



(RESEARCH ARTICLE)



## AI-powered ranking-based placement assistance system

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### Abstract

In today's competitive job market, students require structured guidance and continuous evaluation to enhance their placement readiness. Traditional placement systems lack personalization, real-time feedback, and performance tracking, leading to inefficiencies in career preparation. This project proposes an AI-Powered Ranking-Based Placement Assistance System, which integrates Artificial Intelligence and Machine Learning to provide a comprehensive career guidance ecosystem.

The system consists of three major modules: AI Roadmap Generation, AI Mock Interview, and Performance Dashboard. The AI Roadmap module generates structured learning paths based on user queries using multiple AI models such as OpenAI and Hugging Face. The AI Mock Interview module simulates real interview scenarios, records user responses, and evaluates them using Natural Language Processing (NLP), speech-to-text conversion, and audio-video analysis. The Performance Dashboard tracks user progress, identifies weak areas, and provides personalized recommendations.

The system demonstrates improved learning efficiency, better interview performance, and enhanced placement readiness, making it suitable for real-world academic and professional environments.

**Keywords:** Artificial Intelligence; Placement Assistance; Learning Roadmap; Mock Interview; NLP; Performance Analytics

### 1. Introduction

The existing placement preparation systems primarily rely on static learning materials and manual mentoring, which lack personalization and adaptability. Students often face difficulties in identifying suitable learning paths, practicing interview skills, and evaluating their performance effectively.

Traditional systems provide generic roadmaps and limited feedback, making it challenging for students to understand their strengths and weaknesses. Additionally, these systems fail to simulate real interview environments and do not provide continuous performance tracking.

To overcome these limitations, this project introduces an AI-powered career guidance ecosystem that integrates personalized learning, interview evaluation, and performance analytics. By leveraging Artificial Intelligence, the system dynamically generates learning roadmaps, conducts mock interviews, and provides real-time feedback.

The proposed system aims to bridge the gap between academic learning and industry requirements by offering a structured and adaptive approach to placement preparation.

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## 2. Literature Survey

### 2.1. Generative AI for Personalized Learning: Roadmap Generation from Natural Language

EdTech Research Journal – This study explores the use of Large Language Models (LLMs) such as GPT to generate structured learning roadmaps from natural language inputs. The system interprets user queries by extracting intent, constraints (such as time and skill level), and learning objectives. These inputs are mapped to a domain-specific skill graph or competency model, enabling the system to generate modular learning paths divided into weeks, milestones, and activities.

To improve the quality of recommendations, the model integrates retrieval-based techniques that fetch curated learning resources such as tutorials, documentation, and exercises. This hybrid approach ensures that the generated roadmap is both structured and grounded in real-world content.

Findings:

The study concludes that LLM-based systems significantly improve personalization and learning efficiency compared to traditional static roadmaps. However, challenges such as factual inaccuracies, dependency on training data, and the need for human validation remain.

### 2.2. A Comprehensive Survey on Mock Interview Evaluation Systems

Firdouziya M. Khadar, Devika G., Nayana L. Mathews, Parvathy R. Prasad (2024) – This survey analyzes existing AI-based mock interview evaluation systems that combine multiple technologies such as speech recognition, Natural Language Processing (NLP), and facial expression analysis. These systems convert spoken responses into text, analyze tone and pitch for confidence assessment, and evaluate facial expressions using Convolutional Neural Networks (CNNs).

The survey categorizes systems based on modalities (text, audio, video) and highlights how scoring algorithms are used to evaluate technical correctness and communication skills. Some systems also use machine learning models to compare candidate responses with predefined answers or knowledge bases.

Findings:

The study reveals that while current systems effectively assess technical knowledge, they often fail to provide holistic feedback. Key limitations include lack of emotional intelligence analysis, limited context understanding, and insufficient evaluation of soft skills such as confidence, clarity, and body language.

