“eLIFE bot: The AI-enabled Chatbot for Mental health”

Major Project Report

Submitted in Partial Fulfillment of the Requirements for the Degree of

BACHELOR OF TECHNOLOGY

IN

INFORMATION AND COMMUNICATION TECHNOLOGY ENGINEERING

By

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Under the Guidance of

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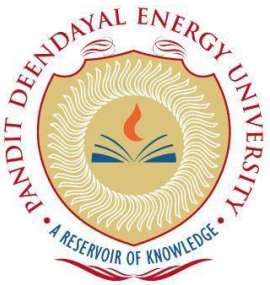

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May 2023

Certificate of Originality of Work

I hereby declare that the B.Tech. Project entitled "eLIFE bot: The AI-enabled Chatbot for Mental health" submitted by me for the partial fulfillment of the degree of Bachelor of Technology to the Dept. of Information and Communication Technology (ICT) Engineering at the School of Technology, Pandit Deendayal Energy University, Gandhinagar, is the original record of the project work carried out by me under the supervision of Prof. Dr. Devlina Adhikari.

I also declare that this written submission adheres to university guidelines for its originality, and proper citations and references have been included wherever required.

I also declare that I have maintained high academic honesty and integrity and have not falsified any data in my submission.

I also understand that violation of any guidelines in this regard will attract disciplinary action by the institute.

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Signature of the Supervisor:

Place: Gandhinagar, Gujarat

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Certificate from the Project Supervisor/Head

This is to certify that the Major Project Report entitled “eLIFE bot: The AI-enabled Chatbot for Mental health” submitted by Ms. Patel Aryaben Kalpeshbhai, Roll No. 19BIT014 towards the partial fulfilment the requirements for the award of degree in Bachelor of Technology in the field of Information and Communication Technology Engineering from the School of Technology, Pandit Deendayal Energy University, Gandhinagar is the record of work carried out by her under my supervision and guidance. The work submitted by the student has in my opinion reached level required for being accepted for examination. The results embodied in this major project work to the best of our knowledge have not been submitted to any other University or Institution for the award of any degree or diploma.

_____

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Patel Aryaben Kalpeshbhai

Abstract

Over the past few years, the prevalence of mental health disorders has increased significantly due to numerous factors, such as heightened stress levels and changes in lifestyle and social dynamics. Moreover, the upsurge in competition in academic and professional spheres spikes the rate of mental illness among youth. This phenomenon is widely regarded as a global crisis that profoundly impacts individuals' overall well-being. Moreover, the COVID-19 pandemic has further exacerbated this problem, leading to an increase in depression among children. By using pioneering technologies like Artificial Intelligence (AI), Natural Language Processing (NLP), and Machine Learning (ML) we helped to bridge the gap, as mental health problems are quite prevalent but often undertreated. So, to resolve this issue, the eLIFE bot is designed to provide users with a safe and confidential space to discuss their mental health concerns, receive support and guidance, and connect with mental health professionals if necessary. We have developed an AI-enabled mental health chatbot using the RASA framework and deployed it on Telegram. The AI-enabled chatbot uses user input to understand users' needs and provide suggestive treatments for self-care by implementing unique features such as gratitude logging, jokes, and displaying psychiatrist data if the user seeks professional help. We have used the standard DASS-21 questionnaire, which allows users to effectively self-assess their mental health issues and gain insight into their severity. We have achieved efficiency, efficacy, and user satisfaction through our interactive responses and by empowering individuals to take control of their mental health. Chatbots can be extremely advantageous in providing accessible and trustworthy health information, considering society's growing reliance on online resources. This study emphasizes the importance of investing in innovative technologies in mental healthcare that have the potential to enhance the lives of people who are dealing with mental health issues.

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Chapter 1
Introduction

1.1 Prologue

Mental ill-being is considered as a separate dimension of psychological functioning that can be measured using various types of emotions such as depression, anxiety, nervousness, loss of interest, and anger. Such Mental illnesses are the most common and have significant adverse effects on functioning, an individual's quality of life, and his or her contribution to society and the economy. Over one billion individuals worldwide have suffered from a mental illness, which can range from the most common conditions of anxiety and depression to psychotic and personality disorders. According to the latest report by WHO, by 2020, an estimated 193 million people had major depressive disorders before the pandemic, while 298 million people had anxiety disorders. After controlling for the COVID-19 pandemic, initial estimates for major depressive disorders and anxiety disorders rose to 246 million and 374 million respectively.

Due to the increasing need of psychological treatment and the labour shortage in the mental healthcare sector due to the COVID-19 pandemic, artificial intelligence (AI) chatbot counselors are getting more attention. There has been an effort to develop digital mental health interventions such as chatbots that can either complement or substitute traditional in-person mental health services within the field of mental health.

Chatbot originated from the term ‘Chat Robot’ are computer systems that enable conversational user interfaces that replicate human communication through text or speech using machine learning and artificial intelligence. With advancements in the field of AI and NLP, chatbots can now be programmed to carry out more complex tasks, such as sentiment analysis and motion detection. The advancement of chatbots from the first ever created ELIZA in the 1960s to the recent new AI language processing from Open AI is ChatGPT as a revolutionary product. The advanced AI automated bots that rely on natural language processing are already hailing the advanced model, which is trained to produce text that sounds human. Nowadays, they are deployed on various apps, websites, and messaging

platforms, and also a vital component of virtual assistants like Siri, and Alexa which are consumer-based, information-driver, and predictive. Moreover, they are used for research, for fun, or to promote a certain candidate, product, or issue on social media.

Traditionally, mental health assistance involved face-to-face meetings with specialized professionals, but with the increasing number of people with mental disorders, there is a need for a scalable solution. Because the availability of mental health services and resources are not sufficient, especially in low and middle-income countries. Telehealth and e-mental health technologies have become more significant in psychological care amid the social distance and lockdowns because they allow individuals to get mental health therapies from the comfort of their own homes and at their fingertips.

A mental health chatbot's primary goal is to help users manage and understand their mental states as much as possible on their own, and to connect with mental health professionals when necessary. Conversational AI chatbots have emerged as a valuable tool in the sector of mental health because of many factors. They can resolve the issues immediately 24/7 a day, at a lower cost than a customer service agent. Chatbots can provide support, treatment, and companionship, which benefits therapists by reducing their workload. It appears to be a solution for people who have difficulty with affordability and accessibility, both in terms of time and location. As a result of the worldwide pandemic and the COVID-19 crisis, there has been a surge in investment in digital mental health treatments, particularly in the use of chatbots. Chatbots are being utilized in the field of mental health to provide support through cognitive and behavioural therapy, offer counseling to manage lifestyle and mental wellness, conduct risk assessments, and perform screening. As an outcome, chatbots have become wildly popular as a part of a digital platform for the worldwide public healthcare sector.

Chatbots have become increasingly popular in recent years, especially in the healthcare sector. These bots are capable of answering the user queries, handling all without human intervention. However, despite their many advantages, chatbots cannot replace human interaction entirely. For one, they lack empathy and emotional intelligence, which are essential components of human communication. While chatbots may be able to provide canned responses to the user’s queries. they cannot truly understand the emotions of a user's situation or provide the same level of emotional support as a human agent. In conclusion, chatbots are incredibly useful tools but still they cannot replace the human touch entirely.

A combination of chatbots and human agents can provide the best of both worlds, allowing to handle large volumes of requests efficiently while still providing personalized support to users when they need it most.

1.2 Motivation

With the increase in the hustle and bustle of life, people of all ages, especially those of a young age, are suffering from some level of stress, anxiety, and different types of concerning issues. The COVID-19 pandemic quickly became one of the global threats responsible for slow progress toward improved well-being, claimed by a World Health Organization report on mental health. In India, children with mental health disorders are mostly undiagnosed and hesitant to seek help or treatment. Smartphones and other mobile technology's burgeoning availability and usability may create new possibilities for overcoming existing barriers. The widespread adoption of AI and NLP technologies in chatbots has revolutionized the way people access mental health support, providing a convenient and accessible solution to traditional therapy methods. Digital mental health interventions such as apps and chatbots, provide new opportunities for resolving issues related to different psychiatric conditions and can serve as an effective way to bridge the access gap. Today, mental health chatbots are becoming increasingly important because they help people seek support, advice, and therapy by evaluating their status and recommending sessions according to their personalized therapy. The most noteworthy thing in developing the chatbot is to make them (users) believe in themselves by trusting the process and celebrating the smaller milestones in their mental well-being.

1.3 Objective

Our proposed system has focused on developing a chatbot to overcome mental health problems through AI and NLP guided technology.

The objectives of our eLIFE bot are:

- Create a user-friendly communication system between the chatbot and the user to maintain users' anonymity for privacy and confidentiality.

- Enable users to better understand their mental health and improve their well-being through suggested techniques.
- To offer timely and accessible mental health care to individuals in need without adding to their financial burden.
- Identify the user's emotion through a text-based sentiment analysis approach using python libraries.
- Provide accurate information about the symptoms of mental health disorders such as depression, anxiety, and stress to help users recognize and address their mental health concerns.
- By providing a self-assessment form (DASS), which empowers users to take control of their mental health and gain insight into the severity of their disorders, contributing to overall well-being and reducing stigma.
- Providing users with a comprehensive database of qualified psychiatrists, including details of their proficiency and experience, in case they require professional medical advice
- Overall, these objectives aim to improve mental health outcomes and contribute to the larger goal of promoting overall well-being by leveraging technology to offer accessible and affordable mental health care.

1.4 Problem Statement

Mental illnesses are quite common and often undertreated in all nations because of the widening gap between those who need treatment and the experts, as well as the lack of a platform to implement an emotionally compelling connection with the users. This exemplifies the demand for e-mental health and telemental health services hampered by issues relating to privacy, data security, and safety, as well as low levels of health literacy among people.

Despite the high demand for mental health services, many people have trouble getting the care they need because of stigma, a lack of money, and a shortage of mental health professionals in some areas. On the other hand, when our mental health is compromised and we don't have access to the right kind of care, our well-being may deteriorate. The emotional needs of users may not be sufficiently met by self-help apps and other existing

technological solutions for mental health, such as teletherapy. A more interactive and responsive method of providing mental health support might be provided by a chatbot that makes use of artificial intelligence and natural language processing.

The chatbot technology helps to respond to countless questions that need immediate management of emotional issues and support in difficult times. This is the area of opportunity to deploy and automate the process of identifying any changes in a person's mental health while maintaining their confidentiality and security by designing a user-friendly and emotionally intelligent chatbot interface, which is an essential need of time.

1.5 Scope of the Project

Mental health is a critical concern that affects millions of people globally, and access to appropriate care and resources is often limited. In response to this pressing need, we have developed the eLIFE bot, a mental health chatbot that uses the RASA Version 3.1 chatbot architecture to provide individualized and efficient mental health care.

- eLIFE bot is built using the RASA Version 3.1 chatbot architecture, which uses machine learning to recognize different text inputs and provide related responses to users.
- Our chatbot aims to create a safe and supportive environment where users can feel heard and understood, without fear of judgment.
- It offers a range of unique features, including gratitude logging, empathetic reactions, a wellness form, and a comprehensive database of qualified psychiatrists.
- The chatbot aims to address mental health problems without keeping the age of the user in consideration, while still protecting their identity by keeping them anonymous.
- By providing individuals in need with easily accessible and convenient help, the eLIFE bot has the potential to significantly impact mental health care.
- The chatbot also includes a wellness form and a DASS-21-based self-report generator to encourage users to adopt healthy lifestyle practices for long-term success and overall well-being.

Our ultimate goal is to make it easy and convenient for individuals in need to access the mental health support and resources they require, thereby significantly impacting mental health care.

1.6 Organization of the Rest of the Report

The thesis project will be organized into several sections to provide a comprehensive overview of the eLIFE chatbot project consisting of five main sections: Literature Review, Methodology, Testing of the Model, Results and Discussion, and Conclusions and Future Scope.

I. The Literature Review section will present a critical review of previous research related to the topic of mental health chatbots and conversational AI. It will summarize the key findings of nine selected papers and identify research gaps that eLIFE bot aims to address.

II. The Methodology section will describe the research design, data collection, and analysis methods used to build eLIFE bot. This section will provide a detailed description of the conversational AI framework RASA with natural language processing and machine learning techniques that were utilized in building the chatbot.

III. The Testing of the Model section will include a detailed description of the testing process, including the test scenarios and the evaluation metrics used to assess the chatbot's performance. It will also present the results of the testing, including any issues that were encountered and how they were addressed to develop a RASA version 3.1 chatbot and its deployment on Telegram.

IV. The Results and Discussion section will present the findings of the project and discuss their implications for mental health support. This section will include a comprehensive evaluation of eLIFE bot's unique features, such as gratitude logging

and empathetic reactions, as well as the wellness form and database of qualified psychiatrists. It will also discuss the results of testing and deployment on Telegram.

V. The Conclusions and Future Scope section will summarize the key findings of the study and provide recommendations for future research and development. This section will discuss the potential impact of eLIFE bot on improving mental health support and accessibility. It will also outline future directions for expanding the chatbot's capabilities and incorporating user feedback.

VI. The References section will list all the sources cited in the report, following the prescribed format of IEEE referencing style.

Chapter 2
Related Works

2.1 Literature Review

In this paper [1], the author describes that in the healthcare domain, day by day the use of AI-guided chatbot systems is increasing. They have designed a chatbot with an easy-to-use interface and also suitable for low reading literacy skills. Even though there are multiple benefits of Using AI in mental health chatbots, there are still limitations and challenges. The author mentioned that their implemented system is unable to remember previous conversation, which might cause unsatisfactory responses and chatbots must keep users' data about their mental well-being private and confidential. Their implemented system lacks the ability to manage emergency situations, where the user's safety is at risk.

In this research paper [2], the authors provide a structured framework for designing AI-based mental health chatbots that are designed to meet specific goals. Most existing chatbots used in the field of mental health are rule-based and are mainly utilized for performing simple and repetitive tasks. The findings from this study highlight the opportunity for AI-based mental health chatbots, which use natural language processing, machine learning, and data mining technologies. These chatbots have the ability to offer improved predictive capabilities for diagnostic screening and risk assessment, provide more personalized experiences, and mimic human-like conversations with enhanced empathy. Over the past few years, several chatbots, such as Wysa and Woebot, have been developed and applied in various areas, including cognitive behavioral therapy support, lifestyle and mental wellness management coaching, risk assessment, and screening. One of the major challenges in developing chatbots is the limitations of algorithms in recognizing and extracting implicit emotions from user interactions, which requires explicit communication between the user and the chatbot.

