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Chatbots in Healthcare

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Abstract: AI automated medical chatbots are conversationally built with technology, with the potential to reduce efforts to healthcare costs and help people with basic medical remedies that help to self diagnose. We built a diagnosis bot that engages patients in the conversation for their medical query and problems to provide with medical aid based on their symptoms and profile. Our chatbot system is qualified to identify symptoms from user inputs. Based on the symptoms and severity, the bot identifies the patient's problem and suggests a natural medicinal recovery, if the condition is severe then it suggests a meeting with the doctor. This determines that a medical chatbot can provide a somewhat accurate diagnosis to patients with simple symptom analysis and an effective conversational approach. Moreover, the relative effectiveness of this bot indicates that more automated medical products may flourish to serve a bigger role in healthcare.
Keywords: Human-machine interaction, Chatbot, Medical Chatbot, Natural Language Processing, Natural Language Generat ion, Machine Learning, Bot.

I. INTRODUCTION

An AI automated medical chatbot is a system with human interaction using natural language processing (NLP) to provide medical aid. The information of the symptoms and the respective problem is available on the internet. We have to connect this medical database that allows the bot to provide accurate and systematic statistics based on the user's symptoms and health profile. Chatbots are used in domains like Customer Support and Services, Virtual Assistance, Online Trainers, and Online Reservations and also for general conversations. We built a diagnosis bot that engages patients and explains their state using natural language processing (NLP). The bot inquires for relevant particulars like - name, age, etc. and appeals for symptoms. Our medical bot can evaluate the user's symptoms based on machine learning (ML) algorithms and natural language processing (NLP) packages. The bot asks progressively more specific questions in order to chain up the symptoms and route to the actual problem.

The three primary components of our system are : recording the patient's medical record, accurate detection of the problem based on provided symptoms; from the medical database and providing with required aid, referring the patient to the most appropriate specialist based on severity of the problem.

Our motive is to show that the proposed medical chatbot could be a better alternative to reach out to on initial terms and this medical bot could be great help in the healthcare sector.

II. LITERATURE SURVEY

1) A systematic review of chatbots in healthcare (2019)

This review identified 25 studies that evaluated the effectiveness of chatbots in healthcare. The studies included chatbots that provided support for mental health, chronic disease management, and patient education. The authors concluded that chatbots can be effective in providing healthcare support, but further research is needed to evaluate their long-term impact.

2) A survey of chatbots for healthcare (2020):

This survey gathered data from 101 healthcare professionals to determine their perceptions of chatbots. The results showed that healthcare professionals were generally positive about chatbots, but had concerns about their accuracy and privacy issues.

3) A study of a chatbot for breast cancer screening (2021)

This study evaluated the effectiveness of a chatbot that provided information and support for breast cancer screening. The authors found that the chatbot was effective in increasing knowledge about breast cancer screening, and was well-received by users.

4) A study of a chatbot for mental health support (2021)

This study evaluated the effectiveness of a chatbot that provided mental health support to university students. The authors found that the chatbot was effective in reducing symptoms of anxiety and depression, and was well-received by users.

5) A review of chatbots for mental health (2021)

This review identified 20 studies that evaluated the effectiveness of chatbots for mental health support. The authors concluded that chatbots can be effective in providing mental health support, but more research is needed to determine the best approaches for different populations.

6) Design and Evaluation of a Conversational Agent to Facilitate the Self-Management of Chronic Pain (2019)

This study developed and evaluated a chatbot to help patients manage chronic pain. The chatbot used NLP to identify patient needs and provided personalized advice and support. The study found that the chatbot was effective in improving patient self-efficacy and reducing pain severity.

7) Design and Development of a Chatbot for the Management of Chronic Diseases (2020)

This study developed a chatbot to help patients manage chronic diseases, such as diabetes and hypertension. The chatbot used machine learning to identify patient needs and provided
personalized advice and support. The study found that the chatbot was effective in improving patient engagement and adherence to treatment.