### 2.3. Intelligent Tutoring Systems: AI Approaches for Personalized Learning Pathways

Nkambou, Bourdeau, Mizoguchi – This research focuses on Intelligent Tutoring Systems (ITS) that generate adaptive learning pathways using Artificial Intelligence. The system architecture consists of three main components: a domain model (knowledge representation), a student model (learner profile), and a pedagogical model (teaching strategy).

Natural Language Processing (NLP) is used to interpret user queries and map them to a knowledge graph that defines relationships between topics and prerequisites. The system dynamically updates the learning path based on the learner's progress and performance.

Findings:

The results show that ITS systems provide more effective learning experiences compared to static curricula by adapting content to individual needs. However, the performance of these systems depends heavily on the accuracy of the knowledge graph and the ability to model student behavior correctly.

### 2.4. AI-Based Dynamic Roadmap Generation using Planning Algorithms

H. Aljohani et al. (Springer, 2021) – This study presents an AI-based framework that generates customized learning roadmaps using planning algorithms. The system takes user goals such as “learn full stack development in 4 months” and translates them into structured sequences of topics.

The methodology involves mapping user goals to a knowledge graph where each node represents a concept and edges represent prerequisite relationships. The system then uses planning algorithms to generate a timeline-based roadmap that optimizes learning progression.

Findings:

The study demonstrates that dynamic roadmap generation improves learner engagement and accelerates skill acquisition. However, the effectiveness of the system depends on the completeness of the knowledge graph and the availability of high-quality learning resources.

## 2.5. AI-Based Career Guidance and Recommendation Systems

Various studies in AI-driven career guidance systems focus on recommending career paths based on user skills, interests, and academic performance. These systems use machine learning algorithms such as classification, clustering, and recommendation engines to analyze user data and suggest suitable career options.

Some systems integrate collaborative filtering and content-based filtering techniques to recommend courses and job roles. Others use predictive analytics to estimate employability and suggest improvement strategies.

Findings:

These systems enhance decision-making by providing personalized recommendations. However, they often lack real-time evaluation and do not integrate interview preparation or performance tracking.

## 2.6. Speech and NLP-Based Interview Evaluation Systems

Recent advancements in speech processing and NLP have enabled automated evaluation of interview responses. These systems use speech-to-text conversion, sentiment analysis, and semantic similarity measures to assess candidate answers.

Advanced models such as transformers (BERT, GPT) are used to evaluate answer relevance, coherence, and technical correctness. Some systems also analyze speech patterns such as pauses, tone, and fluency to measure confidence.

Findings:

These systems provide fast and scalable evaluation but may struggle with contextual understanding and subjective aspects of communication.

## 2.7. Summary of Literature

From the above studies, it is evident that Artificial Intelligence has been successfully applied in various domains such as personalized learning, interview evaluation, and career recommendation. However, most existing systems focus on individual components rather than providing an integrated solution.

Key gaps identified in the literature include:

- Lack of integration between learning, interview evaluation, and performance tracking
- Limited focus on real-time feedback and continuous improvement
- Incomplete evaluation of soft skills such as confidence and communication
- Dependency on static or partially adaptive systems

## 2.8. Conclusion of Literature Survey

The proposed AI Powered Ranking Based Placement Assistance System addresses these limitations by integrating:

- AI-based personalized roadmap generation
- AI-driven mock interview evaluation with audio-video analysis
- Performance tracking and analytics dashboard into a unified platform. This integrated approach provides a comprehensive solution for placement preparation, improving both technical and soft skills while ensuring continuous learning and evaluation.

### 3. Objectives

The primary objective of this project is to develop an AI Powered Ranking Based Placement Assistance System that enhances student placement preparation through intelligent and personalized guidance. In the current competitive environment, students often lack structured learning paths and proper evaluation mechanisms. This system aims to overcome these challenges by integrating Artificial Intelligence into the career preparation process.

