MANAS: Appointment booking and mental health analysis chatbot

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***Abstract* – The integration of Artificial Intelligence (AI) into healthcare infrastructure is transforming service delivery, particularly in the domains of mental health support and administrative efficiency. This paper introduces *Manas*, an AI-powered Hospital Management System (HMS) designed to enhance both clinical and operational functions. Central to the system is an intelligent chatbot that leverages advanced natural language processing models, including DialogFlow and BERT, to conduct empathetic conversations, assess psychological conditions using standardized metrics such as the Depression, Anxiety, and Stress Scales (DASS), and provide actionable feedback for healthcare professionals. Beyond its mental health support capabilities, the system streamlines core hospital functions such as appointment scheduling, bed allocation, and medical inventory oversight. Key features include real-time tracking of doctor availability, prioritization of emergency bed assignments, and automated dissemination of healthcare information. By merging AI technologies with hospital administration, *Manas* delivers a contactless, efficient, and responsive healthcare experience aligned with the growing demand for intelligent medical systems.**

Keywords: Artificial Intelligence, Hospital Management System, Mental Health Chatbot, DialogFlow, BERT, DASS, Appointment Automation, Bed Allocation, Healthcare Informatics, Natural Language Processing.

I. INTRODUCTION

The increasing use of Artificial Intelligence (AI) is transforming how healthcare systems operate, offering smarter ways to improve both clinical care and hospital management. In particular, AI tools like Natural Language Processing (NLP) and chatbots are helping hospitals handle tasks more efficiently and support mental health care. With growing concerns around emotional well-being and the need for better hospital organization, there is a clear demand for solutions that can manage both effectively.

To meet this need, this paper presents *Manas: Appointment Booking and Mental Health Analysis Chatbot*, a modern Hospital Management System (HMS) that brings AI technology into day-to-day healthcare processes. Manas uses DialogFlow to handle conversations and BERT (Bidirectional Encoder Representations from Transformers) to understand user input more deeply. It allows patients to book appointments online, check real-time doctor availability, reserve beds, and access general healthcare information.

Beyond administrative tasks, Manas also includes a mental health analysis feature. The chatbot talks with users to assess their emotional state using standard tools like the Depression, Anxiety, and Stress Scales (DASS), giving early feedback and helping professionals take action when needed. The system can also tell the difference between emergency and regular bed needs, improving how hospital space is used. It includes a pharmaceutical management feature to keep track of medicine and supplies.

By combining basic hospital functions with AI-based mental health support, Manas creates a more complete, smart, and patient-friendly system. It reduces manual work, improves hospital flow, and helps identify mental health issues early, showing how AI can build healthcare tools that are not just efficient—but also caring.

II. LITERATURE REVIEW

A comprehensive review of recent literature was undertaken by exploring credible online journals and academic sources related to Hospital Management Systems (HMS) and AI-based mental health applications. The most relevant research works published within the past four years are summarized below:

[1] Mirko Casu, Sergio Triscari, Sebastiano Battiato, Luca Guarnera, and Pasquale Caponnetto
In their work titled *"AI Chatbots for Mental Health: A Scoping Review of Effectiveness, Feasibility, and Applications"*, the authors conduct an in-depth exploration of AI chatbot applications in mental health care. The review focuses on chatbots' effectiveness in addressing conditions like anxiety, depression, and substance abuse disorders. With advancements in Natural Language Processing (NLP) and Machine Learning (ML), these systems have evolved from basic rule-based bots to intelligent assistants capable of personalized user interaction. The study highlights the emergence of Cyber Health Psychology, which combines digital technology with psychological principles to support mental wellness, especially during the COVID-19 pandemic when remote care tools became essential.

[2] Reuben Crasto, Lance Dias, Dominic Miranda, and Deepali Kayande
The authors propose *"CareBot: A Mental Health ChatBot"*, an AI-driven solution aimed at helping students manage mental health concerns arising from academic stress, societal expectations, and stigma. This chatbot utilizes Transformer-based models and draws upon datasets such as PHQ-9 and WHO-5 to assess users' mental states. It further recommends micro-interventions like relaxation exercises and social interaction. Trained on mental health-related conversations and surveys, the chatbot fosters anonymous and supportive dialogue to reduce stress and anxiety.

