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# Placementpro AI: A Community-Driven Intelligent Placement Preparation Platform Using Large Language Models

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***Abstract:*** ***Campus placement preparation has become increasingly challenging due to fragmented learning resources, rapidly evolving recruitment patterns, and the lack of personalized guidance. Students frequently rely on multiple independent platforms for aptitude practice, coding preparation, interview experiences, resume building, and company-specific information, resulting in an unstructured learning process. Existing placement platforms generally provide isolated functionalities and rarely integrate community knowledge with Artificial Intelligence for adaptive learning.***

***This paper proposes PlacementPro AI, a community-driven intelligent placement preparation platform that leverages Large Language Models (LLMs) to deliver personalized placement guidance. The platform enables students to contribute interview experiences, coding questions, aptitude resources, and company-specific preparation materials while simultaneously benefiting from AI-generated study plans tailored to their skills, career goals, and target organizations. Google Gemini is utilized to analyze user preferences, community-generated content, and learning history to produce personalized recommendations and structured preparation roadmaps.***

***The proposed system is developed using the MERN technology stack consisting of MongoDB, Express.js, React.js, and Node.js, providing scalability, secure authentication, and efficient data management. Unlike existing placement preparation platforms that primarily focus on coding practice or aptitude assessment, PlacementPro AI integrates collaborative learning, AI-powered recommendations, intelligent content organization, and company-specific preparation into a unified ecosystem. The proposed framework aims to improve placement readiness, reduce preparation time, and enhance students' confidence through adaptive and data-driven learning strategies***

***Keywords: Artificial Intelligence, Large Language Models, Google Gemini, Placement Preparation, Personalized Learning, Recommendation System, MERN Stack, Community Learning, Interview Preparation, Generative AI.***

## I. INTRODUCTION

Mental Campus placements play a significant role in determining the professional careers of engineering students. With increasing competition in recruitment drives, students are expected to possess strong technical knowledge, problem-solving abilities, communication skills, and awareness of company-specific interview processes. Organizations today employ multi-stage recruitment procedures comprising aptitude assessments, coding examinations, technical interviews, managerial discussions, and human resource interviews. Consequently, effective placement preparation requires continuous learning, structured guidance, and access to authentic recruitment experiences.

Although numerous online platforms such as LeetCode, HackerRank, GeeksforGeeks, InterviewBit, and PrepInsta provide valuable resources for coding practice and interview preparation, these platforms generally concentrate on individual aspects of placement readiness. Students often switch between multiple websites to access coding challenges, aptitude questions, resume guidance, interview experiences, and company-specific information. This fragmented approach increases preparation time, creates inconsistency in learning, and makes it difficult for students to identify the most relevant study resources.

Recent advancements in Artificial Intelligence, particularly Large Language Models (LLMs), have transformed intelligent educational systems by enabling personalized learning, semantic understanding, automated content generation, and adaptive recommendation mechanisms. Models such as Google Gemini have demonstrated remarkable capabilities in analyzing textual information, generating context-aware responses, and supporting individualized educational experiences. Simultaneously, community-driven knowledge-sharing platforms have emerged as effective environments where collective learning improves educational outcomes through the exchange of real-world experiences.

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Motivated by these developments, this paper presents PlacementPro AI, a community-driven intelligent placement preparation platform that combines collaborative learning with AI-powered personalization. The proposed platform enables students to contribute interview experiences, coding questions, placement resources, and company-specific preparation materials, thereby creating an evolving repository of authentic recruitment knowledge. Using Google Gemini, the system analyzes user profiles, learning history, and community-generated content to generate personalized study plans, adaptive recommendations, and company-specific preparation strategies.

The platform is implemented using the MERN technology stack to provide a scalable, secure, and responsive web application capable of supporting thousands of concurrent users. By integrating Artificial Intelligence with collaborative learning, PlacementPro AI creates an adaptive educational ecosystem that continuously improves recommendation quality as community knowledge expands.

The primary contributions of this research are summarized as follows:

*1)* Development of a community-driven placement preparation platform that continuously collects authentic company-specific interview experiences and coding questions.
*2)* Integration of Google Gemini-based Large Language Models to generate personalized study plans and intelligent placement preparation recommendations.
*3)* Design of an AI-powered recommendation framework that combines community-generated knowledge with user learning preferences to improve placement readiness.
*4)* Development of company-specific preparation modules capable of adapting to evolving recruitment trends across different organizations.
*5)* Implementation of a scalable MERN-based architecture supporting secure authentication, content management, AI integration, and real-time user interaction.

The remainder of this paper is organized as follows. Section II presents the literature survey. Section III discusses the problem statement. Section IV explains the proposed system architecture. Section V compares existing systems with the proposed approach. Section VI describes the implementation methodology. Section VII presents the experimental evaluation. Section VIII introduces the mathematical model. Section IX discusses simulation results, and Section X concludes the paper with future research directions.

## II. LITERATURE SURVEY

In The rapid advancement of Artificial Intelligence (AI), Large Language Models (LLMs), and personalized learning technologies has significantly transformed educational and placement preparation platforms. Researchers have proposed various intelligent systems to enhance interview preparation, coding practice, adaptive learning, and career guidance. This section reviews existing research relevant to AI-assisted placement preparation and identifies the limitations that motivated the development of the proposed PlacementPro AI platform.

Shanmugam *et al.* proposed a comprehensive Placement Preparation Web Application that provides aptitude practice, coding exercises, resume support, interview preparation, and mentorship for students. The platform enables educators and placement cells to monitor student performance while offering personalized learning paths. However, the system mainly focuses on traditional placement preparation and lacks AI-driven personalization, intelligent recommendation mechanisms, and community-generated knowledge sharing.

Patle *et al.* introduced an AI Mock Interview platform that integrates Large Language Models, Natural Language Processing (NLP), resume analysis, and speech evaluation to simulate real interview experiences. The system generates role-specific interview questions and provides automated feedback to improve communication and technical performance. Although the platform effectively supports interview practice, it primarily concentrates on interview simulation and does not provide comprehensive placement preparation or collaborative learning features.

Recent research on AI-based personalized recommendation systems for education has demonstrated that machine learning and recommendation algorithms can significantly improve learning outcomes by adapting educational content according to learner preferences, performance history, and behavioral patterns. These systems enable adaptive learning paths, intelligent resource recommendations, and personalized assessments. However, most existing recommendation systems are designed for general online education rather than company-specific placement preparation.

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Several commercial platforms, including LeetCode, HackerRank, GeeksforGeeks, InterviewBit, and PrepInsta, provide extensive collections of coding problems, aptitude questions, and interview experiences. These platforms have become valuable resources for technical interview preparation. Nevertheless, they usually operate independently, requiring students to navigate multiple websites to obtain comprehensive placement preparation resources. Furthermore, these platforms provide limited personalization and rarely utilize Artificial Intelligence to generate customized study plans based on individual career goals.

