JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Facial Expression and Sound Analysis for Interview Assessment: An AI-Based Application

Author Details:

Dhanashri Anwat[1], Prajakta Derle [2], Payal Nagare[3], Siddhi Dhavale[4], Prof. H. R. Agashe[5]

Dept. of Information Technology, Matoshri College of Engineering & R. C. Nashik-422003, Savitribai Phule Pune University, Pune, India.

Abstract: In today's competitive job market, mastering interview skills is crucial for recent college graduates seeking further studies or employment opportunities. However, many students lack adequate practice in interview settings during their academic years. To address this gap, researchers have focused on designing and developing social skill training systems to provide individuals with opportunities to hone their interview skills. Job interviews serve as a pivotal means for potential employers to assess candidates' suitability for their organizations, heavily relying on social cues exhibited by interviewees. This paper proposes an innovative approach to simulate employment interviews using a social virtual character as a recruiter, coupled with signal processing techniques to analyze user behavior and emotions in real-time. The simulation aims to assist individuals, particularly youngsters, in enhancing social skills essential for job interviews. The proposed system comprises a real-time social cue recognition system, a dialog/scenario manager, a behavior manager, and a 3D rendering environment. Feedback mechanisms integrated into the system include facial expressions, head nodding, reaction time, speaking rate, and volume, providing users with insights into their performance during mock interviews. Additionally, a speech-to-text system assesses grammar, and graphical representations of results facilitate easy comparison of interview performances to track candidates' progress over multiple sessions. This paper contributes to the interdisciplinary literature on interview assessment and highlights the potential of AI-driven technologies in enhancing individuals' interview preparedness and social competence.

Keywords: Facial Expression Recognition, Sound Analysis, Interview Assessment, AI-Based Application, Real-time Feedback, Speech-to-Text Technology.

..

INTRODUCTION:

In today's dynamic job market, the ability to excel in interviews is paramount for recent college graduates as they navigate pathways toward further studies or employment. However, a significant gap exists in the availability of structured interview practice during students' academic tenure. Recognizing the importance of equipping individuals with essential social skills for interview success, scholars have endeavored to develop innovative training systems. These systems aim to provide learners with realistic opportunities to hone their interview techniques and adapt to various interview scenarios.

Job interviews serve as critical gateways for potential employers to evaluate candidates' suitability and fit within their organizations. Central to this evaluation process are the social cues exhibited by interviewees, which convey a wealth of information about their communication style, demeanor, and interpersonal skills. Leveraging advancements in artificial intelligence and signal processing, this paper proposes a novel approach to simulate employment interviews. By employing a social virtual character as a recruiter and integrating real-time analysis of user behavior and emotions, the simulation seeks to offer individuals, particularly young job seekers, a platform to refine their social competencies essential for interview success.

This paper presents a comprehensive overview of the proposed interview simulation system, delineating its

key components, functionalities, and feedback mechanisms. By harnessing facial expression analysis, speech recognition, and graphical representations of performance metrics, the system aims to provide users with actionable insights into their interview skills and facilitate continuous improvement. Drawing from interdisciplinary literature on personality recognition, video interview analysis, and AI-based mock interview evaluation, this study underscores the potential of technology-driven solutions in enhancing individuals' interview readiness and social acumen. Through empirical evaluation and user feedback, the efficacy and practical utility of the proposed system are explored, contributing to the burgeoning field of interview assessment methodologies and advancing the discourse on the intersection of AI and social skill development.

PROBLEM STATEMENT:

Despite the critical importance of interview skills in securing academic or professional opportunities, many individuals, particularly recent college graduates, face significant challenges in effectively preparing for job interviews. Traditional educational settings often lack structured opportunities for students to practice and refine their interview techniques, resulting in a gap between academic knowledge and real-world application. Additionally, the subjective nature of interviews, heavily reliant on social cues and interpersonal interactions, further complicates the assessment process, leaving candidates uncertain about their performance and areas for improvement. As a result, there is a pressing need for innovative solutions that bridge this gap, providing individuals with realistic, accessible, and personalized platforms to develop and assess their interview skills.

