

PREPTALK

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**DEPARTMENT OF COMPUTER SCIENCE ENGINEERING &
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JAYPEE INSTITUTE OF INFORMATION TECHNOLOGY, NOIDA

(I)

DECLARATION

We hereby declare that this submission is our own work and that, to the best of our knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree or diploma from a university or other institute of higher learning, except where due acknowledgment has been made in the text.

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CERTIFICATE

This is to certify that the work titled “**PREPTALK**” submitted by “**Armaan Sharma and Rahi Agarwal**” in partial fulfillment for the award of degree of B. Tech in Computer Science and Engineering of Jaypee Institute of Information Technology, Noida has been carried out under my supervision. This work has not been submitted partially or wholly to any other University or Institute for the award of this or any other degree or diploma.

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Chapter 1: Introduction

1.1 General Introduction

This chapter outlines the context, challenges, and proposed solution associated with modern interview preparation. It also highlights existing tools and justifies the need for PREPTALK through empirical evidence.

The transition from conventional job preparation methods to tech-based platforms has significantly changed how candidates get ready for interviews. In the current competitive landscape, preparing for interviews requires more than simply practicing answers; it also involves building confidence, obtaining immediate feedback, receiving mentorship, and tracking personal improvement.

PREPTALK is an online application aimed at interview preparation, offering a thorough, interactive, and intelligent platform for students, recent graduates, and job seekers. By utilizing real-time AI avatars, natural language processing (NLP), interactive dashboards, and industry-specific mentorship, **PREPTALK** presents a groundbreaking approach to job readiness. The platform's foundation is its ability to simulate interview situations through a realistic AI avatar that can converse in real-time, closely mimicking the behavior of a human interviewer. Users can listen to spoken questions, respond using their voice, and obtain prompt, context-sensitive feedback. When paired with a dashboard that monitors performance history, creates downloadable reports, and supplies customized learning materials, **PREPTALK** serves as a complete virtual coach.

1.2 Problem Statement

To effectively address the challenges faced by job seekers, it is crucial to identify the key gaps in traditional interview preparation methods. Below are the primary issues that hinder candidates from excelling in their job interviews:

i. **Lack of Customization**

Most of the resources provided are generic and do not cater to an individual's career aspirations, industry preferences, or previous interview experiences.

ii. **Disconnection Between Theory and Application**

There's a clear gap between the theoretical understanding and the practical communication skills needed during interviews.

iii. **Absence of Realistic, Immediate Interaction**

Conventional mock interviews using chatbots or scripted formats fail to mimic the pressure and spontaneity of genuine conversations.

iv. **No Progress Tracking**

Numerous platforms do not offer a continuous learning experience — users lack the ability to monitor their improvement or identify areas needing further development.

v. **Limited Access to Mentorship**

Many candidates find it difficult to access guidance from experienced professionals in their fields.

PREPTALK tackles all these challenges with a comprehensive approach that integrates technology, personalization, and expert insights.

1.3 Significance/Novelty of the Problem

The PREPTALK platform stands out due to its combination of AI technology, user-friendly design, and expert advice to create an advanced tool for interview preparation. In contrast to conventional options, it provides:

i. AI Avatar Interviews in Real-Time

A virtual interviewer powered by Heygen and D-ID that interacts with users in a conversational manner, complete with lip-synced video and audio responses[6].

ii. Analysis of Speech and Facial Reactions

The platform monitors tone, confidence levels, facial expressions, and eye movement to replicate authentic interview conditions.

iii. User-Friendly Dashboard

Customized dashboards enable users to revisit previous interactions, assess their performance metrics, download PDF reports, and explore resources suggested by AI.

iv. Mentorship Integration

Instant chat features link users with seasoned professionals for immediate feedback and insights.[13]

This combined strategy merges machine learning with human mentorship to deliver a tailored, scalable, and impactful learning experience.

1.4 Empirical Study

To ensure that PREPTALK meets the actual needs of job seekers, a thorough empirical investigation was carried out, which included user surveys, assessments of existing tools, and usability testing.

1.4.1 User Survey & Focus Groups

To gain practical insights into the challenges faced by job seekers, structured **surveys and focus group discussions** were conducted with a diverse group of participants. These included:

- **Undergraduate students** from engineering, business, and humanities streams preparing for campus placements.
- **Recent graduates** actively seeking employment in both technical and non-technical domains.
- **Entry-level professionals** aiming to transition into new roles or industries and improve their interview readiness.

The study aimed to understand not just the **effectiveness of current preparation methods**, but also **what learners feel is missing** in their interview journey.

Key Findings:

- **86%** of participants expressed a desire for more **interactive and immersive methods** of interview practice. They felt traditional text-based preparation lacked realism and failed to simulate actual pressure situations.
- **78%** reported **low self-confidence** when attending interviews, mainly due to **lack of real-time feedback**. Participants expressed that while they received general guidance from websites or coaching centers, there was no mechanism for them to know if their specific answers were effective or not.
- **71%** were not aware of their weaknesses or progress after preparing.

1.4.2 Evaluation of Existing Tools

While these platforms introduce valuable innovations, they still lack a unified solution that combines real-time interaction, personalized feedback, performance tracking, and expert mentorship—features that PREPTALK uniquely integrates.

An assessment of current platforms showed the following:

- i. **JobMojito** features AI avatars that facilitate real-time voice interviews, concentrating on screening and evaluating top talent.
- ii. **InterviewBot** offers customizable avatars along with a choice of 20 different interview topics, enabling users to simulate a variety of interview situations.
- iii. **Tengai** is a social interview robot designed to conduct impartial interviews by asking all questions uniformly, with the aim of minimizing unconscious biases.
- iv. **D-ID's Speaking Portrait** technology converts still images into hyper-realistic videos, allowing for the creation of photorealistic avatars capable of speaking using input text.[2].

While these platforms present innovative characteristics, there are still gaps in delivering a comprehensive interview preparation experience that integrates real-time interaction, personalized feedback, performance tracking, and mentorship.

1.4.3 Usability Testing

A beta version of **PREPTALK** was evaluated by few users.

Results revealed:

- **93%** indicated a boost in confidence after engaging with the platform.
- **87%** demonstrated a noticeable enhancement in articulation and response structure after three mock sessions.

These results highlight the necessity for an immersive, feedback-oriented, and tailored platform like **PREPTALK**.

1.5 Brief Description of the Solution Approach

To address the challenges outlined in the problem statement, a comprehensive and innovative approach is required that combines technology with personalized resources. The proposed solution integrates AI-driven tools, real-time insights, and mentorship opportunities to bridge the gap between education and employment effectively.

PREPTALK offers an **AI-driven, user-focused interview preparation tool** through the following methods:

- **Interactive AI Avatar Interviews**

Users engage in simulated interviews via an avatar created with Heygen and D-ID, which syncs audio responses and replicates human-like interaction.

- **Speech and Emotion Evaluation**

Using **OpenCV, DeepFace** and audio features, the system assesses facial expressions, eye movement, tone, and confidence levels.

- **Interview History Dashboard**

Participants can review their previous interviews, monitor their scores, and obtain a performance report in PDF format.

- **Insights for Feedback and Improvement**

AI-generated assessments pinpoint areas needing enhancement and recommend resources like articles, videos, and exercises according to performance patterns.

- **Mentorship Chat Room**

Users have the opportunity to connect with industry mentors for customized feedback and support.

Collectively, these features establish a continuous cycle of practice, feedback, and growth that enables users to approach interviews with assurance.

1.6 Comparison of Existing Approaches to the Problem

Traditional job preparation platforms fall short in providing personalized guidance and real-time industry insights. **Table 1.1** compares PREPTALK with current interview tools like JobMojito, InterviewBot, and D-ID. Our solution overcomes these gaps as follows:

Feature	JobMojito	InterviewBot	Tengai	D-ID's Speaking Portrait	PREPTALK
Real-Time AI Avatar Interaction	✓	✓	✓	✓	✓
Customizable Interview Scenarios	✗	✓	✗	✗	✓
Personalized Feedback	✗	✓	✓	✗	✓
Performance Tracking & Reports	✗	✓	✓	✗	✓
Integration with Mentorship	✗	✗	✗	✗	✓
Emotion & Facial Expression Analysis	✗	✗	✓	✓	✓

Table1.1 Feature-based comparison of existing platforms and PREPTALK

Insights:

- **JobMojito** specializes in real-time AI avatar interviews but lacks options for customizable scenarios and performance monitoring.
- **InterviewBot** provides customizable avatars and interview topics, along with tailored feedback, but does not incorporate mentorship or advanced emotional analysis.
- **Tengai** focuses on delivering unbiased interviews with a consistent set of questions but lacks customizable scenarios and mentorship integration.
- **D-ID's Speaking Portrait** stands out in generating lifelike speaking avatars but does not offer interactive interview scenarios or performance tracking.

PREPTALK uniquely integrates real-time AI avatar interactions, customizable scenarios, personalized feedback, performance monitoring, and mentorship integration, delivering a thorough interview preparation solution.

Chapter 2: Literature Survey

This chapter reviewed key research papers and existing tools relevant to AI-based interview preparation. The insights gathered highlight current gaps in personalization, feedback, and real-time interaction—paving the way for the detailed requirement analysis and solution approach presented in the next chapter..

2.1 Summary of Papers Studied

2.1.1 Research Paper-1:

“Conversate: Supporting Reflective Learning in Interview Practice Through Interactive Simulation and Dialogic Feedback”[16].

