



# An AI-Powered Integrated Placement Module with Automated Proctoring and Chatbot-driven Interview Simulation for Higher Education

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**Abstract :** Modern recruitment in higher education requires integrated platforms that evaluate technical skills and soft skills while maintaining examination integrity. This paper presents the design and implementation of a web based Placement Module developed using Node.js, Express.js, MongoDB and EJS (MENE) stack to bridge this gap. The proposed system integrates a secure Online Placement Test featuring real-time camera proctoring to prevent malpractice and an AI-driven Interview Chatbot that utilizes a dynamic database of recently asked industry questions to simulate real-world hiring scenarios. Administrators are provided with a robust dashboard to manage test schedules, update question banks and monitor live sessions. For students, the platform offers a seamless interface to track overall performance analytics, providing data-driven insights into their strengths and areas for improvement. Experimental results indicate that the asynchronous nature of Node.js, combined with the flexible document schema of MongoDB, allows the system to handle concurrent user sessions with high efficiency. This research demonstrates how a unified web-based framework can streamline the placement lifecycle, reducing administrative overhead while enhancing student readiness for professional recruitment.

**Keywords :** Placement module, Emotional Framework, Web-Based Platform, Higher Education, Interview Chatbot, Node.js, MongoDB

## I. INTRODUCTION

Preparing for professional placements is an essential phase in higher education, serving as the primary bridge between theoretical academic learning and real-world industrial demands. The traditional process of conducting campus placements often faces significant logistical challenges, ranging from manual question paper generation to the subjective evaluation of face-to-face interviews. As educational institutions transition toward digital-first environments, there is an urgent need for automated systems that can handle large-scale assessments without compromising on integrity. Consequently, students frequently approach actual recruitment cycles with low confidence due to a lack of familiarity with digitized testing environments. Web-based placement preparation systems offer a superior alternative, utilizing activity-based assessments that enable students to monitor their progress, identify skill gaps, and develop proficiency through structured, high-fidelity simulations.

To address these challenges, this paper introduces SmartPrep, an integrated placement module developed using the Node.js, Express.js, MongoDB, and EJS (MENE) stack. SmartPrep is designed as a comprehensive “one-stop” ecosystem where administrators can seamlessly create, schedule, and manage assessments online. To ensure the integrity and fairness of the process, the platform incorporates real-time video camera-based proctoring to detect and deter malpractice, ensuring high-fidelity testing. Beyond technical assessments, SmartPrep includes an interactive Interview Chatbot module. This bot is loaded with recently asked industry questions to give students a realistic preview of modern hiring standards and simulate real-world interview scenarios. The primary objective of this work is to provide a scalable, secure, and user-friendly platform that optimizes the placement lifecycle for both administrators and students. This research examines contemporary placement practices within the context of rapid technological advancement and increasing industrial requirements. The study is grounded in a systematic review of 25 to 28 research papers related to online assessment systems, proctoring technologies, and AI-driven interview support. By identifying both favorable implementation strategies and potential challenges, this paper highlights the key elements necessary for an effective digital placement preparation platform. The paper is organized as follows. Section II is primarily focused on background and related work. Section III presents the system architecture and design followed by implementation and User interface



in Section IV. The results and discussion is presented in Section V. The paper concludes with a conclusion and future scope.

## II. BACKGROUND AND RELATED WORK

This research study investigated the student and institutional aspects of designing and implementing an online student placement preparation system and an online student placement management system at universities and colleges [8][11]. By creating one complete web-based application, institutions can increase workflow effectiveness, decrease the amount of time and resources spent on performing manual tasks, and provide students with a defined pathway through their placement process [3][10][12][21]. Many studies demonstrate that automated placement applications, by allowing centralized data management, filtering by eligibility, and providing students, training and placement officers, and recruiters with real-time updating of information, lead to increased collaboration and cooperation in the placement process [9][11][16][21]. In contrast, traditional placement management systems face challenges such as limited interactivity, delayed responses, data redundancy, and increased administrative workload, making them less effective than modern placement management systems [18][23][26].