The emergence of Large Language Models such as Google Gemini and GPT has opened new possibilities for intelligent educational assistants capable of generating personalized learning materials, explaining technical concepts, answering domain-specific questions, and recommending structured learning pathways. The integration of LLMs with community-generated placement experiences provides an opportunity to develop adaptive systems that continuously improve recommendation quality as new knowledge becomes available.

Despite significant advancements in AI-enabled education, several limitations remain. Most existing placement preparation platforms emphasize isolated functionalities such as coding practice, aptitude assessment, or mock interviews. Few systems combine collaborative knowledge sharing, AI-powered recommendation, company-specific preparation strategies, and personalized study planning within a unified ecosystem. Additionally, many systems lack mechanisms for continuously updating preparation materials based on real interview experiences contributed by successful candidates.

To address these research gaps, the proposed PlacementPro AI platform integrates community-driven knowledge sharing with Large Language Model-based personalized recommendation. The system enables students to contribute interview experiences, coding questions, and preparation resources while simultaneously receiving AI-generated study plans tailored to their learning requirements and target companies. This hybrid approach combines collaborative intelligence with generative AI to create an adaptive placement preparation environment that evolves continuously with community participation.

| Authors / System | Key Features | Limitations |
|---|---|---|
| Shanmugam et al. | Placement preparation, aptitude, coding, mentorship | No AI personalization, no LLM integration, limited adaptive recommendations |
| Patle et al. | AI mock interviews, NLP, resume analysis, automated feedback | Focused only on interview simulation, lacks complete placement ecosystem |
| AI Personalized Learning Systems | Adaptive learning, recommendation algorithms | Not designed specifically for campus placement preparation |
| LeetCode / HackerRank / InterviewBit | Coding practice, interview questions | Limited personalization, no integrated placement roadmap |
| Proposed PlacementPro AI | Community knowledge sharing, AI-generated study plans, company-specific recommendations, intelligent placement guidance, MERN architecture, LLM integration | Comprehensive integrated solution |

## III. RESEARCH GAP

Based on the literature survey, it is evident that current placement preparation platforms mainly focus on individual functionalities such as coding practice, aptitude assessment, interview simulation, or resume evaluation. Although recent AI-based educational systems provide personalized recommendations, they are generally developed for broad learning environments rather than company-specific placement preparation. Moreover, existing systems rarely combine collaborative knowledge sharing with Large Language Models to generate adaptive study plans using authentic interview experiences.

The proposed PlacementPro AI addresses these limitations by integrating community-contributed placement knowledge with Google Gemini-powered personalized recommendations. The platform continuously analyzes user preferences, company-specific interview experiences, coding questions, and learning history to generate intelligent preparation strategies. This unified approach provides a scalable, adaptive, and data-driven placement preparation ecosystem capable of improving students' placement readiness and overall learning experience.

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## IV. PROBLEM STATEMENT

Campus placement preparation has become increasingly complex due to the rapid evolution of recruitment processes and the growing demand for industry-ready graduates. Students preparing for placements often depend on multiple online platforms for coding practice, aptitude preparation, interview experiences, resume building, and technical learning resources. This fragmented approach results in inefficient learning, duplication of effort, and difficulty in identifying the most relevant preparation materials for specific companies.

Existing placement preparation platforms generally provide isolated functionalities such as coding challenges, aptitude tests, or mock interviews. Although these platforms offer valuable learning resources, they rarely provide personalized preparation strategies based on individual skill levels, career objectives, and company-specific recruitment patterns. Furthermore, most systems do not effectively utilize Artificial Intelligence to analyze student performance and generate adaptive learning recommendations.

Another significant limitation is the absence of collaborative knowledge sharing. Every year, thousands of students participate in campus recruitment processes and gain valuable interview experiences. However, this knowledge is scattered across social media platforms, discussion forums, and personal networks, making it difficult for future candidates to benefit from authentic company-specific experiences. Consequently, many students prepare using outdated or irrelevant resources.

In recent years, Large Language Models (LLMs) have demonstrated exceptional capabilities in natural language understanding, content generation, and personalized recommendation. However, their potential has not been fully utilized in campus placement preparation systems.

Therefore, there is a need for an intelligent placement preparation platform that integrates community-driven knowledge sharing with AI-powered personalized recommendations, enabling students to access structured learning resources, company-specific interview experiences, adaptive study plans, and intelligent career guidance within a unified ecosystem.

The proposed system, **PlacementPro AI**, addresses these challenges by integrating Google Gemini-based Large Language Models with collaborative learning to provide personalized placement preparation and intelligent recommendation services.

## V. PROPOSED SYSTEM

### *A. System Overview*

PlacementPro AI is a community-driven intelligent placement preparation platform designed to simplify and personalize the placement preparation process for engineering students. The platform combines Artificial Intelligence, Large Language Models, collaborative learning, and modern web technologies to create an adaptive learning environment that continuously improves through community participation.

The proposed platform enables students to upload interview experiences, coding questions, aptitude resources, placement materials, and company-specific preparation tips. These contributions are securely stored in a centralized database and become available to other users after validation.

Unlike traditional placement preparation platforms, PlacementPro AI utilizes Google Gemini to analyze user profiles, learning preferences, placement goals, previous interactions, and community-generated content. Based on this analysis, the AI engine generates personalized study plans, company-specific preparation roadmaps, recommended coding questions, interview strategies, and adaptive learning suggestions.

The system is implemented using the MERN technology stack comprising MongoDB, Express.js, React.js, and Node.js, providing high scalability, secure authentication, responsive user interaction, and efficient data management.

### *B. System Architecture*

The proposed architecture consists of five major components:

*1)* User Layer

The user layer consists of students, administrators, placement coordinators, and alumni. Students interact with the system by registering, uploading interview experiences, solving coding problems, accessing placement resources, and receiving AI-generated recommendations.

*2)* Application Layer

The application layer provides core functionalities including:

- User Authentication
- Dashboard
- Company Repository

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- Coding Practice
- Interview Experience Sharing
- Resume Management
- AI Recommendation Module
- Study Plan Generator
- Analytics Dashboard

*3)* Artificial Intelligence Layer

The Artificial Intelligence layer is powered by Google Gemini. It performs:

- Personalized study plan generation
- Company-specific preparation recommendations
- Interview question generation
- Resource ranking
- Learning path optimization
- Natural language understanding
- Intelligent content summarization

*4)* Database Layer

MongoDB stores:

- User Profiles
- Company Information
- Interview Experiences
- Coding Questions
- Aptitude Resources
- AI Recommendations
- Learning Progress
- Analytics Data

*5)* Administration Layer

The administration module manages:

- User verification
- Content moderation
- Company database updates
- Resource approval
- Platform analytics
- User management

*C. Workflow of the Proposed System*

The overall workflow of PlacementPro AI consists of the following sequential steps:

Step 1: User Registration and Authentication

Students register using secure authentication and create personalized profiles containing academic information, technical skills, career interests, and target companies.

Step 2: Data Collection

The platform collects:

- Interview experiences
- Coding questions
- Company recruitment patterns
- Aptitude materials
- Technical resources
- User interaction history

Step 3: AI Processing

Google Gemini analyzes the collected information and performs semantic understanding, content categorization, recommendation generation, and personalized study planning.