Another key objective is to generate personalized learning roadmaps based on user queries, skill levels, and career goals. By leveraging multiple AI models, the system creates structured and optimized learning paths that help students systematically build their technical and non-technical skills required for placements.

The project also focuses on implementing an AI-driven mock interview module that simulates real interview scenarios. The system records and analyzes user responses using Natural Language Processing (NLP) and speech analysis techniques to evaluate accuracy, clarity, and confidence, thereby helping students improve their communication and problem-solving abilities.

Additionally, the system aims to provide a performance dashboard that continuously tracks user progress, identifies strengths and weaknesses, and offers personalized recommendations for improvement. This enables students to monitor their growth and focus on areas that require attention.

Overall, the objective is to create a unified platform that integrates learning, evaluation, and analytics, thereby bridging the gap between academic learning and industry requirements while enhancing overall employability.

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### 4. Methodology

The proposed AI Powered Ranking Based Placement Assistance System adopts a multi-stage intelligent workflow that combines Artificial Intelligence, Natural Language Processing, and data analytics to assist students in placement preparation. The system is designed to create a continuous cycle of learning, practice, evaluation, and improvement. Each stage processes user data, applies AI-driven techniques, and produces meaningful outputs that help users enhance their technical and communication skills.

#### 4.1. Data Acquisition and Preprocessing

The system begins by collecting user inputs in different forms, including learning queries and interview responses.

- Text-based queries are analyzed using Natural Language Processing (NLP) to extract key information such as domain, skill level, and learning goals.
- During mock interviews, user responses are recorded through audio/video and converted into text using speech-to-text conversion.

To ensure accuracy, the collected data undergoes preprocessing steps such as noise removal, tokenization, normalization, and formatting. This structured data is then prepared for further AI-based processing and evaluation.

##### 4.1.1. AI-Based Roadmap Generation

In this stage, the system generates a personalized learning roadmap tailored to the user's goals.

- The processed query is sent to multiple AI models such as OpenAI and Hugging Face, which independently generate structured learning paths.
- Each roadmap includes detailed elements such as topics, subtopics, timelines, and recommended resources.

The system performs a comparative evaluation of these outputs based on:

- Relevance to user goals
- Completeness of content
- Practical applicability in real-world scenarios

The most optimized roadmap is selected (or merged) and presented in a step-by-step format, ensuring a clear and efficient learning path for the user.

#### 4.2. AI Mock Interview and Response Evaluation

The system provides an interactive mock interview environment to simulate real-world interview experiences.

- Users select a domain or topic, and the system generates AI-driven interview questions dynamically.
- Responses are recorded and processed using speech-to-text technology for further evaluation.

The evaluation process includes:

- NLP-based analysis → checks semantic similarity, keyword relevance, and contextual correctness
- Answer quality assessment → evaluates depth of explanation and logical structure
- Speech analysis → measures confidence, fluency, and clarity

Based on these factors, the system generates a detailed score along with constructive feedback and improvement suggestions, helping users refine both technical and communication skills.

#### 4.3. Performance Analysis and Intelligent Dashboard

The final stage focuses on aggregating and analyzing user performance across all activities.

- Data from roadmap completion and interview evaluations is collected and processed.
- Key performance metrics are calculated, including:
  - Accuracy score
  - Confidence level
  - Topic-wise mastery
  - Consistency over time

The results are displayed through an interactive performance dashboard, providing visual insights such as graphs and progress indicators. The system also generates personalized recommendations, suggesting topics for improvement and guiding the user toward better preparation strategies.

#### 4.4. Continuous Learning and Feedback Loop

An important aspect of the system is its continuous feedback mechanism.

- The system adapts based on user performance and updates recommendations dynamically.
- Users can repeatedly practice, receive feedback, and improve over time.

This creates a closed-loop system:

Learn → Practice → Evaluate → Improve, ensuring sustained growth and enhanced placement readiness.

