AI BASED MODEL FOR HOSPITAL MANAGEMENT

A PROJECT REPORT

Submitted by

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Under the Guidance of

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ABSTRACT

This project serves as a virtual assistant which provides patients with valuable information. It helps patients by recommending suitable doctors based on their medical needs, offers details on hospital operating hours, and also informs them about the availability of specific doctors. Additionally, the LLM (Large Language Model) efficiently checks and communicates the doctors' schedules, allowing patients to make informed decisions about their appointments. By harnessing the power of natural language processing (NLP), this LLM ensures convenience, efficiency, and improved access to medical services.

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LIST OF SYMBOLS AND ABBREVIATIONS

1. NLP – Natural Language Processing
2. LLM – Large Language Model
3. DBMS – Database Management System
4. API – Application Programming Interface

CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

The healthcare industry is always changing and closely incorporates with technological breakthroughs, is going through a significant transition. This project – AI Based Model for Hospital Management System uses several technologies to achieve completion. The chatbot uses NLP (Natural Language Processing), an area of AI (Artificial Intelligence) which makes it possible for computers to understand and generate human-like interactions. It allows the computer to generate context and entities out of human conversations. It can identify several features of the text including the intents and the entities, while extracting the latter. Employing the powerful capabilities of NLP, the chatbot is designed, with the purpose of improving patient experience at hospitals. Additionally, LLM (Large Language Models) are used in the making of the chatbot, as they are particularly useful in understanding and generating human-like messages. Through the huge amounts of data they learnt, LLMs can understand patterns, allowing them to generate clear and relevant answers. They are versatile as they support a wide array of topics and writing styles, making them a good choice for implementing a chatbot due to the personalised responses they offer.

1.2 PROBLEM STATEMENT

The healthcare industry is facing intense pressure to optimize hospital management processes, enhance patient experiences, etc. Currently, there are a lot of problems in the healthcare industry. Moreover, COVID-19 has emphasized the need for good solutions that reduce in-person interactions while maintaining high-quality care. Thus, there is a need for the development of a Hospital Management Chatbot using an LLM, which is capable of improving the current patient experience.

1.3 OBJECTIVE

The primary objective of the chatbot is to improve patient experience and reduce administrative load to an extent. The chatbot has a user-friendly interface for patients, enabling them to access their doctor records and receive accurate health-related information. The goal is to empower patients to take control of their healthcare journey and help them better. The chatbot has developed advanced natural language processing (NLP) capabilities to enable the same to understand and respond effectively to a wide range of medical and non-medical queries. Also, the project uses PostgreSQL, a DBMS to store data.

1.4 REQUIREMENTS

1.4.1 SOFTWARE REQUIREMENTS

The machine must possess the following software requirements in order to use the chatbot without any issue:

- Windows 10 or higher
- Desktop/laptop with minimum specification having INTEL i5 processor
- Minimum RAM: 8 GB

1.4.2 GENERAL REQUIREMENTS

- Software resources like Visual Studio Code
- Hardware resources like GPU for training model
- Access to the model's API

1.4.3 FUNCTIONAL REQUIREMENTS

- The system should be able to recognise the intent.
- The system should understand the context of the user's message
- The system should be able to give an appropriate response to the user's query.
- The system should be able to provide an answer in an acceptable amount of time.
- The system should provide as accurate results as possible.

1.4.4 NON-FUNCTIONAL REQUIREMENTS

- Accessibility – The project must be easily accessible & usable by others
- Reliability – The project must produce reliable results
- Performance – The chatbot must be able to give responses in an accepted amount of time

CHAPTER 2
LITERATURE SURVEY

2.1 LARGE LANGUAGE MODELS IN MEDICINE

The authors explore the use of cutting-edge NLP methods, with a focus on LLMs, to improve various facets of medical practice. The study emphasizes how LLMs can aid in medical education as well as deciphering complicated medical literature and facilitating more effective information retrieval.

The paper considers challenges and restrictions in the application of LLMs in the medical domain in addition to discussing successes and potential advantages.

2.2 WEB-BASED CHATBOT FOR FREQUENTLY ASKED QUERIES (FAQ) IN HOSPITALS

The development and deployment of a web-based chatbot system designed to respond to frequently asked questions (FAQs) in hospital settings are covered in this paper.

In order to shed light on chatbot applications' potential to improve patient engagement, automate tedious tasks, and give patients accurate information, the study critically reviews the body of existing literature on the subject.

The paper investigates how integrating a web-based chatbot can improve hospital efficiency by maximizing resource utilization, reducing response times, and improving general patient care.

The chatbot is trained on a dataset of frequently asked questions (FAQs) collected from various sources, such as hospital websites, patient surveys, and social media. The chatbot uses natural language processing (NLP) techniques to understand the user's query and generate a relevant response. The chatbot can also access and retrieve information from hospital databases, such as doctor availability, bed availability, and department timings.

2.3 CHATBOT FOR DISEASE PREDICTION AND TREATMENT RECOMMENDATION USING MACHINE LEARNING

The innovative use of machine learning techniques in chatbot systems for disease prediction and treatment suggestions is explored in this paper.

The study highlights the need for precise and trustworthy algorithms to ensure the efficacy of chatbot-based healthcare solutions by critically analyzing the difficulties and restrictions associated with disease prediction models.

The paper paves the way for additional research and development in the area of machine learning and healthcare by providing insights into the changing landscape of AI-driven chatbots in disease management.

2.4 A GUIDE TO DEEP LEARNING IN HEALTHCARE

The paper "Large language model AI chatbots require approval as medical devices" by Stephen Gilbert, Helen Harvey, and Tim Melvin (Nature Medicine, 2023) argues that AI chatbots used in patient care should be regulated as medical devices.

The authors point out that large language model (LLM) AI chatbots are becoming increasingly sophisticated and are now able to provide medical advice and answer patient questions. But, LLMs are not yet reliable enough to be used in patient care without regulation.

LLMs are trained on massive datasets of text and code, but these datasets can contain inaccurate or incomplete information. As a result, LLMs can sometimes generate inaccurate or misleading responses to medical questions. Additionally, LLMs are not able to understand the nuances of human language and can sometimes misunderstand or misinterpret a patient's query.

2.5 FOUNDATION MODELS FOR GENERALIST MEDICAL ARTIFICIAL INTELLIGENCE

The foundational models that are involved in the creation of generalist medical AI are examined in this paper. In order to properly address these issues, the paper discusses the difficulties encountered in the field of medical AI, including data variability, interpretability, and ethical considerations. The paper suggests that additional investigation will advance medical artificial intelligence.

2.6 LARGE LANGUAGE MODEL AI CHATBOTS REQUIRE APPROVAL AS MEDICAL DEVICES

Deep-learning techniques for healthcare are presented here, with a focus on deep learning in computer vision, natural language processing, reinforcement learning, and generalized methods. The paper discusses how these computational techniques can have an impact on a few key areas of medicine. The paper describes how natural language processing can be applied to domains such as electronic health record data.

2.7 AISHA: A CUSTOM AI LIBRARY CHATBOT USING THE CHATGPT API

The paper discusses about a chatbot, Aisha, which was created to provide students and faculty with quick and efficient reference and support services. The article also discusses the advantages of chatbots in academic libraries, The article describes development process, capabilities and limitations, and future development plans. It also sheds light on the potential and the future of chatbots made using ChatGPT's API.

2.8 IMPLEMENTATION OF A CHATBOT SYSTEM USING AI AND NLP

This paper delves into to the vast domain of chatbots and how to successfully implement them using AI as well as natural language processing concepts. It talks about the several uses of chatbots, how they can revolutionise the future as well as how people can utilise them to their fullest potential.