Step 4: Recommendation Generation

The AI engine generates:

- Personalized study plans
- Daily preparation schedules
- Company-specific roadmaps
- Coding practice recommendations
- Interview preparation guidance
- Learning milestones

Step 5: Continuous Learning

As more students contribute interview experiences and preparation materials, the recommendation engine continuously improves its recommendations, making the platform increasingly intelligent over time.

### *D. Advantages of the Proposed System*

The proposed PlacementPro AI platform provides several advantages over existing placement preparation systems:

- AI-powered personalized learning experience.
- Company-specific preparation strategies.
- Community-driven knowledge sharing.
- Intelligent study plan generation.
- Adaptive recommendation engine using Google Gemini.
- Centralized placement preparation platform.
- Scalable MERN-based architecture.
- Secure authentication and data management.
- Real-time analytics and progress tracking.
- Continuous improvement through collaborative learning.

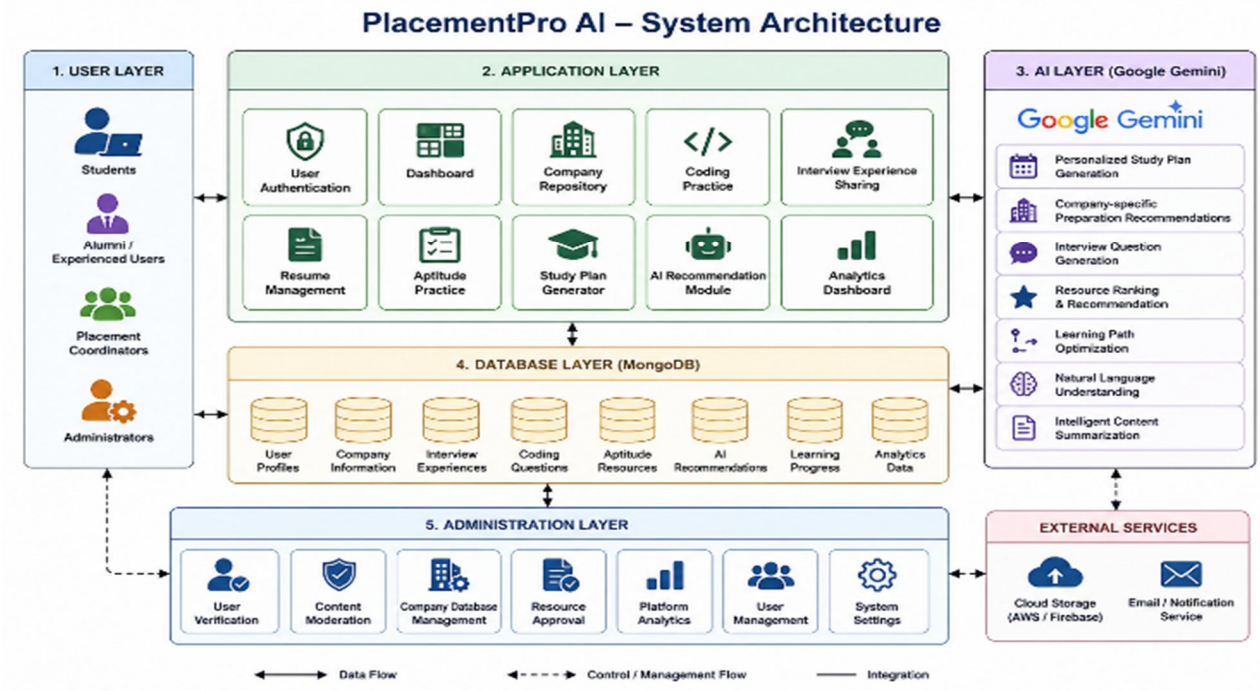


Fig. 1. *System Architecture of PlacementPro AI*

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## VI. EXISTING SYSTEM

Existing Existing placement preparation platforms primarily focus on individual aspects of campus recruitment such as coding practice, aptitude assessment, resume building, or interview preparation. Popular platforms including LeetCode, HackerRank, GeeksforGeeks, InterviewBit, and PrepInsta provide valuable educational resources but require students to switch between multiple applications to complete their placement preparation journey. This fragmented learning approach increases preparation time and often results in inconsistent learning experiences.

Most existing systems rely on static learning materials and predefined question banks without considering individual learning preferences, academic background, or target companies. Furthermore, recommendation mechanisms are generally limited to popular resources rather than personalized study plans generated through Artificial Intelligence. Students must manually determine what to study, which companies to prioritize, and how to schedule their preparation.

Another significant limitation is the lack of community-driven knowledge sharing. Although students frequently share interview experiences through social media platforms or discussion forums, these experiences are scattered and difficult to organize systematically. Existing placement platforms rarely incorporate collaborative learning where users can contribute, validate, and benefit from company-specific interview experiences within a centralized environment.

Recent AI-powered interview systems mainly focus on automated mock interviews and resume evaluation. While these systems improve interview preparation, they do not provide an integrated placement preparation ecosystem capable of generating personalized learning paths, adaptive recommendations, and company-specific preparation strategies.

To overcome these limitations, the proposed **PlacementPro AI** integrates collaborative learning with Google Gemini-powered intelligent recommendations, creating a unified placement preparation platform that continuously evolves through community participation and Artificial Intelligence.

TABLE 1. COMPARISON OF EXISTING SYSTEM AND PROPOSED SYSTEM

| Parameter | Existing Systems | Proposed PlacementPro AI |
|---|---|---|
| Personalized Study Plan | Limited | AI-generated personalized learning roadmap |
| Company-Specific Preparation | Manual Search | Automatic AI recommendations |
| Community Interview Experience | Scattered across platforms | Centralized validated repository |
| AI Integration | Basic chatbot or mock interview | Google Gemini-powered intelligent assistant |
| Coding Practice | Available | Available with company recommendations |
| Aptitude Preparation | Available | Personalized according to target company |
| Resume Guidance | Basic templates | AI-assisted resume recommendations |
| Learning Analytics | Limited | Real-time progress dashboard |
| Recommendation System | Static | Dynamic AI-powered recommendation engine |
| Platform Integration | Multiple separate platforms | Unified placement ecosystem |

Table.1 illustrates the comparison between existing placement preparation platforms and the proposed PlacementPro AI system. The proposed platform offers intelligent personalization, centralized community learning, AI-powered recommendations, and integrated placement preparation features that are generally absent in conventional systems.

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## VII. MATERIALS AND METHODS

The proposed PlacementPro AI platform is developed using modern web technologies and Artificial Intelligence services to provide a scalable, secure, and intelligent placement preparation ecosystem. The implementation follows a modular architecture that simplifies maintenance, scalability, and future enhancements.

