RISSI AI: A Mental Health Chatbot

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Abstract - **Mental health is fundamental to overall well-being and profoundly impacts every aspect of life, from personal relationships to academic and professional success. It is as important as physical health, yet often does not receive the same level of attention or resources. Prioritizing mental health can lead to improved quality of life, enhanced productivity, and better physical health. The proposed project aims to develop an AI-powered chatbot to address challenges in mental health care, including incomplete symptom alleviation, high attrition rates, and loss of follow-up. The chatbot will provide personalized support and engagement to users, leveraging deep learning for its model and featuring a user-friendly interface. The chatbot will utilize advanced natural language processing techniques to understand and respond to users' needs, offering tailored guidance and resources to help manage their mental health. Continuous updates and improvements will be made based on user feedback to ensure the chatbot remains effective and user-friendly in providing support and improving mental health outcomes.**

Keywords – **RNN - recurrent neural networks**

BERT - Bidirectional Encoder Representations from Transformers

NLP - Natural language processing

CSV - Comma Separated Values

JSON - JavaScript Object Notation

I. INTRODUCTION

Mental health is an important part of overall health, but challenges remain in making conditions like depression treatable. Despite advances in treatments and interventions, problems such as absent and diminished symptoms and noncompliance with mental health care persist. These problems can prevent people from getting the support they need and achieving long-term health.

AI chatbots and machine learning offer an effective way to solve these problems directly. Using this technology, we aim to provide easy and personalized support to people with depression and other mental health issues. Identifying language and behaviour patterns that predict depression. This positive approach enables early intervention and support, potentially preventing symptom progression.

Be a part of their mental health. Through personalized interactions and fundraising, these chatbots have the potential to improve clinical outcomes and reduce attrition rates. Promoting sexuality and effective employment improves individual and community health.

II. METHODS

A. DATA COLLECTION AND PREPROCESSING:

Initiate data collection from diverse sources, including mental health forums, support groups, and 1ounselling sessions. Anonymize collected data to ensure user privacy and confidentiality. Preprocess the collected data by removing

irrelevant information and standardizing the format. Continue data collection efforts to ensure representation across various mental health scenarios and demographics.

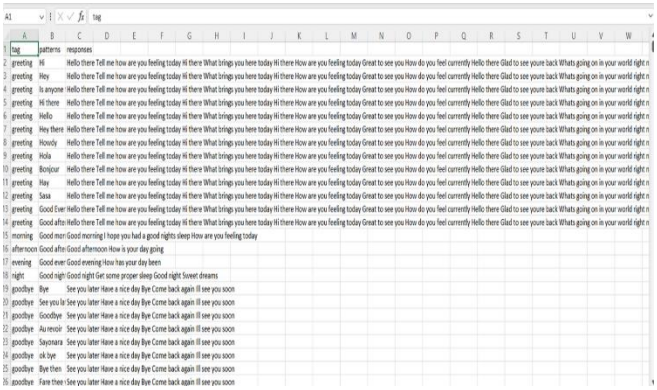

Fig. 1. Dataset

B. NLP AND SENTIMENT ANALYSIS:

Implement Natural Language Processing (NLP) techniques for understanding user inputs and queries. Develop sentiment analysis modules to gauge the emotional context of user messages. Integrate NLP components into the chatbot to enable meaningful interactions. Refine sentiment analysis algorithms to accurately capture users' emotional states. Conduct iterative testing and gather feedback to fine-tune NLP and sentiment analysis functionalities.