Artificial Intelligence (AI), through chatbots and predictive analytics applications, has been a major area of research in the development of placement preparation systems [1][2][5]. Using AI-powered chatbots eliminated the need for students to depend on traditional help desk mechanisms for placement and interview-related queries, while ensuring consistent access to information and guidance [1][15][20][23]. The implementation of chatbot-based systems improves student engagement, personalizes preparation strategies, and streamlines training and placement process [4][9][14][25]. In addition to chatbots, machine learning techniques such as K-Nearest Neighbors (KNN), Support Vector Machine (SVM), and Random Forest are used to predict placement likelihoods and recommend appropriate preparation methods for students [17][19][22].

Web-based placement and enterprise resource planning (ERP)-based placement systems emphasize secure data management, role-based access control, and scalability to support efficient handling of large volumes of student and recruitment data [13][21]. Cloud-based systems and modular architectures provide more affordable and flexible alternatives to traditional systems, making them suitable for colleges and universities with limited financial resources [10][14][25]. Camera monitoring mechanisms and secure authentication systems have been incorporated into modern platforms to ensure fairness and integrity during online assessments and evaluations [6][20]. However, challenges such as user acceptance, lack of technological expertise, system customization requirements, and resistance to change continue to affect successful implementation [16][24][27].

Users are influenced by factors including system usability, reliability, quality of feedback, and institutional support [10][22]. Research indicates that user adoption and long-term effectiveness can be enhanced through continuous training, stakeholder involvement, and phased system deployment strategies [7][14][27]. Hybrid solutions that integrate assessment tools, interview preparation modules, analytics, and real-time communication have been shown to improve user confidence, employability, and placement success rates compared with systems offering limited functionality [6][9][10].

### A. Limited Real-Time Implementation and Experimental Studies

Most existing placement systems have not been tested through real-time institutional deployment. Future work should focus on implementing the system in actual educational environments and evaluating its performance using real usage data and system analytics.

### Lack of Comparative Studies

Although significant progress has been made in chatbot-based placement assistants, web/ERP-based management systems, and AI/ML-driven predictive tools, most existing solutions function in isolation rather than as integrated ecosystems. Limited focus has been given to real-time interoperability, scalable personalization, explainable AI for placement readiness, and integration with academic and recruiter-facing systems, resulting in fragmented placement preparation processes.

## III. SYSTEM ARCHITECTURE

### 3.1 System Architecture (The MVC Pattern)

The SmartPrep platform follows a Model-View-Controller (MVC) architecture to ensure a clean separation



between the user interface and the backend logic. As illustrated in Figure 1, the system is divided into three primary layers: the Client Layer, the Application Server, and the Data Layer.

- **View (Client Layer):** Developed using Embedded JavaScript(EJS). This layer renders the dynamic dashboards for both students and admins, the real-time test interface, and the chatbot UI.
- **Controller (Server Layer):** Powered by Node.js and Express.js. It manages the asynchronous routing, handles authentication (JWT/Sessions), and coordinates the logic for the proctoring and chatbot engines.
- **Model (Data Layer):** Utilizes MongoDB to store unstructured data. This includes student profiles, the question bank, “recently asked” interview questions, and proctoring violation logs.