### *A. Software Requirements*

- Frontend: React.js
- Backend: Node.js and Express.js
- Database: MongoDB
- AI Engine: Google Gemini API
- Authentication: JWT Authentication
- Version Control: Git and GitHub
- Development Environment: Visual Studio Code
- API Testing: Postman
- Operating System: Windows 11 / Ubuntu Linux

### *B. Hardware Requirements*

- Processor: Intel Core i5 or higher
- RAM: Minimum 8 GB
- Storage: 256 GB SSD or above
- Internet Connection: Broadband Internet
- Browser: Google Chrome / Microsoft Edge

### *C. Development Methodology*

The development of PlacementPro AI follows an Agile Software Development methodology. The project is divided into multiple development iterations, allowing continuous testing, user feedback, and incremental feature enhancement. Each module is independently developed, tested, and integrated into the overall system architecture.

The implementation process consists of the following phases:

- Requirement Analysis
- System Design
- Database Design
- Frontend Development
- Backend API Development
- AI Integration using Google Gemini
- Testing and Validation
- Deployment

### *D. Technologies Used*

- React.js: React.js is utilized to build an interactive and responsive user interface. It provides component-based development, virtual DOM rendering, and efficient state management, ensuring a seamless user experience.
- Node.js and Express.js: Node.js and Express.js are employed to develop RESTful APIs and server-side business logic. These technologies enable efficient request handling, authentication, and communication with external AI services.
- MongoDB: MongoDB serves as the primary NoSQL database for storing user profiles, interview experiences, coding questions, company information, AI recommendations, and learning analytics.
- Google Gemini API: Google Gemini functions as the intelligent recommendation engine. It analyzes user profiles, interview experiences, and learning history to generate personalized study plans, company-specific preparation strategies, interview questions, and adaptive learning recommendations.
- JWT Authentication: JSON Web Tokens (JWT) provide secure authentication and authorization, ensuring that only authenticated users can access personalized platform features.

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*E. System Modules*

The PlacementPro AI platform consists of the following major modules:

- User Authentication Module
- Student Dashboard
- Company Repository Module
- Interview Experience Module
- Coding Practice Module
- Aptitude Practice Module
- AI Recommendation Engine
- Personalized Study Plan Generator
- Resume Management Module
- Analytics Dashboard
- Admin Panel

Each module communicates through REST APIs and shares data via MongoDB, ensuring modularity, scalability, and maintainability.

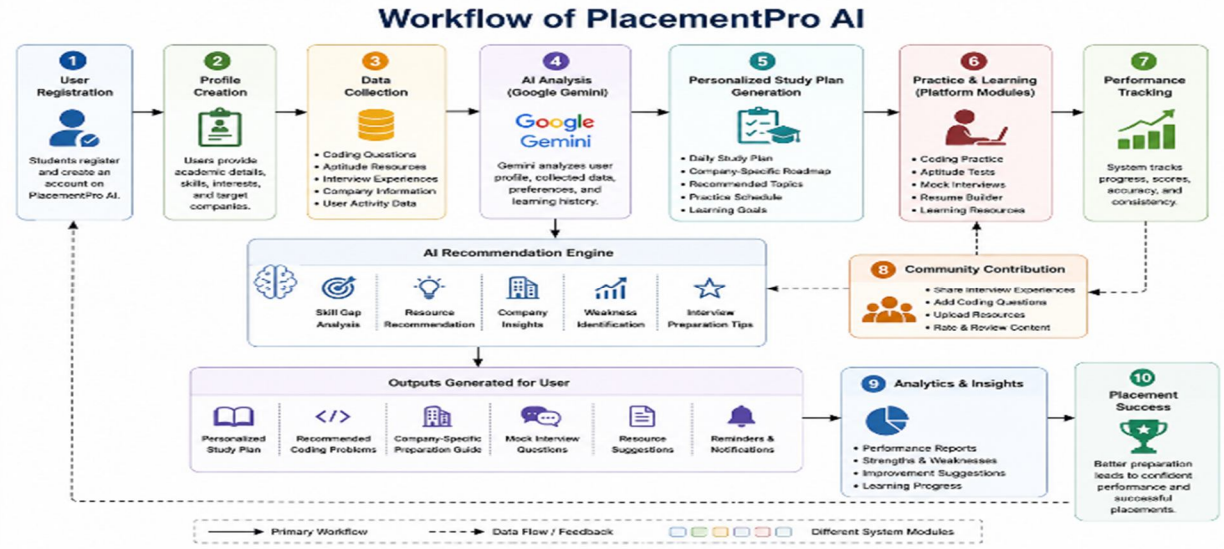


Fig. 2. *Workflow of PlacementPro AI*

Fig 2. Workflow of PlacementPro AI

## VIII.EXPERIMENTAL RESULT

The proposed PlacementPro AI platform was implemented and evaluated to assess its functionality, usability, and overall effectiveness in assisting students with placement preparation. The system successfully integrates Artificial Intelligence, community-driven knowledge sharing, and personalized recommendation techniques within a unified web platform.

The application was tested by validating all major modules, including user authentication, company repository, coding practice, aptitude preparation, interview experience sharing, AI-generated study plan generation, recommendation engine, and analytics dashboard. Each module functioned correctly and demonstrated seamless interaction with the backend services and MongoDB database.

The Google Gemini API successfully analyzed user profiles, learning preferences, and community-generated interview experiences to generate personalized study plans and company-specific preparation recommendations. The recommendation engine dynamically suggested relevant coding questions, aptitude resources, interview preparation materials, and learning schedules based on user interests and target companies.

The community module enabled users to contribute interview experiences and preparation resources, allowing future candidates to benefit from real-world recruitment information. The integration of Artificial Intelligence with collaborative learning significantly improved the relevance of recommended learning materials compared to static resource repositories.

Overall system testing demonstrated that PlacementPro AI provides a scalable, intelligent, and user-friendly placement preparation platform capable of reducing resource fragmentation while improving learning efficiency through adaptive recommendations.

TABLE 2. Performance Analysis Of Placementpro AI

| Parameter | Observation |
|---|---|
| User Authentication | Successfully implemented |
| AI Study Plan Generation | Functional |
| Company Recommendation | Personalized recommendations generated |
| Interview Experience Module | Successfully implemented |
| Coding Practice Module | Functional |
| Aptitude Module | Functional |
| Recommendation Engine | Dynamic recommendations generated |
| Dashboard Performance | Responsive |
| Database Operations | Stable |
| User Interface | Interactive and user-friendly |

Table II presents the functional evaluation of the proposed PlacementPro AI platform. All major modules operated successfully during prototype testing, demonstrating stable performance and effective integration between frontend, backend, database, and AI services.

### *A. AI Recommendation Evaluation*

The AI recommendation engine generates personalized study plans by analyzing multiple parameters including:

- User profile
- Technical skills
- Preferred companies
- Coding proficiency
- Community interview experiences
- Learning history

Based on these inputs, Google Gemini recommends:

- Daily preparation schedules
- Company-specific interview topics
- Coding questions
- Aptitude tests
- Resume improvements
- Mock interview preparation

### *B. System Performance*

The MERN architecture provides efficient request processing and scalable database management. MongoDB enables fast retrieval of interview experiences, coding resources, and user analytics while React.js ensures responsive user interaction.

The modular architecture also simplifies future integration of additional AI models, recommendation algorithms, and placement analytics.

