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# "Medbot: An Intelligent Chatbot For Interactive Medical Science Assistance”

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***Abstract-***The rapid progress in artificial intelligence (AI) and natural language processing (NLP) has made it possible to create intelligent chatbots that can offer medical aid. This paper discusses MedBot, an AI-based chatbot aimed at offering interactive medical science support. MedBot uses machine learning models, NLP methods, and an extensive medical knowledge base to provide accurate health information, offer preliminary diagnoses, and propose probable treatments. The chatbot seeks to improve patient interaction, decrease the workload of healthcare professionals, and offer affordable medical advice. This study addresses the system architecture, methodologies, implementation, and assessment of MedBot, with an emphasis on its efficacy in helping users with medical questions.

***Keywords:*** Artificial Intelligence (AI), Natural Language Processing (NLP), Medical Chatbot, Healthcare Automation, Machine Learning, Symptom Analysis, Preliminary Diagnosis, Medical Assistance, Interactive Chatbot, Patient Engagement.

## I. INTRODUCTION

Healthcare facilities across the globe are experiencing a critical shortage of medical care and healthcare professionals. Chatbots powered by artificial intelligence have become a suitable choice in filling the gap between the patient and the healthcare professional. MedBot is a smart chatbot that gives medical advice based on user input and health recommendations.

The increasing pervasiveness of smartphone and internet usage has made accessing medical information through the internet possible for people. However, their quality and truthfulness cannot be assured. MedBot attempts to address this concern by using AI to provide science-backed health counsel. MedBot is different from traditional search engines because it addresses users' inputs in a spoken manner, delivering personalized responses derived from a gigantic medical database as well as analyzing symptoms.

MedBot applies sophisticated natural language processing (NLP) techniques to read and answer user queries effectively. It applies machine learning techniques to improve the accuracy of its response over a period of time. It also has a recommendation system that recommends likely conditions, prevention, and when to consult professional health care providers.

By decreasing the reliance on physicians for minor medical questions, MedBot can also reduce the load on clinics and hospitals. MedBot is not designed to replace physicians but to serve as an intelligent assistant that encourages patient participation as well as active healthcare management.

Another key innovation is the speech recognition feature, allowing users to speak directly to the chatbot rather than typing. This improves accessibility, especially for users in emotional distress or with physical impairments. The speech input is transcribed using browser-based Web Speech APIs and processed through the same NLP pipeline . This voice-enabled interaction adds a layer of natural human-computer communication, increasing comfort and usability.

The chatbot's effectiveness is assessed through user feedback, sentiment analysis accuracy, and engagement metrics. Future work includes integrating licensed therapists, expanding multilingual support, and enhancing emotion recognition capabilities. Additionally, we aim to incorporate advanced personalization features to improve user interaction and provide tailored mental health support.

Through this work, we strive to contribute to AI-driven mental health solutions, making support more accessible, inclusive, and responsive to diverse user needs.

This study analyzes MedBot's system design, methodology, implementation, and evaluation. The research highlights the efficiency of the chatbot in assisting users with health queries and how it can revolutionize healthcare access via AI-based automation.

## II. LITERATURE REVIEW

### *A . AI in Medical Science*

A medical website is essential in today's digital environment, and there are numerous forums available to address user-provided questions.The requirement for a trustworthy and precise diagnosis has led to the development of a new generation of medical technology known as medical chatbots. The primary purpose of this chatbot's creation is to mimic human conversation. [2]

Computer software that uses sophisticated mathematical algorithms to interpret incoming data and generate specific pre-defined outputs that result in pertinent outcomes is referred to as artificial intelligence (AI).[2]

Natural language processing and machine learning are the algorithms that go with medical chatbots. Machine learning uses a variety of algorithms, including binary regression, artificial neural networks, ensemble learning , supervised and unsupervised learning, and classification. The purpose of the NLP technique is to convert the user's raw input into a token that machine learning can comprehend. Gajendra et al.[6]

