S.A.G.E - A CHATBOT FOR EMOTIONAL WELL-BEING

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**CERTIFIED SPECIALIST**

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**List of Figures**

|  |  |  |
| --- | --- | --- |
| **No.** | **Figures** | **Page no.** |
| 1. | File structure of RASA | 10 |
| 2. | SAGE guiding the user ‘personally’ through a breathing exercise | 15 |
| 3. | Redirection to suicide helpline | 16 |
| 4. | Setting doctor’s appointment reminder | 17 |

**List of Abbreviations**

|  |  |
| --- | --- |
| AI | Artificial Intelligence |
| API | Application Programming Interface |
| ML | Machine Learning |
| NLU | Natural Language Understanding |
| NLP | Natural Language Processing |
| S. A. G. E | Shwetha, Antony, Gayathri, Emotional Chatbot |
| OCD | Obsessive Compulsive Disorder |

**Table of Contents**

|  |  |  |
| --- | --- | --- |
| **No.** | **Content** | **Page no.** |
|  | List of Figures | 2 |
|  | List of Abbreviations | 3 |
|  | Table of Contents | 4 |
|  | Abstract | 5 |
| 1. | Problem Definition | 6 |
| 2. | Introduction | 7 |
| 3. | Literature Survey | 9 |
| 4. | RASA | 10 |
| 5. | Conversational Flow of Chatbot - SAGE | 12 |
| 6. | Results | 15 |
| 7. | Conclusion and Future Scope | 18 |
| 8. | References | 19 |

**Abstract**

Chatbot is a smart algorithm that stimulate and process human conversations to interact with digital devices. Chatbots converse with the users and deliver responses to requests of all kinds using Artificial Intelligence (AI), natural-language processing (NLP), and machine learning (ML). This conversational program has now become an integral part across all different industries including customer services, finance, healthcare. Health chatbots are also being used to address specific issues in healthcare. These are also able to connect patients with clinicians for diagnosis or treatment, thus has the future of becoming [the first contact point for primary care](https://medicalfuturist.com/medpalm-new-ai-medical-chatbots-will-soon-be-better-than-waiting-for-a-doctor). **The chatbot thoroughly asks you about the details of your medical state and offers you various solutions and actionable steps to take.**

This project aims to develop a chatbot that provides support to people who already have diagnosed mental health issues (OCD, Anxiety disorder, Stress etc.) in times of emotional distress by detecting negative sentiments in their conversation. For the development of chatbot we are using an open-source framework called RASA.

RASA is a tool to build custom AI chatbots using Python and natural language understanding (NLU). It works at Level 3 of conversational AI, where it can handle things like the user changing their mind, handling context and even unexpected queries.

Keywords: Chatbots, RASA, Natural Language Processing, Artificial Intelligence, Emotional Analysis, Mental Health

1. **Problem Definition**

The objective of our project is to build and deploy a chatbot powered by Natural Language Processing (NLP) techniques using the RASA framework, a popular open-source framework for building and deploying chatbots and conversational assistants. This project will serve as a valuable resource for individuals seeking support for emotional wellbeing. By leveraging the capabilities of RASA, we will develop a chatbot that can accurately understand user intents, extract relevant information, and generate appropriate responses.

This project focuses on the step-by-step processes involved in building a chatbot using RASA, such as data preprocessing, intent classification, entity recognition, dialogue management, and response generation. By implementing this, we intend to achieve the following objectives:

* Understand the fundamental concepts of NLP and its relevance in chatbot development.
* Gain proficiency in using RASA framework for building and training chatbots.
* Explore different techniques for intent classification and entity recognition.
* Develop a robust dialogue management system to ensure a smooth flow of conversation.
* Implement a response generation mechanism to provide accurate and contextually appropriate replies.

By the end of this project, we aim to deliver a functional chatbot that can intelligently understand user queries, offer relevant information or assistance, and engage in meaningful conversations as mental support system.

