

# CogniView: An AI-Based Cognitive Interview Evaluator Using Multimodal Behavioral Analytics

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**Abstract:** As digital recruitment continues to expand, organizations increasingly require assessment systems that ensure fairness while efficiently managing large applicant pools. Traditional hiring approaches often rely heavily on subjective human judgment, which can lead to inconsistency and unintended bias. To address these challenges, this study presents CogniView, an advanced framework that evaluates candidates using a combination of structured aptitude assessments, natural language processing techniques, and behavioral analytics. The system is designed with an end-to-end architecture that handles candidate authentication, initial skill evaluation, AI-based analysis of responses, and comprehensive reporting driven by data insights. By generating transparent and explainable evaluation metrics, CogniView improves both the accuracy and efficiency of recruitment processes, while still allowing final decisions to be guided by human judgment. Experimental results demonstrate that the proposed approach enhances objectivity and significantly accelerates modern hiring workflows.

**Keywords:** AI Interview Evaluation, Cognitive Assessment, Natural Language Processing, Aptitude Test, Multimodal Analytics, Recruitment Automation.

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## I. INTRODUCTION

*CogniView* is a smart and adaptive framework designed to enhance cognitive interview evaluations by improving efficiency and minimizing human subjectivity. With the rapid adoption of artificial intelligence in recruitment systems, organizations are increasingly shifting toward data-driven and standardized candidate assessment methods. This transition helps address common limitations of traditional hiring practices, such as inconsistency, evaluator fatigue, and implicit bias, thereby enabling more reliable and evidence-based decision-making [1], [2].

The evaluation pipeline begins with a structured competency assessment consisting of multiple-choice questions that test both technical knowledge and logical reasoning abilities. A qualifying threshold of 50 In the next phase, candidates participate in an AI-assisted interview where their written responses are analyzed using Natural Language Processing (NLP) techniques. The system evaluates multiple qualitative aspects, including coherence of thought, reasoning depth, contextual relevance, and clarity of expression. Additionally, semantic analysis and pattern recognition techniques are applied to better understand the

intent and quality of responses, ensuring a more comprehensive assessment beyond simple keyword matching [4].

Despite the use of automated scoring mechanisms, CogniView is intentionally designed as a decision-support system rather than a fully autonomous hiring solution. Human recruiters retain control over final decisions through an interactive administrative dashboard that presents detailed evaluation metrics, comparative insights, and candidate performance summaries. This human-in-the-loop approach ensures transparency, accountability, and ethical compliance in the hiring process.

Furthermore, the framework supports scalability, allowing organizations to efficiently handle large volumes of applicants without compromising assessment quality. The integration of analytics also enables continuous improvement by identifying hiring trends, skill gaps, and evaluation patterns over time. By combining structured testing, intelligent NLP-based evaluation, and human oversight, CogniView establishes a balanced and robust approach to modern recruitment.

Overall, this methodology not only accelerates the hiring cycle but also enhances objectivity, consistency, and fairness in candidate evaluation. It empowers recruiters with actionable insights, leading to more informed and high-quality hiring decisions [8].

## II. LITERATURE SURVEY

The adoption of artificial intelligence in recruitment has transformed interview practices by incorporating technologies such as natural language processing (NLP), affective computing, and multimodal data integration. Research studies show that automated evaluation systems improve consistency, fairness, and efficiency in candidate assessment compared to traditional human-driven methods [1]–[3].

Rai et al. [1] proposed a model for analyzing candidate confidence levels and emotional responses. Their approach combined facial recognition techniques with NLP to detect traits related to professional communication and emotional stability.

Building upon multimodal analysis, Inamdar et al. [2] introduced a mock interview system that integrates speech analysis, facial expression recognition, and textual evaluation. This combined approach enhances the overall accuracy of candidate assessment. In a similar direction, Patil et al. [3] applied deep learning models to generate structured feedback, helping candidates improve their interview performance through simulated practice environments.

