SIDDAGANGA INSTITUTE OF TECHNOLOGY, TUMAKURU-572103

(An Autonomous Institute under Visvesvaraya Technological University, Belagavi)

Project Report on

"AI-Enhanced Interview Monitoring and Personality Analysis"

submitted in partial fulfillment of the requirement for the award of the degree of

BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE & ENGINEERING
Submitted by

Batch No: 45

Sagar M N   (1SI20CS095)

Venkatesha S   (1SI20CS127)

Yuktish R   (1SI20CS134)

under the guidance of

Dr. Sahana Lokesh R

Assistant Professor

Department of CSE

SIT, Tumakuru-03

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

2023-24

SIDDAGANGA INSTITUTE OF TECHNOLOGY, TUMAKURU-572103

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

CERTIFICATE

Certified that the project work entitled "AI-Enhanced Interview Monitoring and Personality Analysis" is a bonafide work carried out by Sagar M N (1SI20CS095), Venkatesha S (1SI20CS095) and Yukthish R(1SI20CS134)in partial fulfillment for the award of degree of Bachelor of Engineering in Computer Science & Engineering from Siddaganga Institute of Technology, an autonomous institute under Visvesvaraya Technological University, Belagavi during the academic year 2023-24. It is certified that all corrections/suggestions indicated for internal assessment have been incorporated in the report deposited in the department library. The Project report has been approved as it satisfies the academic requirements in respect of project work prescribed for the Bachelor of Engineering degree.

Dr. Sahana Lokesh R   Prof. N R Sunitha   Prof. S V Dinesh

Project Guide   Head of the Department   Principal

Assistant Professor   Dept. of CSE   SIT,Tumakuru-03

Dept. of CSE   SIT,Tumakuru-03

SIT,Tumakuru-03

External viva:

Names of the Examiners   **Signature with date**

1.

2.

ACKNOWLEDGEMENT

Abstract

The AI-enhanced Interview Monitoring and Personality Analysis System is a revolutionary project designed to transform the traditional work experience in response to the needs of the evolving recruitment space. At a time when technological progress intersected with increasing demands for streamlined processes, this project sought to address the limitations of traditional automated platforms. Created by the ability to predict a candidate's personality, assess confidence levels, and conduct extensive video and audio analysis, the project aims to provide recruiters with a versatile tool to assess candidates. The main goal is to overcome the limitations of existing automated interview platforms by offering a complete understanding of the candidate that goes beyond superficial boundaries. The recruitment process, especially in a mass recruitment scenario, has many challenges in maintaining the quality of assessment. The AI-powered Interview Monitoring and Personality Analysis System is strategically designed to streamline the high-level recruitment process, ensuring the quality of candidate assessment remains unmatched.The AI-powered Interview Monitoring and Personality Analysis System stands as a testament to innovation in the recruitment industry. By combining advanced technology with a nuanced understanding of human behavior, it promises to revolutionize the way organizations identify and select top talent, ultimately driving success and growth in an increasingly competitive business landscape.the AI-powered Interview Monitoring and Personality Analysis System stands as a testament to innovation in the recruitment industry.

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Chapter 1

Introduction

Presenting AI-enhanced Interview Monitoring and Personality Analysis, a cutting-edge add-on for automated interview systems that distinguishes itself with a special fusion of cutting-edge functionalities. Our AI-enhanced technology uses machine learning to anticipate personalities, gauge confidence, and perform in-depth video and audio analysis, in contrast to traditional solutions. Recruiters can gain more information into prospects with this multifaceted approach than with traditional automated interview systems.

AI-enhanced Personality Analysis and Interview Monitoring puts the standard of candidate evaluation above everything else, not only expediting the large-scale hiring process. Designed with HR experts in mind, the straightforward interface is a useful tool for handling the complexities of high-volume hiring. Our system's proactive approach to preserving the integrity of the hiring process is one of its unique features. It comprises identifying instances of malpractice, offering extra assurance, improving the correctness and dependability of applicant evaluations, and protecting against dishonest business activities.

AI-enhanced Interview Monitoring and Personality Analysis differs from the conventional resume-centric approach by producing thorough candidate profile summaries and succinct insights. Recruiters can quickly and thoroughly review this report, which summarises important details like personality traits, experience, and skills. It's more than just an automated interview system; it's a revolution in hiring practices. Thanks to its distinctive features, which include advanced personality prediction and malpractice detection, recruiting teams looking for efficiency, accuracy, and a deep understanding of each candidate will find it to be a valuable tool. Introducing AI-enhanced Interview Monitoring and Personality Analysis—a recruiting revolution where innovation and dependability combine to create high-achieving teams.

1.1 Motivation

This platform was born from a collective decision to transform traditional recruiting practices to address the changing challenges faced by HR and recruiting teams. The main motivation is to be efficient and fast, solving long-term problems that require time-consuming processes and energy, especially when dealing with a large number of competitors.

In addition, the project was carried out with awareness of the limitations of traditional measurement methods. The integration of machine learning to predict and understand the candidate's behavior, especially through the behavioral aspects, demonstrates that the project transcends the need to provide a better understanding of the person.

Additionally, the project aims to simplify the complexity of the application process for human resources. The project aims to provide decision makers with the necessary tools to make meaningful decisions, instead of knowing their hiring options, by creating comprehensive and visual content that includes intelligence, personality and analysis.

Finally, being aware of the important role of communication in the recruitment process, this service works to close the communication gap. One-click email and phone functionality is designed to facilitate seamless communication between interviewers and candidates, expedite updates on selection or rejection, and streamline follow-up meeting processes. This holistic work serves as a catalyst for positive transformation and offers solutions to many challenges in today's talent recruitment.

1.2 Objectives of the project

1. The project introduces an automated interviewing tool that streamlines the interview process, including tracking and monitoring

2. Employs machine learning and video/voice analysis for a comprehensive personality and confidence assessment of candidates.

3. Easy communication by enabling one-click email communication with candidates, thereby facilitating quick hiring in large numbers.

4. For serving as a valuable assistant for HR/Recruiting teams by providing concise insights and summaries of candidate profiles.

Chapter 2

Literature Survey

[1] Implementation of an Intelligent Exam Supervision System Using Deep Learning Algorithms.

Authors: Mahmood F, Arshad J, Ben Othman MT, Hayat MF, Bhatti N, Jaffery MH, Rehman AU, Hamam H.

The implementation of an Intelligent Exam Supervision System using deep learning algorithms presents several advantages. Firstly, it offers an innovative solution to combat cheating during exams by leveraging advanced technologies such as deep learning. With a reported accuracy rate of around 99.5%, the system demonstrates high accuracy in detecting cheating behavior, ensuring the integrity of the examination process.