**2. Introduction**

In recent years, the field of NLP has gained significant traction due to its applications in various domains, including chatbot development. AI leverages the power of NLP to process and analyze vast amounts of textual data, enabling machines to comprehend and respond to human language with accuracy and context. Chatbots were mainly used in marketing to enhance customer experiences. The chatbot simulates a realistic conversation partner by giving the user appropriate answers in a language that he or she understands. It aims to provide users with an interactive, intelligent, and personalized conversational experience.

Rasa is a leading open-source conversational AI framework which utilizes NLP techniques to build custom chatbots. It offers a range of features and advantages that make it a preferred choice for many developers. Rasa provides a flexible architecture, allowing developers to customize and tailor their conversational agents according to their specific needs.

Chatbots have much potential in the mental health area because getting one’s thorough self-disclosure is crucial for mental health experts to comprehend people’s mental status. A mental health chatbot can be accessed anytime, anywhere, providing individuals with immediate assistance and support. This accessibility can be especially valuable for those who don't have easy access to mental health resources or prefer a more private and anonymous channel of communication. Chatbots or dialogue systems can be used to get the normal informative needs of the user by acting as a friend or a well-wisher.

They provide valuable resources, psychoeducation, and coping strategies to promote mental health awareness and self-care. While they can help track symptoms, offer early intervention, and provide continuous support, it's important to remember that they should not replace professional mental health care. Mental health chatbots are most effective when used as part of a comprehensive mental health care plan, complementing traditional therapy and support services.

Our project aims to build a chatbot powered by AI and developed using Rasa. It utilizes NLP techniques to provide support for individuals facing mental health issues, acting as a personalized assistant. With the help of AI-driven technologies, our chatbot engages in meaningful conversations, offering reminders for medication intake, monitoring diet and sleep routines, and providing relevant mental health resources. Built within the PyCharm development environment, our project combines the power of Rasa's intuitive dialogue management capabilities with intelligent NLP algorithms, providing users with a safe and non-judgmental space to seek assistance. Our goal is to empower individuals to establish healthy habits and routines, ultimately contributing to their overall mental well-being. We believe that technology can play a significant role in promoting well-being, and our project strives to bridge the gap between mental health needs and accessible support systems.

**3. Literature Survey**

With the introduction of digital technologies, the treatment for mental health problems has undergone tremendous transformation. Conversational AI, enabled by technologies that understand, responds to, and learn from customer interactions can be effectively utilized in the field of mental health. A chatbot, a novel digital technology for mental health service, is a software program that simulates conversations with users through text or voice depending on AI [1]. Chatbots are now utilized as personal health assistants to encourage well-being and mental health check-ins during and after interventions. Chatbots track symptoms and behaviours (such as physical activity, sleep hours, and time spent on social media) [2].

Eliza is one of the first natural language processing computer programs created in 1964 by Joseph Weizenbaum [1][4]. Most of the chatbots that help in anxiety and depression (like Woebot, Wysa, and Joyable) uses Cognitive Behavioural Therapy (CBT) to help users cope with symptoms of depression and anxiety [3]. These chatbots won’t ever replace therapists, because nothing can match the human connection. Although chatbots have demonstrated feasibility to provide mental health treatment, more high-quality evidence regarding the effectiveness and acceptability of mental health chatbots is needed [5][6].

Jiao [7] introduced RASA, pair of tools, Rasa NLU and Rasa Co, which are open-source python libraries for building conversational software. They aim to make machine-learning-based dialogue management and language under- standing accessible to non-specialist software developers.

**4. RASA**

RASA is an open-source platform widely used for building chatbots and voice-based AI assistants.  It is a conversational AI platform that supplies the building blocks for creating virtual (digital) assistants or chatbots. It allows users to understand and hold conversations, and connect to messaging channels and third-party systems through a set of APIs.

RASA has two main components: RASA NLU and RASA CORE. RASA NLU interprets the user input and extracts entities and intent with the help of various pipelines. It then converts the input into a dictionary that includes the original text, intent, and entities identified, which is then sent to RASA CORE. RASA CORE is responsible for the chatbot’s response. It selects the appropriate response as per the user input and then sends it back as a chatbot response. RASA also offers RASA X functionality which provides a Web UI and supports interactive learning.