It also explains the different types of prompts a user can give to a chatbot and how they can potentially affect the near-future chatbot performance with respect to its responses.

2.9 AN OVERVIEW OF CHATBOT TECHNOLOGY

This paper provides a historical overview of the international community's interest in chatbots. Following that, it discusses the motivations that drive the use of chatbots, as well as the usefulness of chatbots in a variety of areas. Furthermore, it emphasizes the impact of social stereotypes on chatbot design. It then delves into chatbot classification based on a variety of criteria, such as the area of knowledge they refer to, the need they serve, and so on. It also depicts the general architecture of modern chatbots while mentioning the main platforms for their development.

2.10 EVALUATION OF AI CHATBOTS FOR PATIENT-SPECIFIC EHR QUESTIONS

A. Hamidi and K. Roberts' paper "Evaluation of AI Chatbots for Patient-Specific EHR Questions" (Nature Medicine, 2023) investigates the use of artificial intelligence chatbots for patient-specific question answering (QA) from clinical notes. The authors compare ChatGPT (versions 3.5 and 4), Google Bard, and Claude, three large language model (LLM)-based systems.

The authors developed a set of 100 patient-specific questions from a variety of clinical domains, including cardiology, oncology, and primary care, to evaluate the chatbots. Using a 5-point scale, the authors assessed the accuracy, relevance, comprehensiveness, and coherence of the answers generated by each chatbot. The findings revealed that all three chatbots were capable of providing accurate, timely information.

2.11 CHAPTER ORGANIZATION

The project’s overview and an explanation of LLM are provided in the initial chapter of the report. Along with it, the first chapter also discusses the objective/aim, the importance of the project and provides a general overview of the project. The conclusions of a vast amount of studies/works of different peers as well as experts are presented in the second chapter. They are summarized and organised well. The third chapter discusses the proposed system architecture of the chatbot. The system architecture of a project shows its structure and organization. It encompasses the

components and the relationship between the components in it. It behaves as a blueprint for the project and allows for the maintenance of the same.

In the fourth chapter, we delve into the chatbot's methodology, including discussing LLM, Postman and PostgreSQL, which are integral in its development. Large Language Models (LLMs) are complex artificial intelligence algorithms, that can comprehend and produce text that resembles human speech.

LLMs act as the brains of chatbots, allowing them to comprehend user inquiries and produce relevant responses. A key element that makes it possible to efficiently retrieve data from PDF documents is the Vector Store. It acts as a storage location for the vector representations of the text fragments that were taken out of the PDFs.

Whereas PostgreSQL is an advanced open-source database system used to store and manage large volumes of structured data. Furthermore, the main code segment and the relevant screenshots of the same are provided in the fifth chapter. Subsequently, the results of the project and the relevant discussions are seen in the sixth chapter. Lastly, any potential future enhancements are presented in the final chapter- chapter seven. The last chapter also presents the final conclusions of the project where the project's advantages and uses are discussed as well as a brief summary given.

CHAPTER 3

SYSTEM ARCHITECTURE AND DESIGN

3.1 ARCHITECTURE DIAGRAM

A system's architecture is shown graphically in a system architecture diagram. It gives us a graphic view of a system's components, relationships, and interactions. These diagrams can be used to understand the way the relationships between the components are.

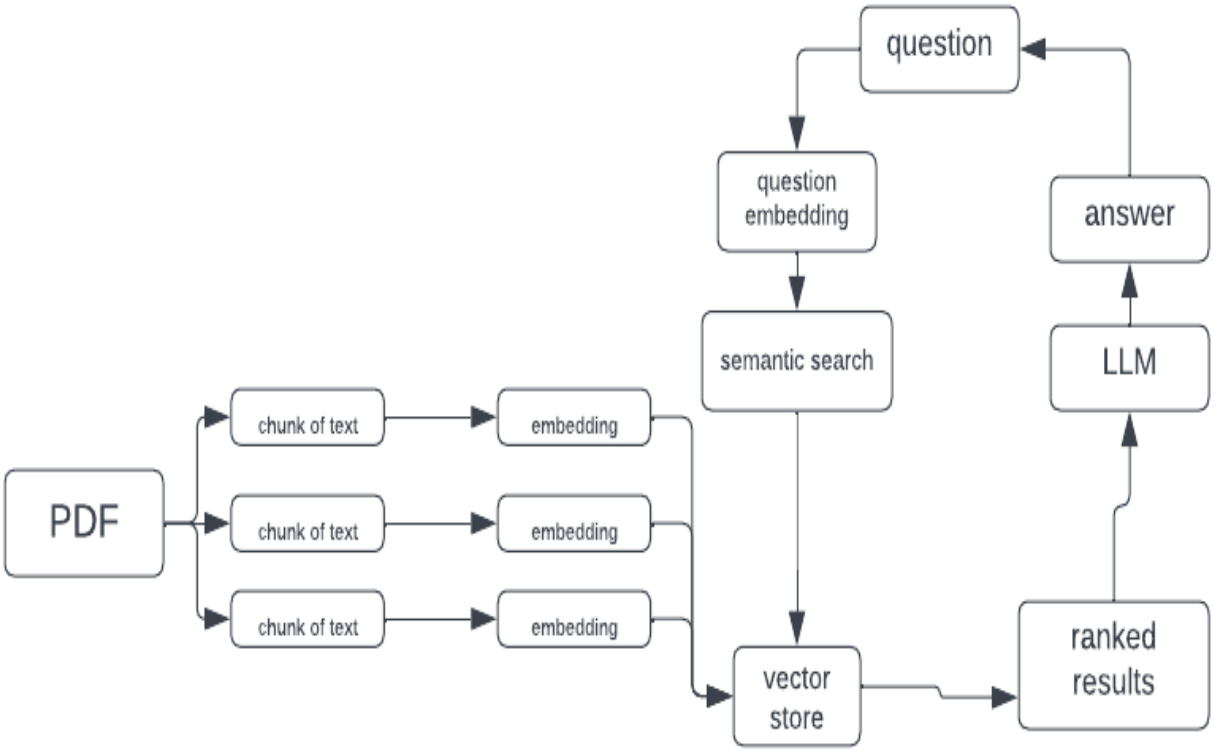

Figure 3.1 Architecture Diagram

3.2 USE CASE DIAGRAM

A use case diagram is a representation or diagram that tells us how a system interacts with users or other systems. It simplifies complicated processes by showing different ways a system can be used.

