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Aura Hire: A Multi-Modal AI Framework for Autonomous, Bias-Reduced and Proctored Technical Recruitment

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Abstract

Modern educational frameworks and industry demands necessitate highly scalable and equitable hiring ecosystems. However, conventional talent acquisition workflows suffer from severe manual bottlenecks and subjective human prejudices. To resolve these systemic inefficiencies, this paper introduces Aura Hire: an autonomous artificial intelligence recruitment platform. By integrating Large Language Models (LLMs), low-latency Voice Agents, and browser-based Computer Vision, the system orchestrates a comprehensive four-stage pipeline. This framework unifies automated resume shortlisting, interactive voice-based behavioral interviews, real-time proctoring, and live technical coding assessments into a single web application. Crucially, the system introduces edge-computed, zero-retention biometric proctoring, fundamentally modernizing the preliminary candidate screening lifecycle while establishing a standardized, bias-resistant, and securely private evaluation methodology.

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1 Introduction

The exponential surge in technical role applications has rendered traditional recruitment practices unsustainable. Conventional strategies relying on manual resume screening and human-led telephonic interviews are notoriously labor-intensive and structurally prone to inconsistency. Currently, human recruiters expend roughly 12 to 15 minutes per candidate just on preliminary screening calls. At scale, this drains hundreds of operational hours, distracting HR departments from strategic acquisition tasks and stalling overall enterprise agility [10, 13, 14]. Furthermore, manual interviewing is inherently vulnerable to unconscious bias; arbitrary factors like a candidate's background, accent, network connectivity, or even interviewer fatigue often skew evaluation outcomes, preventing true meritocratic hiring [9, 15]. Finally, the software tooling landscape is highly fractured. Organizations juggle legacy Applicant Tracking Systems (ATS), separate video conferencing tools, and isolated coding platforms, creating disjointed data silos that complicate final hiring decisions.

To eradicate these obstacles, we present Aura Hire: an AI-powered "Master Recruitment Framework." Moving beyond basic workflow digitization, Aura Hire utilizes Large Language Models (LLMs), natural language Voice Agents, and Computer Vision to fully automate the preliminary assessment layer. It guarantees an objective, standardized evaluation where every applicant engages with an identical, unbiased AI entity.

By centralizing semantic resume parsing, interactive behavioral interviews, and technical code execution into a unified Software-as-a-Service (SaaS) architecture, Aura Hire successfully automates approximately 80%

of the initial screening burden. This paradigm shift not only curbs operational expenditures but structurally democratizes the hiring process by removing human subjectivity from the preliminary candidate filtration phase.

2 Literature Review

The intersection of Artificial Intelligence and human resources has garnered significant academic interest. Research by Agrawal et al. highlights the necessity of multimodal behavioral analytics, proving that comprehensive candidate profiling must extend beyond text to incorporate visual and auditory cues [1]. Concurrently, Naim et al. validated the predictive capabilities of automated job interview analysis [2]. Expanding on these concepts, Liu et al. investigated the nuances of human-computer speech interactions, emphasizing the importance of latency and conversational tone when applicants face AI interviewers [4]. In the realm of asynchronous analysis, Hemamou et al. successfully deployed hierarchical attention models for parsing recorded interview videos [3]. Despite these strides, modern solutions remain fundamentally fragmented—offering isolated coding tests or standalone video analysis. Aura Hire bridges this gap by merging these principles into a synchronous, low-latency web environment, delivering immediate, multi-dimensional feedback.

3 Need of a New System

Existing digital recruitment tools operate primarily as passive repositories rather than active, intelligent evaluators. This ”capability gap” manifests in several critical areas. First, current automated platforms rely heavily on asynchronous video recordings. While these capture visual data, they completely eliminate conversational friction—preventing the assessment of vital soft skills like handling interruptions or contextual problem-solving. Second, severe tool fragmentation prevents holistic scoring. When an applicant’s technical code, communication skills, and resume data are evaluated on three disparate platforms, nuanced insights are lost. Third, the industry desperately needs a mechanism to decouple interview quality from human availability [14]. Finally, remote assessments introduce cheating risks; ensuring integrity without human supervision demands robust, integrated computer vision capabilities [8, 12]. Aura Hire was engineered specifically to eliminate these exact deficiencies.

4 Design and Implementation

4.1 Proposed System Architecture

The Aura Hire platform relies on a cloud-native, highly modular infrastructure designed to process synchronous multi-modal data streams efficiently.

Zone A (Front-end Clients): Constructed using Next.js and Tailwind CSS, this layer features the Recruiter Dashboard for administrative oversight and a distraction-free Candidate Portal equipped with the Monaco Editor for live coding and Face-API.js for browser-level proctoring.