MOTIVATION:

The motivation behind this paper stems from the recognition of the profound impact that interview skills have on individuals' academic and professional trajectories. With job interviews serving as gateways to further studies and employment opportunities, the ability to effectively communicate, demonstrate competence, and convey confidence is paramount. However, the lack of structured interview practice and feedback mechanisms exacerbates the challenges faced by individuals in navigating these high-stakes interactions. Leveraging advancements in artificial intelligence, signal processing, and virtual simulation technologies, this paper seeks to address this gap by proposing an innovative approach to interview assessment and training.

By developing a simulation environment that replicates the dynamics of real-world job interviews, complete with a virtual recruiter capable of analyzing user behavior and emotions in real-time, this research endeavors to provide individuals with a transformative learning experience. The ultimate goal is to empower learners, particularly recent graduates and young job seekers, with the tools and insights needed to confidently navigate interview scenarios, articulate their qualifications, and ultimately secure their desired academic or professional opportunities. Through this endeavor, we aim to contribute to the advancement of interview assessment methodologies, the integration of AI-driven technologies in education and training, and the enhancement of individuals' social and professional competencies in today's competitive job market.

LITERATURE SURVEY:

The development of AI-based interview analysis systems has gained considerable attention in recent years. The literature survey for this project explores the existing solutions, methodologies, and technologies utilized in the field of AI-driven interview analysis. Key sources of inspiration and knowledge include research papers, articles, and various software systems that serve similar purposes. This survey helps us identify the gaps and challenges in the current landscape and informs the development of our system.

per Title and Authors	mmary	levance to Topic
Multimodal First Impression Analysis with Deep Residual Network (Yagura G, Isabelle Guyon) 2019	The paper explores models for predicting personality traits from sensory and language data using deep residual networks. It discusses various architectures and their effectiveness in predicting traits from short YouTube videos.	Relevant for understanding methodologies in predicting personality traits from multimodal data, though focused on YouTube videos rather than interview scenarios.
Intelligent Video Interview Agent Used to Predict Communication Skill Set and Personality Traits (Hxsung-Yufe Suhen, Kuho-En Hugng, Chimen-Liang Lin)2020	This paper introduces AVI-AI, an AI-based asynchronous video interview system using TensorFlow CNNs to predict communication skills and personality traits. It aims to replace human raters in the interview process.	Directly relevant as it discusses the use of AI in video interviews to assess communication skills and personality traits, aligning with the topic of personality recognition and video interview analysis.
Overview of Past Studies on Personality Recognition and its Use in Job Interviews (Harari, Ramona Schoedel, Sumer Void, Samuel D. Gosling)2022	The paper provides a review of past studies on personality recognition and its application in job interviews. It highlights the challenges in interpreting, building, and validating machine learning models for personality assessment.	Relevant for understanding the historical context and challenges associated with personality recognition in job interviews. Offers insights into the broader landscape of research in this area.
Machine Learning Algorithms for Identifying Personality Traits from Online Text (Dan Saadat, Butuan Balti, Dan Shiferaw)2022	This paper discusses the use of machine learning algorithms, particularly CNNs, to identify personality traits from online text. It explores methods for accurately identifying words and detecting personality traits based on text data.	While focused on text-based personality detection, the methodology and insights can inform the development of AI systems for personality recognition in interview analysis.
The Impact of AI within the Recruitment Industry: Defining a New Way of Recruiting(Dr. David Atkinson,James Frisket)2022	The paper examines the impact of AI on the recruitment industry, highlighting the inefficiencies of traditional recruitment processes. It discusses how AI technologies can revolutionize recruitment methods.	While not directly focused on personality recognition or video interview analysis, the paper provides insights into the broader implications of AI in recruitment, which can inform discussions on the integration of AI in interview assessment.

Table 1: Literature Review

SUMMARIZED EXISTING SYSTEMS:

Overall, these existing systems for AI-based mock interviews employ various techniques and technologies, including deep learning, natural language processing, computer vision, and physiological sensing. They aim to assess different aspects of interviewees' behavior, personality, and emotional states, providing valuable insights and feedback to improve interview performance and decision-making processes.