Merits: the system is designed to handle large groups of students, making it suitable for use in classrooms or exam halls with a high number of examinees. Moreover, the system provides real-time monitoring capabilities, enabling immediate intervention to prevent cheating as it occurs. By effectively curbing cheating, this system has the potential to foster fairness in exams, ensuring that students are evaluated based on their own abilities rather than unfair advantages gained through dishonest means.

Demerits: However, the implementation of such a system also raises several concerns. Firstly, there are privacy considerations associated with the constant monitoring of students during exams, leading to potential apprehensions regarding invasion of privacy. Additionally, despite its high accuracy, there is still a possibility of the system making mistakes, either by wrongly accusing innocent students of cheating or failing to detect instances of cheating. Furthermore, there are significant technical challenges involved in setting up and operating the system, including cost considerations that may render it inaccessible to some educational institutions. Moreover, the effectiveness of the system may vary across different types of classrooms or exam settings, raising questions about its applicability in diverse environments. Lastly, while the system provides automated monitoring, human oversight by teachers or invigilators remains essential to ensure the smooth conduct of exams and address any unforeseen issues that may arise.

[2] A Systematic Review on AI-based Proctoring Systems: Past, Present, and Future.

Authors: Aditya Nigam, Rhitvik Pasricha, Tarishi Singh & Prathamesh Churi.

A Systematic Review on AI-based Proctoring Systems provides a comprehensive examination of both AI-based and conventional online proctoring systems, offering insights into various aspects of these technologies.

Merits: The review delves into significant issues such as security, privacy, and ethics in online proctoring, highlighting their importance in ensuring fairness and trustworthiness. By encompassing AI systems alongside other existing systems, the review offers a holistic view of the current landscape of online proctoring, providing readers with a thorough understanding of the subject matter. Furthermore, the review identifies emerging technologies and trends that have the potential to shape the future of online education and proctoring practices.

Demerits: However, the review may have limitations in its coverage, as it only spans from 2015 to 2021, potentially missing newer research or industry developments. Moreover, there might be a bias towards highlighting problems with AI-based proctoring systems, which could result in an incomplete portrayal of the overall picture. Additionally, while the review addresses ethical concerns related to online proctoring, it may lack depth in its discussion and fail to propose clear solutions to address these issues. Lastly, the review may not introduce many new ideas or innovative solutions, focusing more on existing research findings without offering significant contributions in terms of novel approaches or methodologies.

[3] Smart Online Exam Invigilation using AI-based Facial Detection and Recognition Algorithms.

Authors: Thampan, Navya and Arumugam, Senthil and A, Sasikala.

The system offers several advantages in the realm of online exam administration. Firstly, it serves as an effective deterrent against cheating during online exams by employing facial detection and recognition technology, thereby minimizing opportunities for unfair practices.

Merits: It enhances the exam enrollment process by simplifying administrative tasks and

ensuring a secure testing environment for participants. Utilizing state-of-the-art technology, such as facial detection algorithms, the system ensures precise identification and monitoring of exam participants, contributing to its efficiency and reliability. Moreover, the system automates the invigilation process, allowing for simultaneous monitoring of multiple students and optimizing the workload of human invigilators for other essential exam management tasks. By establishing a fair and secure testing environment, the system promotes equity in evaluation, ensuring that student abilities are the sole basis for assessment.

Demerits: Despite its benefits, the system also presents several challenges and concerns. Firstly, its implementation and maintenance require specialized hardware, software, and expertise in facial recognition algorithms, adding to the technical complexity of its deployment. Furthermore, the storage and processing of student facial data raise potential privacy and security risks, including unauthorized access or misuse, posing significant privacy concerns. Additionally, despite advanced algorithms, the system may encounter accuracy issues, such as false positives or negatives, which could compromise its reliability and effectiveness in detecting cheating behavior. Moreover, the setup and maintenance of the system may impose a considerable financial burden on institutions with limited budgets, limiting its accessibility. Lastly, constant surveillance during exams raises ethical considerations regarding student consent, autonomy, and the acceptability of such monitoring methods.

[4] Design of a Voice Activity Detection Algorithm based on Logarithmic Signal Energy.

Author: Selma Ozaydin.

The method presented in this study introduces a novel approach to calculating signal energies in voice activity detection algorithms, potentially increasing accuracy. By adapting the mu-law signal compression method for energy calculation, the study offers a fresh perspective that could lead to more efficient detection.

Merits: The proposed voice activity detection (VAD) algorithm is characterized by its simplicity, making it easy to implement and comprehend. Demonstrating improved detection accuracy, especially in noisy environments with low signal-to-noise ratio (SNR), the method shows promise for real-world applications. The study further enhances its

applicability by testing the algorithm with various types of background noise, such as those found in restaurants, vehicles, and streets.

Demerits: Despite its merits, the evaluation of the algorithm primarily focuses on short-term energy properties, potentially neglecting other crucial aspects of VAD performance. Additionally, while the method outperforms two conventional energy calculation formulas, a broader comparison with state-of-the-art VAD algorithms could provide a more comprehensive assessment of its effectiveness. The study's testing of the algorithm with various background sounds may not encompass all possible environmental conditions, raising concerns about its robustness in unforeseen scenarios. Furthermore, the implementation of the algorithm, despite its simplicity, may pose challenges due to the added complexity of adapting mu-law compression, requiring additional computing resources or expertise. Lastly, while effective at low SNR levels, the algorithm's performance at higher SNR levels remains uncertain, necessitating further investigation for comprehensive applicability.

[5] AI-based Behavioural Analyser for Interviews/Viva.

Authors: Dulmini Yashodha Dissanayake, Venuri Amalya, Raveen Dissanayaka & Lahiru Lakshan.

The AI-based Behavioral Analyzer for Interviews/Viva presents a new approach to the assessment of interviewee behavior and personality traits using machine-based techniques. By focusing on non-verbal cues such as emotions, eye movements, smiles and head movements, the system offers a comprehensive analysis of interviewees' behavior.

Merits: Thanks to the use of deep learning and machine learning models, the system achieves high accuracy in analyzing these stimuli, which indicates its effectiveness. Additionally, the system goes beyond mere behavioral analysis by developing machine learning models to identify the Big Five personality traits with a remarkable degree of accuracy. These findings have practical implications for recruitment processes and provide valuable information for candidate evaluation.

Demerits: However, reliance on nonverbal cues to assess personality may overlook important aspects of verbal communication, leading to biased assessments. The analysis takes into account primarily non-verbal cues in the interview setting, neglecting external factors or individual differences that may influence behavior. Ethical concerns arise regarding privacy, consent, and potential biases in algorithmic decision-making when using

machine-based approaches to personality assessment. In addition, system effectiveness may vary across populations and interview contexts, making generalizations challenging. Finally, interpreting nonverbal cues and translating them into accurate personality assessments requires expertise, which increases the complexity of practical implementation and interpretation.