In [3] have proposed a hypothesis that Behavioural Activation (BA) therapy and Artificial Intelligence (AI) are better materialized in a chatbot setting to provide enduring emotional support, individualized help, and virtual mental health monitoring. Moreover, the primary constructs of the implemented chatbot includes detection of various emotions and thereby

analyzing sentiment along with keeping track of transition in the user moods and providing personalized treatments through RASA framework. The BA based AI chatbot was designed, developed, and then put through a participatory evaluation in a pilot study setting, which proved that it was successful in helping people with mental health issues. The users' changing moods over the course of the study are shown using the mood transition graph in-degree centrality and page rank algorithm. The limitations which could be overcome through their future work by creating a community of like-minded people like introverts along with quotes and daily motivation strategies and also to include language modification with responses including memes and emojis to enhance user experience.

A study [4] sheds light on the growing utilization of the Wysa app during the COVID-19 pandemic and evaluates its effectiveness using PHQ-9 (Patient Health Questionnaire) and GAD-7 (Generalized Anxiety Disorder) assessments. The research paper shows evidence that the Wysa app receives support from its users and usage can result in a substantial decrease in symptoms of anxiety and depression. The app's design prioritizes user safety, security, and privacy, and as per the data privacy and safety policies, the Wysa app does not gather any demographic data from users. However, it is crucial to note that the findings of this study are unique but must be viewed in the context of its limitations. The analysis was limited to installs versus active cases and did not take into account other social or policy factors such as closures or lockdowns. Additionally, the evaluation of efficiency was conducted without a control group.

Fitzpatrick et al. [5] study goal was to find out whether (Woebot) completely automated conversational agents might give self-help training to young adults who self-report having anxiety and depression symptoms and whether it would be feasible, acceptable, and potentially effective. They carried out an unblinded trial of seventy people between the ages of 18 and 28, were given two weeks CBT based techniques according to the online participants answering to PHQ-9, GAD-7, and the Positive and Negative Affect Scale. Our theory was partially substantiated since the study showed that after two weeks, participants in the Woebot group had a considerable drop in depression. Woebot was compared positively to the information-only comparison and was connected with a high level of engagement, with the majority of users utilizing the bot almost daily. Although they have shown effectiveness, web-based cognitive-behavioral therapy (CBT) applications are

characterized by low adherence. A quick and entertaining approach to acquiring help at any time may be provided through conversational agents.

With the advent of AI technologies [6] are developing an easily accessible chatbot to address mental health disorders with personalized treatments, activities, and daily mood tracking. The users are required to fill out a series of questionnaires based on the DASS (Depression Anxiety Stress Scale) and then record their emotional expressions via video of their answers and examine the performance level of the chatbot. They have built tkinter for the GUI, which would advance the user to the next stage of the programme after assessing the DASS data. The chatbot executes various motion detection techniques and carries out sentiment analysis of the text through NLP, which is its last use case in their app. They performed five different testing levels on the basis of functional, non-functional, white box, system, and integration testing. The chatbot's restriction necessitates the creation of two login IDs, one for the user and the other for the therapist to monitor the applicants' conditions following treatment

In this conference paper [7] the authors addressed a pressing need to help students who are struggling with their mental health get the support they need by giving them access to a chatbot tool that can give them closure and encourage them to get help from a professional if necessary. This chatbot will use the Transformer model and up-to-date mental health datasets to generate useful suggestions and conversation in response to user and student queries. The PHQ-9 or WHO-5 questionnaires, along with user feedback, form the basis of the suggestive treatment approach for this chatbot. They also suggest some suggestions to help them feel better in terms of meditation, and suggest some alone time. They have utilized a transformer architectural model whose basic principle is self-attention because it works with complex data made up of an Encoder Decoder system. The perplexity metric, which measures how well the models perform at estimating the probabilities of real, syntactically correct sentences, was used to evaluate the natural language generation models that were used in the tool. According to the feedback given by 100 college students, the DialoGPT model was selected as the system's best model because it produced responses that felt more human-like and sympathetic. The model thereby got 63 percent preference around participants compared to LSTM and RNN models. The limitation of this chatbot model is that the DialoGPT model requires more time to modify than the other models,

which might be a drawback in situations where time and computational resources are constrained.

In this paper [8], the author makes an argument with justification and describes social impacts of AI-based mental health chatbots, such as Woebot, Sayana, Youper, and ChatGPT. The author also discusses potential benefits of AI chatbots for mental health therapy but also makes an argument that there is no way to substitute traditional mental health therapies. The author also mentioned a possible negative social impact such as the replacement of human interaction, the shifting of responsibility for concern and management, security, and cultural competency issues. The author also mentioned that psychiatrists who suggest treatments or therapy should be under licensed mental health professionals. In this paper they have suggested eight different treatment options for those with mental health conditions, in this conversational AI chatbot having a more effective way for solving mental health chatbot in any format, text-based or voice-based.

In this paper [9], the author shed light on various techniques, such as iCBT (internet-delivered cognitive therapy). They have also analyzed and also compared the different existing approaches and solutions in various chatbots SERMO, EMMA and the social robot named Ryan Bot. They have also analyzed a different dataset that are used to train the model. In this paper, author said that due to increasing competitions among the youth, it effects on daily life and also increased rate of self-harm and suicide rates. In their proposed method they have evaluated a used input by PHQ-9 and WHO-5 which are standard questionnaires. They have used two different datasets for the trained model they have used ISEAR and Counsels-chat dataset and for detecting emotions used transform-based training model. Based on analysis they have proposed effective methodology for solving the mental health problems.

2.2 Critical Remarks on previous works

The table below provides a critical review of existing mental health chatbots while keeping various features in mind and providing unbiased comments.

Table 2.2.1: Critical Analysis of Existing Systems

Chatbot Features Name	**Mina**	**Wysa**	**Woebot**	**Joyable**	**Talkspace**
Logo					
Technology	RASA, Python	AI, Natural Language Processing, Psychology Techniques	AI, Natural Language Processing, Cognitive Behavioral Therapy	AI, Cognitive Behavioral Therapy	AI, Mental Health Professionals
Platform	Cross Platform Apps	Cross Platform Apps	Cross Platform Apps	Cross Platform Apps	Cross Platform Apps
Cognitive Behavioral Therapy	Implemented	Implemented	Implemented	Implemented	Implemented
Self-care Tips	Yes	Yes	No	No	No
Mood Tracking	Yes	Yes	Yes	No	Yes
Guided Meditation	No	Yes	No	No	No
Availability of Professionals	Limited availability of mental health professionals	Limited availability of mental health professionals	Limited availability of mental health professionals	Limited availability of mental health professionals	Limited availability of mental health professionals

Cost	Free	Free with in-app purchases	Free	Paid with high cost	Paid with high cost
Limitations	Limited range of mental health conditions addressed, lack of diagnosis and treatment	Limited ability to diagnose and treat mental health conditions, lack of guidance for crisis situations	Limited availability of mental health professionals, lack of customization in the conversation	Limited availability to users in certain regions, lack of guidance for crisis situations	Limited availability to users in certain regions, high cost of professional therapy

The aim is to compare and provide a critical review of the existing mental health chatbots through various features, thereby depicting their strengths and weaknesses and implementation techniques. The use of chatbots in mental health has been increasing in recent years, providing an accessible and cost-effective option for individuals seeking support. However, it is important to assess the effectiveness of these chatbots to determine whether they provide effective treatment, protect their privacy, and successfully address their issues.

Chapter 3

Hardware Design

A hardware requirements list if frequently come along with a hardware compatibility list (HCL), particularly if there is any operating system.

- CPU: Multi-core with at least 2-4 cores, 8 or more cores for larger chatbots
- RAM: 4-8 GB for small chatbots, 16 GB or more for larger chatbots
- Storage: Minimum 10 GB, more depending on size of data
- GPU: Optional but can improve performance for deep learning models
- Network bandwidth: High-speed internet connection with low latency for high volume of traffic.

Chapter 4
Methodology

4.1 Proposed Method

The proposed method intends to solve the mental health issue using the conversational AI framework RASA with natural language processing and machine learning techniques.

RASA Open Source 3.1:

RASA is an open-source framework for building conversational AI assistants and chatbots It enables programmers to create chatbots that can handle natural language input and respond to user requests by performing tasks. RASA v3 NLU and Core Pipeline Architecture NLU, Domain, Config, Endpoints, Stories, and Actions.py are the key components of RASA that enable developers to build chatbots with advanced capabilities such as intent recognition, entity extraction, and dialogue management. With RASA, developers can create chatbots that can understand complex user queries and provide accurate responses in real time. RASA helps build a chatbot by training the model and deploying various custom actions to fulfill users' needs.

The profound elucidation of making a chatbot by using NLTK moves through the many steps:

- Tokenization, which groups a collection of words into tokens,
- Sentiment Analysis: The bot analyzes user responses to determine how well they reflect their emotions.
- Normalization: It looks for typos that could change the meaning of the user query.
- Entity Recognition: The bot searches for many categories of the necessary information.
- Dependency Parsing: The chatbot looks for frequent words that users want to use to communicate.

RASA has two features RASA NLU and RASA Core Dialogue Management

RASA NLU:

RASA NLU is a natural language processing tool that uses pipelines and policies in the configuration file to extract entities from text entered by users, identify and classify the intent, and categorize the intent.Additionally, it conducts a sentimental analysis.

RASA CORE:

RASA Core is in charge of managing sessions, bot responses, and context handling.
RASA core receives structured data from the interpreter in the form of intents and entities, which it uses to decide which action to take for a given input using a probabilistic model.
An action is something that is performed, like showing something to the user or sending them a message.
The decision-making process is dependent on the decision-makers.
The key features of RASA

1. RASA NLP
2. Dialogue Management
3. Open source
4. Multilingual support
5. Integration with other platforms
6. User-friendly interface

The steps are:

1. The message is received and forwarded to an Interpreter, which transforms it into a dictionary that includes the original text, the intent, and any entities discovered (RASA NLU).

2. The Tracker object maintains track of the current state of the conversation. It receives notifications when a new message has arrived.

3. The tracker's current state is passed to the policy.

4. The policy determines the next course of action.

5. The tracker records the specified action.

6. A response is sent to the user.

4.1.1 Data Flow Diagram

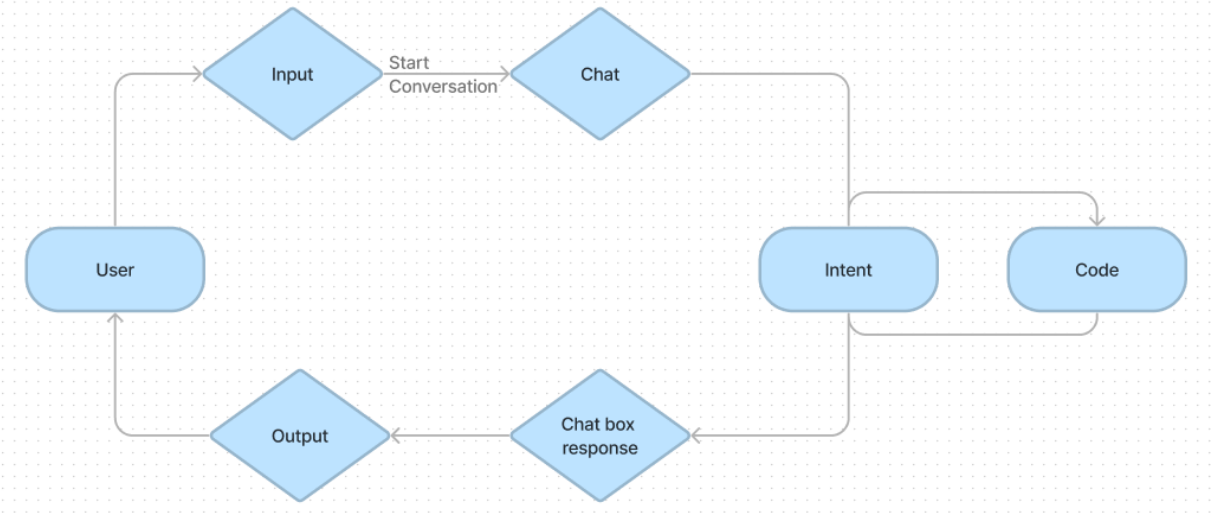


Figure 4.1.1.1: Data Flow of eLIFE Chatbot

As we can see in Figure 4.1.1.1 that the flow of data throughout the entire system and how each module interacts with one another are depicted. A chat or interaction between users serves as the initial input. The chatbot identifies the intents which the question belongs to and then reads the code and responds in accordance with the response. The user will have access to the same output as a response to the query.

4.1.2 System Architecture

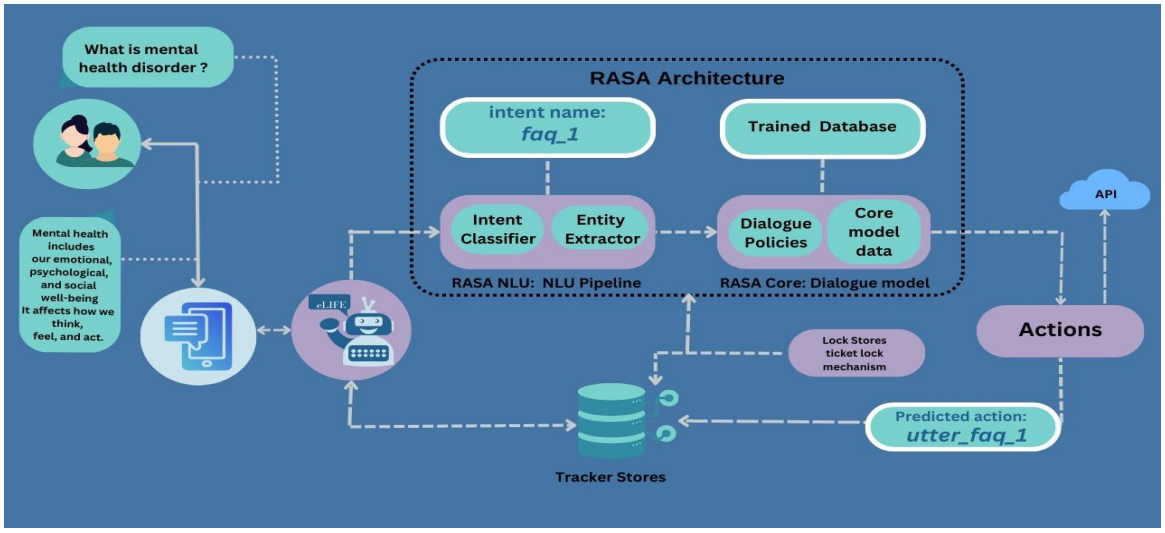


Figure 4.1.2.1: System Architecture of eLIFE Chatbot

The chatbot receives the user query over a channel and sends it to RASA's NLU component, which uses the user's text to find the intents and entities. Following NLU, it enters the RASA's Core Dialogue Model, which holds the training corpus data and policies that are passed on to the Actions. The Actions have several custom actions and utter responses defined, and they are linked to external APIs that forecast the empathetic reaction to the detected intent. The eLIFE bot receives the predicted action and saves it in the Tracker storage. The lock store generates a ticket for the specified conversation ID, which is then provided to our eLIFE bot, and the tracker store saves the predicted action for the identified intent. The eLIFE bot then responds to the user's queries via the channel medium, such as Facebook, Slack, or Telegram.