**File Structure of Rasa:**

**My RASA project:**

actions

data

config.yml

endpoints.yml

*action.py*

domain.yml

credentials.yml

*nlu.yml*

*rules.yml*

*stories.yml*

*\_init\_.py*

Fig. 1. File structure of RASA

*\_\_init\_\_.py*: an empty file that helps python find your actions.

*actions.py*: directory containing the custom action Python scripts. If you need the bot to write specific actions or tasks, you can write and place those scripts in this directory.

*config.yml*: configuration file that contains pipelines policies, and components used by the model for training.

*credentials.yml*: file for configuring external services and credentials, such as API keys.

*data/nlu.yml*: file that contains training data for NLU models; stores intent, entities, and lookup tables for the user input.

*data/rules.yml*: contains rules for dialogue management.

*data/stories.yml*: contains general stories to train the model. Rasa core controls the dialog flow in Rasa by training the chatbot using these stories.

*domain.yml*: file defining the chatbot's domain and specifies a configuration for conversation sessions. It lists all the intents, entities, slots, forms, actions, and responses used by the user.

*endpoints.yml*: File specifying endpoints for external services, like action servers and NLU models.

Additionally, Rasa allows to create custom actions to perform specific tasks or integrate with external services like querying a database or making API calls. Through Rasa API user can connect with various applications like Facebook, Spotify, YouTube etc. thus opening wide range of applications in day-to-day life.

**5. Conversational Flow of Chatbot – SAGE**

In recent years, chatbots have become an integral part of our digital interactions. With advancements in artificial intelligence and natural language processing, chatbots are now capable of engaging in meaningful conversations with users. One crucial aspect of developing an efficient and user-friendly chatbot is designing its conversational flow. This chapter explores the key considerations and strategies involved in creating an effective conversational flow for our chatbot.

The conversational flow is initiated by the user through greetings.SAGE responds back by welcoming the user and initializing the process for personalization.

**STEP 1: Classification of users**

For personalization, users are first classified into three categories; Personal, Formal, Moderate. A machine learning model is designed to classify users based on questionnaires related to personal behavior and preferences. The following steps are done for building the ML classifier.

* + Created a dataset of possible user responses with labelled user category.
  + Trained a decision tree classifier model.
  + Successfully predicted user category on a new data point.

**Questionnaire for classification of user:**

* Are you a talkative or reserved person?

**Buttons:** Talkative | Reserved

* Are you someone who prefers listening and observing more than actively participating in conversation?

**Buttons:** Yes | No

* Do you feel energized or drained after extended period of interaction?

**Buttons:** Energized | Drained

* Do you like being persuaded to do things?

**Buttons:**  I like persuasion | Am not fond but ok with persuasion | I don’t like persuasion

* How much of a personal involvement do you prefer from your friends while engaging in a conversation?

**Buttons:** Low | Medium | High

**STEP 2: Personalization**

Introduction of personalized interaction with users by using the Classifier model to accurately profile the users. According to the predicted user profile SAGE will interact with the user either formally or personally or moderately. All the recommendations, responses and reminders SAGE provides will be in the predicted profile format.

**STEP 3: Functionalities**

The following are the functionalities offered by SAGE:

* ***Breathing and grounding exercises through guidance and video streaming***- SAGE provides users with guided breathing and grounding exercises to help manage anxiety and stress. These exercises can be accessed through the app and may include features such as video streaming to visually guide users through exercises. This functionality aims to promote relaxation and emotional well-being.
* ***Specialized playlist for anxiety from Spotify***- SAGE offers a specialized playlist curated specifically for anxiety management. This feature integrates with Spotify, allowing users to access calming and soothing music that can help alleviate anxiety

symptoms. By creating a dedicated playlist, SAGE aims to provide users with an immersive and personalized experience tailored to their anxiety needs.

