

A
Project
Report on
Real-World AI Chatbot

Developed at
DRC Systems, Gandhinagar, Gujarat, India

Developed by
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Guided By

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April – 2024

CANDIDATE DECLARATION

I declare that the final semester report entitled “**Real-World AI Chatbot**” is my own work conducted under the supervision of the external guide **Tarak Kadiya** from **DRC Systems**.

I further declare that to the best of my knowledge the report for B.Tech. final semester does not contain part of the work which has been submitted for the award of B.Tech. Degree either in this or any other university without proper citation.

Candidate's

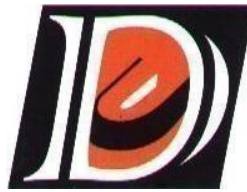
Signature Name :-

Thakkar Jay

Branch:Information Technology

Student ID: 20ITUOS131

DHARMSINH DESAI UNIVERSITY
NADIAD-387001, GUJARAT



CERTIFICATE

This is to certify that the project entitled “**Real-World AI Chatbot**” is a bonafide report of the work carried out by

Mr. Jay Thakkar Student ID No: 20ITUOS131

of Department of Information Technology, semester VIII, under the guidance and supervision for the award of the degree of Bachelor of Technology at Dharmsinh Desai University, Nadiad (Gujarat). They were involved in Project training during the academic year 2023-2024.

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(Project Guide)

Department of Information
Technology, Faculty of Technology,
Dharmsinh Desai
University, Nadiad

Date:

Prof. (Dr.) Vipul. K. Dabhi

Head, Department of Information
Technology, Faculty of Technology,
Dharmsinh Desai
University, Nadiad

Date:

ACKNOWLEDGMENT

It is truly a pleasure to express our thanks and gratitude to everyone who has helped us throughout the process of making this project. This project gave me a great opportunity to think, implement and interact with different aspects of the software development lifecycle. I would like to thank everyone who has helped us at one time or another by providing us with the support, encouragement, and foundation needed to carry out our project throughout the internship.

I express my deep gratitude to our External Project Faculty, **Mr. Tarak Kadiya** and Internal Project Guide, Prof. **Deepak Vegda** for their innovative ideas and efforts. Their seriousness to make our project successful. It was their sincerity that inspired us throughout the project to work hard using technologies adopted by the industry.

I am sincerely grateful to Prof. **Vipul. K. Dabhi** (HOD of the Faculty of IT) for his unconditional and objective support throughout the research and development process. All of which provide us with a supportive environment.

Without them, I would not have achieved our goal. I thank the manager of DRC Systems for giving us the opportunity to work at.

The combination of gratitude, joy and great satisfaction is what we feel like passing our debt on to all those who have contributed directly or indirectly to the implementation of the project.

With Sincere
Regards, Jay
Thakkar.

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ABSTRACT

In today's digital age, the creation of an advanced AI chatbot marks a major advancement in streamlining information retrieval and enhancing user engagement. By harnessing the powerful MERN technology stack and cutting-edge machine learning algorithms, our project introduces a flexible platform poised to transform how users interact with and retrieve information.

- The chatbot accommodates typed queries, enabling users to input their questions and receive responses efficiently.
- Users can upload PDF documents to the chatbot, allowing them to ask questions and receive answers based on the content of the uploaded files.
- Additionally, the chatbot supports vocal inquiries, converting spoken questions into text for seamless interaction and response.
- Additionally, the platform is equipped with document summarization capabilities, providing users with concise insights into the content of uploaded documents.
- A comprehensive history of user interactions is maintained, enabling users to reference past queries and manage content effectively.

COMPANY PROFILE

DRC Systems

Website

- <https://www.drcsystems.com/>

Industries

- Software Development

Company size

- 250 - 500 employees

Headquarters

- Gandhinagar.

Type

- Privately Held

Founded

- 2012

Specialties

- Web development, Android Development, ML, QA.
- DevOps, AWS, Microservices

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0. TRAINING TAKEN IN INDUSTRY

0.1 Objective and Scope of Different Types of Training Undertaken

- We have taken training in Javascript, React.js, Node.js, MongoDB.
- Scope of training is to learn and understand different technologies and platforms which are used in today's corporate world.

0.2 Duration and Schedule of Each Training Phase

Training Undertaken	Duration
Javascript Training	1 week
React.js & MongoDB Training	5 weeks
Node.js Training	2 weeks
Project Work	7 weeks

Table 0.2.1

0.3 Tools and Platform Used

- We have used VS Code, MongoDB Atlas, Postman tools/platforms in our training and project.

0.4 Week-wise List of Topics covered During Training

Topics	Duration
<ul style="list-style-type: none">• Linux• Understood command in Linux• Git commands• Basics of JavaScript• Git advance command revert and rebase	1 week

<p>React.js & MOngoDB Training</p> <ul style="list-style-type: none"> • Advance topics of Javascript • Asynchronous Javascript • Classes and modules • Exception Handling and regex • REST API • Error handling • Basics of React hooks • Class based components • Function based components • React advance hooks • Code cleaning • Code refactoring • State management using context API. • Basics of Redux • React Optimization • MongoDB Schema • Mongoose methods • MongoDB Query • Schema Validation • MongoDB Atlas • Query Optimization 	<p>5 weeks</p>
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<p>Node.js Training</p> <ul style="list-style-type: none"> ● Introduction ● Architecture of Node.js ● Understand of Express server ● Routing ● Middlewares ● Controllers ● App configuration with Options ● Error handling ● REST API controllers ● CRUD operation ● API testing with Postman ● Express Middleware ● Caching ● Session management 	<p>2 weeks</p>
<p>Project Work</p> <ul style="list-style-type: none"> ● Explore API ● Explore SDK and Tested SDK ● REST API creation ● Code Structure ● React Components ● Test Connectivity ● Create users ● OpenAI model creation ● Search query ● Upload document ● Store document ● Ask questions from document ● Ask question through microphone ● View history ● Clear history ● Code-splitting ● Optimize React app ● Implement Node Caching 	<p>7 weeks</p>

Table 0.4.1

0.5 Conclusion and Feedback on Training

- After finishing this training, I now understand the different technologies and platforms used in our project and how they are applied in real-world situations. I've also learned about software design, working with project management tools, time management, and the importance of group discussions and teamwork.

1 INTRODUCTION

1.1 Project Details

Title :- **Real-World AI Chatbot**

Features:-

- Query Resolution: Allows users to post queries and receive pertinent responses.
- Document Analysis: Enables users to upload scientific documents (PDF) for question-based interrogation and real-time answers.
- Voice Interaction: Facilitates voice-based questioning via microphone, with automatic speech-to-text conversion and response generation.
- Document Summarization: Provides users with concise summaries of uploaded documents.
- History Tracking: Enables users to view past interactions and manage their history.

1.2 Purpose

- The project aims to enhance user accessibility to information through advanced AI-driven conversational interfaces, catering to both textual and auditory input modalities. By incorporating document analysis and summarization features, it seeks to streamline information retrieval from scientific documents, thereby fostering efficiency and productivity.

1.3 Scope

- The scope of the project encompasses the development of a robust AI chatbot platform capable of handling diverse user interactions, ranging from simple queries to complex document analysis tasks.
- The platform's versatility allows for seamless integration into various domains, including academia, research, and general knowledge dissemination.

1.4 Objective

The main objectives of developing this project are:

- Implement a user-friendly interface for intuitive interaction.
- Integrate machine learning models for natural language processing and document analysis.
- Ensure real-time responsiveness and accuracy in query resolution.

- Enable seamless transition between text and voice inputs.
- Provide comprehensive document summarization functionalities.
- Implement a secure and efficient history tracking mechanism for user convenience.

1.5 Technology Review

Tech stack: MERN stack (MongoDB, Express.js, React.js, Node.js)

Language: JavaScript (for both front-end and back-end development).

Other tools: Machine learning frameworks for NLP and document analysis, Langchain library from python, OpenAI embeddings, Postman, VS Code, Git , Github. MongoDB Atlas.

2 OVERALL DESCRIPTIONS

2.1 Product Perspective

“Chatbots represent a new trend in how people access information, make decisions, and communicate”

Our AI chatbot project serves as an innovative solution aimed at enhancing user interaction with information through natural language processing (NLP) and document analysis capabilities. It stands as an independent system, designed to seamlessly integrate with various user interfaces and platforms.

2.1.1 Product Features

- Query Resolution
- Document Analysis
- Voice Interaction
- Document Summarization
- History Management

2.2 User Classes and Characteristics

- **Diverse User Backgrounds:** Our user base comprises a wide spectrum of individuals, ranging from seasoned researchers and professionals to students and enthusiasts. Each user group brings a unique set of requirements, expectations, and levels of technical proficiency to the table. Researchers and professionals may seek in-depth document analysis capabilities and advanced querying functionalities tailored to their specific fields of study or work. Students, on the other hand, may require simplified interfaces and educational aids to enhance their learning experiences.
- **Varied Levels of Technical Proficiency:** Users exhibit differing levels of technical proficiency and domain knowledge, influencing their interaction with the AI chatbot. While some users may possess advanced technical skills and familiarity with AI technologies, others may have limited experience or understanding in this domain. A user-friendly interface is paramount in ensuring accessibility and usability for individuals across the proficiency spectrum. Intuitive design, clear instructions, and contextual guidance play crucial roles in facilitating seamless interaction, regardless of the user's technical acumen.

