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AI-Powered Virtual Mock Interview Training and Evaluation System

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ABSTRACT: In the highly competitive modern employment landscape, performing well in corporate interviews requires a robust blend of technical expertise, problem-solving capabilities, and confident communication. Traditional interview preparation methods often fail to simulate the high-pressure, adversarial nature of real-world recruitment and lack objective, scalable evaluation. To bridge this gap, this project presents an AI-Powered Virtual Mock Interview Training and Evaluation System designed to rigorously train candidates and provide high-trust data to recruiters. Developed using a modern technology stack comprising React.js for the frontend and Fast API with PostgreSQL for the backend, the system orchestrates a multi-tiered evaluation pipeline. The process begins with an AI-driven Applicant Tracking System (ATS) that utilizes Natural Language Processing (NLP) to parse resumes, extract skills, and enforce a strict eligibility gate. Qualified candidates proceed to a practice sandbox, which prepares them for the core "Strict Mode" Real Interview module. This high-stakes phase features strictly timed Technical and Aptitude Multiple- Choice Questions with negative marking, an "Adversarial AI" theoretical voice round that actively challenges spoken responses with dynamic follow-up questions, Versant-style corporate communication stress tests, and a live coding "Bug Hunt" utilizing the Monaco Editor under strict time constraints. To ensure enterprise-grade data integrity for prospective recruiters, the system integrates a zero-tolerance AI Proctoring Engine. This security module enforces a "3-Strike Termination Protocol" utilizing computer vision and browser-state monitoring to detect tab- switching, unauthorized mobile phone usage, and multiple human faces in the camera frame. The final output is a verified, comprehensive candidate performance profile equipped with detailed analytics. These profiles are seamlessly shared with partner startup companies, effectively streamlining the recruitment pipeline, eliminating hiring bias, and significantly enhancing candidate employability

KEYWORDS Artificial Intelligence (AI), Virtual Mock Interview Training, Applicant Tracking System (ATS), Natural Language Processing (NLP), Adversarial AI, AI Proctoring, Speech Analysis, Automated Recruitment Pipeline, Performance Analytics.

I. INTRODUCTION

The rapid digitalization of financial services has brought digital payment systems into everyday life. However, traditional authentication mechanisms — including Personal Identification Numbers (PINs), One-Time Passwords (OTPs), and physical cards suffer from significant vulnerabilities such as theft, phishing, and social engineering attacks. These limitations demand a paradigm shift toward identity-centric, biometric-based authentication for secure payment processing. Machine Learning (ML) and Artificial Intelligence (AI) have emerged as transformative technologies enabling computers to learn from data and improve performance without explicit programming. A subset of AI, computer vision, enables machines to interpret and understand visual information from the real world, making it particularly suitable for biometric identification systems. Among all biometric modalities, iris recognition stands out due to the uniqueness and lifelong stability of iris patterns. The iris contains over 200 distinct features, making it one of the most reliable biometric identifiers. Unlike fingerprints that may degrade over time, or facial features that change with age, the iris pattern remains virtually constant throughout a person's lifetime, providing a foundation for highly accurate and permanent identity verification. This paper presents a Secure Payment Platform with Eye Recognition using AI. The system integrates iris recognition powered by MobileNetV2 and Media Pipe with a PIN-based secondary authentication layer, and uses Firebase as a real-time cloud database. The result is a card-less, contactless, and highly secure digital wallet system deployable in retail, transport, and smart city payment environments

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II. LITREATURE SURVEY

In 2025, Shashikant V. Golande et al. proposed a Mock Interview Evaluator Powered by AI aimed at improving interview readiness by integrating models that assess candidate communication skills. The system provides an unbiased, scalable feedback loop for candidates practicing verbal responses to predefined questions. However, it relies on static question banks rather than dynamically adapting the interview to the candidate's specific technical background or resume.

