MOBILE PHONE RECOMMENDER USING MULTI CRITERIA DECISION MAKING ALGORITHM

Ragaventhiran J[1], Sindhuja M[2*], Prasath N[3], Muthu Kumar B[4], Islabudeen M[5]

[1,5]School of Engineering, Presidency University, Bengaluru, Karnataka, India.

[2]Department of Artificial Intelligence and Machine Learning, Rajalakshmi Engineering College, Chennai, India

[3]Department of Networking and Communications, School of Computing, SRM Institute of Science and Technology, Chennai, India

[4]School of Computing and Information Technology, REVA University, Bengaluru, India

Email: jragaventhiran@gmail.com[1], sindhujavignesh06@gmail.com[2*] (corresponding author), prasath283@gmail.com[3], muthu122@gmail.com[4], islabudeen@gmail.com[1]

DOI: https://doi.org/10.22452/mjcs.sp2022no2.4

ABSTRACT

A study found that the depression rate is growing at an alarming rate among everyone. Many people who report symptoms of depression mostly have not been diagnosed or underwent treatments for it. If they do not get proper treatments like medication, therapy, guidance or counselling, it would be difficult for them to lead a happy and stress-free lifestyle. India is already on the cusp of a health crisis, and we urgently require a long-term solution to the problem of depression. People are more inclined to open it up to a smart machine than to a human, according to a recent study. Digital interfaces are gaining traction as feasible options for closing the gap and making mental diagnosis and treatment more accessible and inexpensive to everybody. The aim of the project is to develop a chatbot called Therapy Bot using sentiment analysis and cognitive behavioral therapy to predict the mental health status of an individual. Moreover, the chatbot can serve as a good companion to the affected by communicating with friendly manner and help them recover. The chatbot will personalize its responses based on the user's answer to keep the conversation interesting. The chatbots can be used as a complement to treatment or as a kind of interim support while waiting for an appointment. The benefit of such a method is that, rather than reaching a point where a trip to a psychologist is required, an online free version will reach a large number of people, mitigate the negative effects of depression, and contribute to a better of society.

Keywords: Chatbot, Sentiment Analysis, Cognitive Behavioral Therapy

1.0 INTRODUCTION

To cause machines to recognize human emotional state a ton of exploration has been made on the field of complex artificial knowledge frameworks. Such frameworks learn themselves and secure information by getting to every one of the information accessible on the web. They give great outcomes to feeling or estimation acknowledgment and the client can pose inquiries to those frameworks similarly as one would to another human. Chatbots are starting to show up in the space of psychological wellness care. Individuals living in country networks, or shift laborers, may have issues getting to emotional well-being care arrangements, and chatbots could be utilized as a likely answer for this. Chatbots are turning out to be progressively predominant in the public arena, and it has been anticipated that clients may before long really like to draw in with chatbots, to finish jobs customarily done on a page or portable application. Psychological instability is a main supporter of the worldwide wellbeing trouble, with roughly 33% of individuals encountering chronic weakness in the course of their life. Individuals don't comprehend that they are going through sorrow since it is to some degree a no-no to discuss dysfunctional behavior thus, individuals wind up ending it all. Additionally, the expense of advising from specialists like therapists, analysts is exceptionally high. To give a modest and eff ective method of treatment, open-source talk bots should be created. A compelling treatment choice is Cognitive Behavioral Therapy (CBT). CBT (cognitive behavioral therapy) is a current, objectively situated psychotherapy therapy that takes strong, logical approach to dealing with critical thinking. The main goal is to significantly alter an individual's reasoning or behavior and to assist them in general. CBT likewise gives a proof-based way to deal with treatment. This paper advances the improvement of the online pressure the board and stress treatment web application, which gives an intuitive web- based media-based stage for recuperation in emotional wellness and advance mental prosperity. The target of this undertaking is to work on the enthusiastic strength of the

client by giving little interruptions. These interruptions will allow the client to refocus on his work/life from a new perspective. To accomplish this, we utilize (NLP) Natural Language Processing which empowers correspondence between a human and a PC.
It is primarily utilized in interpretation purposes which incorporates transformation from sound to text and the other way around. To perceive the feeling from the client we utilize conclusion investigation which is a text mining measure. It is a cycle where pre- characterized feeling names "good" or "negative" are appointed to message documents. POS is considered an indivisible piece of NLP which helps in recognizing the classifications and sub classifications of grammatical features in a message document. Bag Of Words (BOW) is one of the famous type of portrayal utilized in NLP and data recovery. The proposed application will fill in as a guiding chatbot, which will offer a conversational support for emotional wellness care dependent on assessment examination and the visit aide stage.

