MediAI: An AI-Powered Chatbot for Enhancing Healthcare Systems

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Abstract: Health is the most necessary thing to live a healthy life, but it is also very hard to get a consultation with any doctor when some health, related issues appear. The present idea proposed is to prepare a medical chatbot application using artificial intelligence that shall diagnose diseases and provide any basic details of the particular disease so that a consulting doctor might be consulted then. The medical chatbot is built to reduce the healthcare costs and improve access to medical knowledge. Some of the chatbots are acting as medical reference books, which help the patient know more about their disease and helps improve their health. The user can achieve the real benefit of a chatbot only when it can diagnose all kinds of diseases and provide necessary information. A text-to-text diagnosis bot engages patients in conversation about their medical issues and provides personalized assistance. It gives a diagnosis of their symptoms. Thus, the people will be given an idea of their health and proper protection.
Keywords: Artificial Intelligence, Pattern Matching, Disease Prediction, Symptom Diagnosis, Natural Language Processing, Chatbot.

1. INTRODUCTION

Needless to say, many people are still not able to access healthcare in time because of various barriers like exorbitant consultation fees, long waiting lists, and geographic unavailability. In recent years, technology-based strategies are surfacing as solutions for these ongoing problems. Among them, medical chatbots have been promising in enhancing the accessibility and affordability of healthcare by serving as initial digital assistants.

The current work suggests the creation of a medical chatbot based on AI that communicates with users in the form of text-based interaction, where users can explain their symptoms in natural language. This type of interaction makes early and individualized pre-diagnosis possible, enabling users to be provided with initial information regarding their health situation prior to visiting a medical expert. This system connects the dots between healthcare professionals and patients, particularly in poor communities, by cutting down on avoidable trips to hospitals and making medical care for worse cases more efficient.

While extensively deployed elsewhere, AI in the healthcare industry is progressing. The chatbot uses pattern recognition and natural language processing (NLP) algorithms to recognize and understand user symptoms. Depending on the information provided, it suggests the most probable disease and offers corresponding next steps. In situations where serious symptoms are identified, the chatbot advises seeking a specialist's opinion and can also recommend healthcare professionals based on the user's preference or geographical location.

Most of the current chatbot implementations in the healthcare space, including Your.MD and Babylon, provide narrow scope and limited interaction models. Such platforms depend more on pre-defined system-initiated queries, which may limit user interaction and decrease diagnostic accuracy. The proposed chatbot fills this gap by providing natural language inputs and a more personalized and dynamic conversation model. It reaches out to users with minimal or no medical knowledge or technical skills, therefore extending its application.

Here, also mentioned is that datasets like MNIST, even though intended for digit classification, have traditionally served to standardize the evaluation of models in AI work. Its format and class definitions permit efficient training and benchmarking. Likewise, the format-designed disease-symptom dataset of the chatbot makes possible consistent and reliable prediction within the program.

In short, this medical chatbot based on AI is not only meant to offer real-time answers to health questions but to create interaction between patients and healthcare systems as well. It hopes to assist people in making more informed decisions regarding when to consult a professional, thus giving a boost to early diagnosis, patient empowerment, and more efficient healthcare.

1.1. Main Contributions

In this paper, the design and implementation of chatbot are introduced with emphasis on its innovative aspects, such as a finite-state conversation model, personalized symptom tracking, and referral to a geolocation-based referral system. The system responds to the necessity for better diagnostic tools that are both user-friendly and medically pertinent. In contrast with previous chatbot systems being narrow in domain and versatility, MediAI

is a scalable framework that can be upgraded with more medical data, voice conversation functionality, and multiple languages in the future.

1.2. Organization of paper

The following sections of the paper provides a detailed review of existing work, current studies and comparative frameworks, describes the architecture and approach of the proposed system, such as symptom diagnosis, and referral logic, highlights the findings realized during system testing and evaluation, followed by discussion of limitations and conclude with conclusion and scope for future improvements.