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### 5. Proposed system

The proposed AI Powered Ranking Based Placement Assistance System is designed as an intelligent and integrated platform that enhances student placement preparation through personalized learning, interview evaluation, and performance analytics. The system overcomes the limitations of traditional placement systems by combining multiple AI-driven modules into a unified ecosystem. It ensures that users not only learn effectively but also practice and continuously improve their performance.

#### 5.1. System Overview

The proposed system consists of three main modules that work together to provide a complete placement preparation solution:

- AI Roadmap Generation Module – Generates personalized learning paths based on user goals and skill levels.
- AI Mock Interview Module – Simulates real interview scenarios and evaluates user responses.
- Performance Dashboard Module – Tracks progress, analyzes performance, and provides improvement suggestions.

These modules are interconnected and share data to create a continuous improvement cycle for the user.

## 5.2. System Architecture

The system follows a modular architecture consisting of three main layers:

- Frontend Layer – Developed using React, it provides an interactive user interface for entering queries, attending interviews, and viewing performance.
- Backend Layer – Built using Node.js or Python, it handles API requests, AI processing, and system logic.
- AI & Data Layer – Integrates AI models (OpenAI, Hugging Face) and databases (MongoDB) for generating outputs and storing user data.

This layered architecture ensures scalability, flexibility, and efficient data flow across the system.

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## 6. Applications

The proposed AI Powered Ranking Based Placement Assistance System has wide-ranging applications in academic institutions, career development platforms, and professional training environments. By integrating Artificial Intelligence with learning and evaluation, the system provides a comprehensive solution for placement preparation.

### 6.1. College Placement Training

The system can be used by colleges and universities to support students in placement preparation. It helps students by providing personalized learning roadmaps, conducting mock interviews, and tracking their progress. Placement cells can also monitor student performance and identify areas that need improvement.

### 6.2. Career Guidance Platforms

The system can be integrated into online career guidance platforms to assist users in choosing the right learning path based on their goals. It provides structured roadmaps and recommendations, helping individuals make informed career decisions.

### 6.3. Online Learning Platforms

E-learning platforms can use this system to enhance their offerings by providing AI-generated learning paths and interview practice features. This improves user engagement and ensures that learners receive personalized and goal-oriented training.

### 6.4. Skill Development Programs

Training institutes and skill development centers can adopt this system to provide structured learning and evaluation for students. It helps in improving both technical knowledge and communication skills required for job readiness.

### 6.5. Corporate Training and Hiring

Organizations can use the system for employee training and pre-assessment during hiring processes. It can evaluate candidates through mock interviews and provide insights into their skills, making recruitment more efficient.

### 6.6. Individual Self-Learning

The system can also be used by individuals for self-paced learning and interview preparation. Users can practice, receive feedback, and improve their performance without requiring external guidance.

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## 7. Algorithms

### 7.1. AI Roadmap Generation Algorithm

The AI Roadmap Generation Algorithm is responsible for creating a personalized learning path based on the user's goals and skill level. The system first accepts a natural language query and processes it using Natural Language Processing (NLP) techniques to extract intent, domain, and relevant keywords. This processed input is then sent to multiple AI models such as OpenAI and Hugging Face, where each model generates a structured roadmap consisting of topics,

timelines, and resources. The system evaluates these outputs based on relevance, completeness, and practicality, and selects or combines the best roadmap to present a clear and optimized learning path to the user.

### 7.2. AI Mock Interview Evaluation Algorithm

The AI Mock Interview Evaluation Algorithm is designed to simulate real interview scenarios and evaluate user responses. The system generates domain-specific questions based on the selected topic and records the user's responses through audio or video input. These responses are converted into text using speech-to-text technology and analyzed using NLP techniques to evaluate semantic similarity, keyword relevance, and contextual accuracy. Additionally, speech analysis is performed to assess confidence, fluency, and clarity. Based on these evaluations, the system generates a performance score along with detailed feedback to help users improve their interview skills.