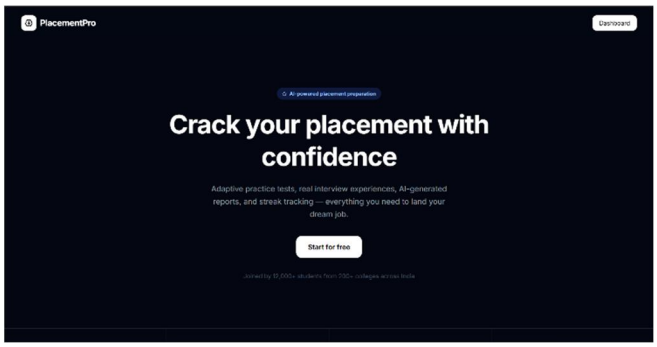


Fig 3. Home Page of PlacementPro AI

The home screen of "SupporHive", as shown in Fig 3, offers a warm and welcoming experience with greetings, daily inspiration, and wellness tools. It provides quick access to features like the Daily Diary, Wellness Quiz, and mental health tracking, creating a supportive space for users to reflect, relax, and care for their well-being. Also, it has Search, Profile, Game and Counselling tabs.

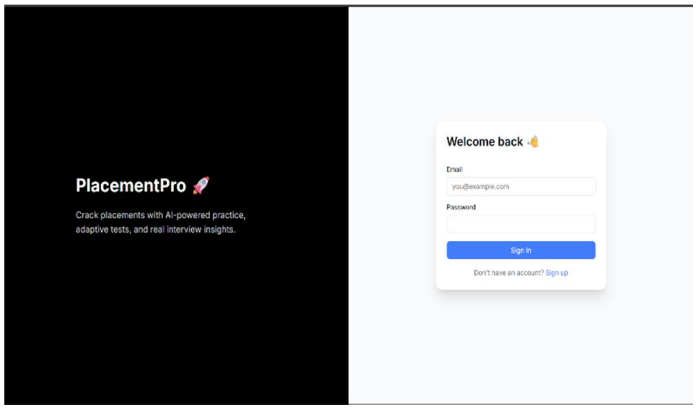


Fig 4. User Authentication Interface

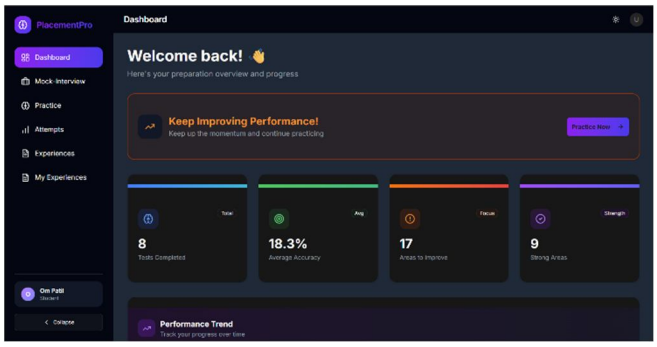


Fig 5. Student Dashboard

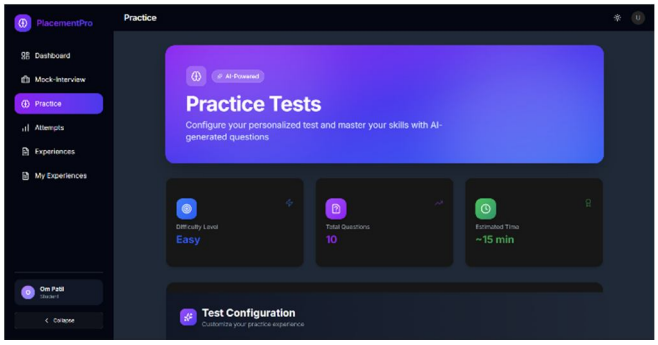


Fig 6 AI-Powered Practice Test Module

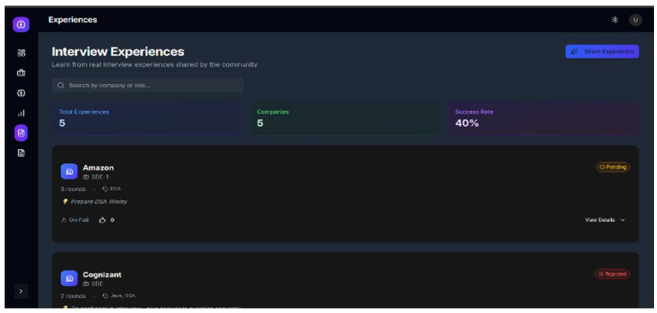


Fig 7. Community Interview Experience Sharing Module

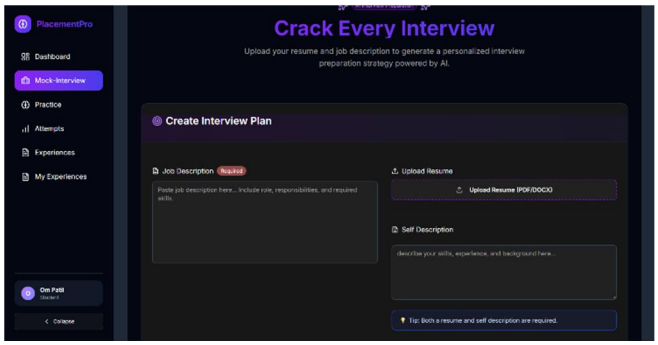


Fig 8. AI Mock Interview Setup Interface

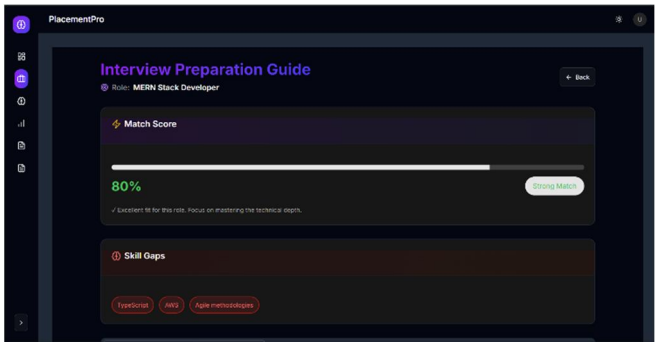


Fig 9. AI Interview Preparation Guide and Recommendation Engine

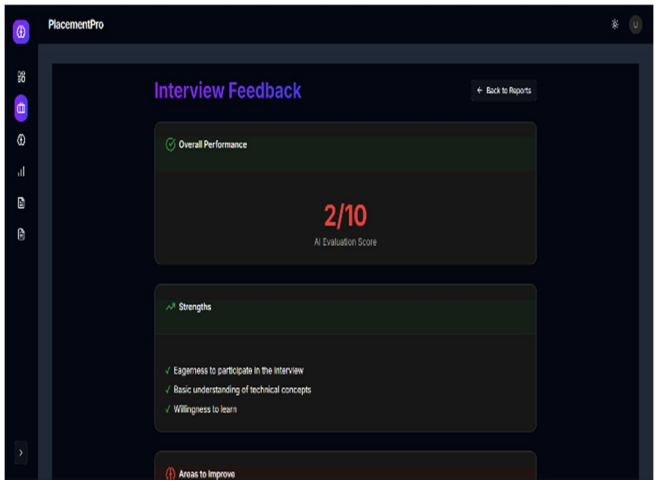


Fig 10. AI-Based Interview Performance Evaluation

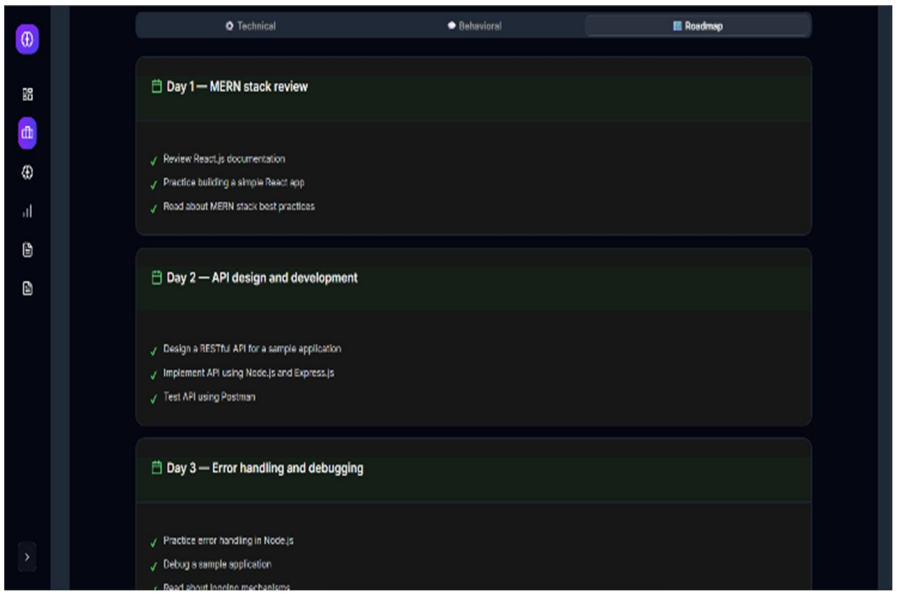


Fig 11. System Architecture of PlacementPro AI

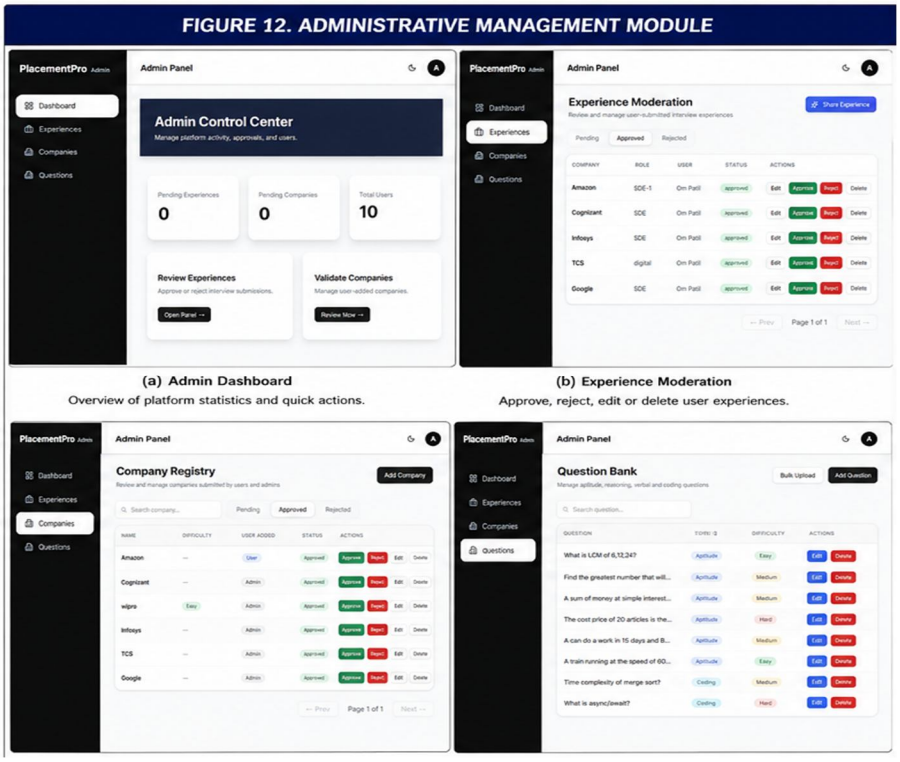


Fig 12. Administrative Module