Recent developments have also emphasized real-time evaluation techniques. Verma et al. [4] investigated semantic similarity methods to automate the validation of technical skills, thereby reducing reliance on subjective judgment. Additionally, Kalra et al. [5] combined aptitude testing with behavioral analysis to design an intelligent system that assists both candidates and recruiters during the hiring process.

Although these studies contribute significantly to automated interview evaluation, the proposed *CogniView* framework advances existing work by delivering a unified, end-to-end solution. It connects initial skill-based screening with final human-supervised decision-making, ensuring a transparent, reliable, and well-structured recruitment process.

## III. RELATED WORK

The domain of automated recruitment has undergone rapid transformation due to advancements in artificial intelligence technologies. Earlier hiring systems primarily depended on resume parsing and keyword-based filtering techniques, which were limited in their ability to evaluate deeper cognitive abilities, problem-solving skills, and behavioral traits of candidates. As a result, such methods often failed to provide a holistic understanding of an applicant's true potential.

In recent years, research has increasingly focused on leveraging computer vision and speech analysis to assess

soft skills and emotional intelligence. For instance, Rai et al. [1] introduced models capable of identifying confidence levels and emotional cues from candidate interactions, while Inamdar et al. [2] proposed a multimodal evaluation system that integrates facial expression recognition with voice-based analysis to produce more comprehensive assessments. These approaches highlight the growing importance of combining multiple behavioral indicators to enhance evaluation accuracy. Further contributions by Patil et al. [3] and Verma et al. [4] demonstrated the effectiveness of AI-driven interview simulations in automating skill assessment and improving candidate preparedness. Their work emphasizes the role of interactive systems in replicating real interview scenarios, allowing candidates to refine their responses in a controlled environment. Additionally, Kalra et al. [5] and Sridevi et al. [6] developed intelligent platforms that utilize vision-based technologies to simulate real-world interview settings, thereby enhancing both technical and behavioral evaluation processes. Modern research is also exploring the integration of multiple data sources to improve the robustness and reliability of candidate scoring. Koshti et al. [7] highlighted the advantages of combining resume analytics, human resource simulations, and technical assessments into a unified evaluation pipeline. Similarly, Nguyen et al. [8] demonstrated the use of Large Language Models (LLMs) for multilingual interview training, enabling systems to support diverse candidate populations across different linguistic backgrounds. Li et al. [9] further examined the complexity of multimodal performance evaluation, focusing on how different input modalities contribute to overall assessment quality. Moreover, Kulkarni et al. [11] enhanced speech-based recruitment systems by incorporating grammatical and linguistic analysis to improve job-role matching accuracy.

In addition to these developments, recent studies have begun to emphasize explainability and fairness in AI-driven hiring systems. Researchers are exploring methods to make algorithmic decisions more transparent and interpretable, ensuring that candidates and recruiters can understand how evaluation outcomes are derived. There is also a growing focus on reducing bias in automated systems by carefully selecting training data and designing ethical evaluation frameworks [1], [2].

Despite these significant advancements, a notable limitation persists across many existing solutions: the absence of a cohesive, end-to-end workflow that seamlessly connects initial screening stages with final decision-making processes. Most systems operate in isolation, addressing only specific aspects such as resume filtering, interview simulation, or behavioral analysis, without integrating them into a unified framework.

To overcome this gap, *CogniView* introduces a comprehensive and transparent platform that combines aptitude-based screening, NLP-driven response evaluation, and human-supervised decision-making into a single pipeline. By integrating these components, the system ensures consistency across all stages of recruitment while maintaining

the essential role of human judgment. This balanced approach not only improves evaluation efficiency but also enhances trust, fairness, and overall effectiveness in modern hiring practices [8].