8) The Effectiveness of Chatbots in Mental Health: A Systematic Review and Meta-Analysis (2020):

This systematic review and meta-analysis evaluated the effectiveness of chatbots in providing mental health support. The review included 13 studies and found that chatbots were effective in reducing symptoms of depression, anxiety, and stress. The study concluded that chatbots could be an effective and scalable tool for mental health support.

9) A Chatbot for the Early Detection of Alzheimer's Disease (2021):

This study developed a chatbot to screen for early signs of Alzheimer's disease. The chatbot used NLP to detect language patterns associated with Alzheimer's disease and provided personalized recommendations for further evaluation. The study found that the chatbot was effective in identifying patients with early signs of Alzheimer's disease.

10) Patient-Reported Outcomes Using a Chatbot for COVID-19 Symptoms: Prospective Cohort Study (2021):

This study evaluated the effectiveness of a chatbot for COVID-19 symptom monitoring. The chatbot used NLP to assess patient symptoms and provided personalized recommendations for further evaluation. The study found that the chatbot was effective in identifying patients with COVID-19 and in reducing the burden on healthcare providers.

III. METHODOLOGY

The healthcare chatbot that we designed is very intuitive and suggests users with basic home remedial medication for the corresponding health issue based on the given symptoms experienced by the user.

Initially the bot enquires whether the user is new or already enrolled. If the user is new then he/she should finish the task of creating a profile (creating an account) and don't worry our medical bot takes care of it by assisting you at every step. Once the user creates an account the bot prompts to login to their account. If the user has visited formerly then he/she just needs to login to their account by providing username and password. By this time, both the types of users are on the same pitch and now they can begin the conversation with the bot.

User should put forward the list of symptoms he/she is suffering from. After acquiring this data, the bot relates it with the type of disease and triggers the respective elementary medication in a heuristic manner.

Now if the user is cured with the advised remedies then it is fine, otherwise they can revisit the chatbot and based on the severity complex of the symptoms, the bot suggests either a medical cure or a visit to respective specialized doctors.

Using the SQL database, we store the diseases/health problems and their symptoms with respective natural medical remedies.

IV. PROPOSED SYSTEM

We proposed a medical chatbot that initializes on user call and guides the users throughout their questionnaire. Our motto is to attend to our users and provide them with all natural medical remedies that bring great relief and cures their problem to a great extent. Attending a doctor when ill is what everyone does, but some people may hesitate or just ignore which may sometimes end up in increasing the severity of the problem.

Thus, one can interact with our medical bot without any hesitation or the fear of having to pay a consultation fee and communicate their symptoms to get a respective solution.

The user has to provide their profile details initially to record their basic profile and health record. Further, the user can provide the bot with the symptoms they have been facing and query for medical aid at initial stages.

The symptom provision pattern is usually of the type :

<query>I am not feeling well</query>
<query>I am sick</query>
<query>I am feeling sick</query>
<query>I am having *</query>
<query>I am suffering from *</query>
<query>Tell me remedies for *</query>
<query>What medication should I take for *</query>
<query>Tell me the cure for *</query>

Based on the query, the bot internally breaks it down into tokens (words) and analyzes the meaning. Word tokenization, POS tagging, Sentence parsing, etc.. are the main aspects of NLP. Then comes NLU in which, intent classification and entity extraction play an important role in understanding these tokenized words and reply in-turn.