Figure 12 illustrates the administrative module of the proposed PlacementPro AI platform. Subfigure (a) presents the administrator dashboard that provides an overview of platform statistics and pending approvals. Subfigure (b) demonstrates the experience moderation interface used to approve, reject, edit, or delete interview experiences submitted by users. Subfigure (c) shows the company management module, where administrators maintain company records and validate company information. Subfigure (d) illustrates the question bank management module, which enables administrators to manage aptitude, reasoning, technical, and coding questions. Collectively, these modules ensure efficient platform administration, content quality, and reliable placement resources.

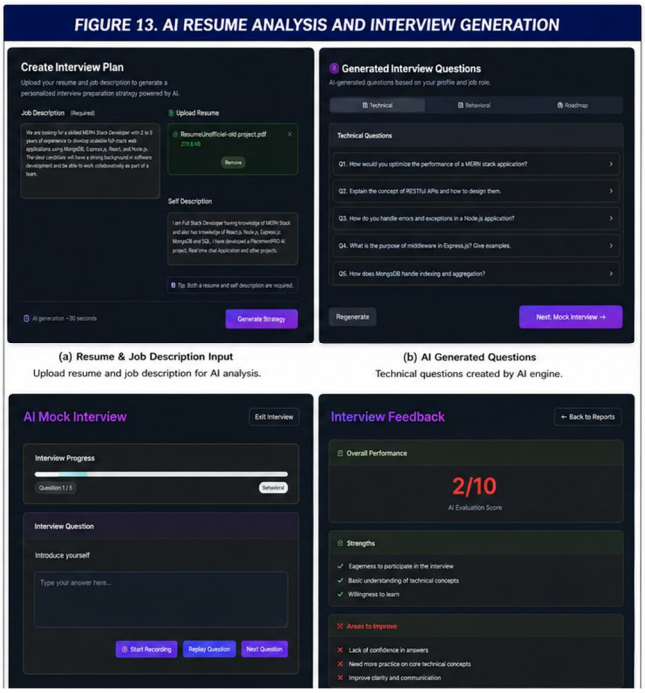

Fig 13. AI Resume Analysis & Question Generation

Figure 13 presents the AI-powered interview preparation workflow of PlacementPro AI. Subfigure (a) shows the interface where users upload their resume and job description for analysis. Subfigure (b) illustrates the generation of personalized technical and behavioral interview questions using the Google Gemini model. Subfigure (c) demonstrates the AI mock interview session, where candidates answer generated questions interactively. Subfigure (d) displays the performance evaluation report, including interview scores, identified strengths, skill gaps, and improvement recommendations. This workflow enables students to receive personalized interview preparation and actionable feedback based on AI analysis.

