A PROJECT REPORT ON

AI-DRIVEN PREDICTIVE DIAGNOSIS CHATBOT FOR HEALTHCARE

SUBMITTED TO MIT SCHOOL OF COMPUTING IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE

BACHELOR OF TECHNOLOGY
(Information Technology-Data Analytics)

BY

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CERTIFICATE

This is to certify that the Project Entitled

AI-DRIVEN PREDICTIVE DIAGNOSIS CHATBOT FOR HEALTHCARE

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is a bonafide work carried out by them under the supervision of **Prof. Dr. Mohit Kumar** and it is submitted towards the partial fulfillment of the requirement of MIT ADT University, Pune for the award of the degree of Bachelor of Technology (Information Technology/Information Technology-DA).

Prof. Dr. Mohit Kumar	Prof. Dr. Prashant Dhotre	Dr. Vipul Dalal
Project Guide	H.O.D	Director
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DECLARATION

We, the team members

Hereby declare that the project work incorporated in the present project entitled **AI-DRIVEN PREDICTIVE DIAGNOSIS CHATBOT FOR HEALTHCARE** is original work. This work (in part or in full) has not been submitted to any University for the award or a Degree or a Diploma. We have properly acknowledged the material collected from secondary sources wherever required. We solely own the responsibility for the originality of the entire content.

Date: 21/11/2024

Name & Signature of the Team Members and Guide

Sonam Bhul	Ayushi Tiwari	Tanay Kumar
Member 1	Member 2	Member 3

Prof. Dr. Mohit Kumar
Project Guide

Seal/Stamp of the college Place:
Date: 21-11-2024

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EXAMINER'S APPROVAL CERTIFICATE

The project report entitled **AI-DRIVEN PREDICTIVE DIAGNOSIS CHATBOT FOR HEALTHCARE** submitted by Sonam Bhul (MITU21BTIT0058), Ayushi Tiwari (MITU21BTIT0018) and Tanay Kumar (MITU21BTIT0060) in partial fulfillment for the award of the degree of Bachelor of Technology (Information Technology/Information Technology-DA) during the academic year 2022-23, of MIT-ADT University, MIT School of Computing, Pune, is hereby approved.

Examiners

Examiner 1
Name and Signature:

Examiner 2
Name and Signature:

ACKNOWLEDGMENTS

*It gives us great pleasure in presenting the project report on **'AI-DRIVEN PREDICTIVE DIAGNOSIS CHATBOT FOR HEALTHCARE'**.*

*We would like to take this opportunity to thank our internal guide **Prof. Dr. Mohit Kumar** for giving us all the help and guidance we needed. We are really grateful to her and for her kind support. Her valuable suggestions were very helpful.*

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ABSTRACT

The **AI-Driven Predictive DIAGNOSIS CHATBOT for Healthcare** is an innovative project that leverages **Retrieval-Augmented Generation (RAG)** combined with advanced lightweight language models (LLMs) such as **LLaMA 2** and **Mistral**. The system is designed to provide **simple, user-friendly guidance** on symptoms, medications, and common ailments, bridging the gap between complex medical terminology and the general public's understanding. By integrating **retrieval techniques** with **LLM capabilities**, it ensures accurate and accessible medical insights tailored to non-technical audiences. This approach empowers users to better understand their health conditions, enabling informed decisions and active engagement in personal health management.

With a focus on promoting **healthcare accessibility and literacy**, the system addresses challenges like language barriers and overwhelming technical jargon in traditional medical resources. By simplifying medical explanations while maintaining accuracy, the project aims to foster a more informed, health-conscious society. Its innovative blend of AI-driven insights and retrieval optimization positions it as a transformative tool in democratizing healthcare, reducing disparities, and encouraging proactive engagement in personal wellness.

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CHAPTER 1 INTRODUCTION

AI-DRIVEN PREDICTIVE DIAGNOSIS CHATBOT FOR HEALTHCARE

1.1 RELEVANCE

The AI-Driven Predictive DIAGNOSIS CHATBOT for Healthcare is highly relevant in today's world, where access to accurate and understandable medical information is crucial for individuals navigating their health journeys. With the increasing complexity of medical terminology and the overwhelming volume of health data available, many people struggle to make sense of their symptoms and treatment options. Its relevance extends beyond individual users, as it aligns with global efforts to bridge gaps in health literacy, enhance healthcare accessibility**,** and reduce the pressure on overburdened healthcare systems. By equipping individuals with the tools to better manage their health proactively, the system supports preventive care, reduces unnecessary medical visits, and fosters more informed healthcare decisions. This not only benefits personal health outcomes but also contributes to a more resilient and efficient healthcare infrastructure, making it a timely and impactful innovation.

1.2 MOTIVATION OF THE PROJECT

- Over 40% of individuals globally face challenges in understanding complex medical terminology and accessing reliable healthcare information.
- Studies show that AI-driven healthcare tools can improve health literacy by over 70%, enabling better decision-making.
- The integration of AI and language models in healthcare has demonstrated a 60% improvement in patient engagement and understanding of personal health.
- Effective systems like this can reduce unnecessary doctor visits by up to 25%, alleviating pressure on healthcare infrastructure while promoting informed health management.

1.3 PROBLEM STATEMENT

- Implementing Retrieval-Augmented Generation (RAG) with lightweight LLMs like LLaMA 2 or Mistral to deliver clear, easy-to-understand guidance on symptoms and medications for common ailments.
- This system combines advanced retrieval techniques with LLMs to simplify medical information, making it more accessible and user-friendly.

1.4 OBJECTIVES

Develop an AI-powered healthcare system leveraging RAG and lightweight language models to provide accurate, user-friendly medical guidance. Ensure accessibility through a mobile-friendly interface and telemedicine compatibility, enabling remote health management and

informed decision-making. Integrate the system into existing healthcare workflows to enhance efficiency and support proactive health management.

1.5 SCOPE

The project involves developing an AI-powered healthcare system using RAG and lightweight language models for accessible medical guidance. It includes integration with existing workflows, mobile compatibility, and telemedicine platforms, with a focus on improving health literacy and cost-efficiency in healthcare.

1.6 ORGANIZATION OF THE REPORT

The report is structured to provide a comprehensive view of the project's progression. It begins with an introduction that sets the stage for the research. Following this, the report comprises chapters that delve into specific aspects: a literature review to establish context, the methodology detailing the technical approach, integration and accessibility considerations, a cost-effectiveness analysis, implementation of an automated screening tool, presentation of results and discussions, conclusions, practical recommendations for future work, a references section, and any necessary appendices. This organization ensures that the report flows logically, addressing each facet of the project in a structured manner.