2. LITERATURE SURVEY

The recent research areas into the development of medical chatbots are on artificial intelligence, natural language processing, and healthcare. Many systems and approaches have been proposed. However, the inclusion of AI in self-diagnosis medical chatbots is still under development. Of the existing literature, the following key contributions inform the development of the proposed medical chatbot:

Simon Hoermann et al. (2017) study was basically on the possibility of doing synchronous text-based mental health interventions. He demonstrated that online text-based therapy, such as individual chats, can be as effective as more traditional treatments. The study showed how helpful synchronous chat technology is for dealing with mental health, where patients interact with professionals in real time. A main conclusion reached with this study is that text-based communication is very effective for healthcare and, in fact, supports the hypothesis that medical chatbots could plausibly employ similar techniques in order to engage and remotely diagnose users. Although the study was conducted on mental health, the overall potential for more wide-ranging healthcare applications from these chat-based systems was underlined.

Saurav Kumar Mishra et al. (2017) study demonstrated a basic virtual chatbot that was related to a principles doctor diagnosing basic health problems. The developed NLP and pattern matching algorithms interpreted the inputs provided by users and gave them diagnoses. It is developed in Python with about 80% accuracy and some ambiguity in approximately 20% of the cases. The value of this research resides in its ability to point to the possibility of virtual doctor chatbots as a first contact line in the healthcare system. It indeed reveals some of the strengths of this system, such as handling basic health information and acting as a pre diagnostic tool, and at the same time, it presents challenges regarding accuracy and clarity of responses imperfections that the presented system is aimed at rectifying through more sophisticated AI and NLP methods.

Divya Madhu et al. (2017) proposed a system in which AI could predict diseases from the symptoms, return an equivocal list of possible treatments, and then analyse the patient's symptoms continuously for real-time feedback before the symptoms worsened. The strength of this model is its proactive approach toward health care, looking toward early detection and intervention. However, they also identified a number of challenges, including the elevated cost of research and implementation and regulatory challenges. This research is a very enlightening insight into the development of AI tools that would indicate early symptoms, potentially guiding the proposed chatbot to give appropriate interventions or refer to a specialist efficiently.

Doina Drăgulescu et al. (2015) described a medical prediction system, which describes that a system predicts possible health conditions on the basis of the analysis of data from patients and symptoms. That system uses AI algorithms to analyse input data, through which it identifies health risks. This is the approach with which the proposed medical chatbot corresponds because the chatbot is intended to predict health conditions on the basis of data regarding symptoms and give proper advice accordingly. It also emphasizes the importance of predictability in AI systems in healthcare. The infusion of AI in the suggested chatbot will enhance the predictive capabilities of the system highly and in the diagnosis of the most complicated medical problems.

Benilda Eleonor V. Comendador et al. (2015) Particularly, Comendador's Pharmabot is a chatbot, which helps users select paediatric medicines based on symptoms. It demonstrates really handy utility of AI chatbots for fast and efficient delivery of medical information. In particular, this chatbot assists in suggesting an over-the-counter medicine for children. Although Pharmabot caters exclusively to pharmaceuticals, it validates that the AI chatbots can be fine-tuned according to the specific requirements of healthcare services. In this respect, medical niches of chatbots are significant for purposes of niche solutions.

Gupta et al. (2021), a multilingual medical chatbot in Hindi, Bengali, English was presented that extends the accessibility to users who do not speak English. They applied BERT-derived features and transformer models to improve symptom classification performance. The system succeeded to understand better the user intention— notably in multiple dialects— which is relevant to the evolution of MediAI in the framework of mutlilingualism.

Nguyen et al. (2024) evaluated an AI-based chatbot trained on multilingual symptom datasets to improve access by minority populations. Their research demonstrated that the incorporation of localized language models into a chatbot NLP layer significantly improved patient engagement and diagnostic precision. This is consistent with the proposed system's expansion to a multilingual support in future versions.