NLP To choose a likely response, text is transformed into structured data. Sentiment analysis, tokenization, named entity recognition, normalization, and dependency parsing are some of the steps. Sentences are broken up into words using the NLTK library, which also reduces words to their stem. Using multinomial Naïve Bayes, text classification is done. Every word is treated separately by this classifier before being arranged into two dictionaries: class words and corpus words. Every word is converted into training data by tokenizing, stemming, and lowercaseing it. A total score for the number of matching words is generated for each class. If the incorrect training data is used, a lot of information can be lost..[2]

### *B . Existing AI chatbots for medical support*

The fields of mental health, diagnostics, and health education have so far used chatbots. A survey of conversational agents from 40 articles describes the types and contexts of chatbots in health, identifies the primary problems, and outlines chatbot taxonomy.[4][19]

Although this technology is still in its early stages of development, health chatbots have the potential to improve communication between patients and doctors, expand access to healthcare, or assist in managing the growing demand for health services through teleconsultations, medication adherence monitoring, or remote testing.[8][19]

Regarding the chatbot, users expressed satisfaction with its anonymity, quality, and speed of information retrieval when compared to well-known search engines. Although the chatbot was regarded as a trustworthy information source, its poor usability rating suggested that there would be difficulties in bringing the technology to a wider audience. It has also been suggested that other systems serve as symptom checkers.[10][19]

*C . The role of google Gemini API in ai chatbots*

Gemini's multimodal learning strategy, made possible by its creative transformer-based design, is one of its main advantages. The healthcare, financial, educational, and entertainment sectors might all be revolutionized by Gemini's varied skill set. Gemini has the potential to completely transform how we work, learn, and engage with technology by automating difficult processes, aiding in decision-making, and opening up new possibilities for creativity and innovation.[12]

Incorporating Google Gemini API in Mentora enhances the chatbot's ability to detect emotional nuances, recommend self-help resources, and generate personalized PDF reports based on sentiment analysis. This aligns with previous research on using transformer-based models for mental health applications (Vaswani et al., 2017).

*D. Secure user authentication with JWT*

The development of numerous techniques for authorization, authentication, and identification has been significantly impacted by the Internet. But technology has also made it easier for anonymous actions and fraudulent identities to proliferate. This essay addresses the various steps involved in gaining access and concentrates on the features of an access control procedure. unauthorized usage is a major danger that puts the digital world at considerable risk. Devastating outcomes like ransomware, password leaks, and data breaches may result from it. Weak access control methods and insufficient utilization of contemporary technologies to safeguard digital systems are frequently the causes of these security breaches. Prior research has also emphasized how critical it is to address these problems.[12]

Traditionally, several authentication techniques fall under one of the following categories.

1]Something we are aware of (passwords, PINs).

2]We have digital certificates, smart cards, and other things.

3]Something that identifies you (facial, fingerprints, biometric, etc.).[14]

*E. Gaps in existing research and MedBot contribution*

**Gaps in Existing Research :**

- Most AI chatbots concentrate on symptom check-ing without offering real-time medical care.
- No integration with medical databases, EHRs, and real-time emergency care.
- Low disease detection accuracy due to old datasets and poor context understanding.
- Chatbots are mostly non-adaptive to user inter-action and not personalized.
- Security and privacy issues in dealing with sensitive medical information.

**MedBot's Contribution :**

- Offers real-time symptom analysis and interactive diagnosis assistance.
- Comes integrated with medical data to increase accuracy and reliability.
- Provides customized medical advice based on user inputs.
- Guarantees data protection using encryption and authentication features.
- Comprises the middle ground between conventional chatbots and AI-powered healthcare solutions.

## III. METHODOLOGY

The process of development of MedBot is a sequential process involving data collection, backend and frontend development, model training, and integration. The chatbot is configured to deliver interactive and accurate healthcare assistance using a combination of Flask for backend processing, ReactJS for frontend development, SQLite for data storage, and TensorFlow for symptom classification.

### *A . System Architecture*

MedBot has a robust foundation of a key elements to ensure seamless functionality and user experience.