[3] Ayush Bijouraa, Sritama Banerjeea, and Kirti Shekhar Pandeya
In their project, titled *"Chatbots for Appointment"*, the authors suggest building a multi-module web platform where chatbots handle appointments for doctors, salons, hostels, and academic admissions. The system employs pattern-matching techniques and an NLP-based chatbot that processes user queries and converts them into structured, actionable data. They propose the use of the Multinomial Naive Bayes algorithm for classifying input texts and selecting relevant responses.

[4] Eliane M. Boucher et al.
In the paper *"Artificially Intelligent Chatbots in Digital Mental Health Interventions: A Review"*, the authors evaluate a wide array of chatbot applications in the mental health domain. Their analysis covers aspects such as user engagement, interface usability, therapeutic relevance, and real-time feedback mechanisms. While the study acknowledges benefits like accessible and tailored support, it also points out limitations including inconsistent research methodologies, questions about long-term effectiveness, and ethical concerns surrounding data privacy and user safety.

III. SYSTEM ARCHITECHTURE

The proposed Hospital Management System (HMS) is built upon a modular architecture comprising three primary components: **User Authentication and Role Management**, **AI Chatbot Integration for Appointments and Mental Health Services**, and **Backend Operations with Calendar Synchronization**. Together, these components ensure a seamless, intelligent, and user-friendly hospital workflow.

A. User Authentication and Role Management

To maintain security and access control, a role-based authentication framework is implemented. The system recognizes four distinct user types: **Administrator, Doctor, Pharmacist, and Patient**, each with specific access privileges.

1. Registration and Access Control

1) **Administrators** are created exclusively through the backend using Django's createsuperuser command.
2) **Doctors and Pharmacists** are onboarded only by administrators through a secure dashboard interface.
3) **Patients** can self-register via the frontend through a protected sign-up form.

2. Role-Specific Access

1) Each role is provided with a dedicated user interface tailored to their functionalities.
2) **Patients** gain access to the integrated chatbot upon login.
3) **Administrators** have full access to the Django admin panel for managing records and system configurations.

B. Chatbot Integration for Appointments and Mental Health Support

The chatbot acts as the core AI element of the system, designed using **DialogFlow** and **BERT**. It handles two primary functions: **appointment scheduling** and **mental health assessment**.

1. Appointment Booking

1) Patients can interact with the chatbot to schedule, modify, or cancel appointments.
2) The chatbot collects essential details such as the department, date, and time.
3) Appointments are automatically synced with **Google Calendar**, ensuring real-time event creation and preventing scheduling conflicts.

2. Mental Health Evaluation

1) Using **Natural Language Processing (NLP)**, the chatbot initiates human-like conversations to assess emotional well-being.
2) DialogFlow handles the intent matching and conversation flow based on user inputs.
3) The underlying **BERT model** is trained using datasets like the **DASS questionnaire** and **CounselChat**, allowing the chatbot to provide an initial mental health screening before users are referred to professionals.

C. Backend Operations and Calendar Synchronization

Administrative control and scheduling are managed through a centralized backend interface, which facilitates efficient data management and appointment coordination.

1. Administrative Functions

1) Administrators can add and manage departments, staff members, and bed allocations.
2) Beds are categorized into general and emergency types, with built-in logic to prevent double-booking.
3) System hygiene is maintained through options like bulk deletion of outdated or inactive appointments.

2. Calendar Integration and Notifications

1) All confirmed appointments are synced with **Google Calendar**.
2) Before confirming a booking, the system validates availability to avoid scheduling overlaps.
3) Automated email or SMS notifications are triggered upon successful booking, update, or cancellation, enhancing communication with users.

IV. METHODOLOGY

A. Data Preparation

1. Intent-specific datasets were gathered and structured to train the chatbot using DialogFlow.
2. For mental health assessment, text data from the DASS (Depression, Anxiety, and Stress Scales) and CounselChat resources were preprocessed—cleaned, categorized, and labeled for BERT model training.
3. The cleaned data underwent tokenization and embedding conversion to make it compatible for fine-tuning language models.

B. Real-Time Chatbot Interaction

1. Authenticated users (patients) access the chatbot interface through the application dashboard.
2. DialogFlow processes user queries in real time, matching them with predefined intents related to appointments or emotional wellness.
3. On detecting a valid intent, the system dynamically generates a relevant response, guiding the user through the next steps.

C. AI Model Training

1. The BERT language model is adapted to interpret emotional and psychological inputs using structured mental health datasets.
2. Fine-tuning was performed using data from DASS and CounselChat to enhance sentiment classification accuracy.
3. The trained model was optimized using TensorFlow and deployed via TensorFlow.js for browser compatibility and seamless integration with DialogFlow.