[6] AI-Based mock interview evaluator: An emotion and confidence classifier model.

Authors: Rubi Mandal, Pranav Lohar, Dhiraj Patil, Apurva Patil and Suvarna Wagh.
The AI-based mock interview evaluator offers a comprehensive assessment of candidates by evaluating their emotions, confidence levels, and knowledge base, providing a holistic view of their readiness for real interviews.

Merits: Utilizing deep learning CNN algorithms for facial expression analysis, the system accurately classifies emotions into seven categories, offering valuable insights into candidates' emotional states. Additionally, speech recognition techniques, coupled with natural language processing, assess candidates' confidence levels based on speech patterns, enhancing the evaluation process. The platform also incorporates keyword mapping and semantic analysis to objectively evaluate candidates' knowledge base by extracting relevant keywords from their responses and mapping them to online resources. Moreover, by simulating real interview scenarios and providing constructive feedback, the platform helps candidates alleviate stress and anxiety while boosting their confidence and communication skills.

Demerits: However, the effectiveness of the platform heavily relies on the accuracy and reliability of underlying technologies, such as facial expression analysis and speech recognition, which may introduce errors or biases. Furthermore, while the platform assesses emotions, confidence, and knowledge, it may overlook other crucial aspects such as critical thinking or problem-solving abilities, essential for interview success. Automated assessment methods could inadvertently introduce bias, leading to unfair evaluations based on factors like accent or cultural differences. Implementing and maintaining the platform requires significant computational resources and expertise in machine learning and natural language processing, making it resource-intensive. Lastly, while the platform provides valuable feedback, it cannot fully replicate the nuanced interactions and personalized

insights offered by human interviewers, potentially missing out on valuable coaching opportunities.

[7] Intelligent video interview agent used to predict communication skill and perceived personality traits.

Authors: Hung-Yue Suen, Kuo-En Hung and Chien-Liang Lin.

The application of an intelligent video interview agent to predict communication skills and personality traits marks a pioneering use of artificial intelligence in recruitment processes.

Merits: This innovative approach enhances efficiency, as the asynchronous video interview (AVI) platform with AI decision agent can expedite the initial stage of employment screening by partially replacing human raters, potentially saving time and resources. Leveraging a TensorFlow convolutional neural network (CNN), the AVI-AI system demonstrates remarkable accuracy in predicting job candidates' communication skills and certain personality traits, as perceived by experienced human resource professionals. Moreover, the system provides a comprehensive assessment by accurately predicting candidates' interpersonal communication skills and traits such as openness, agreeableness, and neuroticism, thereby offering valuable insights for recruitment decisions. The reliability of the system's predictions is reinforced by interrater reliability values, affirming the validity of its assessments.

Demerits: But the system encounters challenges in accurately predicting certain personality traits such as conscientiousness and extraversion. Additionally, variations in human perception may not be fully accounted for by the system, potentially leading to discrepancies in predictions. Furthermore, the AI may lack a complete understanding of the contextual nuances present in interviews compared to humans, which can affect prediction accuracy. The effectiveness of the system heavily relies on the quality and biases present in the training data, posing a dependency issue. Moreover, the use of AI in recruitment raises ethical concerns regarding fairness, transparency, and potential bias, necessitating careful oversight and consideration of ethical implications.

[8] Application of Adversarial Domain Adaptation to Voice Activity Detection.

Authors: TaeSoo Kim and Jong Hwan Ko.

The application of adversarial domain adaptation to Voice Activity Detection (VAD) offers several advantages. Firstly, it enhances the robustness of the VAD system by improving its ability to detect speech regions in noisy environments characterized by diverse noise types and low signal-to-noise ratios (SNR).

Merits: This approach combines supervised learning for training Deep Neural Network (DNN) models with unsupervised learning to address area mismatch between noisy and clean audio streams, resulting in more effective detection. The experimental validation conducted in the study demonstrates that the proposed method outperforms other DNN-based models trained with hand-crafted acoustic features, indicating its effectiveness in improving detection performance in noisy environments.

Demerits: However, there are also limitations associated with the implementation of adversarial domain adaptation in VAD. Firstly, this approach may introduce complexity to the VAD system, necessitating additional computational resources and expertise for implementation. Additionally, the effectiveness of the proposed method heavily relies on the quality and representativeness of the training data, which may introduce biases and affect performance in real-world scenarios. Furthermore, the paper's focus specifically on the application of adversarial domain adaptation to VAD may overlook other factors that could impact performance, such as speaker variability or background noise characteristics.

[9] is An Automated System for the Assessment of Interview Performance through Audio and Emotion Cues.

Authors: Priya Kanna, S. Mohamed Mansoor Roomi, P. Shanmugavadivu, M. G. Sethuraman and P. Kalaivani.

The system provides several advantages in the realm of interview performance assessment. Firstly, it automates the analysis and evaluation process, alleviating the time and effort required by human assessors.

Merits: By integrating both facial expressions from visual frames and audio cues, it offers a comprehensive assessment of interviewee performance through multimodal signal integration. Moreover, the system conducts emotion analysis, enabling a deeper understanding

of the interviewee's non-verbal communication cues, thereby enhancing the assessment process. Utilizing advanced feature extraction techniques like Histogram of Oriented Gradients (HOG) and Mel Frequency Cepstral Coefficients (MFCC) ensures accurate extraction from visual and audio cues. Additionally, the system provides performance ratings, categorizing performance as poor, medium, or high, facilitating decision-making during recruitment.

Demerits: Despite its advantages, the system has several limitations. Firstly, its ability to classify complex emotions may be limited, potentially overlooking subtleties in expression beyond basic categories. Moreover, the system's reliance on technical infrastructure for video capturing and processing may not be feasible in all interview settings. Additionally, automated analysis may fail to capture the context and nuances of interview interactions, leading to potential biases or inaccuracies in performance assessment. Furthermore, the system's sole reliance on facial expressions and audio cues may overlook other crucial aspects of interview performance, such as body language or tone of voice. Lastly, complete automation may result in a lack of human oversight, potentially missing subjective insights that human assessors can provide.

[10] Automation of HR Interview System using JESS Inference Engine.

Authors: Kush Kumar, Abhay Kumar, Kumar Abhishek & D.K. Singh.

Automation of the HR interview process using the JESS Inference Engine offers several advantages. Firstly, it enhances decision-making efficiency by deriving conclusions from existing data and executing actions based on predefined rules.

