

A Survey of Artificial Intelligence Approaches for Mental Healthcare Chatbots

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Abstract— The research paper explores the evolving landscape of mental health care chatbots, examining their features, challenges, and future prospects. By synthesizing current research and developments, we aim to provide insights into the potential benefits and limitations of integrating chatbots into mental health care. According to the literature survey these systems have used different frameworks of Natural Language Processing (NLP), Natural Language Understanding (NLU) technologies and ML models.

The chatbot aims to make a discussion between mortal and machine. Healthcare chatbot system stores the knowledge database to identify the judgment and making a decision to answer the question of the users and save their time and get the instant response.

Keywords— *Natural Language Processing, Artificial Intelligence, Mental Healthcare system, Machine learning, Natural Language Understanding, Chatbot*

I. INTRODUCTION

In recent years, the integration of artificial intelligence (AI) in Mental healthcare has entered in a new era of personalized and efficient medical services. One groundbreaking application of AI in the healthcare domain is the emergence of medical chatbots. These intelligent conversational agents leverage natural language processing (NLP) and machine learning (ML) techniques to interact with users, providing information, guidance, and support in a manner akin to human conversation. Medical chatbots hold tremendous potential to revolutionize healthcare by offering immediate access to medical information, facilitating

remote patient monitoring, and streamlining communication between healthcare providers and patients.

This introduction explores the key techniques employed in the development of mental healthcare chatbots, ranging from the underlying machine learning algorithms to natural language understanding and integration with electronic health records. As we delve into the intricacies of these techniques, it becomes evident that medical chatbots not only have the potential to alleviate the burden on healthcare systems but also to empower individuals in managing their health proactively. Moreover, their non-intrusive and user-friendly nature makes them a valuable tool in promoting health literacy and fostering a more informed and engaged patient population.

In the subsequent sections, we will examine the core components of medical chatbot techniques, shedding light on their capabilities, challenges, and the ethical considerations that accompany their widespread adoption. As we navigate this evolving landscape, it is clear that medical chatbots represent a significant stride towards a more accessible, efficient, and patient-centric healthcare ecosystem.

With the advancement of AI, virtual assistants can now be found in every part of the globe. They use voice queries to retrieve answers, conduct activities, and make recommendations based on the needs of the user. With continued use, they adapt to the user's specific language usages, searches, and preferences [4]. When examining the evolution of the chatbots, they are created to become undetectable to humans to pass the Turing test [1] In the emerging digital economy, a conversational bot with a voice and/or chat interface can play a key part in

overcoming the existing hurdles to making primary healthcare inexpensive, accessible, and perhaps sustainable [5]. But, when comparing the existing chatbots that are at the commercial level like, Apple (Siri), Amazon (Alexa), Google (Assistant), Microsoft (Cortana), all they have scalable self-service channels in the form of digital voice assistants and chatbots, they cannot (yet) be used in healthcare [5]. From the technological perspective, Chatbots are natural language processing systems that are utilized as a virtual conversation for agents, simulating human interactions (speak with them any time they want [1]) and are included in AI gadgets. While this technology is still in its early stages of development, health chatbots have the potential to improve access to healthcare, improve doctor-patient and clinic-patient communication, and assist in the management of the growing demand for health services such as remote testing, medication adherence monitoring, and teleconsultations [2]. Also, Specific health surveys, setting up personal health related reminders, communication with clinical teams, booking appointments, retrieving, and analyzing health data, or the translation of diagnostic patterns considering behavioral indicators like physical activity, sleep, or nutrition are all possible with chatbot technology. The technologies in the existing chatbots have the potential to change the way that healthcare is delivered by improving adoption, fairness, and cost-effectiveness while decreasing the health and well-being gap, but these assumptions require more investigation [1]. Further, the chatbot was seen as a trustworthy source of information, but its simplicity of use was ranked lower, indicating difficulties in scaling up the technology. Sometimes, when all the patients' requirements are met, they show emotion, and they may pose a risk to patients owing to erroneous self-diagnosis. The purpose of the study was to look at the characteristics, drawbacks of the existing applications, and evaluation of unconstrained techniques for AI-powered health chatbots that are utilized for health-related objectives. The remaining section of this paper is as follows. The literature review includes the chatbot related studies that have been done so far in healthcare domain. The discussion section includes survey done by using 150+ participants in society to get an idea about their awareness and experience level of using these healthcare chatbots. Moreover, discussion includes the technologies and features used in existing

systems. Finally, paper includes a conclusion and further work.