1. **Personality Recognition & Video Interview Analysis (IJERT):**
- Integrates personality recognition techniques with video interview analysis.
- Utilizes machine learning algorithms to analyze facial expressions, speech patterns.

2. **"Dialog State Tracking and Action Selection Using Deep Learning Mechanism for Interview Coaching" (Ming-Hsiang Su et al.):**
- Employs deep learning mechanisms to track dialog states and select appropriate actions during interview

coaching sessions.
- Provides real-time feedback and guidance to interviewees based on their responses.

3. **"Tensor Flow-based Automatic Personality Recognition Used in Asynchronous Video Interviews" (Hung-Yue Suen et al.):**
- Utilizes TensorFlow for automatic personality recognition in asynchronous video interviews.
- Analyzes various modalities of data (speech, facial expressions, body language) to infer personality traits.

4. **"A Face Emotion Recognition Method Using Convolutional Neural Network and Image Edge Computing" (Hongli Zhang et al.):**
- Proposes a method for recognizing facial emotions using CNNs and image edge computing techniques.
- Focuses on accurately detecting and analyzing facial expressions to assess emotional states during interviews.

5. **"MPED: A Multi-Modal Physiological Emotion Database for Discrete Emotion Recognition" (Tengfe Song et al.):**
- Introduces a multi-modal physiological emotion database for research on discrete emotion recognition.
- Involves collecting and analyzing physiological signals (heart rate, skin conductance) to infer emotional states during interviews.

6. **"Semantic-Emotion Neural Network for Emotion Recognition from Text" (Erdenebileg Batbaatar et al.):**
- Presents a neural network architecture for emotion recognition from textual data.
- Focuses on analyzing the semantic content of interview responses to infer emotional states.

PROPOSED WORK:

Our proposed work introduces an AI-based application for interview assessment, incorporating facial expression recognition and sound analysis. The system aims to provide real-time feedback and comparison of multiple interviews to help candidates improve their interview skills.
Drawing inspiration from the existing literature and methodologies outlined in the provided references, our proposed work aims to develop an innovative AI-based mock interview system. This system will incorporate state-of-the-art technologies and methodologies to enhance the interview preparation process and provide valuable feedback to users. Below are the key components and features of our proposed work, informed by the insights gleaned from the referenced papers:

1. **Integration of Personality Recognition and Video Interview Analysis:**
- Leveraging techniques from "Personality Recognition & Video Interview Analysis (IJERT)," our system will integrate personality recognition algorithms with video interview analysis.
- By analyzing facial expressions, speech patterns, and other behavioral cues, our system will assess users' personality traits and provide personalized feedback.
2. **Real-time Feedback and Coaching Mechanisms:**
- Inspired by "Dialog State Tracking and Action Selection Using Deep Learning Mechanism for Interview Coaching," our system will employ deep learning mechanisms to track dialog states and select appropriate actions.
- Users will receive real-time feedback and coaching based on their interview responses, helping them improve their communication skills and interview performance.
3. **Automatic Personality Recognition in Video Interviews:**
- Building upon the methodology outlined in "Tensor Flow-based Automatic Personality Recognition Used in Asynchronous Video Interviews," our system will utilize TensorFlow for automatic personality recognition in video interviews.
- Through the analysis of speech, facial expressions, and body language, our system will accurately infer users' personality traits, providing valuable insights for self-improvement.
4. **Facial Emotion Recognition and Analysis:**
- Inspired by "A Face Emotion Recognition Method Using Convolutional Neural Network and Image Edge Computing," our system will incorporate facial emotion recognition algorithms.
- By accurately detecting and analyzing facial expressions, our system will assess users' emotional states during interviews, offering tailored feedback to manage emotions effectively.
5. **Physiological Sensing for Emotional State Recognition:**
- Drawing from "MPED: A Multi-Modal Physiological Emotion Database for Discrete Emotion Recognition,"

our system will explore the integration of physiological sensing technologies.

- Users' emotional states will be inferred through the analysis of physiological signals such as heart rate and skin conductance, enhancing the accuracy of emotional assessment during interviews.