In 2024, Prof. Farendrakumar S. Ghodichor et al. introduced an AI-Powered Mock Interview Evaluator designed to enhance interview preparation through an emotion and confidence classifier model. The system analyzes facial expressions, vocal tone, and language patterns during mock interviews to offer comprehensive insights into the interviewee's emotional state and confidence levels. However, the platform functions primarily as a practice sandbox and lacks the high-stakes, strict proctoring mechanisms required to prevent cheating in real-world recruitment scenarios
In 2025, Anubhav Singh et al. developed INTERVIEW HUB, an AI-Powered Real-Time Mock Interview Platform using a conversational voice agent. The system integrates Large Language Models (LLMs) with real-time Speech-to-Text (STT) processing to simulate an immersive conversational environment and provide structured, unbiased feedback. However, it lacks an initial resume-based filtering mechanism, allowing candidates of any skill level to access the system without prior qualification or ATS screening.

In 2025, Saurabh Yadav et al. presented an automated system for Resume Analysis using Natural Language Processing (NLP) and Applicant Tracking System (ATS) algorithms. The proposed solution extracts key information such as personal details, educational background, and skills to score and rank resumes based on their relevance to specific job descriptions. However, the system is limited to document analysis and does not practically validate whether the candidate actually possesses the extracted skills through live testing.

In 2025, Sandesh Dunbale et al. proposed an AI Based Mock Interview System that helps users prepare for real-world job interviews through domain-specific mock sessions. The system evaluates domain-specific questions via audio while machine learning algorithms analyze facial expressions and voice tone to detect confidence, nervousness, speech rate, and pitch. However, the system relies on traditional Q&A formatting and lacks applied engineering evaluations, such as live coding or debugging tasks under strict time constraints.

PROBLEM STATEMENT

Existing interview preparation and recruitment platforms rely primarily on manual human evaluation or static, unmonitored question banks. Traditional mock interviews are highly subjective, time-consuming, and consistently fail to replicate the high-pressure, adversarial environment of modern corporate technical interviews. Conversely, automated evaluation systems often function merely as practice sandboxes without enterprise-grade security. They lack strict proctoring mechanisms, making them highly susceptible to candidate malpractice such as screen- switching, mobile phone assistance, and unauthorized code copy-pasting. Because these platforms authenticate the completion of a test rather than the verified integrity of the candidate's environment, the resulting performance data is considered untrustworthy by actual hiring managers and recruiters. Furthermore, current recruitment infrastructures treat Applicant Tracking Systems (ATS), verbal communication evaluations, and technical coding assessments as isolated, disconnected tools. This fragmentation allows candidates to easily bypass initial screening filters through resume "keyword stuffing" without ever proving their applied technical competency. These critical limitations necessitate a unified, AI-driven virtual interview system that rigorously filters candidates. There is a critical need for a platform that dynamically challenges candidates through adversarial AI questioning and strictly timed coding tasks, while simultaneously enforcing a zero-tolerance AI proctoring engine to guarantee total data integrity and provide unbiased, verified candidate profiles for partner startup companies.

III. RESEARCH METHODOLOGY

The proposed system establishes a highly secure, multi-tiered Virtual Mock Interview Training and Evaluation platform using a modern React.js frontend and a Fast API backend. The architecture is designed to progressively filter candidates through a series of intelligent gates, culminating in a highly proctored, adversarial interview environment. The system processes natural language, speech, and real-time video frames to assess technical competency, communication skills, and environmental integrity. The methodology is executed through five interconnected modules.
The system architecture is designed as an integrated virtual mock interview and recruitment framework consisting of four key component layers. The User Interface Layer provides the React.js-based web application accessible by candidates

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and recruiters, featuring a secure Monaco Code Editor and media capture interfaces. The AI and Proctoring Layer handles natural language processing for resume parsing, Whisper Speech-to-Text for real-time audio transcription, and computer vision utilizing OpenCV and YOLOv8 for strict environment monitoring. The Evaluation Core and Authentication Hub in the Processing Layer, engineered using Fast API, manages dynamic interview generation, adversarial LLM integration, negative marking algorithms, and the 3-Strike security protocol logic. The PostgreSQL Database Layer securely stores user credentials, ATS skill extractions, proctoring violation logs, and final HR reports