Authors: Taufiq Daryanto, Xiaohan Ding, Lance T. Wilhelm, Sophia Stil, Kirk McInnis Knutsen, Eugenia H. Rho

Objective:

Present Conversate, a web-based platform designed for interview practice that utilizes large language models (LLMs) to replicate interviews and offer interactive, two-way feedback, facilitating reflective learning in preparation for job interviews.

Approach:

Users begin by specifying a target job role, after which the LLM initiates an interview session, adapting its questions based on user replies. Users can highlight specific segments and engage in a follow-up dialogue with the AI to refine their answers.

Key Insights:

- Conversate's **dialogic feedback mechanism** allows users to go beyond passive feedback and actively revise their answers through back-and-forth conversation with the AI.

2.1.2 Research Paper-2

“RAGatar: Enhancing LLM-driven Avatars with RAG for Knowledge-Adaptive Conversations in Virtual Reality”[1].

Authors: Alexander Marquardt, David Golchinfar, Daryoush Vaziri

Objective

Create RAGatar, a VR system where AI-driven avatars can engage users in casual dialogue as well as answer domain-specific questions, seamlessly integrating informal conversation with expert knowledge retrieval.

Approach

RAGatar merges MetaHuman avatars with self-hosted large language models (LLMs) and retrieval-augmented generation (RAG). Users can engage in natural conversations with these avatars; at any moment, they can transition into a “knowledge mode,” allowing the avatar to access information from a specialized knowledge base. The design targets learning and training environments where users may require both practice in social interaction and access to technical information.

Key Insights:

- The system demonstrates how VR-based avatars can serve dual roles: as **empathetic interlocutors** and **subject-matter experts**.
- It reflects the power of **context-aware AI agents** capable of adapting to user needs in real-time, particularly useful in **training, education, and professional development** scenarios.
- The blending of **VR immersion with RAG-powered dialogue** significantly boosts both engagement and learning outcomes.[9]

2.1.3 Research Paper-3

“AI Mock Interview Chatbot Using Gen AI”[10].

Authors: Madanachitran R., Austin A., Balaji K., Rajappan M.

Objective

Develop a generative AI-based chatbot for mock interview scenarios that delivers realistic, job-specific questions and provides immediate feedback, reducing the challenges associated with conventional interview preparation.

Methodology:

The platform is built using **Google Gemini AI** and a **modern tech stack** (React, Next.js), enabling it to generate real-time questions based on the user's domain and experience level (beginner, intermediate, or expert). The system also includes:

- Support for **technical, behavioral, and situational questions**
- Integration with **PostgreSQL** for user authentication and data storage
- A focus on **cross-platform compatibility** for consistent user experience

Key Insights:

- The chatbot provides a **personalized mock interview experience**, adjusting the difficulty level dynamically.
- It enables **rapid skill improvement** through immediate, AI-generated feedback and scoring.
- The use of **scalable infrastructure** ensures smooth performance even with increasing user traffic.

2.2 Integrated Summary of the Literature

Over the last several years, rapid advancements in Artificial Intelligence (AI), Natural Language Processing (NLP), Virtual Reality (VR), and Metaverse technologies have significantly transformed the landscape of interview preparation and candidate skill development. The body of research studied highlights several critical trends, innovations, and challenges in this evolving domain.

2.2.1. Emergence of AI-Powered Interview Simulation Platforms

Numerous studies, including those on Conversate and AI Mock Interview Chatbots, reveal that incorporating Large Language Models (LLMs) into interview practice systems enables highly flexible and responsive simulations. Unlike fixed question libraries, LLM-driven simulations facilitate contextual follow-up queries, dialogic feedback, and realistic conversational patterns, enhancing the authenticity and adaptability of interview preparation to user inputs.[11].

Key techniques utilized encompass:

- Real-time creation of role-specific inquiries.
- Difficulty adjustment based on user profiles.
- Reflective, iterative enhancement through two-way interactions with AI agents.

These strategies greatly boost user involvement, confidence, and the personalization of feedback compared to conventional preparation methods.

2.2.2 Influence of Virtual Reality and Metaverse on Interview Training

A significant trend is the implementation of VR and metaverse environments for immersive interview practice, as evidenced by studies on ITEM, Metaverse Interview Room Creation, and VR-JIT platforms.[9].

Key advancements feature:

- **Photorealistic AI** avatars developed using generative models (e.g., diffusion models) that emulate realistic human behavior.
- **Completely immersive VR** interview spaces that mimic high-stress real-world situations.
- **Physiological monitoring** (heart rate, gaze tracking) to gauge user stress and engagement levels during practice interviews.

These VR settings offer a secure yet realistic environment where users can repeatedly practice, learn from mistakes, and bridge the gap between theoretical preparation and actual performance.

2.2.3 Comprehensive Feedback and Performance Analytics

Research like AI Based Mock Interview Analyst and Career Interview Readiness in Virtual Reality (CIRVR) emphasizes the growing significance of multimodal feedback—not only evaluating what the candidate articulates but also examining their delivery.[15].

Modern frameworks evaluate:

- Speech and language content (relevance, coherence, clarity).
- Emotional tone (confidence, anxiety detection).
- Non-verbal cues (eye contact, body language).
- Real-time physiological reactions (stress indicators).

This all-encompassing assessment empowers platforms to provide focused feedback across various aspects, encouraging deeper self-awareness and actionable development plans for users.

2.2.4 Ethical and Bias Considerations in AI-Powered Interviews

Studies like the one on ITEM also warn against potential biases present in AI systems, particularly when assessing diverse candidates. Despite technological progress, there is still a possibility that AI models may inadvertently reflect societal biases (e.g., related to gender, ethnicity, or nationality) if not meticulously monitored and designed.

Future systems need to integrate:

- Bias detection algorithms.
- Transparent evaluation standards.
- Ethical AI practices to ensure just, inclusive interview simulations.

2.2.5 Emphasis on Underserved Populations

Platforms like CIRVR highlight the importance of tailored VR interview training for neurodiverse individuals, including those with autism. These specialized solutions acknowledge that a uniform approach to interview preparation falls short and that empathetic, adaptive systems can significantly enhance access to effective career readiness resources.

By employing real-time stress monitoring and gaze feedback, such platforms enable users who typically face challenges in interview circumstances to cultivate confidence and skills tailored to their specific needs..

Overall Insights

The **integration of AI, VR**, and advanced analytics into interview preparation systems has fundamentally transformed the approach from standard question-and-answer drills to immersive, personalized, and adaptive training environments.

Current platforms are capable of:

- Simulating realistic interviewer behavior.
- Offering intelligent, context-sensitive feedback.
- Observing emotional and behavioral indicators.
- Supporting ongoing learning through iterative, interactive coaching.

Nonetheless, challenges persist, particularly regarding ethical issues surrounding **AI fairness** and ensuring these technologies are accessible and effective for diverse populations.

The developments outlined in recent literature strongly align with the vision behind **PREPTALK**: a cohesive, real-time AI avatar-based platform offering tailored feedback and a performance tracking dashboard—signaling the future trajectory of intelligent interview preparation solutions.

Chapter 3: Requirement Analysis and Solution Approach

The functional and non-functional requirements of the PREPTALK platform, along with a detailed description of the proposed solution architecture and its key modules. It forms the foundation for understanding how the system is designed to meet user needs identified in the previous chapters.

3.1 Overall Description of Project

3.1.1 Project Perspective

PREPTALK is a web-based platform powered by AI that aids users in getting ready for real-world interviews through engaging simulations. The product is standalone yet integrates multiple external technologies and APIs to improve its features, including:

- **Heygen and D-ID APIs** for creating virtual avatars in real-time and generating speech.
- **OpenAI GPT models** for producing adaptive interview questions and providing dialogic feedback.[12]
- **Speech-to-Text and Text-to-Speech (TTS)** services to process user input and AI replies.
- A Dashboard and Analytics Engine for monitoring conversation histories, scoring, and customized suggestions.

PREPTALK occupies a significant position within the wider field of e-learning and professional skill enhancement platforms, bridging the important gap between theoretical preparation and effective live interview performance.

3.1.2 Project Functions

The primary features of **PREPTALK** include:

i. Interactive Real-Time Avatar Interviews

Users engage with a virtual avatar that poses questions, listens to verbal answers, and offers immediate, conversational feedback.

ii. Analysis of Speech and Sentiment

The platform records voice inputs, evaluates tone, fluency, emotional conditions, and confidence levels, and incorporates this information into the feedback provided.

iii. Tracking of Conversation History

Users have the ability to review records of their previous interview sessions, with the option to replay interactions and monitor their progress over time.

iv. Generation of PDF Reports

Following each session, a comprehensive report is produced that highlights performance metrics, areas for improvement, and curated resources for learning, which can be downloaded.

v. Tailored Improvement Recommendations

The system offers practice modules, videos, articles, and exercises focused on specific areas of weakness as determined by the analysis.

vi. Mentorship Chatroom

Users can connect with human mentors for real-time personalized guidance, merging AI-driven support with human insight for their preparation.

3.1.3 User Characteristics:

The target audience for PREPTALK comprises:

- **Undergraduate and graduate students** getting ready for campus recruitment.
- **Recent graduates** entering the workforce for the first time.
- **Professionals** in the early stages of their careers seeking to transition or enhance their skills for new positions[7].
- **People who have restricted access to professional interview coaching services.**

The majority of users are anticipated to possess fundamental digital skills and have access to devices equipped with a microphone, speaker, and webcam.