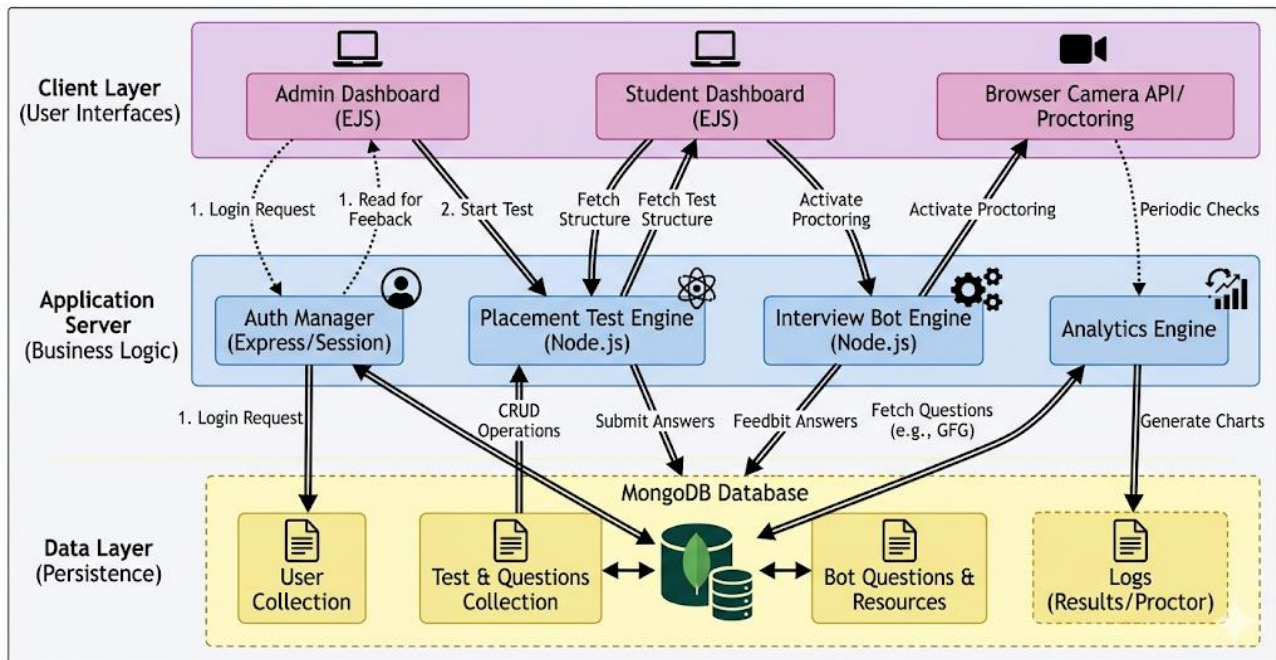


Figure 1: System Architecture Diagram of the SmartPrep Platform (MENE Stack)

### 3.2 KeyModule Workflows

#### A. Automated Proctoring Logic(Camera Integration)

**Proctored Examination Environment:** During assessments, the module activates the device’s camera. To ensure test integrity, the module utilizes the browser’s getUserMedia API. Upon initialization, the system requests camera permission. During the test, the frontend performs periodic monitoring to ensure the student remains in the frame. Any detected violations (e.g., student leaving the frame) are sent to the Express server and stored as a flag in the MongoDB “Logs” collection.

#### B. Interview Chatbot Engine

The chatbot acts as an interactive conversational interface. It pulls from a MongoDB collection titled InterviewQuestions, which is regularly updated by the Admin with recently asked industry questions. It uses a recursive function to present questions and records student text responses for evaluation. Students can engage with the chatbot at any time to practice answering technical and HR-related questions. The bot provides immediate access to structured answers and resources.

#### C. Analytics and Performance Tracking

The “Overall Performance” features aggregates data from the objective placement test score, chatbot engagement, and the proctoring “Integrity Score” to provide a holistic view of student readiness

### 3.3 Database Schema Design

The data modeling in MongoDB is structured into three primary collections to ensure efficient data retrieval

- Users: { studentName, email, prn, studentClass, password }
- Admins: { email, password }
- Tests: { questions:[...], duration, createdAt }
- Questions: { questionText, options:[...], correctAnswer, category, topic, level }
- Results: { userId, testId, score, totalMarks, performance, createdAt }
- TestSchedule: { testNo, testId, type, subtype, marks, startTime, endTime }
- ProctorImage: { testId, image, timestamp }



- InterviewQuestions: { title, link, company, source }
- AdminInterview Bank: { company, category, subcategory, type, questions:[...] }

IV. IMPLEMENTATION AND USER INTERFACE

The following screenshots illustrate the functional flow of the SmartPrep platform, from secure authentication to the final performance analytics.