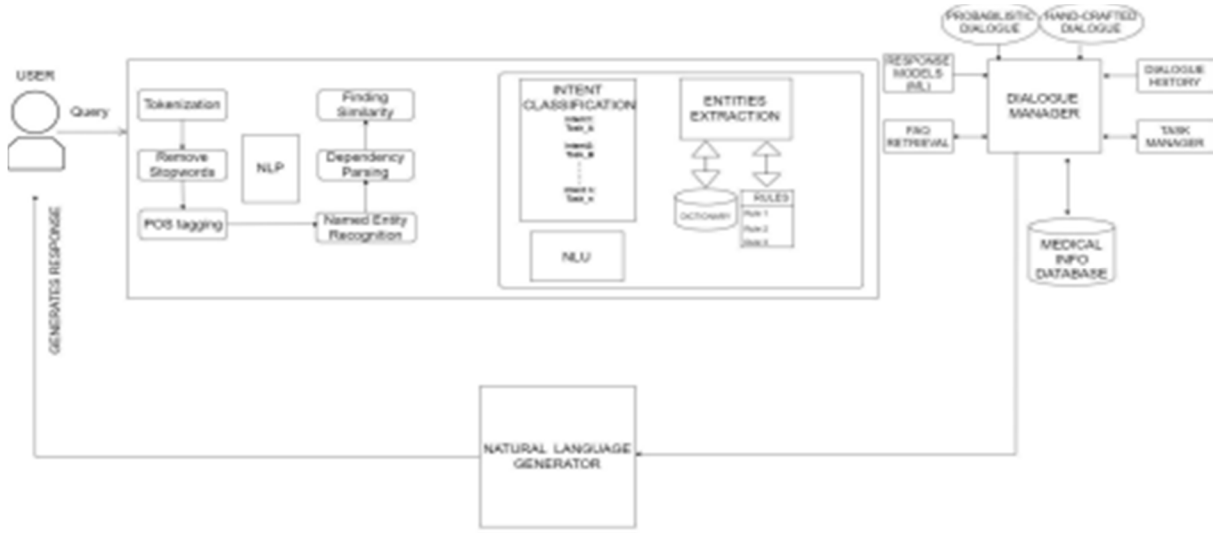

Fig 4.1 Query Processing within the Chatbot

The dialogue manager contains the respective ML models, dialogue history and it keeps up with the task manager in order to generate the appropriate response.

Our medical bot takes the user-provided symptoms and analyzes the query internally by going through the above processing and traces the problem with the help of a medical database that is our bot's backend base.

The NLG is a part of our medical bot's architecture as it is used to return or generate a response, with respect to the user's query. With the help of NLP and NLU, the bot can only break down the sentences and words to analyze the meaning and understand what task to perform. NLG performs the next major task which is, to generate a response or reply back with an appropriate solution statement for the user's query.

Our bot is trained to input the user's profile before going for the query-solution session. The user's profile includes - user's name, age, and some basic health details (height/weight (approx), bp/sugar/diabetes/thyroid related issue verification) as this will help us to keep up with the user's details and medical health record.

Further, the questionnaire session begins, where the user can query the bot on symptoms he/she has been facing, the bot then checks for the problem and its medical remedies one can follow for self-diagnose. Based on the severity complex of the problem, the bot can also suggest a visit to the doctor.

The aid we are trying to provide to the patients via the bot is a natural medical remedy that can lead to a speedy recovery in initial stages. Hence, we intended to provide our bot with a natural medical database connectivity, that has natural remedies for health problems instead of allopathic medicines.