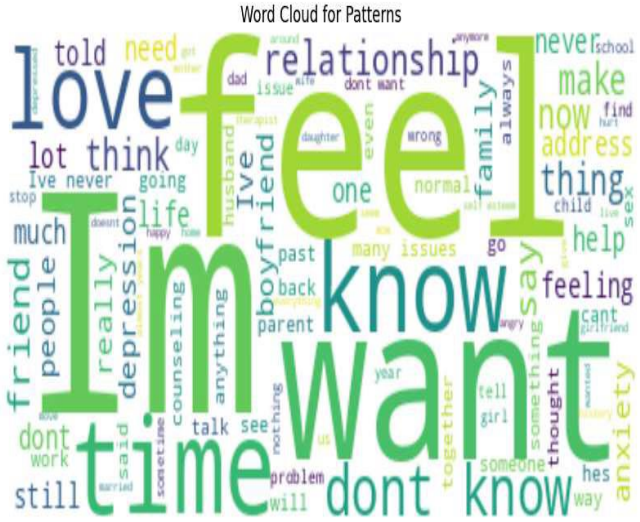

Fig 2. Word cloud

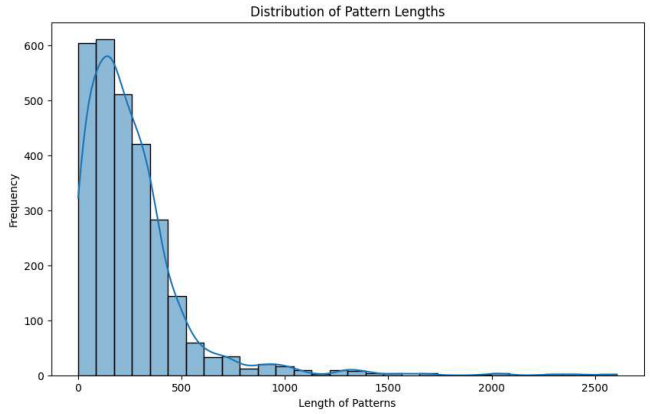

Fig 3. Distribution Length of User Queries

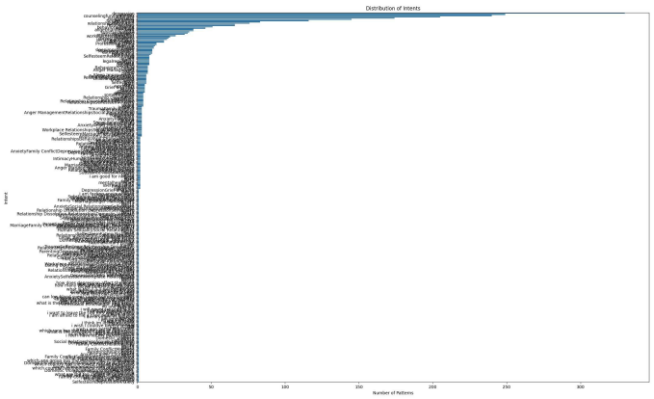

Fig. 4. Classification of Anxiety and sadness

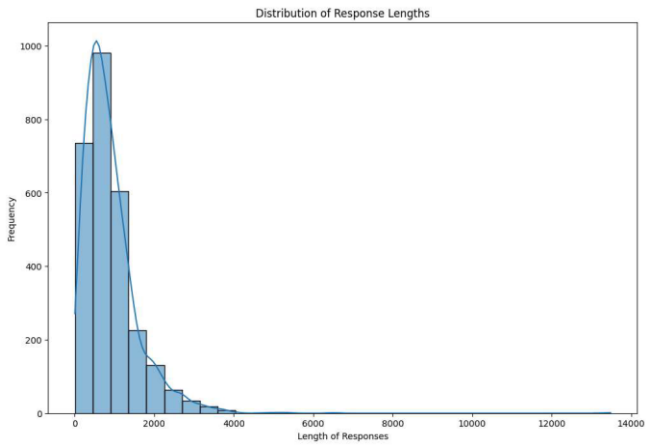

Fig 5. Distribution of Responses Lengths

C. MACHINE LEARNING MODELS:

Train supervised learning models using preprocessed datasets to enable the chatbot to understand and respond to user queries effectively. Monitor model performance and assess accuracy in

understanding user intents. Incorporate reinforcement learning techniques to allow the chatbot to learn from user interactions and improve over time. Iterate on model improvements based on user feedback and performance evaluations.

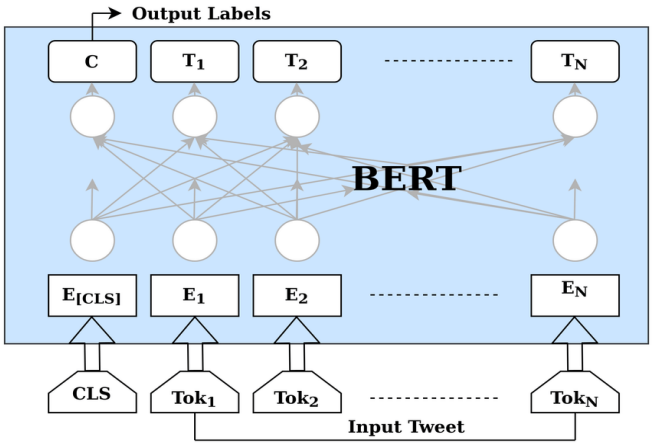

Fig. 6. BERT model Architecture

D. APPLICATION DEVELOPMENT:

Design a user-friendly interface for the chatbot application, ensuring accessibility and ease of use. Choose the appropriate platform (web, mobile, etc.) for deploying the chatbot application. Develop the frontend of the application, focusing on intuitive design and smooth user experience. Integrate the frontend with the chatbot's NLP and sentiment analysis modules to enable seamless communication.

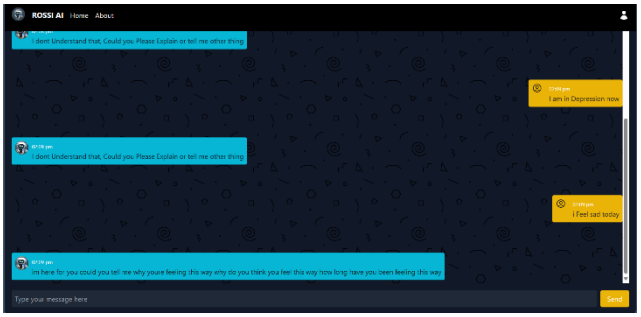

Fig. 7. Application

E. SOFTWARE TESTING AND DEPLOYMENT:

Collaborate with mental health professionals to conduct thorough user testing, ensuring that the chatbot meets user needs and expectations. Incorporate feedback from user testing to make final adjustments and improvements. Deploy the chatbot application to the target platform, ensuring stability and scalability. Continuously monitor and update the chatbot to address any issues and improve performance based on user feedback and emerging trends in mental health support.