2.3 Operating Environment

Hardware Requirement for Operating

- Personal Computer
- Processor: Intel dual core or above
- Processor Speed: Minimum 1 GHz; Recommended 2GHz or more
- RAM: 4 GB RAM or above
- Hard Disk: Minimum 32 GB; Recommended 64 GB or more
- Stable Internet Connection

Software Requirement for Operating

- Any browsers (recommended Chrome)
- Git
- VSCode
- CORS extension (optional)

2.4 Assumption and Dependencies

- The user should have basic knowledge of computers and software.
- The user should have Internet connectivity.

2.5 Project Development Approach

- The Agile Model is used for project development. We have selected Agile Model because of its beneficial speed without affecting the quality of product and agile makes the team so much more productive.

Agile Model

- Agile SDLC model is a combination of iterative and incremental process models with focus on process adaptability and customer satisfaction by rapid delivery of working software products. Agile Methods break the product into small incremental builds. These builds are provided in iterations. Each iteration typically lasts from about one to three weeks. Every iteration involves cross functional teams working simultaneously on various areas like planning, requirements analysis, design, coding, unit testing, and acceptance testing. At the end of the iteration a working product is displayed to the customer and important stakeholders.

What is Agile?

- Agile models believe that every project needs to be handled differently and the existing methods need to be tailored to best suit the project requirements. In agile the tasks are divided into time boxes (small time frames) to deliver specific features for a release.
- Iterative approach is taken and working software build is delivered after each iteration. Each build is incremental in terms of features; the final build holds all the features required by the customer.

Advantages of using Agile Model

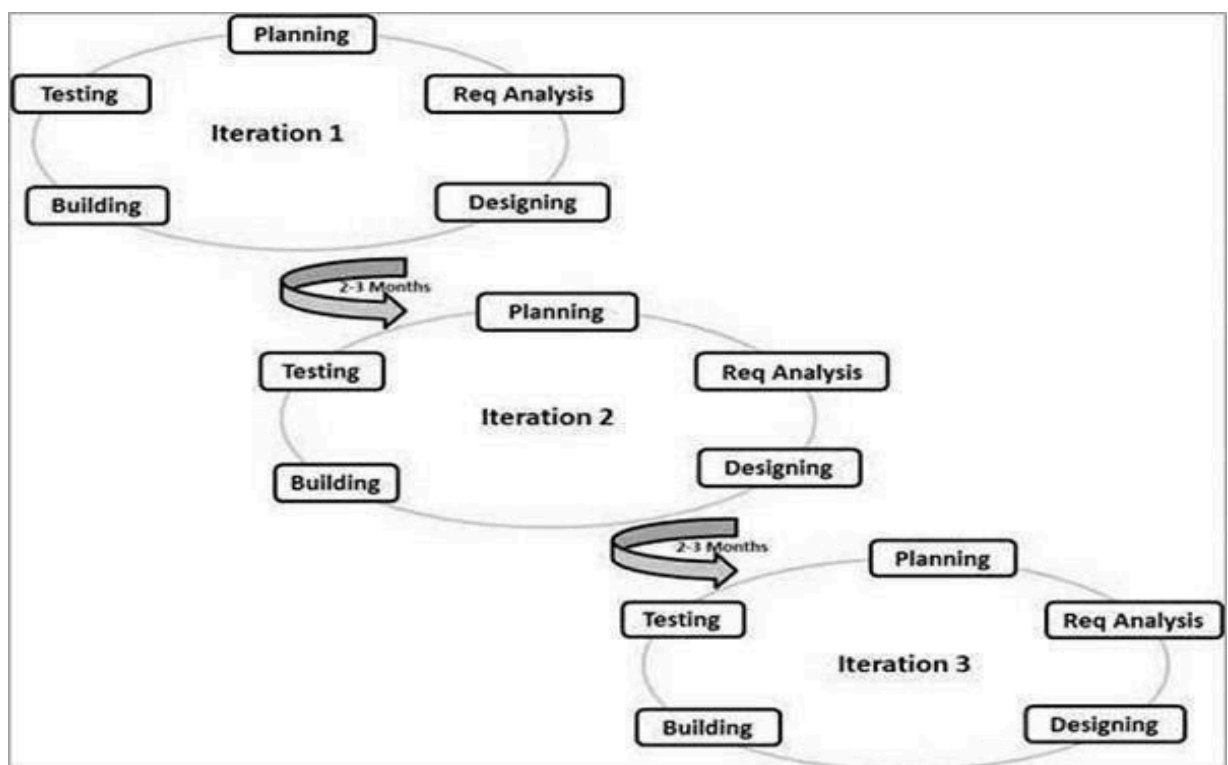


Fig 2.5.1

Customer satisfaction by rapid, continuous delivery of useful software. People and interactions are emphasized rather than processes and tools. Customers, developers and testers constantly interact with each other. Working software is delivered frequently (weeks rather than months). Face-to-face conversation is the best form of communication. Close, daily cooperation between business people and developers. Continuous attention to technical excellence and good design.

Disadvantages of using Agile Model

- In case of some software deliverables, especially the large ones, it is difficult to assess the effort required at the beginning of the software development life cycle.
- There is a lack of emphasis on necessary designing and documentation. The project can easily get taken off track if the customer representative is not clear what final outcome that they want.
- Only senior programmers are capable of taking the kind of decisions required during the development process. Hence it has no place for newbie programmers, unless combined with experienced employees.

Milestones and Deliverables

- Milestones are identified in order to complete the entire project in the time duration. Milestones are identified for every sprint of Crest Data Systems.

PHASE	DELIVERABLES	PURPOSE
System Requirement and Analysis	<ul style="list-style-type: none"> ● Requirement Gathering and analysis. ● Functional Specification ● Non-functional Specification 	It gives an exact understanding of the user's requirements.
System Design	<ul style="list-style-type: none"> ● Class Diagram ● Use Case diagram ● Sequence diagram ● Activity diagram 	It gives the logical structure that describes the system.

Implementation & Testing	<ul style="list-style-type: none"> The output obtained for the required functionality after implementing and doing testing. 	It makes the system robust and reliable.
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Table 2.5.2

Roles and Responsibility

Name	Role				
	Analysis	Designing	Coding	Testing	Documentation
Jay Thakkar	✓	✓	✓	✓	✓

Table 2.5.3

3 SYSTEM REQUIREMENTS

This Section describes all Functional as well as Non-functional requirements. It contains descriptions of functions and capabilities that the product must provide.

3.1 Functional Requirement

- Functional requirements describe how a product must behave, what its features and functions.

F1: Login

- **Input:** Email id and Password.
- **Output:** logged in in navigate to profile section
- **Processing:** Verify login credentials and generate response

F2: Register

- **Input:** Name, email, password, etc...
- **Output:** Navigate to the chat section.
- **Processing:** Create a user in DB and send acknowledgement mail to user.

F3: User Query Interaction

- **Input:** Textual query entered by the user.
- **Output:** Response generated by the chatbot in real-time.
- **Processing:** Natural Language Processing (NLP) algorithms analyze the user query and generate a relevant response based on the available knowledge base.

F4: Document Upload and Questioning

- **Input:** Scientific document uploaded by the user in PDF format.
- **Output:** Answers to questions posed by the user based on the document content.
- **Processing:** The system extracts information from the uploaded document and applies NLP techniques to answer user questions in real-time.

F5: Voice Interaction

- **Input:** Voice query captured through the microphone.
- **Output:** Textual response provided by the chatbot.
- **Processing:** Speech-to-text conversion is performed on the voice input, followed by the same processing flow as a textual query to generate a response based on the uploaded document content.

F6: Document Summarization

- **Input:** Request from the user to summarize the uploaded document.
- **Output:** Concise summary of the document content.
- **Processing:** Summarization algorithms analyze the document's key points and generate a condensed summary for user reference.

F7: View Interaction History

- **Input:** None
- **Output:** Display interaction history
- **Processing:** retrieving the interaction history data from the system's database and formatting it for display.

F8: Remove Content from History

- **Input:** Specific entries which user want to remove
- **Output:** Updated history after removing such entries
- **Processing:** Identifying and removing the selected entries from the interaction history stored in the system's database.

3.2 Non-Functional Requirement

3.2.1 Usability

Usability defines how difficult it will be for a user to learn and operate the System. The user interface shall be intuitive and user-friendly, requiring minimal training for users to navigate and interact with the chatbot.

Efficiency of use:-

Users can easily interact with the system. Most tasks a user can complete without any help. It has no complex design so any user can easily interact.

3.2.2 Reliability

Reliability defines how likely it is for the software to work without failure for a given period. Reliability decreases because of bugs in the code, hardware failures, or problems with other system components.

It should have mechanisms in place for automatic recovery from system failures or crashes, ensuring continuous operation.

3.2.3 Performance

Performance is a quality attribute that describes the responsiveness of the system to various user interactions with it.

The actions take minimal seconds to fetch the information

Document analysis and summarization processes shall be completed within 10 seconds for documents up to 50 pages in length.