CHAPTER 2 LITERATURE SURVEY

AI-DRIVEN PREDICTIVE DIAGNOSIS CHATBOT FOR HEALTHCARE

2.1 RELATED WORK

1) **Paper name:** Leveraging LLM: Implementing an Advanced AI Chatbot for Healthcare
   Year: 2024
   Authors: Ajinkya Mhatre, Sandeep R. Warhade, Sayali Kokate, Omkar Pawar, Samyak Jain

   Description: The paper evaluates the use of Large Language Models (LLMs) in healthcare chatbots for addressing general illness queries, achieving 61% accuracy. It highlights LLMs' benefits in providing accurate, personalized medical guidance and discusses challenges like accuracy, privacy, and bias. The research aims to enhance patient engagement and healthcare accessibility through intelligent chatbot systems.

2) **Paper name:** A Medical Chatbot: Your Healthcare Assistance
   Year: 2024
   Authors: Harsh Jain

   Description: The paper presents the development of a Medical ChatBot using the Llama 2 model to enhance healthcare accessibility. The chatbot, built with open-source technologies and AI methods, provides accurate medical information and emotional support through efficient processing and rapid response generation. It showcases promising performance in user query handling and highlights its potential to improve healthcare communication and support.

3) **Paper name:** Efficiency-Driven Custom Chatbot Development: Unleashing LangChain, RAG, and Performance-Optimized LLM Fusion
   Year: 2024
   Authors: S. Vidivelli, Manikandan Ramachandran, A. Dharunbalaji

   Description: The paper introduces a highly efficient medical chatbot leveraging LangChain, Retrieval-Augmented Generation (RAG), and performance-efficient Large Language Models (LLMs) like LoRA and QLoRA. The chatbot uses LangChain for customization, RAG for web-scraping data, and fine-tuned LLMs for rapid, accurate responses. This approach enhances user interactions, provides comprehensive medical information, and improves efficiency. The chatbot was tested using various metrics, showing strong performance in patient education and support.

4) **Paper name:** Integrating RAG with LLMs in Nephrology: Advancing Practical Applications
   Year: 2024
   Authors: Jing Miao, Charat Thongprayoon, Supawadee Suppadungsuk, Oscar A. Garcia Valencia, Wisit Cheungpasitporn
   Description: The paper explores integrating Large Language Models (LLMs) with Retrieval-Augmented Generation (RAG) techniques in nephrology. It addresses challenges such as

LLMs' inaccuracies and hallucinations by using prompt engineering and RAG to improve response accuracy and relevance. The study highlights the development of a ChatGPT model aligned with KDIGO 2023 guidelines for chronic kidney disease, demonstrating its potential for providing precise medical advice.

SR. NO.	YEAR	TITLE	AUTHOR	RESULT	LIMITATION
1	2024	Leveraging LLM: Implementing an Advanced AI Chatbot for Healthcare	Ajinkya Mhatre, Sandeep R. Warhade, Sayali Kokate, Omkar Pawar, Samyak Jain	- LLM-based chatbots showed 61% accuracy in general illness queries.	- Issues with accuracy, biases, and ethical concerns remain.
2	2024	A Medical Chatbot: Your Healthcare Assistance	Harsh Jain	- Llama 2-based ChatBot delivers accurate medical info and improves access.	- Needs more refinement for better functionality.
3	2024	Efficiency-Driven Custom Chatbot Development: Unleashing LangChain, RAG, and Performance-Optimized LLM Fusion	S. Vidivelli, Manikandan Ramachandran, A. Dharunbalaj	- The chatbot efficiently delivers healthcare information using advanced technologies.	- Requires improvements in accuracy and user interaction.
4	2021	Integrating RAG with LLMs in Nephrology: Advancing Practical Applications	Jing Miao, Charat Thongprayoon, Supawadee Suppadungsuk,Oscar A. Garcia Valencia, Wisit Cheungpasitporn	- LLMs with RAG improve nephrology care and education.	- Accuracy and reliability of information are still challenging.
5	2024	Health-LLM: Personalized Retrieval-Augmented Disease Prediction Model	Mingyu Jin, Qinkai Yu, Chong Zhang, Dong Shu	- Health-LLM achieves 83.3%, outperforming baseline models like GPT-3.5, GPT-4,	- Performance might degrade with diverse patient data not

				and fine-tuned Llama-2.	represented in training sets.
6	2024	Efficiency-Driven Custom Chatbot Development: Unleashing LangChain, RAG, and Performance-Optimized LLM Fusion	S. Vidivelli, Manikandan Ramachandran, A. Dharunbalaji	- Fine-tuning with Peft and QLoRA improved dental terminology understanding.	- RAG doesn't fully eliminate dependency on external data.
7	2024	Building Certified Medical Chatbots: Overcoming Unstructured Data Limitations with Modular RAG	Leonardo Sanna, Patrizio Bellan, Simone Magnolini, Marina Segala, Saba Ghanbari Haez, Monica Consolandi, Mauro Dragoni	- 85% accuracy in retrieving relevant documents.	- Unstructured texts caused issues with topic modeling and consistency.
8	2024	Chatbots and Large Language Models in Radiology: A Practical Primer for Clinical and Research Applications	IshRajesh Bhayana	- LLMs show impressive performance on medical and radiology benchmarks.	- LLMs may generate inaccurate or misleading information.

2.2 GAP IDENTIFICATION

Exploring AI-driven solutions for simplifying medical information and improving healthcare access reveals several research gaps and opportunities. Here are some key gaps we aim to address with the AI-Driven Predictive DIAGNOSIS CHATBOT for Healthcare:

- We have addressed the need for clear, accurate, and accessible healthcare guidance by developing an advanced AI-powered system that can translate complex medical

terminology into easy-to-understand explanations of symptoms, medications, and common health conditions.

- Our solution aims to enhance health literacy and empower individuals to make informed health decisions by providing personalized, contextually relevant information, reducing reliance on healthcare professionals for basic health queries. This contributes to improved self-management and better health outcomes.

