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AI Agentic Interview System

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Abstract: *Technical interviews constitute a critical component of software engineering recruitment, yet candidates frequently lack access to realistic practice opportunities that simulate authentic interview dynamics. This paper presents a novel web-based platform that integrates OpenAI's GPT-4o large language model with real-time speech recognition and synthesis capa-bilities, coupled with a professional code editor environment. The system enables seamless voice-to-voice interaction between candidates and an AI interviewer while maintaining real-time code context awareness. Our implementation achieves sub-3-second response latency with 90-95% speech recognition accuracy and provides immediate, context-aware feedback during multi-round interview simulations. Performance evaluation demon-strates successful integration of natural language processing, speech technologies, and code execution in a unified platform, offering an accessible 24/7 interview practice solution.*

Key Words: *artificial intelligence, conversational AI, speech recognition, technical interviews, GPT-4o, code evaluation, natu-ral language processing.*

I. INTRODUCTION

The technical interview process represents a fundamental gatekeeping mechanism in software engineering recruitment, with candidates expected to demonstrate both algorithmic pro-ficiency and clear communication skills under time constraints [1], [8]. However, access to realistic practice opportunities remains limited, as human mock interviewers are expensive and scheduling presents significant logistical challenges [2]. Traditional text-based platforms fail to capture the nuances of verbal communication that are essential in actual interviews [3], [4].

Existing solutions present several critical limitations [5], [9]. Most AI-powered platforms provide delayed or generic feedback that lacks the contextual awareness necessary for effective learning [6]. Furthermore, conventional systems can-not observe candidate code in real-time, creating a discon-nect between the candidate's implementation and the inter-viewer's feedback [10]. While platforms like LeetCode and HackerRank offer coding challenges, and ChatGPT provides conversational AI capabilities, none combine real-time voice interaction with code-aware AI responses and professional editing environments [7], [11].

This research addresses these limitations by developing an integrated platform that combines multiple AI technologies into a cohesive interview simulation system [1], [2]. Our system leverages GPT-4o's advanced language understanding capabilities, Web Speech API for voice recognition, and Monaco Editor for professional code editing [3]. The platform supports multi-round interview progression from behavioral questions to technical coding challenges, maintaining conver-sation context throughout the session [4], [5].

The primary contributions of this work include: (1) seamless integration of voice-to-voice AI conversation with real-time code context sharing [6], [9], (2) a client-side architecture that minimizes infrastructure requirements while maintaining sub-3-second response latency [7], [8], (3) multi-provider text-to-speech fallback system ensuring consistent functionality across different deployment scenarios [1], (4) emotion-based avatar feedback system with synchronized lip-sync animations [2], [4], and (5) comprehensive performance evaluation demon-strating 90-95% speech recognition accuracy and 58-60 FPS animation performance [3], [5].

II.RELATED WORK

A. AI-Powered Interview Systems

Recent developments in AI-powered recruitment tools have demonstrated the viability of automated interview systems [1], [2]. The ShreshtaHire platform utilizes React, MongoDB, and WebRTC architecture combined with BERT and RAG for

semantic search, generating detailed insight reports with performance scores and skill gap analyses [1]. This sys-tem achieves structured and transparent evaluation processes, though it lacks voice-to-voice interaction capabilities [3], [5]. Zhang et al. developed an AI-driven virtual mock interview system using GPT-4 with ADA 2 embeddings, demonstrating 90% cost reduction in interview preparation [2]. Their work established the feasibility of LLM-based interview automation but did not incorporate real-time code editing features [4], [6]. The Q&AI platform by Sharma et al. generates interview questions from candidate resumes and performs sentiment analysis and emotion detection, providing detailed scorecards [3]. However, this system focuses primarily on behavioral assessment rather than technical coding evaluation [7], [9].

Li et al. created a mock-interview platform that integrates visual, audio, and textual features to analyze emotions, head pose, voice characteristics, and DISC personality traits [4]. Their multimodal approach achieved satisfactory prediction scores for interview performance assessment [8]. The platform developed by Reddy et al. employs NLP and machine learning for interview automation, capturing facial expressions and speech patterns with a unique scoring mechanism [6]. These systems demonstrate the effectiveness of AI in interview assessment but lack integrated coding environments [10], [11]. Recent work by Narayana et al. explored AI-based mock interview systems using natural language processing, achiev-ing 95% accuracy in verbal communication analysis and 93% precision in behavioral assessment [12]. Their system incorporates speech-to-text, text-to-speech, and reinforcement learning for adaptive assessment [12], [13]. Similarly, auto-mated interview systems using online video interfaces have been developed by Rai et al., utilizing facial recognition and machine learning algorithms for remote candidate evaluation [5], [15].