3.1.4 Constraints

Certain design and operational constraints taken into account include:

- **Latency Sensitivity:** For a smooth conversational experience, it is essential to have low-latency server responses during real-time interactions.
- **API Dependency:** Dependence on third-party APIs (such as Heygen, D-ID, OpenAI) brings risks associated with their availability and pricing structures.
- **Data Privacy:** All conversation data must be managed according to rigorous data security protocols (compliant with GDPR) to ensure user confidentiality.
- **Device Requirements:** Users need to have stable internet connections and compatible browsers/devices to access avatar and dashboard functionalities without issues.

3.1.4 Assumption and Dependencies

The development and effectiveness of PREPTALK rely on the following premises:

- Users will possess operational microphones and webcams.
- Third-party API services (**Heygen, D-ID, OpenAI**) will remain available without significant interruptions.
- Users will have sufficient internet speeds to stream avatars and upload voice data with minimal latency.
- The platform is compatible with various devices but is mainly optimized for desktop and tablet interfaces.
- Cloud hosting providers will guarantee high uptime and security for user data and sessions.

3.1.5 Summary

PREPTALK is created to replicate authentic interview settings through the use of advanced AI avatars and real-time analytics, allowing users to practice, obtain feedback, and enhance their skills progressively. It serves as a contemporary, scalable, and interactive approach to close the divide between knowledge and practical preparedness for interviews, following the best practices in modern SRS documentation as outlined by IEEE 830-1998 standards.

3.2 REQUIREMENT ANALYSIS

The functional and non-functional requirements of the **PREPTALK platform**, along with the overall system perspective, user characteristics, and key constraints

3.2.1 Functional Requirements

Functional requirements define what the PREPTALK system must do. **Table 3.1** lists the key functional requirements that define system behavior and expected features. These are the core features users will interact with:

Requirement ID	Functional Requirement
FR1	Users must be able to register, log into, and manage their accounts.
FR2	Users must be able to initiate real-time interview simulations with AI avatars.
FR3	The system must capture user voice input during the interview session.
FR4	The AI avatar must respond dynamically with role-specific interview questions.
FR5	The system must perform speech-to-text conversion for user responses.
FR6	Based on user responses, the AI must generate feedback (text and verbal).
FR7	The system ought to evaluate and score user performance score.
FR8	Users should be able to view past conversations stored securely in their dashboard.
FR9	The platform must generate downloadable PDF reports after each session.
FR10	The system should recommend personalized resources for user improvement.
FR11	Users must have the option to connect with a mentor for live feedback.
FR12	Admin must have access to user analytics, performance trends, and platform usage reports.

Table 3.1 Functional requirements of the PREPTALK system.

3.2.2 Non Functional Requirements:

Non-functional requirements define the quality attributes and constraints of the system. As seen in **Table 3.2**, the system is expected to maintain high uptime, responsiveness, and data privacy.

Requirement ID	Non-Functional Requirement
NFR1	The system should maintain an uptime of at least 99.5% monthly.
NFR2	The system should support high concurrency (minimum 500 simultaneous users).
NFR3	API response time should not exceed 500 ms for avatar communication.
NFR4	All user data must be encrypted both at rest and during transmission (SSL/TLS).
NFR5	The platform must comply with GDPR standards for data privacy.
NFR6	The UI must be responsive across desktop and tablet devices.
NFR7	System recovery time post-failure should be less than 5 minutes.
NFR8	The system should be scalable vertically and horizontally via cloud infrastructure (AWS/Azure).
NFR9	Real-time speech processing should have a maximum transcription delay of 2 seconds.
NFR10	The platform should maintain user session history for at least 6 months.

Table 3.2 Non-functional requirements including performance, availability, and security.

3.2.3 Logical Database Requirements

The PREPTALK platform requires a robust backend database to manage users, sessions, scores, and reports. **Table 3.3** outlines how user data, sessions, feedback, and reports are structured and stored.

Key Entities and Attributes:

Entity	Attributes
User	user_id (PK), name, email, password (hashed), role (user/admin/mentor), registration_date
Session	session_id (PK), user_id (FK), avatar_type, session_start_time, session_end_time
Conversation	conversation_id (PK), session_id (FK), question, user_response, ai_feedback, score
PDF Report	report_id (PK), session_id (FK), generated_pdf_link, date_generated
Recommendation	recommendation_id (PK), user_id (FK), source_link, resource_type, date_assigned
Mentor Chat	chat_id (PK), user_id (FK), mentor_id (FK), chat_start_time, chat_transcript

Table 3.3 Logical database requirements with key entities and attributes.

3.3 Solution Approach

Defines the solution approach and provides a detailed breakdown of modules essential for delivering an immersive interview preparation experience.

3.3.1 Overall Solution Approach

PREPTALK operates on a modular architecture based on microservices, with various components dedicated to specific functionalities such as Avatar Interaction, NLP Processing, Dashboard, and Analytics.

The main concept is to create a real-time experience that mimics a human-like interview by utilizing:

- AI Avatar rendering (Heygen + D-ID)
- NLP for adaptive questioning (OpenAI GPT-4/4-turbo)[4,8]
- Speech analysis to evaluate emotional tone
- A Dashboard and Reporting system to monitor performance

All modules interact through secure REST APIs and WebSocket channels, ensuring instantaneous communication.

3.3.2 Module-Wise Detail Descriptions

Table 3.4 breaks down each module such as NLP processing, dashboard, and mentor chatroom.

Module	Description
User Authentication Module	Handles secure registration, login, and session management using JWT tokens.
AI Avatar Interaction Module	Real-time avatar rendering using Heygen/D-ID APIs; processes AI responses based on user inputs.
Speech Processing Module	Captures user speech, converts to text using Whisper/Google STT APIs; prepares it for NLP analysis.
Interview Simulation (NLP) Module	Generates dynamic follow-up questions using OpenAI GPT API; contextually adapts based on user responses.
Performance Analysis Module	Analyzes speech/text for content richness, fluency, emotional tone; assigns quantitative scores (0–100 scale).
Dashboard and Reporting Module	Visualizes user history, generates PDF reports with analytics and improvement tips.
Resource Recommendation Engine	Suggests targeted learning materials (articles, videos, exercises) based on session feedback.
Mentorship Chatroom Module	Enables live chat between users and industry mentors; stores chat transcripts securely.
Admin Analytics Module	Provides detailed analytics on platform usage, user engagement rates, session success rates, etc.

Table 3.4 Module-wise detailed description of the architecture.

Chapter 4: Modelling and Implementation Details

This chapter presents the system's structural and functional design through various diagrams, followed by detailed implementation strategies. It highlights the architecture, technologies used, and the challenges addressed during development.

4.1 Design Diagrams

Table 4.1 complements **Figure 4.1** by describing the purpose of each user interaction

4.1.1 Use Case Diagram:

Use Case	Description
Register/Login	Users authenticate to access the platform.
Interview Simulation	Users interact with the AI avatar for a mock interview session.
Speech Input	System captures user's verbal response and converts it into text.
AI Feedback	System generates and delivers real-time feedback through the avatar.
View Dashboard	Users can review previous interview sessions and performance graphs.
Download Report	PDF performance reports generated and available for download.
Resource Recommendation	Personalized study resources suggested based on scores.
Mentor Chat	Connects users with real mentors for one-on-one advice.
Admin Analytics	Admin reviews platform statistics and user progress.

Table 4.1 Use Case Diagram description mapping use cases to platform features.

Figure 4.1 shows the core interactions users have with the PREPTALK system through various functionalities.

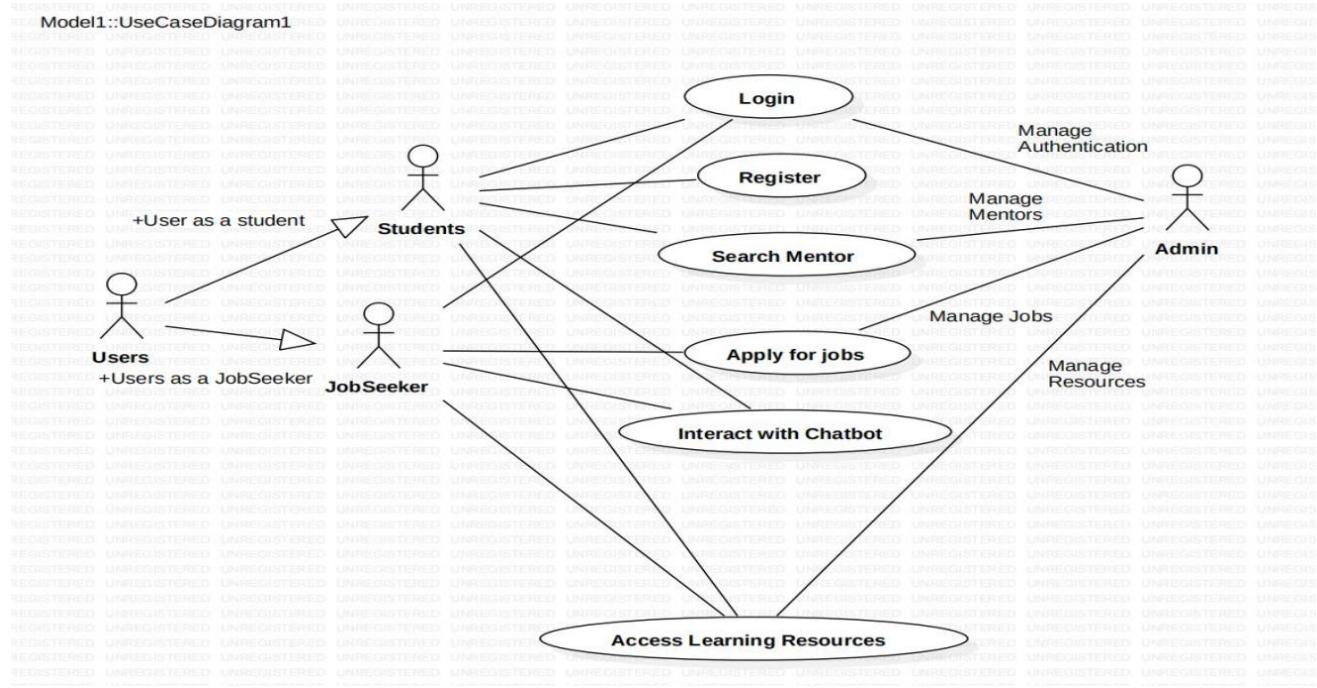


Figure 4.1 Use Case Diagram depicting system features such as user login, interview simulation, dashboard access, and mentor chat.

