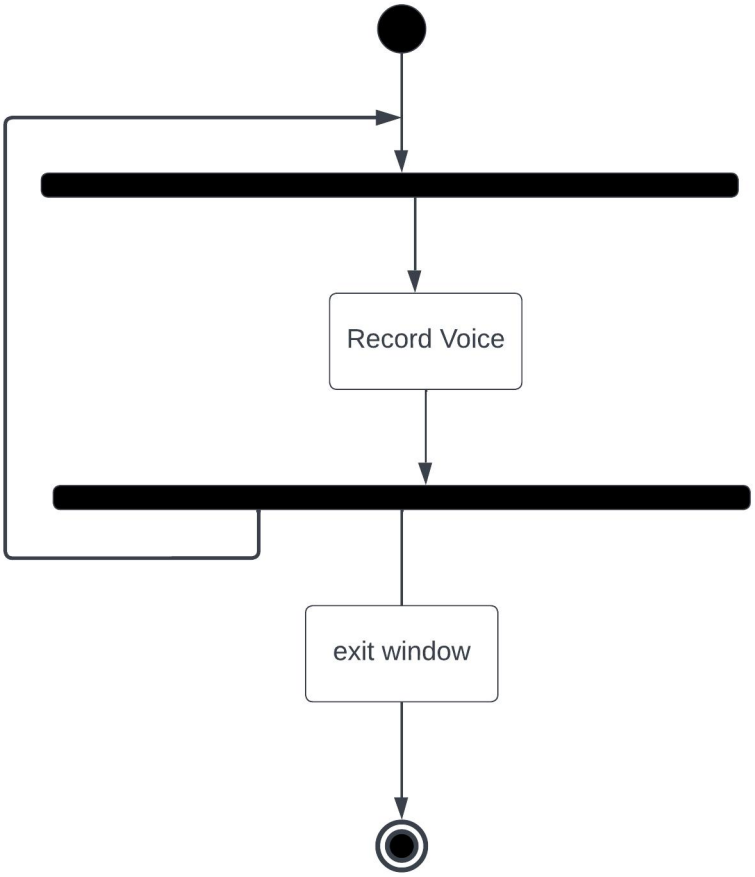

Fig. 3.5.2 Activity Diagram(LVL 2.3)

Chapter 4: Implementation

4.1 Methodology

The set of methods and techniques used to conduct research to achieve our goals for the proposed NLP(Natural language Processing) model.

4.1.1 Techniques Used

I. **Sequence to sequence:** Sequence to sequence or Seq2Seq is a type of neural network model was implemented in natural language processing (NLP) to take a sequence of input and output pairs as training data and learn to generate output sequences based on the input sequences.

Strengths:

a. Could handle input and output sequences of variable lengths
b. Could generate variable-length output sequences that did not necessarily correspond to the length of the input sequence
c. Could learn complex dependencies between the input and output sequences

Weaknesses:

a. Required large amounts of training data to avoid over-fitting
b. Could be computationally expensive, especially when dealing with long sequences
c. Could suffer from the problem of generating generic output that did not accurately capture the nuances of the input sequence

II. **Transformers :** Transformers is a neural network architecture used in natural language processing that uses self-attention to handle sequential data without prior feature engineering, achieving high accuracy and flexibility. Transformers are large size and resource requirements make it challenging to develop and deploy effectively.

Strengths:

a. Ability to handle sequential data without prior feature engineering
b. Highly accurate model due to self-attention mechanism
c. Ability to handle variable-length input sequences, making it well-suited for tasks such as language translation and sentiment analysis.

Weaknesses:

a. Requires vast amounts of data and computational resources for training
b. Model complexity and large number of parameters make it difficult to interpret inner workings and identify potential biases
c. Deploying these models in production can be challenging, especially in resource-constrained environments.

III. **Bag of Words :** The Bag of Words (BoW) is a model that represents text as a simple count of the occurrence of individual words or tokens, without considering the order of the words in the text.

Strength:

a. BoW is a simple and effective model for text classification tasks, especially for large datasets.
b. It is computationally efficient and easy to implement.
c. BoW can handle large vocabularies and can capture the frequency of rare words in the text.

Weakness:

a. BoW does not consider the context or order of words in the text, which can result in a loss of important information.
b. It treats all words as equally important and does not account for the fact that some words may carry more meaning or have greater importance than others.
c. BoW can suffer from the "curse of dimensionality" problem, where the feature space becomes too large and sparse for efficient processing.