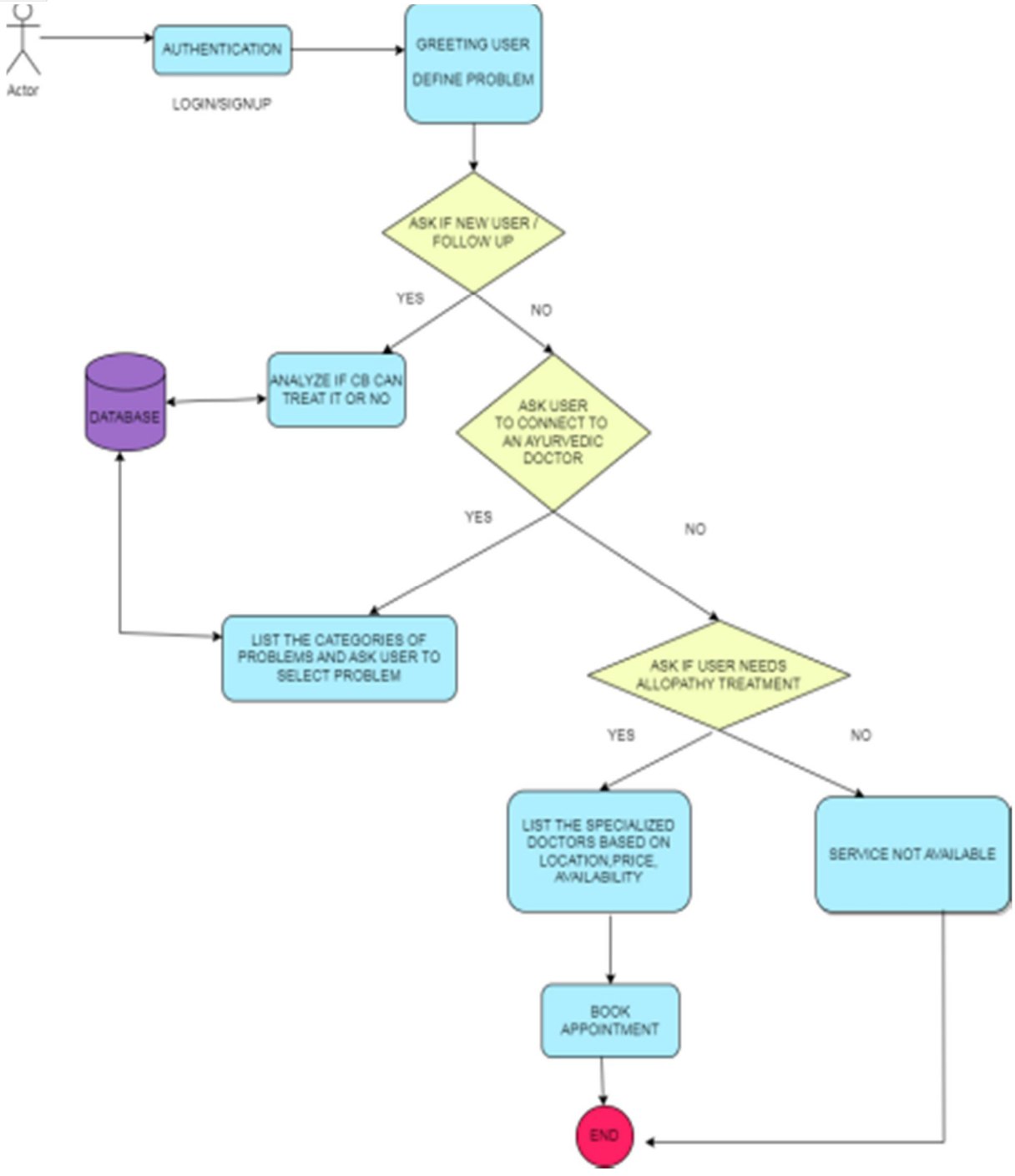

Fig 4.2 Interface Design

V. FUTURE DEVELOPMENTS

We have to work on connecting with hospitals so that we can avail doctor services to patients based on the severity of their problem. The user can only interact with the bot by telling his/her symptoms and get back accurate analysis of their problem and the respective medical aid to be taken as of now. So, we have to work on bringing together the hospitals available nearby and suggest the specialized doctors. The bot should also be developed such that it learns the patient's problem severity and suggests the doctors based on the user's preference (filters applied : area, distance, cost, ambience, reviews) and if the user wants to book an appointment, the bot should be programmed to look for the slots available to catch an appointment with the respective physician. Thus, we have to connect to hospitals and their databases in order to achieve this task.

VI. CONCLUSION

While the industry is already flooded with various healthcare chatbots, we still see a reluctance towards experimentation with more evolved use cases. This is partly because Conversational AI is still evolving and has a long way to go.

As natural language understanding and artificial intelligence technologies evolve, we will see the emergence of more sophisticated healthcare chatbot solutions.

Healthcare chatbots will require a fine balance between human empathy and machine intelligence to develop chatbot solutions that can address today's healthcare challenges.