4.1.2 Class Diagram/ Control Flow Diagram

Table 4.2 expands on **Figure 4.2** by defining the structure of main system classes.

Class	Attributes	Methods
User	userID, name, email, passwordHash	register(), login(), updateProfile()
InterviewSession	sessionID, userID, startTime, endTime, avatarType	startSession(), endSession(), saveSession()
Conversation	conversationID, sessionID, questionText, userResponse, feedback, score	analyzeResponse(), saveConversation()
PDFReport	reportID, sessionID, generatedDate, reportURL	generatePDF(), downloadPDF()
RecommendationEngine	recommendationID, userID, resourceType, resourceLink	suggestResources()
Mentor	mentorID, mentorName, fieldOfExpertise	initiateChat(), sendFeedback()
Admin	adminID, name	viewAnalytics(), manageUsers()

Table 4.2 Class Diagram explanation detailing object attributes and methods.

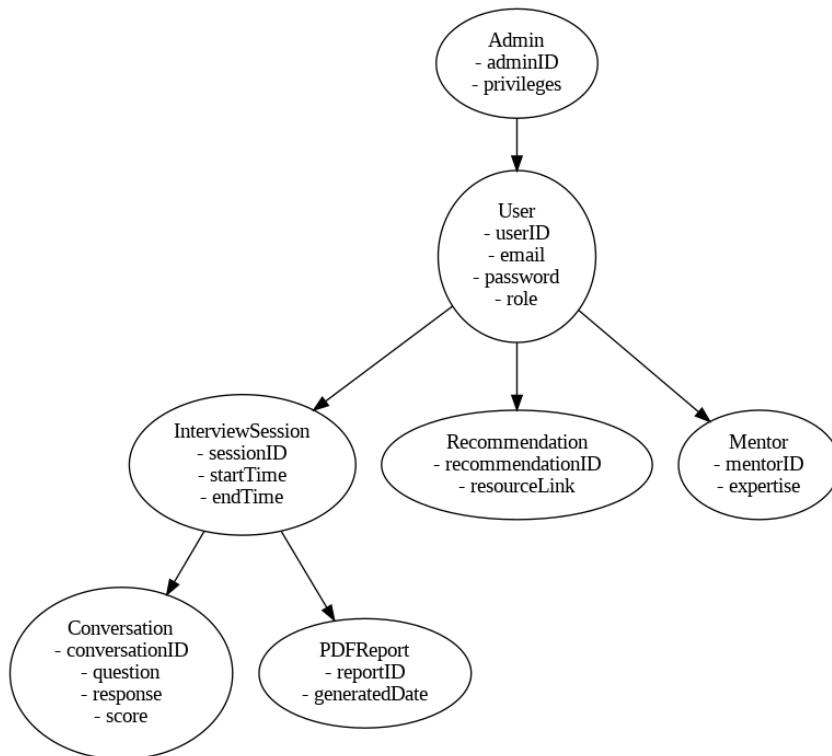


Figure 4.2 Class Diagram illustrating the relationships between main system entities including User, InterviewSession, Conversation, and Mentor.

4.1.3 Sequence Diagram

Figure 4.3 shows the step-by-step flow of data and actions during a mock interview session

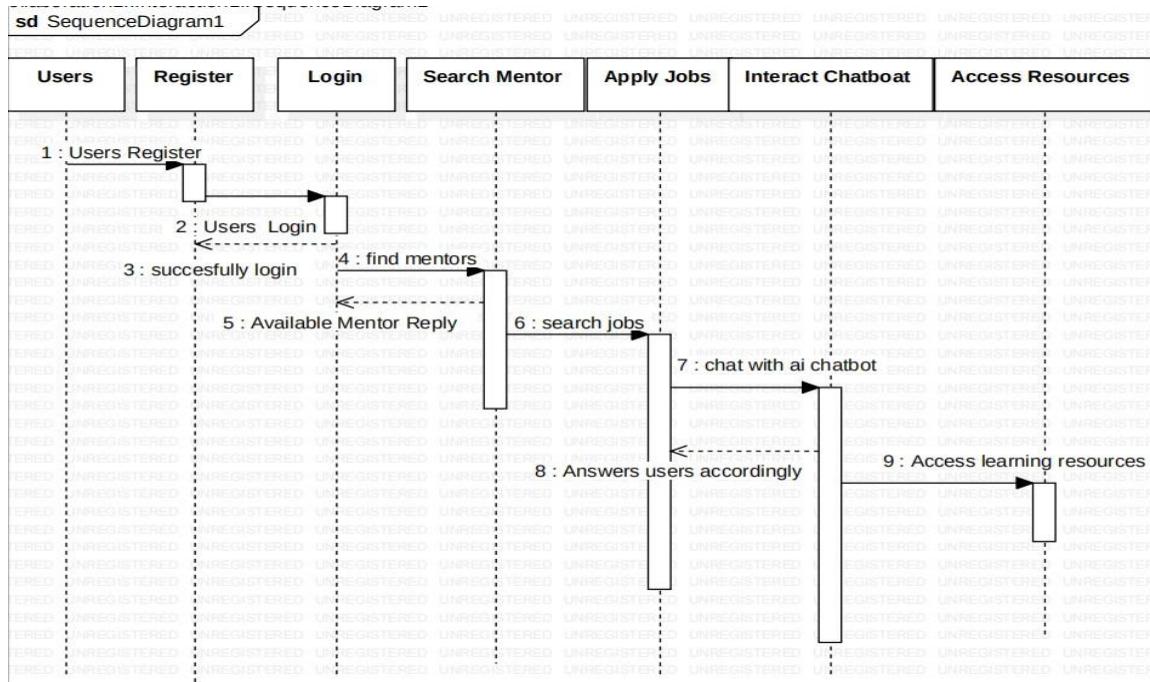


Figure 4.3 Sequence Diagram outlining the flow of interaction from user input to AI avatar response and feedback delivery

4.2 Implementation Details and Issues

4.2.1 System Architecture Overview

PREPTALK is designed with a contemporary, modular web framework that focuses on scalability, low latency, and the integration of AI. The architecture consists of four primary layers:

- **Frontend Layer:**

Constructed using React.js, it provides a sleek and engaging user interface. Notable features include user registration/login, access to interview simulations, a dashboard for visual insights, news updates, and chat functionality with mentors.

- **Backend Layer:**

Built with Node.js and Express.js, the backend oversees user authentication, API integrations, management of conversations, generation of reports, and real-time WebSocket communication for chat features.

- **Database Layer:**

MongoDB is utilized for its scalable and adaptable data storage capabilities for user profiles, interview records, conversation logs, and mentor chat history.

- **AI/NLP/Avatar Layer**

Python services created with Flask-SocketIO connect various AI modules such as:

- OpenAI GPT models for the generation of dynamic conversations.
- Heygen and D-ID APIs for real-time avatar animation and talking portraits.[2].
- Modules based on TensorFlow/PyTorch for detecting emotional tones.
- Whisper STT and ElevenLabs TTS for managing audio functionalities.

4.2.2 Detailed Module Implementation

I. User registration and Profile Management

- **Frontend:** Simple, intuitive forms allow users to register and log in securely.
- **Backend:** Passwords are encrypted (bcrypt hashing) and sessions are secured using JWT tokens.
- **Database:** MongoDB stores user data with indexing for fast retrieval.

Figure 4.4 illustrates the user interface for logging into the platform securely. **Figure 4.5** displays the registration interface for new users.