Merits: This can lead to quicker and more accurate decisions during interviews. Secondly, inference engines like JESS are adaptable and capable of learning over time, improving their accuracy and ability to handle complex scenarios, which is crucial for developing intelligent software systems. Additionally, automating the HR interview process saves time for both interviewers and candidates by streamlining repetitive tasks and decision-making processes. Moreover, using a structured approach based on predefined rules ensures standardization in the interview process, promoting consistency and fairness across all interviews. Lastly, the scalability of the system allows it to efficiently handle a large volume of interviews without compromising accuracy.

Demerits: However, there are certain drawbacks to automating the HR interview process

using the JESS Inference Engine. Firstly, the initial setup and configuration of the JESS Inference Engine may be complex and require technical expertise and time investment. Users unfamiliar with JESS or inference engines may face a learning curve in understanding how to effectively utilize its features. Additionally, the accuracy of the automated HR interview system heavily depends on the quality and relevance of the data fed into the inference engine, highlighting the importance of data quality. Furthermore, if not carefully designed and trained, the automated system may inherit biases present in the training data, potentially leading to unfair or discriminatory outcomes. Lastly, automation may result in reduced human interaction during the interview process, impacting the candidate experience and the ability to assess non-verbal cues effectively.

[11] Proct-Xam-AI which is AI Based Proctoring.

Authors: Samuel Monteiro, Rutuja Bhate, Lav Sharma and Phiroj Shaikh.

Proct-Xam-AI, an AI-based proctoring system, offers several benefits in ensuring exam integrity and fairness. Firstly, it enhances proctoring capabilities by providing teachers with advanced monitoring tools to detect suspicious behavior, thereby maintaining the credibility of online education.

Merits: Additionally, the system facilitates a flexible exam environment, allowing students to take exams from any location, which is convenient for remote learners. Furthermore, through comprehensive monitoring using AI algorithms like CNN/RNN, the system ensures thorough surveillance, including tracking eye and lip movements to enhance exam security. Real-time intervention features such as screen sharing verification and warning messages enable supervisors to promptly address any irregularities detected during exams.

Demerits: The implementation of AI-based proctoring systems also poses several challenges and concerns. Firstly, it may require significant technical expertise and resources, potentially creating obstacles for institutions with limited technical capabilities. Moreover, continuous monitoring of students through webcams raises privacy concerns, as it involves capturing and analyzing students' facial expressions and movements. Additionally, the system may produce false positives, flagging certain behaviors as suspicious erroneously, which could lead to unwarranted interruptions or penalties for students. Furthermore, accessibility issues may arise for students with limited access to reliable internet connections or compatible devices, affecting their participation in exams conducted via

the AI-based proctoring system. Lastly, resistance to change from some students and educators may stem from concerns about fairness, invasiveness, and overdependence on technology for assessment.

[12] Tensorflow-Based Automatic Personality Recognition Used in Asynchronous Video Interviews.

Authors: Hafsa Fatima and Abdul Bari Mohammed.

The paper introduces an end-to-end AI interviewing system capable of automatically recognizing individual personality traits, providing valuable insights for recruitment processes.

Merits: Utilizing convolutional neural network (CNN) models and TensorFlow AI engine demonstrates advanced deep learning techniques for extracting features from asynchronous video interviews (AVIs) to perform personality recognition. The experimental results indicate a high accuracy rate ranging between 90.9% and 97.4% in recognizing the "big five" personality traits of interviewees, showcasing the effectiveness of the AI-based interview agent. The semi-supervised deep learning approach used in the study performs well despite the lack of labor-intensive manual annotation and labeling, suggesting potential for scalability and efficiency. Moreover, the AI-based interview agent can supplement or replace self-reported personality assessments, offering a more objective and reliable method that is less susceptible to distortion by job applicants seeking socially desirable outcomes.

Demerits: The system's reliance on facial expressions and nonverbal cues captured in asynchronous video interviews may not fully capture the complexity of human personality, potentially leading to inaccuracies or oversimplifications. Additionally, the AI-based system may struggle to interpret nuances in communication and behavior that are crucial for accurately assessing personality traits in different contexts. Concerns about privacy, fairness, and potential bias in decision-making are raised due to the use of AI in personality assessment, necessitating careful consideration of ethical implications. While the semi-supervised deep learning approach performs well in the study, its effectiveness on a larger scale with diverse datasets remains to be validated, highlighting the need for further research and validation. Moreover, depending too heavily on AI-based personality assessment may overlook the importance of human judgment and intuition in recruitment

processes, potentially leading to unintended consequences or biases.

[13] Exploring the Applicability of Artificial Intelligence in Recruitment and Selection Processes: A Focus on the Recruitment Phase.

Author: Anusha Hewage.

It focuses on the recruitment phase and contributes to theoretical knowledge by presenting a conceptual model for understanding AI's effective utilization in recruitment and selection processes.

Merits: It integrates Human Resource Management (HRM) literature with technology adoption theory, offering a comprehensive framework to comprehend AI's impact on recruitment. The paper provides practical insights into the suitability of AI in specific recruitment phases such as sourcing and candidate engagement, facilitating decision-making for HRM practitioners and organizations. By considering the perspectives of recruitment professionals, the study ensures the practical relevance of its findings. Additionally, conducting a qualitative study allows for in-depth exploration and understanding of the nuances surrounding AI adoption in recruitment processes.

Demerits: However, the study's focus solely on the recruitment phase may overlook other aspects of AI integration in HRM processes. It also indicates a reluctance among professionals to use AI in certain recruitment stages, highlighting potential barriers to widespread adoption. Furthermore, relying on qualitative data limits the generalizability of findings and the ability to quantify the impact of AI in recruitment. The study suggests the need for further research to address the reluctance in AI adoption and explore its effectiveness in all recruitment stages. Moreover, the perspectives gathered from recruitment professionals may be biased or influenced by individual opinions or organizational contexts, potentially affecting the neutrality of the findings.

[14] The Big Five Personality Traits and Earnings: A Meta-Analysis.

Authors: Giammarco Alderotti, Chiara Rapallini and Silvio Traverso.

The paper offers a comprehensive analysis by thoroughly examining a wide range of studies, providing a detailed overview of how different personality traits relate to individuals' earnings.

Merits: This holistic approach ensures a comprehensive understanding of the topic and

offers valuable insights for further research and practical applications. It effectively identifies and elucidates the connections between specific personality traits, such as Openness and Conscientiousness, and higher earnings, contributing to our understanding of the role of personality in determining economic outcomes. Additionally, the paper reveals negative relationships between certain personality traits, like Agreeableness and Neuroticism, and earnings, providing a nuanced perspective on the subject matter. The absence of publication bias enhances the credibility and reliability of the findings, strengthening confidence in the observed associations between personality and earnings. Furthermore, the paper considers influential factors such as cultural differences, gender, and characteristics of academic journals, going beyond simple associations to explore the complexities of the relationship.