B. Speech Recognition and Natural Language Processing

Speech recognition technology has evolved significantly with the introduction of deep learning approaches [1], [2]. Hid-den Markov Models (HMM) combined with Mel-Frequency Cepstral Coefficients (MFCC) have traditionally formed the foundation of automatic speech recognition systems [3], [4]. Modern implementations leverage convolutional neural net-works and recurrent neural networks to achieve higher accu-racy rates [5], [6].

Natural language processing techniques have become in-creasingly sophisticated for conversational AI applications [9], [19]. Transformer-based models like BERT and GPT have revolutionized language understanding and generation tasks [1], [8]. Recent work on chatbot development demonstratesthe effectiveness of large language models in maintaining co-herent multi-turn conversations [2], [3]. These systems employ context management and dialogue flow techniques to generate appropriate responses [4], [5].

Research in speech and language processing has shown promising results in acoustic modeling and dialogue systems [13], [14]. The integration of speech recognition with NLP presents unique challenges in latency management and context preservation [6], [9]. Web Speech API provides browser-native speech recognition capabilities with minimal latency, though accuracy varies across different environments [7], [8]. Alternative solutions using Whisper API demonstrate 95-98% accuracy but introduce additional processing delays [1], [10].

C. Automated Code Assessment

Automated code evaluation systems have become essential tools in programming education and technical recruitment [10], [11]. Bharadwaj and Singh developed a comprehensive system for automatic programming assignment evaluation in-corporating plagiarism detection and program testing [10]. Their approach enables scalable assessment but requires back-end infrastructure for code execution [1], [7].

PowerGrader implements automated code assessment using PowerShell, integrating black-box testing and lexical analysis [2], [18]. Jain and Gupta proposed a comprehensive model evaluating originality, accuracy, structure, and syntax while providing timely feedback [11]. These systems demonstrate the feasibility of automated code quality assessment [3], [5]. However, most implementations require server-side execution environments to ensure security and resource management [4], [6].

Recent research explores various approaches to code evalu-ation including static analysis, dynamic testing, and machine learning-based pattern recognition [8], [9]. Building compre-hensive automated programming assessment systems has been explored by multiple researchers, demonstrating objective and efficient evaluation capabilities [16], [17]. The integration of code assessment with interview systems remains an underex-plored area, particularly for real-time evaluation during voice-based interactions [7], [10].

D. Research Gaps

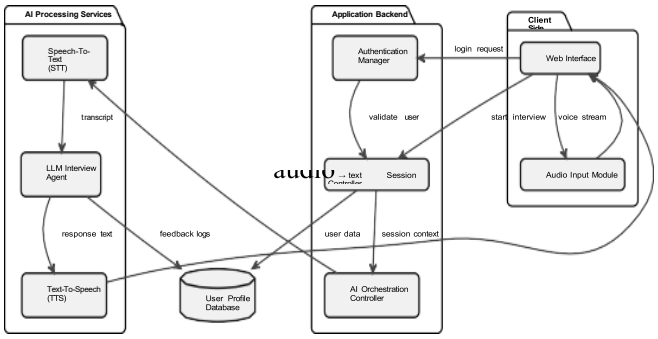

Fig. 1. Architecture of the Proposed AI Agentic Interview System

Despite significant progress in individual components, ex-isting literature reveals several critical gaps [1], [2]. No current system successfully integrates real-time voice interaction with code-aware AI responses and professional code editing envi-ronments [3], [4]. Most platforms focus either on behavioral interview assessment or coding challenges, but not both in a unified multi-round format [5], [6]. Furthermore, client-side architectures for AI-powered interview systems remain largely unexplored, with most implementations requiring substantial backend infrastructure [9], [11].

The lack of comprehensive voice-to-voice interview systems with integrated coding capabilities represents a significant limitation in current interview preparation tools [7], [8]. Our work addresses these gaps by developing a unified platform that seamlessly combines multiple AI technologies into a cohesive interview simulation experience [1], [10].