The chatbot shall respond to user queries within 3 seconds under normal operating conditions.

3.2.4 Security

Security requirements ensure that the software is protected from unauthorized access to the system and its stored data. It considers different levels of authorization and authentication across different user's roles. For instance, some of the containers will only be accessible to the specified users.

Access to user interaction history and sensitive functionalities shall be restricted to authenticated users only.

4 SYSTEM DESIGN

4.1 Use Case Diagram

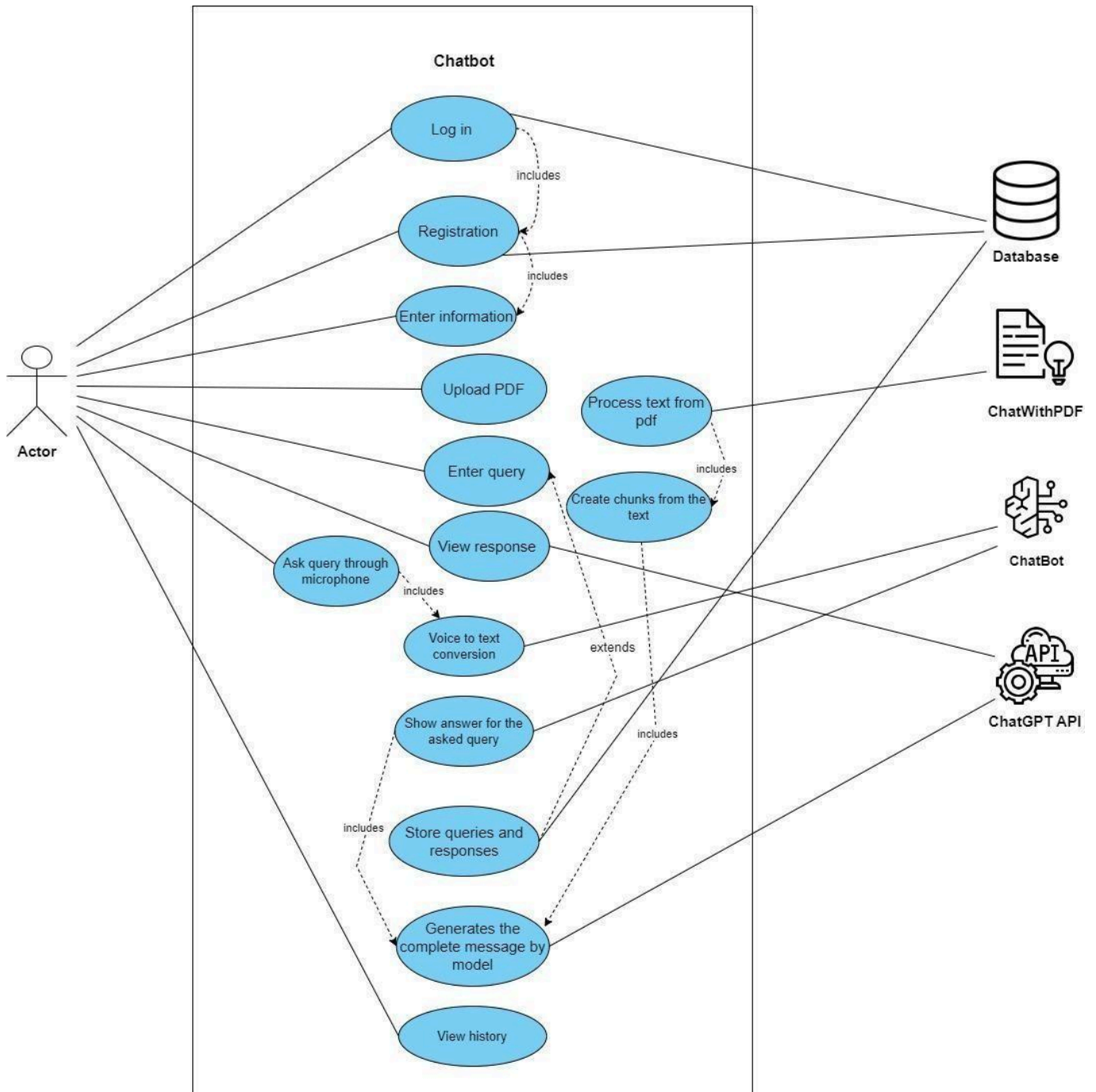


Fig 4.1

4.2 Activity Diagram

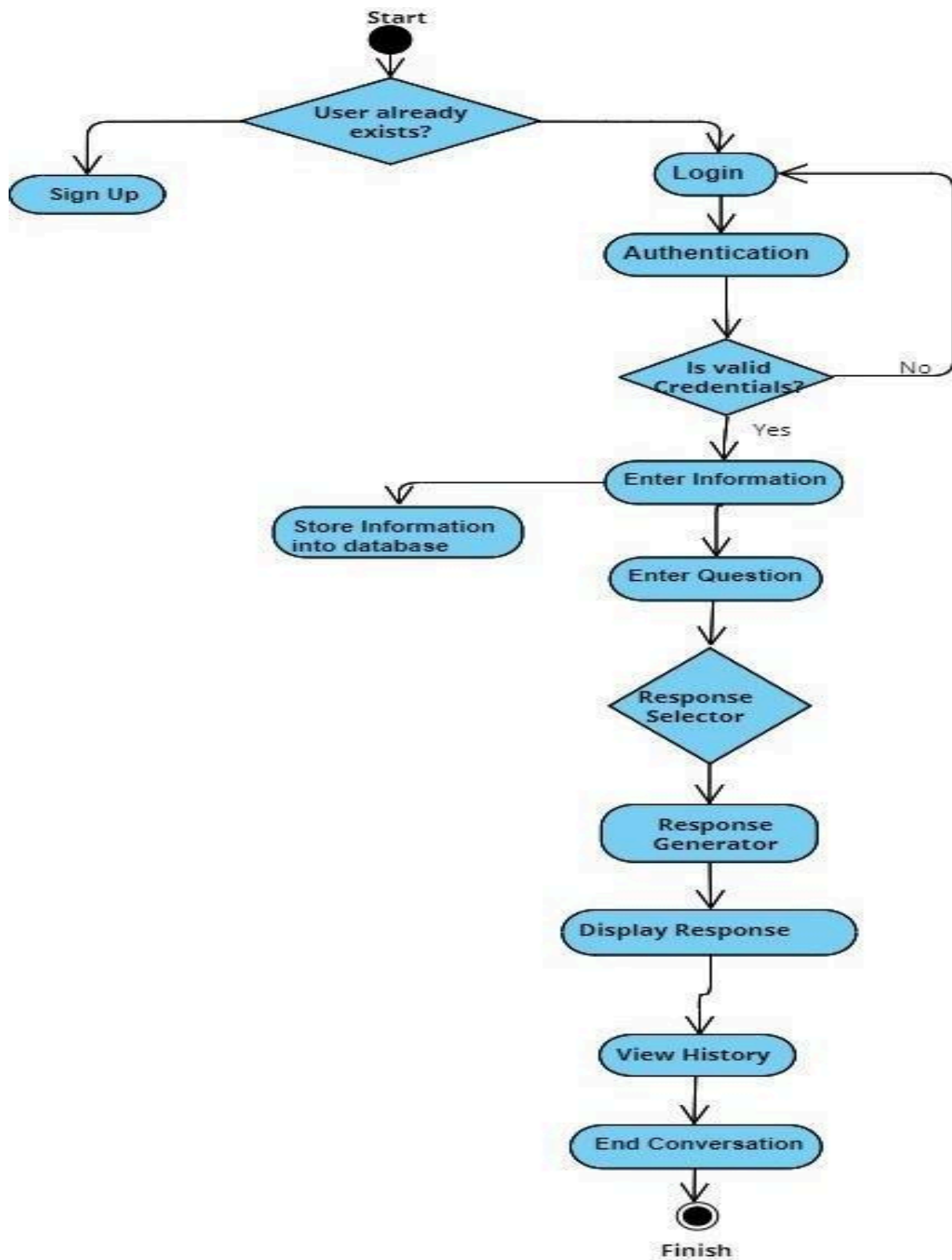


Fig 4.2

4.3 Sequence Diagram

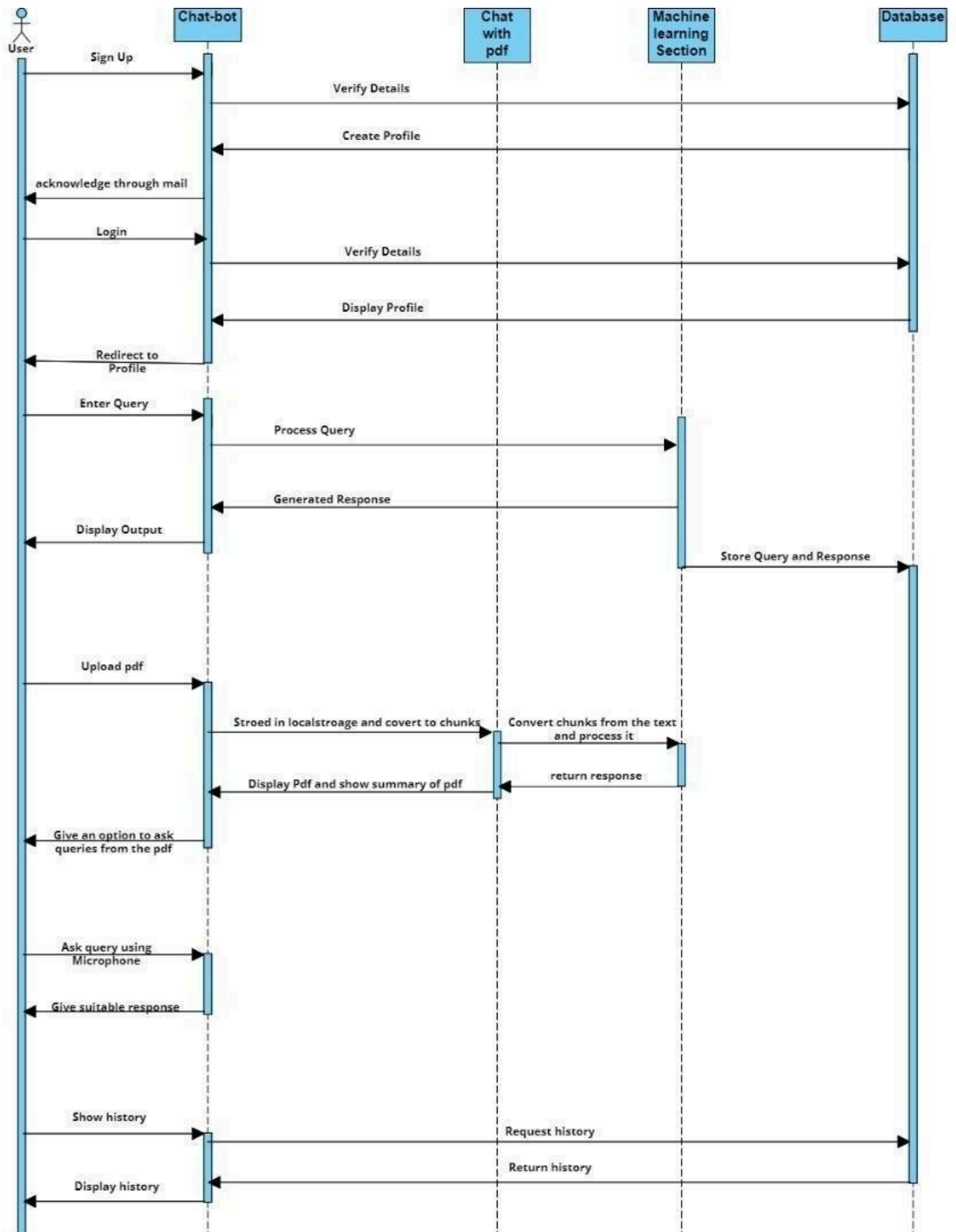


Fig 4.3

4.4 Class Diagram

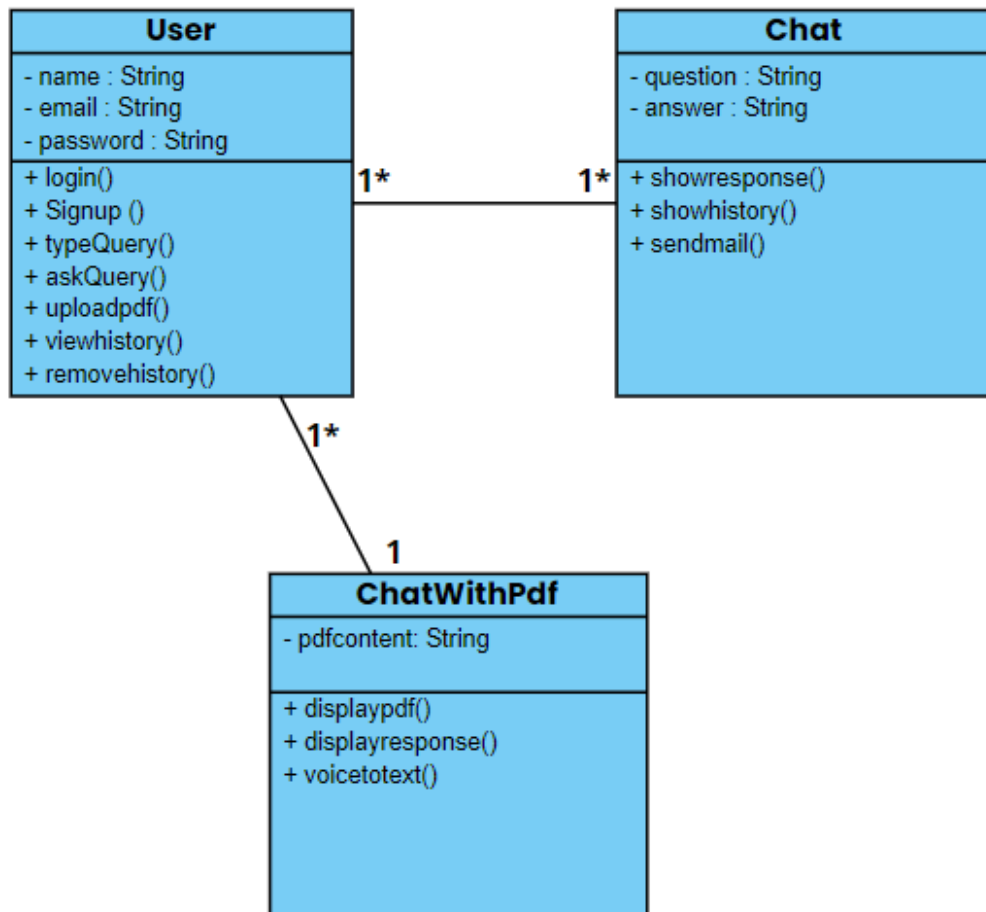


Fig 4.4

4.5 Flow Diagram of the machine learning model used in ChatWithPDF option

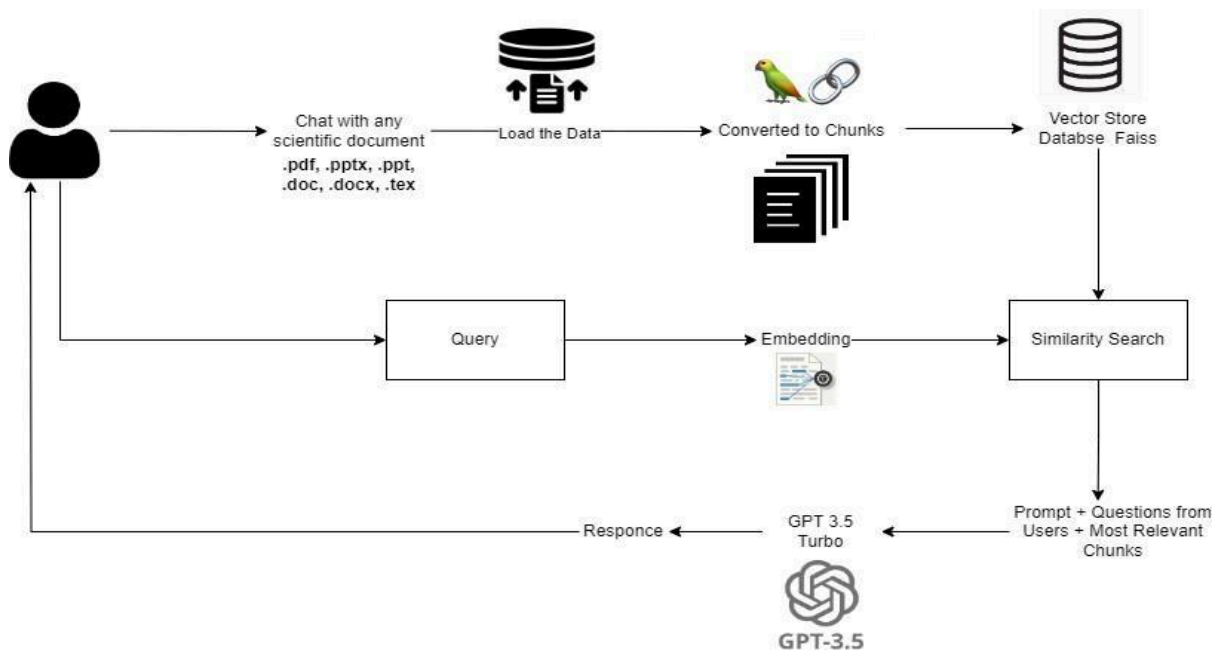


Fig 4.5

5 IMPLEMENTATION PLANNING

5.1 Implementation Environment

For the implementation of the project, we will need the following as basic platforms and tools:

- Visual Studio- This IDE is used for back-end-related work.
- Postman- This software is used for API testing.
- Git – Deploy code into the GitHub.

5.2 Module Specification

Our application is divided into various action modules

- Registration module
- Login module
- Query Processing module
- Document Upload and Analysis Module
- Voice Interaction Module
- Document Summarization Module
- Interaction History Management Module
- Email Notification Module
- User Interface Module
- Backend Server Module
- Database Connection Module

5.3 Coding Standards

To make the system coding easy, easy to remember and reduce the chances of errors some techniques are used at the time of coding of the application which is called coding standard. The coding standard which we adopted during the coding is explained as follows:

- Each nested block should be properly indented and spaced.
- The code should be properly commented for understanding easily.
- Comments regarding the statements increase the understandability of the code.
- Better to avoid use of digits in variable names.
- The name of the function must describe the reason for using the function clearly and briefly.