Zone B (Application Core): The Next.js App Router acts as the middleware orchestrator, managing secure session states via Clerk and routing sensitive API data streams without exposing backend logic.

Zone C (External Cloud Services): Heavy computational lifting is delegated to third-party APIs: Google Gemini drives the LLM context generation, Vapi.ai handles ultra-low latency voice synthesis, Cloudinary manages media storage, and Supabase hosts the PostgreSQL relational database.

4.2 Functional Modules and Data Flow

The framework executes a strictly defined four-step operational flow:

1. **Setup & Scripting:** Recruiters input job parameters. Google Gemini semantically analyzes these requirements to autonomously generate a customized interview script and coding challenge.
2. **Resume Screening:** Candidates upload resumes. An LLM-driven parsing algorithm calculates a relevance score, instantly filtering out candidates falling below a strict 60% compatibility threshold [5, 11].
3. **Video Interview:** Qualified candidates enter a synchronous session. The Vapi.ai agent conducts a conversational interview [7], while Face-API.js simultaneously tracks behavioral cues like gaze deviation and expression tension.
4. **Technical Assessment:** Engineering candidates face a live coding challenge. The integrated Monaco Editor compiles and executes their code, automatically evaluating syntax validity and computational complexity [6].

4.3 Use Case Diagram

The interactions within the Aura Hire ecosystem are visualized in Figure 1. Recruiters manage the pipeline (job creation, report review), while candidates navigate the assessment stages (resume upload, AI voice round, coding).

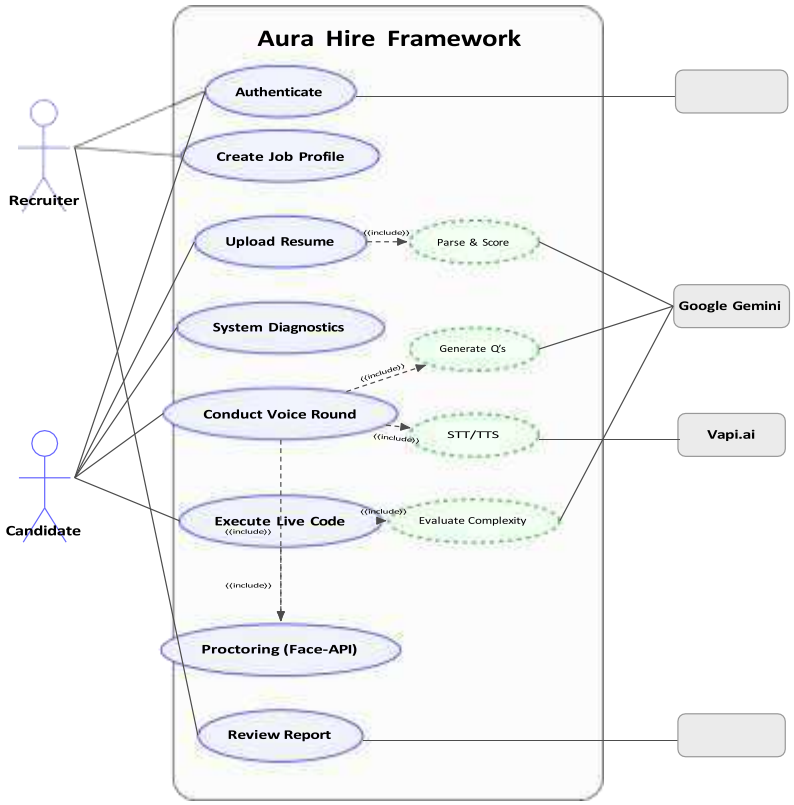


Fig. 1 System Use Case Architecture mapping primary actors to core assessment functions.

4.4 System Overview and Interface Validation

The chronological workflow initiates with the automated generation of an encrypted interview link based on recruiter parameters. Figure 2 showcases the sequential data flow from the resume filtration threshold to the final coding execution.