II. LITERATURE REVIEW

In Literature review we got to know that why the Mental healthcare chatbot was introduced and how it was introduced in this section we got to know different chatbots that are used with different frameworks that are NLP (Natural Processing Language), NLU and ML (Machine Learning). Basically, Healthcare Chatbots are introduced to provide benefit to the users or clients so, that they can save their time and can get the response anytime whenever they are required.

Divya S, Indumathi V, Ishwarya S, Priyasankari M, Kalpana Devi S [1] stated that NLP is used for interpreting the user input and generating the response. Chatbots can provide low costs and improved treatments. NLP and pattern matching algorithms are useful in development of chat bots. Symptoms are extracted using string searching algorithm. More features like location, duration and intensity of symptoms can be added. Abdullah Faiz Ur Rahman Khilji, Sahinur Rahman Laskar, Partha Pakray [2] stated that A dataset is prepared first then it is analyzed by the experts. Pre-processing like removal of stop words, tokenization and stemming. Personally, speaking to doctors and their intervention is very important. Easier set of questions should be asked to avoid confusion and for proper diagnosis by representing user's message as a Bag of Words, and Chatbots used to reduce cost and time.

Some of the Mental healthcare chatbots reviews are:

- *Knowledge-enabled Personalized Chatbot for Asthma Self-Management*

The research study [3] is a chatbot that is designed for a pediatric patient who is suffering from asthma whose age limit is between ages 8-15. So this chatbot acts as a knowledge-enabled chatbot system that can be considered as a personalized health application. Following the concept of the chatbots, this kBot is well concerned about the patients' history of data generating meaningful responses to each person separately using the help of the in-depth domain knowledge. Monitoring the patient's daily medication adherence and tracking the environmental

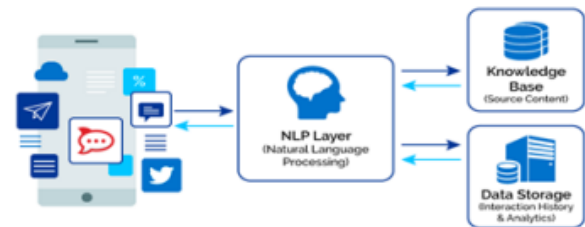
data and health signals can be considered as the core-functionalities of kBot. The front end of this application comes as an android application and the backend as a web-based server application for data handling procedures. The special feature of kBot is that it supports both voice and text which increases the interaction between both user and client. this kBot is a python web application that serves as well as instantiated more no of kBot clients. The functionalities such as database operation, ability in pushing notifications, email alerts file log, and weather report are conducted by the server layer. Also, Google Android applications are considered as the clients of this system. Also, NLP (Natural Language Processing and ML (Machine Learning) bases Google's well known developer platform," Dialog Flow used for both dialogue Parsing and processing. With the help of these technologies, kBot reveals that there is a considerable acceptance of this kBot as an 'asthma self-management 'system among the experts who are in a domain and nondomain areas.

- *EMMA: An Emotion-Aware Wellbeing Chatbot*

Also, the study introduces the "Emma "chatbot application which is the first emotionally intelligent and expensive mHealth agent. The specialty of Emma is that it can provide suggestions for wellness using a form of micro intervention. Further, the study states that the system can detect users' emotions or moods using the smartphone sensor data purely. For this purpose, a specific machine learning model has been used for generating self-reports of the users separately by inferring mood from sensor data, suggesting suitable wellness activities, driving emotional dialogues, etc. So, Emma provides emotionally suitable micro-activities for mental wellness using an empathetic way. Also, It can detect personal mood using the location data of the smartphone. Also, the study describes how they optimized the mobile app to measure phone sensors. According to the study, a prediction engine has been developed to reach the aim of translating sensor data into effect.

The survey of the different chatbots are very useful

for the patients to get the benefit according their problems and save their time and get instant remedies.