2.0 RELATED WORKS

The main idea of the task, according to Pranav Rane et al. [1], is to change the client's perspective by providing various types of media or workouts using Sentiment Analysis. The customer's current outlook is determined by conclusion analysis, and the unpleasant feeling is alleviated by showing the client appropriate media. The main idea of the task, according to Pranav Rane et al. [1], is to change the client's perspective by providing various types of media or workouts using Sentiment Analysis. The customer's current outlook is determined by conclusion analysis, and the unpleasant feeling is alleviated by showing the client appropriate media. Kathinka Olsrud Sigurd et al. [3] Suggested that, Exploring the utilization of man-made brainpower (AI) in the wellbeing area, explicitly the utilization of chatbots in the association with individuals living with psychological wellness issues who are needing specific assistance, utilizes chatbot for exact and exact outcomes. Rather than reaching a point when a visit to a therapist is required, Pratik Kataria et al. [4] believe that an online free help will reach a large number of people, intervene in the sick effects of suffering, and contribute to the growth of society. The chatbot can empower inspiration boosting discussion with the client and will customize its answers according to the client to keep the discussion locking in.

Samuel Bell et al. [5] proposed, a relative investigation of treatment meetings with human specialists versus a chatbot is made for discovering proof to recommend that when contrasted with a human advisor, members find chatbot- gave treatment less helpful, less agreeable. Their discoveries recommended that exploration about the chatbots for intellectual conduct treatment would be more powerful in working on the emotional wellness of a person. Simon Rice et al. [6] suggested that, the advancement of the directed online social treatment (MOST) web application is required, since it gives an intelligent web-based media-based stage for individuals in recuperation of emotional well-being. He additionally gave an outline of the framework's primary components and examined their present work in regards to the consolidation of artificial knowledge strategies to upgrade client commitment that would work on the revelation and conveyance of treatment content. Ahmed Fadhil et al. [7] Stated the idea of conversational UIs (CUIs) for wellbeing and its UX plan standards in conversational interfaces and chatterbots, giving an overview of significant examinations and depicting UX plan standards and connection designs. For researchers and developers to follow while developing or building area explicit CUIs, this establishes a roadmap to identify best practices and address CUI setup difficulties. David Ireland et al. [8] recommended that, Chatbots can possibly outfit these advances in a clever methodology that will have significant consequences for emotional wellness administration conveyance. Here he depicts the sort of preparing and advancement that would be needed for a ClinPsy Chatbot and talked about its expected status for development of this field. Sameena Thabassum et al. [9] stated that, Sentiment examination is portrayed as the method involved with classifying a message or explanation into positive, negative or impartial. This paper examines about consolidating estimation investigation in Chatbot and the requirement for a compassionate Chatbot. This Chatbot attempts to track down the best important answer for the inquiry that the client has posed. In the event that a Chatbot is equipped for understanding the supposition of client, he/she can easily connect with the chatbot [9-11].

Sentiment analysis, sometimes called sentiment mine or emotions analysis, is a technique for assessing people's emotions. AI employs natural language, text analytics, and computational linguistics to extract critical information for decision-making [12]. With the growth of deep learning in the machine learning sector, several research studies [13] [14] [15][17] have found that AI-powered deep learning combined with sentiment analysis can dramatically increase chatbot performance while maintaining a high level of user experience. In [14], Vyas developed a hybrid model for chatbots, integrating the management of a retrieval-based computer with the contextual preservation characteristics of Long Short-Term Memory to produce a lifelike chatbot. H.N. lo found that deep learning technology is a possible research topic in efficient chatbot creation after analysing many chatbots and

conversational agents in [13] Richard Csaky [15] proposed a recurrent encoder-decoder model for response generating conversational modelling that uses retrieval-based or generative-based techniques. The authors of [16] conducted a survey and compared various strategies for designing Chatbots. With deep learning techniques trained on Twitter discussions of users and agents from over 60 businesses, created a conversational system to automatically provide responses for users requests on social media. Anandhan et. al study seeks to find ranking experts' generated from the tag relationship among users in the CQA websites in order to construct user profiles in which the users' interests are represented in the form of tags [18].

3.0 PROPOSED SYSTEM

The suggested system would consist of a mobile application that will provide guided self-assessment and advice for stress, anxiety, melancholy, sleep, and self-esteem. We offer a bot that can engage the user in a positive dialogue. To keep the discussion more engaging, the chatbot will deliver short and personalized responses based on the user's reaction. The chatbot is capable of providing various activities to be followed to combat mental illness. The system is proposed to provide immediate remedies in no time as per the user requirements. The user can schedule their interactions as they wish according to their convenience. The system is capable of providing immediate solutions in no time as per the user requirements.

3.1 About The Dataset

The dataset can be used for classification and text mining process. Data is available in csv file and loaded with a “File Loader” node. The dataset as shown in fig (1) is text_emotion with 40,000 instances. These instances can be used to classify various emotions or sentiments in the text. The sentiment labels are stored in the category field. It includes two categories (sentiment and content). The dataset consists of text with various emotions like empty, sadness, worry etc. Using sentiment analysis various emotions in the text can be identified and the needed solutions can be provided using cognitive behavioural therapy.