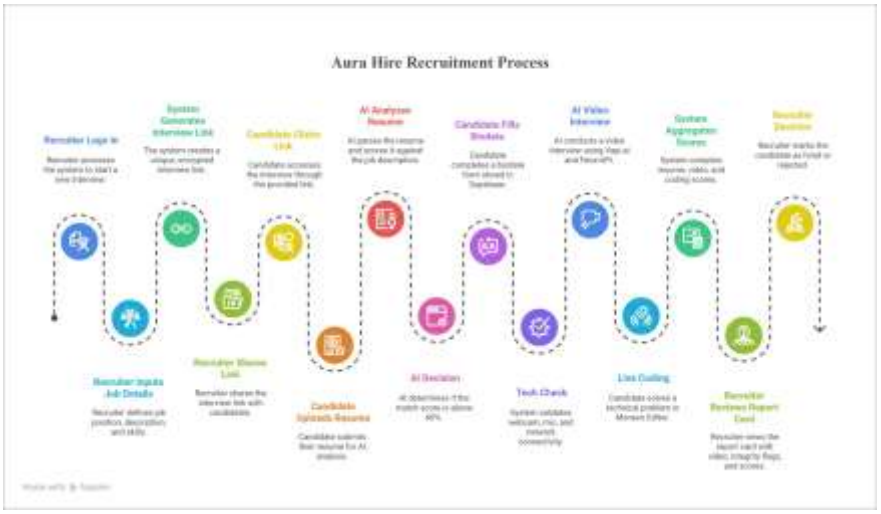


Fig. 2 Step-by-step sequential workflow of the Aura Hire Framework.

The Recruiter Dashboard (Figure 3) acts as the operational nerve center, enabling managers to initiate drives and view aggregated analytics. Concurrently, the automated Resume Parser (Figure 4) details the semantic matching metrics before a candidate is ever contacted, highlighting the system's ability to process applications without human intervention.

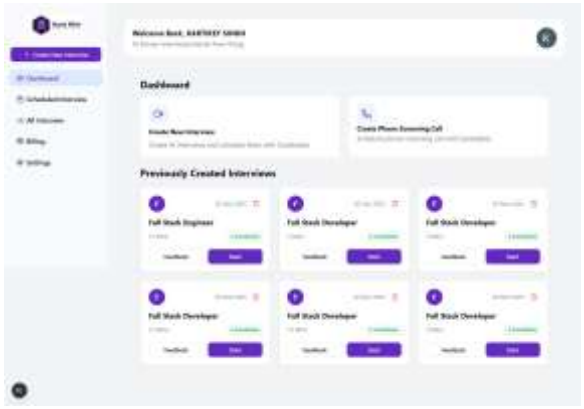


Fig. 3 Recruiter Dashboard displaying active job pipelines.



Fig. 4 Automated Resume Parser detailing matching metrics.

5 Methodology

Aura Hire transitions recruitment to an autonomous state through a rigid four-phase pipeline. Phase one initiates contextual intelligence; rather than pulling from static databases, Google Gemini semantically decodes the job description to spawn dynamic, role-specific questions and coding constraints. This dynamic synthesis ensures that the resulting technical assessments are strictly aligned with the exact requirements of the role, effectively eliminating the redundancy of generic question banks.

Phase two deploys the high-efficiency screening layer, immediately terminating applications that fail to meet a 60% semantic resume match threshold. Phase three executes the synchronous assessment, where Vapi.ai facilitates natural, latency-free conversation, and Face-API.js relentlessly monitors physiological cues (gaze vectors, facial tension) to ensure exam integrity.

Following the interview, recruiters interact with the Comprehensive Results matrix (Figure 5), which isolates technical prowess from communication skills. Crucially, as depicted in Figure 6, the framework implements an Explainable AI (XAI) methodology, translating raw data into an Automated Feedback Report that contextualizes candidate strengths and flags behavioral anomalies.



Fig. 5 Candidate Results separating technical and behavioral metrics.

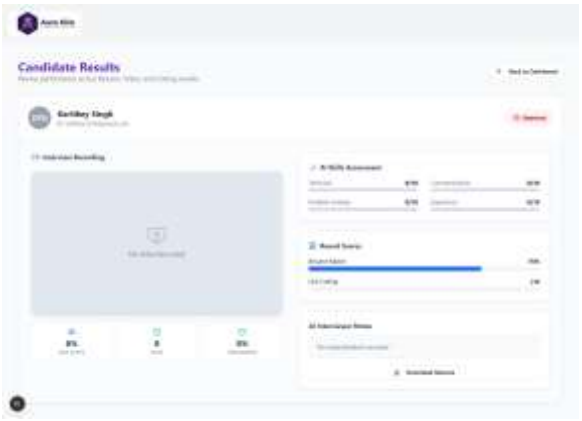


Fig. 6 XAI-driven Qualitative Feedback and Recommendation.

The final phase synthesizes these isolated data streams. The framework aggregates normalized scores from the initial resume parser, the Voice Agent's conversational transcription, and the live compiler's output logic into a singular Supabase repository. This complex, multi-modal integration allows the application to produce a definitive, bias-reduced "Recommended/Not Recommended" verdict based on comprehensive candidate profiling.

6 Functional Validation and Evaluation Model

Because Aura Hire functions as a unified software architecture, standard empirical human trials were substituted with a rigorous functional evaluation of the scoring algorithm and system latency metrics. This ensures the foundational mathematics of the platform operate securely prior to commercial scaling.