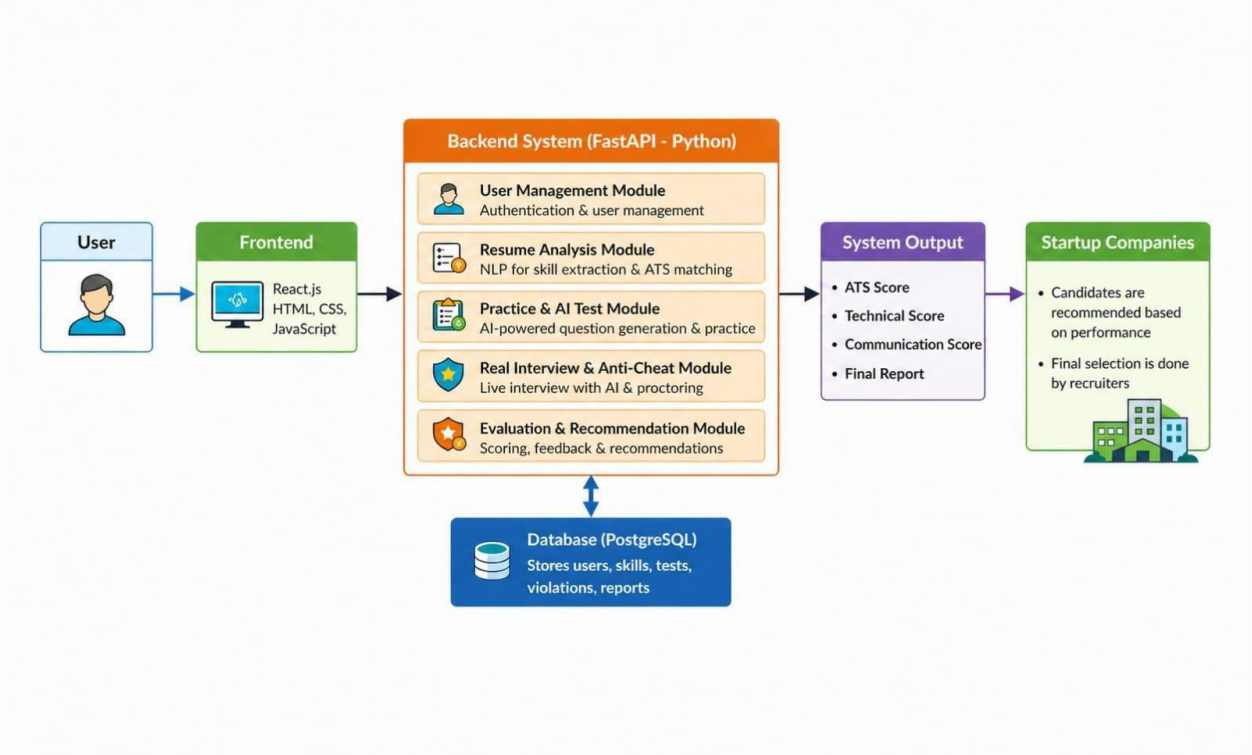

Fig.1. AI- Powered Virtual Mock Interview Training and Evaluation System

User Management Module

The User Management Module is responsible for secure onboarding, authentication, and session management. It utilizes JSON Web Tokens (JWT) to establish secure, stateless communication between the React.js frontend and the Fast API backend. Candidates register and maintain profiles containing their historical performance data. Crucially, this module includes an "Administrative Override" (Master Key) feature. This allows authorized faculty or administrators to bypass the strict progressive locks (e.g., the 80% minimum score gates) to review and test the downstream modules without altering the strict security architecture required for standard candidates

Resume Analysis Module

This module serves as the primary screening gateway (Gate 1). When a candidate uploads their resume, the system employs Natural Language Processing (NLP) techniques, specifically Named Entity Recognition (NER), to parse the document and extract key technical skills. The system then calculates an Applicant Tracking System (ATS) score by cross-referencing the extracted skills against predefined industry domains. The module enforces a strict $\ge 80\%$ ATS threshold; candidates failing to meet these criteria are locked out of the interview modules and are instead provided with an automated, dynamically generated feedback report highlighting critical missing skills to guide their preparation.