Demerits: While the paper provides valuable insights, its findings may not be universally applicable across different cultural contexts or demographic groups, highlighting the need for further research in diverse populations. The reliance on existing data from previous studies may introduce biases or limitations inherent in the primary research, constraining the analysis by the quality and scope of available studies. Moreover, the relationship between personality and earnings is influenced by numerous factors, and while the paper offers valuable insights, it may not fully capture the complexity of these interactions. Additionally, the paper cannot establish causality between personality traits and earnings, only identifying associations. Despite efforts to minimize bias, individual studies included in the analysis may still be subject to methodological limitations or biases, emphasizing the importance of interpreting the findings accurately.

[15] Challenges in Recruitment and Selection Process: An Empirical Study.

Authors: Sophia Diana Rozario, Sitalakshmi Venkatraman and Adil Abbas.

The paper on Challenges in Recruitment and Selection Process presents valuable insights into these processes, particularly within the tertiary and dual education sectors in Australia. It offers a comprehensive approach by examining various factors such as feedback provision, interview panel participation, relevance of interview questions, duration, and bias, providing a thorough analysis of the process.

Merits: Furthermore, the study is based on empirical research, incorporating data from different perspectives including hiring members, successful applicants, and unsuccessful

applicants, thereby enhancing its credibility and relevance. Additionally, by identifying critical aspects of the employee selection process, the paper offers potential recommendations for enhancing recruitment and selection procedures, which could be valuable for improving similar processes in other organizations or sectors.

Demerits: However, the study has limitations in its scope as it focuses specifically on the recruitment and selection process within the tertiary and dual education sectors in Australia, limiting its generalizability to other industries or regions. Additionally, there is a lack of comparative analysis with recruitment and selection processes in other sectors or countries, which could provide broader insights into best practices. Despite efforts to analyze biases in the selection process, the study itself may be subject to biases inherent in the data collection and analysis methods employed. Moreover, while the paper offers recommendations for enhancing the recruitment and selection process, implementing these recommendations in practice may pose challenges due to organizational constraints or cultural factors.

Chapter 3

Design and Implementation Details

In this chapter, we'll explore how we built and put together the AI-enhanced Interview Monitoring and Personality Analysis System. We'll discuss the steps we took, the technology we used, and how everything works together to make this project a reality. This chapter gives a behind-the-scenes look at how our system was created.

3.1 Software Development Methodology

Our interview tracking and personality analysis system heralds an AI-enhanced transformational approach. By integrating cutting-edge features rooted in machine learning, our methodology promises to redefine the recruiting landscape. At its core is a multifaceted strategy that uses advanced personality predictions and careful interview tracking to streamline candidate assessment. With a focus on efficiency, accuracy and a deep understanding of each candidate, our methodology seamlessly aligns with the requirements of modern recruitment teams. By offering in-depth candidate profile summaries and concise information, it goes beyond the limitations of traditional resume-centric approaches and puts actionable data at the disposal of recruiters. In addition, our proactive approach to maintaining the integrity of the recruitment process ensures trust and reliability in the assessment of applicants and protects against unfair practices. Embracing innovation and reliability, our methodology represents a paradigm shift in recruiting, ready to elevate organizations towards building high performance teams.

3.2 Software Requirements

The software project necessitates a versatile solution tailored to meet the specific needs of the organization. It requires a user-friendly interface with intuitive navigation for enhanced usability. The system should prioritize efficiency, scalability, and reliability to support current operations and future growth.

3.2.1 Functional Requirements

1. Personality Prediction: The system must employ advanced machine learning techniques to accurately anticipate candidate personalities, leveraging video and audio analysis during interviews.

2. Confidence Assessment: It should incorporate algorithms to evaluate candidates' confidence levels throughout interviews, providing valuable insights into their demeanor and self-assurance.

3. Video and Audio Analysis: The system needs to conduct thorough examinations of interview recordings, extracting pertinent details regarding candidates' communication skills, behavior, and overall performance.

4. Candidate Assessment: Recruiters must have access to comprehensive candidate assessments generated by the system, encompassing personality traits, communication proficiency, and confidence levels.

5. User Interface: A user-friendly interface is essential, enabling recruiters to effortlessly interact with the system and interpret candidate assessments for informed decision-making.

This system signifies a revolutionary approach to recruitment, leveraging cutting-edge technologies for accurate candidate assessments and a more clear understanding of each applicant.

3.2.2 Non Functional Requirements

1. Accuracy: Additionally, the algorithms should be capable of handling diverse data sets with accuracy, ensuring unbiased evaluations across various demographics and backgrounds. Moreover, transparent documentation and regular validation processes are essential to maintain the integrity of the algorithmic decision-making, instilling further trust in the recruitment process.

2. Efficiency: streamlined processing of interview data enables swift candidate evaluations, expediting hiring decisions and optimizing organizational productivity. Seamless integration with existing systems and automated workflows enhance efficiency, ensuring timely and informed recruitment outcomes.

3. Scalability: Scalability is imperative to meet fluctuating recruitment needs, effortlessly managing extensive candidate pools and interview loads while maintaining optimal performance. Dynamic resource allocation and robust infrastructure ensure seamless scalability.

4. Security: Robust security measures must safeguard interview data, ensuring confidentiality and integrity while adhering to industry standards and regulatory requirements.

5. Reliability: uninterrupted access to the system is essential, minimizing downtime and ensuring consistent performance to sustain recruiters' seamless workflow throughout the recruitment cycle. Implementing redundant systems and proactive monitoring mechanisms bolster system reliability.
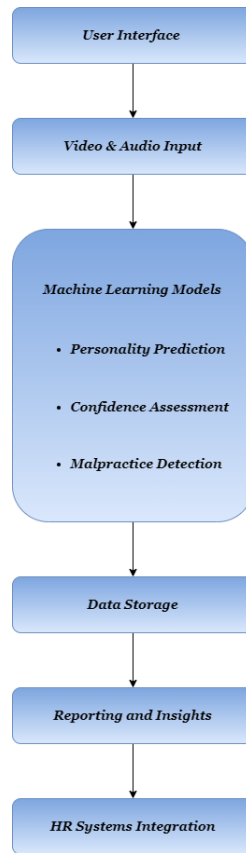
3.3 High Level Design