4.1.3 Technical Description

- config.yml: It specifies all the required configurations to run a chatbot by configuring pipelines for the NLU and policies for the dialogue management of the CORE part of the components, keeping in mind the parameters for the process of training and testing.

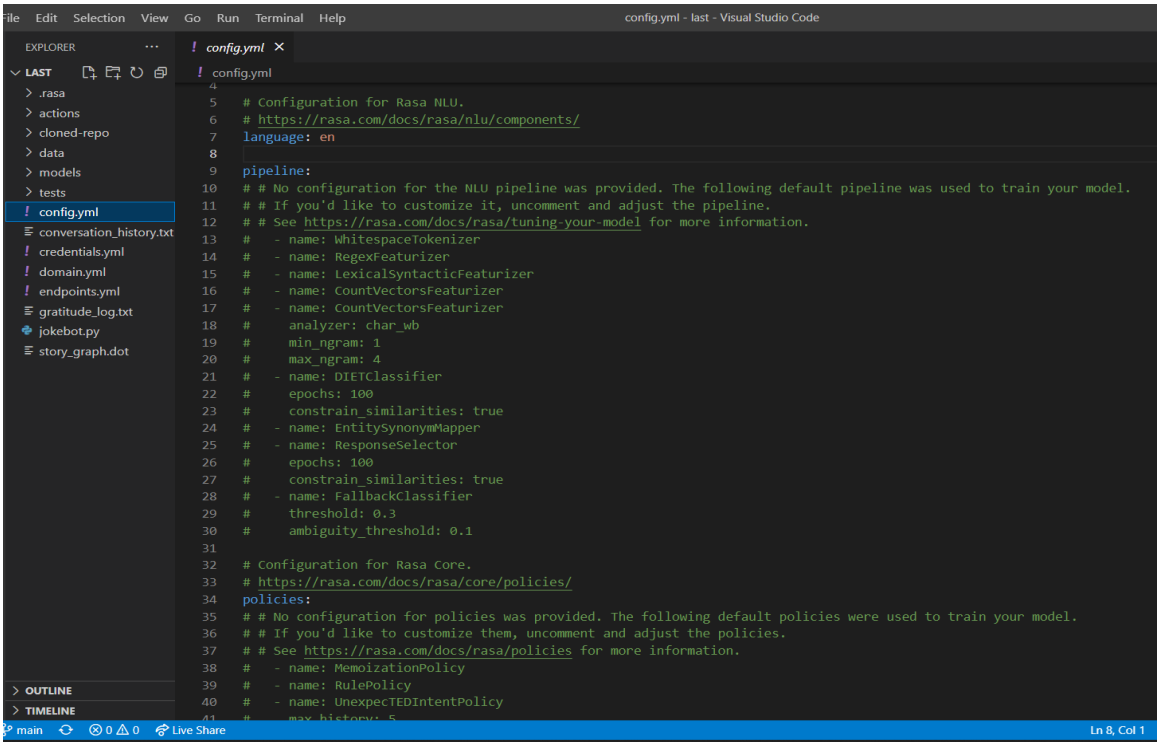


Figure 4.1.3.1: config.yml File

- domain.yml: This file outlines the chatbot's domain by including the details of intents, entities, actions, and responses, along with the session configuration time. Moreover, it stores the information about the slots, which is considered a bot memory, along with forms that define the desired forms with the requested slots.

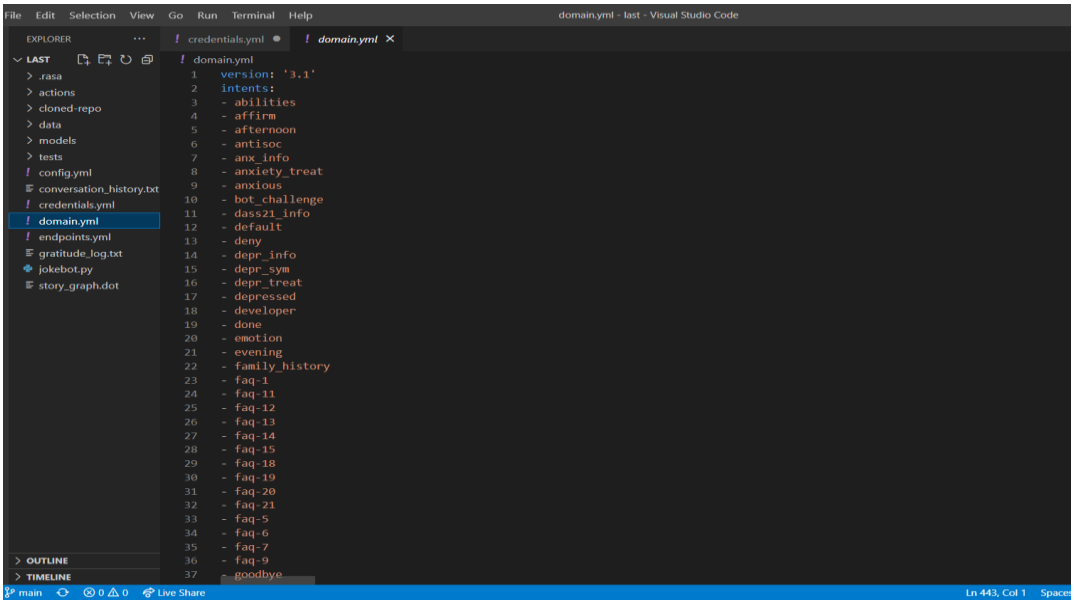


Figure 4.1.3.2: domain.yml File

- data/nlu.yml: The training information for the chatbot's NLU component is contained in this file. Examples of user inputs are provided, along with the corresponding intents and entities that the chatbot needs to be capable of identifying.

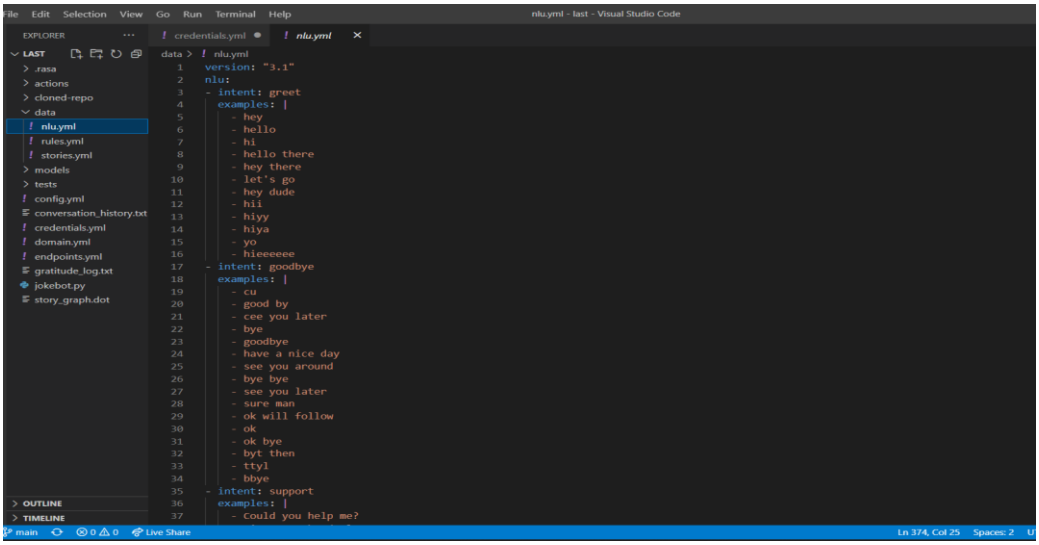


Figure 4.1.3.3: data/nlu.yml File

- data/stories.yml: The training information for the chatbot's core component is contained in this file. Along with the expected actions and responses, it provides examples of user-chatbot interactions.

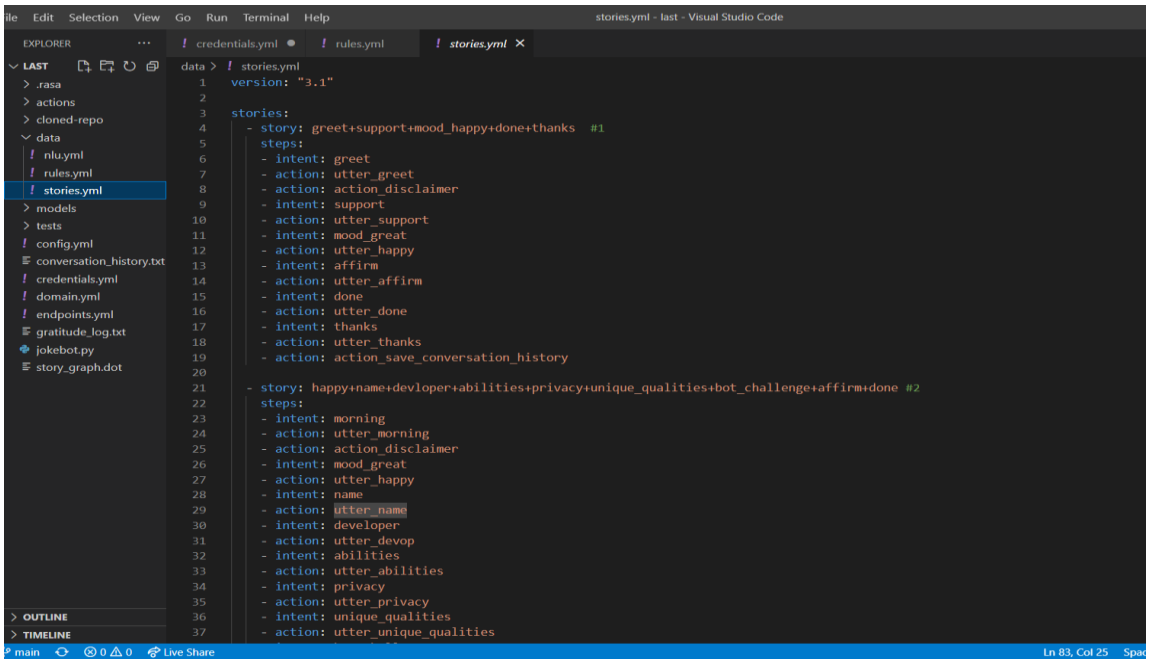


Figure 4.1.3.4: data/stories.yml File

- actions/actions.py: The chatbot's custom actions' source code is located in this file. To respond to user requests, these actions might involve contacting external APIs, searching databases, or carrying out other tasks.

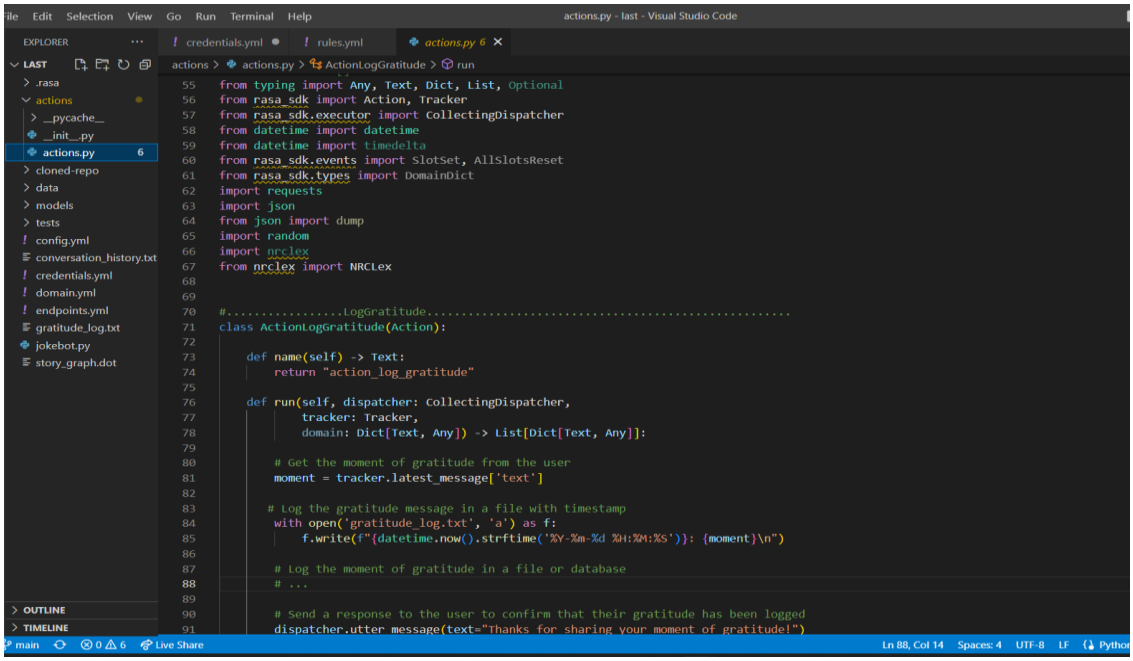


Figure 4.1.3.5: actions/action.py File

- endpoints.yml: This file specifies the chatbot's endpoints, along with its webhook and action server settings.