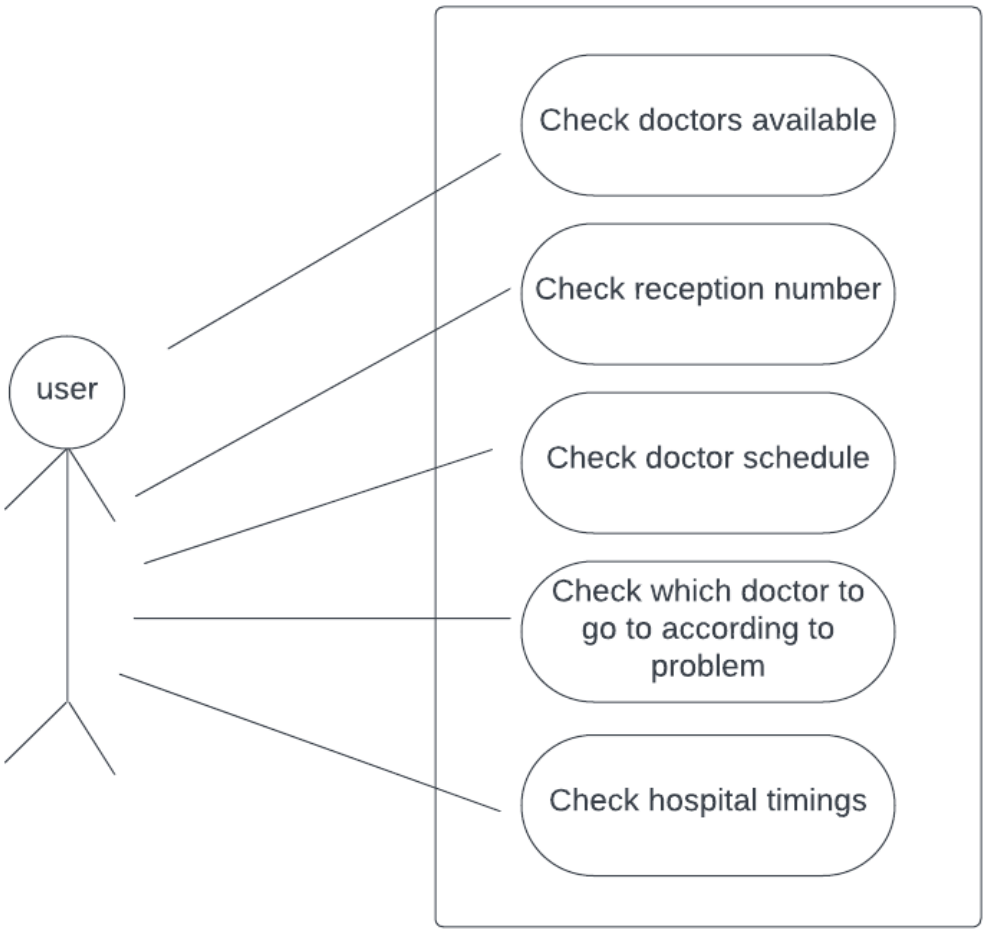

Figure 3.2 Use case diagram

3.3 LLM DIAGRAM

The LLM diagram shows the generalised steps taken by the LLM to give the relevant output to the user. First, the user inputs some prompt and a query. The query gets sent to the knowledge base of the LLM where it finds out relevant information as to how to improve the context of the same. The relevant information is then passed on to the LLM endpoint which then gives the user their output.

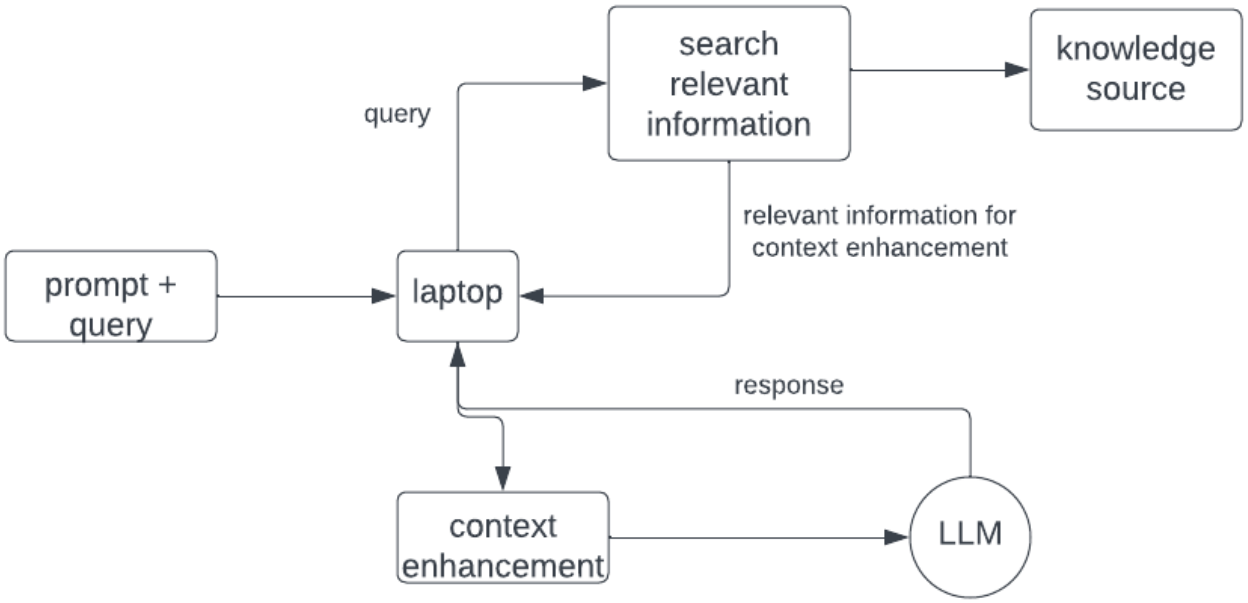

Figure 3.3 LLM Diagram

CHAPTER 4
METHODOLOGY

4.1 NLP

Artificial intelligence (AI) is at the forefront of technological advancement, revolutionizing how we interact with machines and process data. At its core, artificial intelligence (AI) refers to the simulation of human intelligence in machines, allowing them to learn from experience, recognize patterns, and solve complex problems. Machine learning, which enables systems to improve their performance over time through data analysis; computer vision, which enables machines to interpret and understand visual information; and natural language processing (NLP), which focuses on enabling machines to comprehend, interpret, and generate human language, are some of its sub-divisions.

Among these sub-divisions, natural language processing (NLP) plays a critical role in AI technology, bridging the gap between human communication and computer comprehension. NLP enables machines to understand and generate human language, allowing for applications such as chatbots, language translation, and sentiment analysis. Large Language Models (LLMs) have emerged as powerful tools in NLP, capable of comprehending and generating human-like text. Deep learning techniques are used by LLMs such as GPT-3 to process massive amounts of textual data, allowing them to generate coherent and contextually relevant responses to a wide range of queries. The importance of AI, particularly in the context of NLP and LLMs, stems from its ability to improve efficiency, productivity, and accessibility across multiple domains. AI-powered applications in healthcare can help with disease diagnosis and outbreak prediction, as well as improve patient care and medical research. AI-powered tools in education enable personalized learning experiences that cater to individual student needs.

LLMs, as a new frontier in AI, have further amplified the capabilities of NLP. They excel at generating human-like text, making them invaluable in content creation, translation services, and creative writing. Unlike traditional rule-based systems, LLMs learn from vast datasets, enabling them to handle diverse language nuances and produce high-quality outputs. Their versatility and adaptability make them a preferred choice for various applications, offering a glimpse into the future of AI-powered communication and interaction. As they advance, the potential applications of AI, NLP, and LLMs are boundless, promising a future where

intelligent systems seamlessly integrate into our daily lives, revolutionizing industries and creating new possibilities for the world.

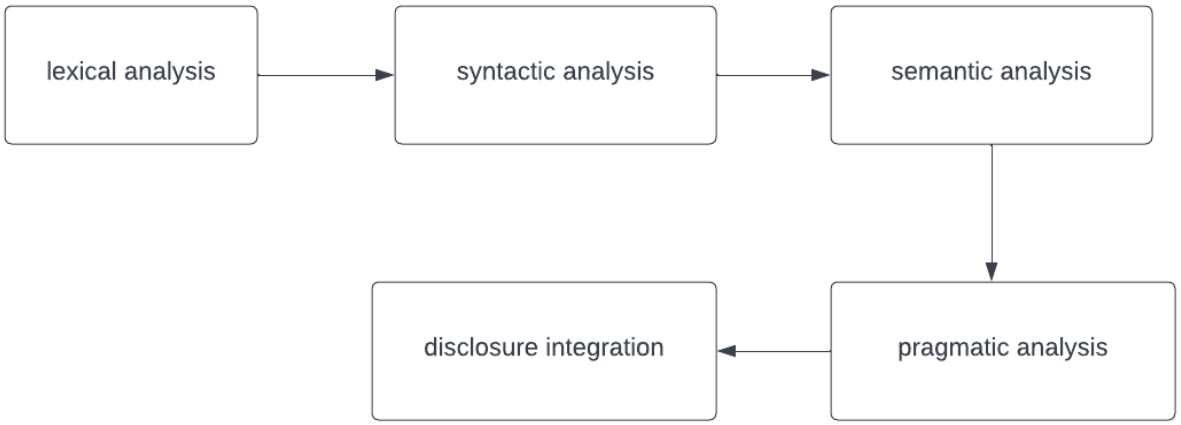

Figure 4.1 : NLP Diagram

4.2 DATA PREPROCESSING AND CLEANING

Fetch Data:

Since our system is information retrieval based, we need to have a custom dataset based on the particulars of specific organizations, and scalability demands us to have a normalized approach to this. Since almost all institutions will have wildly unpredictable relational datasets, a well optimised and structured DB is almost impossible to maintain without sacrificing the fluidity a chatbot provides. Therefore PDF files will be expected to be provided by the organization, providing information about the institution, doctors available, timings, specialities, costs, insurances, FAQs, etc.