* ***Reminder functionality to set sleep pattern and appointment using Google calendar***- SAGE includes a reminder functionality that assists users in setting up their sleep patterns and appointments. By integrating with Google Calendar, the app can send reminders and notifications to users, helping them maintain a regular sleep schedule and stay organized with their appointments. This feature promotes healthy sleep habits and aids in managing daily routines effectively.
* ***Redirection of users to suicidal helpline in case of suicidal threat in speech***- SAGE is designed to prioritize user safety and mental well-being. In the event of a user expressing or indicating suicidal thoughts or threats through speech, the app includes a critical feature that redirects them to a helpline specifically dedicated to providing support for individuals in crisis. This functionality ensures that users in distress receive immediate assistance from trained professionals, emphasizing the importance of mental health support and intervention.

**6. Results**

**Example 1: Guiding breathing exercise for personal profile**

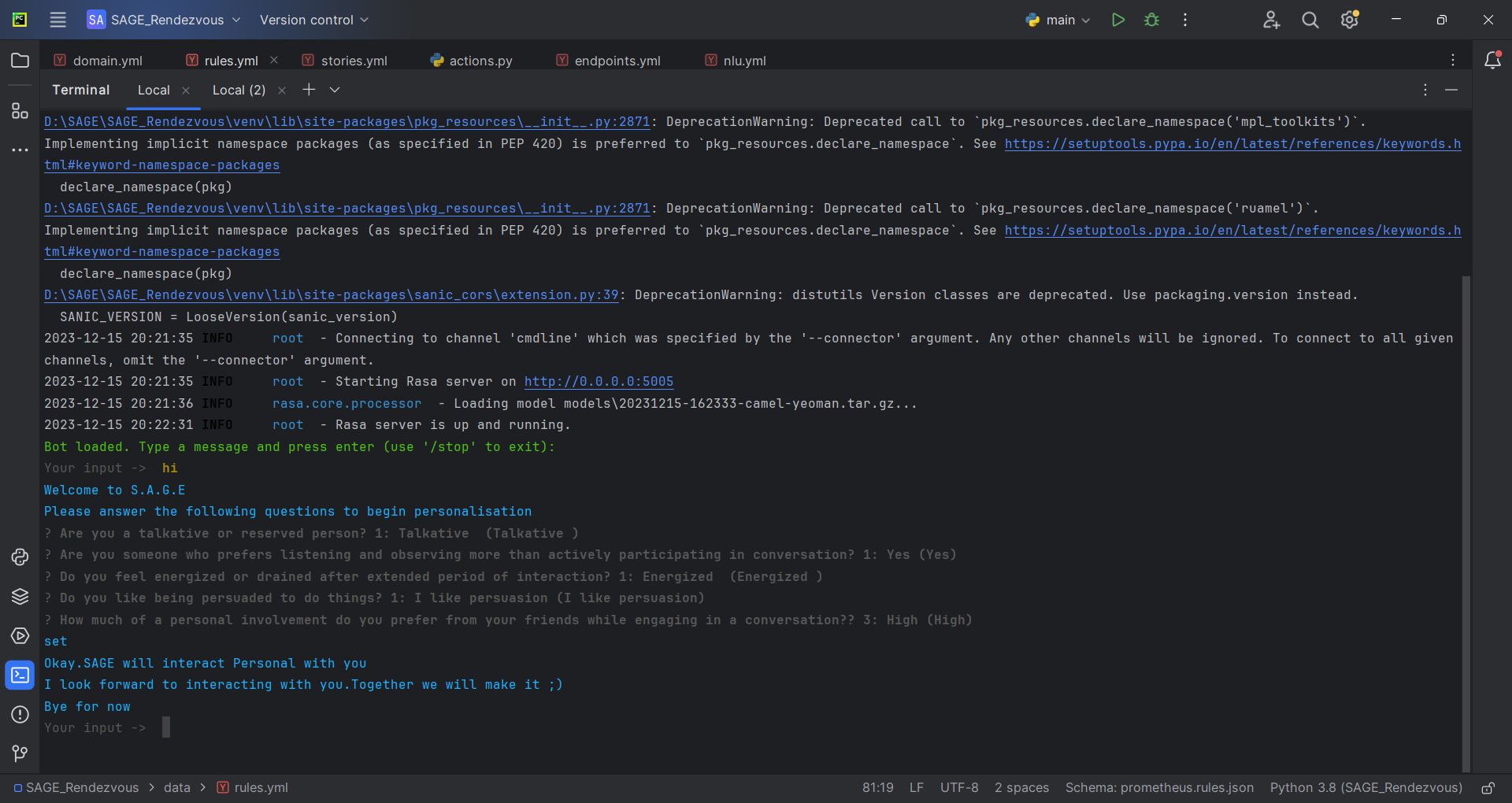
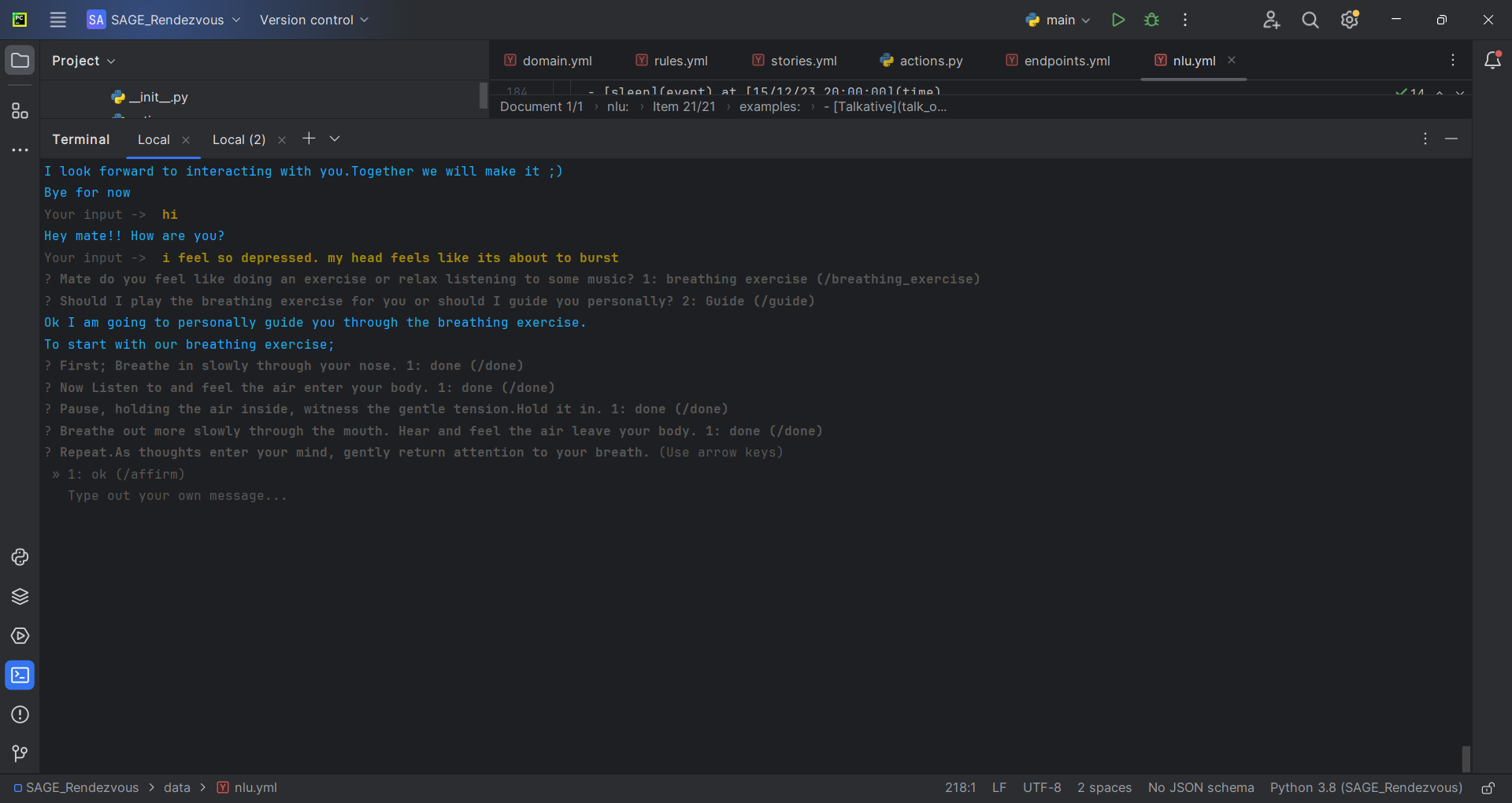
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Fig. 2. SAGE guiding the user ‘personally’ through a breathing exercise