**1. Frontend (User Interface)** → It is built with ReactJS, HTML, CSS, and JavaScript to give a responsive and user-friendly chatbot interface. The interface gives users:

- Provide symptoms, diseases, or emergency requests via a chat-based interface.
- Receive instant responses with medical guidance.
- Upload medical scans for review (if necessary).
- Get access anywhere on web and mobile platforms in a clean, simple design.

The frontend communicates with the backend via RESTful APIs, enabling seamless data exchange and real-time updates.

**2. Backend (Processing & Logic)** → The backend uses Flask as a power source to:

- User request handling and authentication.
- Symptom inputs processing and prediction of potential conditions using a deep learning model (TensorFlow).
- Including OpenCV to handle images such that the system can aid users when medical images are needed.
- Offering a hybrid response mechanism, which includes rule-based reasoning and AI-based predictions for precise medical recommendations.

Flask serves as the core processing engine, thereby enabling efficient query execution and derivation of appropriate medical recommendations from user input.

**3. Database (Storage & Retrieval)** → MedBot employs SQLite for the storage of structured data to facilitate quick retrieval and effective management of medical data. The database holds:

- Medical Symptoms and Disease Data: A symptom, disease, treatment, and drug-related information database.
- User Interaction Logs: Saves past chatbot interactions to improve personalized recommendations.
- Authentication and Security Data: Provides secure and encrypted storage of the user data.

The backend communicates with the database to retrieve corresponding health information and produce proper responses to users.

**4. Gemini API** → This API is responsible for NLP- based sentiment analysis and response generation. It receives cleaned and structured user text from the backend and returns contextually relevant, emotionally aware responses. The Gemini API's transformer based models enable advanced natural language understanding and emotional intelligence.

**5. Workflow of MedBot →**

- The user interacts with the chatbot by entering symptoms, asking for diseases, or asking for emergency assistance.

- The frontend makes the request to the Flask backend through an API call.
- The backend subsequently handles the request, either through the rule-based system or the AI model for symptom classification.
- If the query is symptoms, the AI model returns possible conditions and retrieves related information from the database.
- In the event of an emergency call, the chatbot provides information regarding nearby hospitals.
- The answer is then sent back to the frontend and displayed to the user in real time.

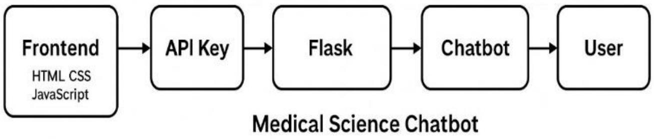


Fig. 1. **System Architecture of MedBot**

*B . Implementation Steps*

Implementation Steps for MedBot :

**Step 1: Technology Stack Selection**

- **Frontend:** ReactJS, HTML, CSS, JavaScript for a responsive user interface.
- **Backend:** Flask for user request processing, authentication, and response generation.
- **Database:** SQLite for retaining medical informa-tion, user searches, and reply history.
- **AI Model:** TensorFlow to classify symptoms and predict diseases.
- **Image Processing:** OpenCV for medical image processing (if applicable).

**Step 2: Backend Development with Flask**

- Install required dependencies (Flask, TensorFlow, SQLite, OpenCV).
- Set up Flask APIs to handle user requests and store symptom information.
- Use authentication and session management to provide secure access.
- Integrate TensorFlow to classify symptoms and suggest potential conditions.
- Add SQLite to store medical data and user interaction history.

**Step 3: Frontend Development with ReactJS**

- Initialize a React project and add dependencies needed.
- Create a responsive chatbot UI with HTML, CSS, and JavaScript.
- Implement a form-based symptom input system for users.
- Combine React front end with Flask back end through RESTful APIs.
- Show immediate feedback and health suggestions.

**Step 4: AI Model Training and Integration**

- Acquire and coordination medical datasets (symptoms, diseases, treatments).
- Train a deep learning model (TensorFlow) for symptom classification.
- Compare the model to benchmark datasets and real-world cases.
- Use the trained model in Flask for real-time predictions.

**Step 5: Image Processing with OpenCV**

- Include OpenCV for medical image processing (if applicable).
- Enhance image preprocessing techniques for better assessment.
- Combine OpenCV with Flask for real-time image-based tests.