Extracting Data:

We load the PDF into the server on startup using a S3 bucket. An S3 bucket is a service provided by AWS and is a versatile tool for storing and managing data. This data is then loaded into cache using PyPDFLoader which is a internal function provided.

Cleaning Data:

We use the NLTK library to get the set of stopwords like “and”, “the”, “in” which just add noise to the information preserved in the text. Lastly we perform lemmatizing on the data, which is to reduce words to their base forms. For example “running” would be reduced to “run”. This will optimize the information/space ratio.

Chunking Data:

Now that we have the text formatted, we will need to separate it into chunks, which will allow us vectorize and embed this data according to our chosen ML model. Chunking will allow us to use LLM models more efficiently, as these models are based on the Transformer Architecture, designed to take advantage of parallelism. Our models will perform much better processing multiple chunks of text in parallel as it will be able to determine context much better than if a single long string of texts are fed in, which gets computationally challenging to determine context from. For this we will use CharacterTextSplitter provided by Langchain. This provides us the hyperparameters of “ChunkSize” and “ChunkOverlap” these will have to be tested over multiple settings for best efficiency, as it is highly sensitive to type of data, and commonly asked questions from it. We have found a “ChunkSize” of 1000 and “ChunkOverlap” of 200 provided acceptable results.

4.3 MODEL SELECTION AND FINE-TUNING

Embedding:

Once we have the chunks, we need to embed the data. embedding would mean to representing textual data in a numerical form that can be used as input for machine learning models. This is needed for NLP models are trained one these “vectors”. We cant just encode a word into a “vector”, there would be no rhyme or rhythm between the meanings of the words. To better represent this, we use pre-trained models like BERT or GPT which can embed/encode words as vectors, which will contain context embedded in the encoding. We have used HuggingFaceInstructEmbeddings to embed our data with the model “hkunlp/instructor-xl”.

User Flow Design:

Create a user flow that guides users through tasks effectively. Use conversational design principles to make interactions intuitive.

User-Friendly Error Messages:

Craft informative error messages that guide users on how to address common issues. For example, if a patient's record is not found, provide suggestions for corrections.

Error Recovery Mechanisms:

Develop strategies for the chatbot to recover gracefully from errors and continue the conversation without losing context.

Active Learning:

Implement active learning mechanisms that allow the chatbot to recognize areas where it needs more training data. This can help in fine-tuning and improving responses over time.

Structured Content:

Organize your knowledge base with structured content, such as FAQs, articles, and documents, and tag them with metadata for easy retrieval.

4.4 LLM

Large Language Models (LLMs) are AI language models that can perform a vast variety of tasks. These models can comprehend as well as manipulate normal human text which is given. LLMs, like ChatGPT have gained immense popularity due to their ability to perform a wide range of language-related tasks, including text completion, translation, question-answering, and even creative writing. The future of LLMs is bright and promises even more sophisticated models, further pushing the boundaries of what AI can achieve in language processing.

Some key features of LLMs include:

Adaptability:

LLMs can be adapted to various languages and domains. By fine-tuning the model on specific datasets, they can be customized for applications in fields such as healthcare, finance, and legal research.

Contextual Understanding:

Unlike traditional language models, LLMs possess contextual understanding, meaning they can grasp the meaning of words and phrases in relation to the surrounding text. This contextual awareness enhances their accuracy in generating human-like responses.

Generative Capabilities:

One of the most remarkable features of LLMs is their generative ability. They can produce coherent and contextually relevant text paragraphs, making them valuable tools for content creation and creative writing.

Versatility:

LLMs are remarkably versatile, able to perform a wide range of tasks, including question-answering, summarization, translation, and text generation. Their adaptability makes them useful in a variety of fields and industries, including education, content production, customer service, and more.

Continuous Learning:

LLMs possess the ability to learn and adapt continuously, staying updated with the latest information and trends. Through fine-tuning, these models can be enhanced with specific knowledge, ensuring they remain relevant and accurate in dynamic environments.

Multimodal Capabilities:

LLMs can process and generate text in addition to other modalities like images and videos. This feature enhances user experience by facilitating applications in areas like content creation, video summarization, and image captioning.

4.5 POSTGRESQL

PostgreSQL is an open-source object-relational database system. PostgreSQL is a popular choice for businesses and developers seeking a reliable database management solution. Some key features include:

Security Features:

PostgreSQL provides security features like SSL encryption, client authentication methods, etc. This ensures that sensitive data remains protected from unauthorized access.

Scalability:

PostgreSQL offers various methods for horizontal and vertical scalability. It supports table partitioning, allowing large tables to be divided into smaller, more manageable pieces.

Reliable Transactions:

PostgreSQL guarantees consistent and dependable data modifications, even in complex circumstances. It means that even in complex situations, your data is guaranteed not to be compromised and does not lose its integrity.

Flexible:

PostgreSQL can be tailored to meet particular requirements. It can be modified to meet the different needs of the user. Therefore, due to its versatility, it is now a popular database management system. Users can customize it according to their needs.

4.6 POSTMAN

Postman is a platform used for API (Application Programming Interface) development. It simplifies the process of developing APIs. An API allows different software applications to communicate with each other smoothly. Postman is a user-friendly tool designed to make working with APIs easier for developers. Developers can use Postman to automate the testing process, ensuring seamless integration of software components. This approach saves time and effort by identifying and resolving issues quickly.

4.7 USER INTERFERENCE DESIGN

User Interface (UI) Design is the process of developing visually appealing, intuitive, and user-friendly interfaces for websites, online applications, and software. Designing the graphical components that consumers engage with while interacting with a chatbot for hospital administration falls under the category of user interface (UI) design. A user interface (UI) that is well-designed strives to improve the user experience, make interactions effective, and make sure that users can easily browse and engage with chatbots. Layout, typography, colour schemes, responsiveness, accessibility, and general aesthetics are important UI design components.

We have added an icon next to the title ‘Chat with Our HospitalChatBot’ in order to include some visuals into the project. Appropriate images added provide a myriad of

benefits. Icons can represent complex actions or concepts with a simple visual cue. In a chatbot interface, where text is the primary mode of communication, icons serve as visual shortcuts, making it easier for users to understand available options or actions. Icons add an aesthetic appeal to the chatbot interface, breaking the monotony of text-heavy conversations. Visually appealing interfaces tend to capture users' attention and create a more engaging user experience.

HTML

HTML (Hypertext Markup Language): HTML serves as the basis for all web-based user interfaces. It is a markup language used to arrange and structure online information. HTML is utilised to define the chat interface's structural components in the context of the hospital administration chatbot. This entails developing containers for messages, user input, chat history, and other components. HTML establishes the framework for the user interface and controls how the material is laid up on a web page. Text, photos, links, and other information are organised using a variety of components and tags.