**Example 2: Redirection to suicide helpline**

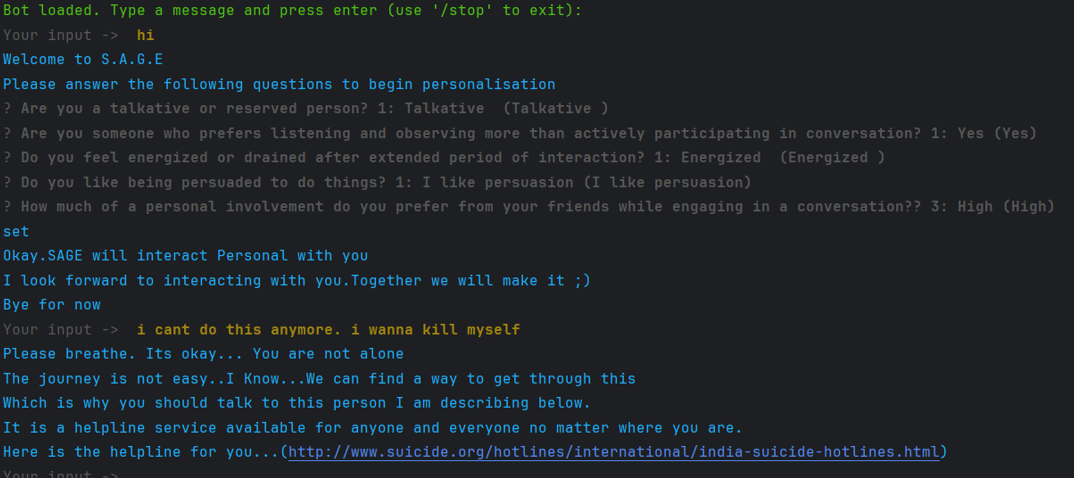
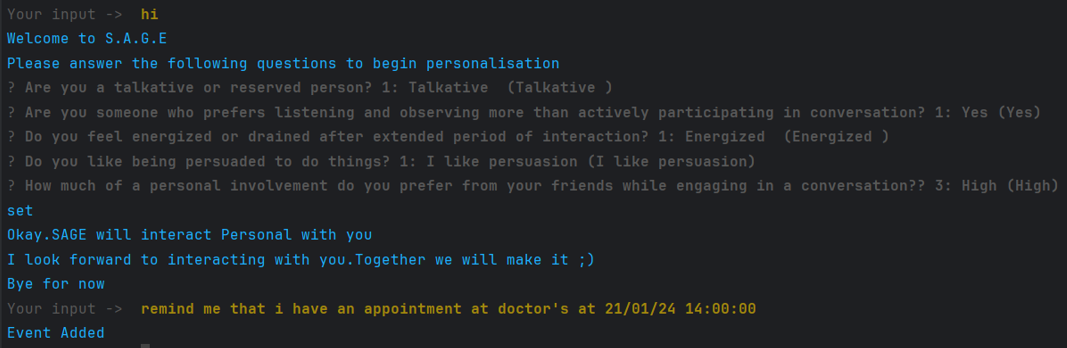
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Fig. 3. Redirection to suicide helpline