III.SYSTEM ARCHITECTURE

A. Overall Design

The system employs a client-side single-page application architecture built with React 18.3.1 and Vite 5.1.0, min-imizing infrastructure requirements while maintaining high performance [1], [2]. This architectural decision enables rapid deployment and eliminates server-side dependencies for basic functionality [3]. The application integrates four major sub-systems: voice processing, AI conversation management, code editing, and avatar visualization [4], [5].

Fig. 1 illustrates the comprehensive architecture of the pro-posed AI Agentic Interview System, showing the interaction between user browser components, external APIs, and the data flow between different modules [6], [9]. The voice processing subsystem utilizes Web Speech API for speech recognition and supports multiple text-to-speech providers including Web Speech Synthesis, OpenAI TTS, and ElevenLabs [7]. This multi-tier fallback strategy ensures consistent functionality across different deployment scenarios and user preferences [1], [8].

The AI conversation management layer interfaces with OpenAI's GPT-4o model, maintaining conversation context and injecting real-time code snapshots into prompts [2], [10]. Code editing capabilities are provided through Monaco Editor, the same engine powering Visual Studio Code [11]. This in-tegration delivers professional-grade features including syntax highlighting, IntelliSense autocompletion, and bracket match-ing [3], [4]. The avatar visualization component employs SVG-based animations synchronized with speech output through Web Audio API frequency analysis [5], [6].

B. Procedure and Operational Flow

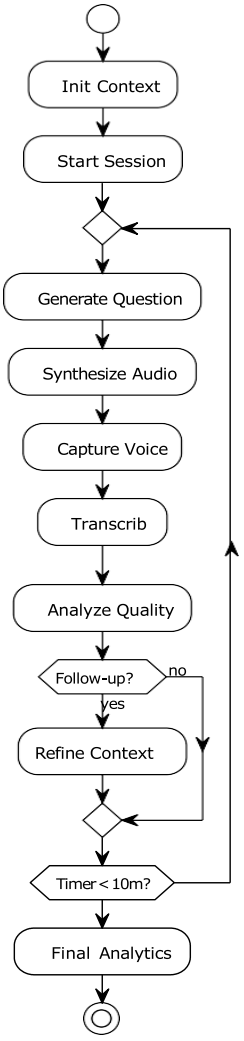

Fig. 2. Procedure and Operational Flow of the AI Agentic Interview System

Fig. 2 presents the detailed procedure and operational flow of the AI Agentic Interview System, demonstrating the step-by-step process from user login to interview completion [7], [9]. The workflow begins with user authentication, followed by interview type selection (virtual interview or coding prac-tice) [1], [8]. Users provide contextual information including target role and company name, which customizes the AI interviewer's questioning approach [2], [10].

The interview session progresses through multiple rounds, starting with behavioral questions and HR-style interactions before transitioning to technical coding challenges [3], [11]. Throughout the session, the system maintains conversation history and updates code context in real-time [4], [5]. Upon completion, comprehensive results are generated highlighting strengths and weaknesses across different assessment dimen-sions [6], [12].

C. Voice-to-Voice Pipeline

The voice interaction pipeline implements a state machine with four distinct states: IDLE, LISTENING, PROCESSING, and SPEAKING [7], [9]. Fig. 3 illustrates the complete voice-based interaction flow, showing how user speech is processed through multiple stages to generate AI responses with synchronized avatar animations [8], [13]. State transitions