#### IV. PROBLEM STATEMENT AND RESEARCH OBJECTIVES

##### ➤ Problem Statement

Conventional recruitment relies heavily on human-led interviews, which are frequently influenced by personal prejudice and inconsistent grading criteria. Furthermore, many existing automated systems lack transparency and fail to connect different evaluation stages, such as aptitude testing and behavioral analysis, into a single platform. This lack of integration and clarity often results in hiring decisions that are unreliable and difficult to justify.

##### ➤ Research Objectives

The primary goal of this research is to establish a more dependable and transparent assessment framework through

the following objectives:

- To architect a systematic and logical workflow for AI-facilitated interview assessments.
- To merge preliminary competency testing with sophisticated, AI-powered linguistic evaluation.
- To utilize Natural Language Processing (NLP) for the objective quantification of verbal proficiency and cognitive reasoning.
- To produce clear, data-driven performance summaries that assist HR professionals in making well-informed selections.

#### V. SYSTEM ARCHITECTURE

The CogniView system follows a modular web-based architecture consisting of a candidate interface, aptitude testing module, AI interview engine, evaluation engine, and admin dashboard.

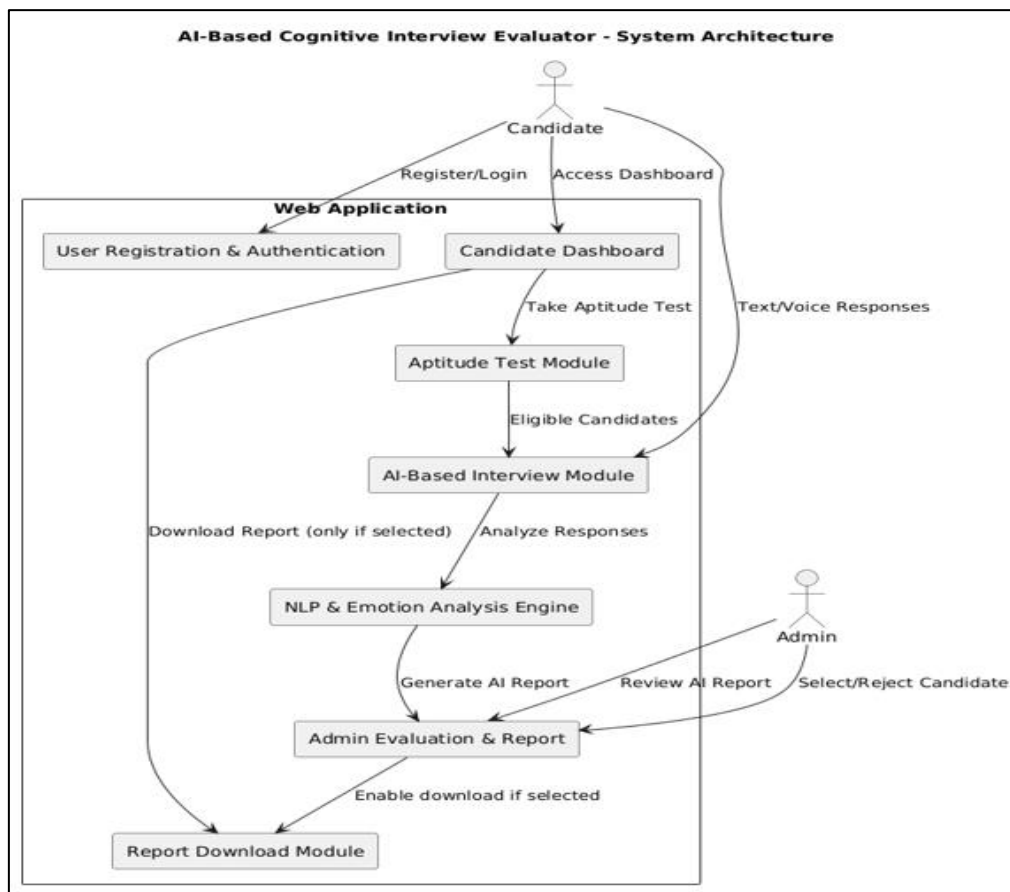


Fig 1 System Architecture of the Proposed AI-Based Cognitive Interview Evaluator

##### ➤ Architecture Description

The architectural design of the CogniView platform, illustrated in Figure 1, follows a modular and layered approach that emphasizes security, scalability, and interpretability of results. The system is structured to ensure smooth data flow between components while maintaining robustness and flexibility for future enhancements. This design enables efficient handling of large applicant volumes

without compromising performance or evaluation accuracy [7], [8].