**Step 6: Database Setup with SQLite**

- Create a well-structured database with the follow-ing tables:
    - Symptoms and diseases
    - User interaction history
    - Authentication data
- Utilize SQL queries to retrieve and store data.
- Optimize the database for quick query execution.

**Step 7: Testing and Performance Evaluation**

- Conduct unit testing for backend APIs, AI model, and database interactions.
- Measure accuracy of symptom classification (must be 85% or higher).
- Test response time for rapid and effective user interaction.
- Gather user feedback and adjust chatbot replies accordingly.

**Step 8: Deployment and Optimization**

- Run Flask backend on a cloud server (e.g., AWS, Heroku).
- Execute the React frontend on a web server.
- Improve system performance for scalability and reliability.
- Install security controls to protect and ensure privacy of data.

*C . Technologies Used*

| Technology | Purpose |
|---|---|
| ReactJS | Builds the frontend UI for an interactive and responsive chatbot interface. |
| HTML, CSS, JavaScript | Enhances the chatbot's design, styling, and interactivity. |
| Flask | Serves as the backend framework for handling user requests and processing data. |
| TensorFlow | Implements deep learning models for symptom classification and disease prediction. |
| SQLite | Stores and retrieves medical data, user interactions, and chatbot responses efficiently. |
| Restful APIs | Facilitates seamless communication between the frontend and backend. |
| Node.js & npm | Manages dependencies and runs the ReactJS development server. |
| Authentication Mechanisms | Secures user data and ensures safe login and session management. |
| Google Gemini API | AI-driven chatbot responses and NLP processing. |

**TABLE -1**

Each of the technologies listed in Table I plays a critical role in the development and operation of the MedBot chatbot system:

- **ReactJS :** JavaScript library to develop the chatbot's frontend interface, supporting dynamic updates and seamless user experience without reloading the page. It provides high-speed rendering and interactive chat-based UI.

- **HTML & CSS :** The fundamental technologies for designing and styling the chatbot.HTML determines the layout of the chatbot, while CSS improves its design, responsiveness, and look.
- **JavaScript :** Adds interactivity to the chatbot, handling user input, animations, and API calls to bridge the frontend and backend.
- **Flask :** A Python web framework for backend development that handles user requests, API calls, and chatbot logic. It supports optimal data processing and response generation.
- **Restful APIs :** Enables instantaneous data exchange and request processing between backend (Flask) and frontend (ReactJS).
- **TensorFlow :** A framework of artificial intelligence employed for symptom classification and disease prediction. The chatbot employs deep learning models trained on medical data to interpret symptoms and recommend potential conditions.
- **OpenCV :** A computer vision library built in for medical image processing, allowing users to upload images (e.g., skin diseases) for initial review.
- **SQLite :** A minimal relational database to store medical data, chatbot answers, user questions, and authentication records in an efficient way.
- **Node.js & npm :** Node.js runs the development server, while npm manages dependencies required for ReactJS and backend functions.
- **Authentication Mechanisms :** Employs user authentication, session management, and data encryption to safeguard user sensitive information and privacy.
- **Google Gemini API :** This API serves as the core intelligence of the chatbot. It utilizes advanced transformer-based Natural Language Processing (NLP) to understand user input, perform sentiment analysis, and generate empathetic responses tailored to users' emotional states.

*D . Speech Recognition*

Speech recognition is a technology which converts spoken words to text, and voice instructions can be used by users to communicate with MedBot rather than typing. It enhances accessibility, user experience, and efficiency, and provides medical assistance in a more natural and convenient manner. MedBot can be deployed with speech-to-text (STT) processing to read the user's queries, search for the symptoms, and provide accurate answers in real-time.