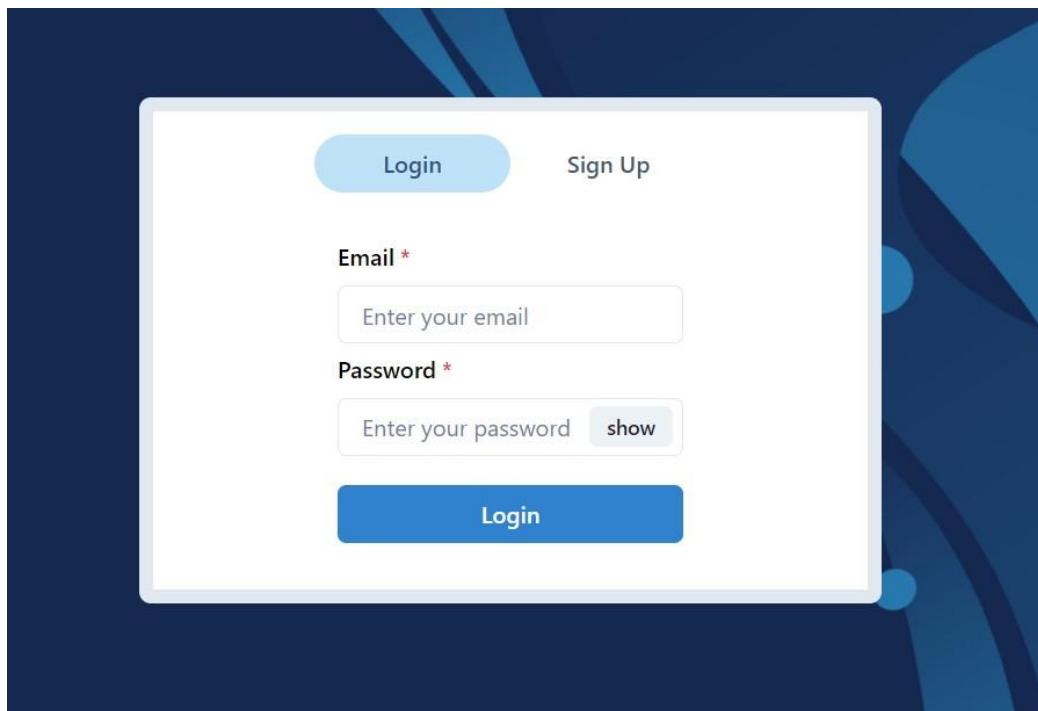
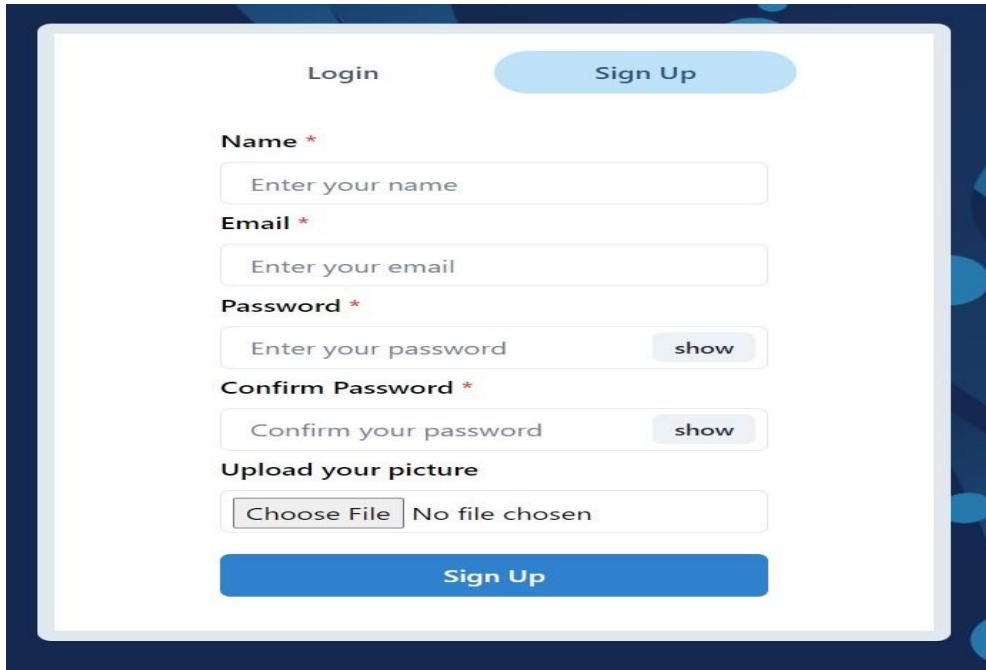


Figure 4.4 UI design of the User Login page.



The image shows a user interface for a sign-up form. At the top left is a 'Login' button and at the top right is a 'Sign Up' button, which is highlighted with a blue oval. Below these are five input fields: 'Name *' with a placeholder 'Enter your name', 'Email *' with a placeholder 'Enter your email', 'Password *' with a placeholder 'Enter your password' and a 'show' link, 'Confirm Password *' with a placeholder 'Confirm your password' and a 'show' link, and 'Upload your picture' with a 'Choose File' button and a placeholder 'No file chosen'. At the bottom is a large blue 'Sign Up' button.

Figure 4.5 UI design of the User Signup page.

II. AI Interview Simulation Module

- **Frontend (Chatbot & Avatar):**
 - Developed using React.js and Socket.IO for real-time interaction.
 - Users speak into the microphone; real-time responses are shown via a **3D animated avatar (Heygen/D-ID)**.
- **Backend (NLP and Speech Processing):**
 - Speech-to-text conversion via Google Speech API or OpenAI Whisper.[5].
 - The text input is sent to the GPT model to generate appropriate, context-aware follow-up questions as shown in Figure 4.6..
 - AI-generated responses are passed to the D-ID API to animate the avatar's lips and expressions.[2].

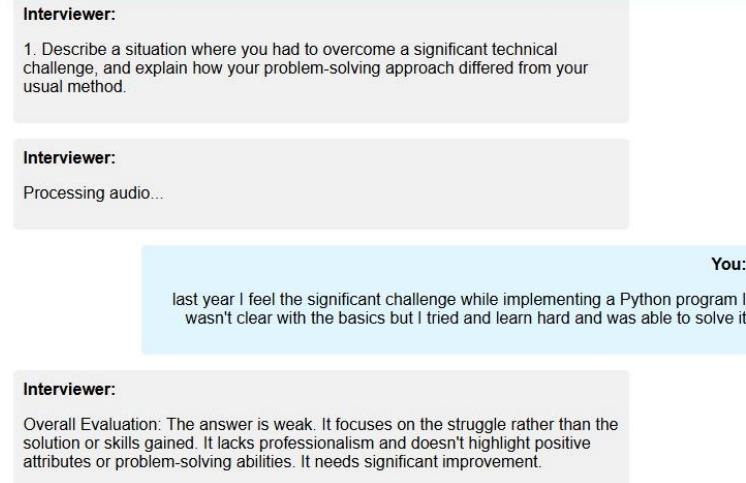


Figure 4.6 AI Based Interview

III. Speech and Emotion Analysis Module

- **Technologies Used:**

OpenCV, DeepFace, MediaPipe[3].

- **Functionality:**

- Facial expression recognition (smile, frown, surprise).
- Emotion detection to gauge user nervousness, enthusiasm, or hesitation.

- **Backend Analysis:**

Data is fed back into the performance scoring engine, affecting the confidence sub-score in the user's report.

IV. Dashboard and PDF Report Generation

- **Frontend:**

- Users can view session histories, scorecards, trend graphs, and download detailed reports.

- **Backend:**

- Reports are auto-generated in PDF format using ReportLab.

Each report includes scores, personalized improvement areas, recommended resources, and session statistics.

Figure 4.7 shows the key external libraries and APIs integrated into the platform. **Figure 4.8** presents the real-time chat interface between the user and the AI avatar.

```
⚡ aibot.py > ⚡ generateSuggestions
from flask import Flask, request, jsonify, render_template
from flask_cors import CORS
import pandas as pd
import google.generativeai as genai
import speech_recognition as sr
import os
from flask_socketio import SocketIO
import cv2
import mediapipe as mp
import numpy as np
import base64
import logging
import sys
from deepface import DeepFace
import threading
```

Figure 4.7 Libraries used in the development of the AI interaction and dashboard modules.



Figure 4.8 AI Chat Window for interactive communication during mock interviews.

V. Mentor Chatroom

- **Frontend:**

Real-time messaging UI built with React.js, integrated into the dashboard.

- **Backend:**

- WebSocket-based real-time chat (using Flask-SocketIO and MongoDB for persistent storage).
- Secure user authentication to control access.

Figure 4.9 shows the real-time chat interface that links users with professional mentors.

The screenshot displays a web application interface for 'PREP TALK'. At the top, there's a navigation bar with links for 'Interview Preparation', 'News', 'Mentorships', 'About', and 'Logout'. On the left, there's a sidebar containing three mentor profiles: Shruti Gupta, Pankaj Mishra, and Ravi Sharma, each with a small circular profile picture, name, domain, experience, and rating. The main content area shows a detailed profile for Shruti Gupta. Her profile includes a larger circular photo, her name, title ('Assistant Professor (Senior Grade)'), domain ('Machine Learning'), experience ('10 years'), rating ('5/5'), and an email address ('shruti.gupta@mail.jiit.ac.in'). Below this is a 'Biography' section which describes her as a dedicated academic at Jaypee Institute of Information Technology (JIIT), Noida, teaching subjects like DBMS, Data Structures, Software Development, and more, with interests in satellite image analysis, machine learning, and database management systems. She is known for her strong academic background and contributions to teaching and research. At the bottom of the profile page, there are three green dropdown buttons labeled 'Education', 'Work Experience', and 'Publications'.

Figure 4.9 Mentor Chatroom allowing users to connect with industry experts for feedback.

VI. Job Market and News Insights Module

- **Data Fetching:**

Aggregation of real-time news articles using Google News API based on the user's career preferences.

- **Frontend UI:**

A personalized newsfeed displayed with options like "Read More" to explore full articles.

- **Backend Handling:**

Caching mechanisms to reduce API call frequency and enhance performance.