	A	B
1	sentimen	content
2	empty	@tiffanylue i know i was listenin to bad habit earlier and i started freakin at his part =[
3	sadness	Layin n bed with a headache ughhhh...waitin on your call...
4	sadness	Funeral ceremony...gloomy friday...
5	enthusias	wants to hang out with friends SOON!
6	neutral	@dannycastillo We want to trade with someone who has Houston tickets, but no one will.
7	worry	Re-pinging @ghostridah14: why didn't you go to prom? BC my bf didn't like my friends
8	sadness	I should be sleep, but im not! thinking about an old friend who I want. but he's married now. damn, & he wants me 2! scandalous!
9	worry	Hmmm. http://www.djhero.com/ is down
10	sadness	@charviray Charlene my love. I miss you
11	sadness	@kelcouch I'm sorry at least it's Friday?
12	neutral	cant fall asleep
13	worry	Choked on her retainers
14	sadness	Ugh! I have to beat this stupid song to get to the next rude!
15	sadness	@BrodyJenner if u watch the hills in london u will realise what tourture it is because were weeks and weeks late i just watch itonlinelol
16	surprise	Got the news
17	sadness	The storm is here and the electricity is gone
18	love	@annarosekerr agreed
19	sadness	So sleepy again and it's not even that late. I fail once again.
20	worry	@PerezHilton lady gaga tweeted about not being impressed by her video leaking just so you know
21	sadness	How are YOU convinced that I have always wanted you? What signals did I give off...damn I think I just lost another friend
22	worry	@raaaaaaek oh too bad! I hope it gets better. I've been having sleep issues lately too
23	fun	Wondering why I'm awake at 7am,writing a new song,plotting my evil secret plots muahahaha...oh damn it,not secret anymore

text_emotion

Fig. 1: Text emotion with instances

3.2 Algorithm of overall process

The system's process, as depicted in Figure 2, is as follows: A web application or a mobile application can be used to start a conversation with the chatbot. To eliminate the noisy and incomplete data, the corpus is given to the pre-processing stage, which performs tokenization, stemming, and lemmatization. Sentiment analysis is used to discover the many emotions expressed in a text. To identify the distinct parts of speech, parts of speech labeling is used. BOW representation is utilized to determine the rate of recurrence of text, and gramme filtering is used to discover negations in the text. Various cures or treatment recommendations are supplied based on the user's

response, which can aid in their mental health improvement. Knocking down a substring into pieces like phrases, sentences, symbol, sentences, and other tokens is how emotion analysis is done [12].

3.2.1 Steps for the proposed system

Input: User Text

Step 1: Tokenization, stemming and lemmatization is performed.

Step 2: Various parts of speech is identified.

Step 3: The frequency of occurrence of text (BOW) is determined.

Step 4: Recommendation text as output

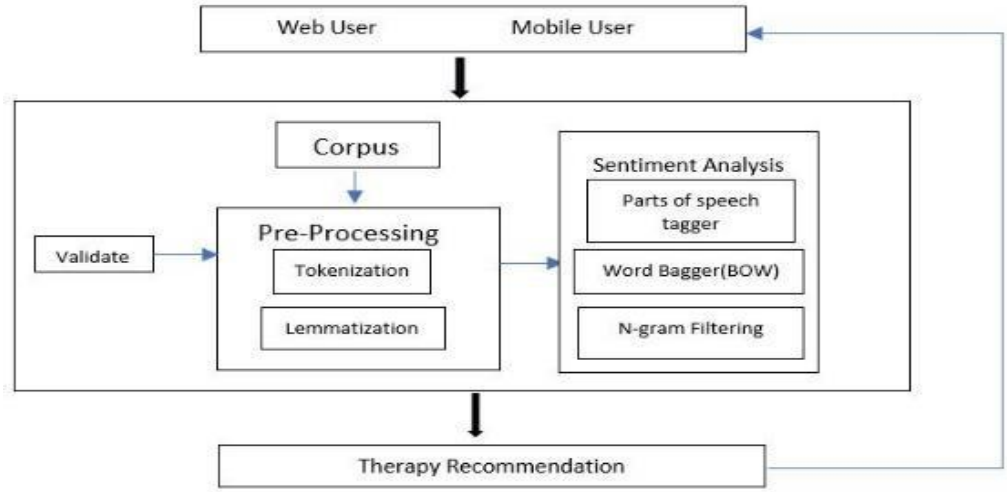

Fig. 2: Architecture diagram of the overall process

3.2.2 Preprocessing

Real time data tend to consist of noisy, incomplete and missing data. Low quality data always produce low quality output; hence we need to perform pre- processing which smoothens or cleans the data using various techniques like tokenization and lemmatization.

3.2.3 Tokenization

It is the process of dividing the text into different segments or of different tokens. Tokens consist of words or entities in a text.