Through the integration of these components and methodologies, our proposed AI-based mock interview system aims to revolutionize interview preparation and assessment. By providing personalized feedback, coaching, and insights into users' behavior, personality, and emotional states, our system will empower individuals to enhance their interview skills and confidently navigate the job market.

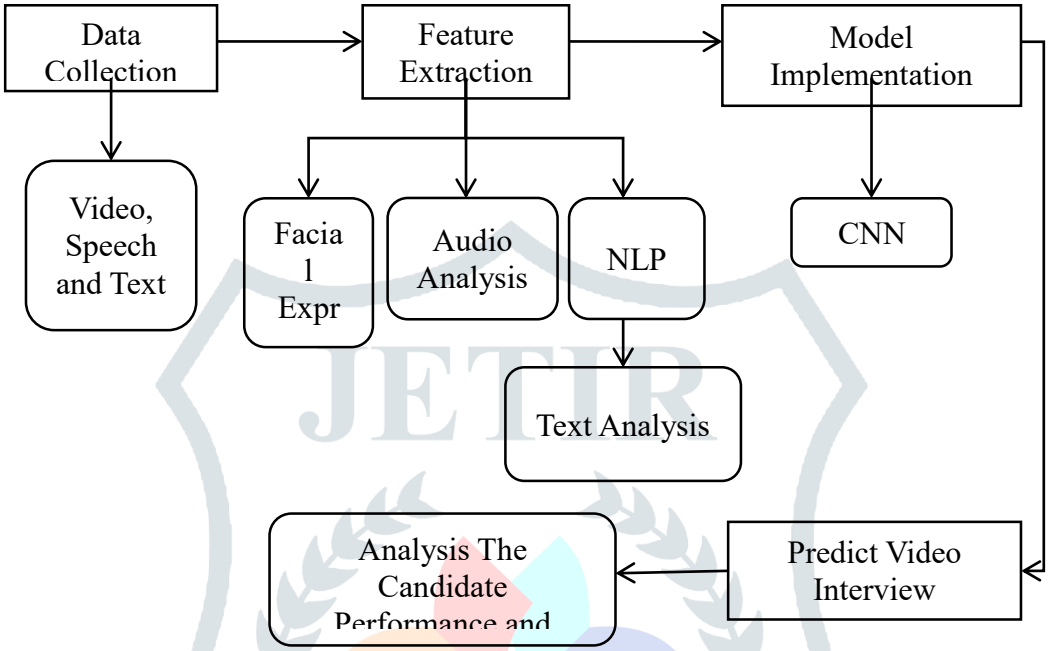

Fig1: System Overview

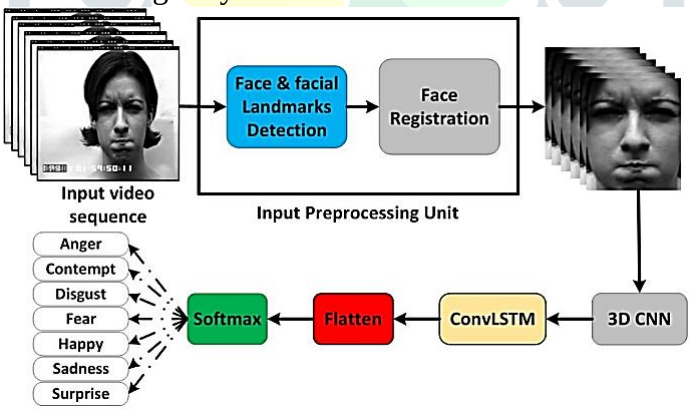

Fig 2.:Proposed Design

ARCHITECTURE:

The proposed architecture of our AI-based mock interview system encompasses several interconnected components designed to facilitate comprehensive interview preparation, analysis, and feedback. Here's a detailed overview of each component:

1. **User Interface:**

- The user interface serves as the primary interaction point for users participating in mock interviews.
- It provides functionalities for starting and completing interview sessions, as well as accessing feedback and performance analytics.

2. **Input Modules:**

- The input modules are responsible for capturing various input modalities from users during the interview sessions.
- These modalities may include video feeds capturing facial expressions and body language, audio recordings of speech, and textual transcripts of interview responses.