The interaction begins at a web-based client interface, which serves as the primary access point for users. Through this interface, candidates can register, authenticate, and participate in various assessment stages. Secure authentication mechanisms, including encrypted credentials

and session management techniques, are implemented to safeguard user information and prevent unauthorized access. This ensures compliance with data protection standards and enhances user trust in the platform [2].

After successful login, candidates are guided to a personalized dashboard that organizes the assessment workflow. The first stage involves a preliminary evaluation module designed to test fundamental competencies such as logical reasoning, quantitative aptitude, and verbal ability. This module uses automated scoring algorithms to generate unbiased results, acting as an initial screening layer. By enforcing a qualification threshold, the system ensures that only capable candidates proceed to advanced evaluation stages, thereby optimizing computational resources and recruiter effort [3], [5].

Candidates who meet the required criteria are then advanced to the intelligent interview engine. In this stage, users respond to a predefined set of structured questions aimed at evaluating both technical understanding and communication skills. The responses are captured in real time and securely transmitted to the backend analytical system. The design supports extensibility, allowing integration of additional input formats such as audio or video for future multimodal analysis [9].

At the core of the system lies the analytical engine, which processes candidate responses using Natural Language Processing (NLP) techniques. This module evaluates multiple dimensions, including semantic relevance, grammatical correctness, coherence of ideas, and richness of vocabulary.

Additionally, sentiment analysis and contextual understanding are applied to infer emotional tone and depth of reasoning. The system can also incorporate behavioral indicators, such as tone and response patterns, to provide a more comprehensive assessment of candidate performance [4], [11].

To further enhance evaluation quality, the platform supports data aggregation and normalization techniques that combine results from different modules into a unified scoring framework. This ensures consistency across multiple evaluation parameters and reduces discrepancies that may arise from isolated analysis methods [7].

The final component of the architecture is the administrative dashboard, which serves as a decision-support interface for recruiters. This module presents detailed reports, including performance scores, comparative analytics, and visual summaries of candidate evaluations. Recruiters can review these insights to make informed hiring decisions while maintaining full control over the final outcome. The inclusion of explainable metrics ensures transparency and allows stakeholders to understand how each evaluation was derived [1].

Overall, the CogniView architecture integrates automated assessment with human oversight, creating a balanced recruitment ecosystem. By combining intelligent evaluation mechanisms with secure system design and scalable infrastructure, the platform significantly improves the efficiency, fairness, and reliability of the hiring process [8].