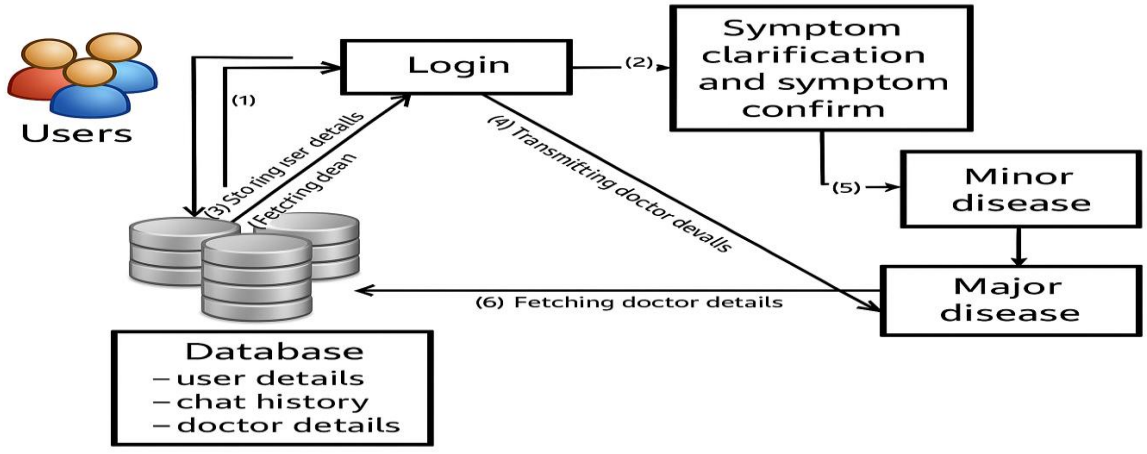

Figure 1: *Functional Architecture*

3. PROPOSED SYSTEM

This proposed system aims to work on self-diagnosis medical chatbots with AI. The chatbot directly communicates with the user to gather information about his problem through an interface in the form of a conversation and provides tentative diagnoses, which would help users in checking their health issues before consulting medical professionals. The main objective of this chatbot is to provide healthcare solutions at relatively less costs and to make medical knowledge accessible to all.

3.1. System Overview

The chatbot engages the user in a series of questions about the symptoms, elicits relevant medical information related to symptoms, and uses it to work out possible diagnoses. It then determines the condition as a minor disease or a major disease, and if diagnosed with a major disease, it recommends a healthcare provider or a specialist for further consultation. Major operations in the system include: Symptom Extraction, Symptom Mapping, Diagnosis, Specialist Referral (if needed).

3.2. Functional Architecture

The system consists of the following elements:

User Login: Users must log onto the system. Their login details are verified, and their session is initiated, which allows them to initiate a conversation with the chatbot.

Conversation Storage: The system saves a record of all the conversation in the database, so that it may later be referenced. This provides users with history from previous conversations and the system with the opportunity to capitalize on trends or make more pointed recommendations based on a history of entries.

Symptom Elucidation: The chatbot starts a set of diagnostic questions, and the user needs to input his or her symptoms in natural language. In this scenario, the system relies on the skills of NLP for extracting applicable symptoms from the input text.

Disease Classification: After all the above symptom clarification, the chatbot classifies the disease as either minor or major. When it is minor, the system suggests simple treatment recommendations or first aid. When it is major, the system suggests contacting a healthcare professional and leaves contact details.

3.3. Finite State Graph

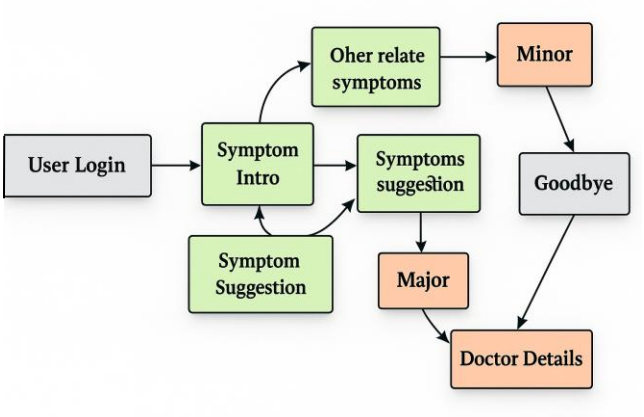

Figure 2: *Finite State Graph*

The design of the chatbot's dialogue is represented by using a finite state graph. This structure ensures smooth, step-by-step interaction with the user, and enables a properly ordered arrangement of inputs and outputs in the system. The principal phases the system contains in conversations are:

Presentation and Utente Identification: The system will ask the user to log in into the system using their email and password. This way, every session will be associated with a particular user profile.