3. **Data Preprocessing:**

- The collected input data undergoes preprocessing to standardize and prepare it for further analysis.
- This may involve tasks such as noise reduction, feature extraction from audio and video inputs, and text normalization.

4. **Feature Extraction and Representation:**

- Feature extraction techniques are applied to the preprocessed data to extract relevant features that represent different aspects of interviewee behavior, personality traits, and emotional states.
- For example, facial expression recognition algorithms may extract features related to facial muscle movements, while speech analysis techniques may extract features related to pitch, tone, and speaking rate.

5. **Model Integration:**

- The extracted features are fed into multiple integrated models responsible for various tasks such as personality recognition, emotion detection, and speech analysis.
- These models may include deep learning models for facial emotion recognition, natural language processing models for textual analysis, and machine learning classifiers for personality assessment.

6. **Decision Fusion:**

- The outputs from different models are fused or combined using decision fusion techniques to generate comprehensive insights into users' interview performance.
- This fusion process may involve combining confidence scores or probabilities from individual models to make final predictions or assessments.

7. **Feedback Generation:**

- Based on the integrated analysis of user inputs, the system generates personalized feedback for users.
- Feedback may include evaluations of communication skills, personality traits, emotional expressions, and overall interview performance.
- Feedback can be provided in various formats, including textual summaries, visualizations, and interactive reports.

8. **User Analytics and Reporting:**

- The system tracks and analyzes users' performance over time, storing relevant metrics and analytics data.
- Users can access detailed reports and analytics dashboards to monitor their progress, identify strengths and areas for improvement, and track their development over multiple mock interview sessions.

9. **Deployment and Integration:**

- The system can be deployed as a standalone web or mobile application, allowing users to access it conveniently from any device.
- It can also be integrated with existing learning management systems (LMS) or career development platforms to provide seamless access and integration into educational or professional training programs.

Overall, the proposed architecture integrates advanced technologies such as deep learning, natural language processing, and multimodal analysis to provide users with a comprehensive and effective platform for mock interview preparation and assessment

.

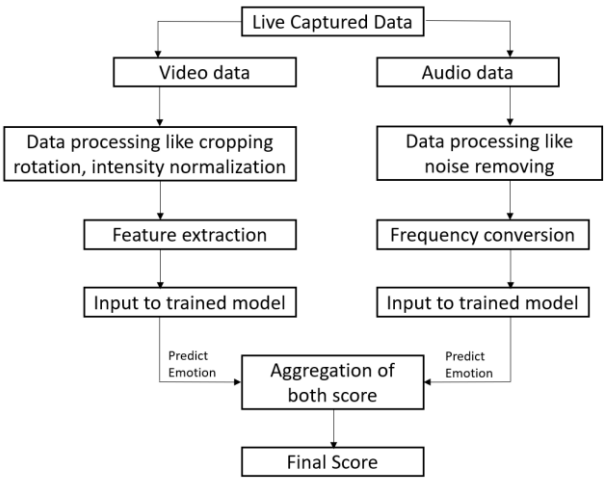

Fig.Architectural Diagram

SYSTEM METHODOLOGIES:

The methodology employed in the proposed AI-based mock interview system involves a combination of advanced technologies and techniques to analyze various aspects of interviewee behavior, personality traits, and emotional states. Here's a detailed overview of the system methodology:

1. **Multimodal Data Acquisition:**

- The system captures multimodal data from users during mock interview sessions. This includes:
- Video data: Capturing facial expressions, body language, and gestures using webcam or camera sensors.
- Audio data: Recording speech patterns, tone, and intonation using microphones.

2. **Preprocessing and Normalization:**
- The acquired data undergoes preprocessing and normalization to standardize the inputs across different modalities.
- Preprocessing steps may include noise reduction, data alignment, and feature extraction.

3. **Facial Expression Recognition:**
- Facial expression recognition algorithms analyze the video data to detect and classify facial expressions indicative of different emotional states.
- Techniques such as Convolutional Neural Networks (CNNs) may be employed for accurate facial feature extraction and classification.