CHAPTER 3

SOFTWARE REQUIREMENT SPECIFICATION

AI-DRIVEN PREDICTIVE DIAGNOSIS CHATBOT FOR HEALTHCARE

3.1 INTRODUCTION

The AI-Driven Predictive DIAGNOSIS CHATBOT for Healthcare aims to make medical information more accessible and understandable. By combining Retrieval-Augmented Generation (RAG) with lightweight language models like LLaMA 2 and Mistral, the system provides clear, accurate explanations of symptoms, medications, and common ailments. This approach bridges the gap between complex medical terminology and the general public's need for easy-to-understand guidance. The project seeks to enhance health literacy, empower individuals to make informed health decisions, and reduce the burden on healthcare systems by promoting self-management and preventive care.

3.2 PURPOSE AND SCOPE OF DOCUMENT

The purpose of this document is to provide a comprehensive overview of the AI-Driven Predictive DIAGNOSIS CHATBOT for Healthcare project. It outlines the project's objectives, methodology, and anticipated outcomes for stakeholders, healthcare professionals, and researchers. The scope includes developing an AI-powered system using Retrieval-Augmented Generation (RAG) and lightweight language models like LLaMA 2 and Mistral, designing it for easy access and understanding of healthcare information, and integrating it into user-friendly platforms. This document highlights the project's significance in improving health literacy, enhancing healthcare accessibility, and empowering individuals to make informed health decisions, ultimately contributing to a more efficient and proactive healthcare ecosystem.

3.3 GENERAL DESCRIPTION

The AI-Driven Predictive DIAGNOSIS CHATBOT for Healthcare is designed to enhance accessibility to accurate healthcare information for individuals and healthcare professionals. Its features include an advanced AI-powered system utilizing Retrieval-Augmented Generation (RAG) and lightweight language models like LLaMA 2 and Mistral for clear, accurate explanations of symptoms, medications, and common ailments. The system is compatible with multiple platforms, ensuring easy access across devices, and is designed to integrate seamlessly into everyday health management practices. Its significance lies in improving health literacy, empowering individuals to make informed health decisions, and reducing the burden on healthcare systems by promoting self-management and preventive care, especially in underserved regions with limited access to medical resources.

3.4 FUNCTIONAL REQUIREMENTS

This section outlines the key functionalities of the AI-Driven Predictive DIAGNOSIS

CHATBOT for Healthcare, emphasizing the outcomes and impacts of its operation. Functional requirements, such as real-time health data processing, symptom analysis, and medication recommendations, are prioritized to ensure efficient and accurate healthcare guidance.

3.5 INTERFACE REQUIREMENTS

In this, software interfaces which mean how software program communicates with each other or users either in form of any language, code, or message are fully described or explained.

3.6 PERFORMANCE REQUIREMENTS

In this, how a software system performs desired functions under specific condition is explained. It also explains required time, required memory, maximum error rate, etc.

3.7 DESIGN CONSTRAINTS

In this, constraints which simply means limitation or restriction are specified and explained for design team. Examples may include use of a particular algorithm, hardware and software limitations, etc.

3.8 NON-FUNCTIONAL ATTRIBUTES

In this, non-functional attributes are explained that are required by software system for better performance. An example may include Security, Portability, Reliability, Reusability, Application compatibility, Data integrity, Scalability capacity, etc.

3.9 NON-FUNCTIONAL REQUIREMENTS

- Interface Requirements
- Performance Requirements
- Software quality attributes such as availability [related to Reliability], modifiability [includes portability, reusability, scalability], performance, security, testability and usability [includes self-adaptability and user adaptability].

3.10 OVERVIEW OF RESPONSIBILITIES OF DEVELOPER

What all activities carried out by developer?

CHAPTER 4

PROJECT DESIGN AND IMPLEMENTATION

AI-DRIVEN PREDICTIVE DIAGNOSIS CHATBOT FOR HEALTHCARE

4.1 ARCHITECTURAL DIAGRAM

A description of the system architecture and architectural diagram needs to be presented.