IV. **GPT-3:** Generative Pre-trained Transformer 3, is a state-of-the-art natural language processing (NLP) model developed by OpenAI. It is a deep learning model that uses a transformer architecture and has been trained on a massive amount of text data to generate human-like text responses.

Strength:

a. Versatility: GPT-3 can be used for a wide range of NLP tasks, including text generation, translation, summarization, and more.

b. Language Understanding: It has a strong ability to understand and generate natural language, allowing it to produce coherent and contextually relevant responses.

c. Large-Scale Training: The model's extensive training on a vast amount of data enables it to capture complex patterns and nuances in language.

d. Zero-shot Learning: GPT-3 has the capability to perform tasks it hasn't been specifically trained for, making it adaptable and capable of generalizing to new tasks.

e. Creativity: The model can generate creative and novel text outputs, which can be useful in various creative writing and content generation applications.

Weaknesses:

a. Lack of Factual Accuracy: While GPT-3 can generate fluent and contextually appropriate responses, it may not always provide accurate or factually correct information. The model may generate plausible-sounding but incorrect statements.

b. Sensitivity to Input Phrasing: GPT-3's responses can be sensitive to minor changes in input phrasing, potentially leading to inconsistent or contradictory answers for similar questions.

c. Limited Control and Bias: The model may generate biased or inappropriate responses, as it learns from the vast amount of text data available on the internet, which can include biased or harmful content. It requires careful monitoring and fine-tuning to mitigate these issues.

4.1.2 Comparative Analysis of Technologies used

Upon asking 50 questions a comparative analysis of three processing methods - Seq2Seq, Transformers, and Bag of Words - was conducted. The aim of this analysis was to evaluate the performance of these models in generating accurate and meaningful responses to user queries. The evaluation was based on the accuracy and time taken to generate responses, providing insights into the strengths and weaknesses of each method. This analysis can assist researchers and practitioners in the field of natural language processing to make informed decisions when selecting a model that is best suited for their specific use case. Following is the bar chart representing the number of accurate answers provided by each model.

The follwing figure 4.1.2 illustrates the comparative analysis of no. Of questions answered correctly out of 50.

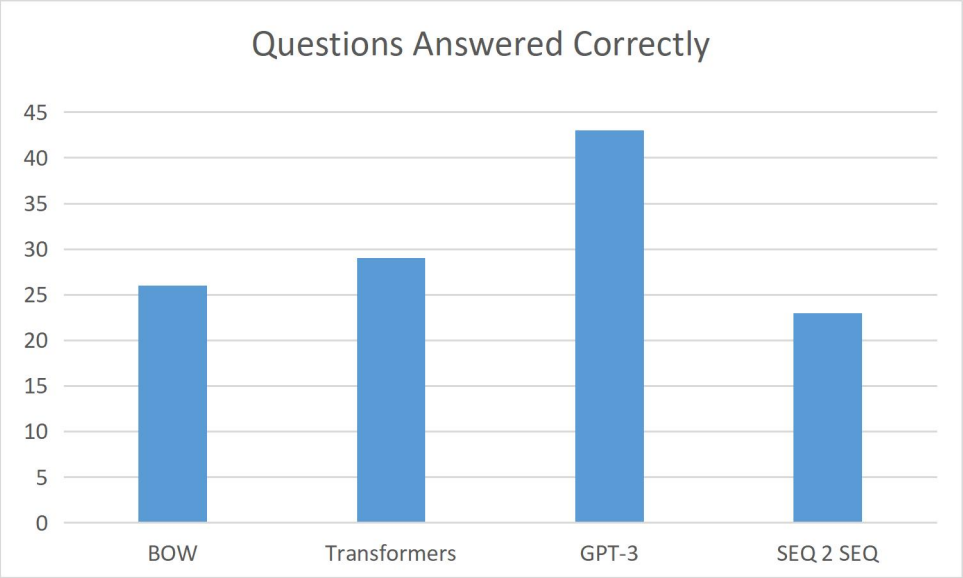

Fig. 4.1.2 Comparative analysis of NLP models

4.1.3 Results of the Analysis

The comparative analysis of Seq2Seq, Transformers, and Bag of Words has provided valuable insights into their performance in generating responses to a given set of questions. Transformers were found to be the most accurate method, followed by bag of words, while Seq2Seq was the least accurate. However, Bag of Words was significantly faster to train and predict. Overall, this analysis highlights the importance of selecting the appropriate natural language processing method based on the specific requirements of a task to achieve the desired outcomes.