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Practice & AI Test Module

Operating as the secondary gateway (Gate 2), the Practice Sandbox provides a comprehensive training environment. Candidates who clear the ATS screening are tested across four foundational modalities:

- A 30-question test combining domain-specific Technical MCQs and Aptitude logic.
- A text-based conceptual theory round to evaluate foundational knowledge.
- A Versant-style English fluency test focusing on read-aloud and story-retelling capabilities.
- A fundamental algorithmic coding assessment.

The system continuously evaluates the candidate's performance across these four sections. To unlock the final real interview environment, the candidate must achieve a cumulative average score of $\go 80\%$, ensuring that only highly prepared individuals proceed to the proctored stage.

Real Interview & Anti-Cheat Module

This is the flagship module of the system, transforming the platform from a practice tool into an enterprise-grade recruitment filter. It enforces a "Strict Mode" environment governed by a Zero- Tolerance AI Proctoring Engine. The proctoring system utilizes the browser's Visibility API to detect tab-switching, while the backend processes webcam frames using the YOLOv8 object detection model and facial recognition algorithms to detect mobile phones or multiple human faces. A "3-Strike Protocol" actively terminates the session upon repeated violations. Concurrently, the candidate must navigate four high-pressure rounds:

- The MCQ (Round 1): 30 JD-specific MCQs with strict 45-second/60-second timers and a
- -0.25 negative marking penalty for incorrect answers.
- Adversarial AI Theory (Round 2): A voice-only round where a Large Language Model (LLM) analyses the candidate's spoken transcript via Whisper STT and instantly fires back a targeted, challenging counter-question to test the depth of their knowledge.
- Client Escalation (Round 3): A corporate communication stress test where the candidate has a single, 60-second attempt to leave a professional voicemail resolving an emergency scenario (e.g., an angry client).
- The Bug Hunt (Round 4): A heavily restricted Monaco Code Editor pre-loaded with an inefficient, buggy algorithm. With copy/paste explicitly disabled, the candidate has 15 minutes to find three logical bugs and optimize the time complexity.

Evaluation & Recommendation Module

The final module functions as the ultimate decision engine and reporting dashboard. The Score Aggregator compiles disparate data streams—including negative-marking deductions, LLM theoretical evaluations, Cloudflare AI communication scores, and coding efficiency metrics. It computes a mathematically verified final average. The Recommendation Engine applies a strict

75% hiring threshold to this final score. The system then generates a highly detailed JSON performance report comprising round-by-round analytics, identified technical strengths, and a log of any proctoring warnings triggered during the session. These verified, cheat-proof profiles are subsequently rendered on the Recruiter Dashboard, allowing partner startup companies to seamlessly recruit top-tier, validated engineering talent.

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IV. RESULTS

User Dashboard Page

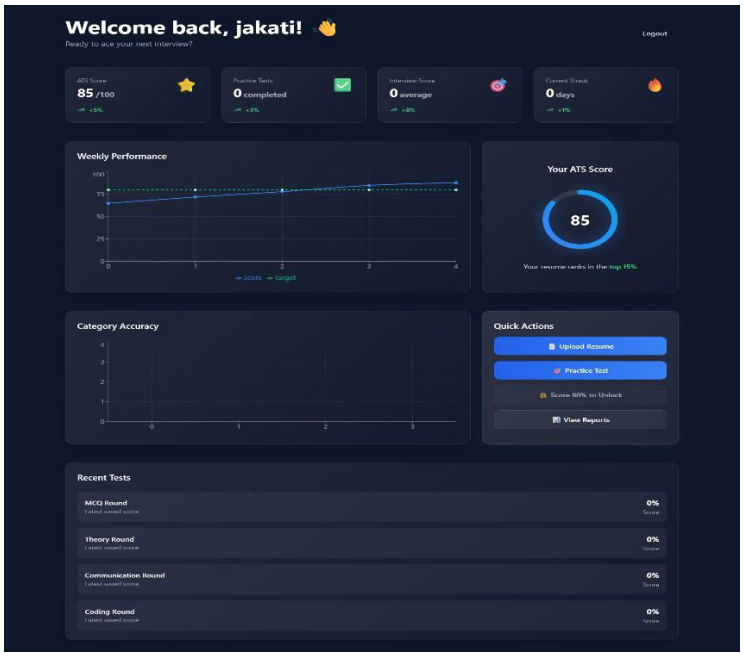

Fig.2. User Dashboard Page

The dashboard provides a centralized interface where candidates can view their activities, track their overall ATS score, and monitor ongoing practice tests in a structured manner. It highlights weekly performance metrics, category accuracy, and provides quick navigation options to help users prepare for upcoming interviews