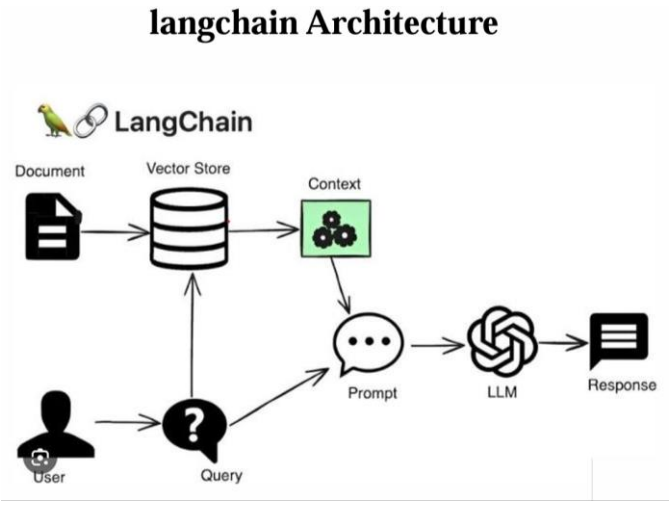

Figure 4.1.1: langchain Architecture diagram

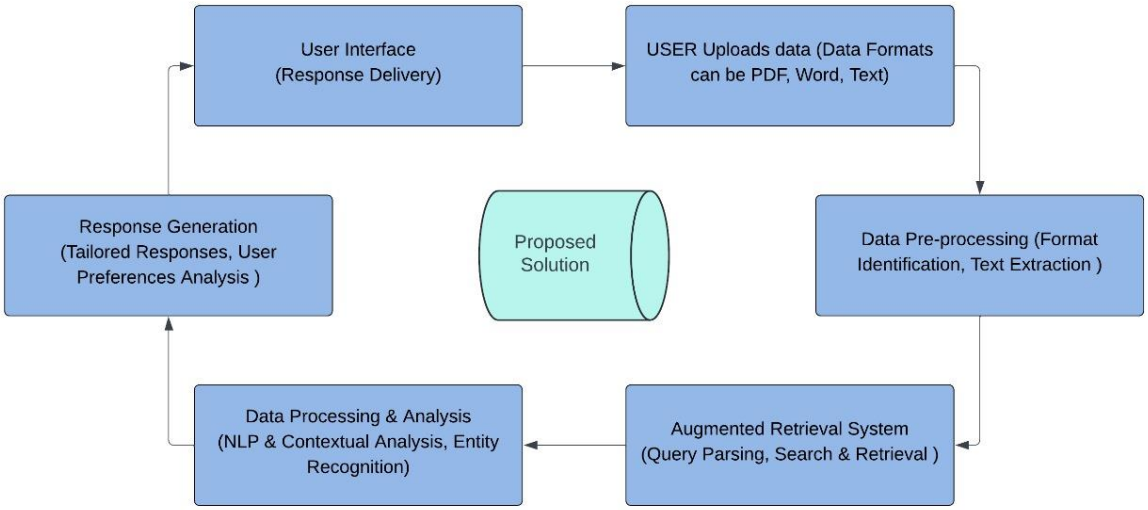

Figure 4.1.2: Proposed Solution diagram

4.2 METHODOLOGY

The methodology should include problem formulation and the processes used to solve the problem, prove or disprove the hypothesis. Use illustrations to clarify ideas and support conclusions. How you have solved the problem. Methodology is used in solving the problem. This should include computational methodology and experimental details. If the work is computational, this section talks about the methodology that is used in solving the problem. Computational methodology deals with

1. Equations
2. Model
3. Formulation
4. Specifications
5. Solving procedure

Experimental methodology deals with

1. Approach used for solving the problem
2. Dataset details
3. Block diagram of proposed seminar work
4. Algorithms etc.

4.3 USAGE SCENARIO

This section provides various usage scenarios for the system to be developed.

4.3.1 User profiles

The profiles of all user categories are described here (Actors and their Description)

4.3.2 Use-cases

All use-cases for the software are presented. Description of all main Use cases using use case template is to be provided.

Table 4.1: Use Cases

4.3.3 Use Case View

Use Case Diagram. Example is given below

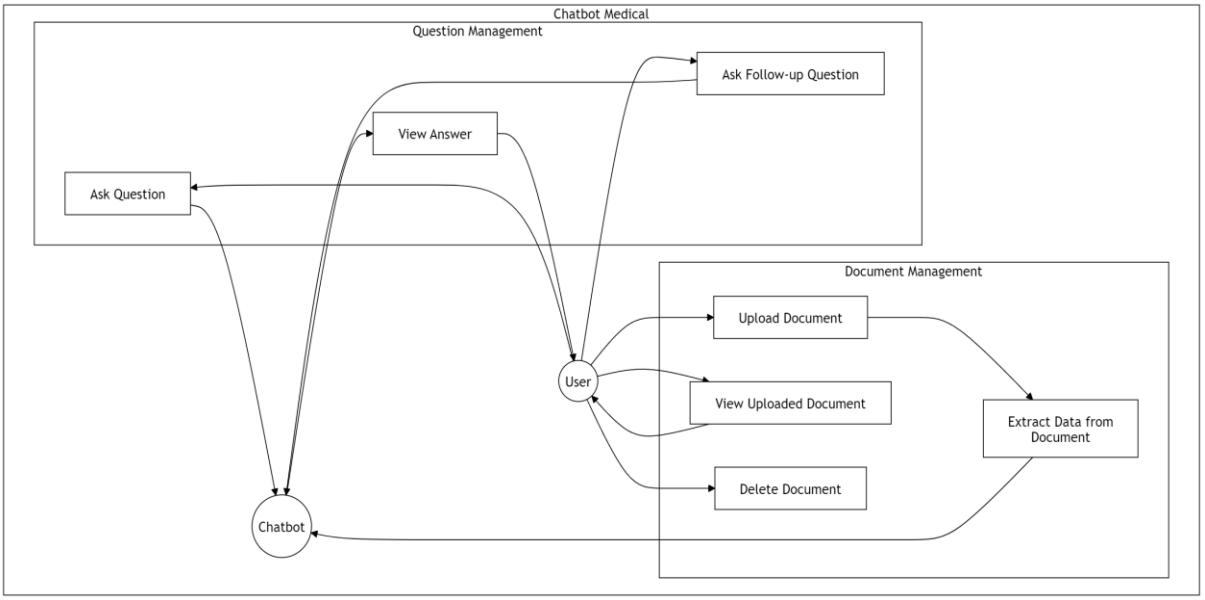

Figure 4.2: Use case diagram

4.4 DATA MODEL AND DESCRIPTION

4.4.1 Data Description

Data objects that will be managed/manipulated by the software are described in this section. The database entities or files or data structures required to be described. For data objects details can be given as below

4.4.2 Data objects and Relationships

Data objects and their major attributes and relationships among data objects are de- scribed using an ERD- like form.

4.4.3 Data Flow Diagram Level 0 Data Flow Diagram Level 1 Data Flow Diagram

4.4.4 Activity Diagram:

A description of each software function is presented. A processing narrative for function ‘n’ is presented. Steps / Activity Diagrams. For Example Refer 4.3

Sr. No.	Use Case	Description	Actors	Assumptions
1.	Symptom Analysis	Analyzes user symptoms and provides health insights.	End User, AI System	Users input accurate symptoms, and the system has access to medical knowledge.
2.	Medication Guidance	Suggests medications and treatments based on symptoms.	End User, AI System	System offers clear medication suggestions for common conditions.
3.	Personalized Advice	Provides personalized health advice based on symptoms and health history.	End User, AI System	Users input health history, and the system delivers tailored, understandable advice.

- The Activity diagram represents the steps taken.

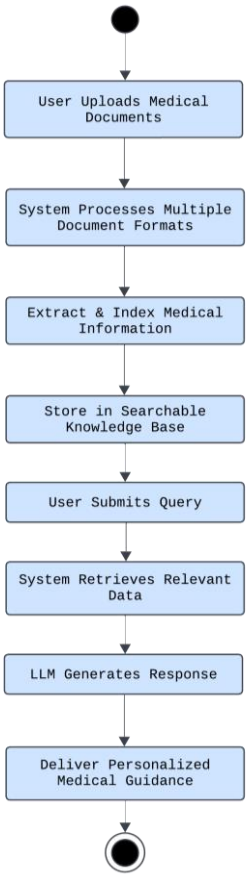

Figure 4.3: Activity diagram

4.5 CLASS DIAGRAM

Class diagrams, Interaction Diagrams, Algorithms. Description of each component description required.