3.2.4 Stemming

It is the process of eliminating affixes from a word to obtain the root word. Stemming, Stemmed, Stemitization > (stem) where stem is the root word.

3.2.5 Lemmatization

It is similar to stemming but capable of capturing the canonical form of the word called lemma. For example, running, ran->(run) and Better->(good)

3.2.6 Sentiment Analysis

It is a process used in text mining. It is a method of analysing various emotions in a text. It is used in identifying the user's attitude towards expressing a text whether it is positive, negative or neutral. This technique helps to determine the mental state of the users thereby improving their mental wellbeing and provide betterment to the society.

3.2.7 Natural-Language Processing

It explains how to Programme computers and how to analyses enormous quantities of natural language input. It enables human-machine, machine-human interaction and makes the conversation engaging. NLP is capable of identifying the natural language of the users. Through NLP the chatbots can easily analyses the user's queries and provide quick response.

Spellchecker, Auto - completion, Voice messaging service, Spam filters, and Related terms on search engines are all instances of NLP that individuals use every day.

3.2.8 Parts of Speech Tagger

It is a software that reads text in one language and assigns parts of speech(noun|verb|adjective). It requires the installation of Java 1.8+ and plenty of memory capacity. (POS)parts of speech tagger is mainly used for word sense disambiguation. For example, She saw a bear and Your efforts will bear fruit

In case1 bear denotes a noun and in case2 bear denotes a verb. POS helps in identifying the parts of speech in a sentence. POS can be used with NLP to predict entities by contextual words around them. It performs tokenization, a processof converting text to tokens.

3.2.9 Bag of Words

It's a type of representation utilized in natural language processing and information retrieval. It's often used in document classification, where the frequency of each word is a key characteristic for machine learning classifiers.

1) Joe likes to watch movies. Maria likes movies too.

2) Maria also likes to watch football games.

Based on the above, a list is created

BOOW1= {"Joe":1," likes":2,"to":1," watch":1," movies":2," Mary":1," too":1};

BOOW2= {"Maria":1," also":1," likes":1,"to":1," watch":1," football":1," games":1};

BOOW is an order less document representation tells only the counts or frequencies of occurrence.

3.2.10 N-GRAMS

N-grams are a group of words that are ordered and have a length of n. Ngrams are particularly good at detecting syntactic patterns that we need, like as negations. e.g., "not happy". For the above example, a Bigram model can be represented as

["Joe likes"," likes to","to watch"," watch movies",
" Maria likes"," likes movies"," movies too"]

4.0 RESULTS AND DISCUSSION

The snapshot as shown in figure 3 is the preprocessed code that has removed all the noisy and inconsistent data through the process of tokenization, stemming and lemmatization. This process helps in making the sentiment analysis work easier and effective.

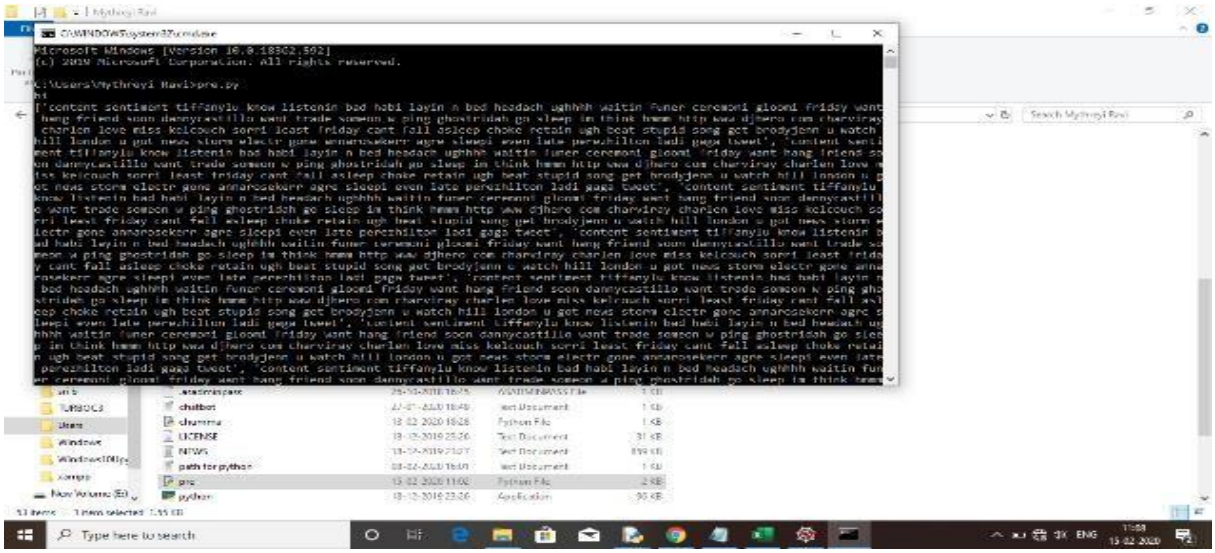

Fig. 3: The preprocessed code that has removed all the noisy and inconsistent data

Figure 4 depicts the emotional classification and polarity of the bot's highlighted responses, while Figure 5 summarizes the same. Trust is the most common feeling conveyed in these responses. The marked responses also contained sadness and dread. The polarity of answers is represented by the last two bars. It shows that among flagged responses, the percentage of successful remarks is slightly larger than the number of bad responses [14].