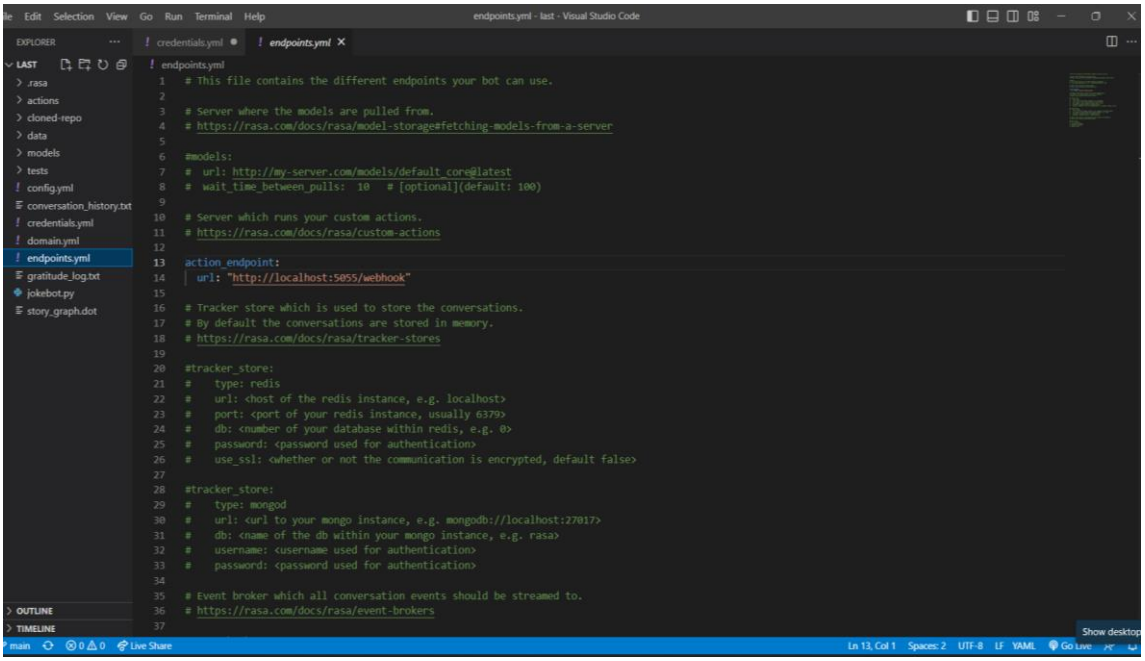


Figure 4.1.3.6: endpoints.yml File

- data/rules.yml: This file in RASA is used to specify the guidelines that the chatbot should adhere to when interacting with users. Instead of relying solely on machine learning models to predict the best course of action, rules enable the chatbot to take specific actions in response to certain conditions or triggers.

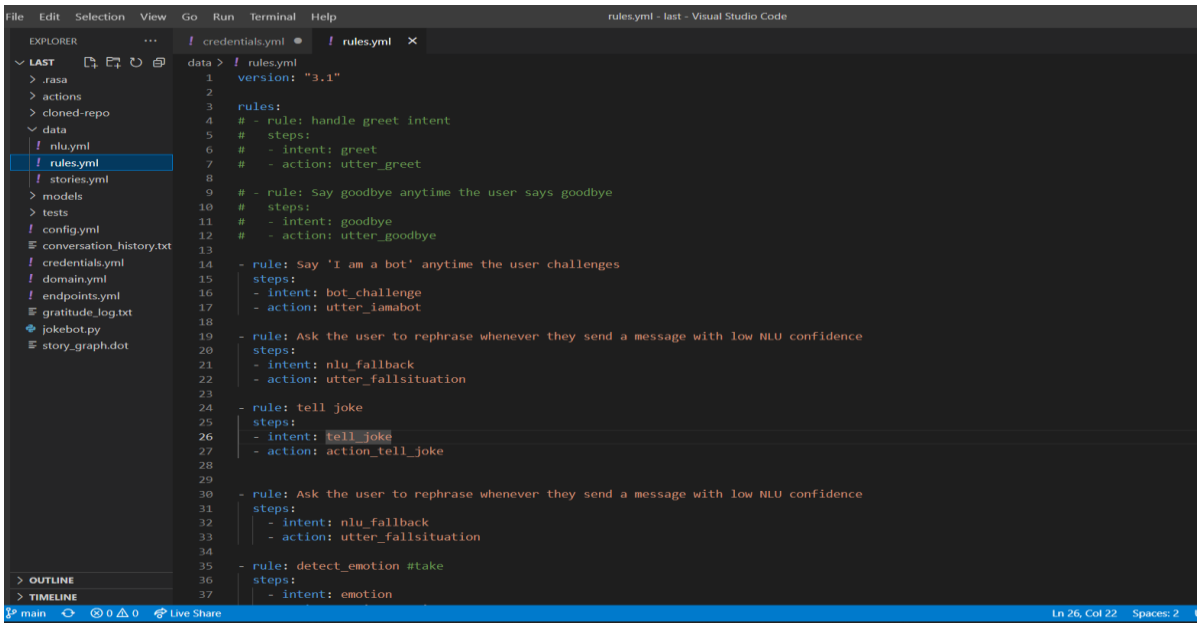


Figure 4.1.3.7: data/rules.yml File

COMMANDS:

- The project was created using the **rasa init** command.
- Necessary changes were made in the.yml files according to desired chatbot functionality.
- The **rasa data validate** command was used to validate data files and check for story conflicts.
- If the chatbot was not classifying text to the correct intent, the **rasa interactive** command was used to change the user's input to the desired intent classifier.
- The **rasa visualize** command was used to visualize story flow as we can see in the below figure.

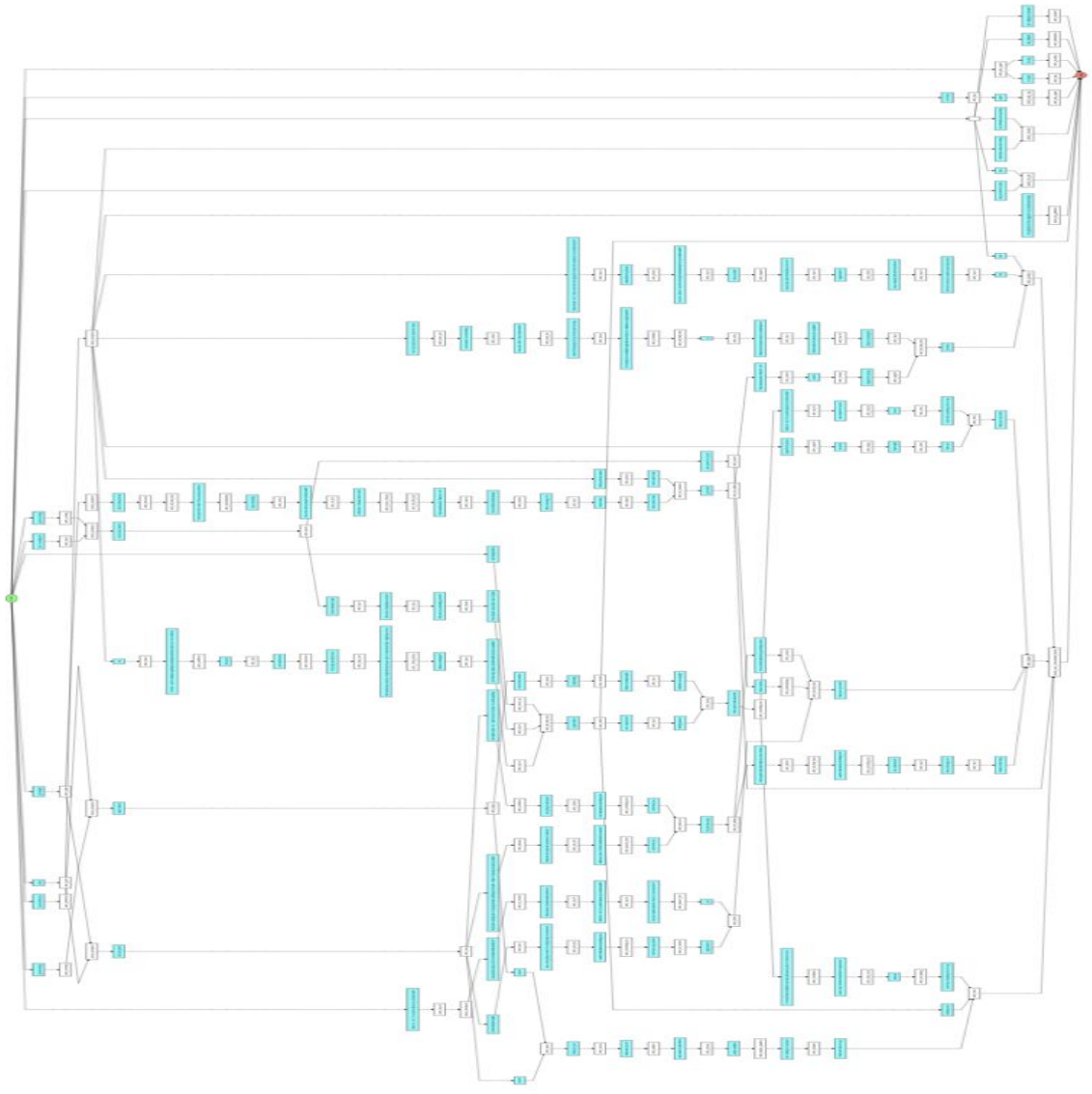


Figure 4.1.3.8: Story Flow using rasa visualize

The project was trained using the **rasa train** command as we can see in the below Figure 4.1.3.9.

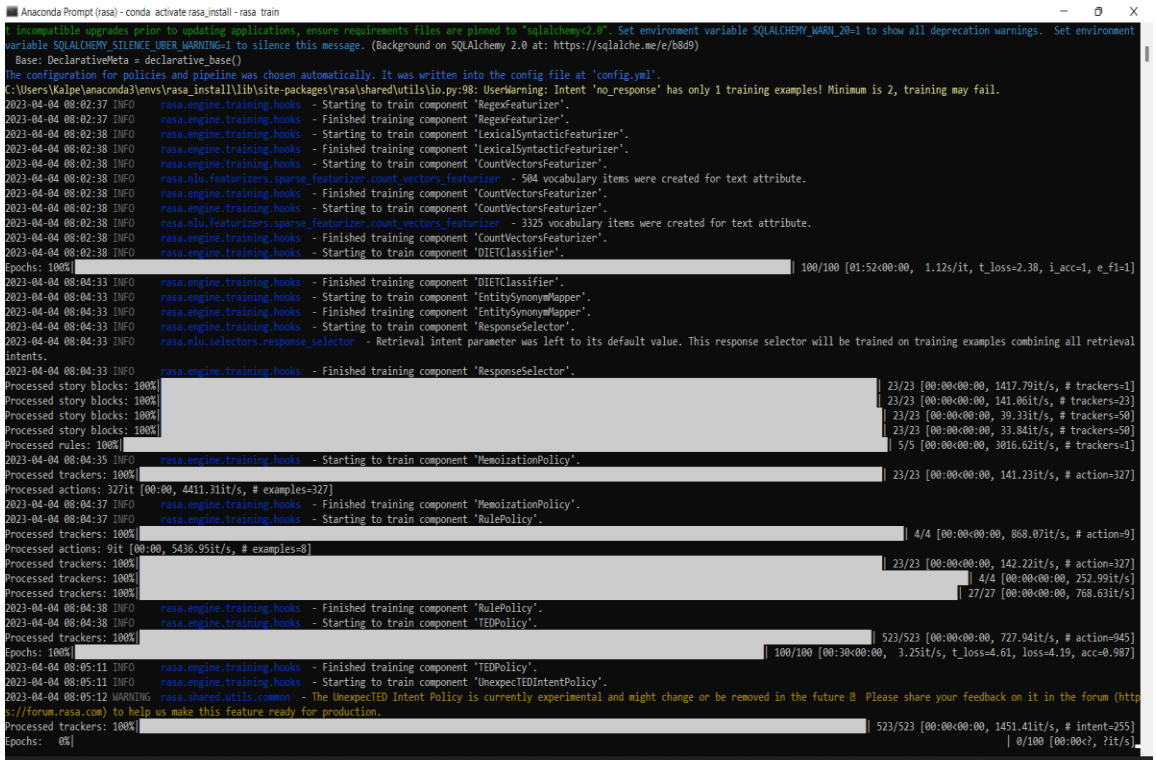


Figure 4.1.3.9: Trained the Model

If custom actions were enabled, the **rasa run actions** command was executed as per the below Figure.

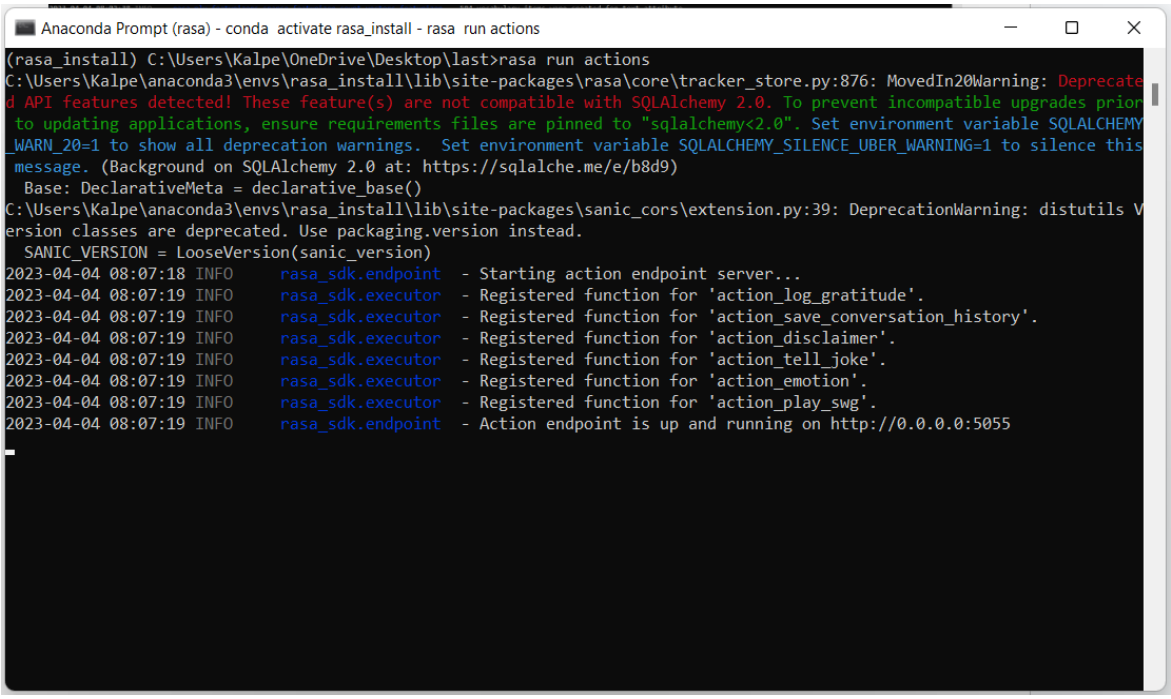


Figure 4.1.3.10: Run Custom Actions

Interactions with the chatbot were tested using the **rasa shell** command as we can show in Figure 4.1.3.11.