4.5.1 Class Diagram

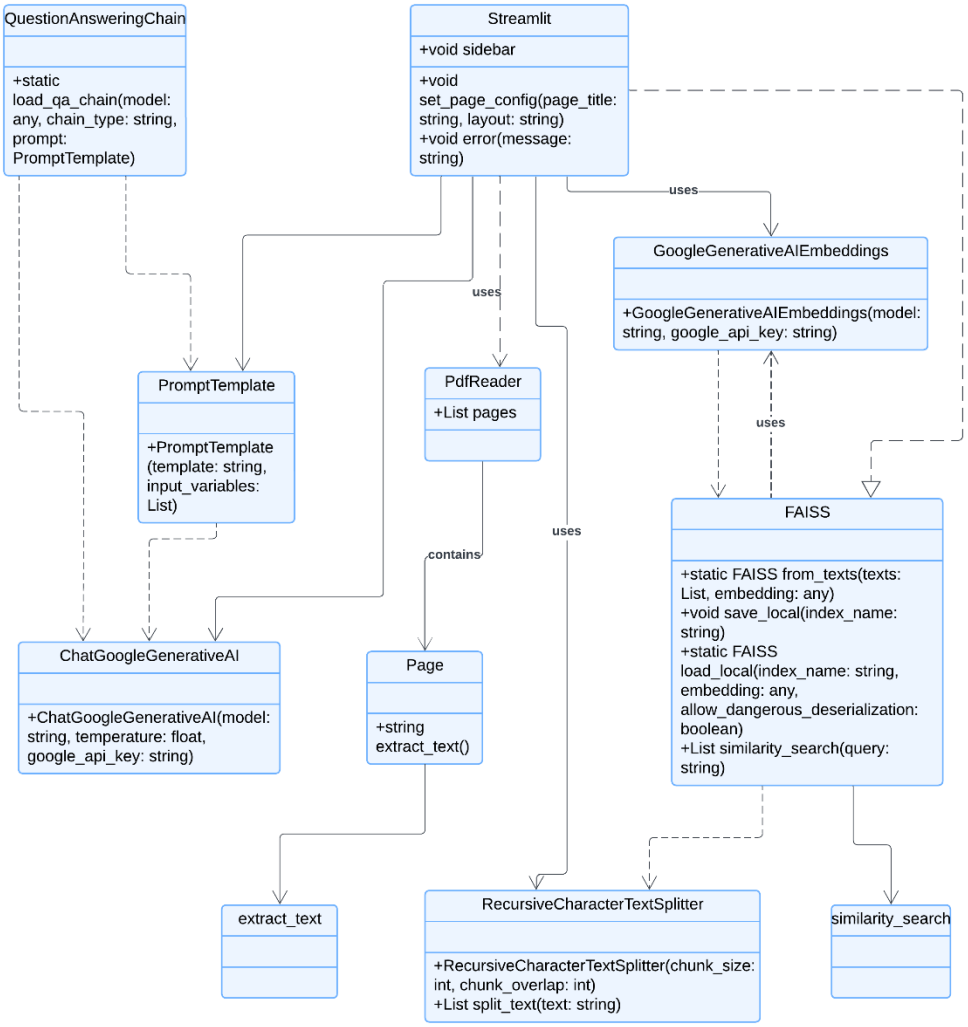

Figure 4.4: Class Diagram

4.6 SEQUENCE DIAGRAM

Sequence Diagram is an interaction diagram that details how operations are carried out – what messages are sent and when.

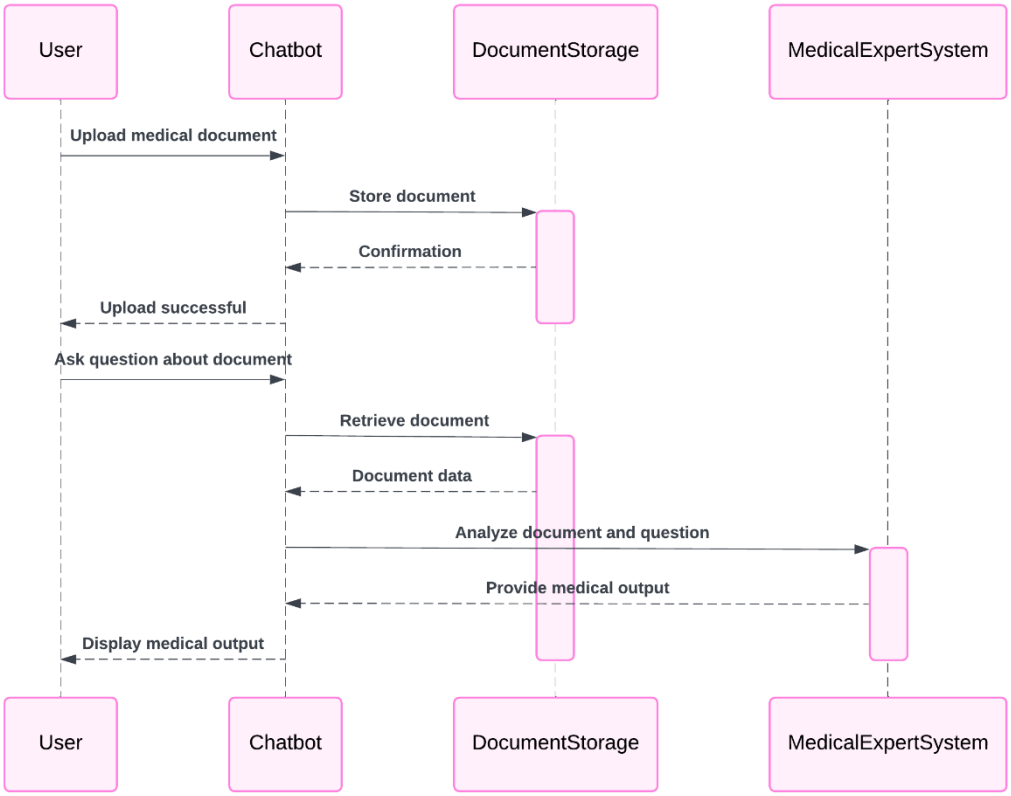

Figure 4.5: Sequence Diagram

CHAPTER 5 RESULTS

AI-DRIVEN PREDICTIVE DIAGNOSIS CHATBOT FOR HEALTHCARE

The AI-Driven Predictive DIAGNOSIS CHATBOT demonstrated significant potential during healthcare trials, streamlining the analysis of medical data, including patient histories, lab results, and imaging summaries. By organizing this information into a structured knowledge base, it ensured efficient indexing and seamless retrieval of critical insights. The integration of a lightweight Large Language Model (LLM) further elevated the system's capabilities, delivering concise, personalized, and evidence-based responses to user queries. This tailored approach ensured accuracy and relevance while minimizing the risk of misinformation. With ongoing refinement, this innovative system has the potential to transform healthcare by improving diagnostics, enabling personalized treatment plans, and enhancing patient outcomes.