Figure 3.1: System Architecture

The above figure 3.1 the AI-enhanced Interview Monitoring and Personality Analysis system's core components and their functionalities. It starts with the User Interface, enabling user interaction and data input. Video and Audio Input capture interview data for analysis. Machine Learning Models analyze candidate behavior and speech patterns to predict personalities and detect anomalies. Results are securely stored in Data Storage. Reporting and Insights distill analysis into actionable information. HR Systems Integration facilitates data exchange with HR tools. Together, these components create a cohesive system that enhances recruitment efficiency.
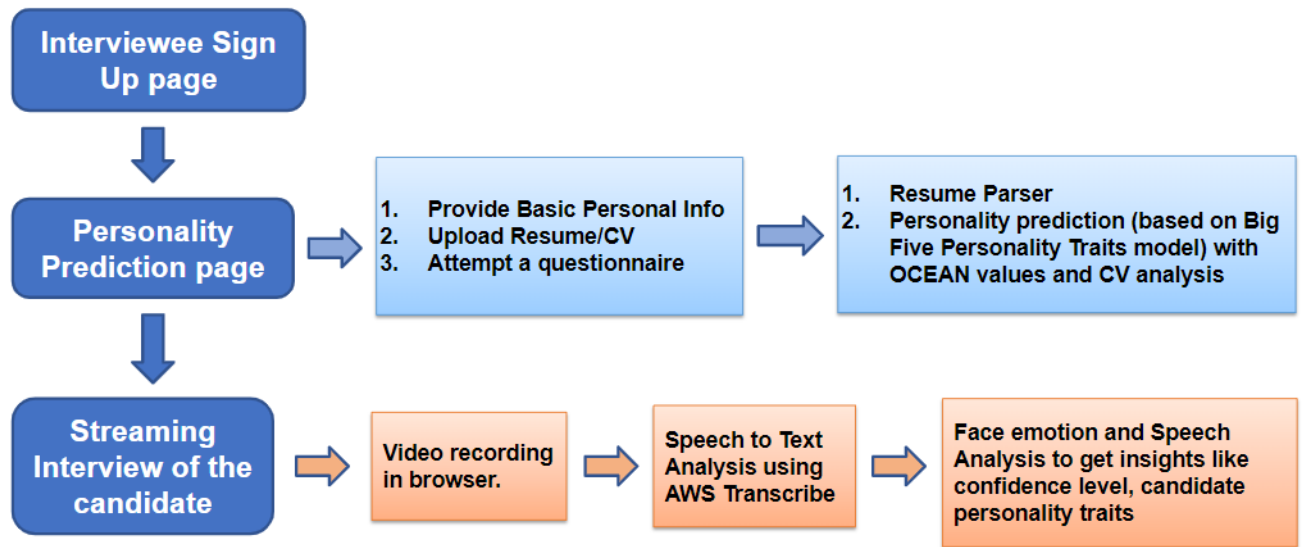
3.3.1 Interviewee Flowchart

Figure 3.2: Interviewee's page workflow.

The illustrated workflow depicted in the figure offers a holistic view from the interviewee's perspective, providing a lucid comprehension of the platform's accessible features. It meticulously outlines the functionalities and options available, empowering interviewees with the necessary tools to navigate the interview process effectively. This comprehensive overview fosters confidence and ensures a seamless, user-friendly experience, enabling interviewees to engage with the system confidently and make informed decisions throughout.

Moreover, by presenting a clear road map of available features, the figure enhances the interviewee's understanding of the platform's dynamics and facilitates their interaction during the interview process. It serves as a guiding beacon, encouraging active participation and empowering interviewees to explore the platform's capabilities fully. This deeper comprehension not only enriches the interviewee's experience but also cultivates a collaborative environment
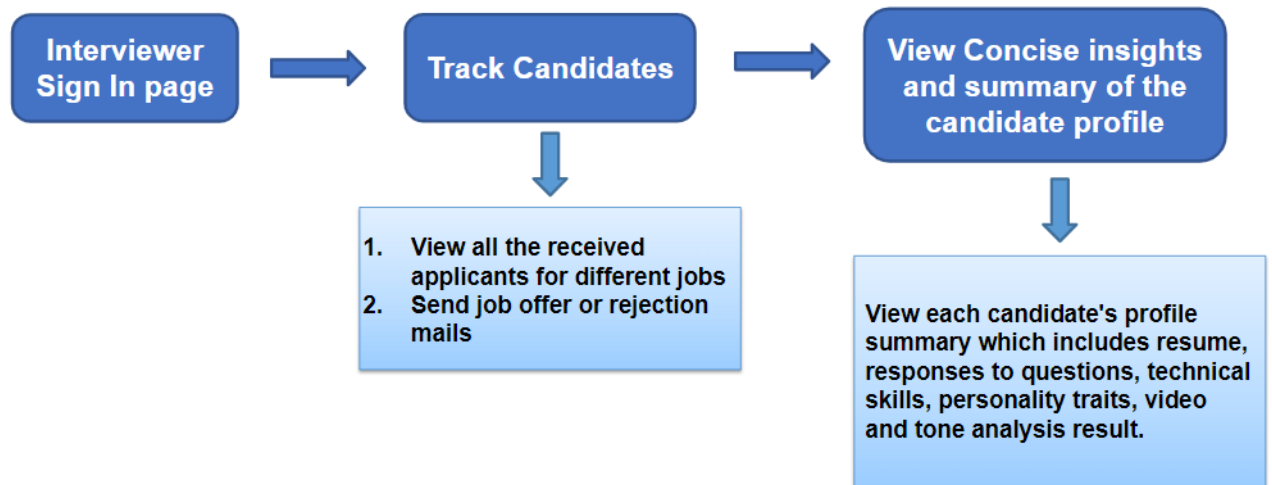
3.3.2   Interviewer Flowchart

Figure 3.3: Interviewer page workflow.

The illustrated figure provides interviewers with a comprehensive view of candidate profiles, incorporating essential details alongside personality reports and other pertinent information. By centralizing all necessary data within a single interface, the process is streamlined, simplifying the interview procedure. This consolidation eliminates the need for navigating multiple platforms or documents, enabling interviewers to efficiently access and review candidate information. Consequently, interviewers can make well-informed decisions promptly, leveraging the insights gleaned from the integrated data to tailor their approach to each interview session effectively.