D. Appointment Handling and Calendar Sync

1. When users request appointments, the chatbot collects preferred dates, times, and department choices.
2. The system validates availability by integrating with the Google Calendar API to prevent overlaps.

3. Patients can also update or cancel their bookings via conversational prompts within the chatbot.

E. Notifications and Usage Reporting

1. Confirmation messages and reminders are automatically dispatched via email after booking, rescheduling, or cancellation.
2. The admin interface provides tools to generate visual reports and usage summaries for appointments.
3. Interaction logs and appointment records are utilized to monitor user engagement and mental health trends.

V. DEVELOPMENT ENVIRONMENT

A. Programming Language and Framework:-
Python & Django – Python serves as the base programming language, with Django acting as the primary backend framework. Django is chosen for its modular structure, secure data management, and rapid development features. It handles core business logic, API interactions, and administrative operations across the platform.

B. Natural Language Processing and AI Models:-
Dialogflow – This tool powers the chatbot's conversation flow and intent recognition. It enables the system to understand and engage with users through natural language, supporting mental health interactions and appointment scheduling.
BERT – The Bidirectional Encoder Representations from Transformers (BERT) model is integrated for conducting sentiment analysis on user inputs. It allows the chatbot to interpret emotional cues and provide contextually relevant responses, especially for mental health-related queries.

C. Database Management
PostgreSQL – An enterprise-grade, open-source relational database used to store and manage structured data. It maintains user information, booking records, chat interactions, and administrative details with consistency, performance, and security.

D. Deployment and Cloud Services:-
Google Cloud Platform (GCP) – Chosen for hosting the application and managing its cloud infrastructure. GCP offers scalability, reliability, and built-in support for integrating services like Dialogflow and cloud-based data storage.

E. Authentication and Admin Management:-
Django Admin Panel – A built-in feature of Django used for backend content management. It gives administrators control over user accounts, appointment schedules, and departmental settings via a clean and secure interface.
Secure User Authentication – Leveraging Django's built-in authentication system to enforce role-based access for patients, doctors, pharmacists, and administrators, ensuring a safe and personalized user experience.

VI. CHALLENGES AND LIMITATIONS

1) Although BERT is a powerful language model, its emotional understanding is still limited to the quality and scope of the dataset it is trained on. Misinterpretation of user emotions may occur, especially in nuanced or culturally specific contexts.
2) The chatbot operates based on trained patterns and lacks real-time contextual understanding or memory of long conversations, which can hinder deep mental health assessments.
3) The system relies heavily on internet connectivity and external platforms like Dialogflow and Google Cloud. Any downtime in these services can affect functionality.
4) Handling sensitive medical and mental health data requires strict adherence to data protection protocols. Despite using secure frameworks, safeguarding patient privacy in deployment and storage remains a critical challenge.
5) The chatbot can provide basic support but is not a substitute for professional mental health care. Its responses should be seen as initial guidance, not final advice.

VII. EXPERIMENTAL RESULTS

A. *Performance Evaluation*

The system was tested for responsiveness, accuracy, and integration across multiple user roles—admin, doctor, and patient. The chatbot, powered by Dialogflow, demonstrated high intent recognition accuracy with minimal latency in real-time interactions. The BERT-based mental health analysis provided reliable emotional state assessments, indicating successful fine-tuning with relevant datasets. Integration with PostgreSQL and the Django backend ensured robust data handling and minimal query response times.

B. *Results*

Due to space constraints, it is not feasible to include all implementation screenshots in this paper. However, a selected set of key images has been included to provide a clear understanding of the project's core functionalities and system workflow.