OUTPUTS

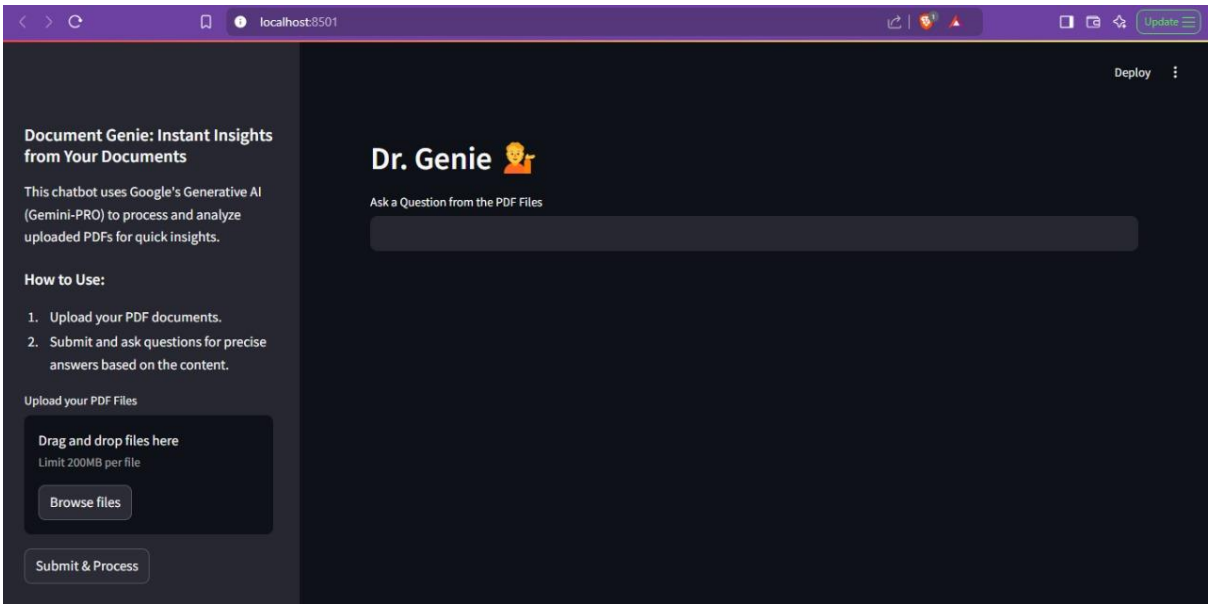

Figure 5.1: User Interface

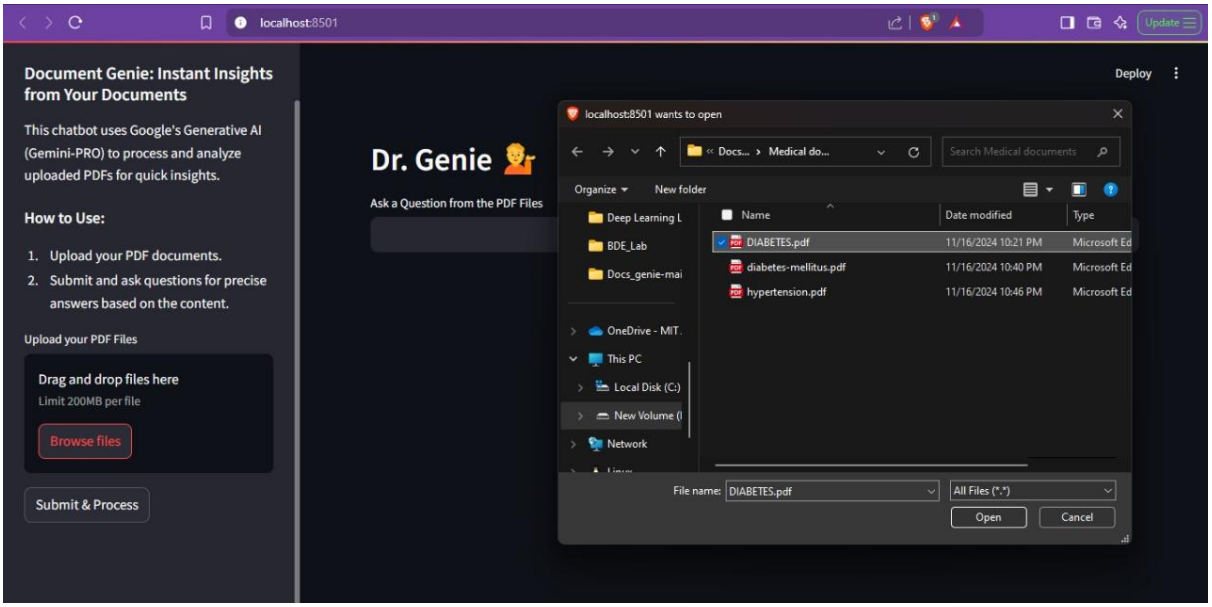

Figure 5.1: Uploading a document (PDF)