4.1 System Environment & Access

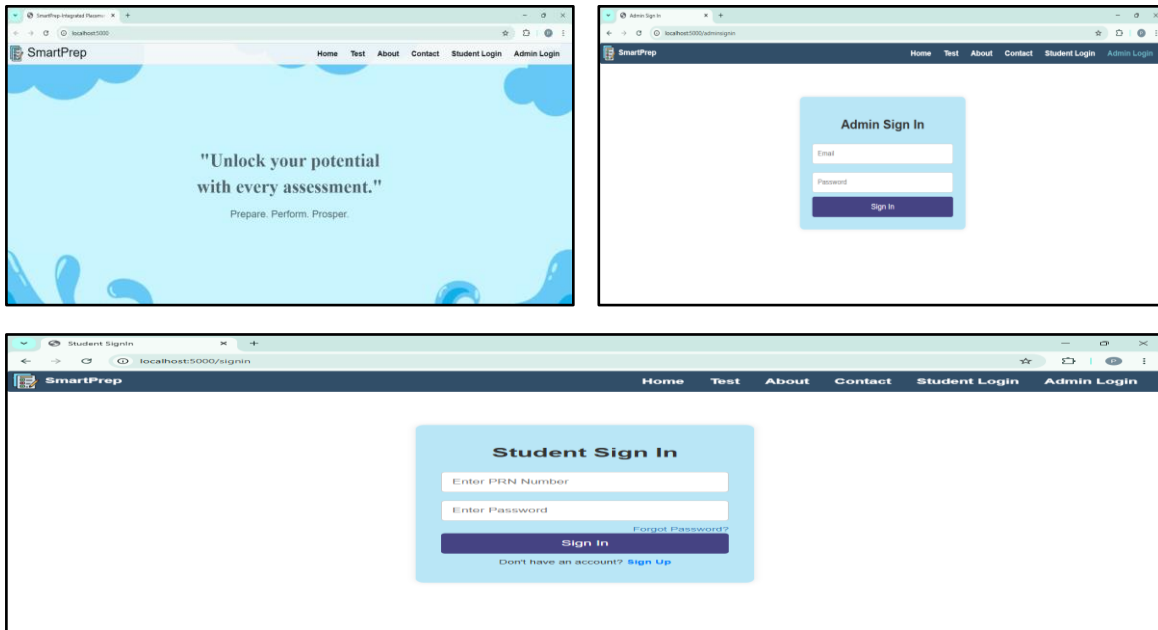


Figure 2: Landing Page, Student Login Interface and Admin Login Interface

Figure 2 illustrates the main entry screens of the SmartPrep platform. These interfaces provide users and administrators with secure access to the system’s features and services.