Resume Analysis Page

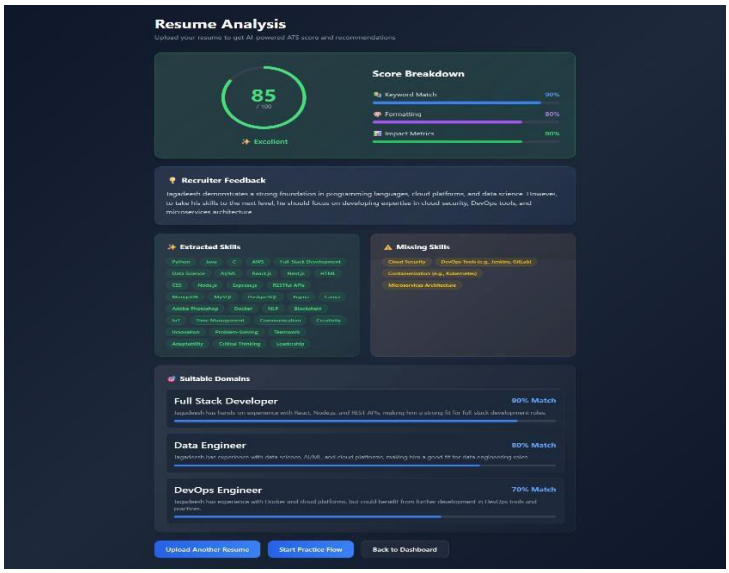

Fig.3. Resume Analysis Page

This initial intake page uses NLP to parse uploaded resumes, extracting core competencies to calculate an ATS score, provide immediate recruiter feedback, and map skills to suitable job domains.

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Practice Sequence Setup Page

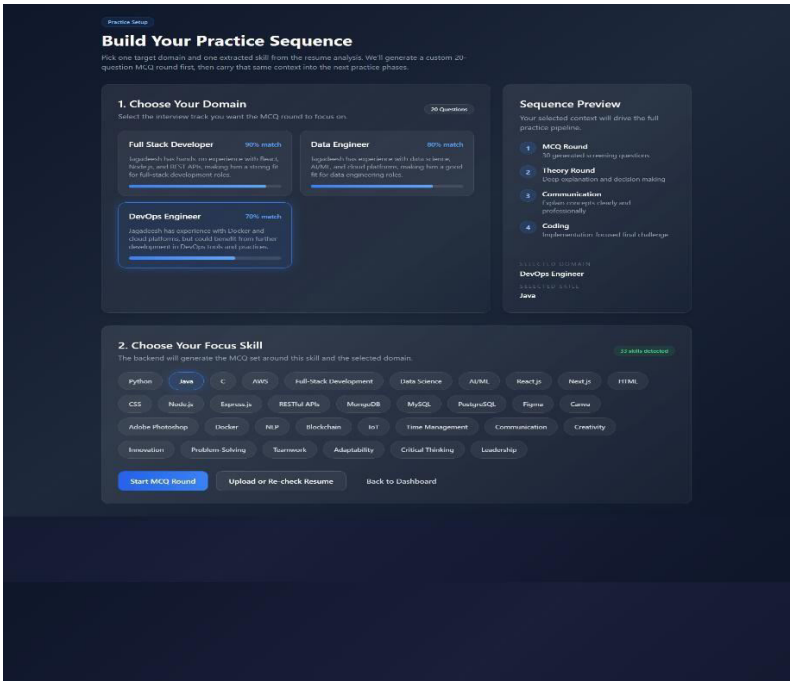

Fig.4. Practice Sequence Setup Page

This page allows users to dynamically generate a targeted practice workflow based on their extracted skills. It outlines the upcoming four-stage pipeline—including MCQ, theory, communication, and coding—enabling candidates to choose a focus domain and specific technical skill to drive the interview context.