4.1.4 Implementation Screenshots

I. Bag of words: The following figure illustrates the working model for BoW model

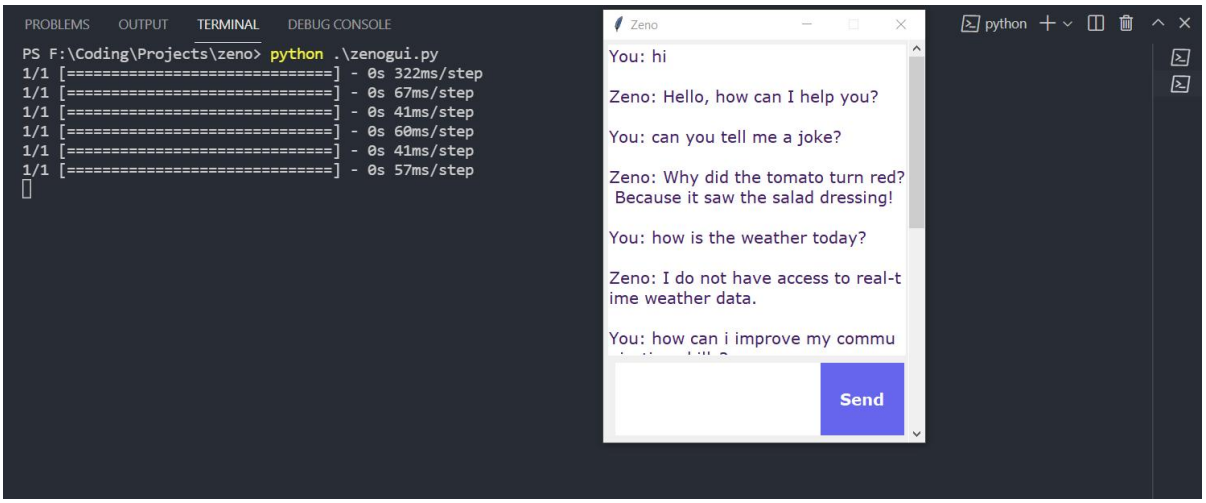

Fig 4.1.4(i) Screenshot of implementation - Bag of words

II. Seq2Seq: The following figure illustrates the working model for Seq2Seq model

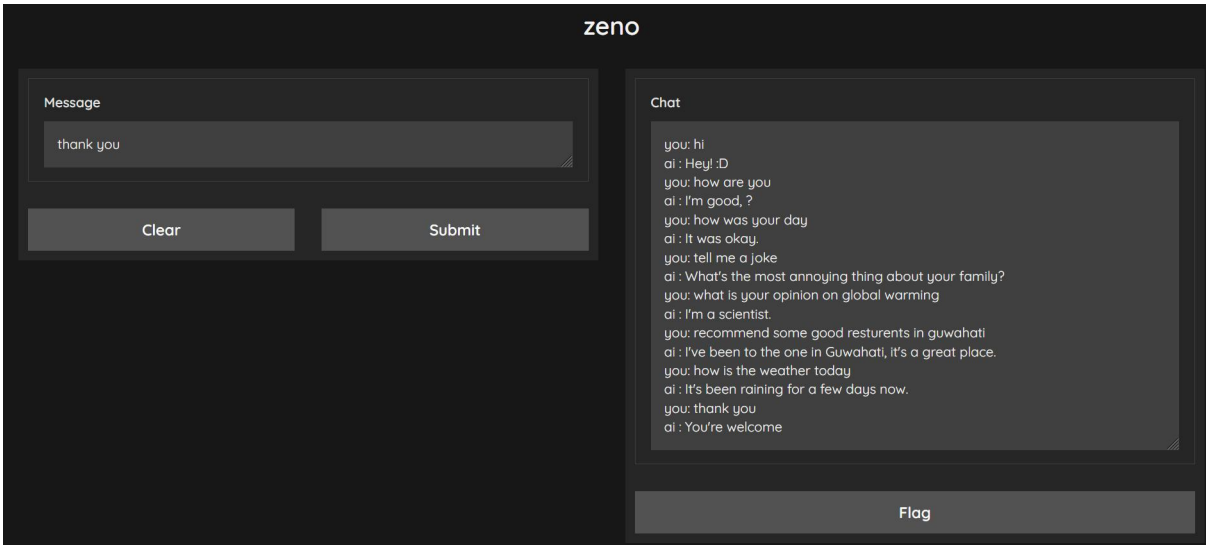

Fig. 4.1.4(ii) Screenshot of implementation - Seq2Seq