III. PROPOSED METHODOLOGY

This proposed methodology, researchers can systematically investigate and contribute to the evolving field of medical chatbot techniques, addressing technical, ethical, and user-centered aspects to advance the application of AI in healthcare.

- *User Interface Design and Human-Computer Interaction (HCI):*
Design an intuitive and user-friendly interface for the medical chatbot. Consider principles of HCI to enhance user experience, trust, and engagement. Conduct usability testing to gather feedback and iteratively improve the chatbot's interface.
- *Evaluation Metrics:*
Define evaluation metrics to assess the performance of the medical chatbot. Metrics may include accuracy, precision, recall, user satisfaction, and response time. Perform rigorous evaluations using both simulated and real-world scenarios.
- *Ethical Considerations and Regulatory Compliance:*
Evaluate the ethical implications of the medical chatbot, addressing issues such as privacy, consent, and responsible data use. Ensure compliance with healthcare regulations and guidelines, and propose strategies for mitigating ethical concerns.

- *Challenges and Future Directions:*

Discuss the challenges encountered during the research and propose solutions. Provide recommendations for future research directions, identifying areas for further improvement and innovation in medical chatbot techniques.

- *Documentation and Reporting:*

Document the entire research process, including methodology, data sources, algorithm implementations, and evaluation results. Prepare a comprehensive report that outlines the findings, contributions, and implications of the study.

- *User Interface Design and Human-Computer Interaction (HCI):*

Learn principles of HCI and user interface design specific to medical chatbots. Explore how a well-designed interface enhances user experience, trust, and engagement in healthcare interactions.

- *Data Collection and Preprocessing:*

Gather relevant datasets for training the chatbot. This may include healthcare dialogue datasets, electronic health records (EHR), and medical literature. Preprocess the data to ensure it is suitable for training machine learning models.

IV. MODULE DESCRIPTION AND IMPLEMENTATION

- *Understand the Role of AI in Healthcare chatbot:*

Explore the evolving landscape of AI applications in healthcare and the significance of medical chatbots in improving accessibility, dissemination.

- *Foundations of Natural Language Processing (NLP):*

Gain insights into the fundamentals of NLP and its application in medical chatbots. Understand how NLP techniques enable chatbots to comprehend and generate human-like language.

- *Machine Learning Algorithms for Chatbot Development:*

Examine various machine learning algorithms employed in the development of medical chatbots. Explore their role in tasks such as intent recognition, entity extraction, and context-aware responses.

- *Integration with Electronic Health Records (EHR):*

Investigate methods for securely integrating medical chatbots with electronic health records. Understand the challenges and opportunities associated with extracting and utilizing health data for personalized interactions.

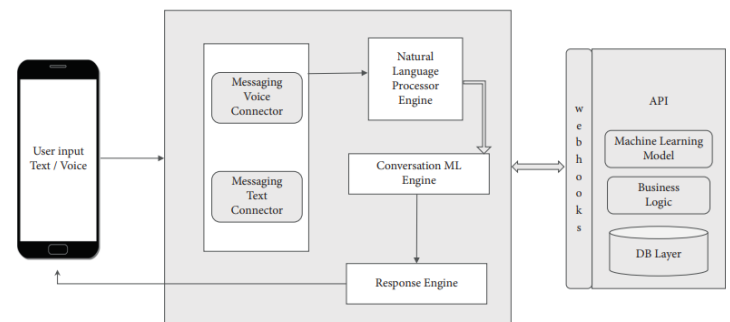


FIGURE 1: ChatBot high-level design architecture.

V. RESULT

The training phase will train the python executed and the application runs in localhost server which provides appropriate details according to t queries. In Home page of portal user can interact with tabs. The frontend interface of healthcare assistant is displayed on localhost server and ready to solve the patient symptoms on basis of specific disease [12]. Then chatbot will ask the question where the user supposed to discuss the problems related to health. If the patient is suffering from fever then the chatbot will give the medications.