Real Interview Selection Page

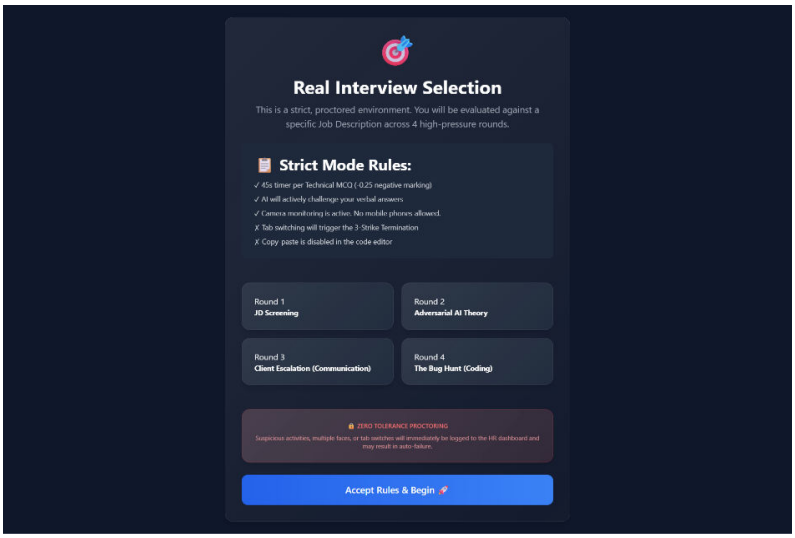

Fig.5. Real Interview Selection Page

This page establishes the high-stakes environment of the real interview track. It displays the four high-pressure rounds and explicitly states the strict evaluation criteria, including the zero- tolerance proctoring rules regarding tab switching and camera monitoring, before the candidate begins the session

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JD Screening Interface Page

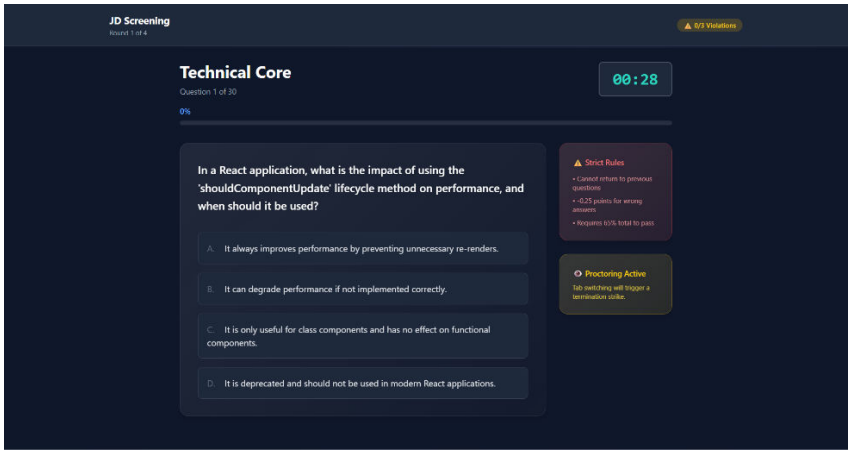

Fig.6.JD Screening Interface Page

Here, the system executes the first technical round by generating a structured 30-question assessment based on the initial configuration. The interface enforces a strict 45-second timer per question and active proctoring to evaluate the candidate across 20 skill-based technical questions and 10 mathematical aptitude questions.