III. Transformers: The following figure illustrates the working model for Transformers model

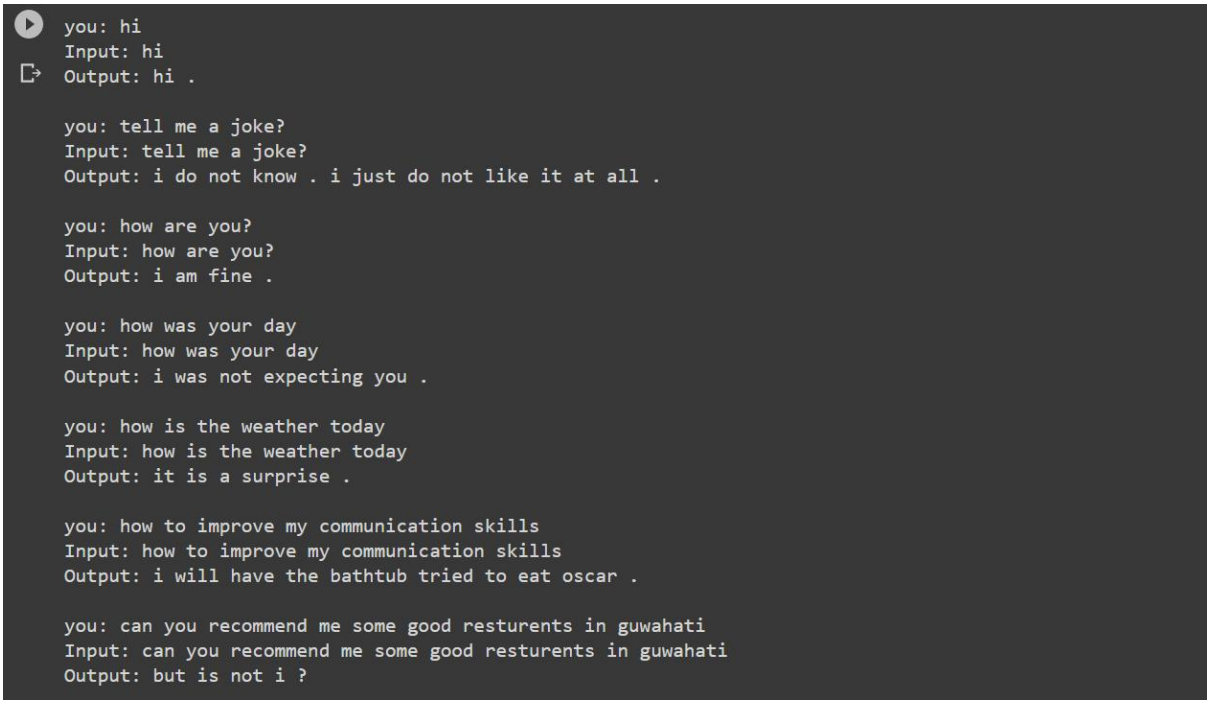

Fig. 4.1.4(iii) Screenshot of implementation - Transformers

IV. GPT -3 : The following figure illustrates the working model for GPT-3 model

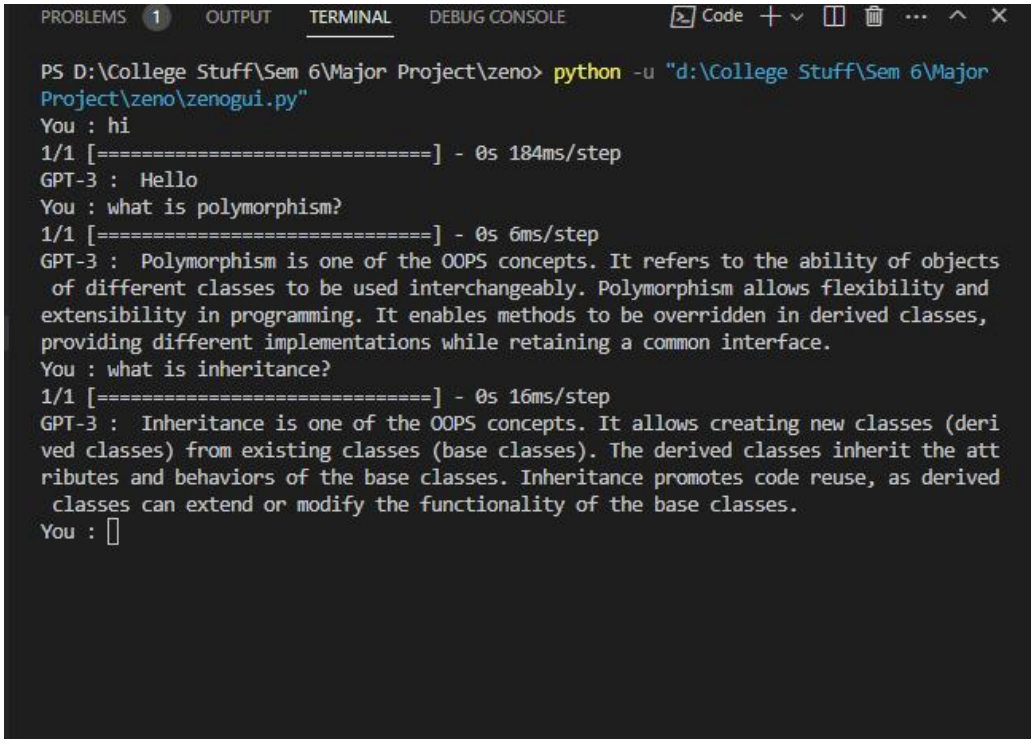

Fig. 4.1.4(iv) Screenshot of implementation - GPT-3