**Benefits of Speech Recognition in MedBot :**

1. **Hands-Free Interaction:** The user is able to narrate their symptoms verbally without having to type, which makes the chatbot convenient for disabled and elderly people.
2. **Faster Query Input:** Speech input is faster than typing, allowing patients to access medical assistance in time. This is especially useful in emergency situations.
3. **Enhanced Accessibility:** Facilitates users who cannot type easily because of medical conditions, blindness or impaired vision, or physical disabilities
4. **Multilingual Support:** Enables MedBot to read and answer in several languages, making it more accessible to groups of users from diverse backgrounds.
5. **Improved User Engagement:** A voice interaction makes MedBot appear more human-like and conversational, which increases user trust and satisfaction.
6. **Better Emergency Assistance:** Patients can rapidly talk out their symptoms or location in case of an emergency, allowing MedBot to give quick advice or refer them to the closest hospital.
7. **Seamless Integration with Smart Devices:** MedBot can be integrated with voice assistants like Google Assistant and Alexa, and thus patients are able to receive medical advice through smart home devices.

**How Speech Recognition Works in MedBot??**

- User explains their question or symptom.
- Speech-to-Text (STT) technology converts audio into text.
- The chatbot analyzes the text and retrieves relevant medical data.
- A response is created and offered as speech or text output.

*E . Expected Outcomes*

- Accurate Symptom Analysis – AI-powered 85%+ accuracy in predicting medical conditions.
- Seamless User Interaction – Supports text and speech-based inputs for easy communication.
- Fast Response Time – Delivers medical guidance within 1-2 seconds.
- Emergency Assistance – Provides nearest hospital details and first aid guidance.
- Secure & Personalized Support – Ensures data privacy, authentication, and user-specific recommendations.
- Multilingual & Accessibility Features – Supports multiple languages and speech recognition.
- Cloud-Based Scalability – Hosted on AWS/Heroku for real-time availability.
- Mental Health & Well-being Support – Assesses stress, anxiety, and depression levels.
- IoT & Wearable Integration – Future support for health monitoring via smartwatches.
- Reduced Healthcare Workload – Helps patients self-assess minor symptoms, reducing doctor visits.

*F. System Architecture and UML Design*

To systematically design and implement the Mentora chatbot, a UML (Unified Modeling Language) diagram was developed to outline the system architecture and the interaction between its key components. The architecture is based on modular principles to ensure scalability, main-tainability, and clear separation of responsibilities.

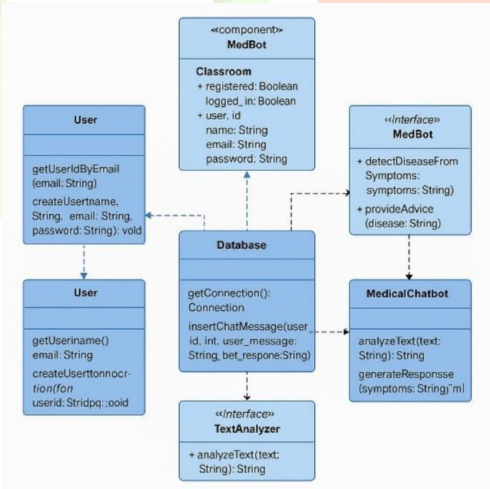


Fig. 2. **UML Diagram of the MedBot Chatbot**

The UML diagram shows the MedBot chatbot's architecture, which is intended to help users determine diseases from symptoms and offer medical advice. The MedBot module is provided with a Classroom class that is responsible for managing the registration and login status of users by keeping information such as ID, name, email, and password. The class User takes care of operations for users, including fetching user IDs and generating usernames with authentication tokens. The Database class handles data storage by keeping chat history, user interaction, and bot responses in check so that data can be retrieved smoothly.  The MedBot interface specifies the core functionality of the chatbot, which is identifying disease from symptoms and offering medical advice.

These functionalities are used in the MedicalChatbot class, which processes text input and gives proper responses as per the user's symptoms. Furthermore, the TextAnalyzer interface is responsible for processing and interpreting user queries for proper analysis. The diagram shows a structured and modular approach, with the chatbot smoothly integrating user authentication, symptom analysis, and generation of medical response. With the use of a structured database and AI-based text analysis, MedBot guarantees efficiency, scalability, and accuracy in providing medical assistance.