Adversarial AI Theory Page

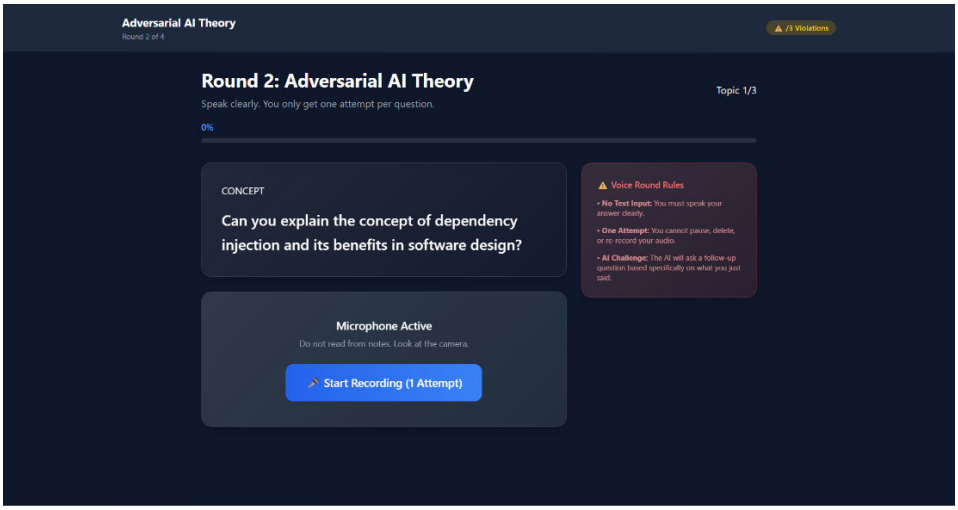

Fig.7. Adversarial AI Theory Page

This page transitions the candidate to an active recall voice assessment. The candidate must verbally explain complex software design concepts in a single recording attempt. Crucially, it highlights the AI challenge mechanic, where the underlying LLM dynamically generates follow- up questions based specifically on the user's spoken response.

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Client Escalation Page

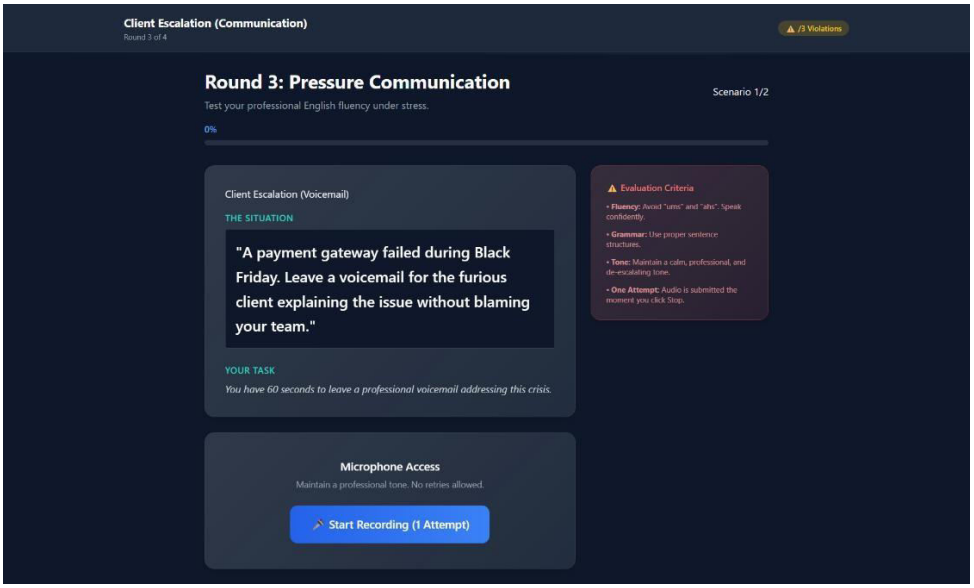

Fig.8. Client Escalation Page

This page evaluates the candidate's professional English fluency and soft skills under stress. The system presents a high-pressure scenario, requiring the user to record a 60-second voicemail addressing a crisis. The audio is then transcribed and evaluated for grammar, tone, and confidence.