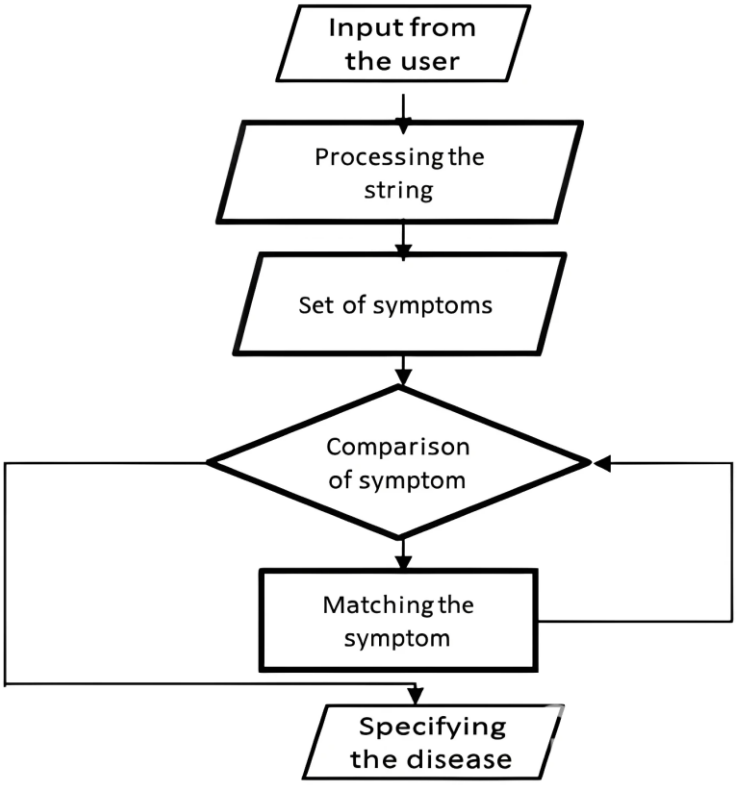

Figure 3: *Specifying the disease*

Acquisizione of Symptoms: The chatbot will ask the user to describe their symptoms. There is a cycle of states of extracting symptoms that will give the system enough information upon which to make a diagnosis.

Proof of symptoms: In a first collection of symptoms, the chatbot offers possible associated symptoms that the user could confirm. This will make the diagnosis more precise.

Diagnosis and follow-up: Following the validation of confirmed symptoms by the system, it continues with diagnosis. If critical, the chatbot shall refer to a specialist for the user. If otherwise, it provides general health counsel and asks the user to monitor the symptoms.

3.4. Validation By the User and Extraction of Symptoms

User Authentication: The bot ensures that only authenticated users can access the system. Users need to enter their login credentials which are an email and password checked against a database for verification purposes. It therefore binds every conversation as well as the medical history to the appropriate user.

Symptom Extraction: The key characteristic of this chatbot is its ability to comprehend user input about medical symptoms. The chatbot uses the string searching algorithms for keyword detection in an input that represent symptoms. It processes the direct and indirect symptom descriptions, and examples include: Direct input: "I am having a cough and fever." Indirect input: "I feel week and my throat is sore." The system identifies medical terms from user input, even when symptoms are described vaguely or non-specifically. For more complex sentences, it breaks down the input and identifies symptoms like "fever" or "sore throat" while ignoring irrelevant parts like "feel weak."

3.5. Mapping Extracted Symptoms with Datasets

After the system has extracted the symptoms, it then maps them to diseases using a trained dataset. This dataset consists of an exhaustive listing of all diseases and the corresponding symptoms. This process entails the following:

Symptom Matching: The chatbot creates a list of the closest matching symptoms by its dataset based on what the user inputted.

Confirmation of Symptoms: The system nudges the user by asking if indeed they are experiencing those symptoms. This dialogue further refines the shortlist of potential diseases. Assume a user is coughing. The potential symptomatic items which might be associated could be fever, difficulty in breathing, or sore throat. Depending upon what the user answers, it shortlists some possible diseases.

3.6. Disease Classification and Diagnosis

After determining the existence of the disease, the chatbot discovers which of the diseases may have the symptoms by comparing user symptoms to the documented ones in its database. It then categorizes it as belonging to one of two categories

Mild Disease: If the symptoms have not resulted in severity and might be deemed fatal, the system proposes simple medicines like rest, hydration, or medicine available over the counter.

Major Disease: If the symptoms are for a dangerous disease (pneumonia or diabetes, for instance), the bot provides the user with the advice to see a specialized medical professional. For that goal, it informs about available specialists depending on the user location or their preferences saved in the database. Diagnosis is an essential step to make sure the right advice reaches the user and informs him or her when to take further action. Because the system aims to reduce false alarms, it also encourages users to see the doctor if necessary.