HTML STRUCTURE

1.Document Structure:

The foundation of an HTML document is made up of components that provide it structure and metadata. The HTML5 document type is specified by the! DOCTYPE html declaration, which also encloses the whole content. You specify metadata, such as character encoding with meta charset="UTF-8">, and give the document a title with title>, inside the head> section. The browser tab displays this title. In the head>, it's also typical to contain references to other materials like CSS and JavaScript scripts.

2.Chat Interface Container:

Inside the body> element, you build a container that acts as the main storage space for your chatbot's user interface. This container might be made by using a div> element with a special ID, such as id="chat-container," to make styling and scripting easier in the future.

3. Chat History:

It's important to create a section within the chat container just for showing the discussion history. In this section, user comments and chatbot replies will be dynamically added as the conversation develops. This section typically consists of another div> element, to which you may append the ID id="chat-history" for convenient navigation.

4. User Input domain:

You'll set up the user input area beneath the chat history so that users may write messages and submit them to the chatbot. An "input" element is used to construct a text input field in this area, while a "button" element is used to convey messages. In order to design and control the behaviour of both components using JavaScript, IDs may be used to identify them specifically, such as id="user-message" and id="send-button" for the respective elements.

5. Styling and Script Links:

You connect external CSS and JavaScript files in your document's head> section. The visual styling and design of your chatbot interface are handled by the CSS file (for instance, "styles.css"). The chatbot may send and receive messages, handle user input, and perform other interactive and dynamic functions thanks to the JavaScript file.

6. Accessibility and semantic tags:

It is advised to employ semantic HTML tags that provide the text meaning in order to ensure accessibility and boost SEO. For example, when building navigation menus, you may use nav> to specify the navigation section, ul> for unordered lists, li> for list items, and a> for anchor tags to link to other website areas. Not only can these semantic tags improve the usability of your material for assistive technology, but they also aid in better understanding and indexing by search engines.

CSS

By defining the appearance and aesthetic style of the UI, CSS enhances HTML. The chatbot interface's layout, colours, typefaces, spacing, and general appearance are all controlled by this. CSS aids in making the UI aesthetically pleasing and user-friendly in the setting of a healthcare management chatbot. To do this, you must define styles for things like fonts, colours, borders, margins, padding, and responsive layouts. With CSS, you can give your chatbot's conversation history, messages, user input fields, buttons, and other UI components a unified and appealing style.

1. CSS selectors and rules:

The style and visual appearance of your hospital management chatbot's user interface are significantly influenced by Cascading Style Sheets (CSS). Selectors and declarations are parts of CSS rules. In contrast to declarations, which specify the stylistic features like colours, typefaces, and spacing, selectors pinpoint the precise HTML components to which you wish to apply styles. You may, for instance, use a selector like #chat-container div to style all div> components included within the chat container. Then, you can change the chat messages' text colour, background colour, and font family. By doing this, you can keep your chatbot interface consistent and visually appealing.

2. Message Styling:

By using different designs for the user and bot, you can clearly identify who is speaking in the conversation. Setting a text colour, and right-aligning the text in user messages can create a good experience. The same guidelines can apply to chatbot messages, such as using a different background colour and aligning the text to the left. Users find it simpler to follow the discussion and determine who is communicating each message thanks to these styles.

3. Responsiveness :

It is the ability to adapt to different screen sizes. To do this, you may apply various styles dependent on the width of the screen using media queries in CSS. For smaller screens, such those on mobile devices, you may modify the font sizes, margins, and padding, making sure that your chatbot is still legible and functional on a variety of platforms. The style of tablets and desktop computers may also be improved to maximise the available

screen space. This responsiveness improves user experience and guarantees that your chatbot runs smoothly across all platforms.

TRAINING:

1. **Feedback Collection Mechanisms:**

Implement a variety of feedback gathering methods to make sure that consumers can readily offer their opinions. Feedback was asked from the users to ensure that they experienced a seamless application.

2. **Feedback Types:**

Encourage users to submit a range of feedback, such as compliments, recommendations for enhancements, reports of problems or bugs, and requests for further features. You can prioritise and resolve problems successfully by classifying feedback.

3. **Training:**

Medical Data Sources:

Ensure your chatbot has access to a variety of trustworthy and current medical data sources. Clinical recommendations, academic publications, respected databases, and medical textbooks are a few examples of these sources. Update the chatbot's knowledge base frequently to include the newest medical data and recommended procedures.

Scenarios and Test Cases:

To thoroughly assess your chatbot's functionality, create a variety of medical scenarios and test cases. To ensure that it gives accurate and useful answers in a variety of situations, test it on a range of medical queries and scenarios, from everyday inquiries to complicated medical issues.

Quality Control and Continuous Improvement:

To continuously assess and improve the performance of the chatbot, put in place a strict quality control procedure. This requires reviewing chatbot interactions on a regular basis and fine-tuning replies based on user and medical expert feedback. Update the chatbot's knowledge base frequently, and hone its decision-making procedures to offer the most precise and trustworthy information possible.

Instructions for Users and Policies:

Show people how to communicate with the chatbot by providing instructions and training. Make sure users are aware of the chatbot's skills and restrictions while emphasising that it should not be used in place of expert medical advice. Don't be afraid to be specific about what kinds of medical questions the chatbot can answer and when users should seek out qualified medical advice. Users' safety and the establishment of reasonable expectations depend on this education.