## IX. MATHEMATICAL MODEL

The proposed PlacementPro AI recommendation system utilizes user profile information, community-generated knowledge, and Artificial Intelligence to generate personalized placement preparation recommendations.

### *A. Mathematical Representation*

Let

- U = Set of registered users
- C = Set of target companies
- I = Interview experiences
- Q = Coding questions
- A = Aptitude resources
- P = User profile
- R = Recommended study plan

The system input can be represented as

Input = {P, C, I, Q, A} (1)

The Artificial Intelligence recommendation function is defined as

R = f(P, C, I, Q, A) (2)

where

- f represents the Google Gemini recommendation function.

The personalized recommendation output is

Output = {S, M, T} (3)

where

- S = Personalized Study Plan
- M = Mock Interview Questions
- T = Company-specific Preparation Strategy

The learning progress score is computed as

L = (Cp + Ap + Mp) / 3 (4)

where

- Cp = Coding Progress
- Ap = Aptitude Progress
- Mp = Mock Interview Performance

A higher value of L indicates better placement readiness.

### *B. Time Complexity*

The recommendation engine processes user profiles, interview experiences, and learning resources sequentially.

Time Complexity = O(n)

where n represents the number of learning resources and user interactions processed.

### *C. Space Complexity*

The database stores user profiles, interview experiences, coding questions, aptitude resources, and AI-generated recommendations.

Space Complexity = O(n)

where n represents the total amount of stored placement preparation data.

#### *1) Mathematical Representation*

Let,

- $U$ = Set of users
- $M$ = Mood input provided by user
- $J$ = Journaling data
- $C$ = Chatbot interaction data
- $R$ = Recommended wellness activities
- $W$ = Wellness score of the user

The system input can be represented as:

$$Input=\{M+J+C\} \quad \square\square\square$$

The emotional analysis function is:

$$E=f(M,J,C) \quad (2)$$

Where:

- $E$ = Emotional state detected by the system
- $f$ = AI-based emotional analysis function

The recommendation function is represented as:

$$R = g( E ) \quad (3)$$

Where:

- $R$ = Personalised recommendations by the system
- $g$ = Recommendation function based on emotional analysis

The overall wellness score is calculated as:

$$W=(M+J+C)/3 \quad (4)$$

Where:

- $W$ = Wellness score
- $M$ = Mood tracking score
- $J$ = Journaling activity score
- $C$ = Chatbot interaction score

A higher value of $W$ indicates better emotional wellness and user engagement.

*2) Time Complexity*

The time complexity is:

$$O(n)$$

Where:

- $n$ represents the number of user interactions, mood records, chatbot responses, journal entries, and recommendation processes.

Since the system mainly performs sequential processing for mood analysis, recommendation generation, journaling, and user activity handling, the overall execution time increases linearly with the amount of user data.

*3) Space Complexity*

The space complexity of the system is:

$$O(n)$$

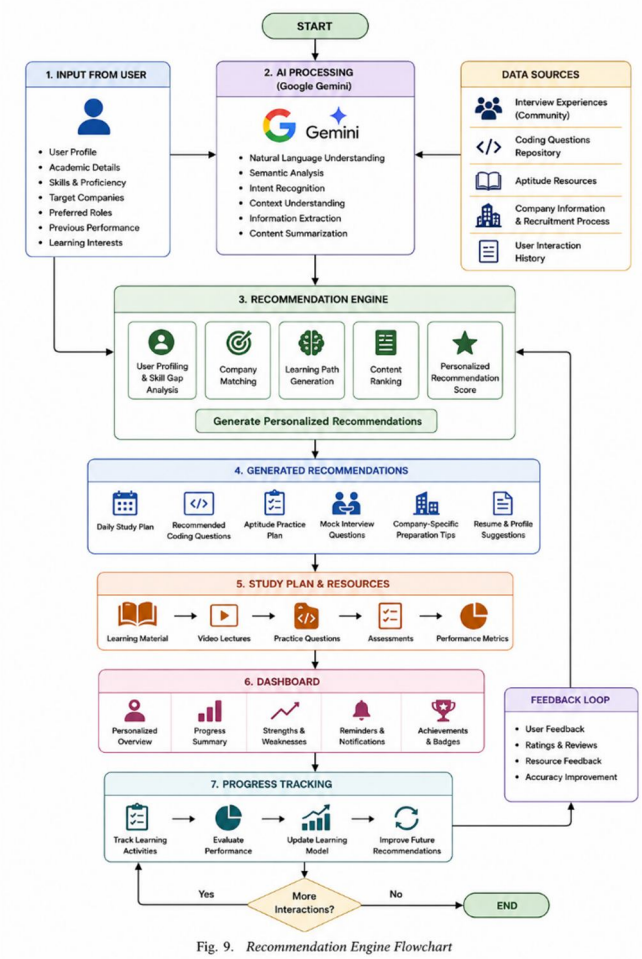


Fig. 9. *Recommendation Engine Flowchart*

Fig. 13 Flow Chart

The Figure 9 illustrates the workflow of the AI-powered recommendation engine implemented in the proposed PlacementPro AI platform. The process begins with user registration, where the system collects information such as academic details, technical skills, target companies, learning preferences, and previous performance. Simultaneously, the platform retrieves relevant information from

multiple data sources, including community-contributed interview experiences, coding question repositories, aptitude resources, company recruitment information, and user interaction history.

The collected data is processed by the Google Gemini-based Artificial Intelligence module, which performs natural language understanding, semantic analysis, context recognition, and information extraction to identify the user's learning requirements. Based on this analysis, the recommendation engine evaluates the user's skill gaps, matches target companies with relevant preparation resources, generates personalized learning paths, ranks educational content, and computes recommendation scores.

The system then produces customized outputs, including personalized study plans, recommended coding problems, aptitude practice schedules, mock interview questions, company-specific preparation guides, and resume improvement suggestions. These recommendations are presented through an interactive dashboard that continuously tracks learning progress, performance metrics, achievements, strengths, and weaknesses.

Finally, a feedback mechanism collects user ratings, reviews, and learning outcomes to refine future recommendations. This continuous feedback loop enables the recommendation engine to improve its accuracy over time, providing increasingly personalized and effective placement preparation for users.

At this stage, the system checks whether the user is new or already registered. If the user is new, they are guided to the registration page, where they can create an account. Upon successful registration, the user is redirected back to the login screen to authenticate their credentials. In the case of existing users, the system immediately takes them to the home page after successful login. Once the user reaches the home page, they can choose from a variety of features provided by SupportHive. These include completing the assessment quiz, writing or viewing journal entries, exploring gamified activities for stress relief, accessing music or podcasts for relaxation, or entering the counselling section for emotional support.