6 TESTING

6.1 Testing Plan

- The testing technique that is going to be used in the project is White box testing. In White box testing the Tester knows the internal structure of the code or the program of the software.

White Box Testing:

- It is a software testing technique in which the internal structure, design, and coding of software are tested to verify the flow of input-output and to improve design, usability, and security.
- Out of the 2 methods for testing, black box testing and white box testing, we would be using white box testing as we are well aware of the internal functionalities of our application unlike in black box testing.

6.2 Testing Strategy

The development process repeats this testing sub-process several times for the following phases.

- **Unit Testing:** It ensures that all code meets quality standards before it's deployed. Also, it detects software bugs earlier.
- **Integration Testing:** It tests whether the various programs that make up a system, interface with each other as desired, fit together and whether the interfaces between the programs are correct.

We also used below testing methods:

- **Smoke testing:** It is a software testing process that determines whether the deployed software build is stable or not. Smoke testing is a confirmation for the QA team to proceed with further software testing.
- **Exploratory testing:** It is suited for specific testing scenarios. While testing other scenarios, most of the bugs we find. It is often described as simultaneous learning, test design, and execution.
- **Regression testing:** Ensures that new coding doesn't interrupt existing coding features. Assures there are no defects or bugs after implementing software updates.

6.3 Test Cases

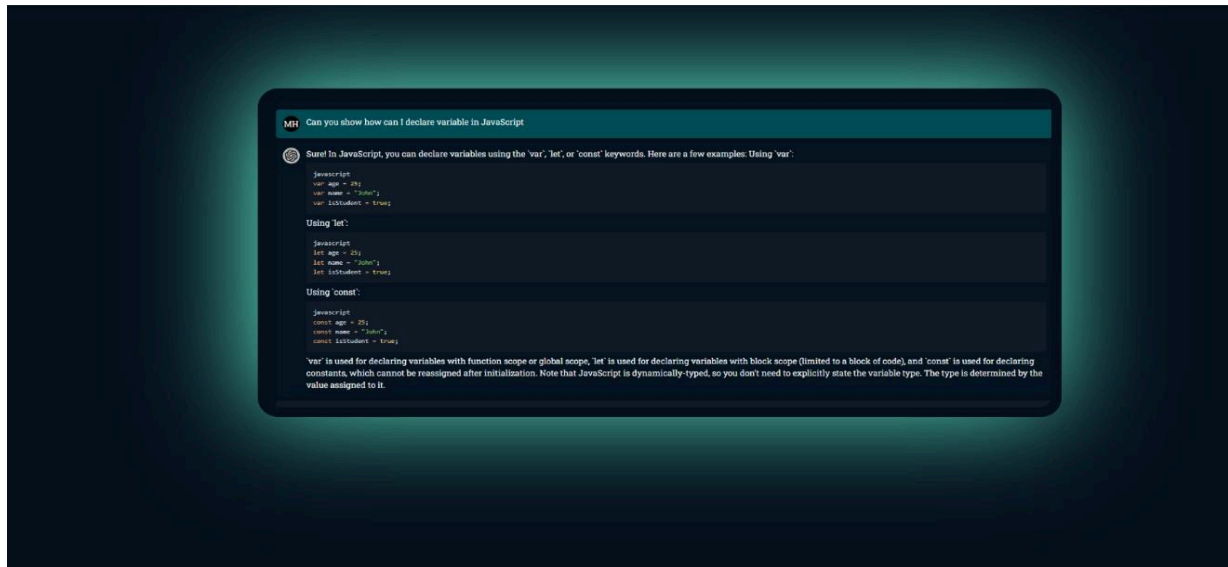
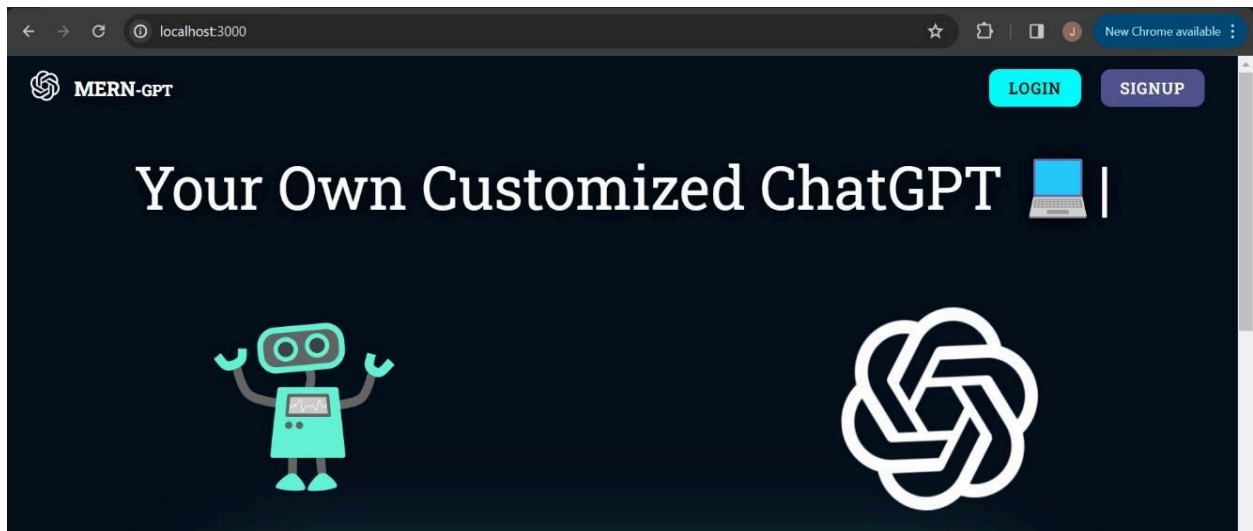
Functionality under test	Test Case	Expected Output	Actual Output	Result
Test Connectivity	Validate input parameters (username, password)	Test Connectivity passed the message	Test Connectivity passed the message	Passed
Create User	Validate input parameters.	The user will be created with a unique User ID for each user.	The user will be created with a unique User ID for each user.	Passed
Acknowledge user	Validate input parameters (email id)	The user will get an acknowledgment email just after registering on the platform.	The user will get an acknowledgment email just after registering on the platform.	Passed
Query processing	Validate input parameters (typed query as text)	The response will be generated by the chatbot as per the respective question.	The response will be generated by the chatbot as per the respective question.	Passed
PDF uploading	Validate input parameters (file type)	The user will upload the pdf file and will get a response as the file is uploaded successfully.	The user will upload the pdf file and will get a response as the file is uploaded successfully.	Passed

Summary of the uploaded document	Validate input parameters (file type)	The user will get a summary of the uploaded pdf as soon as the pdf is uploaded successfully.	The user will get a summary of the uploaded pdf as soon as the pdf is uploaded successfully.	Passed
Query answering with the context of the PDF uploaded	Validate input parameters (query as text)	The user will get the response for the asked query as per the information available in the document.	The user will get the response for the asked query as per the information available in the document.	Passed
Query parsing using the microphone	Validate input parameters (asked query as voice)	The asked query first will be converted into text till the off button of the microphone is pressed and then after it will respond to the asked a query.	The asked query first will be converted into text till the off button of the microphone is pressed and then after it will respond to the asked a query.	Passed
Show interaction history	Validate input parameters (query and its responses)	The user will be able to view the interaction history when needed.	The user will be able to view the interaction history when needed.	Passed
Clear interaction history	Validate input parameters (query and its responses)	The user will be able to remove the interaction history when needed.	The user will be able to remove the interaction history when needed.	Passed
Log out	Validate input parameters (username)	The user will be able to log out from the platform when needed.	The user will be able to log out from the platform when needed.	Passed