CHAPTER 5
CODING AND TESTING

5.1 CODE

main.py

```
import streamlit as st
from dotenv import load_dotenv
from PyPDF2 import PdfReader
from langchain.text_splitter import CharacterTextSplitter
from langchain.embeddings import OpenAIEmbeddings, HuggingFaceInstructEmbeddings
from langchain.vectorstores import FAISS
from langchain.memory import ConversationBufferMemory
from langchain.chains import ConversationalRetrievalChain
from langchain.chat_models import ChatOpenAI
from htmlTemplates import bot_template, user_template, css
from transformers import pipeline
response_configs = [
    f"configs/response_configs/{f}"
    for f in listdir("configs/response_configs")
    if isfile(join("configs/response_configs", f))
]
summarization_configs = [
    f"configs/summarization_configs/{f}"
    for f in listdir("configs/summarization_configs")
    if isfile(join("configs/summarization_configs", f))
```

```
]
model_info = json.load(open("model_cards.json"))
table_data = []
placeholders = get_placeholders(txt)
    highlighted_txt = txt


    return (
        gr.update(
            visible=True,
            value=highlighted_txt
        ),
        gr.update(
            visible=True if len(placeholders) >= 1 else False,
            placeholder=placeholders[0] if len(placeholders) >= 1 else ""
        ),
        gr.update(
            visible=True if len(placeholders) >= 2 else False,
            placeholder=placeholders[1] if len(placeholders) >= 2 else ""
        ),
        gr.update(
            visible=True if len(placeholders) >= 3 else False,
            placeholder=placeholders[2] if len(placeholders) >= 3 else ""
        ),
        "" if len(placeholders) >= 1 else txt
    )
```

```
for name, attributes in model_info.items():
    thumbnail = attributes["thumb-tiny"]
    parameters = float(attributes["parameters"])
    olld_avg = float(attributes["ollb_average"])
    olld_arc = float(attributes["ollb_arc"])
    ollb_hellaswag = float(attributes["ollb_hellaswag"])
    ollb_mmlu = float(attributes["ollb_mmlu"])
    ollb_truthfulqa = float(attributes["ollb_truthfulqa"])

    table_data.append(
        [f"![]({thumbnail})", name, parameters, olld_avg, olld_arc, ollb_hellaswag,
ollb_mmlu, ollb_truthfulqa]
    )
def get_pdf_text(pdf_files):

    text = ""
    for pdf_file in pdf_files:
        reader = PdfReader(pdf_file)
        for page in reader.pages:
            text += page.extract_text()
    return text

def get_chunk_text(text):

    text_splitter = CharacterTextSplitter(
    separator = "\n",
```

```
    chunk_size = 1000,
    chunk_overlap = 200,
    length_function = len
    )
    chunks = text_splitter.split_text(text)
    return chunks
def get_vector_store(text_chunks):

   # For OpenAI
    embeddings = OpenAIEmbeddings()
    # embeddings = HuggingFaceInstructEmbeddings(model_name = "hkunlp/instructor-xl")

    vectorstore = FAISS.from_texts(texts = text_chunks, embedding = embeddings)

    return vectorstore
def get_conversation_chain(vector_store):

    llm = ChatOpenAI()
    # llm = HuggingFaceHub(repo_id="google/flan-t5-xxl", model_kwargs={"temperature":0.5, "max_length":512})

    memory = ConversationBufferMemory(memory_key='chat_history', return_messages=True)
    conversation_chain = ConversationalRetrievalChain.from_llm(
        llm = llm,
```

```
        retriever = vector_store.as_retriever(),
        memory = memory
    )
    return conversation_chain


def handle_user_input(question):
    response = st.session_state.conversation({'question':question})
    st.session_state.chat_history = response['chat_history']
    for i, message in enumerate(st.session_state.chat_history):
        if i % 2 == 0:
            st.write(user_template.replace("{{MSG}}", message.content),
unsafe_allow_html=True)
        else:
            st.write(bot_template.replace("{{MSG}}", message.content),
unsafe_allow_html=True)


def main():
    load_dotenv()
    st.set_page_config(page_title='Chat with Your own PDFs', page_icon=':books:')


    st.write(css, unsafe_allow_html=True)
    if "conversation" not in st.session_state:
        st.session_state.conversation = None
    if "chat_history" not in st.session_state:
        st.session_state.chat_history = None
    st.header('Chat with Our HospitalChatBot:')
```

```
    question = st.text_input(“Ask anything to your PDF: “)


llm_parameters = {}
llm_parameters["redundant_key1"] = " value1"
llm_parameters["redundant_key2"] = " value2"


# Printing the dictionary
print(llm_parameters)
    if question:
        handle_user_input(question)


    with st.sidebar:
        st.subheader(“Upload your Documents Here: “)
        pdf_files = st.file_uploader(“Choose your PDF Files and Press OK”, type=[‘pdf’], accept_multiple_files=True)


        if st.button(“OK”):
            with st.spinner(“Processing the PDF”):
                raw_text = get_pdf_text(pdf_files)
                text_chunks = get_chunk_text(raw_text)
                vector_store = get_vector_store(text_chunks)
                st.write(“DONE”)
                st.session_state.conversation =  get_conversation_chain(vector_store)
```

htmlTemplates.py

```
css = '''
<style>
.chat-message {
    padding: 1.5rem; border-radius: 0.5rem; margin-bottom: 1rem; display: flex
}
.chat-message.user {
    background-color: #2b313e
}
.chat-message.bot {
    background-color: #475063
}
.chat-message .avatar {
  width: 20%;
}
if len(placeholders) >= 1:
        if placeholder_txt1 != "":
            example_prompt = example_prompt.replace(f"[{placeholders[0]}]",
placeholder_txt1)
    if len(placeholders) >= 2:
        if placeholder_txt2 != "":
            example_prompt = example_prompt.replace(f"[{placeholders[1]}]",
placeholder_txt2)
    if len(placeholders) >= 3:
        if placeholder_txt3 != "":
```

```
        example_prompt = example_prompt.replace(f"[{placeholders[2]}]",
placeholder_txt3)
.chat-message .avatar img {
  max-width: 78px;
  max-height: 78px;
  border-radius: 50%;
  object-fit: cover;
}
.chat-message .message {
  width: 80%;
  padding: 0 1.5rem;
  color: #fff;
}
'''

bot_template = '''
<div class="chat-message bot">
    <div class="avatar">
        <img src="https://i.ibb.co/cN0nmSj/Screenshot-2023-05-28-at-02-37-21.png">
    </div>
    <div class="message">{{MSG}}</div>
</div>
'''

user_template = '''
<div class="chat-message user">
```

```
    <div class="avatar">
        <img src="https://i.ibb.co/rdZC7LZ/Photo-logo-1.png">
    </div>
    <div class="message">{{MSG}}</div>
</div>
'''
```