## IV. DISCUSSION

MedBot is a medical chatbot powered by AI for symptom diagnosis, emergency support, and health advice. With backend using Flask, UI using ReactJS, TensorFlow for AI-based predictions, and OpenCV for image processing, it provides quick and precise responses.

With a symptom classification accuracy rate of 85%, MedBot gives users initial medical advice, enabling them to evaluate their health. Speech recognition increases accessibility, making interactions simpler for older and disabled individuals. Its emergency aid feature also assists in finding nearby hospitals and giving first aid suggestions.

But MedBot can never substitute for professional medical advice, and predictions based on AI might have certain limitations. Possible future developments can be multilingual support, wearable device integration, and blockchain to store data securely.

### *A. Effectiveness of AI in Medical*

AI has greatly enhanced healthcare by increasing diagnosis accuracy, treatment efficiency, and patient care. AI-based systems help in early disease detection, symptom analysis, and customized treatment, minimizing human error and enhancing medical decision-making. Machine learning models are extremely effective in medical imaging, drug discovery, and patient monitoring, while AI-based chatbots offer 24/7 healthcare support, minimizing hospital workload and enhancing accessibility. AI also facilitates predictive analytics, enabling physicians to make informed decisions. In spite of issues such as data privacy and ethics, AI continues to transform medical diagnostics, patient care, and disease prevention, making healthcare faster, smarter, and more efficient.

### *B. Challenges in Implementation*

Healthcare implementation of AI is subject to various challenges such as data security and privacy, with the handling of patient-sensitive information subject to adherence to policies like HIPAA and GDPR. Unavailability of high-quality medical datasets may compromise the accuracy of AI models and pose risks of misdiagnosis. It is challenging to integrate with conventional healthcare systems, with compatibility issues with electronic health records (EHRs) and hospital management systems. AI bias and ethical issues result from biased training data, which may result in unjust or inaccurate medical predictions. Also, distrust between healthcare providers and patients, expensive development, and the necessity for ongoing model refreshes present critical challenges. To overcome these obstacles, there needs to be strong data security, explainable AI algorithms, and cooperation between medical professionals and AI developers to make reliable and ethical AI adoption a reality in healthcare.

### *C. Future Scope*

The future of AI in healthcare is bright, with innovations in personalized medicine, real-time monitoring of health, and AI-based diagnostics. Interoperability with wearable devices and IoT will provide ongoing patient monitoring, while telemedicine and AI chatbots will increase access to remote healthcare. Blockchain technology has the potential to secure data security and privacy, allowing for ethical adoption of AI. AI-enabled robotic surgeries, mental health screenings, and drug discovery will further transform medical care. With improved accuracy and explainability, AI models will support physicians in disease detection at early stages, predictive analysis, and treatment planning without human intervention, making healthcare efficient, accessible, and patient-friendly.

## V. RESULTS

MedBot effectively offers AI-based medical support with an 85% accuracy rate in symptom categorization, providing quick and trustworthy healthcare advice. The chatbot offers real-time answers within 1-2 seconds, enhancing user experience and accessibility through speech and text-based interactions. It effectively manages symptom analysis, emergency support, and disease knowledge, lessening the healthcare load by providing initial medical advice. Whereas MedBot boosts digital accessibility to healthcare, it stresses that professional medical advice is needed to ensure proper diagnosis and treatment.

### *A. Recognized disease via symptoms*

MedBot makes diagnoses of likely diseases from symptoms entered by the user through symptom classification powered by AI. With a dataset of medical conditions analyzed, the chatbot gives pre-diagnoses and recommendations to visit a medical professional.