4.2 Mobile Application Implementation: Visual Overview of interface

4.2.1 Implementation of Application Drawer:

The following figure showcases the App drawer functionalities of the Zeno Application

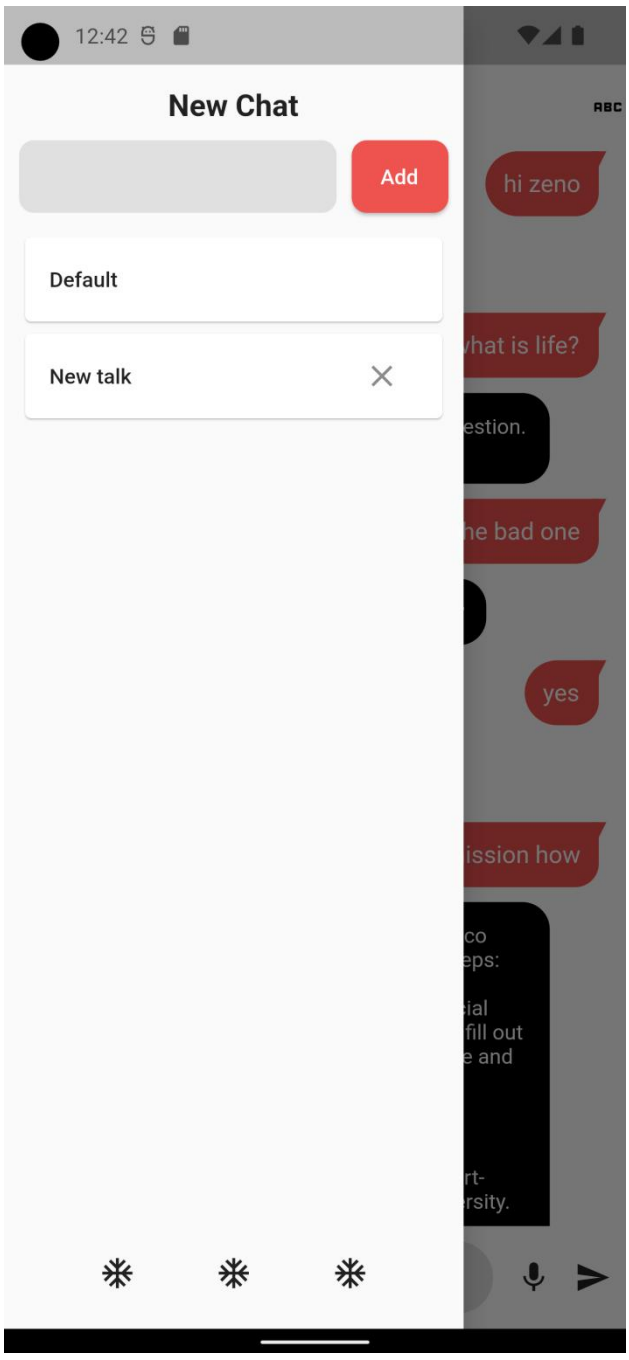

Fig. 4.2.1 Application UI, App Drawer

4.2.2 Implementation of Application of Voice Recording

The following figure showcases the Recording functionality of the Zeno Application