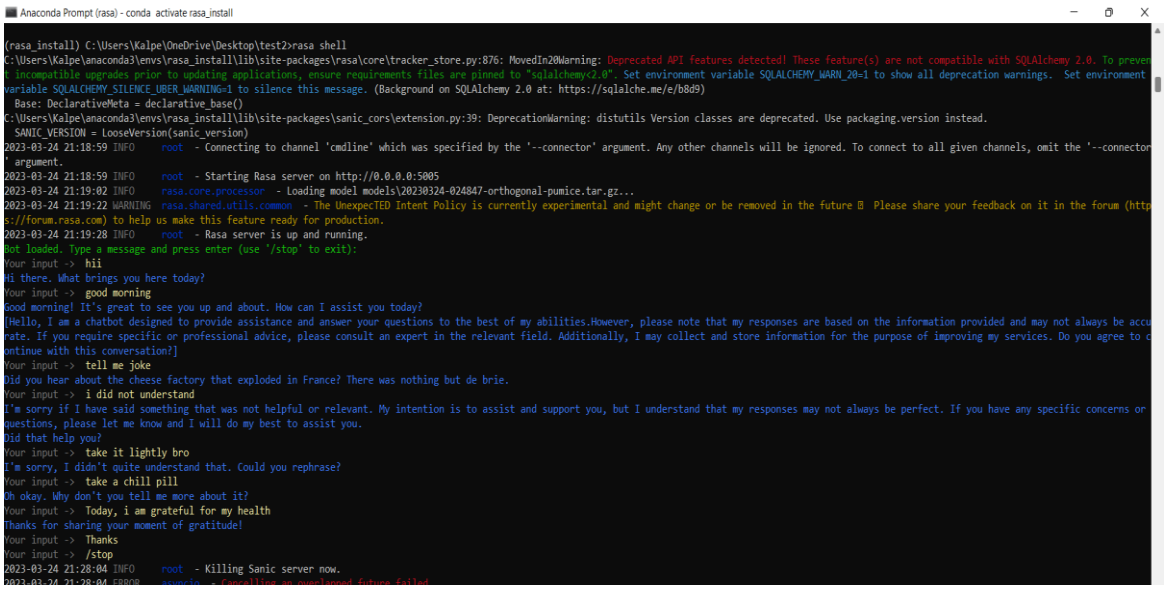


Figure 4.1.3.11: Communicate with the bot

4.1.4 Use-case diagram

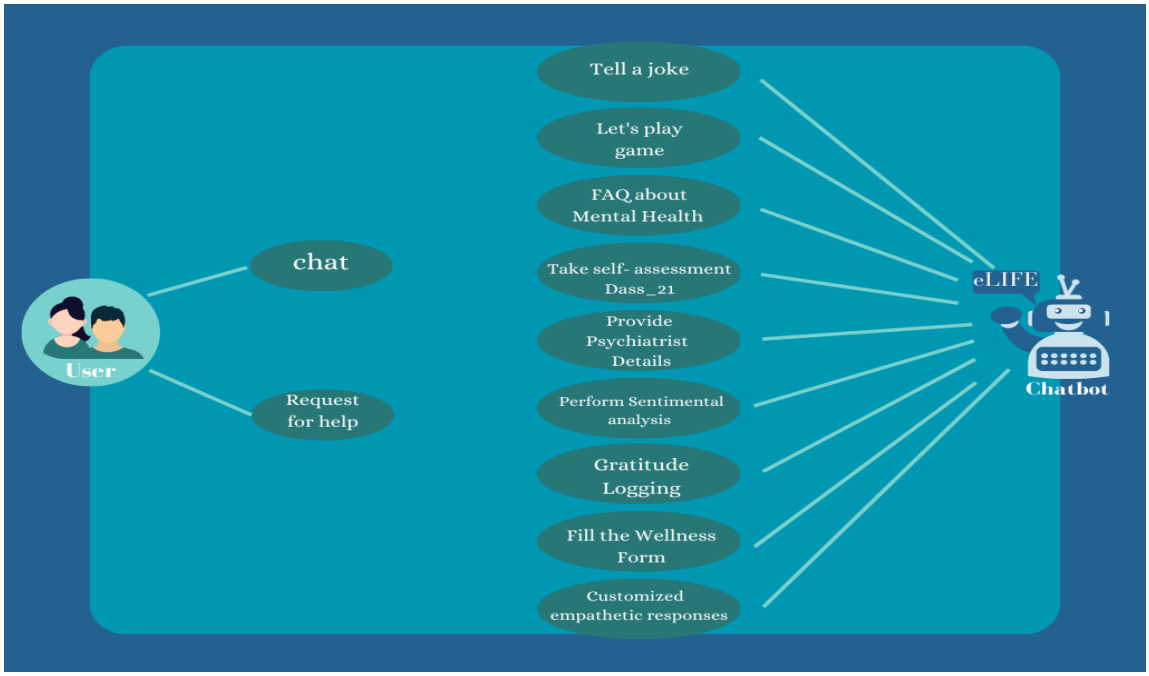


Figure 4.1.4.1: Use-case Diagram

In the following Figure 4.1.4.1, various use cases of chatbots for solving mental health problems are depicted. The first use case is for the user who can chat or communicate with the chatbot. The next use case for the user is to ask or request help if the user is in

depression, stress, or anxiety. The next use cases are for the chatbot which converse with the user like if the user wants to make themselves laugh via jokes or want to play a game for mood fresh or wants information about mental health. If a user wants a sentimental analysis, then the chatbot performs sentiment analysis on the text. If a user wants to take a DASS-21 self-assessment then it saves the data and shows the score along with the severity. Based on the DASS-21 score, if the score is severe and if the user wants psychiatrist Data, then chatbot gives them the information about Psychiatrist available in Ahmedabad. The next use case is that chatbot suggests users to fill a wellness form about their diet, exercise and sleep etc. Also, one use case is that Chatbot asks users to write good things that happen via Gratitude logging.

4.2 Implementation

4.2.1 Integrating External APIs in Rasa:

In our developed RASA chatbot we have implemented different features. For implementing Jokes in our RASA chatbot we have used jokebot api.

Here's the steps for integrating jokebot api in RASA chatbot:

- Create a jokebot.py file and write Python code that uses the requests library to make an HTTP GET request to the "**https://api.jokes.one/jod**" endpoint and retrieve a JSON response. The get_joke () function returns the JSON response as a Python dictionary as we can see in the below Figure.

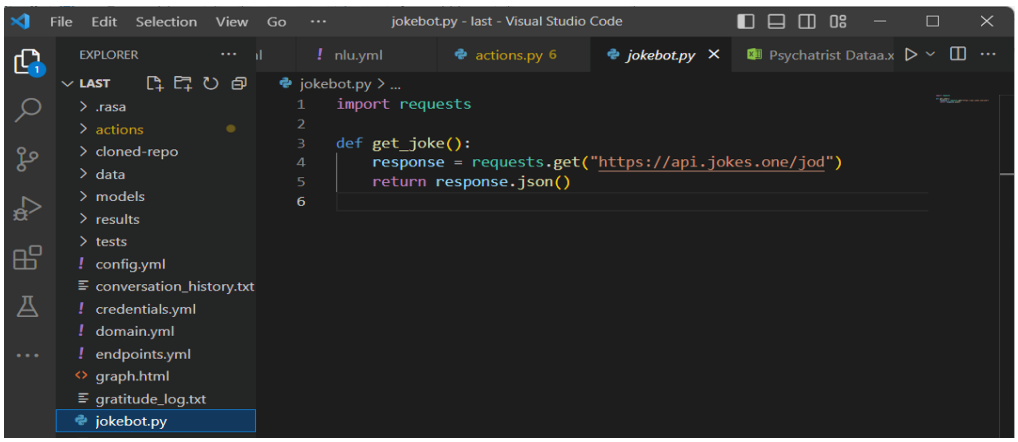


Figure 4.2.1.1: Create jokebot.py File

- As we can show in Figure 4.2.1.1 that creates a custom action that will trigger the API call and extract the relevant data from the JSON response.

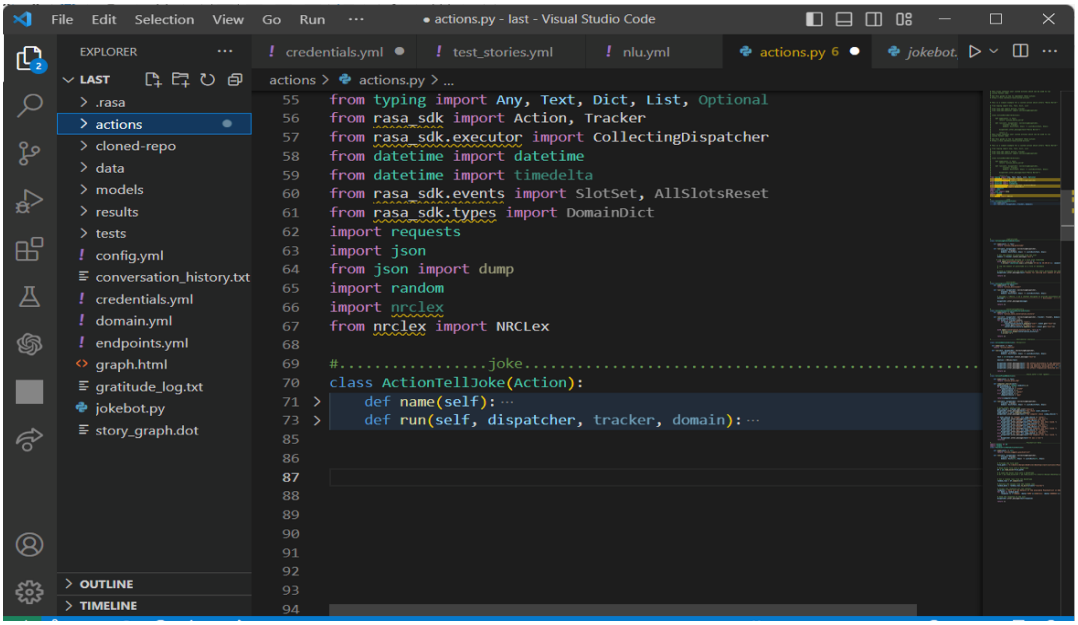


Figure 4.2.1.1: Custom Action for Implementing Jokes

4.2.2 Suggest Psychiatrist Data from Database in RASA:

- We have created a file called Psychiatrist Data with the details mentioned about the Psychiatrist like name, address, contact, experience, and services as per the below Figure.

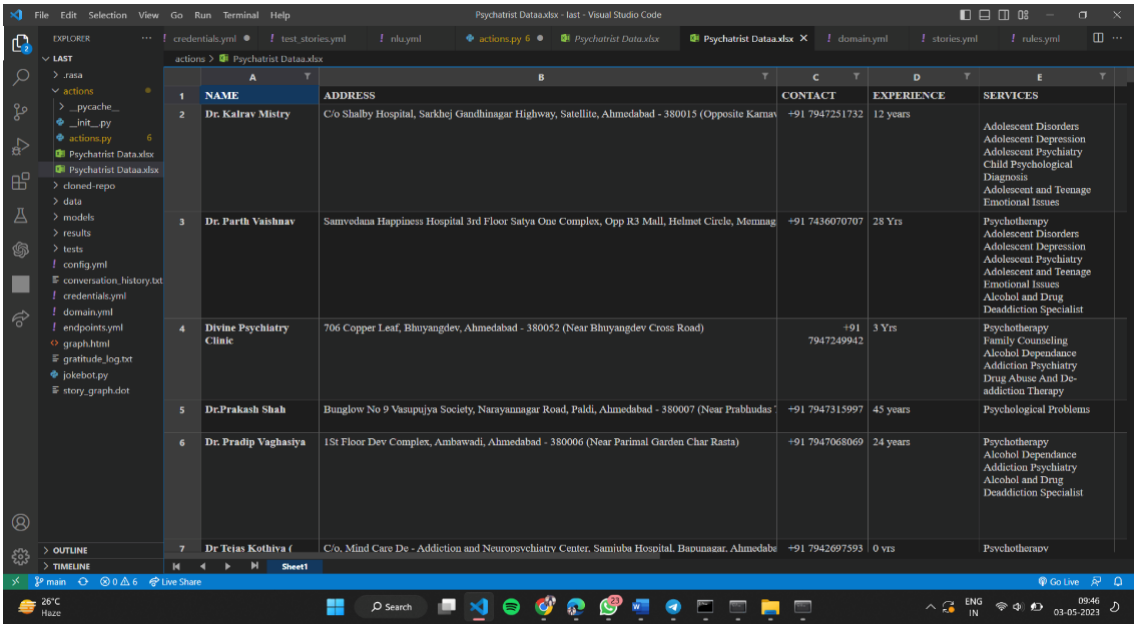


Figure 4.2.2.1: Data of Psychiatrist

- In action.py, we have written a custom for fetching the psychiatrist data whenever the user ask for it as per the below Figure.

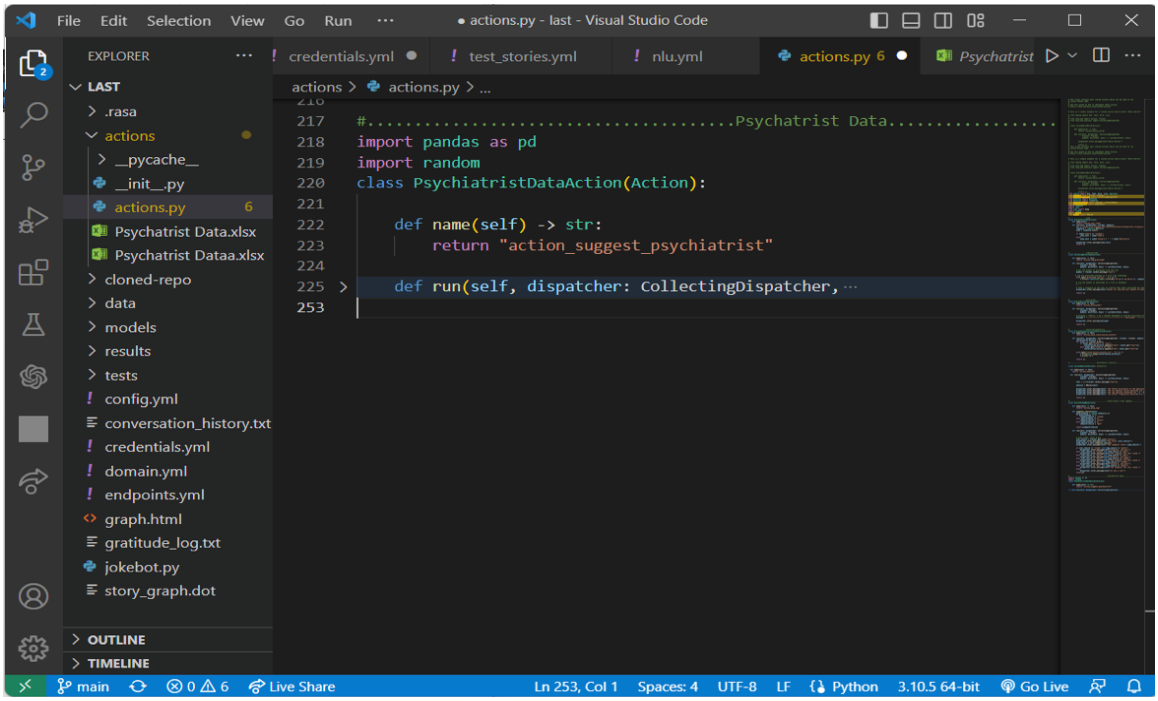


Figure 4.2.2.2: Custom Action for Suggest Psychiatrist

4.2.3 Flowchart of Proposed System

This is a flowchart of our proposed system shown in below Figure 4.2.3.1, wherein the user is encouraged to initiate the chat, and thereby the eLIFE bot will respond with a greeting and inform our users about our unique features of a mental health chatbot, which comprise seven different services offered by us to our users. If they enter text not related to mental health, then a fall-action is generated, which provides a customized response that this is a mental health chatbot and that they should kindly ask questions about it or try to rephrase their question so we can provide the best possible answer to their queries. The four features listed will generate the results based on intent classification and entity extraction and provide the best possible empathetic responses to the queries asked by the user. In the jokes section we have called an external API that creates a custom action that will trigger the API call and extract the relevant data from the JSON response. We have created a database of the list of psychiatrists with details ranging from their name, contact number, and services they offered along with experience in the field of mental health treatments and display to users through a custom action. The DASS-21 form is deployed as a web page wherein the user will be given the 21 questions to answer and their scores along with severity will be

displayed for Depression, Anxiety and Stress respectively according to their sub-scales given.