3.7. Doctor Referral System

Another important feature of the chatbot is, in case a major disease is suspected, it refers the user to the doctor. It has a database of specialists. So, it can find a doctor for a user based on symptoms and location.

Specialist Matching: it cross-checks the disease detected against a list of the specialists, such as cardiologists, dermatologists, etc., so it suggests the most suitable healthcare provider. Geolocation: The application can be integrated with geolocation services to suggest specialists around the user's location so that the referral is both practical and accessible.

3.8. User History and Follow-Up

The interesting aspect of the chatbot is that it keeps a record of earlier conversations and symptoms, hence enabling access to health history. This provision will help the users monitor those symptoms or conditions that keep on repeating themselves and give the doctor more information should the user ever want to see a healthcare professional again.

Health History Storage: The system stores a history of all communications with the user, such as reported symptoms and concluded diagnoses. The historical record could possibly help users examine their health, related patterns and nudge them toward more rational choices.

Detection of Recurring Symptoms: If the system determines that the user is persistently reporting similar or identical symptoms in sessions, it can alert the user to further investigation or specific recommendations (results).

4. RESULTS AND DISCUSSIONS

4.1. Results

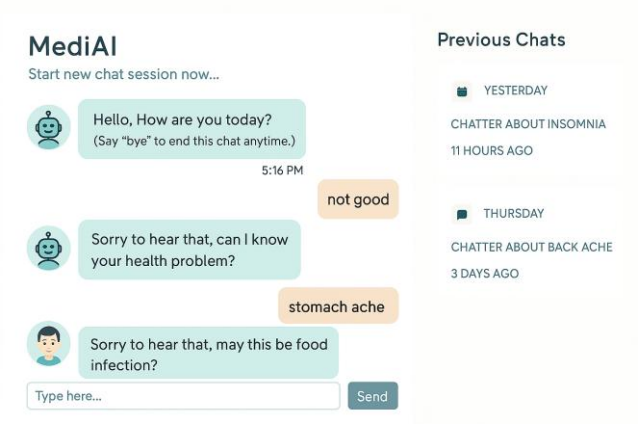

Figure 4: *Results Prediction*

The ways in which users could interact with the MediAI chatbot and how the chatbot accesses symptoms using natural language it also evaluated whether contributions were incorporated for preliminary results input and considerations Users were requested to report their medical history based on their own terms. It understood "I have had a fever and headache" and "I feel so weak and I can't focus," which can be perceived as vaguer or indirect references. It had been built through NLP systems and a string-matching logic willing to tear apart and decompose a wide array of input expressions and handle the mess of nested input data.

As the discussion continued, the chatbot approached user with more dialogues in order to verify other symptoms that may or may not be connected. This softens the input and smooths systemic output for added accuracy in disease prediction Full Year. Once the most likely disease is found, it classifies this as minor or major. In the case of minor would normally tell the patient to rest and insure fluids. But if the symptoms were severe, the user would be encouraged to see a doctor, which the chatbot would tell it while making the recommendation and citing others.

The system was potent enough to leave us the ability to see their chat history. It also served as a history or memory for your interaction with the chat bot and for you to refer to them and answer any subsequent questions. For example, if a candidate user reported tiredness and a cough more than once on different sessions, the system recorded it by prompting the user to act by taking an extra consultation.

Furthermore, on accuracy, the chatbot recommendations were appropriate and quite close to users' wishes in the majority of the conversations. Although it is by no means to be used to replace a medical professional, the