4.2 Administrator Control Module

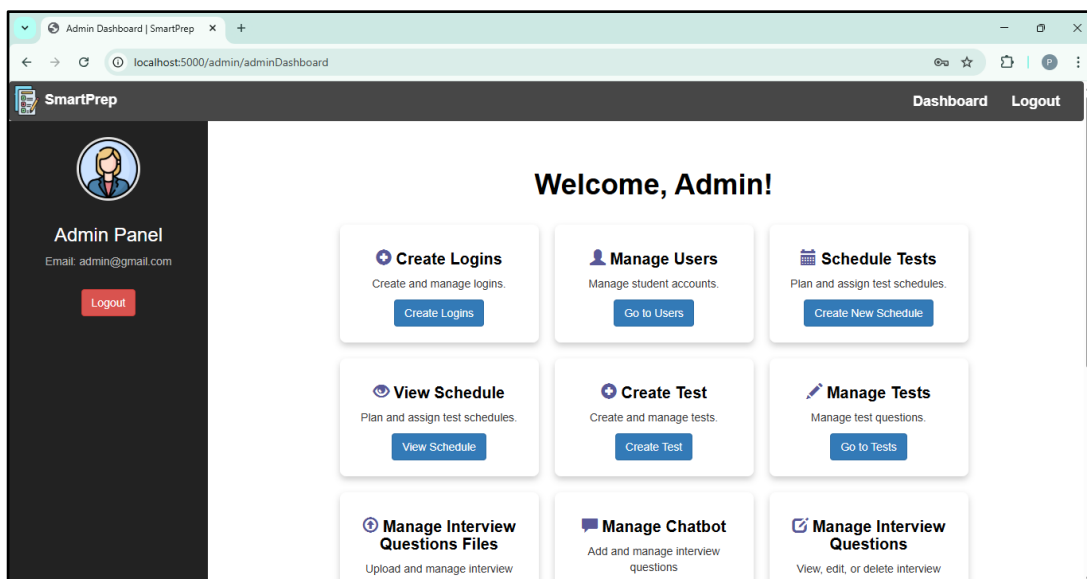


Figure 3: Main Admin Dashboard



Figure 3 illustrates the main administrative dashboard, providing centralized access to user management, test scheduling, test creation and other system administration functions.

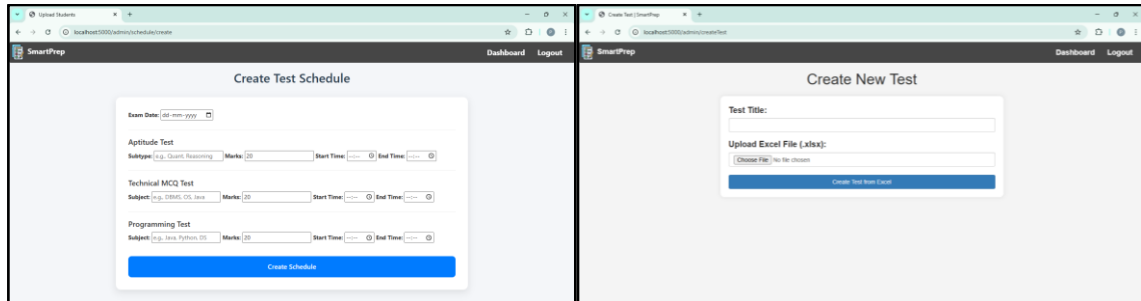


Figure 4: Test Creation Suite (Adding questions and defining the time limit).

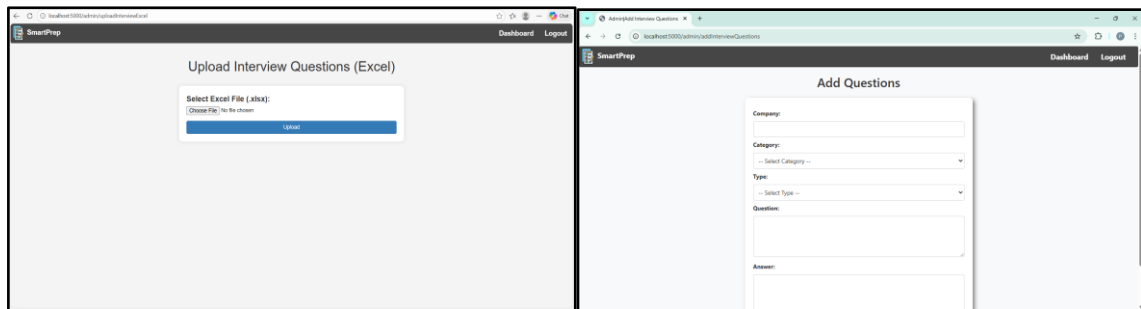


Figure 5: Interview Database Management (Adding "Recently Asked Questions" and links to GeeksForGeeks).

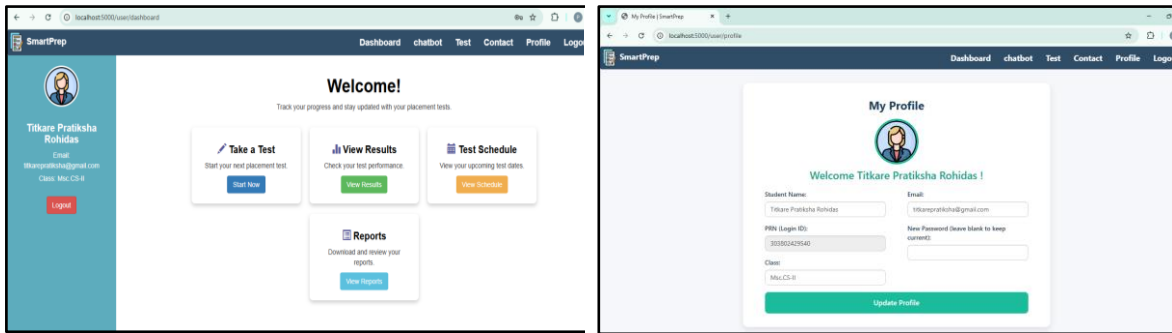


Figure 6: Camera permission and hardware verification (Illustrates the process conducted before the examination to ensure the student’s webcam is functioning properly for online proctoring).