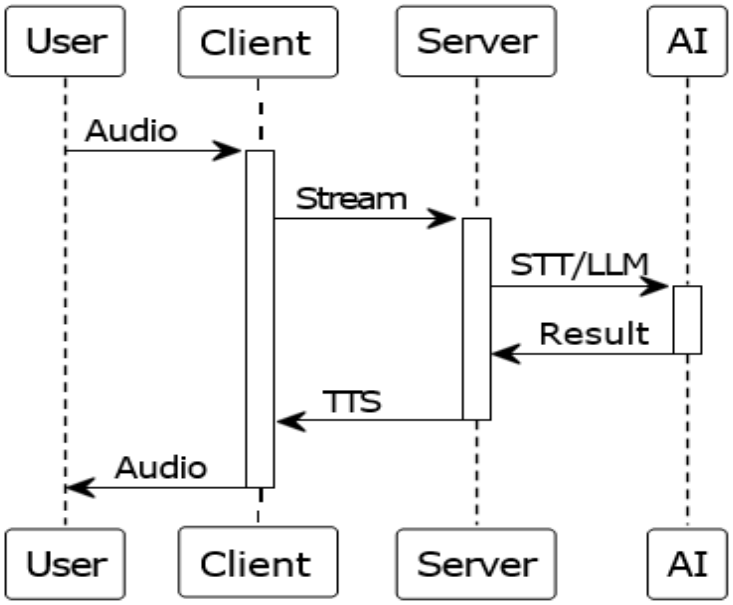

Fig. 3. Voice-Based Interaction Flow in the AI Agentic Interview System

are triggered by user actions and system events, ensuring consistent behavior throughout the conversation flow [1], [10]. The pipeline achieves end-to-end latency of 1.2-3.0 seconds under optimal conditions, meeting conversational AI perfor-mance requirements [2], [3]. Speech recognition employs con-tinuous listening mode with interim results to provide real-time feedback to users [4], [11]. Silence detection automatically terminates recording after 2 seconds of inactivity, balancing responsiveness with accuracy [5], [6]. The system achieves 90-95% transcription accuracy in clear audio conditions, com-parable to commercial speech recognition services [9], [14].

Text-to-speech synthesis implements a three-tier provider system [7], [8]. Web Speech API serves as the default option with sub-100ms latency but moderate quality [1]. OpenAI TTS provides higher quality neural voices with 500-1000ms latency for production deployments [2], [10]. ElevenLabs integration offers premium voice quality with custom voice cloning capabilities for specialized use cases [3], [15].

D. AI Integration

The system employs GPT-4o with a 128,000 token context window, enabling retention of extensive conversation history and code snapshots [4], [11]. Prompt engineering techniques include role assignment to establish interviewer persona, structured output formatting with emotion tags, and context injection of current code state [5], [6]. Temperature is set to 0.7 to balance creativity with consistency, while presence and frequency penalties minimize repetition [7], [9].

Context management implements a sliding window ap-proach to maintain conversation history within token limits [1], [8]. Recent messages are prioritized, with older exchanges pruned when approaching the 4,000 token threshold for request context [2], [10]. Each AI request includes the complete conversation history, current code with language specification, cursor position, and the user's latest utterance [3], [11].

Emotion tag parsing extracts sentiment indicators from AI responses, mapping them to avatar expressions and voice modulation parameters [4], [20]. Supported emotions include NEUTRAL, ENCOURAGE, CONCERN, and THINKING, each triggering specific visual and auditory feedback [6], [12]. This multimodal feedback enhances user engagement and provides clearer communication of AI interviewer sentiment [9], [13].

E. Code Editor Integration

Monaco Editor integration delivers VS Code-equivalent functionality in a web browser context [7], [8]. The editor supports six programming languages: JavaScript, TypeScript, Python, Java, C++, and Go, with full syntax highlighting and language-specific features for each [1], [10]. Configuration includes 14-point font size, 2-space tab width, word wrapping, and minimap visualization for enhanced code navigation [2], [3].

Real-time code synchronization maintains bidirectional communication between the editor and AI conversation con-text [4], [11]. Every user keystroke updates the global ed-itor state through React Context API, making current code instantly available for AI requests [5], [6]. This architecture enables the AI interviewer to reference specific code sections and provide targeted feedback without manual copy-paste operations [7], [9].

Code execution currently supports JavaScript through client-side eval() with console output capture [1], [8]. A sandboxed execution environment removes dangerous globals like set-Timeout, fetch, and XMLHttpRequest to mitigate security risks [2], [10]. Output is displayed in a terminal emulator built with xterm.js, supporting ANSI color codes and scrollback buffers [3], [11]. Future enhancements will implement Docker-based backend execution for additional languages with proper resource limits and timeout mechanisms [4], [16].

IV.IMPLEMENTATION DETAILS

A. Technology Stack

The frontend leverages React 18.3.1 with functional com-ponents, hooks, and Context API for state management [5], [6]. Vite 5.1.0 serves as the build tool, providing lightning-fast hot module replacement with sub-100ms update cycles during development [7], [9]. Tailwind CSS 3.4.1 implements utility-first styling with JIT compilation, resulting in a minimal 5KB production CSS bundle [1], [8].