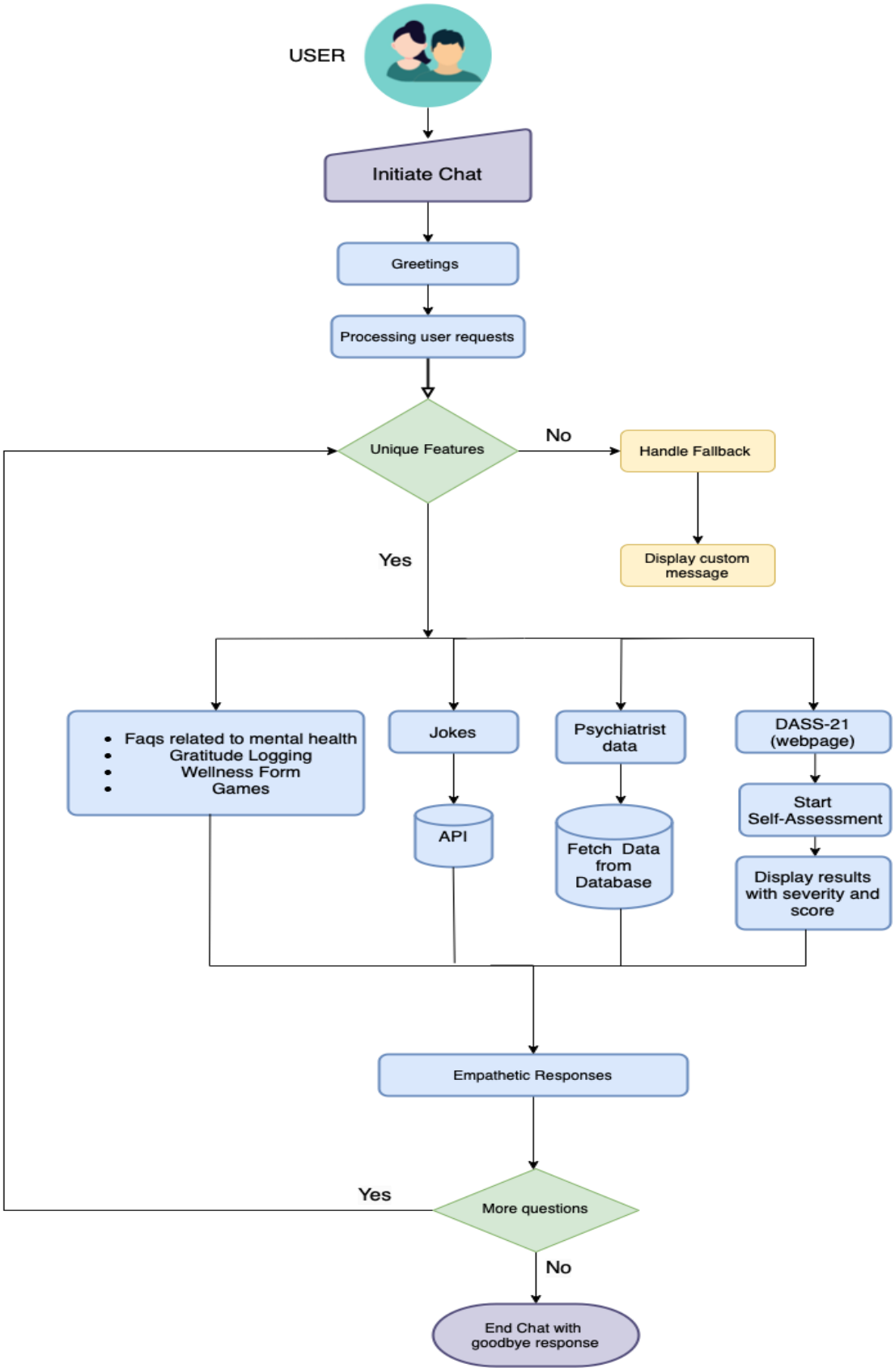


Figure 4.2.3.1: Flowchart of Proposed System

4.3 Deployment

Chatbot Deployment on Telegram:

After building a chatbot in the RASA framework. We have decided to deploy on the platform of Telegram. For deployment on Telegram

- Train the model successfully.
- Open Telegram and write BotFather in the search bar.
- After that click on BotFather. In this write /newbot for creating a new bot.
- Then choose a name for the bot and username for the bot.
- After successfully choosing the name, they give us a token to access the HTTP API.
- Now, open the command prompt and run the command “ngrok http 5005” after running this copy paste the webhook_url.

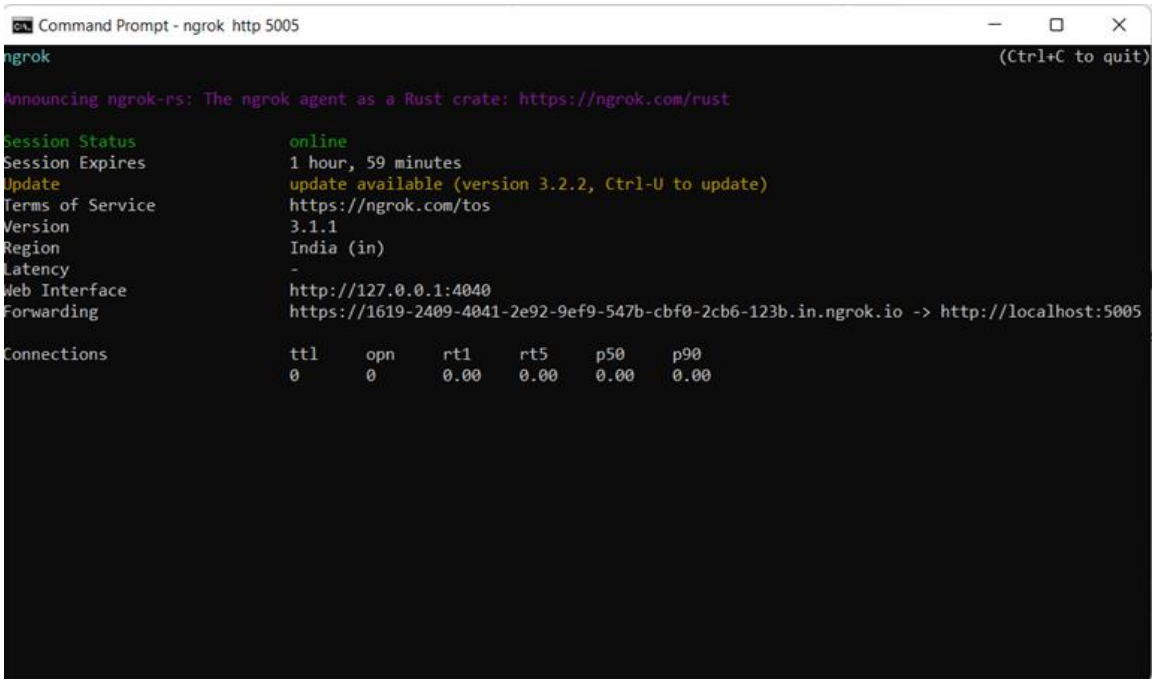


Figure 4.3.1: Run Command for Webhook_url

- Now open credential.py file and write access token, verify and webhook_url.

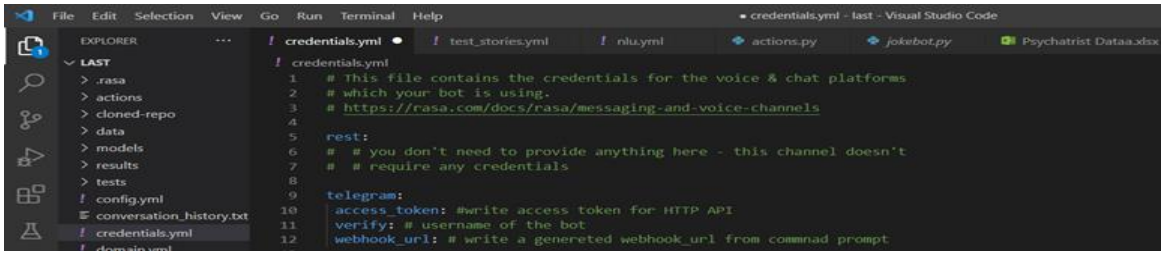


Figure 4.3.2: Required Credential for Deployment

- Open two Anaconda powershell prompt(rasa) terminal and run a command **rasa run –enable-api –cors "*"** and" **rasa run actions** respectively.

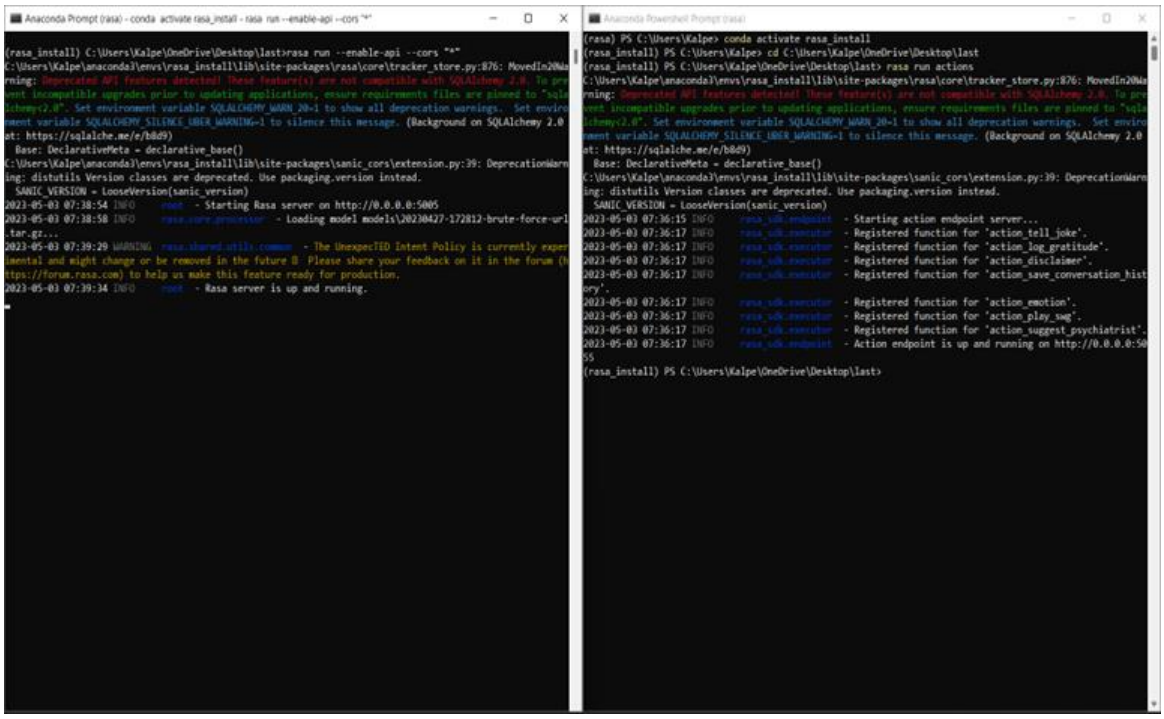
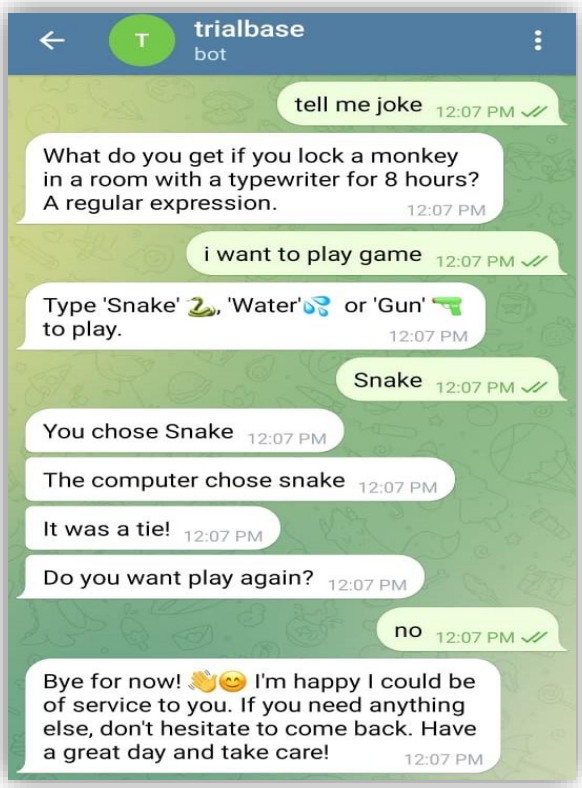


Figure 4.3.3: Run a Custom Action and Rasa shell

- Now we are able to communicate with our chatbot in Telegram as per the below screenshots.

Figure 4.3.4: Chat with eLIFE bot in Telegram



Chapter 5
Testing of the Model

- Open a terminal and navigate to your RASA project directory.
- Before testing the RASA model, make sure that the RASA model is trained.
- To test a RASA model, you can use the **rasa test** command in the terminal. This command evaluates the performance of your trained RASA model against a set of test stories and NLU data.
- The test results include several reports, each of which provides different types of information about the performance of your RASA model.
- Here are some of the snippets of reports that are generated, such as Intent Prediction Confidence Distribution, Intent Confusion Matrix and Stories Confusion Matrix.