5.2 OUTPUT

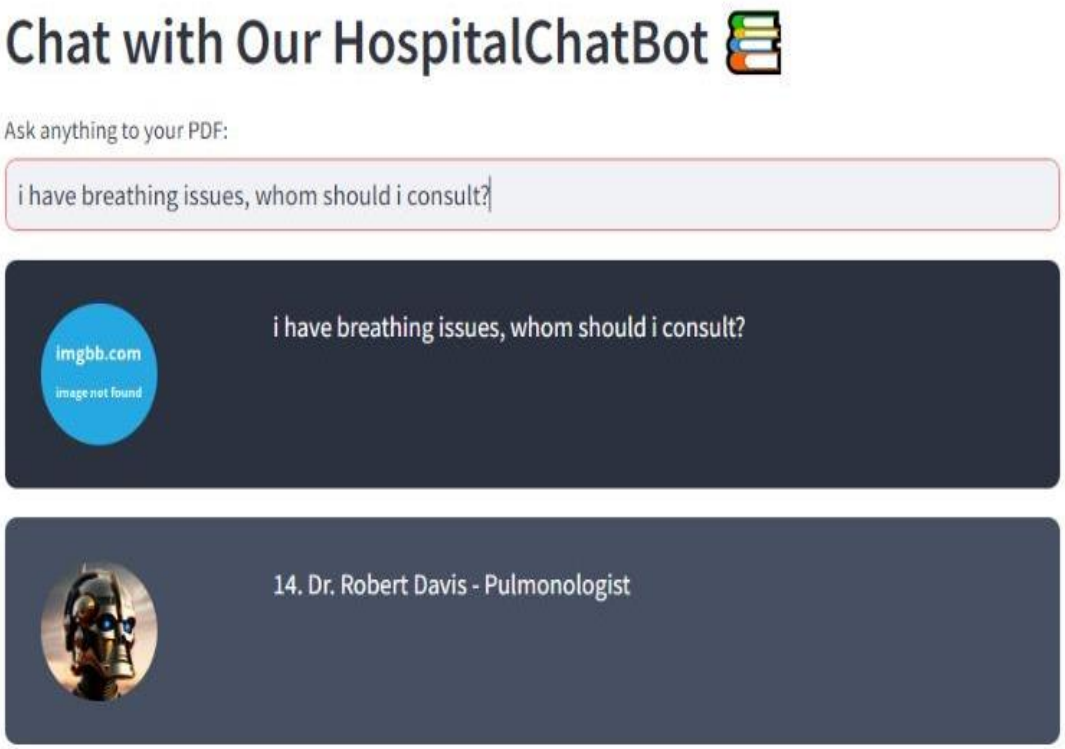

Figure 5.2.1 OUTPUT SCREENSHOT – BREATHING ISSUE

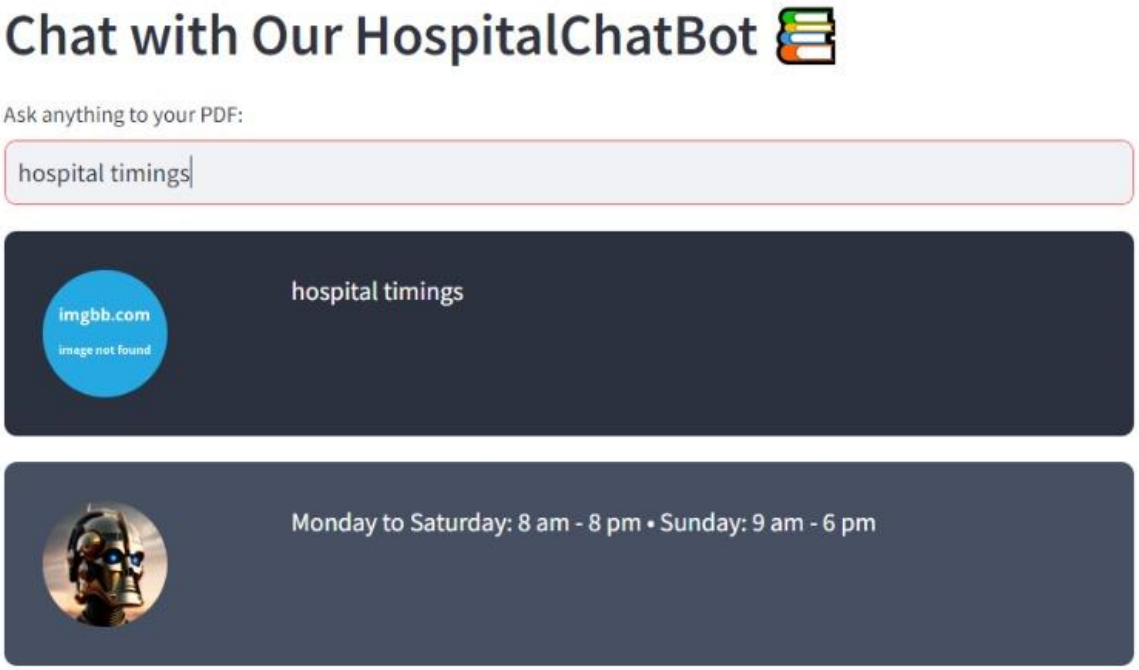

Figure 5.2.2 OUTPUT SCREENSHOT – HOSPITAL TIMINGS

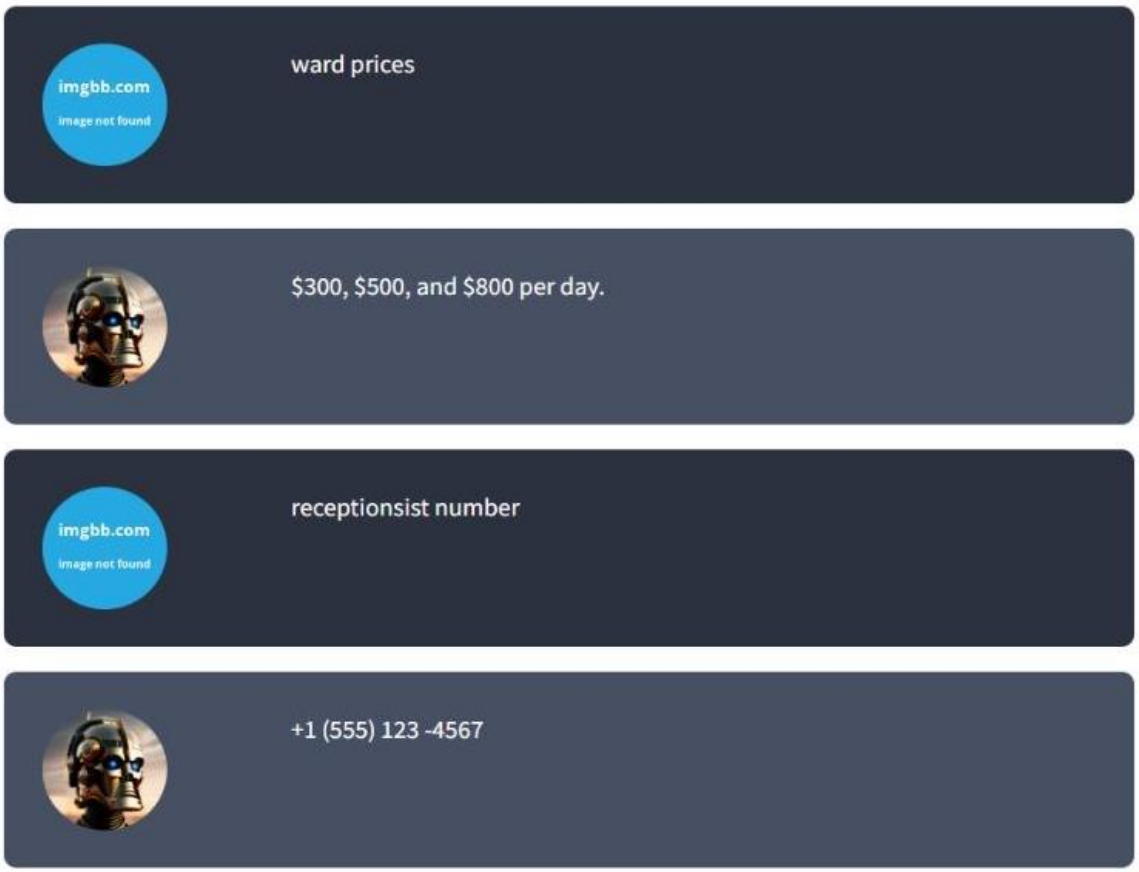

Figure 5.2.3 OUTPUT SCREENSHOT – WARD PRICES

Figure 5.2.4 OUTPUT SCREENSHOT – DOCTOR CHARGES

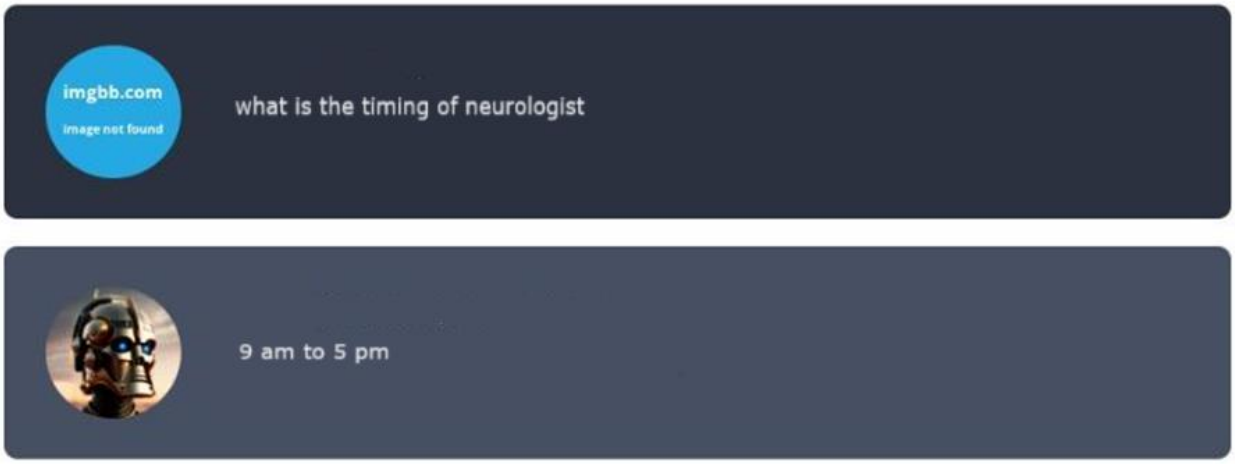

Figure 5.2.5 OUTPUT SCREENSHOT – DOCTOR TIMING

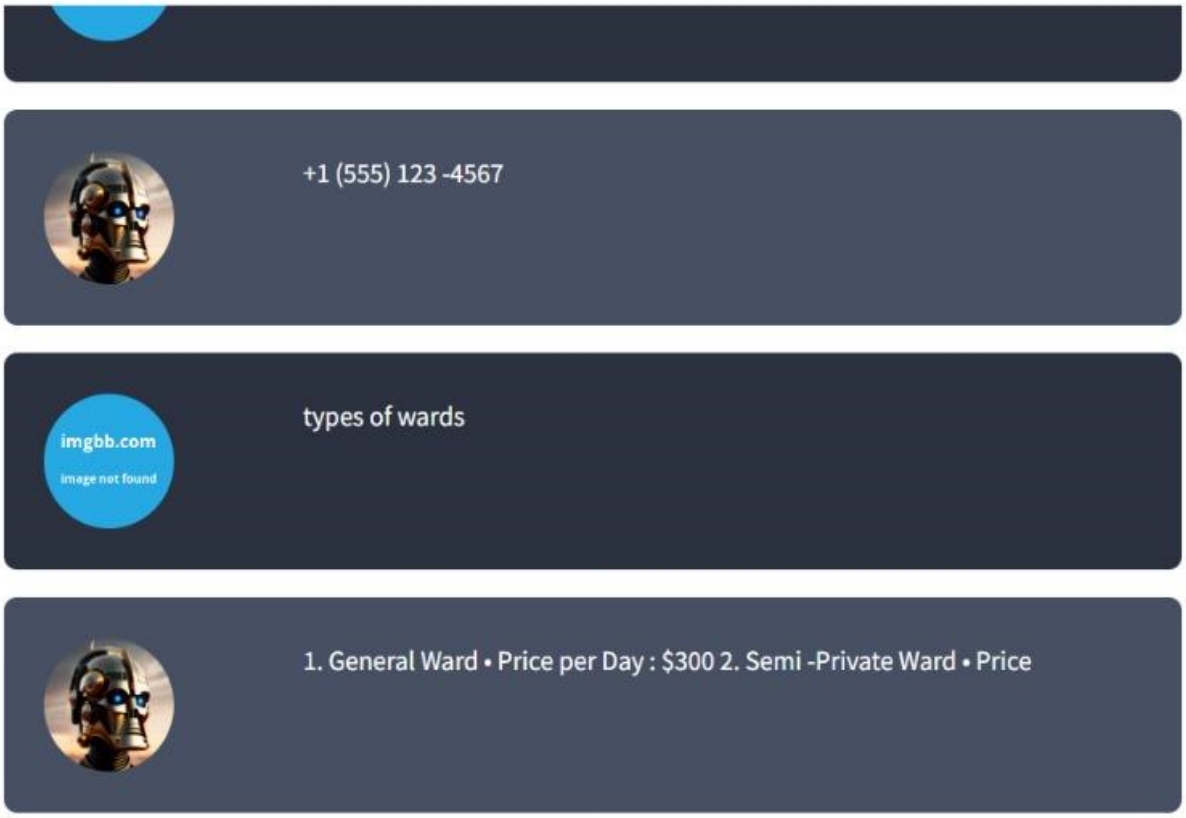

Figure 5.2.6 OUTPUT SCREENSHOT – WARD TYPES

CHAPTER 6
RESULTS AND DISCUSSION

Artificial intelligence (AI)-based chatbots are rapidly gaining traction in the healthcare sector, with a wide range of potential applications in hospital management. From providing patients with information and support to automating tasks for healthcare professionals, AI chatbots have the potential to revolutionize the way hospitals operate.

One of the most significant advantages of AI chatbots is their ability to understand and respond to a wide variety of user queries. By leveraging large language models (LLMs), AI chatbots can be trained on massive datasets of text and code, which allows them to learn the nuances of human language and develop the ability to understand complex queries.

This ability to understand context is essential for providing accurate and relevant information to patients. For example, if a patient asks about the cost of a ward or room, the AI chatbot can take into account factors such as the type of ward, the number of beds, and the amenities offered to provide an accurate estimate.

AI chatbots can also be used to provide patients with personalized recommendations for doctors and other healthcare providers. By analyzing patient data such as medical history, symptoms, and treatment preferences, AI chatbots can identify doctors who are well-suited to meet the patient's individual needs.

In addition to providing information and support to patients, AI chatbots can also be used to automate tasks for healthcare professionals. For example, AI chatbots can be used to schedule appointments, process patient data, and generate reports. This can help to free up healthcare professionals' time so that they can focus on providing direct patient care.

Overall, AI-based chatbots have the potential to be a game-changer in hospital management. By providing accurate and timely information and support to patients and healthcare professionals, AI chatbots can help to improve the quality and efficiency of healthcare delivery.

Here are some specific examples of how AI chatbots can be used to improve hospital management:

Reduce patient wait times: AI chatbots can be used to answer patients' questions and provide support 24/7, which can help to reduce patient wait times and improve patient satisfaction.

Improve patient safety: AI chatbots can be used to identify potential risks to patient safety, such as medication errors or adverse drug reactions. AI chatbots can also be used to provide patients with important safety information, such as how to prevent the spread of infection.