These methods will lead to better Mental healthcare chatbot according to the user requirements:

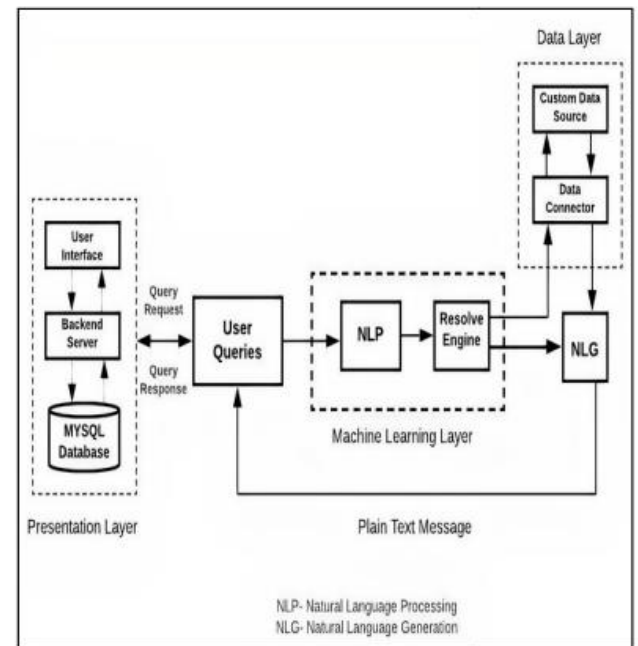
- *Natural Language Processing (NLP)* is a domain of artificial intelligence that provides machines to learn, read and understand the meaning of human languages. NLP based autonomous provides variety of languages, which makes

communication through verbal and nonverbal easier [2] In the healthcare chatbot, NLP is used for text processing. The characteristics of NLP in medical domain is useful:

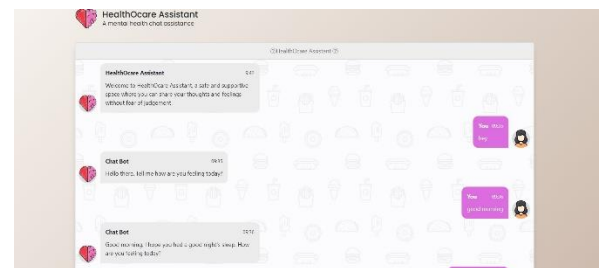
1. *Sentence Tokenization*: In this method whole sentence is divided into substrings and breaks into smaller words. When a patient enters the query in form of sentences, a whole set of words are converted into tokens, also split the sentences when there is punctuation mark.
2. *Word Tokenization*: There are varieties of words, which are present in the dictionaries. The segmentation of sentences is carried out. Words are assigned to tokens. The chatbot helps to classify the words according to the category present in medical records and gives the optimum feedback to a user.
3. *Stemming and Lemmatization*: Stemming is process, where words are chopped out from beginning and end. Whereas, lemmatization is used in morphological analysis for extraction of words. When doctors entered the wrong data on their database, the responses of chatbot are not relevant.

VI. FUTURE SCOPE

- With the increasing technologies in the field of AI, ML and implementation of chatbots in various fields there are many future modules that can be added to the current proposed chatbot. Medical counseling via Video call connecting direct to the Doctor. Making the Chatbot available in different languages using NLP platforms. Linking the bot to the map application for proper location of the hospital recommended. Making the Bot more user friendly and available and accessed in remote areas. And give instant response to the users or patients and save time.



AI based Mental Healthcare Chatbot By using NLP (Natural language processing)



VII. CONCLUSION

The main aim of the project AI Based Healthcare chatbot system using (NLP) Natural Language Processing, which is easy to use and more secure than the current system it will cure the diseases and helps to maintain proper health in the current system. This system reduces the possibility of diseases. The information is processed and store in the database, then it is reverted to the user. Also, it provides an accurate information about the health symptoms and medicines to the patients. By using diagnosis software, the results are generated accurate and fast. For end users it became easy to gain access in healthcare website and explore different types of services. After using such web-based applications, the results of healthcare were

affected in different countries and rate of mortality was steadily decreased. With the help of this natural language processing the proposed system can help the government organizations and hospitals also help in the development of the country. Thus, we successfully build up a system for hospitals and medical institute so that user can ask their queries with the medical assistant and book the doctor's appointment by giving text messages.

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