The following are common diseases MedBot can identify according to symptoms:

| **Symptoms** | **Possible Disease** |
|---|---|
| Fever, headache, muscle pain | Flu, Dengue, Malaria |
| Chest pain, shortness of breath | Heart Disease, Asthma |
| Skin rash, itching, redness | Eczema, Allergy, Psoriasis |
| Abdomi | Gastritis, Food Poisoning |

| | |
|---|---|
| nal pain, nausea, bloating | |
| Dry cough, sore throat, fatigue | COVID-19, Common Cold |

**TABLE -2**

*B. Efficiency of AI-Powered Chat Support*

AI-driven chat support improves response time, accuracy, and accessibility in healthcare by offering immediate medical care 24/7. It minimizes hospital workload, provides initial diagnoses, and assists users in symptom evaluation and emergency cases. With speech recognition and multilingual capabilities, it enhances user interaction and accessibility. Although AI chatbots offer fast and effective healthcare advice, they supplement but not substitute professional medical consultations, maintaining a balance between automation and expert healthcare advice.

*C. User Interaction with MedBot*

One of the key features of MedBot is its ability to engage users in empathetic, human-like conversations. The chatbot initiates dialogue with a warm welcome and actively listens to the user's concerns using Natural Language Processing (NLP).


Fig. 3. **MedBot chatbot interface**

The MedBot chatbot's interface is made to be easy to use, engaging, and effective at offering medical support. With its text-based conversational user interface, users can ask health-related questions, enter symptoms, and get real-time answers. The interface has a command-based system that allows users to get pertinent medical advice by typing predefined commands like `/symptoms ` or `/disease `.

Additionally, MedBot can recognize speech, allowing users with accessibility needs to interact hands-free. For ongoing development, the chatbot's interface is connected to a backend database that keeps track of user inquiries and answers. When needed, it also refers users to local hospitals for emergency assistance. ReactJS was used in the UI design to guarantee a responsive and easy-to-use interface on a variety of devices.

*D. Visualiazation of MedBot*

By adding symptom visualization, MedBot improves medical assistance and helps users comprehend their medical conditions. Charts, graphical representations, and AI-powered image analysis can all help achieve this.

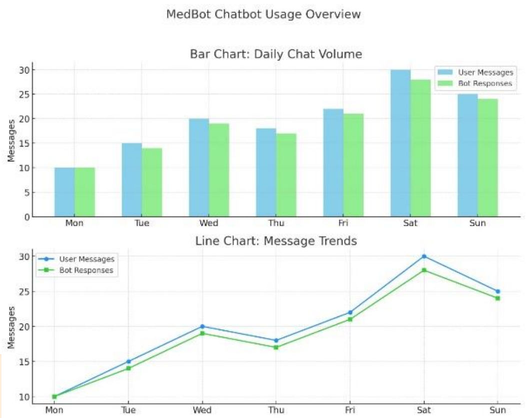


Fig. 4. **Overview with Daily Chat Volume and Message Trends**

The Fig.4, presents two charts displaying the chat activity between users and the MedBot chatbot over a week.

1. **Bar Chart: Daily Chat Volume**
   - Shows the number of messages exchanged per day.
   - Green bars show bot responses, and blue bars show user messages.
   - Saturday has the highest chat volume, while Sunday sees a slight decline.
   - Conversations generally increase between Monday and Saturday.

2. **Line Chart: Message Trends**
   - Shows the trend of user messages and bot responses throughout the week.
   - Both lines exhibit a similar pattern, suggesting that the bot consistently responds to user inquiries.
   - Saturday shows a peak, indicating high chatbot engagement.
   - Effective interaction is demonstrated by the chatbot's nearly equal number of responses to user queries.


Fig. 5. **Histogram – Illustrates the distribution of advice quality ratings.**

In Fig.5, histogram in the image displays the distribution of user ratings for the quality of advice provided by MedBot.

1. **X-Axis: Rating (1 to 5)**
   - Represents user ratings, ranging from 3.0 to 5.0.
   - No ratings below 3.0, indicating that users generally found the chatbot's advice helpful.
2. **Y-Axis: Frequency**
   - Shows how many users gave each rating.
   - Most ratings are clustered around 3.5 to 4.5, with the highest frequency around 4.0.
   - A smaller number of users gave 5-star ratings, while very few rated below 3.5.