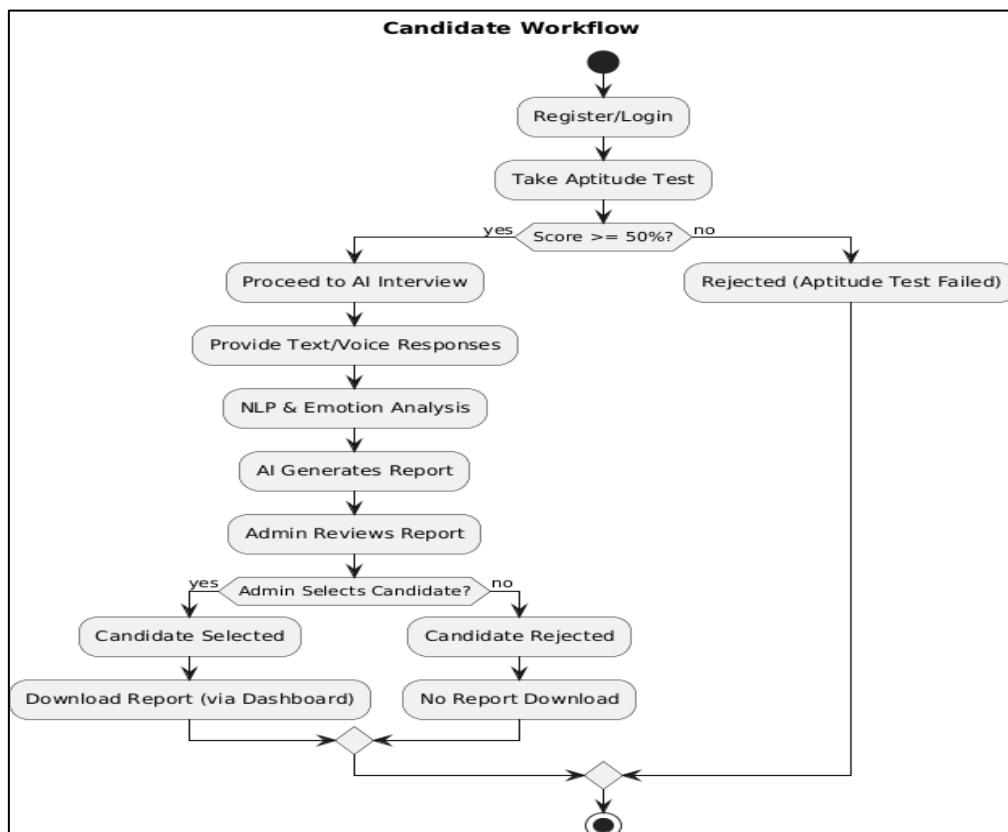


Fig 2 Candidate Workflow in the AI-Based cognitive Interview Evaluation System

## VI. WORKING FLOW OF AI-BASED COGNITIVE INTERVIEW EVALUATOR

### ➤ Workflow Description

Figure 2 depicts the step-by-step workflow followed by a candidate during the cognitive interview evaluation process.

The operational flow of the CogniView system starts with user onboarding, where candidates create an account and log in through a secure authentication mechanism. Only verified users are granted access to the platform, ensuring data integrity and preventing unauthorized participation. Once authenticated, candidates are guided into the structured assessment pipeline through a user-friendly dashboard that clearly outlines each stage of the process.

The first stage involves a standardized aptitude examination designed to evaluate fundamental cognitive abilities. This test measures essential skills such as logical reasoning, numerical aptitude, and verbal comprehension. The questions are carefully structured to provide a balanced assessment, and the system evaluates responses instantly using an automated scoring mechanism. This eliminates manual intervention and ensures unbiased results from the very beginning of the workflow.

Following the completion of the aptitude test, the system applies a qualification checkpoint to determine whether the candidate is eligible to proceed further. A minimum threshold score of 50 Candidates who pass the screening phase are directed to the AI-powered interview module. In this stage, they are presented with a set of predefined, structured questions designed to assess both technical knowledge and communication skills. Responses are provided in text format and are securely stored in the system database. The platform ensures data confidentiality by implementing secure storage and transmission protocols, thereby protecting candidate information throughout the process.

Once the responses are collected, they are processed by the analytical engine, where advanced Natural Language Processing (NLP) techniques are applied. The system performs feature extraction to evaluate multiple linguistic and cognitive parameters. These include sentiment analysis to understand emotional tone, vocabulary diversity to measure expressive capability, and semantic relevance to assess how

well the response aligns with the question. Additionally, coherence and logical flow are analyzed to determine how effectively ideas are structured and communicated.

After extracting these features, the system aggregates the results using a weighted scoring model. Each evaluation parameter is assigned a specific importance level, allowing the system to compute a comprehensive performance score. This approach ensures that multiple aspects of candidate performance are considered rather than relying on a single metric. The generated score is accompanied by a detailed analytical report that highlights strengths, weaknesses, and overall performance trends.