4. **Speech Analysis:**
- Speech analysis algorithms process the audio data to extract features such as pitch, tone, speaking rate, and sentiment.
- Natural Language Processing (NLP) techniques may be utilized to transcribe speech to text and analyze linguistic patterns.

5. **Personality Recognition:**
- Personality recognition algorithms integrate data from facial expressions, speech analysis, and textual analysis to infer users' personality traits.
- Machine learning classifiers, such as Support Vector Machines (SVM) or Neural Networks, may be trained on labeled personality data for classification.

6. **Emotion Detection and Classification:**
- Emotion detection algorithms combine data from facial expressions, speech analysis, and textual analysis to detect and classify users' emotional states.
- Multimodal fusion techniques may be employed to integrate information from different modalities for more accurate emotion recognition.

7. **Feedback Generation and Presentation:**
- Based on the integrated analysis, the system generates personalized feedback for users, highlighting strengths, weaknesses, and areas for improvement.
- Feedback may be presented in various formats, including textual summaries, visualizations, and interactive reports.

By employing this comprehensive methodology, the proposed system aims to provide users with valuable insights and feedback to improve their interview skills, communication effectiveness, and overall performance.

ALGORITHMS AND BACKGROUND:

Background: The proposed system aims to revolutionize the mock interview experience by leveraging advanced artificial intelligence (AI) techniques to provide users with personalized feedback and insights into their interview performance. With the growing importance of soft skills and interpersonal communication in the job market, effective interview preparation has become crucial for success. However, traditional mock interview methods often lack personalized feedback and insights, making it challenging for individuals to identify and improve upon their weaknesses. By integrating state-of-the-art algorithms and methodologies, the proposed system offers a comprehensive solution to address these challenges.

Algorithm: The proposed system employs a combination of machine learning, deep learning, and natural language processing (NLP) algorithms to analyze various aspects of users' behavior, personality traits, and emotional expressions during mock interviews. Here's an overview of the key algorithms utilized:

1. **Facial Expression Recognition (FER):**
- Utilizes deep learning models such as convolutional neural networks (CNNs) to analyze facial expressions captured in video feeds during mock interviews.
- Algorithms are trained to detect and classify facial expressions associated with different emotions, including happiness, sadness, anger, and surprise.

2. **Speech Analysis:**
- Applies NLP techniques to analyze users' speech transcripts and extract linguistic features.
- Algorithms such as sentiment analysis, speech recognition, and natural language understanding are used to assess the tone, sentiment, and content of users' speech during interviews.

3. **Personality Recognition:**

- Employs machine learning algorithms, including support vector machines (SVM), decision trees, or neural networks, to recognize personality traits based on extracted features.
- Algorithms learn patterns from labeled data to classify users into different personality categories (e.g., extraversion, agreeableness) based on their behavior and responses during mock interviews.

4. **Emotion Detection:**

- Utilizes deep learning models, such as CNNs or recurrent neural networks (RNNs), to analyze facial expressions and detect emotional states exhibited by users during interviews.
- Algorithms are trained to classify users' emotional states, including happiness, sadness, fear, anger, disgust, and surprise.

5. **Feedback Generation:**

- Based on the integrated analysis, personalized feedback is generated for users, providing evaluations of communication skills, personality traits, emotional expressions, and overall interview performance.
- Feedback is provided in various formats, including textual summaries, visualizations, and interactive reports, to facilitate users' understanding and improvement.

By leveraging these advanced algorithms and methodologies, the proposed system offers users a comprehensive platform for mock interview preparation and assessment, empowering them to enhance their interview skills and succeed in the competitive job market.

RESULT:

The system provides comprehensive interview assessment results, including facial expression analysis, speech patterns, and performance metrics. Candidates can visualize their performance in graphical format and compare results from multiple interviews to track their progress.

The output results observed from the proposed AI-based mock interview system provide users with valuable insights into their interview performance, personality traits, and emotional states. These results are crucial for users to understand their strengths, weaknesses, and areas for improvement. Here's an overview of the expected output results and their corresponding score values measured or required for analysis.