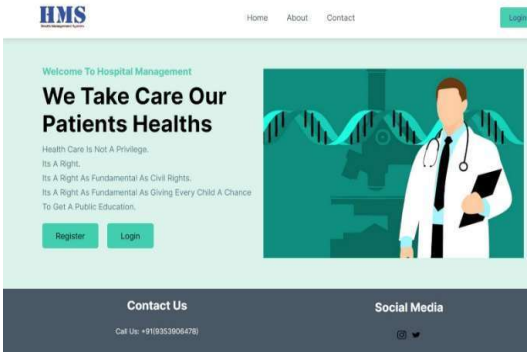

Fig 1 : Home page

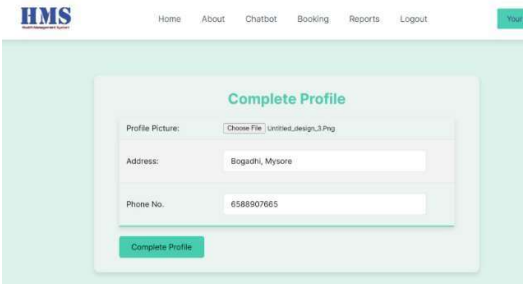

Fig 2 : Profile Form

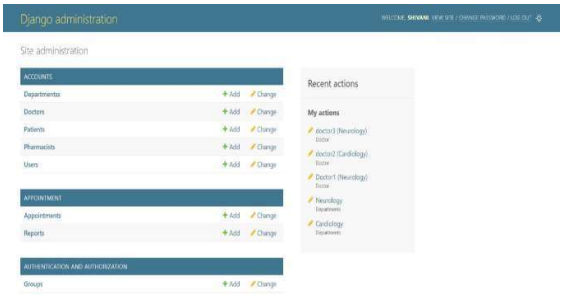

Fig 3: Django Admin Panel

Fig 4: All appointments and bookings list

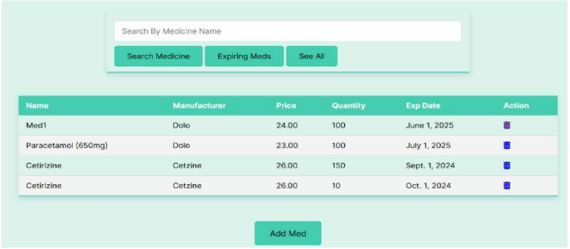

Fig 5: Pharmacy Module

Fig 6: Medical Report pdf

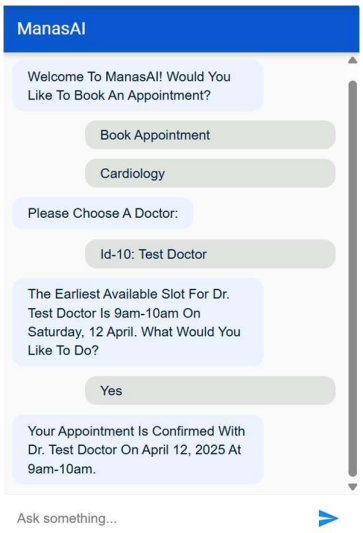

Fig 7: Chatbot Appointment Booking

Fig 8: Mental Health Chatbot

VIII. CONCLUSION

The proposed Hospital Management System, augmented with an AI-driven chatbot, offers a cohesive platform that not only enhances healthcare operational efficiency but also provides valuable support for mental health care. By leveraging Dialogflow for natural language processing and BERT for sentiment analysis, this system effectively integrates administrative functionalities with psychological support. Patients can effortlessly book appointments and receive timely assistance, while healthcare providers benefit from reduced administrative load and improved preliminary mental health evaluations.

The inclusion of datasets like CounselChat further enriches the chatbot's ability to deliver context-aware, empathetic responses, mimicking real-world mental health conversations. This integration promotes a more patient-centered approach to healthcare and lays the groundwork for scalable, digital healthcare solutions. As AI technology progresses, such systems have the potential to revolutionize traditional hospital workflows, expanding access to personalized, comprehensive care in both urban and remote locations.

IX. FUTURE SCOPE

While the existing system provides robust appointment scheduling and mental health analysis through chatbot interaction, several enhancements can be explored to expand its capabilities and effectiveness:

1. *Multilingual Chatbot Functionality:-* Incorporating support for multiple languages would make the system more inclusive, catering to patients from diverse linguistic backgrounds and improving accessibility across different regions.

2. *Enhanced Emotion Recognition* Future iterations may benefit from integrating advanced sentiment detection through multimodal inputs, such as vocal tone or facial expressions, to more accurately assess user emotions during conversations.

3. *Integration with Wearable Health Technology* Synchronizing the chatbot with data from wearable health devices (e.g., heart rate monitors, sleep trackers) can provide real-time physiological insights, offering deeper context for both mental and physical health assessments.

4. *Expanded and Diversified Training Data* Incorporating larger, more representative datasets in future model training will improve the chatbot's ability to understand varied mental health conditions and user demographics, thereby enhancing response accuracy.

5. *Predictive Mental Health Analytics* By analyzing interaction data over time, the system could identify patterns and proactively alert healthcare providers to emerging mental health trends, enabling early intervention and better long-term outcomes.

X. REFERENCES

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