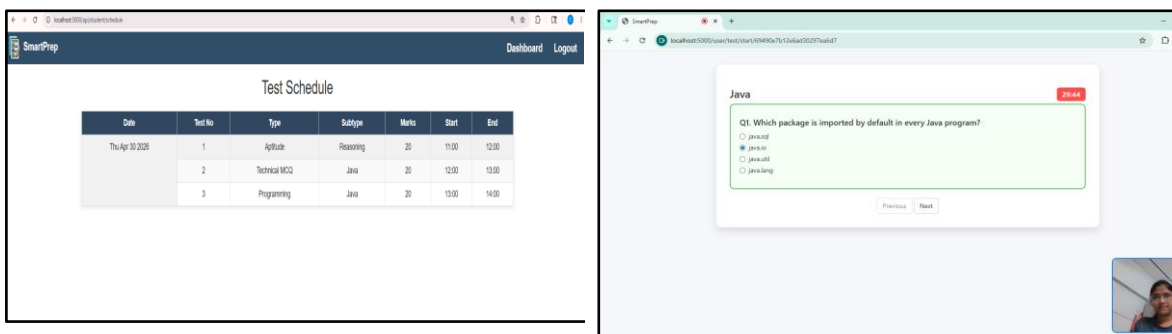
### 4.3 Student Experience & Assessment

#### Student Dashboard and Readiness Check:

Upon login, students are presented with a personalized list of “Assessments” and “Interview Chat Bot”. Figure 7 illustrates the sequential views of the Student Dashboard, Integrated Proctored Environment and Interview Chatbot.

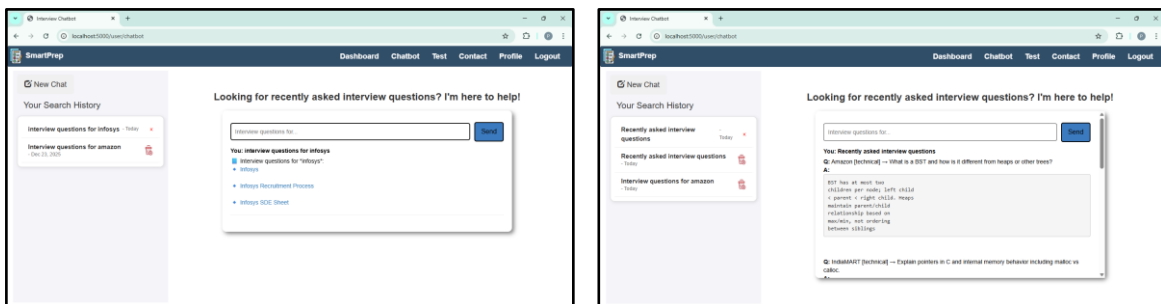


7 (a) Student Home Dashboard and Profile



7 (b) Test Schedule

7 (c) Live Proctored Test Interface



7 (d) Interview Chatbot Interaction

Figure 7 Sequential views of the Student Dashboard, Integrated Proctored Environment and Interview Chatbot

V. RESULT AND DISCUSSION

The SmartPrep platform was evaluated through a series of controlled tests involving a sample group of students and administrators. The goal was to assess the efficiency of the MENE stack in handling real-time data and the effectiveness of the AI-proctoring and chatbot modules. The Overall Performance Distribution report shows student performance, where green represents good performers (70-100%), orange represents average performers (40-69%), and red represents poor performers (0-39%), with most students falling in the average category.