Furthermore, the accessibility of comprehensive candidate information enhances the efficacy of the evaluation process. With all relevant details readily available, interviewers can conduct thorough assessments, ensuring a holistic understanding of each candidate's qualifications and suitability for the role. This streamlined workflow not only enhances interviewer productivity but also fosters a smoother interview experience for both interviewers and candidates alike.
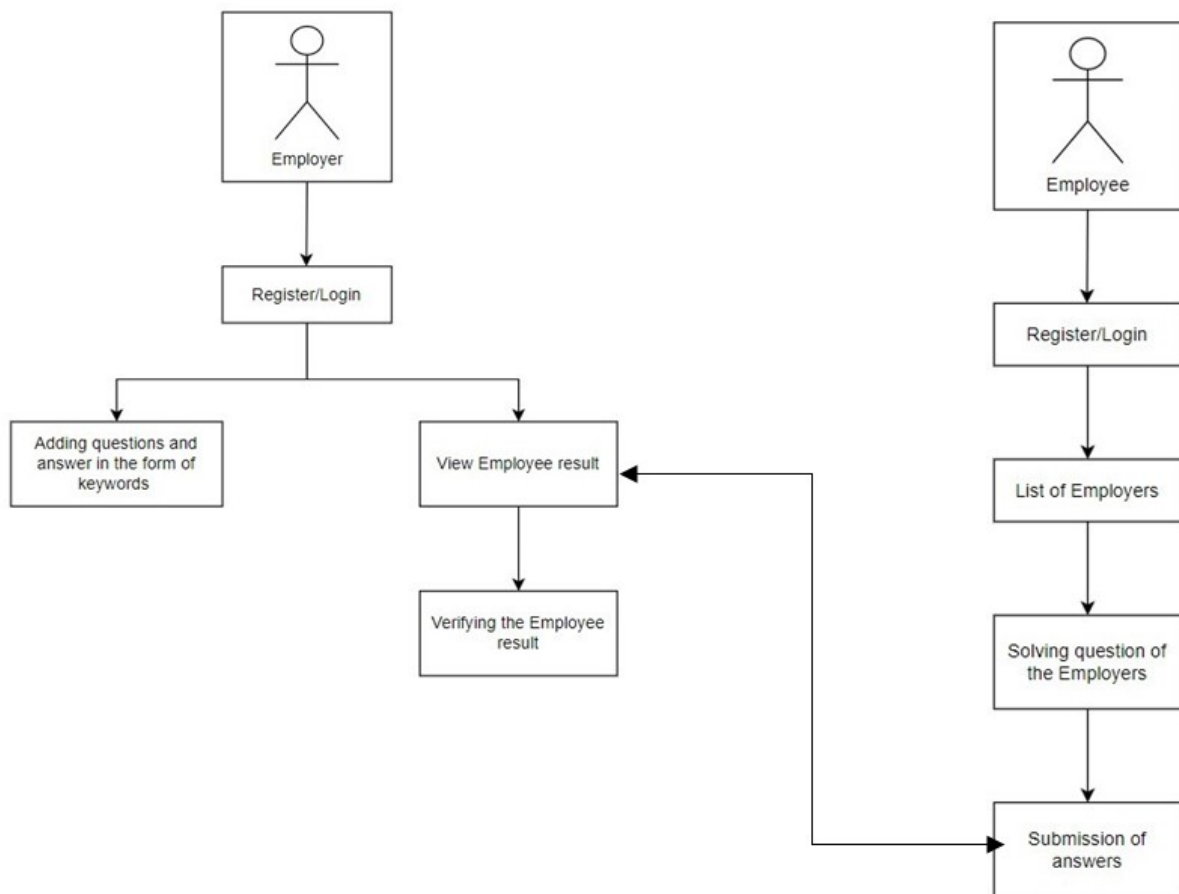
3.3.3 UML Diagram

Figure 3.4: UML diagram for proposed System

The design proposed will have the user interaction as shown in the figure 3.4 the employer and employee will be having separate environments which will be interconnected as the questions posted by the employer will be visible in the employee screen who will be attempting the interview and the recording done will undergo analysis and the complete analysis will be available to Employer in their screen where he can download or select the candidate directly.

3.4   Implementation

The proposed design is built using various on demand technologies which are all discussed in this section along with the outcomes of the project which are all inline with the objectives.

3.4.1   Tools and Technologies

Python: Python is a high-level, general-purpose programming language. Its design philosophy emphasizes code readability with its notable use of significant whitespace. Its language constructs and object-oriented approach aim to help programmers write clear, logical code for small and large-scale projects.

SQLite: SQLite is a lightweight, open-source, relational database management system (RDBMS) that stores structured data in a single file on a computer's hard drive. It's a serverless, in-memory library that doesn't require installation or configuration, and can run on all platforms, including macOS and Windows.

HTML: HTML stands for Hyper Text Markup Language. HTML is the standard markup language for creating Web pages. HTML describes the structure of a Web page. HTML consists of a series of elements. HTML elements tell the browser how to display the content.

JavaScript: JavaScript is a high-level, interpreted computer programming language that is often used to create dynamic and interactive websites. JavaScript is a text-based programming language that is one of the three core technologies of the World Wide Web, along with HTML and CSS.

Visual Studio Code: Visual Studio Code (VS Code) is a free, open-source source-code editor developed by Microsoft for Windows, Linux, macOS, and web browsers. It's primarily used to fix and repair coding errors in web and cloud applications.