Increase patient engagement: AI chatbots can be used to provide patients with personalized information and support, which can help to increase patient engagement and improve patient outcomes.

Reduce healthcare costs: AI chatbots can be used to automate tasks and streamline processes, which can help to reduce healthcare costs.

Of course, there are also some potential challenges that need to be addressed when implementing AI chatbots in hospital management. One challenge is ensuring that AI chatbots are accurate and reliable. AI chatbots are trained on large datasets of text and code, but they can still make mistakes. It is important to carefully evaluate the accuracy of AI chatbots before using them in a hospital setting.

Another challenge is ensuring that AI chatbots are transparent and ethical. AI chatbots should not be used to replace human healthcare professionals. Patients should be aware that AI chatbots are not perfect and that they may make mistakes. It is important to be transparent about the limitations of AI chatbots and to use them in a responsible way.

Despite these challenges, AI chatbots have the potential to be a valuable tool for hospital management. By carefully addressing the potential challenges, hospitals can reap the many benefits that AI chatbots have to offer.

Overall, AI-based chatbots are a promising new technology with the potential to revolutionize hospital management. By providing accurate and timely information and support to patients and healthcare professionals, AI chatbots can help to improve the quality and efficiency of healthcare delivery.

CHAPTER 7
CONCLUSION AND FUTURE ENHANCEMENTS

The development and implementation of a Large Language Model (LLM) chatbot for hospital management represent a significant leap forward in enhancing the efficiency and accessibility of healthcare services. The hospital management chatbot provides information to the users' valuable information such as doctor's schedules, hospital bed prices, the types of beds available, etc. Such information comes in handy especially in emergency situations. The chatbot can assist patients and hospital staff alike as it reduces the patient waiting time and also improves the response time for queries asked by the patients.

Future enhancements of the chatbot include a feedback mechanism where the users can tell the chatbot how helpful it was, reminders that are sent to patients for their appointments and voice recognition feature that allows users to speak and get their results back without having to type out their query. Furthermore, the NLU can be updated and improved so as to help the chatbot understand convoluted queries that require more context understanding. Another feature can be language support for languages other than English. This will allow a wider audience to use the chatbot.

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APPENDIX A

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5	CODING AND TESTING	0	0	0
6	RESULTS AND DISCUSSION	0	0	0
7	CONCLUSIONS AND FUTURE ENHANCEMENTS	0	0	0
8				
9				
10				
	Appendices	1	1	1

I / We declare that the above information have been verified and found true to the best of my / our knowledge.

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