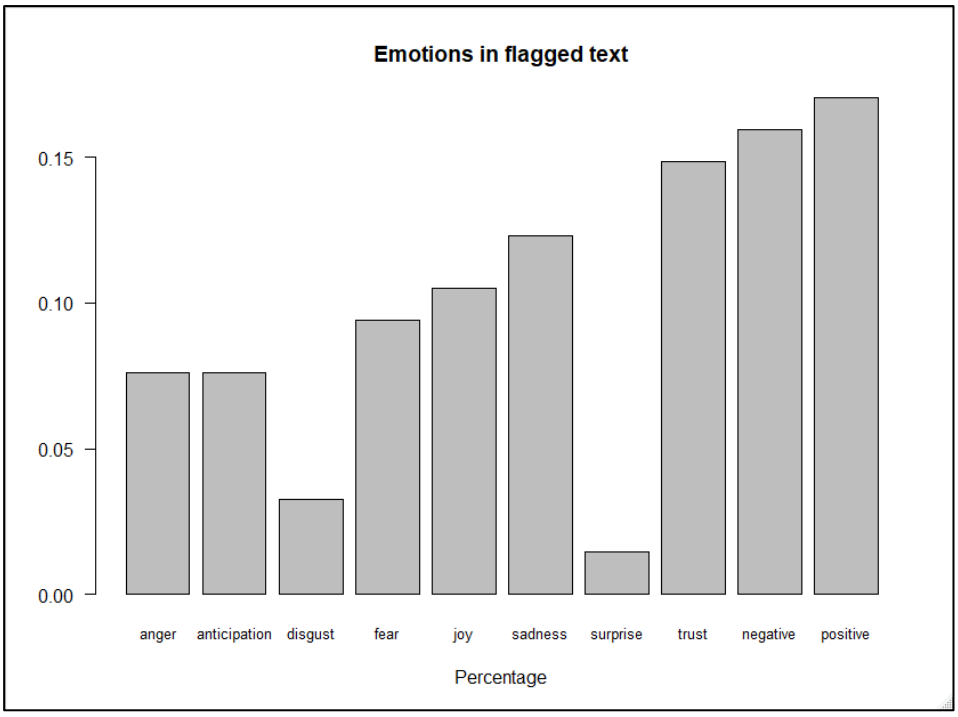

Fig. 4: Emotional Classification

```
> summary(flagged_snt)
     anger        anticipation      disgust          fear             joy        
 Min.   :0.00   Min.   :0.00   Min.   :0.00   Min.   :0.00   Min.   :0.00  
 1st Qu.:0.00   1st Qu.:0.00   1st Qu.:0.00   1st Qu.:0.00   1st Qu.:0.00  
 Median :1.00   Median :1.00   Median :0.00   Median :1.00   Median :1.00  
 Mean   :0.84   Mean   :0.84   Mean   :0.36   Mean   :1.04   Mean   :1.16  
 3rd Qu.:1.00   3rd Qu.:1.00   3rd Qu.:1.00   3rd Qu.:1.00   3rd Qu.:2.00  
 Max.   :3.00   Max.   :3.00   Max.   :2.00   Max.   :4.00   Max.   :5.00  
    sadness         surprise         trust          negative        positive      
 Min.   :0.00   Min.   :0.00   Min.   :0.00   Min.   :0.00   Min.   :0.00  
 1st Qu.:1.00   1st Qu.:0.00   1st Qu.:1.00   1st Qu.:1.00   1st Qu.:0.00  
 Median :1.00   Median :0.00   Median :1.00   Median :2.00   Median :1.00  
 Mean   :1.36   Mean   :0.16   Mean   :1.64   Mean   :1.76   Mean   :1.88  
 3rd Qu.:2.00   3rd Qu.:0.00   3rd Qu.:2.00   3rd Qu.:2.00   3rd Qu.:2.00  
 Max.   :5.00   Max.   :2.00   Max.   :6.00   Max.   :5.00   Max.   :8.00  
```

Fig. 5: Flagged responses summary

The chatbot as shown in figure 6 to 9 is written in python to enable effective communication with the user. A conversational UI is one that uses friendly language to guide the user and support their mental health.

```
Hi, I'm chatty and I chat alot ;)
>hi
Hello
>my name is ram
Hello ram,very much glad to speak to you, How are you today ?
>iam not good
oh are u not feeling well?
>ya
chill that's not a matter,we will solve it
>thanks
chill bro iam now your friend ,there is no need of thanks
>wow
cool!!hey shall we continue with some activities
>yes
that's great we will start now
>what to do
okay now i will keep asikng some questions and you need to answer them,shall i?
>sure
currently how do you feel,what is your mental state
>
```

Fig. 6: A conversational UI is one that uses friendly language to guide the user.