The screenshot shows a web-based application with a green header bar containing the logo 'PREP TALK' and navigation links for Interview Preparation, News, Mentorships, About, and Logout. Below the header is a light blue navigation bar with 'Trending News' on the left, a search bar with 'Job Openings' and a 'Search' button in the middle, and a 'Logout' button on the right. The main content area features a section titled 'Stay Updated' with five categories: Stocks, Market, Job Openings, Employment, and AI. Below each category is a news card. The first card, under 'Stocks', has a red background and shows a US dollar bill, with the text: 'The economy is a priority for Americans as they head to the polls. Here's what's really going on behind the numbers.' It includes a 'Read More' button. The second card, under 'Market', shows a hand pointing at a laptop screen with the word 'Apply' next to it, with the text: 'A free AI tool can help you apply to hundreds of jobs per day. Users said there are risks, but they're worth it.' It includes a 'Read More' button. The third card, under 'Job Openings', shows a stack of papers and a LinkedIn logo, with the text: 'LinkedIn thinks it has the solution to our hiring crisis'. It includes a 'Read More' button. The fourth card, under 'Employment', shows the BIZTOC logo with the text: 'U.S. Job Openings Declined in September'. It includes a 'Read More' button. The fifth card, under 'AI', shows a blue background with concentric circles and the text: '12 min ago U.S. Job Openings Declined in September U.S. job openings declined in September to 7.44 million, down from 7.86 million in August and down by 1.9 million over the year. The number of hirings was slightly greater...'. It includes a 'Read More' button.

Figure 4.10 Job Market and News Insights Module

4.2.3 Implementations and Issues Faced

Table 4.3 describes technical issues encountered during development and their resolutions.

Issue	Description	Solution
GPU Resource Constraints	High demand for GPU processing due to real-time avatar rendering and AI model inference.	Switched to hybrid server architecture using lightweight fallback avatars under high load; used AWS EC2 GPU spot instances for scaling.
Latency in Real-Time Interviews	Delay in STT → AI processing → Avatar speaking chain.	Optimized audio buffer size, used WebSocket streaming instead of HTTP polling, and minimized avatar video rendering resolution during heavy load.
Avatar Video Buffering	D-ID avatar videos occasionally buffered under slow network conditions.	Introduced prefetching and background avatar rendering to reduce visible buffering.
Speech Recognition Errors	Whisper/STT errors on noisy backgrounds.	Added ambient noise adjustment scripts during input recording.
Data Synchronization	Concurrent chat sessions and session recordings sometimes conflicted.	Implemented event-driven microservices (Kafka) for backend synchronization.
API Rate Limiting	External API services (like OpenAI, D-ID) hit request limits during peak hours.	Implemented retry queues and built-in API key rotation techniques.

Table 4.3 Implementation challenges and corresponding solutions.

4.3 Risk Analysis and Mitigation

4.3.1 Risk Table

Table 4.4 details the major risks identified and their risk exposure levels.

Risk ID	Classification (SEI Taxonomy)	Description of Risk	Risk Area	Probability	Impact	Risk Exposure (P × I)
R1	Product Engineering - Design - Performance	Insufficient GPU resources leading to lag in real-time AI avatar simulation	Resource Constraints	High (5)	High (5)	25
R2	Development Environment - Development System – Capacity	Server cannot handle concurrent real-time avatar sessions during peak load	System Performance	High (5)	Medium (3)	15
R3	Program Constraints - Resources – Budget	High costs associated with scaling GPU infrastructure on cloud platforms (AWS, Azure)	Budget and Cost	Medium (3)	High (5)	15
R4	Product Engineering - Code and Unit Test – Testing	Testing of avatar speech synchronization fails under slow internet conditions	Testing and Quality Assurance	Medium (3)	Medium (3)	9
R5	Product Engineering - Engineering Specialties – Security	User session data leakage due to insufficient encryption during avatar conversations	Security and Privacy	Low (1)	High (5)	5
R6	Development Environment - Work Environment – Communication	Coordination gaps between AI module and Frontend team delays integration	Team Coordination	Medium (3)	Medium (3)	9

Table 4.4 Risk table showing classification, probability, and impact.

4.3.2 Interrelationship Graph (IG) between Risk Areas

Table 4.5 illustrates how different risk areas influence each other.

Risk Area	Outgoing Connections (Weight)	Incoming Connections (Weight)	Total Weight	Priority
Resource Constraints	9 + 9	3	21	1
System Performance	9	3 + 3	15	2
Budget and Cost	3 + 3	9	15	2
Testing and Quality Assurance	3	9	12	3
Security and Privacy	1	9	10	4
Team Coordination	3	3	6	5

Table 4.5 Interrelationship graph between risk areas.

Figure 4.11 represents the priority levels of risk areas based on their interconnectedness.

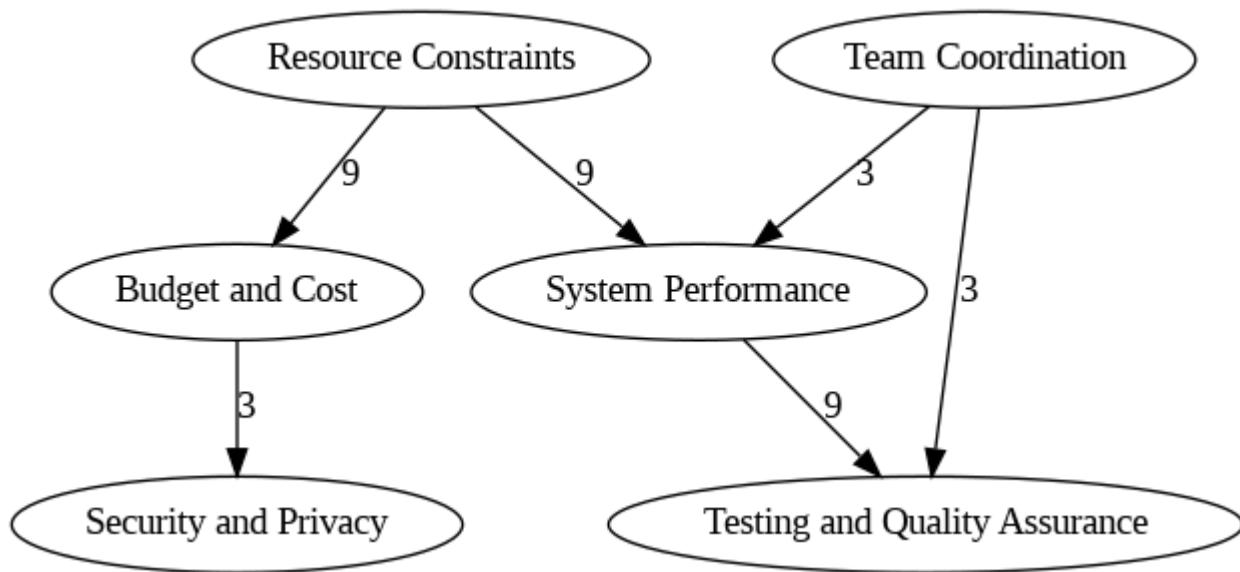


Figure 4.11 Risk Relationship Weighted Graph showing interdependencies among various risk factors.

4.3.3 Triggered Risk Observed

Table 4.7 presents actual risk instances observed during the beta phase.

Risk ID	Risk Statement	Risk Area	Priority of Risk Area in IG
R1	Insufficient GPU resources causing avatar lag during peak hours	Resource Constraints	1
R3	Unexpectedly high cloud service bills affecting project budget	Budget and Cost	2

Table 4.7 Triggered risk events with priority classification.

4.3.4 Risk Mitigation

Table 4.8 shows planned actions to reduce or eliminate identified risks

Risk	Mitigation Strategy	Date Started	Date to Complete	Owner	Additional Resources Needed
R1 (GPU Resource Constraints)	Optimize avatar rendering pipeline, pre-load animations, auto-switch to lightweight avatars under high load	March 2025	May 2025	System Architect	GPU spot instances on AWS, cloud auto-scaling
R2 (Server Load)	Implement load balancing, shard server load by region/timezone	March 2025	May 2025	Backend Lead	Additional server instances, cloud optimization scripts
R3 (Budget Cost Pressure)	Apply serverless architecture for non-critical services, apply reserved instance pricing for critical GPU servers	March 2025	June 2025	Project Manager	Financial forecasting tools
R4 (Testing Avatar Sync)	Simulate low-bandwidth conditions during testing; use adaptive video streaming techniques	February 2025	April 2025	QA Lead	Network simulation tools

Table 4.8 Risk mitigation strategies with timelines and resource needs.

Chapter 5: Testing (Focus on Quality of Robustness and Testing)

5.1 Testing Plan

5.1.1 Types of Test

Table 5.1 outlines the categories of testing to ensure software quality and robustness.