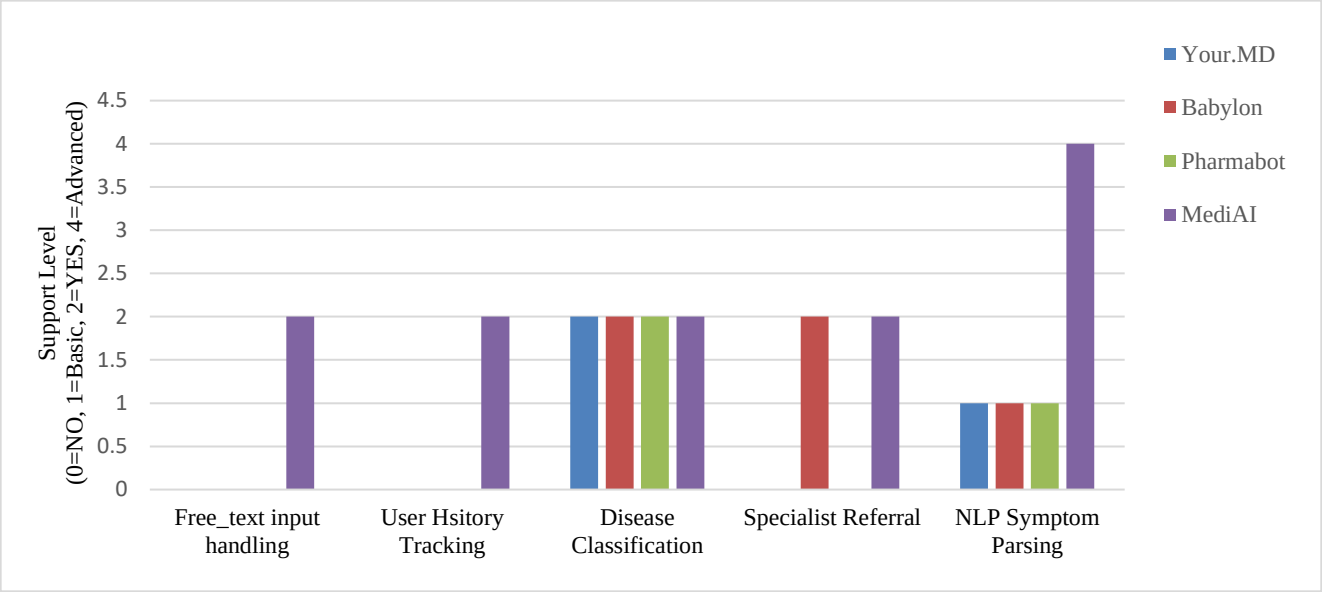

Figure 5: *Comparative Feature Support in Medical Chatbots*

tool came in handy as it was able to provide some insight into a user's state at first glance. It also helped decrease the dependence on going to see a doctor right away with small symptoms and instructed the user when to consult a health professional.

The figure 4 shows how user text with the chatbot and the accurate result will be shown to the user at the end of symptom clarification. Then the user can view their previous chat to know what they have discussed earlier.

Table 1 - *Comparison between existing systems and MediAI*

	Your.MD	**Babylon**	**Pharmabot**	**MediAI**
Free text input handling	No	No	No	Yes
User History Tracking	No	No	No	Yes
Disease Classification	Yes	Yes	Yes	Yes
Specialist Referral	No	Yes	No	Yes
NLP Symptom Parsing	Basic	Basic	Basic	Advanced

4.2. Limitations

However, the current system merely relies on a pre-defined symptom-to-disease mapping dataset, so it cannot adapt to the more complex or variable medical cases. Nor does it yet take into account important data like the duration of a symptom, its intensity or its location in the body. These omissions may cause the chatbot to not understand ambiguous or general descriptions of a health issue at times. And it is not yet hooked up with electronic health records, which might otherwise help provide personalized and truer recommendations.

4.3. Conclusion

Medical diagnostic chatbots are a step towards inclusive and accessible health Artificial Intelligence coupled with Natural Language Processing enables the system to engage in meaningful conversations with the user, helping them identify their health problems through a set of symptoms. Its usefulness is, therefore, not just the early assessment of the severity of these states but also, after some time, checking how the user responded to them so that it can thus learn to make (more) accurate assessments. This approach may serve an important role in reducing inappropriate hospital utilization and encouraging appropriate medical advising when needed. Generally speaking, the chatbot serves as a discreet resource for citizens to enhance their health literacy and to take better-informed decisions on when they should have professional care.

4.4. Future Work

In the future, there are some further enchancements that can be added to the chatbot. For instance, the addition of voice interaction can assist those who have typing challenges or vision problem. In addition to the machine learning updates of course, the bot could also offer some more advanced symptom analysis to further suggest possibilities. Expanding the medical database to encompass more languages would make it more suitable for the diverse user base. In addition, real-time monitoring and active health control technology can be realized by integrating wearable health technology. Furthermore, if the system could be extended to support regulations, it would expand its use in clinical or telemedicine practice.

Such improvements would be intended to move the chatbot to being a full-fledged healthcare assistant.

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