The final stage of the workflow involves human evaluation through the administrative dashboard. Recruiters access AI-generated summaries, visual insights, and comparative analytics for each candidate. Based on this information, they make the final hiring decision, ensuring that automated recommendations are validated through human judgment. This human-in-the-loop approach maintains accountability and reduces the risks associated with fully automated decision-making.

At the conclusion of the process, selected candidates are provided with detailed feedback reports, offering insights into their performance. Candidates who are not selected receive appropriate notifications, ensuring transparency and closure. The structured nature of this workflow guarantees consistency across all applicants, enhances objectivity in evaluation, and significantly improves the overall efficiency of the recruitment process.

### ➤ Candidate Registration and Authentication

Candidates create a secure account using a username and password. Authentication ensures controlled access to system resources.

### ➤ Aptitude Test

Candidates complete a standardized aptitude test. Only candidates scoring above 50% proceed to the interview stage.

### ➤ AI Interview

Eligible candidates respond to predefined interview questions using text input. Responses are securely stored for analysis.

Table 1 Sample Candidate Evaluation Results

Candidate ID	Aptitude (%)	NLP Score	Final Score	Status
C1	65	78	72	Selected
C2	48	–	–	Rejected
C3	72	85	78	Selected
C4	55	70	62	Selected

### ➤ Feature Extraction and Evaluation

NLP techniques extract sentiment polarity, lexical diversity, and semantic relevance. Optional emotion indicators enhance evaluation accuracy.

### ➤ Score Computation

Final scores are computed using a weighted model:

$$S_{final} = 0.4 \times S_{aptitude} + 0.6 \times S_{NLP} \tag{1}$$

➤ *Admin Dashboard Review*

HR personnel review AI-generated reports and make final decisions.

## VII. METHODOLOGY

The CogniView system employs a multi-stage evaluation methodology combining aptitude testing and NLP-based in-terview analysis.

➤ *Aptitude Evaluation*

The aptitude test assesses logical reasoning and verbal ability using automated scoring to ensure objectivity.

➤ *NLP-Based Interview Analysis*

Text preprocessing includes tokenization, stop-word removal, and vectorization. Sentiment analysis, lexical diversity, and semantic relevance are computed.

➤ *Score Fusion Model*

A weighted score fusion model combines aptitude and interview scores:

$$S_{final} = \alpha S_{aptitude} + \beta S_{NLP} \quad (2)$$

Where  $\alpha = 0.4$  and  $\beta = 0.6$ .

➤ *Decision Thresholding*

Candidates failing to meet minimum thresholds are automatically disqualified.

## VIII. SYSTEM IMPLEMENTATION

This section details the technical execution of CogniView, focusing on the software stack, modular components, and the flow of data through the evaluation pipeline.

➤ *Architectural Design and UI*

The platform utilizes a modular client-server architecture to ensure independent scalability of the testing and analysis engines. The frontend is constructed using ReactJS and TypeScript, providing a secure and type-safe environment.

Applicants interact with a streamlined interface for registration and assessment, while recruiters utilize a specialized dashboard for data visualization. To maintain security, sensitive session data is managed via JSON Web Tokens (JWT), and the UI is designed to be fully responsive across various hardware devices.

➤ *Backend and Analysis Engines*

The server-side logic is powered by Python and Flask, acting as a centralized hub for all processing modules. The system handles authentication through hashed password storage and coordinates the execution of the NLP and behavioral engines.

The NLP Processing Module utilizes NLTK and SpaCy to perform text cleaning, lemmatization, and feature

extraction, such as sentiment and coherence. For behavioral context, Librosa is used to extract vocal cues like pitch and speech tempo, while a CNN-based Emotion Module identifies facial expressions to provide a supplementary layer of candidate analysis.