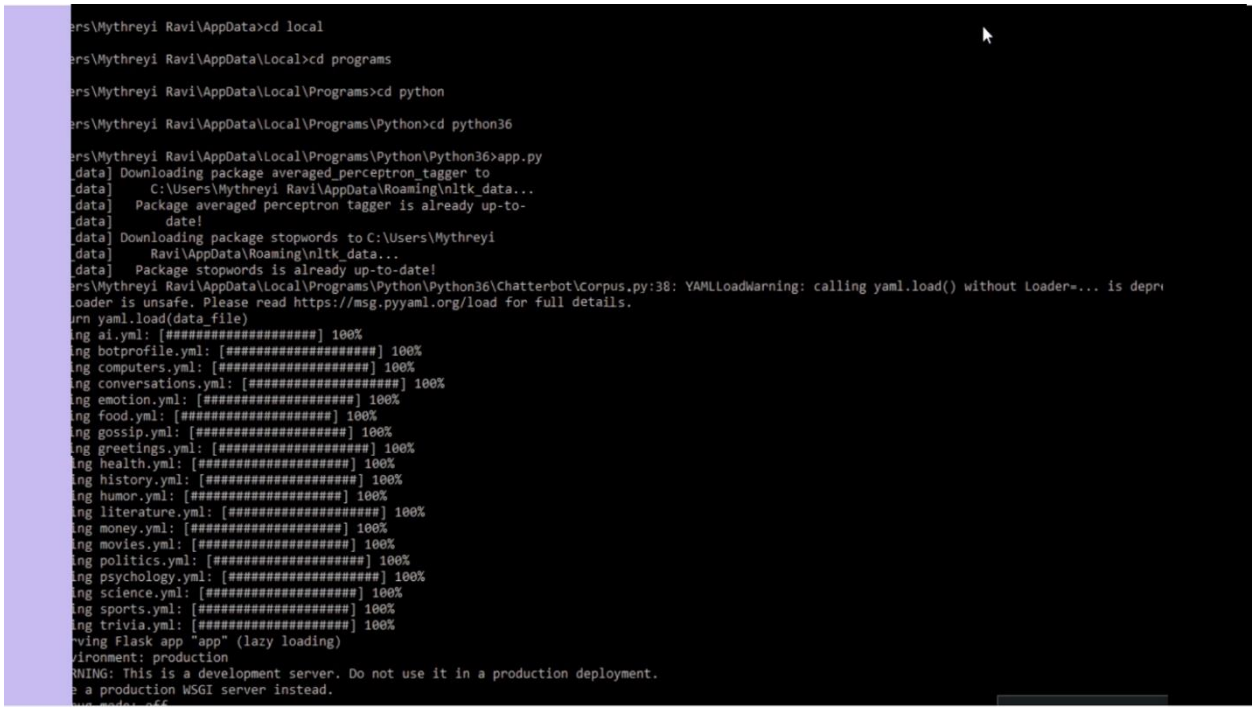

Fig. 7: Data Loading

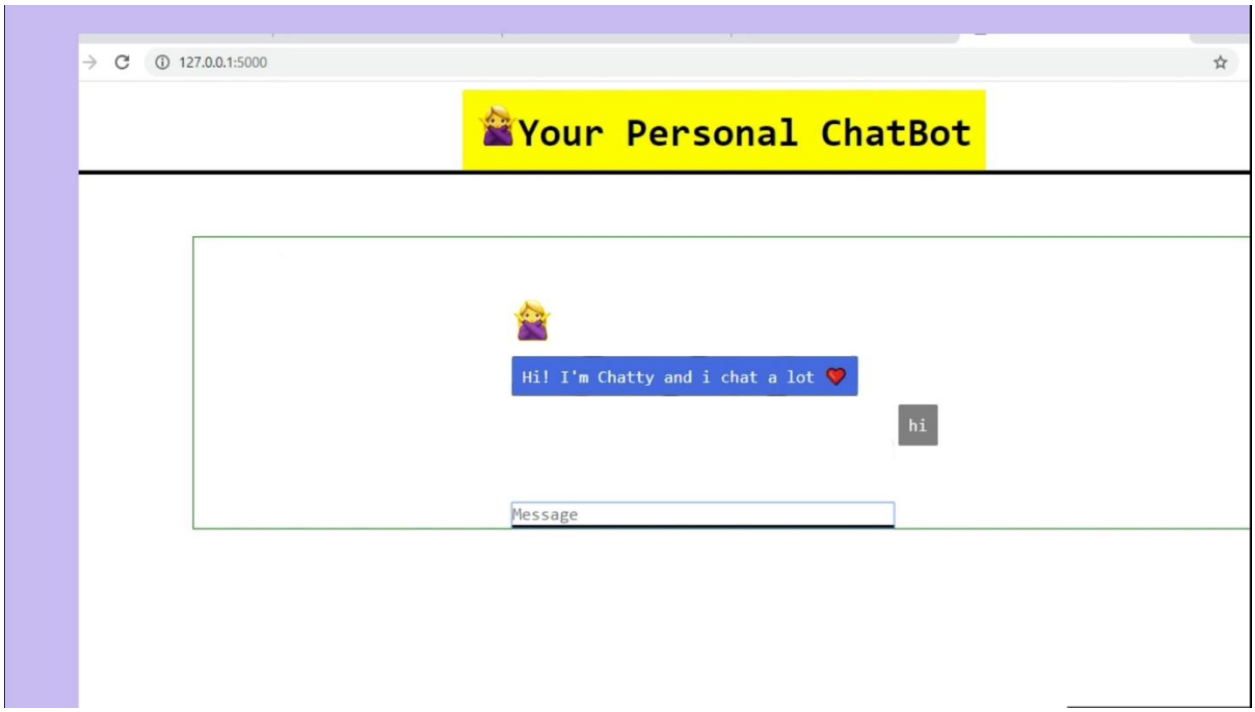

Fig. 8: Sample welcome Conversation

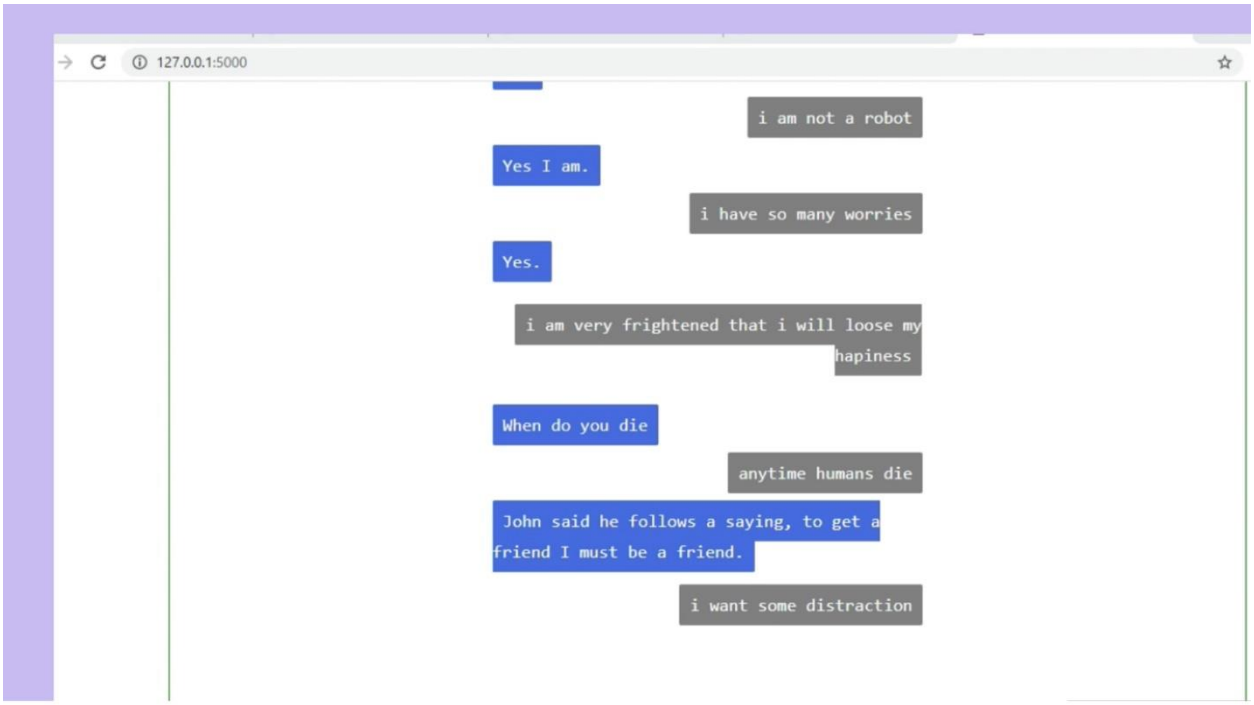

Fig. 9: Chatbot responses to user

5.0 CONCLUSION

Rather than reaching a point when a consultation to a psychiatrist is required, the system delivers a free online service that will touch a large number of people. The system also helps to alleviate the negative effects of negative and contributes to the welfare of society by quickly giving numerous cures and therapy recommendations according to the needs of the user. Finally, we ask, "How far do we get with pure end-to-end learning approaches, i.e., developing systems where the sole input is a corpus of past conversations?" from a technological and methodological standpoint. Although NLP technology has advanced significantly in recent years, it is debatable if today's learning-based Chatbot Recommender System is genuinely useful. Combining learning approaches with various types of structured knowledge appears to be the key to future conversational recommender systems that are more useful, trustworthy, and predictable.