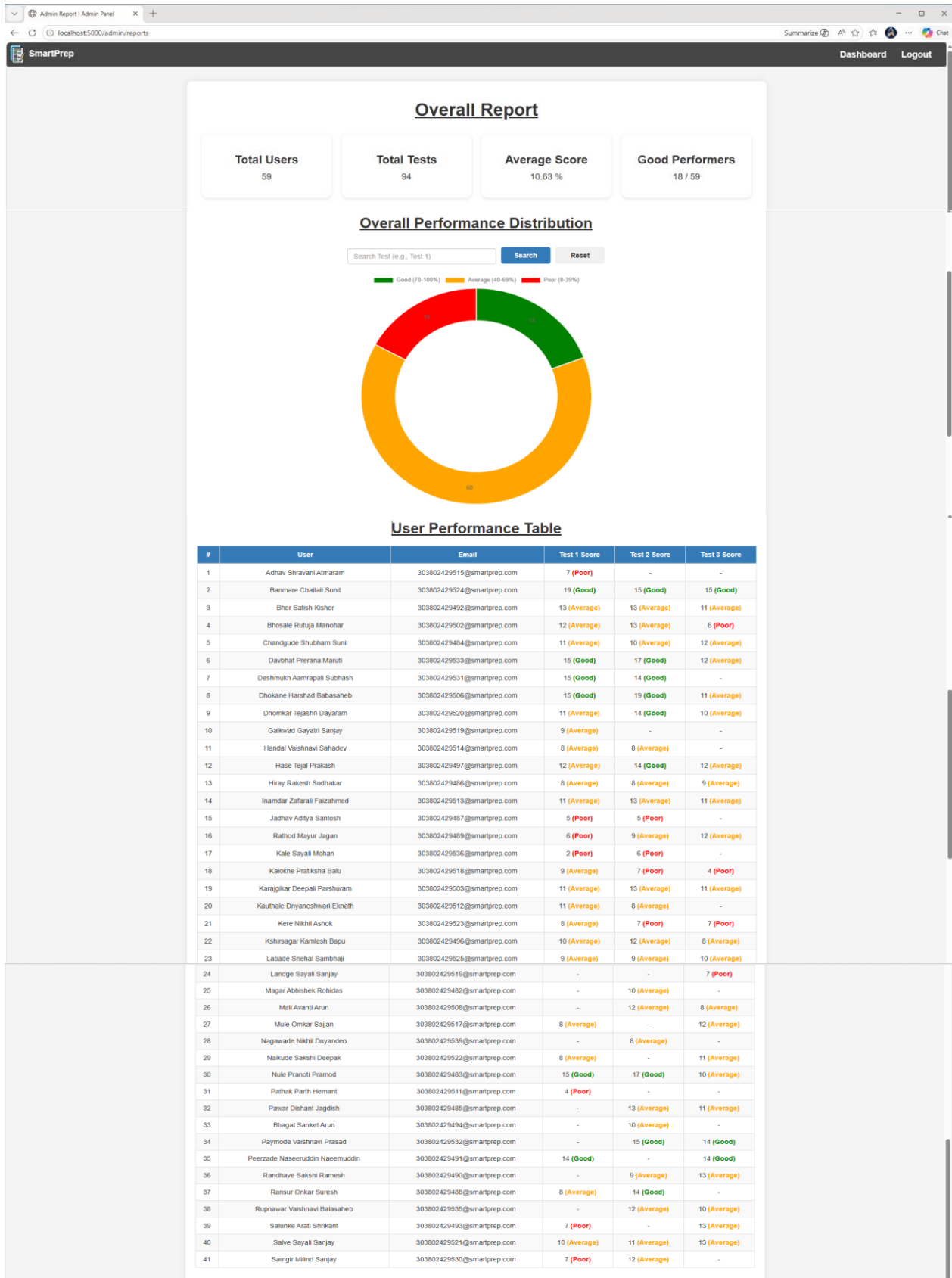


Figure 8: Overall Performance Report



Figure 8 illustrates the Overall Performance Report of users through a graphical score distribution and performance table. It helps in analyzing the number of good, average and poor performers along with individual test scores.