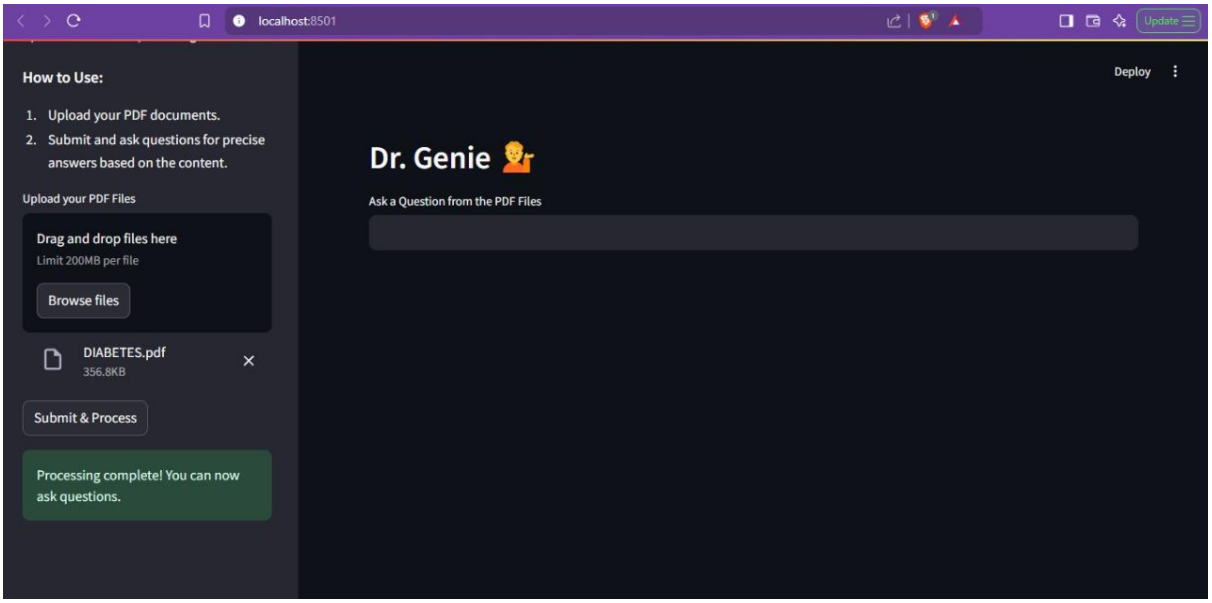

Figure 5.3: Document Processing Completed

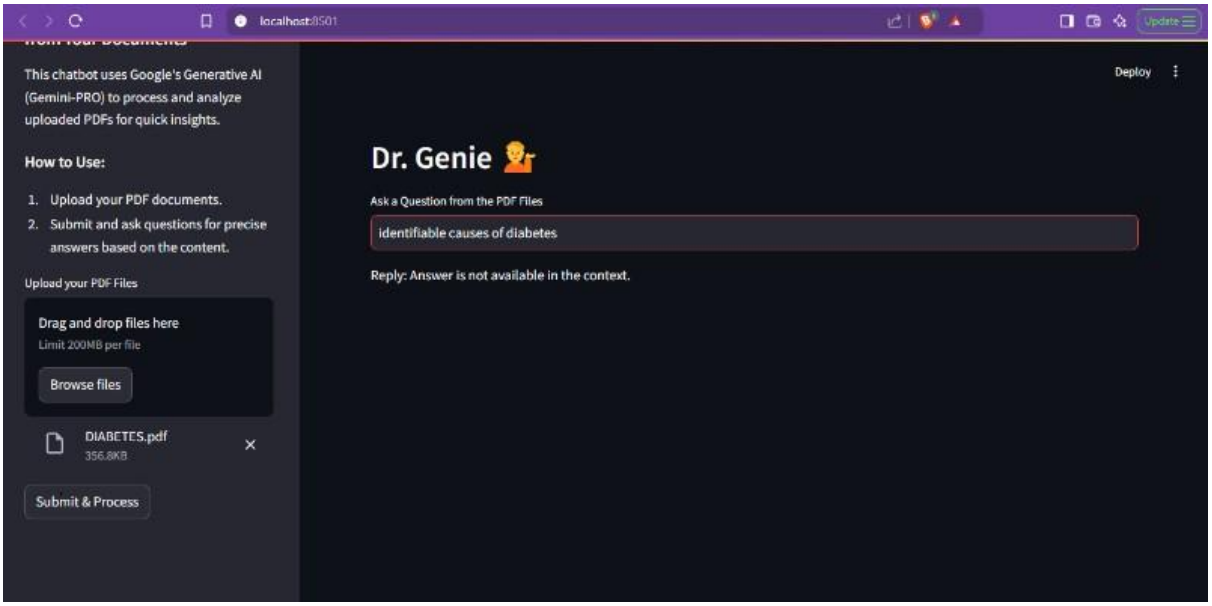

Figure 5.4: Answer not available in the content

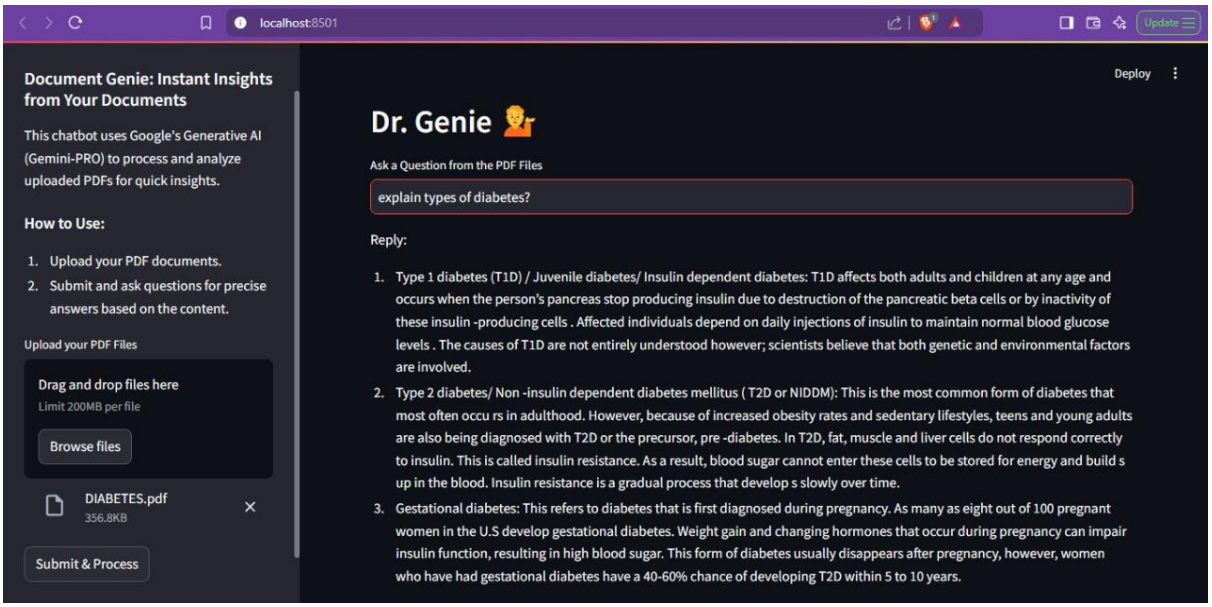

Figure 5.5: Answer produced for the provided question

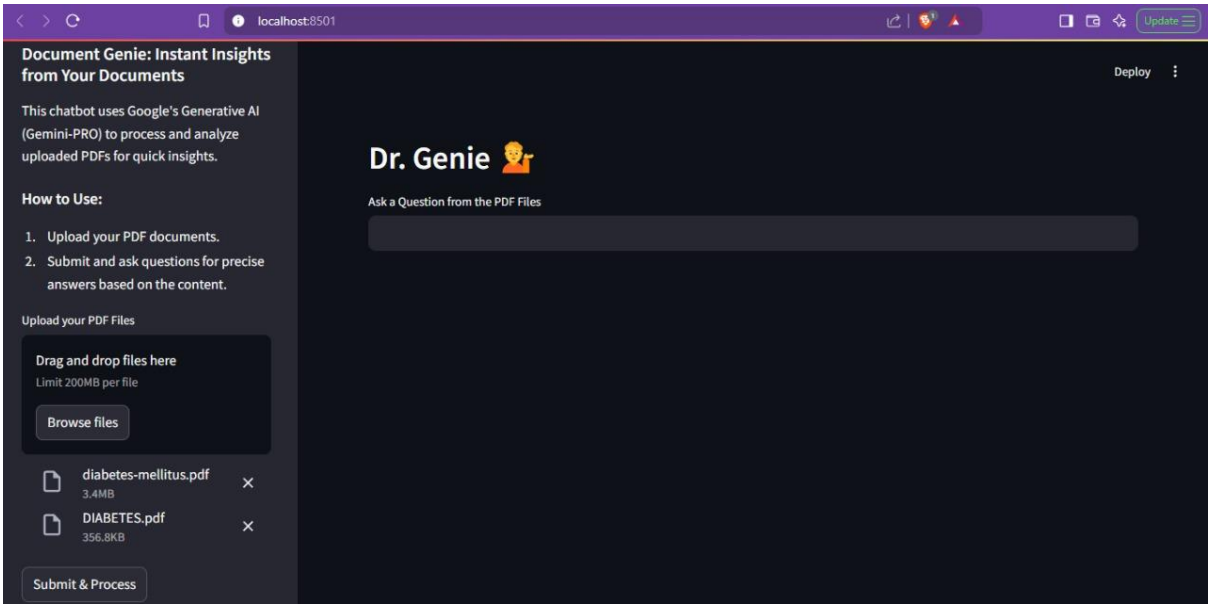

Figure 5.6: Uploading multiple Documents

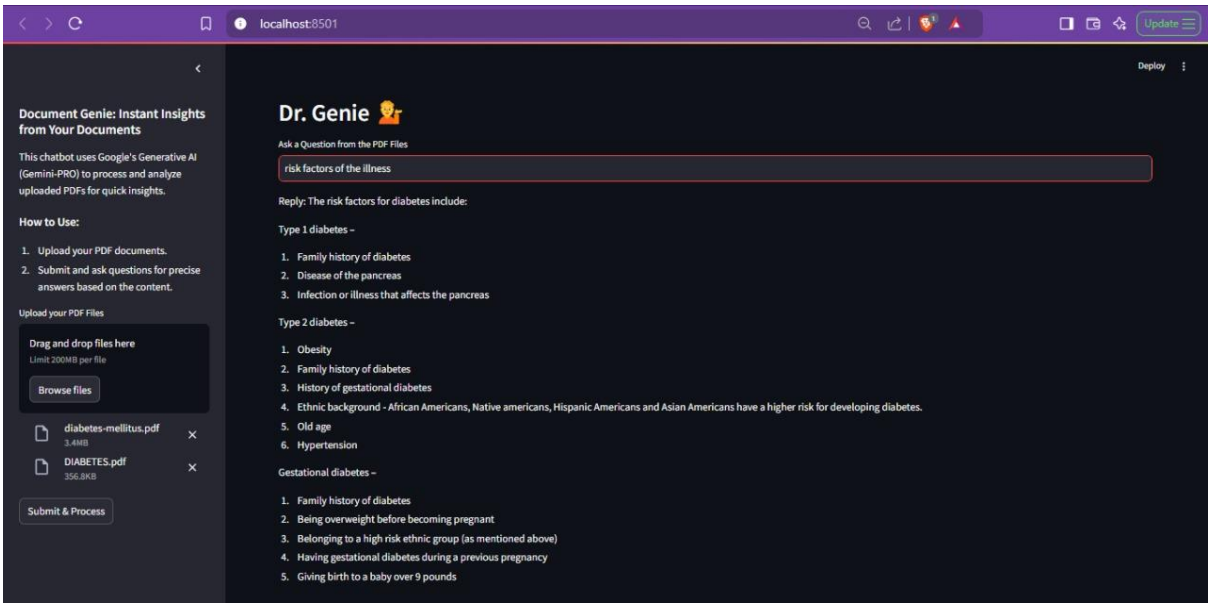

Figure 5.7: Answer generated from multiple documents

CHAPTER 6 CONCLUSION AND FUTURE SCOPE

AI-DRIVEN PREDICTIVE DIAGNOSIS CHATBOT FOR HEALTHCARE

CONCLUSION:

Through extensive research, the AI-Driven Predictive Diagnosis Chatbot for Healthcare has proven to be an effective solution for simplifying medical information. By utilizing Retrieval-Augmented Generation (RAG) and lightweight language models like LLaMA 2 and Mistral, the system can provide clear, accessible healthcare guidance. This approach enables individuals to better understand symptoms, medications, and common health conditions, promoting proactive health management. By automating the process of health data retrieval and explanation, the system reduces reliance on healthcare professionals for basic queries, improving health literacy and empowering users to make informed decisions.

FUTURE SCOPE:

The AI-Driven Predictive Diagnosis Chatbot for Healthcare has vast potential for further enhancement. Future improvements could include the continuous refinement of language models for more accurate and contextually relevant health advice, integration with diverse health data sources to provide more personalized recommendations, and adaptability to various user needs and health conditions. Additionally, expanding the system to include real-time health monitoring and predictive analytics could enhance its ability to prevent health issues before they arise. These advancements aim to further improve the effectiveness and accessibility of healthcare, ultimately contributing to a more informed, proactive, and efficient healthcare ecosystem.

CHAPTER 7 REFERENCES

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ANNEXURE A

PLAGIARISM REPORT

AI-DRIVEN PREDICTIVE DIAGNOSIS CHATBOT FOR HEALTHCARE

Plagiarism report

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