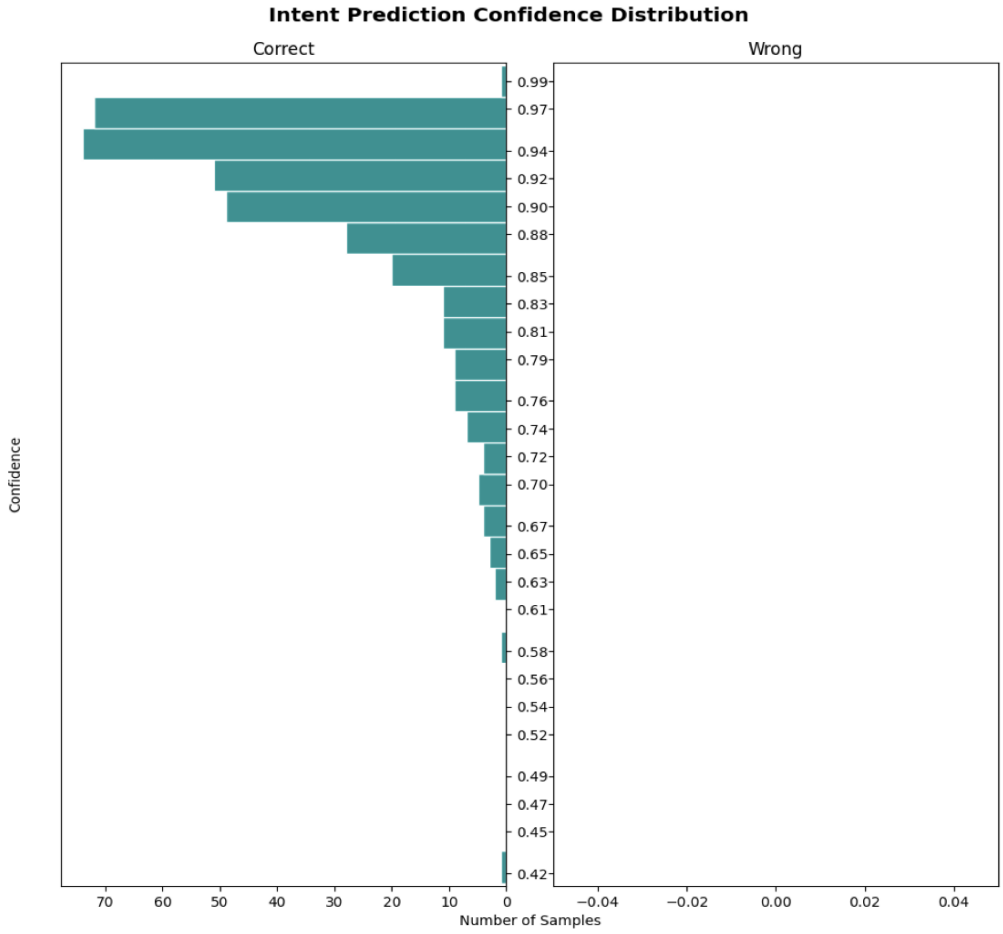


Figure 5.1: Intent Prediction Distribution

The intent prediction distribution is a list of all possible intents and their associated probabilities, where the sum of all probabilities equals 1 as we see in the figure of intent prediction.

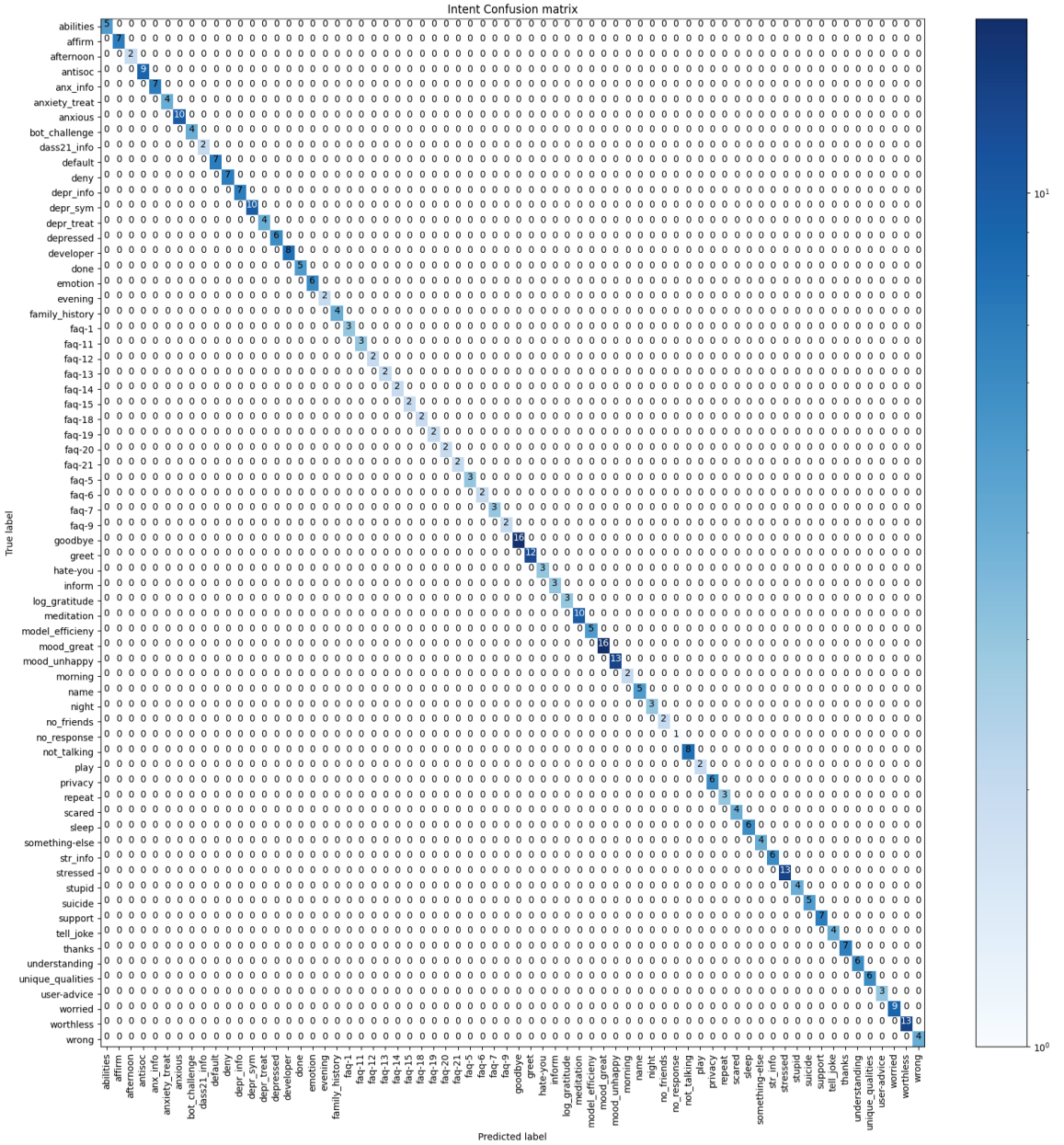


Figure 5.2: Intent Confusion Matrix

An intent confusion matrix is a report generated by RASA after running the **rasa test** command, which shows how well the model has classified each intent in the test data. The intent confusion matrix is a table that shows the actual intents in the rows and the predicted intents in the columns. Each cell in the table shows the number of test examples that belong to the actual intent and were classified as the predicted intent. The diagonal of the matrix

represents the number of correct predictions, while the off-diagonal entries represent misclassifications.

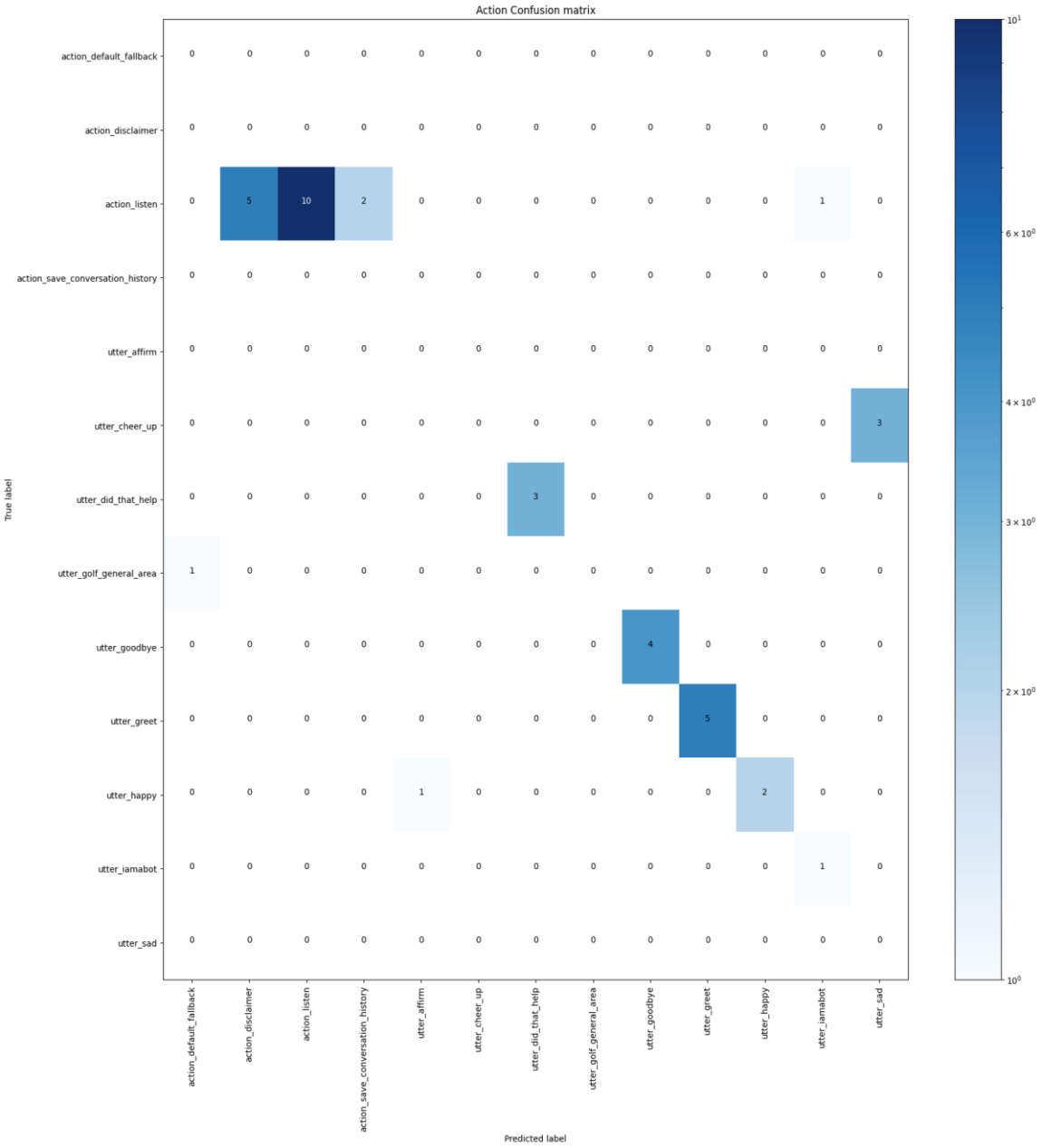


Figure 5.3: Action Confusion Matrix

The stories confusion matrix is a table that shows the actual next actions in the rows and the predicted next actions in the columns. Each cell in the table shows the number of times the actual next action was predicted correctly as well as any incorrect predictions. The diagonal of the matrix represents the number of correct predictions, while the off-diagonal entries represent misclassifications.

Chapter 6

Results and Discussion

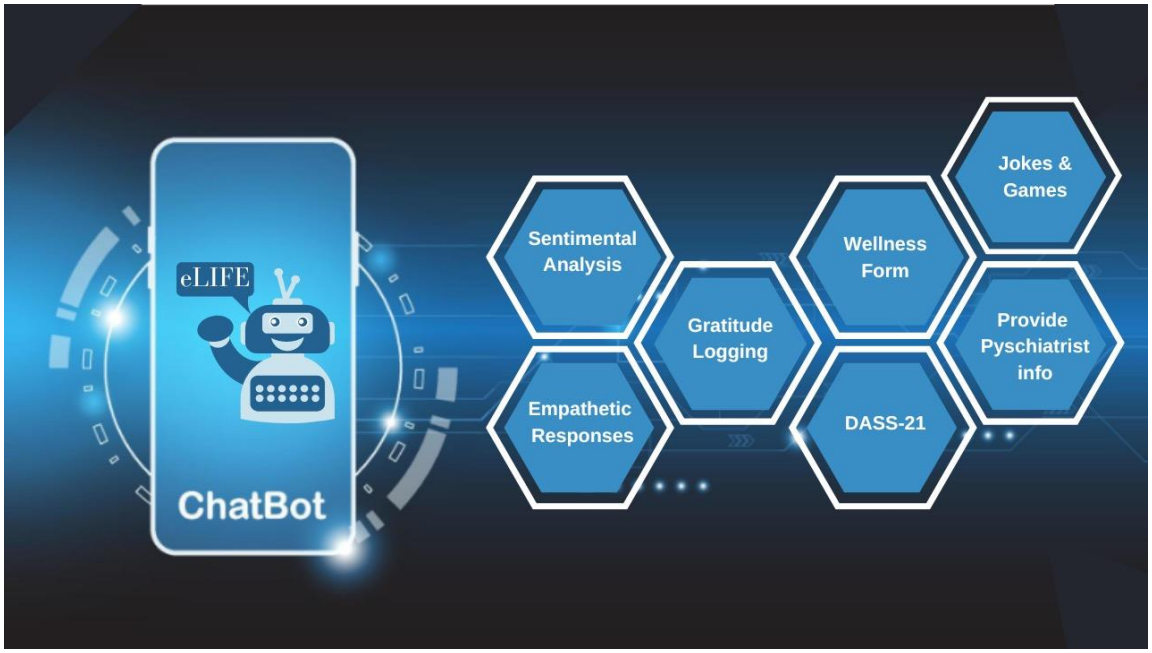


Figure 6.1: Unique Features of eLIFE bot

Millions of individuals throughout the world are afflicted by the serious problem of mental health. Access to mental health care and services are limiting and difficult to find that provide accurate details for the treatment of mental health disorder.Therefore, we have created eLIFE bot, a mental health chatbot using the RASAVersion 3 chatbot framework in order to address this problem.Our chatbot incorporates a range of unique features that set it apart from other mental health resources.

Unique Features: Our mental health chatbot incorporates the following unique features as per Figure 6.1:

- **Gratitude Logging:** It has been demonstrated that logging one's gratitude on a daily or weekly basis improves one's mental health. Our chatbot asks users to do this. Using RASA's custom actions and timestamp function, , we have incorporated this functionality which enables users to submit their replies quickly and conveniently.