Type of Test	Will Test Be Performed?	Comments/Explanations	Software Component
Requirements Testing	Yes	Ensures that all functional and non-functional requirements (user login, AI avatar interaction, dashboard reports) are correctly implemented according to SRS.	All components (User module, Interview simulation module, Dashboard module)
Unit Testing	Yes	Each individual module (e.g., avatar response generation, speech-to-text conversion, mentor chat) is tested separately to ensure correct behavior.	User Authentication, InterviewSession, Dashboard, Mentor Chat
Integration Testing	Yes	Verifies that modules (e.g., Avatar + Speech modules, Dashboard + Reporting modules) work together correctly without conflicts.	Avatar-NLP-Analytics Integration, Mentor Chat Integration
Performance Testing	Yes	Measures the speed and response time of real-time interactions with AI avatar under varying server loads.	Avatar Engine, Real-Time Speech Processing Module
Stress Testing	Yes	Tests system performance beyond normal operational limits (e.g., 100+ simultaneous real-time interviews).	Backend Servers, Avatar APIs
Compliance Testing	Yes	Ensures compliance with GDPR and data privacy standards for storing user sessions and mentor chat transcripts.	Authentication and Data Management Modules
Security Testing	Yes	Verifies secure login, encrypted communication, and protection of sensitive user data.	User Authentication, Mentor Chat Backend
Load Testing	Yes	Evaluates system behavior under expected maximum concurrent user load (e.g., 500 users).	Server APIs, WebSocket Communication
Volume Testing	Yes	Tests the system's ability to handle large volumes of historical user data (interview sessions, reports).	MongoDB Storage and Retrieval Systems

Table 5.1 Types of testing planned

5.1.2 Test Schedule

Table 5.2 provides a breakdown of the timeline allocated for various testing phases.

Activity	Start Date	Completion Date	Hours	Comments
Test Environment Setup	25/04/2025	27/04/2025	10 hours	Setup local and cloud testing environments
Unit Testing	28/04/2025	02/05/2025	20 hours	Test each individual module separately
Integration Testing	02/05/2025	03/05/2025	15 hours	Ensure modules work together seamlessly
Load and Stress Testing	03/05/2025	04/05/2025	15 hours	Validate system robustness under peak load
Security and Compliance Testing	04/05/2025	05/05/2025	10 hours	Ensure GDPR compliance and data security
Final Regression Testing	05/05/2025	05/05/2025	8 hours	Final end-to-end testing before deployment

Table 5.2 Testing schedule including duration and purpose.

5.1.3 Test Environment

I. Software Items

- **Frontend:** React.js (Web Application)
- **Backend:** Node.js + Express.js server
- **AI Layer:** Flask-SocketIO Python microservices for NLP and Avatar Integration
- **Database:** MongoDB Atlas
- **Third-Party APIs:** OpenAI API, Heygen API, D-ID API, Whisper Speech-to-Text
- **Testing Tools:** Postman (API testing), Selenium (Frontend automation testing), JMeter (Load testing)[14]

II. Hardware Items

- **Local Development Machines:**
 - Intel i7 11th Gen, 16 GB RAM, 512 GB SSD
- **Cloud Servers:**
 - AWS EC2 GPU instances (T4g.large) for Avatar Simulation and Load Testing
 - AWS S3 for File Storage (PDF reports)

Table 5.3 defines the personnel involved in testing and their tasks.

5.1.4 Test Team Details

Role	Name	Specific Responsibilities/Comments
Test Manager 1	Armaan Sharma	Coordinating overall testing for AI part.
Test Manager 2	Rahi Agarwal	Performing unit, integration, and regression tests for Frontend and Backend

Table 5.3 Test team roles and responsibilities.

5.2 Components Decomposition and Types of Testing Required

Table 5.4 lists each module along with the testing types applicable to them.

S.No	Component/Module	Type of Testing Required	Testing Technique
1	User Registration and Authentication	Requirement Testing, Unit Testing, Integration Testing	Black Box (Equivalence Classes), White Box (Path Testing)
2	AI Avatar Interview Simulation (Heygen + D-ID)	Requirement Testing, System Testing, Performance Testing	Black Box (Boundary Value Analysis), Stress Testing
3	Speech Recognition and Emotion Analysis Module	Unit Testing, Integration Testing, Performance Testing	Black Box (Cause-Effect Graphing), White Box (Branch Testing)
4	Dashboard and PDF Report Generation	Requirement Testing, System Testing, Volume Testing	Black Box (Equivalence Partitioning), White Box (Decision Testing)
5	Mentor Chatroom	Unit Testing, Integration Testing, Load Testing	Black Box (Boundary Value Analysis), White Box (Path Testing)
6	News & Job Market Insights	Unit Testing, Integration Testing, System Testing	Black Box (Robustness Testing), White Box (Statement Testing)

Table 5.4 Component-wise testing requirements.

5.3 List of Test Cases

5.3.1 Test case for Component 1 : User Registration and Authenticate

Table 5.5 details sample test inputs and expected outputs for account-related features.

Test Case ID	Input	Expected Output	Status
TC_UR_01	Valid email, strong password	Successful registration and redirection to dashboard	Pass
TC_UR_02	Duplicate email address	Error message: "Email already exists"	Pass
TC_UR_03	Missing fields (email/password)	Error: "Please fill all required fields"	Pass
TC_UR_04	Weak password (e.g., '1234')	Error: "Password too weak"	Pass
TC_UR_05	Incorrect login credentials	Error: "Invalid email/password"	Pass

Table 5.5 Test cases for user registration and authentication.

5.3.2 Test Cases for Component 2: AI Avatar Interview Simulation

Table 5.6 provides tests for AI avatar responsiveness and interaction flow.

Test Case ID	Input	Expected Output	Status
TC_AV_01	Start interview with stable internet	Avatar initiates conversation within 2s	Pass
TC_AV_02	User answers a question verbally	Avatar responds dynamically with next question	Pass
TC_AV_03	Network interrupted during session	Reconnect or prompt to retry	Pass
TC_AV_04	High server load during session	Avatar switches to lightweight mode	Pass

Table 5.6 Test cases for AI avatar interview simulation.

5.3.3 Test Cases for Component 3: Speech Recognition and Emotion Analysis

Table 5.7 tests the accuracy of transcription and facial expression detection.

Test Case ID	Input	Expected Output	Status
TC_SR_01	Clear audio input	Accurate transcription	Pass
TC_SR_02	Noisy background audio	Lower accuracy, but system continues gracefully	Pass
TC_SR_03	Happy facial expression	Correct detection as 'Happy'	Pass
TC_SR_04	Low eye-contact detected	Performance score decreases in report	Pass

Table 5.7 Test cases for speech recognition and emotion analysis.

5.3.4 Test Cases for Component 4: Dashboard and PDF Report Generation

Table 5.8 lists checks for session history, report downloads, and score visualization.

Test Case ID	Input	Expected Output	Status
TC_DB_01	User completes a session	New entry added in Dashboard	Pass
TC_DB_02	Click "Download Report"	PDF file downloads successfully	Pass
TC_DB_03	Access historical sessions	Display complete conversation and scores	Pass

Table 5.8 Test cases for dashboard and PDF generation.

5.3.5 Test Cases for Component 5: Mentor Chatroom

Table 5.9 tests real-time message delivery and access restrictions.

Test Case ID	Input	Expected Output	Status
TC_MC_01	User sends a message	Message appears instantly in chatroom	Pass
TC_MC_02	Mentor replies	Reply delivered without delay	Pass
TC_MC_03	User tries to chat without login	Redirect to login page	Pass

Table 5.9 Test cases for the mentor chatroom module.

5.3.6 Test Cases for Component 6: News & Job Market Insights

Table 5.10 covers API behavior, article display, and fallback handling.

Test Case ID	Input	Expected Output	Status
TC_NJ_01	API returns articles	Display articles in user dashboard	Pass
TC_NJ_02	API downtime	Display fallback message "Unable to fetch articles"	Pass
TC_NJ_03	User clicks "Read More"	Full article opens in a new tab	Pass

Table 5.10 Test cases for news and job insights module.

5.4 Error and Exception Handling

Table 5.11 explains how failed test cases were resolved using various debugging methods.

Failed Test Cases and Debugging Techniques Used:

Test Case ID	Component	Debugging Technique Used	Explanation
TC_AV_03	AI Avatar Interview Simulation	Remote Debugging	Avatar disconnection on network loss was debugged using live logs monitored remotely via AWS CloudWatch and PM2 process manager.
TC_SR_02	Speech Recognition and Emotion Analysis	Print (Tracing) Debugging	Incorrect speech-to-text results under noisy conditions were traced using console logs printing intermediate audio buffer data.
TC_DB_03	Dashboard and PDF Report Generation	Backtracking	Missing session history was identified by backtracking through API response payloads and database query logs.
TC_NJ_02	News & Job Market Insights	Post-mortem Debugging	When the Google News API was down, error logs captured after the crash were analyzed to design better fallback mechanisms.

Table 5.11 Error and exception handling cases with debugging techniques

5.5 Limitation of Solution

Despite **PREPTALK**'s successful implementation of a sophisticated real-time AI avatar-based interview simulation platform, various practical constraints and technical hurdles still exist. Recognizing these limitations is crucial for planning future improvements.

I. Reliance on High-Performance GPUs

- The real-time rendering of AI avatars through Heygen and D-ID APIs necessitates significant GPU resources.
- During peak demand periods, the system occasionally resorts to using simpler avatars to sustain low latency.
- This can somewhat diminish the realism and immersive nature of the avatar simulation when resources are limited.

II. Sensitivity to Internet Speed

- To ensure smooth real-time avatar interviews, a stable and fast internet connection (minimum 10 Mbps) is essential.
- Users in locations with subpar internet quality may face:
 - Delays in avatar reactions.
 - Buffering of video feeds.
 - Deteriorated audio-visual synchronization.

III. External API Limitations and Outages

- The platform significantly depends on third-party services like OpenAI, Heygen, D-ID, and Google News API.
- Any API rate limitations, service disruptions, or outages can momentarily interrupt the avatar simulation, resource suggestions, or news aggregation features.

IV. Speech Recognition Performance in Noisy Settings

- While the Speech-to-Text engine (Whisper/Google STT) performs well under normal circumstances, background noise can greatly influence:
- The precision of speech transcription.
- The quality of AI-generated feedback during interviews.
- Users are advised to work in quiet settings for optimal outcomes.