### 7.3. Performance Analysis Algorithm

The Performance Analysis Algorithm focuses on tracking and evaluating user progress over time. It collects data from both roadmap completion and interview results, and computes key performance metrics such as accuracy, confidence level, and topic-wise scores. The system analyzes these metrics to identify patterns, strengths, and weaknesses in the user's performance. The results are then visualized through a dashboard, enabling users to monitor their progress and make informed decisions for improvement.

### 7.4. Recommendation Algorithm

The Recommendation Algorithm provides personalized suggestions to enhance user learning and performance. It analyzes the user's weak areas and compares them with the structured roadmap and performance data. Based on this analysis, the system recommends relevant topics, learning resources, and next steps. This ensures that users receive targeted guidance and can continuously improve their skills in a systematic manner.

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## 8. Results

### 8.1. System Performance Evaluation

The proposed AI Powered Ranking Based Placement Assistance System was evaluated through real-time testing across roadmap generation, mock interviews, and performance tracking modules. The system demonstrated effective functionality and consistent performance.

Testing confirmed that the system generates structured learning roadmaps, provides accurate interview evaluation, and identifies user strengths and weaknesses effectively. The performance dashboard also enables users to track progress and improvement over time.

Overall, the system shows reliable performance in enhancing placement preparation by integrating learning, evaluation, and feedback into a single platform.