- **Joke:** Our chatbot uses jokes in its replies whenever the user is unhappy or sad,

giving them a pleasant relief and assisting in stress reduction. We have called an api for jokes which has around 5000 arbitrary jokes using RASA's Custom Actions functionality.

- **Sentimental Analysis:**From a corpus of text, NRCLex will gauge emotional impact.Based on the WordNet synonym sets from the NLTK library and the National Research Council Canada's (NRC) affect lexicon (see link below), the effect dictionary has over 27,000 terms. Measured emotional effects include the following: fear, anger, anticipation, trust , surprise, positive ,negative , sadness, disgust and joy. It depicts the top emotions detected in a sentence, along with the list of affected dictionaries by specifying frequencies of the emotions detected.

- **Empathetic Reactions:** By giving users empathic replies, our chatbot makes them feel heard and understood. Using RASA's examples in the domain.yml module, we have developed our chatbot to offer sympathetic answers in response to user input.

- **Handle Fall-Back Action / Outside-the-Box Questions:** In the event that a user's inquiry is not understood by our chatbot or if there is a technical problem, it has a backup plan. RASA's Fallback Policy has been used to train the chatbot to respond to unusual queries or assertions by acknowledging the user's message and directing the discussion back to the original subject of mental health.

- **Provide Psychiatrist data:** If a user requires professional medical assistance for mental health concerns, our platform offers a comprehensive database of qualified psychiatrists. Each psychiatrist's profile includes their experience, contact information, location, and the specific services they offer related to different types of mental health issues. By providing this information, we aim to connect users with the appropriate mental health professionals who can provide the necessary care and support. We understand that seeking help for mental health concerns can be difficult, which is why our platform strives to provide a safe and supportive environment for users to access the resources they need.

- **Wellness Form :** Users are required to fill out a form that requests information about their exercise routines, including the types of exercises they did, their sleep

habits, their adherence to a healthy diet, their levels of stress, and the goals they hope to achieve. By gathering this data, thereby encouraging users to adopt healthy lifestyle practices for long-term success in order to promote overall well-being.

- **DASS-21-based self-report generator**: The Depression, Anxiety, and Stress Scale (DASS) is a set of three self-report scales intended to evaluate the negative states of mind of depression, anxiety, and stress. In our proposed method, we are going to implement DASS-21. The DASS-21 is a self-report measure with 21 items designed to assess three associated negative emotional conditions: anxiety, tension/stress, and depression. The result will be multiplied by two in order to compare with the standard DASS. The user's mental condition, such as depression, anxiety, and stress, will be identified based on the DASS evaluation score, along with levels such as normal, mild, moderate, severe, and extremely severe. The user will be sent to the next part of the app based on the results.

Table 6.1: Depression, Anxiety, and Stress Scale

Level	Depression	Anxiety	Stress
Normal	0-9	0-7	0-14
Mild	10-13	8-9	15-18
Moderate	14-20	10-14	19-25
Severe	21-27	15-19	26-33
Extremely Severe	28+	20+	34+

In conclusion by using the RASA Version 3.1 chatbot architecture, we have created a mental health chatbot with a variety of distinctive features that are intended to give consumers individualised and efficient mental health care. Our chatbot gives people quick, open access, and private mental health help by integrating features like gratitude logging, joke, sentiment analysis, sympathetic replies, and fall-back action. By giving individuals in need with easily accessible and convenient help, we think that our chatbot will significantly influence mental health care.

The code snippet executed on the RASA Shell provides evidence of the evaluation conducted on the RASA NLU component, which has been divided into two categories for reporting purposes.

Below figures depicts the code snippet were in, the reports generated after testing stories in the RASA 3.1 chatbot by running a command rasa test which generates evaluation result of RASA Core part by providing the correct classified stories along with F1-Score, Precision and Accuracy and generates a confusion matrix for the same.

1. The first category includes the Intent evaluation reports, which contain information about the accuracy of the Intent classification, correct Intent prediction, and the associated confusion matrix (without normalization).

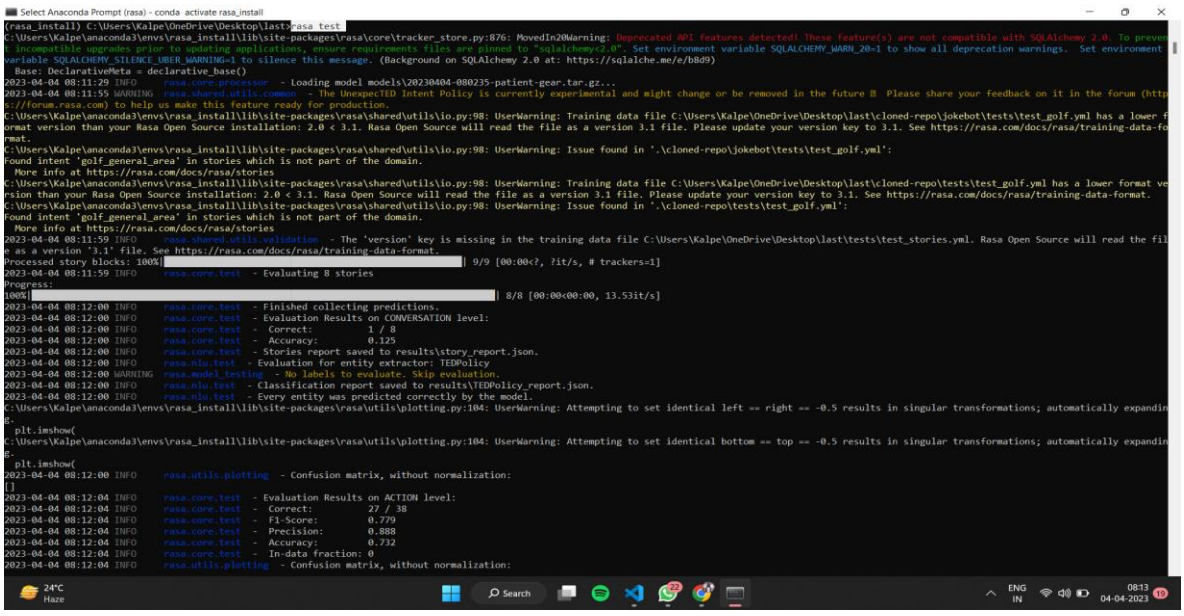


Figure 6.2: Run rasa test Command for RASA core

2. The second category includes the Entity evaluation reports, which detail the performance of the DIETClassifier entity extractor in predicting each entity and generating a confusion matrix (without normalization).

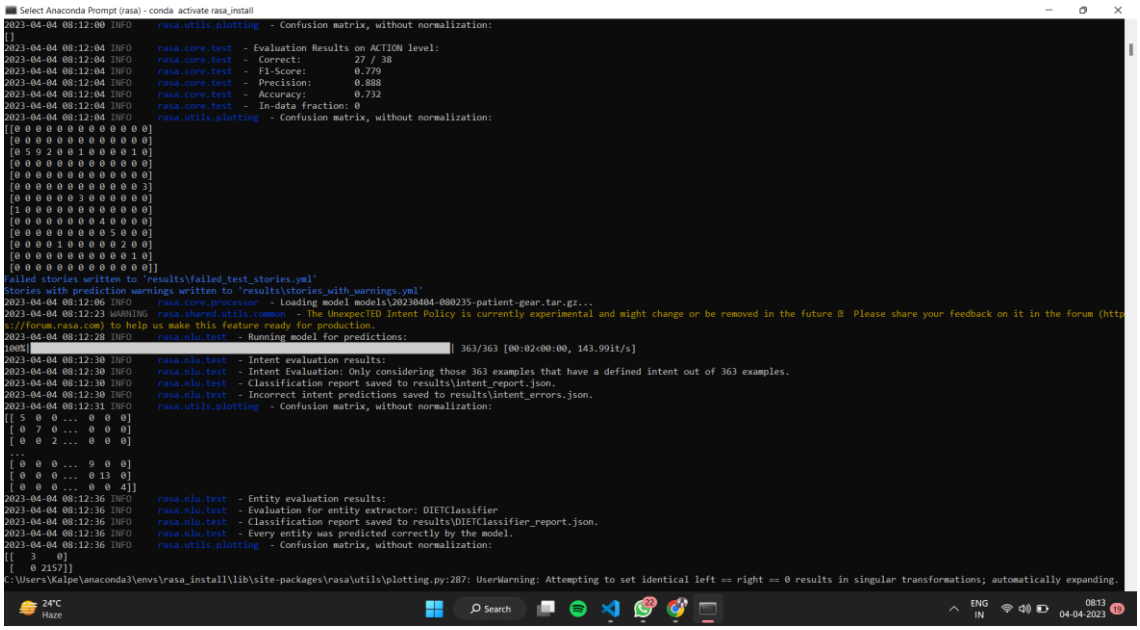


Figure 6.3: Run rasa test Command for RASA nlu

Finally, the **rasa test** command was executed to test the chatbot model on the basis of test stories through both components.

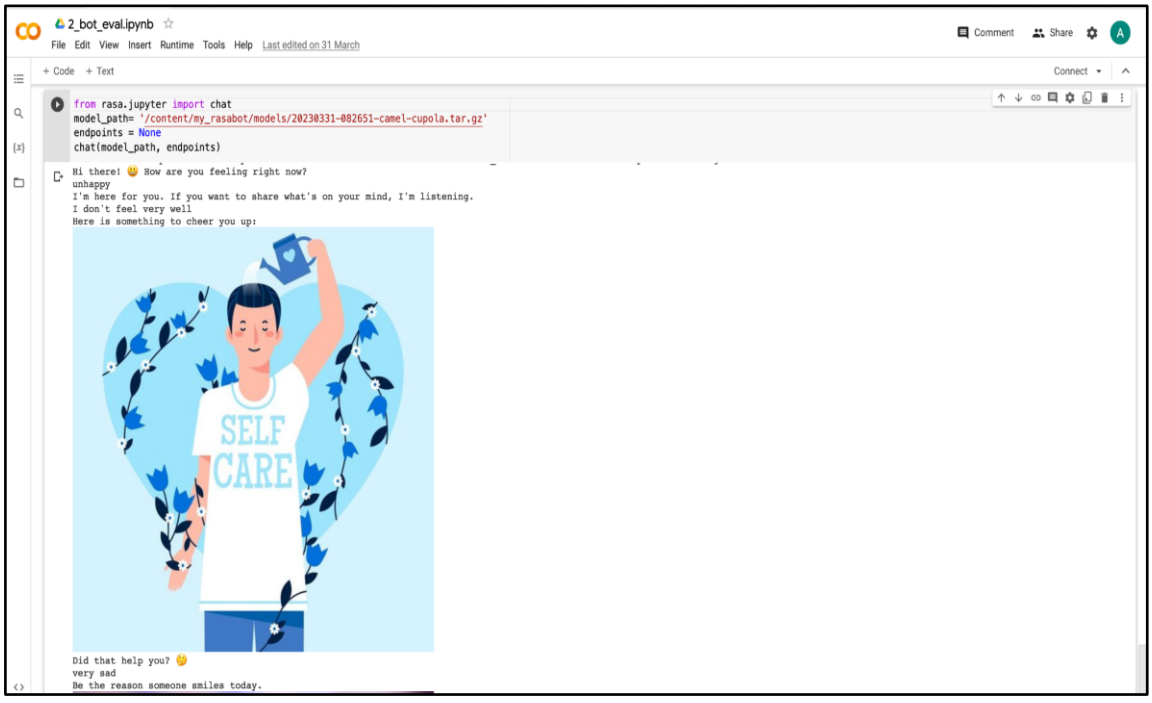


Figure 6.4 Converse with eLIFE bot

Our chatbot for mental health has been designed with special features to give its users a safe and supportive atmosphere where they feel heard and can share whatever they feel

without being afraid that they will be judged. Through our features, they will be provided with tailored, personalized responses that make them feel empathetic and human-like. We also try to provide accurate FAQs related to mental health topics such as sadness, anxiety, meditation, sleep, being scared, and many more.We aim to connect users with the right mental health specialists who can give them the care and support they need through the use of these features.In order to foster long-term success and overall well-being, our wellness form and DASS-21-based self-report generator aim to motivate users to adopt healthy lifestyle practises. Even though the eLIFE bot includes noteworthy features, it's important to acknowledge its limitations. Our chatbot is intended to provide users with initial support and resources, but it cannot replace the role of a licensed mental health professional. Our study intends to address the mental health problems without keeping the age of the user in consideration and we think that it is required to understand the users age to provide right advice which would be useful to them but at same time wanted to protect their identity by staying anonymous. Furthermore, in future we are determined to include a voice enabled feature which helps to bridge the gap between the users who find it difficult to address their problems through a text-based interface.

Chapter 7
Conclusions and Future Scope

7.1 Conclusions

Mental health is a fundamental human right that significantly influences personal, societal, and economic development. As we navigate through life, we experience varying degrees of challenges and distress that affect our overall well-being. Therefore, it is crucial to prioritize mental health and seek innovative ways to promote it. Many people suffer from mental illness but are oblivious to it because they are too busy to see a therapist. It is apparent that AI and NLP powered mental health chatbots such as eLIFE hold tremendous potential for helping people with their mental health and encouraging them to feel good about themselves. The user can utilize our services whenever they are going through a rough patch in their life. Our mental health chatbot incorporates a gratitude logging feature, which has been shown to improve mental health outcomes. In addition, it utilizes a sentiment analysis tool to gauge the user's emotional state and provide empathetic responses. It also provides a fallback action for handling outside-the-box questions and a directory of qualified psychiatrists for users who require professional medical assistance. We also developed a wellness form and a DASS-21-based self-report generator to gather information about the user's exercise routines, sleep habits, adherence to a healthy diet, and levels of stress, anxiety, and depression and provide empathetic responses to the user, which has the potential to improve user engagement and adherence. Our study encourages the development of mental health chatbots, which show great potential for improving mental health awareness and accessibility to support services. Our research contributes to this field, and we look forward to future advancements in the application of chatbots in mental healthcare.

7.2 Future Scope

The proposed eLIFE chatbot can further improve its effectiveness by expanding the conversational training data between the user and the chatbot. This chatbot can also become more technologically advanced if we integrate a voice-based feature. It then captures the user's voice and converts it into text, and when we can perform emotion detection, we can provide personalized recommendations. We can also improve this bot further by accessing

the user’s location, and if the DASS_21 score is severe, we can provide a list of psychiatrists in his or her location or nearest to his or her location. We can collect feedback from some close friends or family members when users start to use the chatbot via Telegram to improve its responses. We can send an alert message via various mobile applications when the user's DASS_21 score is severe. Understanding the severity of mental states, we can make an effort to connect with professionals via online counselling sessions or by booking an appointment.

References

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