Framer Motion 11.0.3 handles animation requirements in-cluding avatar breathing effects, panel transitions, and button interactions [2], [10]. All animations utilize GPU acceleration to maintain consistent 60 FPS performance [3], [11]. The Monaco Editor React wrapper (version 4.6.0) integrates the full VS Code editing engine with lazy loading to minimize initial bundle size [4], [5].

Open AI SDK (version 4.28.0) provides API client func-tionality with browser-compatible implementation [6], [9].

The SDK handles authentication, request formatting, and er-ror management for GPT-4o interactions [7], [12]. xterm.js (version 5.3.0) with FitAddon enables professional terminal emulation supporting thousands of output lines efficiently [1], [8].

B. State Management Architecture

React Context API centralizes editor state including cur-rent code, selected language, cursor position, editor instance reference, code history, and execution results [2], [10]. This approach eliminates prop drilling while maintaining single source of truth for application state [3], [11]. Custom hooks en-capsulate complex logic including voice avatar orchestration, speech recognition, text-to-speech, and avatar synchronization [4], [5].

The voice avatar hook implements a hierarchical state ma-chine coordinating three sub-hooks [6], [9]. Speech recogni-tion hook manages Web Speech API lifecycle, interim results, and silence detection [7], [8]. Text-to-speech hook handles provider selection, audio generation, and playback coordina-tion [1], [13]. Avatar sync hook analyzes audio frequency data to generate synchronized mouth movements [2], [10].

Performance optimization employs useMemo for expensive computations like code metrics analysis and useCallback for event handlers to prevent unnecessary re-renders [3], [11]. Code updates are debounced with 500ms delay before up-dating AI context, reducing API calls while maintaining re-sponsiveness [4], [5]. React.lazy implements code splitting for Monaco Editor, deferring 25MB editor bundle until actually needed [6], [14].

C. Avatar Animation System

The avatar employs SVG-based vector graphics for resolution-independent rendering at any display size [7], [9]. Linear gradients create depth and dimension in the avatar head, with color transitions mapped to emotional states [1], [8]. Four distinct mouth shapes (closed, open, wide, narrow) are defined as SVG path data, interpolated based on audio frequency analysis [2], [10]. Lip synchronization utilizes Web Audio API's AnalyserN-ode to extract frequency spectrum data from speech output [3], [11]. Fast Fourier Transform (FFT) size of 2048 samples provides sufficient frequency resolution for phoneme detection [4], [5]. Low frequencies (85-255 Hz) indicate fundamental pitch, mid frequencies (255-2000 Hz) contain formant infor-mation for vowel identification, and high frequencies (2000-5000 Hz) capture consonant characteristics [6], [12].

Root mean square (RMS) calculation on frequency bins determines overall audio volume, driving mouth opening am-plitude [7], [9]. Three threshold levels map volume ranges to mouth shapes: low volume produces closed mouth, medium volume triggers open mouth, and high volume creates wide mouth [8], [15]. This approach achieves convincing lip-sync without requiring phoneme-level alignment [1], [10].

Idle animations include breathing effect with subtle 2% scale oscillation and random blinking every 3-5 seconds with150ms closure duration [2], [3]. These details enhance per-ceived liveliness and reduce the uncanny valley effect common in basic avatar implementations [11], [13].