REFERENCES

[1] P. Rane, K. Bhansali, and S. Nair "Sentimental analysis to improve emotional health of user", *International Journal of Computer Applications*, Vol. 120, No. 1, June 2015, pp. 21 – 24, doi: 10.5120/21191-3844.

[2] G. Cameron, D. Cameron, G. Megaw, R. Bond, M. Mulvenna, S. O'Neiil, C. Armour, and M. McTear "Assessing the usability of a chatbot for mental healthcare", in *proceedings of INSCI 2018 International Workshops, St. Petersburg, Russia*, Springer, October 2018, pp. 121- 132, doi: 10.1007/978-3 -03 0-17705-8_11.

[3] K. O. Aspvin, S. Rognhaugen and S. D. Reder, "Exploring the use of AI in mental health treatment through the chatbot PRATE-PETRA", Specialization in research in design of IT "Interaction with AI", 2018.

[4] P. Kataria, K. Rode, A. Jain, P. Dwivedi and S. Bhingarkar "User adaptive chatbot for mitigating depression", *International Journal of Pure and Applied Mathematics*, Vol. 118, No. 16, 2018, pp. 349-361.

[5] S. Bell, C. Wood a n d A. Sarkar, "Perception of Chatbots in Therapy", in *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems, May 2019*, pp.1-6, doi: 10.1145/3290607.3313072.

[6] S. D'Alfonso, O. Santesteban-Echarri, S. Rice, G. Wadley, R. Lederman, C. Miles, J. Gleeson and M. Alvarez-Jimenez, Artificial Intelligence-Assisted Online Social Therapy for Youth Mental Health. *Front. Psychol.* Vol.8, 2017, doi: 10.3389/fpsyg.2017.00796.

[7] A. Fadhil and G. Schiavo, Designing for Health Chatbots. *ArXiv, abs/1902.09022, 2019.*

[8] D. Bradford and D. Ireland, "Virtually there: Chatbots for Mental Health support?" , in *Digital Participation: Engaging Diverse and Marginalised Communities, an OZCHI workshop, Nov 29 2016, Launceston, Australia.*

[9] V. Sharma, M. Goyal, and D. Malik. "An intelligent behaviour shown by chatbot system", *International Journal of New Technology and Research,* Vol. 3 No. 4, April 2017, pp. 52-54.

[10] A. Mondal, M. Dey, D. Das, S. Nagpal and K. Garda, "Chatbot: An automated conversation system for the educational domain", in *2018 International Joint Symposium on Artificial Intelligence and Natural Language Processing (iSAI-NLP),* 2018, pp. 1-5.

[11] Alaa Ali Abd-Alrazaq, Asma Rababeh, Mohannad Alajlani, Bridette M Bewick, and Mowafa Househ, "Effectiveness and Safety of Using Chatbots to Improve Mental Health: Systematic Review and Meta-Analysis" *Journal of Medical Internet Research,* Vol 22, No.7, July 2020.

[12] Sentiment Analysis, *https://en.wikipedia.org/wiki/Sentiment_analysis*.

[13] R.S. Kamath, "Analysis of Twitter Data on Demonetization in India: An Opinion Mining Approach", in *International Conference on Demonetization and Remonetization: Issues and Challenges for Global Business, Kolhapur*, 4th and 5th August 2017, pp. 75-84.

[14] H. N. Io and C. B. Lee, "Chatbots and conversational agents: A bibliometric analysis", in 2017 *Proceedings of IEEE International Conference on Industrial Engineering & Engineering Management (IEEM), 2017*, pp. 215–219, doi: 10.1109/EM.2017.8289883.

[15] V. A. Bhagwat, "Deep Learning for Chatbots", *SJSU Scholar Works Master's Projects Master's Theses and Graduate Research, Spring* 2018, San Jose State University.

[16] R. Csaky, "Deep Learning Based Chatbot Models", in *Scientific Students' Associations Report, Department of Automation and Applied Informatics, Budapest University of Technology and Economics, 2017.*

[17] V. Pandi, P. Nithiyanandam, S. Manickavasagam, I. M. Meerasha, R. Jaganathan, and M. K. Balasubramanian," A Comprehensive Analysis of Consumer Decisions on Twitter Dataset Using Machine Learning Algorithms", in *International Journal of Artificial Intelligence* , Vol. 11, No. 3, September 2022, pp. 1085-1093, doi: 10.11591/ijai.v11.i3.pp1085-1093.

[18] A. Anandhan, M. A. Ismail and L. Shuib, "Expert Recommendation Through Tag Relationship In Community Question Answering", *Malaysian Journal of Computer Science*, Vol. 35, No. 3, July 2022, pp. 201–221, doi: 10.22452/mjcs.vol35no3.2.