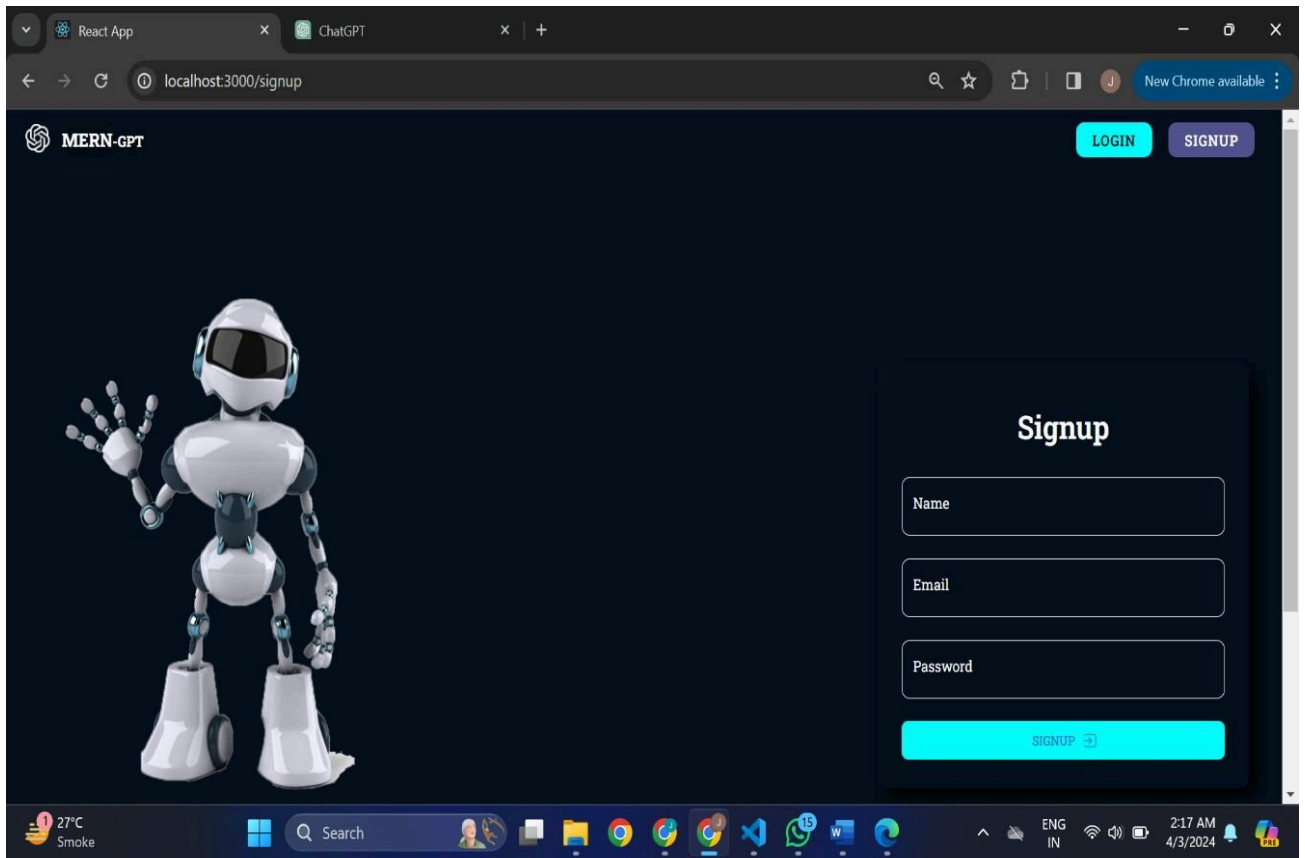
Table 6.3.1

7 USER MANUAL

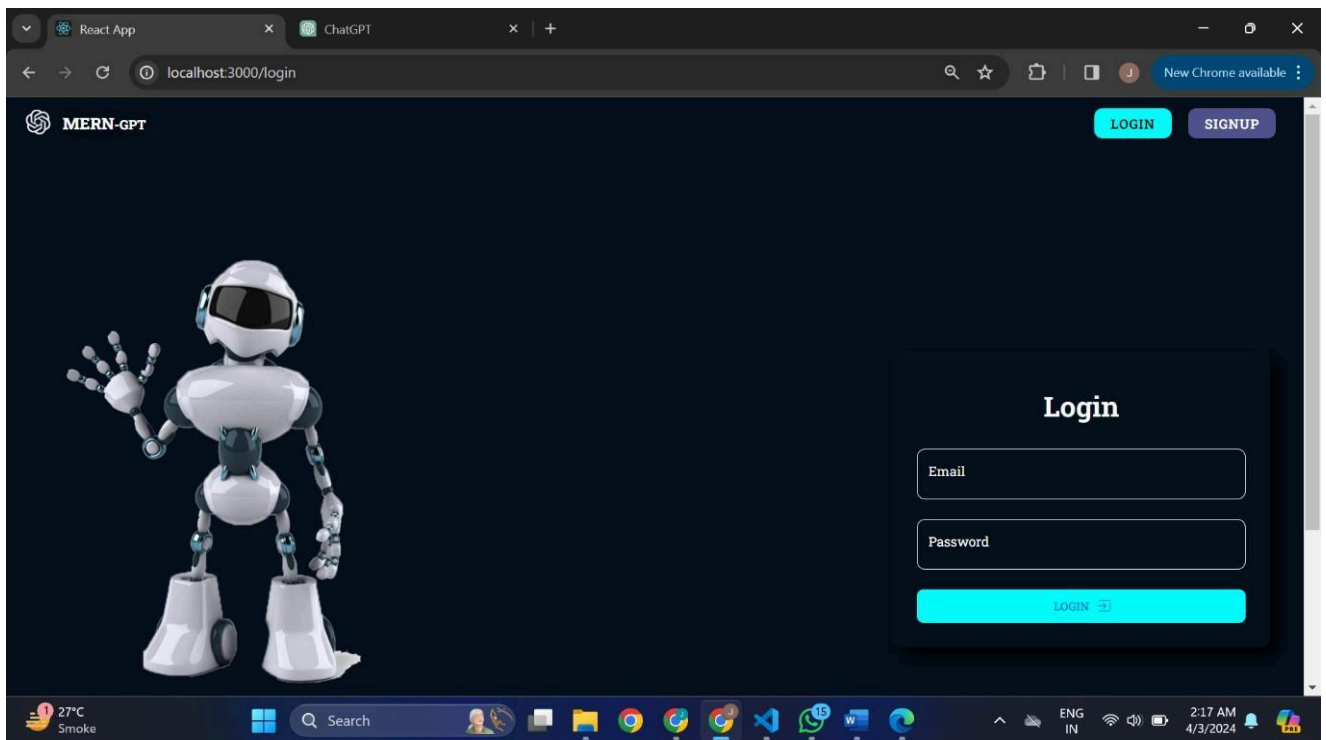
- Home Page



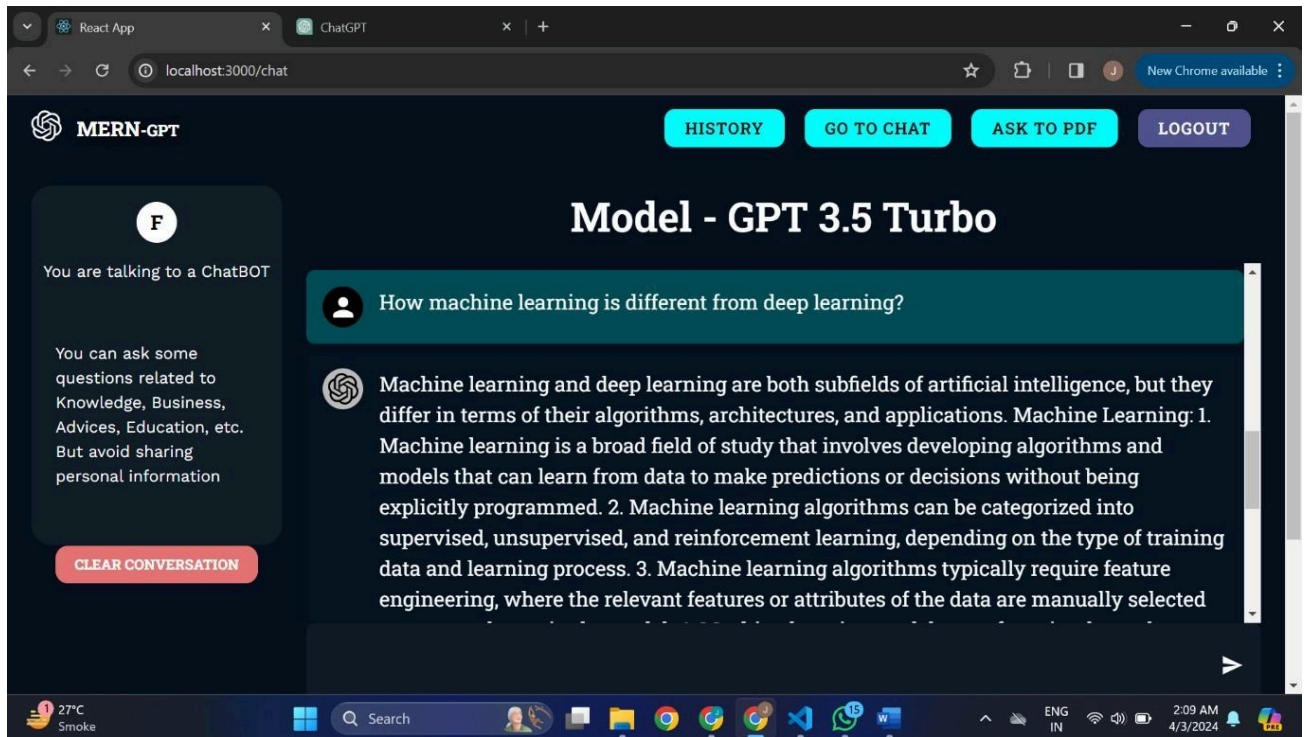
- **Sign Up**



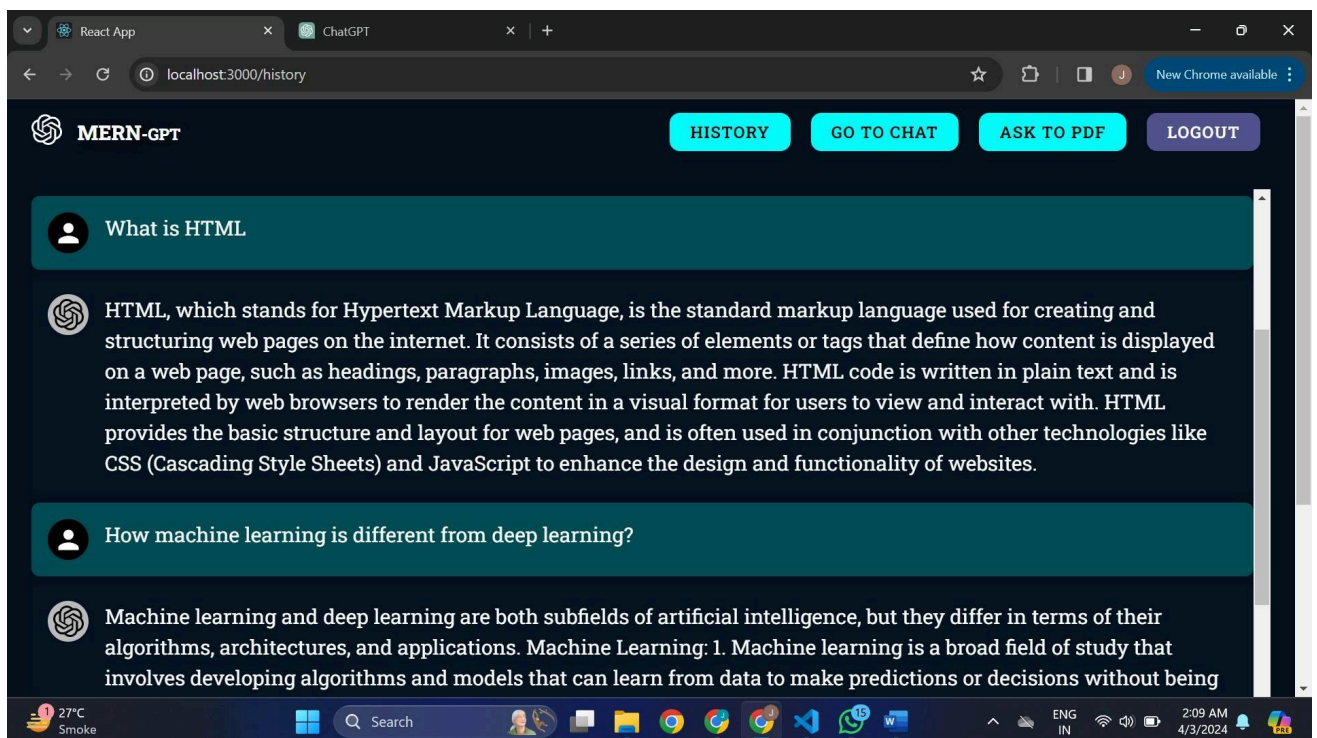
- **Login**



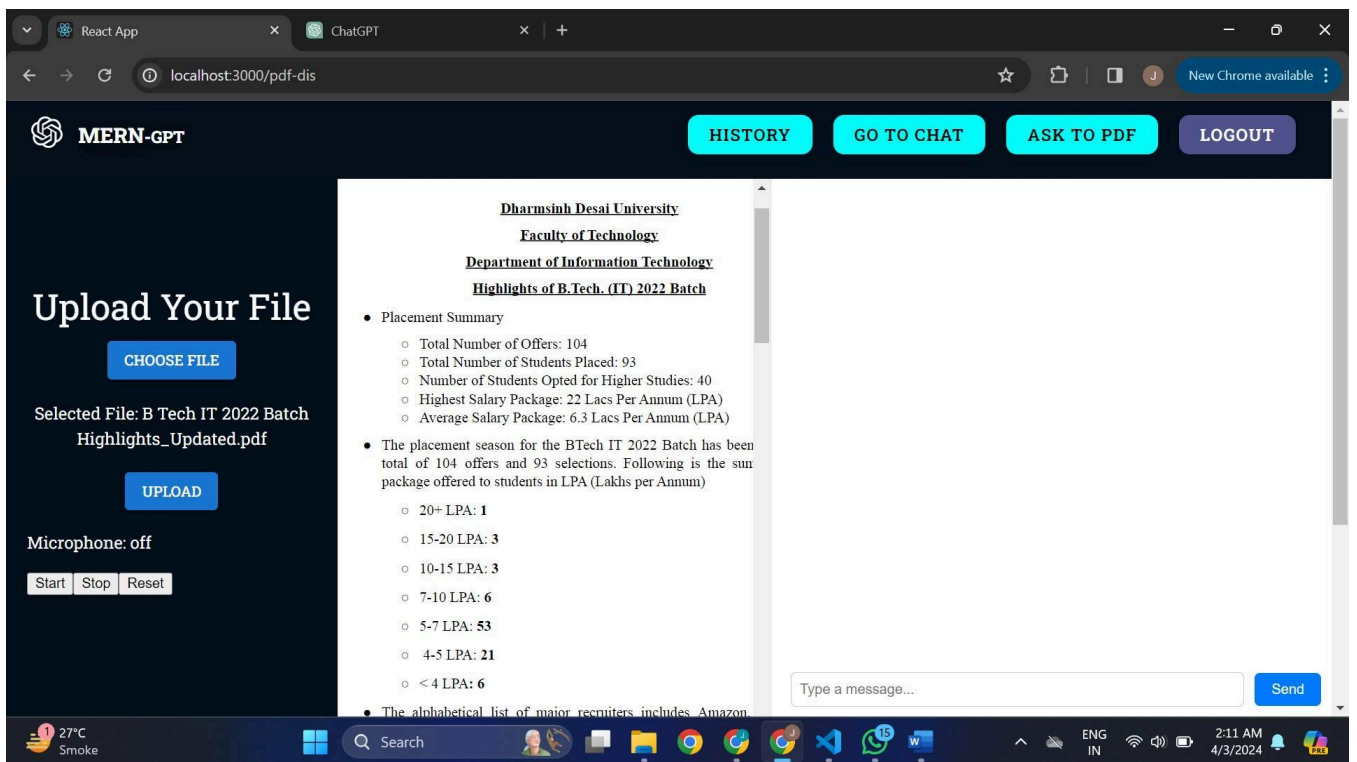
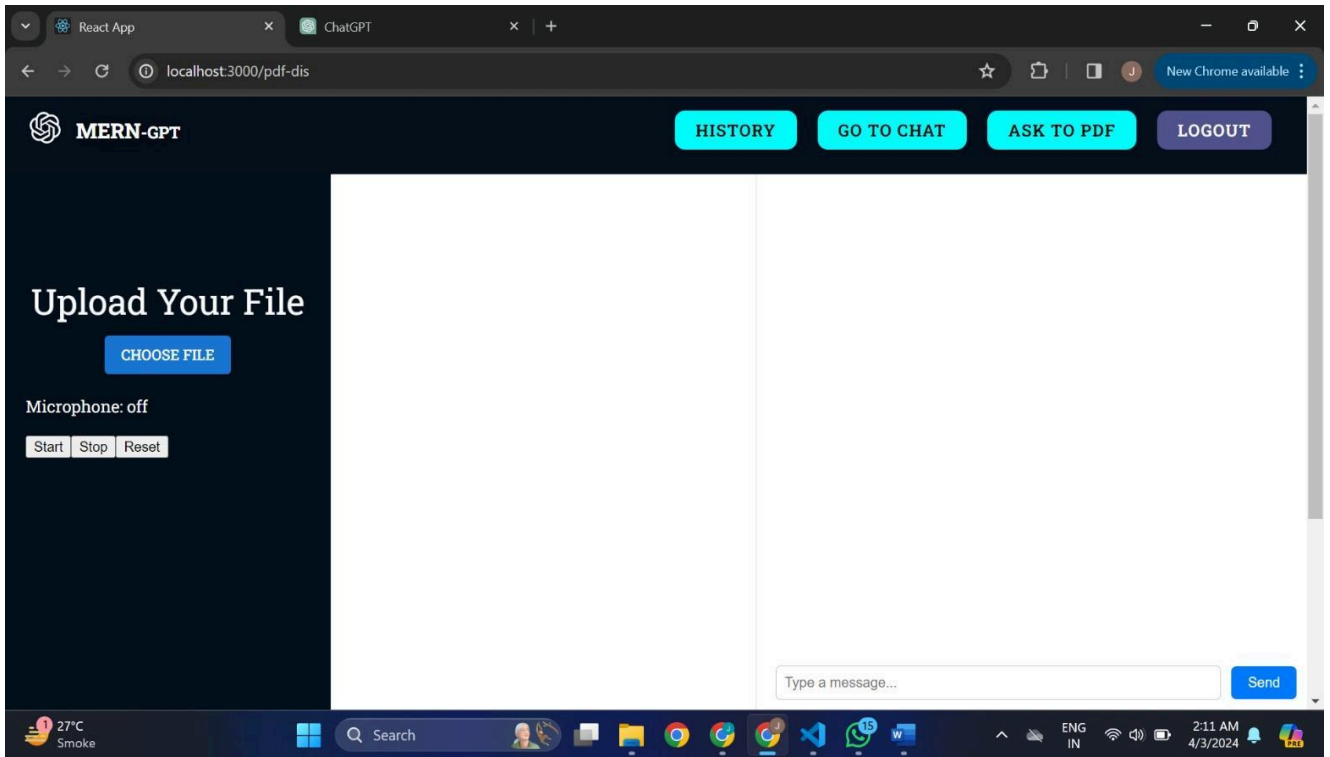
- Chat Page



- History Page



- Upload Pdf



• Ask Pdf

The screenshot shows the MERN-GPT web application in a browser window. The address bar shows `localhost:3000/pdf-dis`. The application has a dark theme with a sidebar on the left for file upload, a central PDF viewer, and a chat area on the right.