The Bug Hunt Coding Page

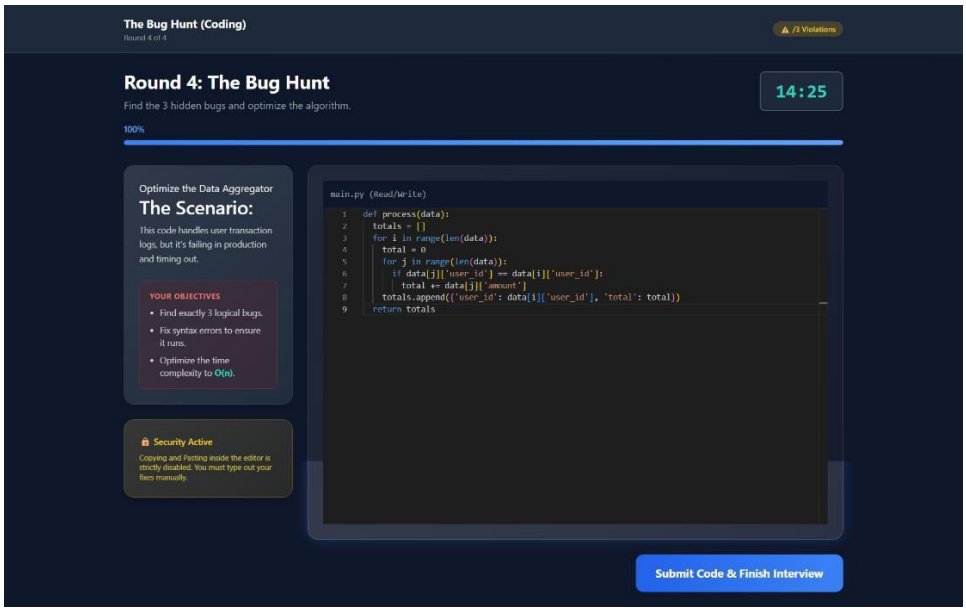

Fig.9.The Bug Hunt Coding Page

This page provides an in-browser code editor for the final technical hurdle. It tasks the candidate with finding logical bugs, fixing syntax errors, and optimizing a script's time complexity to O(n) within a 15-minute window. Security features actively disable copy-pasting to ensure the integrity of the assessment.

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V. CONCLUSION AND FUTURE ENHANCEMENTS

AI- Powered Virtual Mock Interview Training and Evaluation System presents a highly comprehensive and scalable approach to automated candidate evaluation and career preparation. By leveraging advancements in Artificial Intelligence, Natural Language Processing, and modern full-stack web technologies, the system successfully bridges the gap between traditional, static preparation methods and the dynamic, high-pressure expectations of modern industry recruiters. Core functionalities—such as AI-driven resume parsing, dynamic generation of tailored technical and mathematical aptitude assessments, and real-time conversational evaluations—have been seamlessly integrated into a cohesive platform. The architecture, built upon a highly responsive React frontend and a robust Fast API backend, ensures a seamless user experience while maintaining the strict, zero-tolerance proctoring standards required to accurately simulate real- world testing environments. A primary strength of this system lies in its adaptive intelligence and holistic evaluation metrics. Rather than relying solely on standardized multiple-choice tests, the platform utilizes advanced speech-to-text models and Large Language Models (LLMs) to actively challenge candidates. Through features like the Adversarial AI Theory round and the pressure- inducing Client Escalation scenario, the system evaluates not just what a candidate knows, but how effectively they communicate under stress. Combined with the final algorithmic Bug Hunt, the platform delivers a thorough evaluation of both hard technical skills and critical soft skills, empowering candidates to systematically identify their weaknesses and build confidence.

Despite achieving its core objectives, the system offers significant scope for future enhancements to improve its capabilities and enterprise applicability. A primary upgrade would be the integration of computer vision algorithms for multi-modal non-verbal analysis, allowing the system to evaluate eye contact, facial expressions, and overall posture via the candidate's video feed. Additionally, expanding the technical screening to include secure, containerized coding environments (e.g., using Docker) would allow the system to support a wider array of programming languages and execute candidate code dynamically against hidden unit tests. To further refine the assessment quality, implementing Adaptive Item Response Theory (IRT) would allow the system to dynamically adjust the difficulty of multiple-choice questions based on the candidate's real-time performance. Finally, developing an Enterprise Recruiter Dashboard with RESTful APIs would allow for seamless integration with existing Applicant Tracking Systems (ATS), while incorporating advanced anomaly detection—such as continuous voice-matching and gaze-tracking—would further solidify the platform's proctoring integrity for corporate hiring pipelines.

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