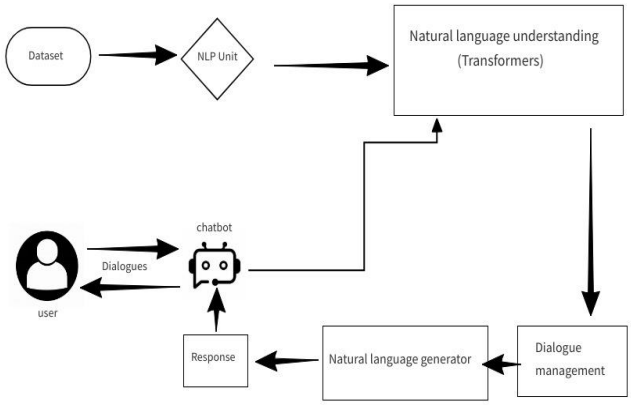

Fig. 8. Overall Architecture

III. ALGORITHM

1. Import necessary libraries, including NumPy, Pandas, JSON,Regular Expression, Random, TensorFlow, Plotly, and Transformers.
2. Read the intents data from the intents.json' file.
3. Create a Pandas DataFrame from the loaded JSON data.
4. Load csv data and combine to the dataframe.
5. Reformat the DataFrame to have separate lists for 'tag,' 'patterns,'and 'responses.'
6. Tokenize the patterns using the TensorFlow Tokenizer.
7. Get the vocabulary size..'
8. Load the BERT-based transformer model and tokenizer from the Transformers library or Pytorch.

9. Train the model on the prepared data with a specified batch size and early stopping callback
10. Define a function to generate answers using the trained model and tokenizer.

IV. RESULTS

Evaluation of natural language generation models can prove to be a challenge considering the fact that each generative task varies as per the situation. While it is arduous to find relevant metrics to evaluate these models, methods for comparing texts do exist. For this system, perplexity will be used to evaluate the models and represent the performance of these models. Using this method, the model should ideally assign high probabilities to real, factual sentences and lower probabilities to sentences that are syntactically incorrect. Hence, perplexity itself should be at its lowest for the best performing model.

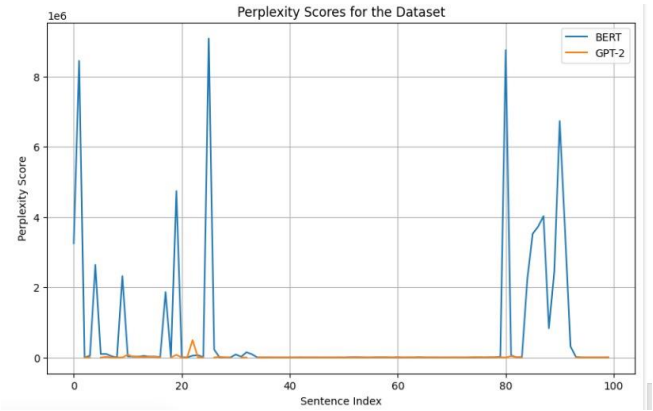

Fig. 9. Perplexity Comparison between GPT 2.5 and BERT

$$PP(W) = \sqrt[N]{\frac{1}{P(w_1, w_2, \ldots, w_N)}}$$

Here P represents the probability of words of the test set, which is inversed and normalised to get the perplexity

V. DISCUSSION

The reason a chat bot was chosen as the method of communication over other means such as online questionnaires, google forms and personal communication comes from the results obtained in various research papers where communication with a chat bot received more accurate results over others.

This tool has been idealized in order to bridge the gaps presented in former studies. Gaps like inability to converse with the subject, inability to receive feedback on the subject's mood and inability to compel the subject to continue with self- improvement or seek professional help.

This chatbot cannot be a real substitute for a psychologist or a mental health professional, if the need for professional help comes up on any particular case the tool will prompt the individual to seek it out. However, the intent is to create a tool to offer a decent amount of closure and to give a feeling to the users that their problems are being heard. Often, the mental health of students can drastically decline if they do not have someone to speak to. Even the simple act of listening and responding can change the student's attitude towards that problem, and they feel empowered.

In further versions the implementation of a virtual therapist may be possible to dive deeper into the more complex deep leaning aspect of the tool. The chatbot could be fitted with a text-to-speech converter that would make the process that much more lifelike or human, allowing the user to speak to the bot rather than converse in textual conversation through the help of a speech-to-text converter on the input side of the chatbot.

VI. CONCLUSION

In summary, this project marks a significant milestone in the realm of mental health support and technology. By leveraging advanced natural language processing techniques, Transformers BERT model and innovative web-based solutions, we have developed a powerful and accessible tool for enhancing mental well-being and emotional

support. The chatbot's ability to understand and empathize with users' concerns in real-time represents a crucial step forward in addressing the complexities of mental health challenges.

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