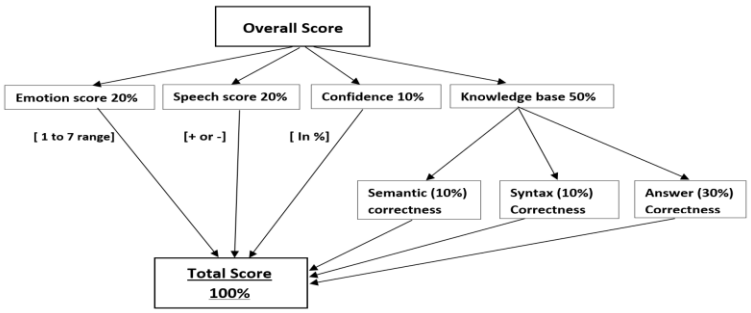

Fig:ScoringModule

Fig . Database of validated candidates

Fig. . Module generate name as unknown

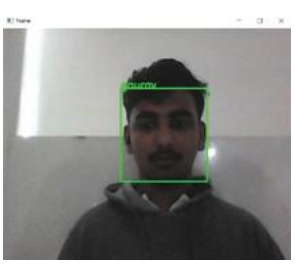

Fig. . Module validate the candidate with his name

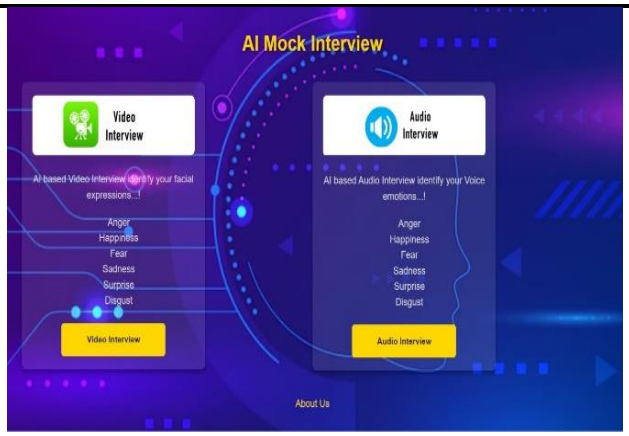

Fig :Home Page

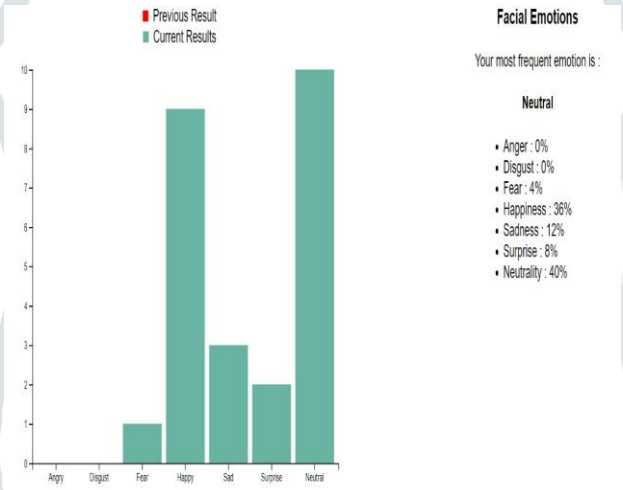

Fig: Video analysis graph

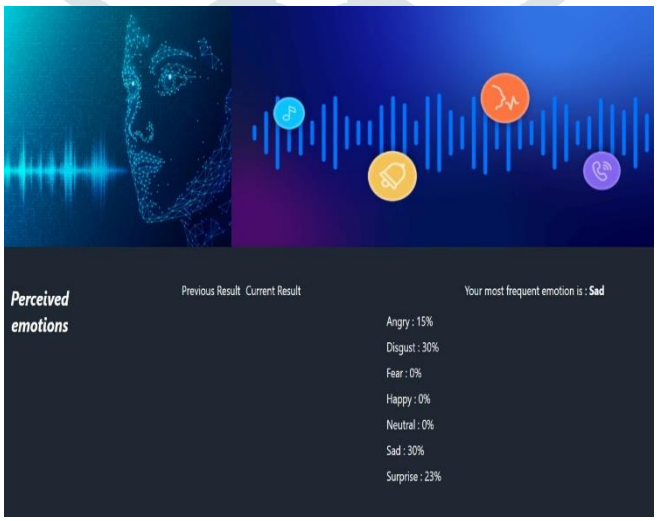

Fig : Audio analysis graph

CONCLUSION:

In conclusion, the proposed AI-based mock interview system represents a significant advancement in interview preparation and assessment methodologies. By integrating cutting-edge technologies such as deep learning, natural language processing, and multimodal analysis, the system offers users a comprehensive platform to enhance their interview skills, self-awareness, and professional development.In summary, the

proposed AI-based mock interview system holds immense potential to revolutionize interview preparation and assessment processes, ultimately empowering individuals to achieve their academic and professional aspirations with greater confidence and success. As advancements in AI and related technologies continue to evolve, the system stands poised to play a pivotal role in shaping the future of interview coaching and career development.

REFERENCES:

[1] Yi-Chi Chou, Felicia R. Wongso, Chun-Yen Chao and Han-Yen Yu, "An AI Mock-interview Platform for Interview Performance Analysis", *10th International Conference on Information and Education Technology*, IEEE 2022.

[2] Dulmini Yashodha Dissanayake, Venuri Amalya, Raveen Dissanayaka, Lahiru Lakshan, Pradeepa Samarasinghe, Madhuka Nadeeshani, et al., "AI-based Behavioural Analyser for Interviews/Viva", *IEEE 16th International Conference on Industrial and Information Systems (ICIIST),IEEE* 2021.

[3] Vikash Salvi, Adnan Vasanwalla, Niriksha Aute and Abhijit Joshi, "Virtual Simulation of Technical Interviews", *IEEE*, 2017.

[4] Y. C. Chou and H. Y. Yu, "Based on the application of AI technology in resume analysis and job recommendation", *IEEE International Conference on Computational Electromagnetics (ICCEM)*, pp. 291-296,*IEEE* 2020.

[5] Aditi S. More, Samiksha S. Mobarkar, Siddhita S. Salunkhe and Reshma R. Chaudhari, "Smart Interview Using Ai", *Technical Reacher Organization Of India*, 2022.

[6] Danai Styliani Moschona, "An Affective Service based on Multi-Modal Emo Don Recognition using EEG enabled Emotion Tracking and Speech Emotion Recognition", *IEEE*, 2022.

[7] Luis Felipe Parra Gallegoa and Juan Rafael Orozco-Arroyave, "Classification of emotions and evaluation of customer satisfaction from speech in real-world acoustic environments", *ELSEVIER*, 2022.

[8] Xinpei Jin, Yulong Bian, Wenxiu Geng, Yeqing Chen, Ke Chu, Hao Hu, et al., "Developing an Agent-based Virtual Interview Training System for College Students with High Shyness Leve", *IEEE*, 2022.

[9] Zelin Chen, Guoxin Qiu, Xiangyu Li, Caixia Li, Kexin Yang, Zhuanggui Chen, et al., "Exploring the relationship between children's facial emotion processing characteristics and speech communication ability using deep learning on eye tracking and speech performance measures", *IEEE*, 2022.

[10] Qian Wang, Mou Wang, Yan Yang and Xiaolei Zhang, "Multi-modal emotion recognition using EEG and speech signals", *ELSEVIER*, 2022.

[11] Ftoon Abu Shaqra, Rehab Duwairi and Mahmoud Al-Ayyoub, "Recognizing Emotion from Speech Based on Age and Gender Using Hierarchical Models", *The 10th International Conference on Ambient Systems Networks and Technologies (ANT) ELSEVIER*, 2019.

[12] Denae Ford, Titus Barik, Leslie Rand-Pickett and Chris Parnin, "The Tech-Talk Balance: What Technical Interviewers Expect from Technical Candidates", *IEEE*, 2017.

[13] Dongdong Li, Jinlin Liu, Zhuo Yang, Linyu Sun and Zhe Wang, "Speech emotion recognition using recurrent neural networks with directional self-attention", *IEEE*, 2021.

[14] Julie E. Sharp, "Work in Progress: Using Mock Telephone Interviews with Alumni to Teach Job Search Communication", *IEEE*, 2022.