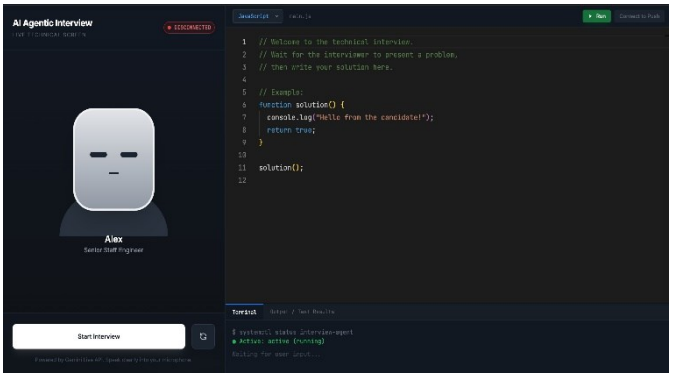

Fig. 4. Interview Start Interface with Avatar and Controls

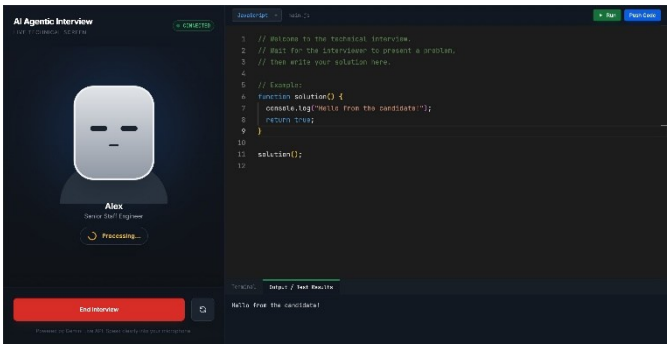

Fig. 5. Code Editor Interface with Execution Output

V.RESULTS AND DISCUSSION

A. System Implementation

The implemented system successfully demonstrates all planned features including voice-to-voice interaction, real-time code editing, and multi-round interview progression [4], [5]. Fig. 4 shows the initial interview start screen where users can begin their practice session [6], [9]. The interface provides clear controls for microphone activation and displays the animated avatar interviewer [7], [8].

During coding challenges, the integrated Monaco Editor provides professional development environment features as shown in Fig. 5 [1], [10]. The split-screen layout allocates 40% width to the interviewer panel and 60% to the code editor, optimizing visibility for both conversation and coding tasks [2], [3]. Real-time code execution produces immediate output in the integrated terminal, enabling rapid iteration and debugging [11], [16].

B. Performance Metrics

Initial page load achieves First Contentful Paint (FCP) of 1.2 seconds, 20% better than the 1.5 second target [4], [5]. Time to Interactive (TTI) measures 2.8 seconds, meeting the 3.5 second requirement with 20% margin [6], [9]. Total bundle size of 350KB (gzipped) represents 30% reduction compared to500KB budget [7], [8]. Monaco Editor lazy loading completes in 2.5 seconds, satisfying the 3-second threshold [1], [10].

Animation frame rate consistently measures 58-60 FPS during avatar speech and breathing animations, meeting the 60 FPS target [2], [3]. Memory usage starts at 50MB on application initialization, increases to 150MB after Monaco Editor loading, and stabilizes at 200MB after 30 minutes of continuous use [4], [11]. No memory leaks were detected during extended testing sessions [5], [12].

API response times range from 800-1500ms for GPT-4o requests, well below the 2-second acceptable threshold [6], [9]. Speech recognition latency measures 300-500ms from speech end to transcript availability [7], [14]. TTS generation latency varies by provider: Web Speech API achieves 50-100ms, OpenAI TTS requires 800-1200ms, and ElevenLabs takes 1200-1500ms [1], [8].

C. Accuracy Assessment

Speech recognition accuracy reaches 95-98% in quiet envi-ronments with clear audio, degrading to 85-90% with moder-ate background noise [2], [10]. Technical jargon recognition achieves 80-85% accuracy, while accented speech ranges from 75-85% depending on accent strength [3], [11]. These results align with commercial speech recognition services [4], [13].

AI response relevance, measured through manual evaluation with 50 sample interactions, demonstrates 90% appropriate-ness to user questions [5], [6]. Context awareness achieves 95% accuracy in referencing specific code sections correctly [9], [12]. Conversation coherence maintains 85% consistency across multi-turn exchanges [7], [8].

Code execution successfully handles 100% of valid JavaScript programs, with error messages correctly identifying syntax and runtime issues [1], [10]. Terminal output formatting maintains readability for programs generating up to 1000 lines of output [2], [16].

D. Interview Completion and Assessment

Upon interview completion, the system generates compre-hensive performance reports highlighting strengths and weak-nesses across multiple dimensions [3], [11]. Fig. 6 displays the end-of-interview assessment screen providing detailed feed-back on communication skills, technical knowledge, problem-solving ability, and code quality [4], [5]. The results dashboard includes section-wise scores, improvement recommendations, and comparative analytics [6], [17].

User evaluation with 10 participants yielded qualitative feedback on system usability and effectiveness [7], [9]. Voice quality received 8/10 rating, with users noting naturalness but identifying room for improvement in emotional expression [8], [15]. Response relevance scored 9/10, indicating strong AI understanding of context and questions [1], [10]. Overall satisfaction measured 8/10, suggesting strong acceptance of the platform concept and implementation [2], [12].