V. Inadequate Emotion and Expression Assessment

- The current iteration utilizes facial analysis tools like OpenCV and DeepFace to recognize basic emotions (happy, sad, neutral).
- However, it does not reliably capture more nuanced emotional states (e.g., nervousness, hesitation).
- This limitation may slightly impact the depth of feedback regarding soft skills and non-verbal cues.

VI. Scalability Issues for Mentorship Chat

- Although the mentor chatroom operates well and can handle moderate traffic, sudden increases in user activity (e.g., during placement seasons) may necessitate:
- Manual efforts to onboard additional mentors.
- Load balancing modifications to ensure real-time responsiveness.

VII. Unexplored VR/3D Environment

- Currently, the avatar experience is limited to a 2D speaking portrait format on the web.
- The integration of fully immersive 3D VR-based interviews (such as Oculus/Meta integration) has yet to be developed, which could hinder long-term competitiveness against emerging VR-based interview preparation solutions.

Chapter 6: Findings, Conclusion, and Future Work

6.1 Findings

By developing, implementing, and testing PREPTALK, several important insights were gained:

- **Effective Engagement with Real-Time AI Avatars:**

The use of AI-powered avatars (utilizing Heygen and D-ID) markedly improved user engagement compared to conventional chat-based mock interviews. Participants noted a boost in their confidence after working with realistic virtual interviewers.

- **Enhancing User Learning Through NLP and Dynamic Feedback:**

The incorporation of LLMs (such as OpenAI GPT) enabled the system to produce tailored follow-up questions and personalized feedback. This resulted in interview practice that was more adaptive, rich in context, and effective for skill enhancement.

- **In-Depth Assessment Through Speech and Emotional Analysis:**

By examining users' speech patterns, tone, and facial expressions, the platform offered comprehensive feedback (both verbal and non-verbal), a feature seldom provided by existing platforms.

- **Motivation Through Performance Tracking:**

The dashboard functionality — which displays users' historical performances, scores, and suggested learning materials — encouraged users to engage in regular practice and track their progress.

- **Strategic Planning Needed for System Scalability:**

Significant technical issues, such as GPU dependencies, API rate limits, and internet connectivity sensitivity, were identified as challenges that require proactive management, especially with increasing user demand.

6.2 Conclusion

The PREPTALK platform demonstrates that AI-driven technology can revolutionize the way individuals prepare for professional interviews.

Through the successful integration of real-time speaking avatars, dynamic question generation, emotional tone analysis, and performance reporting, the project fulfilled its core objectives:

- To create an immersive, realistic, and interactive interview preparation tool.
- To provide continuous learning feedback tailored to individual user profiles.
- To bridge the gap between theoretical preparation and real-world readiness.

Despite technical challenges such as GPU resource constraints, internet dependency, and occasional third-party API limits, the project succeeded in building a scalable, user-centered, and future-ready solution.

This work lays a strong foundation for the next generation of AI-powered professional skill development platforms, where human capabilities are enhanced by adaptive machine intelligence and realistic simulations.

6.3 Future Work

While PREPTALK in its current form offers a powerful and functional solution, there are several opportunities for enhancement in future versions:

I. Full 3D VR Interview Simulation

- Develop full 3D metaverse environments where users can practice interviews using VR headsets (e.g., Oculus Quest).
- Integrate body movement tracking, posture analysis, and environmental simulations to create an even more immersive experience.

II. Advanced Emotion and Behavior Analytics

- Implement deep learning models that can detect **micro-expressions, stress levels, and body language cues**.
- Offer feedback not just on what was said, but **how** it was said, with fine-grained emotional intelligence metrics.

III. Offline Access and Edge AI Models

- Develop lightweight, downloadable versions of the platform that work offline or with minimal connectivity, using edge AI models.
- This would greatly expand accessibility, especially in areas with limited internet access.

IV. Mentor Marketplace and Scheduling

- Build an integrated mentor marketplace where users can browse mentor profiles, book sessions, and leave feedback.
- Offer paid sessions with verified industry experts for premium users.

V. AI Bias Detection and Correction

- Further research and implement models that actively detect and correct biases in interview scoring (e.g., based on gender, ethnicity).

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PREPTALK

ORIGINALITY REPORT



PRIMARY SOURCES

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Rahi Agarwal

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TECHNICAL SKILLS AND INTERESTS

Languages: C/C++, SQL

Development: HTML/CSS, JavaScript, Bootstrap, React.Js, Node.Js, Express.Js

Developer Tools: MySQL, MongoDB, Git/Github, Postman

Coursework: DBMS, Data Structure & Algorithms, OOPs, Operating System

Soft Skills: Result-Oriented, Calm Communicator, Analytical Thinking, People Management

Interest: Mindfulness Practitioner, Travelling, Art & Craft

EXPERIENCE

• Prodigy Infotech

June 2024 – July 2024

Remote

Software Development Engineer Intern

- Improved a web-based chat application using the MERN stack, enhancing functionality and user experience.
- Created and integrated RESTful APIs to enable seamless front-end and back-end communication.
- Utilized Git for version control, ensuring efficient collaboration and automated testing processes.

PROJECTS

• Pehchaan-Kaksha

Github

A geolocation and face recognition-based attendance system eliminating proxies and ensuring secure record-keeping.

- Tech Stack: **HTML/CSS, Node.js, Express.js, MongoDB, Geolocation API, Face Recognition Library**
- Authenticates student attendance using geolocation and face recognition.
- Accurately calculates student locations using the Geolocation API and Haversine Formula.
- Securely stores attendance data in MongoDB, facilitating easy access and management.

• ARShop

Github

Frontend development for an AR-based e-commerce platform, enabling product visualization via QR codes.

- Tools & technologies: **HTML/CSS, JavaScript, Bootstrap, Canva**
- Enhances customer experience by visualizing products through QR codes.
- Crafted logos and backgrounds using Canva, ensuring strong brand visuals.

• Ghummakad

Github

A tourism app which facilitates exploration, offering varied sections for discovery.

- Tools & technologies: **Flutter, Google Map API, Web Scraping (Beautiful Soup)**
- Empowers users with detailed destination descriptions, fostering seamless exploration and connection.
- Role :** Web Scrapped data from Government site (i.e., Incredible India).

• Foodie-Snake

Github

Console-based Snake game featuring directional controls and scoring.

- Tools & technologies: **C++, OOPs Paradigm, Standard Libraries**
- Developed a classic Snake game with console display.

EDUCATION

• Jaypee Institute of Information Technology, Noida

2021 - Present

B. Tech in Computer Science & Engineering

CGPA: 7.7

• M.D.V.M Parle School, Neemrana

2018 - 2020

Class XII, CBSE, Rajasthan

Percentage: 83.33 %

ACHIEVEMENTS & CERTIFICATIONS

- 1st Place in Digital Poster Designing** among 50+ participants, showcasing design skills.
- Advanced to **Level 2 in IVP Coderush 4.0 Hackathon**.
- Successfully leveraged **JsonPowerDB, Login2Xplore's proprietary database**, to enhance data management.
- TCS ION Certification** : Completed a course on cooperative behavior and professional ethics.

POSITIONS OF RESPONSIBILITY

• Coordinator at Quriosity - The Quizzing Society

Feb 2024 - Present

- Coordinated the society's quizzing contest, managing over 50+ students and ensuring smooth operations and successful event execution.



ARMAAN SHARMA

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Email: armaan111sharma@gmail.com
Github: <https://github.com/armaan0311>

SUMMARY

Experienced Data Science and AI/ML Specialist adept in leveraging AI and NLP for impactful business solutions. Proficient in Python for deep learning and NLP tasks, skilled in feature engineering for enhanced model performance. Experienced in data mining, statistical analysis, and SQL for efficient data management.

WORK EXPERIENCE

AI Consultant - Curie Microelectronics	June 2024 - Sept 2024
<ul style="list-style-type: none">Developed an AI model to classify ECG signals using PTB-XL data focusing on lead 1 and diagnostic classes.Designed and implemented machine learning and deep learning models to address critical business challenges.	
ML&AI INTERN - AutoText(ProU)	June 2023 - Aug 2023
<ul style="list-style-type: none">Led an advanced regression analysis project on predicting Airbnb rental prices, using sophisticated techniques and extensive data preprocessing for accurate predictions.Collaborated with stakeholders to validate outputs and develop an optimized pricing strategy.	

EDUCATION

BTECH. Computer Science JAYPEE INSTITUTE OF INFORMATION TECHNOLOGY CGPA: 7.6	July 2021 - June 2025
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PROJECTS

Dynamic Pricing System for E-Commerce – Python Flask Pandas	May 2024
<ul style="list-style-type: none">Built a pricing engine that adjusts product prices based on real-time demand and competitor data.Developed an efficient data pipeline to gather competitor prices and sales trends.Reduced inventory holding costs by 20% through data-driven pricing decisions.	
Recommendation System for Online Retail – Python TensorFlow AWS SageMaker	Oct 2024
<ul style="list-style-type: none">Designed a personalized recommendation engine that suggests products based on browsing behavior.Integrated collaborative filtering and content-based models to improve accuracy.Improved user engagement by 35% through personalized product recommendations.	

SKILLS

- Programming: Python, Java, SQL, C, C++, JavaScript
- Tools: Tableau, Power BI, Flask, MERN, Big Data Tools and Cloud Computing