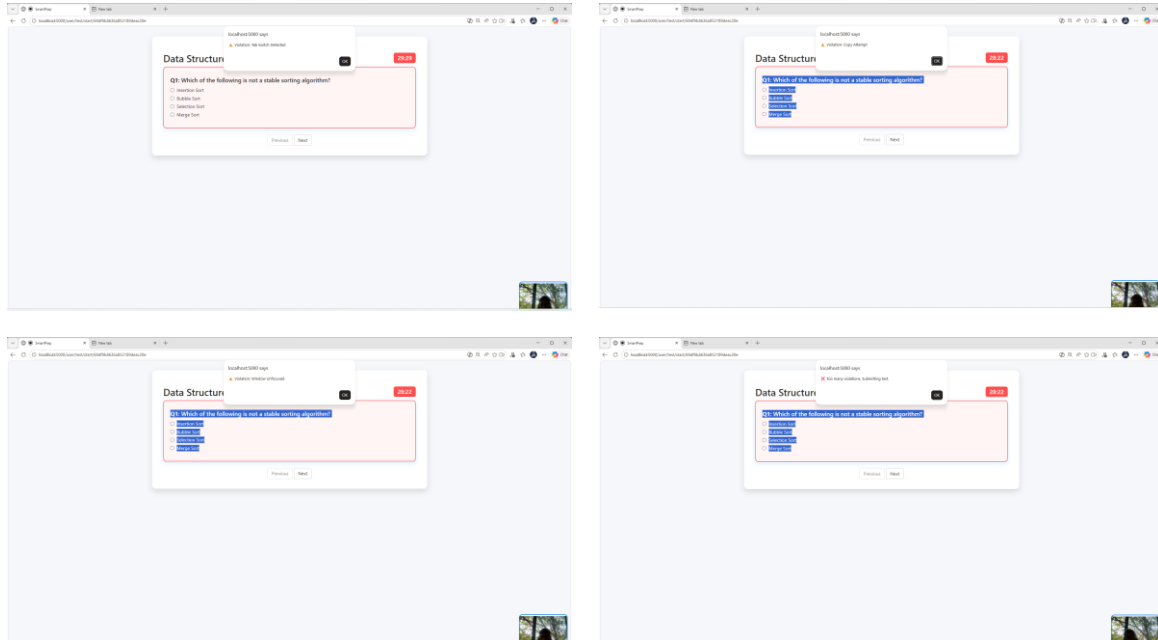


Figure 9: Integrated Proctored Environment

Figure 9 illustrates the proctoring features used to maintain examination integrity. Alerts are generated for tab switching, copy attempts and loss of window focus during the test. If multiple violations are detected, the system automatically submits the test and notifies the student.

## VI. CONCLUSION

The SmartPrep platform provides an integrated, streamlined solution for modern placement preparation. By centralizing high-stakes testing, real-time performance analysis, and AI-driven interview simulations into a single MENE-stack ecosystem, the project offers an innovative alternative to traditional, fragmented preparation methods. Evidence gathered during development indicates that these digital and AI-enhanced features significantly improve student engagement and reduce “interview anxiety.” Furthermore, by automating scheduling, proctoring, and grading, SmartPrep effectively minimizes the administrative workload for placement teams while providing deep insights into institutional success rates. Ultimately, the platform succeeds in creating a flexible, user-friendly environment that bridges the gap between academic learning and industry readiness.

## VII. FUTURE SCOPE

To further evolve the SmartPrep system, several enhancements are planned:

- **NLP & Semantic Analysis:** Upgrading the SmartBot with advanced Natural Language Processing to provide nuanced, qualitative feedback on interview responses.
- **Integrated Code Compiler:** Adding a live coding sandbox within the proctored environment to support technical programming training.
- **Mobile Accessibility:** Developing a dedicated mobile application for real-time score notifications and “on-the-go” practice sessions.
- **Enhanced Biometrics:** Incorporating eye-tracking and emotion-recognition AI to deepen the accuracy of the proctoring integrity score.
- **Microservices Transition:** Scaling the architecture to support massive concurrent user loads through cloud-native microservices.



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