**Example 3: Adding an appointment reminder using Google calendar**

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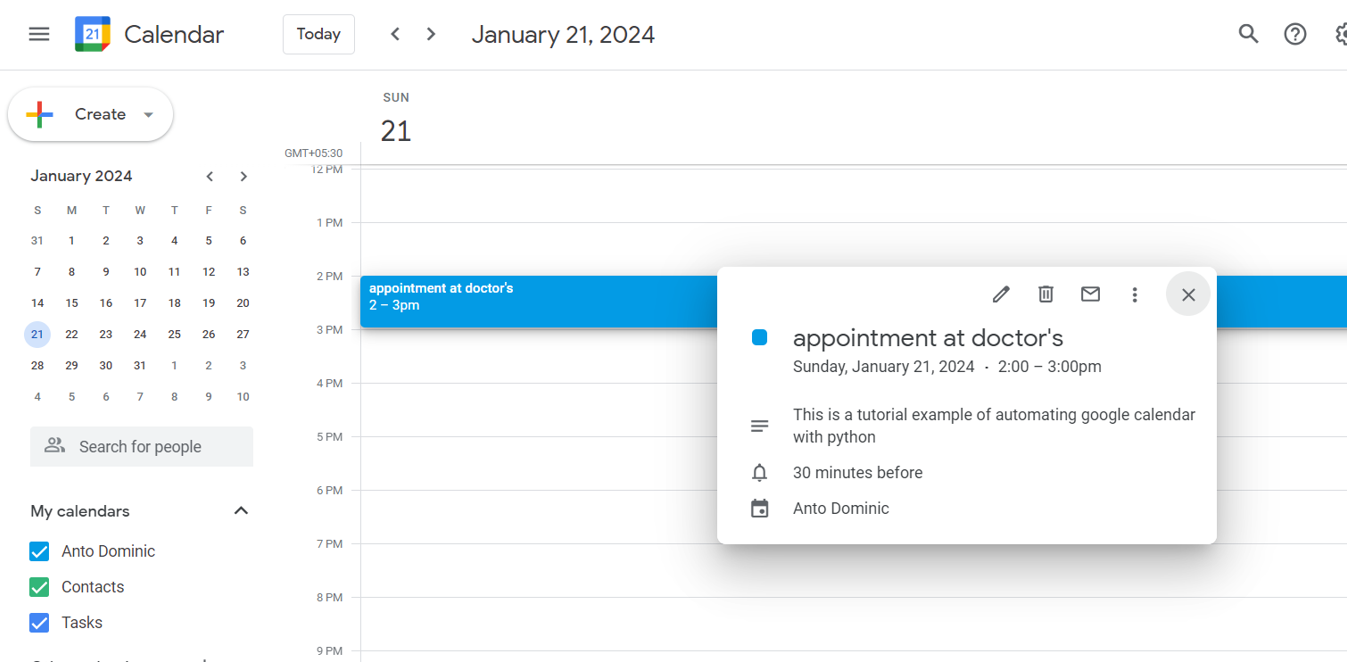
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Fig. 4. Setting doctor’s appointment reminder

**7. Conclusion and Future Scope**

In the realm of mental health, SAGE has emerged as a compassionate guide, offering support, resources, and personalized assistance to those in need. By seamlessly blending advanced AI capabilities with an empathetic touch, SAGE has redefined the landscape of mental wellness through its multifaceted approach. SAGE has successfully transcended the traditional boundaries of mental health support, enriching lives with tailored exercises, soothing music playlists on Spotify, and gentle reminders for quality sleep. Its holistic approach has helped users cultivate healthy habits and find moments of peace in their daily routines.

By seamlessly integrating with platforms like Spotify, Google calendar etc. SAGE has demonstrated the potential of AI-driven interventions in enhancing holistic mental health experiences. Through the power of meaningful conversations, mindfulness exercises, personalized sleep alarms and curated music, SAGE has sowed the seeds of resilience, self-care, and emotional literacy. Its impact extends beyond the digital realm, nurturing a community of individuals who prioritize their mental well-being and seek personalized support.

The future holds boundless opportunities for SAGE to further expand its impact, forge new connections, and continue its mission of nurturing mental wellness with empathy, insight, and unwavering support. The expansion of the bot will encompass the inclusion of a diet routine checker, the implementation of user logins and a User Interface, further enhancing its capacity to provide comprehensive support for holistic well-being. Also, chatbots are prone to mistakes since they only mimic the conversations without understanding. These mistakes are something that can be avoided and worked upon in the future.

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