➤ *Data Storage and Human Oversight*

CogniView employs a dual-database strategy: MySQL manages structured records like user credentials and test scores, while MongoDB stores unstructured data, including interview transcripts and feature vectors.

Final selection remains a human-driven process; the administrator reviews AI-generated summaries and manually records hiring decisions. This "human-in-the-loop" approach, supported by role-based access control and encrypted storage, ensures that the recruitment process remains both technically advanced and ethically accountable.

## IX. ADVANTAGES AND LIMITATIONS

➤ *Advantages*

- **Neutral Candidate Assessment:** Standardized benchmarks and NLP models minimize subjective bias, ensuring that all applicants are evaluated against a consistent and fair grading scale.
- **Human-in-the-Loop Oversight:** The system generates data-driven metrics to support recruiters while retaining human authority for final selection to ensure ethical accountability.
- **High-Capacity Scalability:** The web-centric architecture facilitates the simultaneous processing of large applicant pools, making it highly efficient for mass recruitment cycles.
- **Clarity in Grading:** Transparent score breakdowns provide interpretable insights, allowing administrators to easily validate and justify the specific performance ratings of candidates.
- **Data Security and Privacy:** Role-based access protocols safeguard sensitive candidate records, ensuring that personal data remains confidential and accessible only to authorized personnel.

➤ *Limitations*

- **Absence of Multimodal Data:** The current version is restricted to text analysis and does not evaluate non-verbal indicators like facial expressions, hand gestures, or vocal tone.
- **Impact of Language Proficiency:** Scoring may be skewed by a candidate's verbal fluency, potentially penalizing talented applicants who possess strong logic but limited linguistic command.
- **Semantic and Contextual Barriers:** The system may struggle with nuances such as sarcasm or metaphors, leading to possible inaccuracies in measuring a candidate's depth of reasoning.
- **Generalized Assessment Scope:** The platform evaluates broad cognitive traits but lacks the specialized modules

required for deep-dive technical testing or live coding simulations.

- Human-Dependent Decision Logic: The framework serves as a support tool rather than an autonomous recruiter, requiring manual oversight for final verification and selection.

## X. FUTURE WORK

The next phase of CogniView will move beyond simple text analysis to create a more complete "multimodal" system. This means the AI will use deep learning to look at facial expressions and listen to voice patterns in real-time. By tracking eye movements and measuring things like speech speed, pitch, and pauses, the system can better understand a candidate's confidence and stress levels. When these visual and sound-based clues are mixed with the current language analysis, the final evaluation becomes much more accurate.

Additionally, we plan to make the system smarter and fairer. We will use "explainable AI" so that recruiters can clearly see how scores are calculated, helping to prevent any unfair bias. We also want to create "adaptive interviews," where the AI changes the questions based on how the candidate answered previous ones, allowing for a better look at their problem-solving skills. Finally, by moving the platform to the cloud and connecting it with standard company HR software, CogniView will become a more secure and easy-to-use tool for businesses of all sizes.

## XI. CONCLUSION

The CogniView platform introduces a transparent, AI-augmented methodology for conducting and assessing cognitive interviews. The recruitment funnel begins with a rigorous preliminary screening via an objective aptitude examination. By implementing a mandatory performance threshold of 50

During the subsequent phase, the system leverages Natural Language Processing (NLP) to examine candidate responses.

This computational analysis provides an impartial, data-centric evaluation of an individual's linguistic clarity, logical reasoning, and cognitive structure. Unlike traditional interviews, this method mitigates human subconscious bias and ensures evaluation consistency across a large candidate pool.

Furthermore, the architecture promotes recruitment efficiency through automation while preserving essential human agency. An integrated administrative dashboard allows HR professionals to review AI-generated insights and linguistic metrics before finalizing hiring decisions. This human-in-the-loop configuration ensures that the final selection is both accountable and interpretable. Ultimately, CogniView represents a scalable, modular solution that enhances the objectivity and speed of modern talent acquisition without sacrificing fairness or ethical standards.

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