Thus, our chatbot will be of a greater use to patient's as it is interactive, quick-responsive, and provides the user with required medical guidance.

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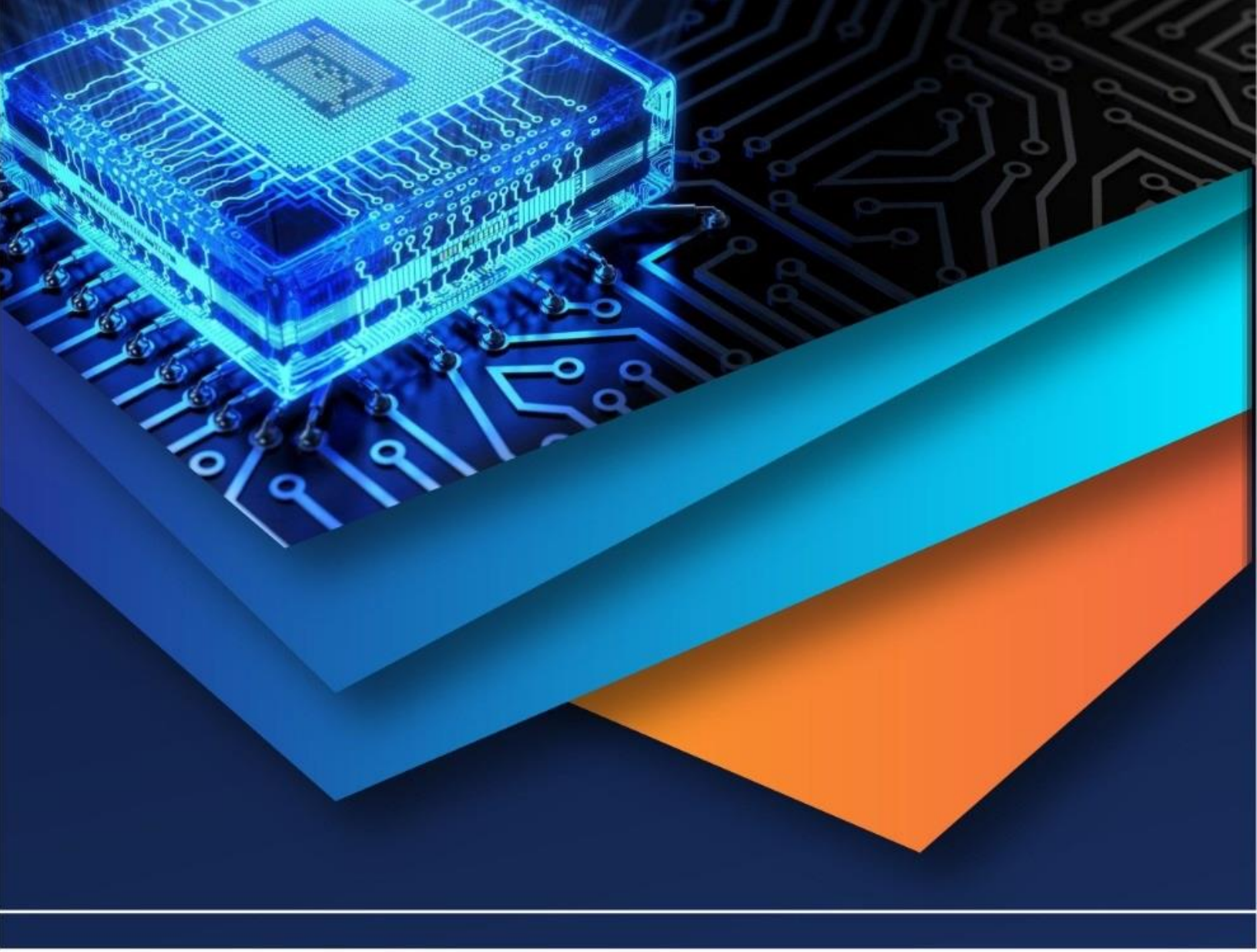

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