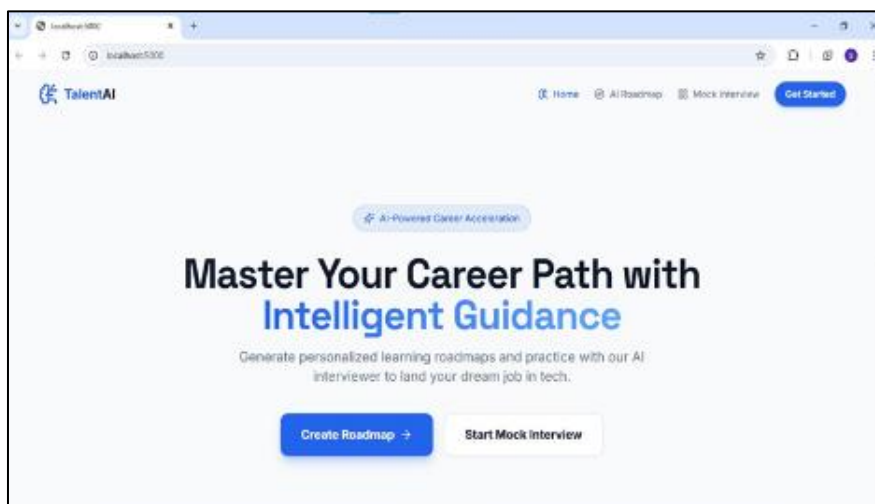


Figure 1 Home Page of AI Placement Assistance System

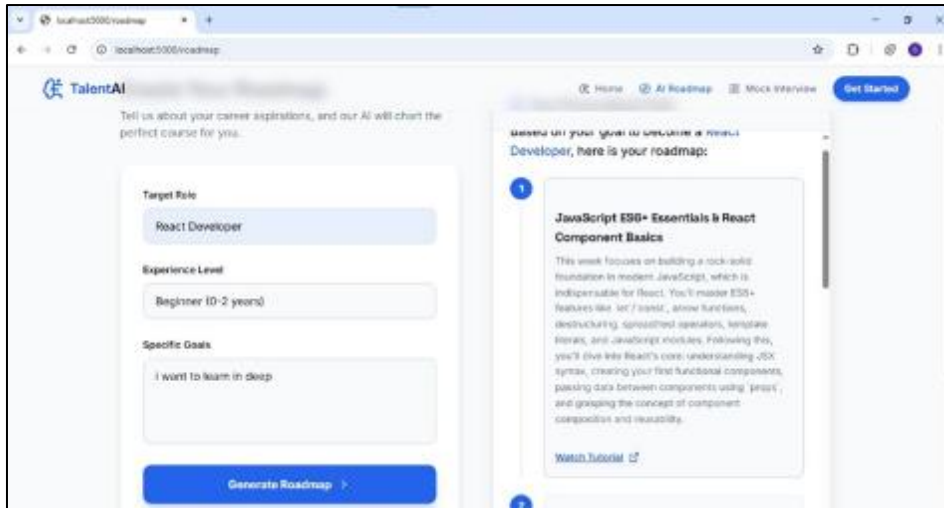


Figure 2 Roadmap Generation Module Output

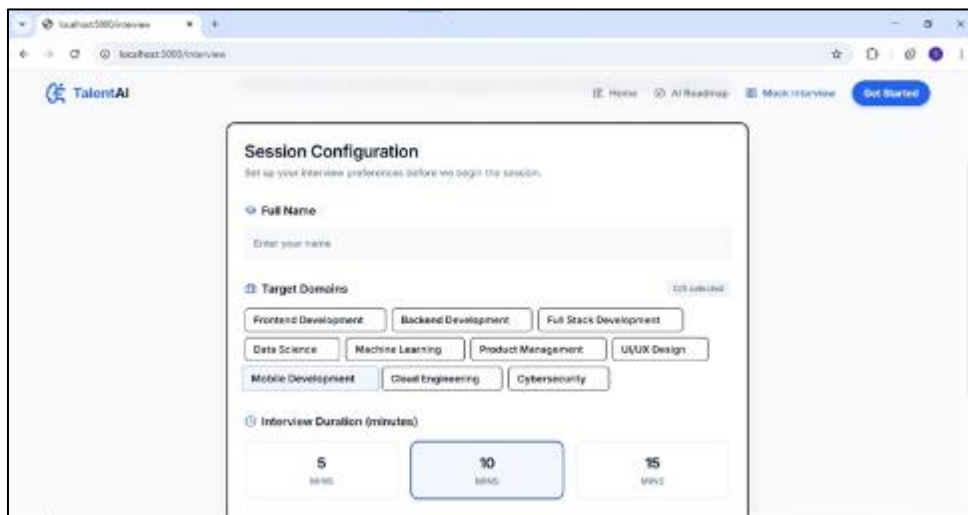


Figure 3 AI Mock Interview Interface

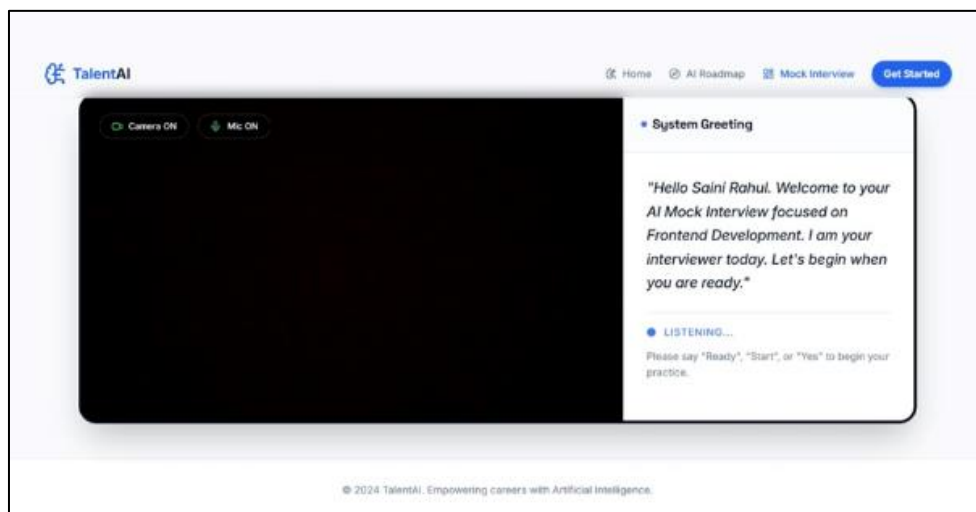
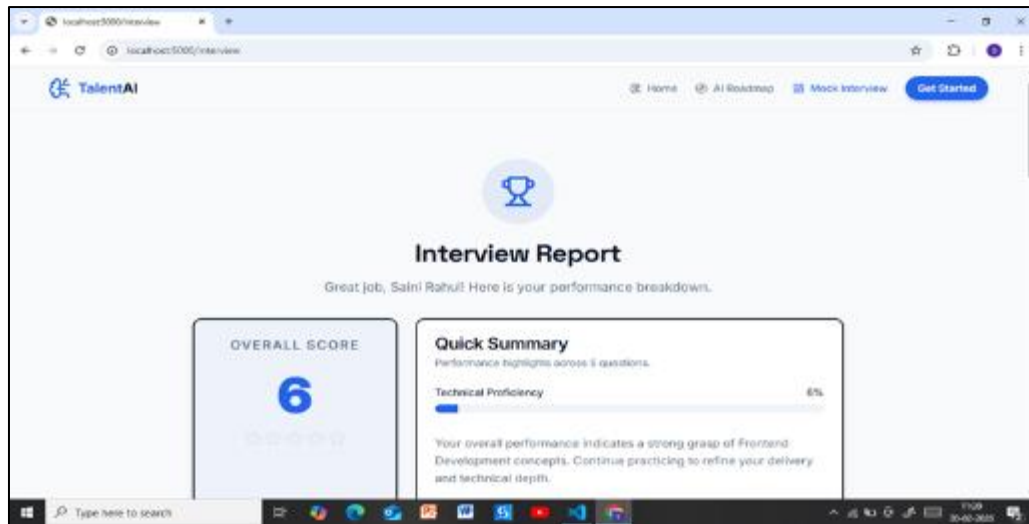


Figure 4 Interview Question Screen



**Figure 5** Interview Feedback Screen

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## 9. Conclusion

The proposed AI Powered Ranking Based Placement Assistance System successfully addresses the challenges faced by students in placement preparation by providing a structured, intelligent, and personalized solution. By integrating Artificial Intelligence into learning, interview evaluation, and performance tracking, the system creates a complete ecosystem that enhances both technical and communication skills.

The AI Roadmap module helps users follow a clear and goal-oriented learning path, while the AI Mock Interview module provides realistic interview practice and detailed feedback. The Performance Dashboard enables continuous monitoring of progress and identifies areas for improvement. This combination ensures that users can learn, practice, and improve effectively in a single platform.

Overall, the system bridges the gap between academic learning and industry requirements by offering personalized guidance and real-time evaluation. It improves placement readiness, increases confidence, and supports continuous skill development, making it a valuable tool for both students and educational institutions.

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## 10. Future Enhancements

The proposed AI Powered Ranking Based Placement Assistance System can be further enhanced by incorporating advanced features to improve its functionality and scalability. One major improvement is the integration of real-time emotion and body language analysis during mock interviews to evaluate user confidence and communication more accurately.

The system can also be extended to include AI-based resume analysis and job matching, where user profiles are analyzed and matched with suitable job opportunities. Integration with platforms such as LinkedIn and job portals can further enhance career guidance and placement opportunities.

Additionally, the system can support multilingual capabilities, allowing users from diverse backgrounds to interact with the platform in their preferred language. Features such as gamification, including badges, scores, and leaderboards, can be introduced to increase user engagement and motivation.

In the future, the system can incorporate advanced AI models and domain-specific fine-tuning to improve the accuracy of roadmap generation and interview evaluation. With continuous updates and enhancements, the platform can evolve into a comprehensive AI-driven career development ecosystem for students and professionals.

### **Compliance with ethical standards**

#### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

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