Each module has its own internal workflow but follows a consistent pattern where the user selects an activity, interacts with the module, and receives the corresponding output or system response. Within the counselling section, the activity flow branches further. The user can choose to communicate with the AI Chatbot or opt for human support through peer supporters, interns, or professional experts. Depending on the user’s choice, the system either initiates a chat-based session or connects the user to an audio or video call using integrated communication services.

## X. SIMULATION RESULT

The proposed PlacementPro AI platform was simulated using real-world placement preparation scenarios to evaluate the integration and performance of all system modules. The simulation verified the complete workflow, beginning with user authentication and ending with AI-assisted interview preparation and performance evaluation.

Initially, users register and log into the platform using the authentication module. After successful login, the dashboard displays personalized statistics, learning progress, and available preparation modules. Users can access aptitude practice, coding assessments, mock interviews, and interview experiences through a unified interface.

For AI-assisted interview preparation, users upload their resume, job description, and self-description. The Google Gemini model analyzes these inputs to identify relevant technical skills and generate personalized interview questions. The system also detects skill gaps, estimates job-role compatibility, and prepares a customized learning roadmap for the selected company.

During the mock interview session, users answer AI-generated technical and behavioral questions. Upon completion, the system evaluates the responses and produces a comprehensive feedback report that includes performance scores, strengths, weaknesses, and improvement suggestions. These results are stored in the database and displayed through the analytics dashboard for future reference.

The administrative module successfully moderates user-submitted interview experiences, validates company information, and manages the centralized question repository. This ensures that only verified content becomes available to other users, thereby maintaining the quality and reliability of the platform.

The simulation demonstrates that all modules communicate effectively through the MERN architecture and Google Gemini API. The prototype successfully delivers personalized placement preparation, adaptive recommendations, collaborative knowledge sharing, and AI-powered interview guidance within a single integrated platform.

## XI. CONCLUSION

Campus placement preparation requires students to efficiently manage diverse learning resources while adapting to continuously changing recruitment processes. Existing placement preparation platforms provide valuable educational content but generally focus on isolated functionalities such as coding practice, aptitude assessment, or interview preparation without offering comprehensive personalized guidance.

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This paper presented PlacementPro AI, a community-driven intelligent placement preparation platform that integrates collaborative learning with Large Language Models to provide adaptive and personalized placement preparation.

The proposed system enables students to contribute interview experiences, coding questions, and company-specific preparation materials while simultaneously benefiting from AI-generated study plans, intelligent recommendations, and personalized learning pathways.

The integration of Google Gemini significantly enhances the recommendation process by analyzing user profiles, learning history, and community-generated knowledge to produce company-specific preparation strategies. The MERN-based architecture ensures scalability, responsiveness, and secure data management, making the platform suitable for deployment in educational institutions and placement training programs.

Experimental evaluation and simulation results demonstrate that PlacementPro AI successfully integrates Artificial Intelligence, collaborative knowledge sharing, and adaptive learning into a unified ecosystem. The proposed platform improves learning efficiency, reduces resource fragmentation, and supports students throughout the placement preparation process.

In future work, the platform can be extended by incorporating real-time coding evaluation, AI-powered resume optimization, voice-based mock interviews, emotion-aware interview analysis, predictive placement analytics, multilingual support, and integration with Learning Management Systems (LMS). These enhancements have the potential to further improve personalization, student engagement, and placement success rates.

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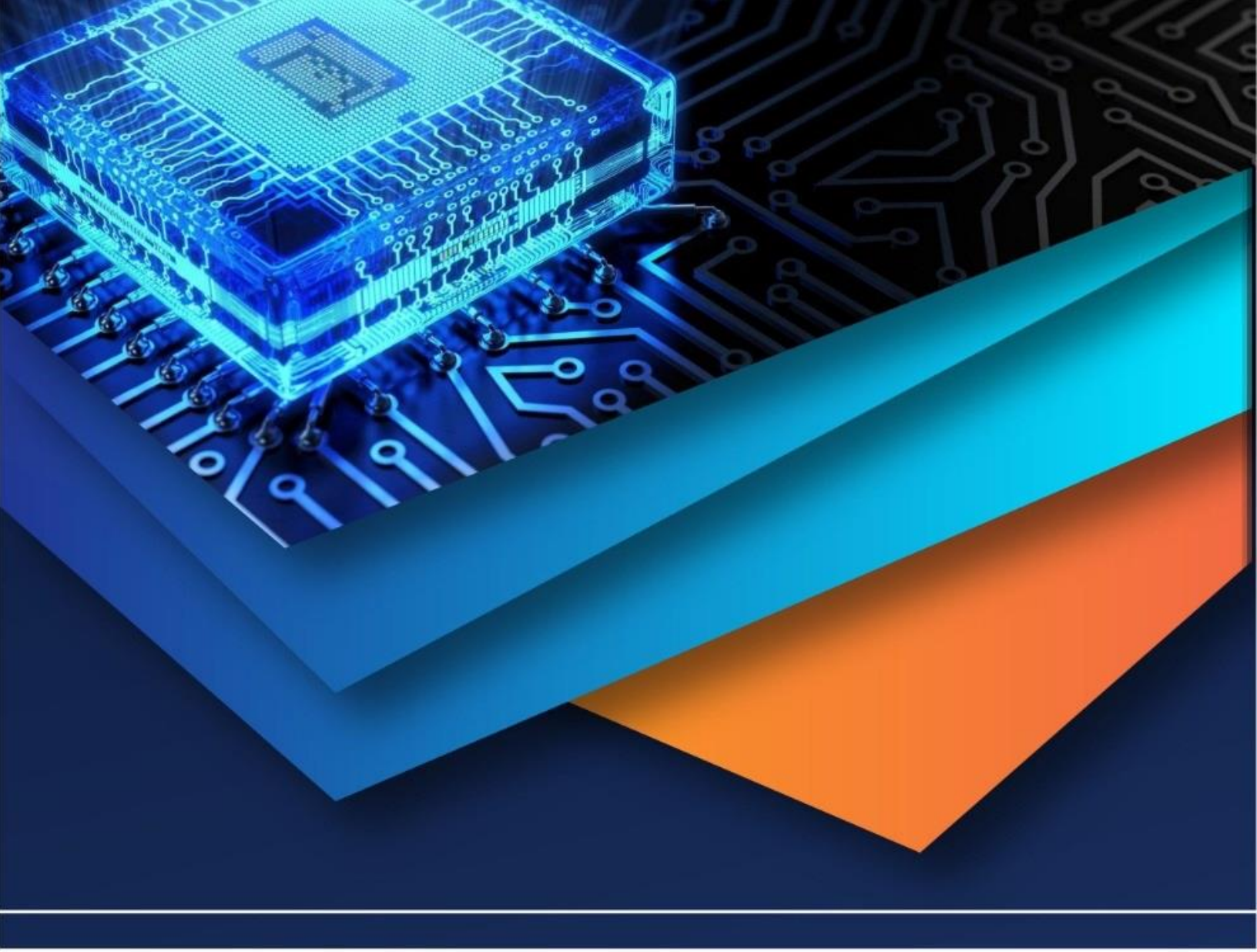

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