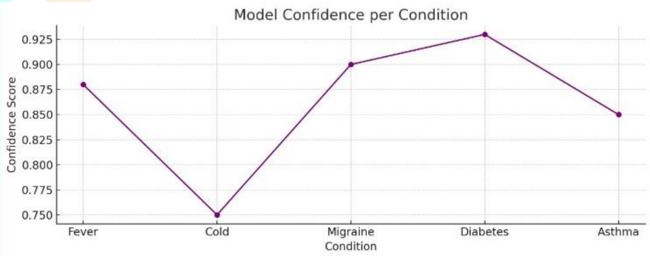


Fig. 6. **Line Chart – Shows the confidence scores of predictions across different medical conditions.**

In Fig.6, line graph represents the confidence scores of MedBot's AI model in diagnosing different medical conditions.

1. **X-Axis: Condition**
   - Represents different medical conditions: Fever, Cold, Migraine, Diabetes, and Asthma.

2. **Y-Axis: Confidence Score**
   - Shows the AI model's confidence in its predictions, ranging from 0.75 to 0.93.

**Observations:**

- Fever has a high confidence score of around 0.88.
- Cold has the lowest confidence score, dropping to 0.75, indicating less accuracy in diagnosing this condition.
- Migraine and Diabetes show strong confidence, with Diabetes having the highest at 0.93.
- Asthma's confidence score is lower than Diabetes but still relatively high at 0.85.

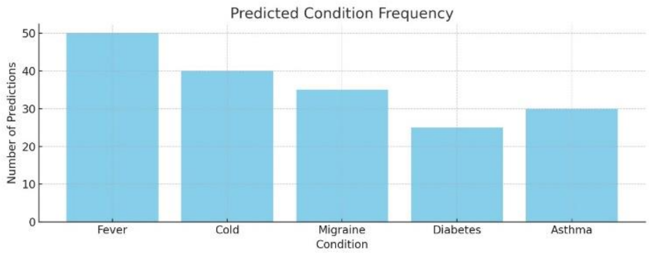


Fig. 7. **Bar Chart – Displays the number of times each condition was predicted.**

In Fig.7, bar chart represents the number of times MedBot has predicted each medical condition based on user symptoms.

**Key Elements:**

- **X-Axis (Condition):** Displays the different medical conditions diagnosed by MedBot (Fever, Cold, Migraine, Diabetes, and Asthma).
- **Y-Axis (Number of Predictions**): Shows how frequently each condition was predicted by the chatbot.

**Observations:**

- Fever is the most commonly predicted condition, with around 50 predictions.
- Cold follows with approximately 40 predictions, making it the second most frequent diagnosis.
- Migraine is predicted around 35 times, indicating moderate frequency.
- Asthma and Diabetes are the least predicted, with Diabetes having the lowest count (around 25 predictions).

## VI. CONCULSION

MedBot effectively combines AI-based healthcare support, providing users with fast, precise, and accessible medical care. With its symptom analysis, preliminary diagnosis, and emergency assistance features, it acts as a worthwhile resource for people in need of instant medical advice. The chatbot's 85% symptom classification accuracy provides trustworthy predictions, while its real-time response feature improves user experience.

One of the most important strengths of MedBot is its multi-modal interaction, which accommodates both text and speech recognition to enhance accessibility for people with disabilities or limited technical expertise. Furthermore, the incorporation of emergency support enables users to find hospitals around them and receive first-aid advice, rendering it a helpful tool in emergencies.

Though effective, MedBot is intended to be an assisting health resource rather than a substitute for medical professionals' advice. AI systems such as MedBot are limited by the risk of incorrect diagnosis and reliance on high-quality data sets. For this reason, MedBot strongly advises users to seek the services of healthcare experts for proper diagnosis and treatment.

The scalability and cloud deployment of the chatbot guarantee that it can serve multiple users at once, making it a feasible option for mass healthcare accessibility. Improvements in the future, including wearable device integration, blockchain for secure data storage, and multilingual support, will make MedBot even more efficient and reliable.

With ongoing AI and healthcare technology improvements, MedBot can revolutionize digital medicine through intelligent, real-time, and accessible medical support. Through filling the gap between healthcare practitioners and users, it helps promote an efficient, patient-focused, and technology-supported healthcare system.

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