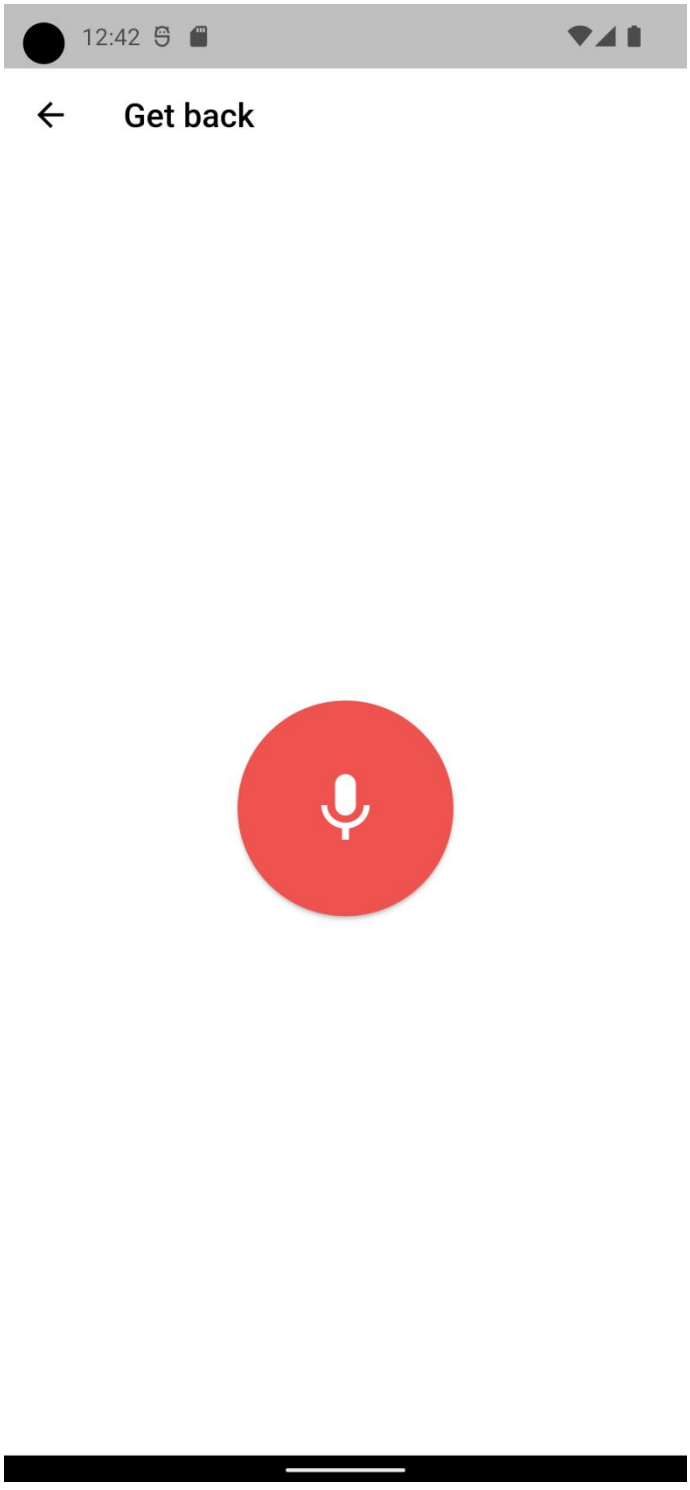

Fig. 4.2.2 Application UI, Voice Recording

4.2.3 Implementation of Application of Version Information Page.

The following figure showcases the Version info component of the Zeno Application

Fig. 4.2.3 Application UI, Version Information

4.2.4 Implementation of Application Chat System.

The following figure showcases the Implemented Chat System for the Zeno Application