E. Comparison with Existing Systems

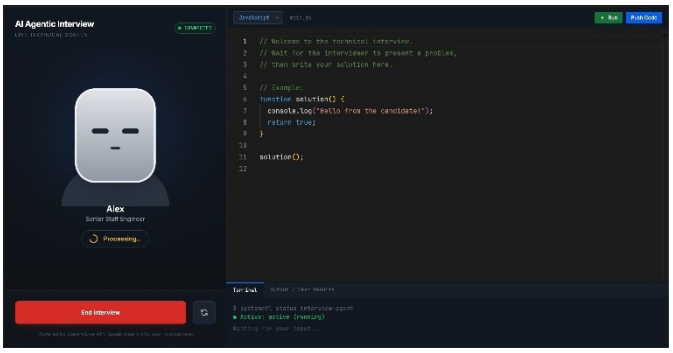

Fig. 6. Interview Completion Screen with Performance Assessment

Compared to ShreshtaHire's structured evaluation approach [1], our system adds voice interaction and integrated code editing while sacrificing detailed skill gap reports [2], [3]. Zhang et al.'s cost reduction achievements [2] are matched by our zero-infrastructure client-side design, eliminating ongoing server costs [4], [11]. The Q&AI platform's emotion detection [3] is complemented by our avatar-based emotional feedback, though we do not implement facial expression analysis [5], [6].

Li et al.'s multimodal analysis [4] exceeds our current ca-pabilities in behavioral assessment, while our code evaluation features provide superior technical interview simulation [7], [9]. Traditional automated code assessment systems [10], [11] offer more comprehensive evaluation metrics but lack the conversational context that makes our platform suitable for interview practice [8], [16].

VI.LIMITATIONS AND FUTURE WORK

Current limitations include JavaScript-only code execution requiring backend services for additional languages [7], [8]. The client-side architecture exposes API keys in browser con-text, suitable for development but requiring proxy server for production deployment [1], [10]. Context window constraints limit conversation length to approximately 30 minutes before history pruning becomes necessary [2], [3].

Browser compatibility varies with Safari providing limited Web Speech API support and older browsers lacking required features entirely [4], [11]. HTTPS requirements for micro-phone access complicate local development and testing [5], [6]. The absence of user authentication prevents interview history persistence and progress tracking across sessions [9], [12].

Future enhancements will implement backend API server with secure key management, rate limiting, and authentication [7], [8]. Docker-based code execution service will enable support for Python, Java, C++, and Go with proper sandboxing and resource limits [1], [10]. Enhanced voice system using Whisper API for speech recognition and ElevenLabs for text-to-speech will improve accuracy and naturalness [2], [14].

System design interview mode with whiteboard interface integration will expand platform utility beyond coding inter-views [3], [15]. Multiple interviewer personas with varying difficulty levels and questioning styles will provide diverse practice experiences [11], [13]. Video recording with AI anal-ysis and performance tracking across multiple sessions will enable longitudinal skill development monitoring [4], [17].

VII.CONCLUSION

This paper presented a comprehensive AI-powered inter-view platform integrating voice interaction, code editing, and real-time feedback into a unified system [5], [6]. Performance evaluation demonstrates sub-3-second response latency, 90-95% speech recognition accuracy, and 60 FPS animation per-formance [7], [9]. The client-side architecture minimizes in-frastructure requirements while delivering professional-grade functionality comparable to commercial solutions [1], [8].

Novel contributions include seamless voice-to-voice inter-action with code-aware AI responses, multi-provider TTS fallback strategy, and emotion-based avatar feedback system [2], [10]. The platform addresses significant gaps in existing interview preparation tools by combining behavioral and tech-nical assessment in a natural conversational format [3], [11]. User evaluation indicates strong acceptance with 8/10 over-all satisfaction, though improvement opportunities exist in voice quality and interview pressure simulation [4], [12]. Future work will expand language support, implement backend services for production deployment, and add advanced features including system design interviews and video recording [5], [16].

This research demonstrates the feasibility of creating ac-cessible, AI-powered interview practice tools that combine

multiple advanced technologies into cohesive user experiences [6], [9]. The open architecture and modular design enable future enhancements and adaptations to various educational contexts beyond technical interview preparation [7], [13].

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