Upload Your File

CHOOSE FILE

Selected File: B Tech IT 2022 Batch Highlights_Updated.pdf

UPLOAD

Microphone: off

Start Stop Reset

Dharmsinh Desai University
Faculty of Technology
Department of Information Technology
Highlights of B.Tech. (IT) 2022 Batch

- Placement Summary
 - Total Number of Offers: 104
 - Total Number of Students Placed: 93
 - Number of Students Opted for Higher Studies: 4
 - Highest Salary Package: 22 Lacs Per Annum (L)
 - Average Salary Package: 6.3 Lacs Per Annum (L)
- The placement season for the BTech IT 2022 Batch total of 104 offers and 93 selections. Following is package offered to students in LPA (Lakhs per Annum)
 - 20+ LPA: 1
 - 15-20 LPA: 3
 - 10-15 LPA: 3
 - 7-10 LPA: 6
 - 5-7 LPA: 53
 - 4-5 LPA: 21

• Pdf Uploaded Successfully. Now You can ask question

What is the Highest salary?

The highest salary offered to students in LPA (Lakhs per Annum) is 22 Lacs Per Annum.

How many students are placed?

93 students are placed.

How many students get 10-15 lpa

3

Type a message... Send

• Use Microphone

The screenshot shows the MERN-GPT web application in a browser window. The address bar shows `localhost:3000/pdf-dis`. The application has a dark theme with a sidebar on the left for file upload, a central PDF viewer, and a chat area on the right.

Upload Your File

CHOOSE FILE

Selected File: Achievements-IT-May2021.pdf

UPLOAD

Microphone: on

Start Stop Reset

Awards / Recognition

- Start-Up Recognition and Awards
 - Jayanti Kanani from 2011 Batch was one of the co-founder and principal inventor of Polygon (previously Manic Network) which is a blockchain technology based startup founded in 2018. Currently the company is listed in US Stock exchange and recently got investments from Mark Cuban (one of the renowned investor in US). The company's valuation is estimated to be more than 4 Billion USD as of now (in Jan 2021).
 - CMARIX TechnoLabs Pvt. Ltd. - a company founded by Mr. Ching Mudra, 2004 Batch pass out, has won GESIA Award for Best Software Company 2018.
 - Mr. Kunal Shah, from 2019 Batch, along with 3 team mates won Tech to Protect Codeathon 2019 regional and also came 3rd overall in California State. The main cause of this event was to help the first responders (police, fire fighters) of the USA by developing a technology based product. They also won a cash prize of USD 6000.
 - G.E.I.E. Alendistad, a company founded by Mr. Darsh Bhatt and Mr. Rutvij Dave from 2019 Batch, was ranked amongst the Top 100 startup in the word by Startup Istanbul 2019. They developed an AR-VR based product for education domain which was declared as one of the "Top 50 Innovative Products" by Catapult in association with Amazon Lemnithpad & BusinessWorld.
- Economic Times Young Leaders Program 2012
 - Mr. Sagar Sarabhai from 2007 batch was selected for the Economic Times Young Leaders Program 2012. A total of 17,000 nominees were assessed on 9 leadership qualities in 4 phases. On progressive short listing, 78 finalists interviewed with a panel comprising the CEOs of McKinsey, J.P. Morgan, Citic, Google, Unilever, Infosys, Genpact, Marico and HCL that selected the final list of 28 Young Leaders including Mr. Sagar Sarabhai.
- Best Performance Awards
 - Mr. Mayur Saxena of 2008 batch was awarded with The Most Valuable Contributor Award as well as The Dream Team Award in the year 2010 by IGATE.
 - Mr. Priti Modgi from 2009 batch was awarded with The Shining Star and The Spark Winner Awards by Cognizant Technology for the best performance in 2014.
 - Mr. Vanshi Doshi from 2009 batch was awarded with Star Award by Capgemini India Ltd for the best performance in 2013. He was also awarded with The Best Newcomer Award for the year 2010-11 by CIGNEX Dataanalytics.

• Pdf Uploaded Successfully. Now You can ask question

best performance

Send

8 LIMITATION AND FUTURE ENHANCEMENTS

8.1 Limitation

- The current implementation relies on API keys for response generation, which may have restrictions on the number of queries served. This could potentially limit the scalability and usage of the chatbot.
- Users are restricted to uploading only one document at a time, which may inconvenience those who wish to analyze multiple documents simultaneously.
- The chatbot currently lacks functionality for image explanation, image-to-text, and text-to-image conversions.
- Responses generated by the model do not include citations indicating the source page or location within the document, potentially hindering the ability to verify and cross-reference information.
- The chatbot currently supports only one document type, namely PDF. This restricts its applicability to other document formats commonly used in various domains.

8.2 Future Enhancements

- Explore alternative methods for response generation that do not rely on limited API keys, such as developing in-house models or leveraging cloud-based services with higher query limits.
- Implement functionality to allow users to upload and analyze multiple documents simultaneously, improving efficiency and user experience.
- Incorporate advanced algorithms for image and table analysis, enabling the chatbot to extract information from graphical and tabular data within documents.
- Enhance metadata retrieval algorithms to provide more accurate and comprehensive information about document attributes, such as the number of tables, words, and other relevant statistics.
- Integrate features to automatically cite the source of responses generated by the model, including the page number or location within the document, to enhance transparency and credibility.
- Extend the chatbot's capabilities to support a wider range of document formats beyond PDF, including Word documents, images, and other commonly used file types.

8.3 Vision and applications:

The identified limitations serve as catalysts for future enhancements and developments, propelling the project towards broader applications and utility. By addressing these shortcomings, the chatbot can unlock various opportunities, including:

- Enhanced Scientific Document Understanding:

The chatbot's improved analysis capabilities will facilitate deeper comprehension and explanation of scientific documents, benefiting researchers, academics, and professionals in

diverse fields.

- Educational Aid for Students:

Students can leverage the chatbot to gain insights and explanations from their textbooks, reinforcing their understanding of complex concepts through interactive querying and learning.

- Accessibility for Users with Disabilities:

The incorporation of microphone-based query options ensures accessibility for users with typing difficulties, providing them with an intuitive and inclusive platform for information retrieval.

8.4 Summary of project work

- The Real World AI Chatbot project is a cutting-edge application developed using the MERN (MongoDB, Express.js, React.js, Node.js) technology stack and machine learning models. It aims to revolutionize information retrieval and document analysis through intuitive interaction methods and advanced algorithms.
- The chatbot offers a plethora of functionalities designed to cater to diverse user needs. Users can effortlessly pose queries, upload scientific documents in PDF format, and even interact via speech input through the microphone. The system utilizes machine learning models to convert speech to text and generate responses based on the content of the uploaded document in real-time.
- Additionally, users have the option to obtain summaries of uploaded documents and manage their interaction history, including the removal of specific entries. Furthermore, the project incorporates user registration with email notification upon successful registration, ensuring a seamless user experience.
- While the project exhibits remarkable functionality, it also acknowledges certain limitations, such as API key constraints, single-document upload restriction, and the absence of image and table analysis capabilities. However, these drawbacks serve as catalysts for future enhancements, paving the way for a more robust and versatile application.
- Looking ahead, the project envisions broader applications, including enhanced scientific document understanding, educational support for students, and increased accessibility for users with disabilities. By continuously addressing limitations and innovating, the Real World AI Chatbot project strives to be at the forefront of conversational AI technology, facilitating seamless information retrieval and analysis for users across various domains and demographics.

9 CONCLUSION

- Developing the Real-World AI Chatbot has been an enlightening journey, pushing me beyond my comfort zone and igniting a passion for machine learning.
- Despite encountering challenges, I persisted, learning invaluable lessons along the way.
- This project has not only equipped me with technical skills but also instilled in me a sense of resilience and determination.
- As I bid farewell to this endeavor, I am grateful for the growth and confidence it has afforded me.
- Armed with newfound knowledge and a steadfast resolve, I eagerly anticipate the next chapter of my journey, ready to conquer new challenges and embrace limitless possibilities.

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11 EXPERIENCE

Throughout the project's development, I was fortunate to receive invaluable guidance and mentorship from Deepak Vegda and Tarak Kadiya. Their expertise and support empowered me to explore diverse tasks and refine our chatbot's functionalities. Working alongside a team of skilled professionals was both enriching and inspiring, fostering a collaborative environment conducive to growth.

This experience has not only enhanced my technical proficiency but has also instilled in me a deep sense of professionalism and teamwork. I am grateful for the opportunity and look forward to applying these lessons in future endeavors.