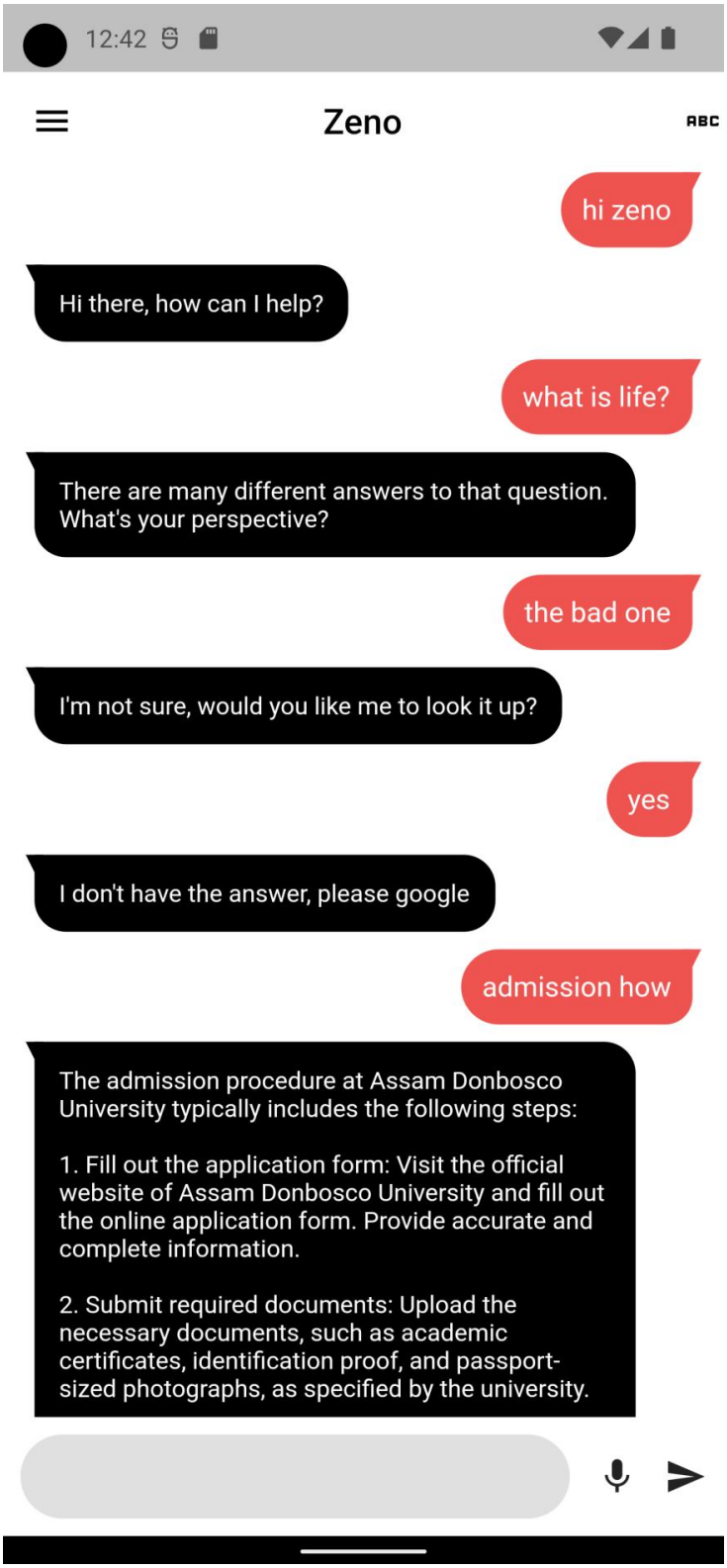

Fig. 4.2.4 Application UI, Chat System

Chapter 5: Conclusion & Future Scope

In conclusion, Zeno serves as a reliable and effective AI assistant for students, designed to help them manage their schedules, find relevant resources, and answer their questions. With its user-friendly interface, advanced NLP model with voice recognition technology, Zeno aims to provide students with the support they need to succeed academically. Furthermore, its technical feasibility, economic viability, and operational feasibility. Zeno can be a valuable addition to students' academic toolkit. It can help them save time and reduce stress while studying, leading to better academic performance.

Furthermore Zeno can be developed to be more specific to the user by studying their usage patterns and habits becoming used to their needs, suggesting and answering questions specifically made proving to be more useful in facilitating a better education.

For the Future Scope Zeno’s Knowledge base can be expanded to add more and more courses introducing Zeno to more students. Alleviating the burden of administrative tasks and facilitating quick access to educational resources, allowing the students to focus more on their learning and intellectual growth increasing the potential to improve time management and foster self-directed learning ultimately contributing to academic success.

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