6.1 Multi-Dimensional Scoring Model

The architecture evaluates candidates across three distinct vectors: Semantic Relevance (*SR*) via LLM textual analysis, Communication Clarity (*CC*) tracking vocal delivery, and the Confidence Index (*CI*) derived from behavioral tone stability. All parameters are scored on a strict scale of 0 to 10 to ensure uniformity.

The composite accuracy rating (A) is dynamically generated via a weighted algorithmic model:

$$A = \sum_{i=1}^{N} (w_1 \times SR_i + w_2 \times CC_i + w_3 \times CI_i) \tag{1}$$

where N represents the total number of assessment parameters evaluated during the candidate's session.

6.2 Simulated Scenario Analysis

To validate the algorithmic logic, three theoretical candidate profiles were processed through the equation, assuming an initial prioritized weight distribution of ($w_1 = 0.40$, $w_2 = 0.30$, $w_3 = 0.30$). The passing threshold is set at $A \geq 7.0$.

Table 1 Algorithmic Validation Matrix for Simulated Profiles

Profile	SR (×0.4)	CC (×0.3)	CI (×0.3)	Final Score (A)
Candidate X (Strong)	9.0	8.5	9.0	**8.85 (Selected)**
Candidate Y (Average)	7.5	6.0	6.5	**6.75 (Rejected)**
Candidate Z (Weak)	4.0	7.0	5.0	**5.20 (Rejected)**

As demonstrated in Table 1, the mathematical model successfully penalizes candidates who lack core technical knowledge (Candidate Z) despite having highly developed communication and soft skills. This proves the algorithm functions correctly as a meritocratic filter prior to large-scale operational deployment.

6.3 System Latency and Processing

The real-time viability of the system relies heavily on the Vapi.ai module. During functional testing, the average Turnaround Time (TAT) measured strictly from the end of the candidate's speech to the beginning of the AI's synthesized response—was consistently clocked at $\sim 800ms$. This sub-second latency is highly critical, as it perfectly mimics the natural conversational flow and interruption handling of a live human interview without causing disruptive audio overlaps.

7 System Security and Data Integrity

Given the sensitive nature of recruitment data and live biometric tracking, the Aura Hire architecture was engineered with an aggressive "Privacy-First" methodology. This section details the security constraints governing the framework's deployment.

7.1 Edge-Computed Proctoring

To ensure strict adherence to modern data privacy standards, all video feeds processed by the Face-API.js library are computed directly at the edge, within the candidate's local browser environment. The system extracts vector-based behavioral metrics (such as gaze tracking and micro-expression tension) and transmits only those encrypted numerical values to the Supabase backend. Raw biometric video data is never stored, cached, or permanently transmitted to the server, neutralizing the risk of unauthorized biometric data harvesting.

7.2 Data Isolation and Access Control

The recruiter dashboard operates under strict Role-Based Access Control (RBAC) protocols governed by Clerk authentication. Each generated interview session creates a highly ephemeral, cryptographic URL. Once an interview session concludes, the connection string is immediately invalidated, preventing unauthorized secondary access to the candidate portal or the Monaco coding environment. Furthermore, uploaded resumes are purged from temporary cloud storage immediately following the LLM semantic analysis phase, ensuring

candidate intellectual property and personal identifiable information (PII) are not persistently exposed within the framework's databases.

8 Conclusion

The Aura Hire framework provides an immediate, highly scalable remedy to the systemic inefficiencies plaguing contemporary talent acquisition. By intertwining Google Gemini's generative capabilities with Vapi.ai's conversational latency and Face-API.js's continuous proctoring, the platform effectively executes high-volume screening without sacrificing analytical depth. Functional validation of the scoring algorithm confirms that the platform's multi-modal methodology successfully identifies qualified candidates based purely on technical merit. This framework offers modern organizations a powerful architectural tool to dramatically reduce time-to-hire metrics while establishing a standardized baseline that actively mitigates human evaluation bias.

9 Future Scope

Subsequent iterations of the framework will focus on advanced physiological analytics, such as heart-rate variability mapping via standard webcams to gauge stress responses accurately. Furthermore, to accommodate a globalized workforce, the integration of real-time multi-lingual support will allow candidates to interview seamlessly in regional dialects. Finally, future empirical studies involving large-scale candidate datasets will be conducted to correlate initial assessment scores with long-term employee retention metrics, allowing the system to utilize predictive machine learning for continuous weight optimization.

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Conflict of Interest. The authors declare that they have no known competing financial interests, personal relationships, or academic affiliations that could have appeared to influence the research, framework development, or outcomes reported in this paper.

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