3.4.2 Outcomes

1. Simplified Recruitment Automation: Efficiently automate and expedite the recruitment process for greater efficiency.

2. Accurate Personality Prediction: Using machine learning algorithms, achieve accurate personality predictions.

3. Comprehensive Candidate Evaluation: Conduct holistic assessments using advanced video and tone analysis tools.

4. Instant Communication Automation: Enable one-click automated communication with candidates using email features.

5. Scalable Rapid Recruitment: Handle huge quantities of recruitment easily with a scalable and rapid approach.

6. User-Friendly HR Interface: Provide a user-friendly interface for HR and recruitment teams to improve usability.

7. Improved Recruitment Experience: Enhance the entire recruitment experience for both companies and candidates.

Chapter 4

Results

The AI enhanced model built for reducing the hiring process burden has been successfully built and the Design working and effectiveness are discussed in the below sections
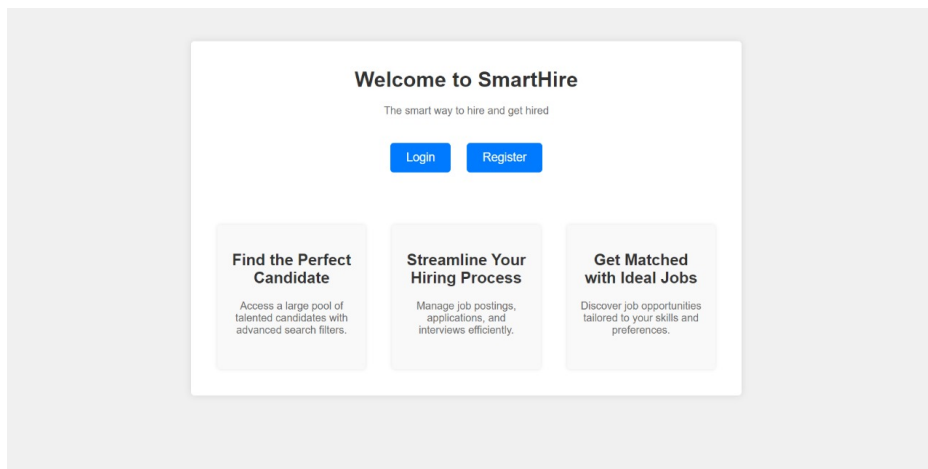
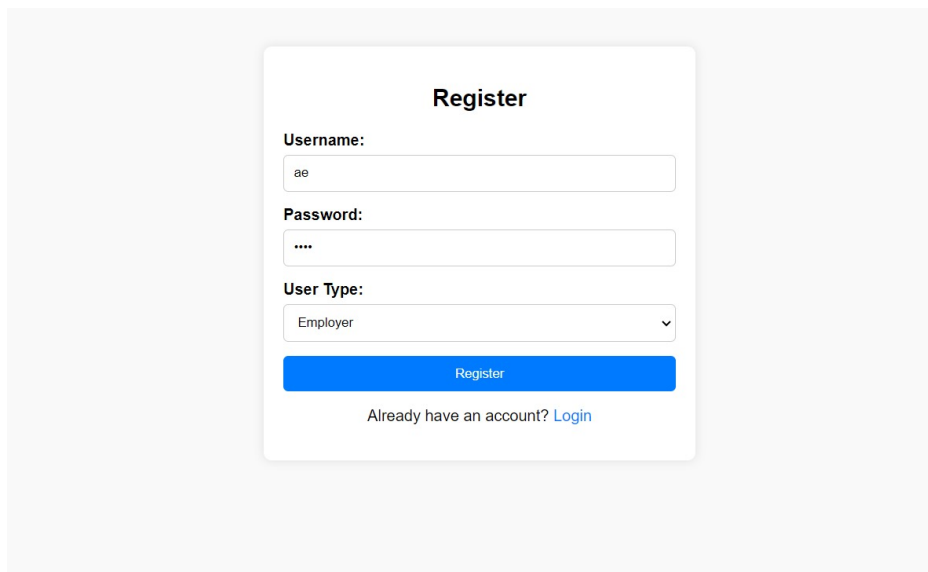## 4.1   Results Snapshots

Figure 4.1: The common user interface

Figure 4.2: The employer Register/login page

Figure 4.3: Employer home page to add Questions

In the figure 4.3 the employer home page he has a option to add the questions and matching keywords as the answers

Figure 4.4: Employee register or login page

In the above figure 4.4 the employee login page is displayed as the user type is set to "Employee"

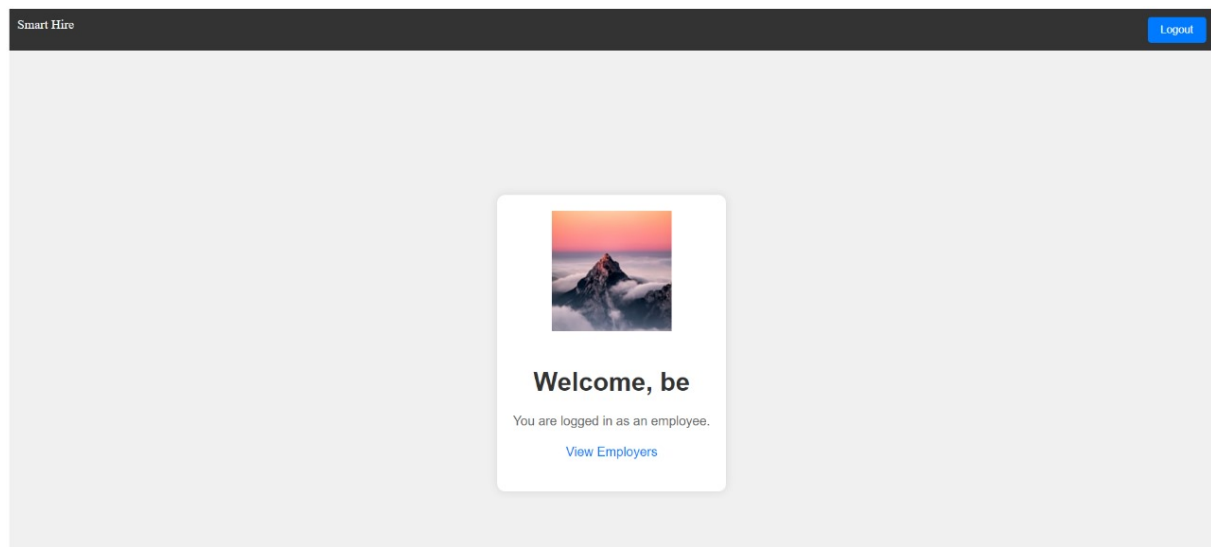Figure 4.5: Successfully logged in as interviewee

Upon successfully registering the employee gets the page shown in the figure 4.5 where there is option to navigate further to view the list of employers.
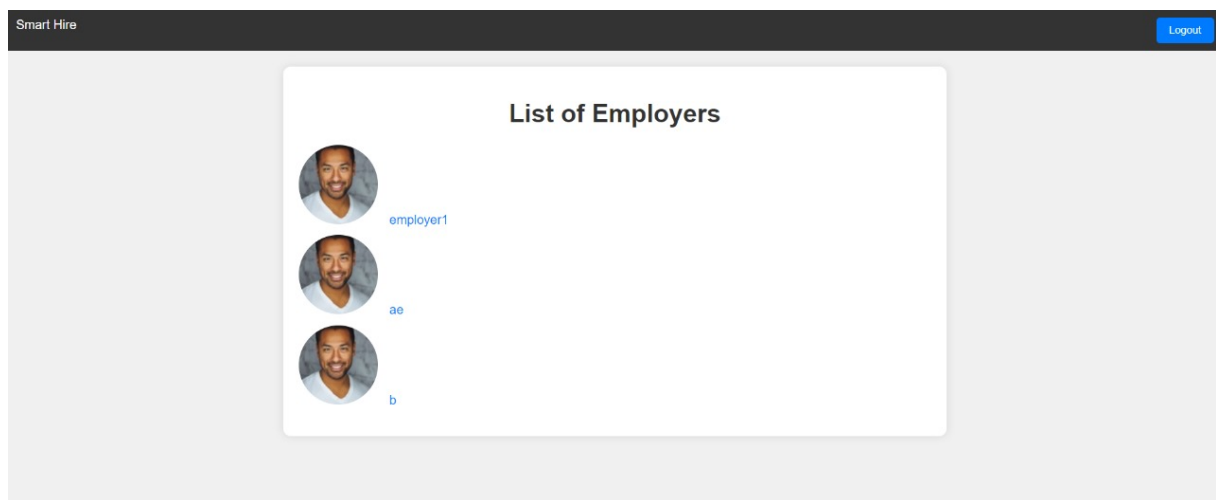
Figure 4.6: List of employers who have posted the exam

In the figure 4.5 once the employee gets in he will find the list of employers and different type of interviews like technical and HR.
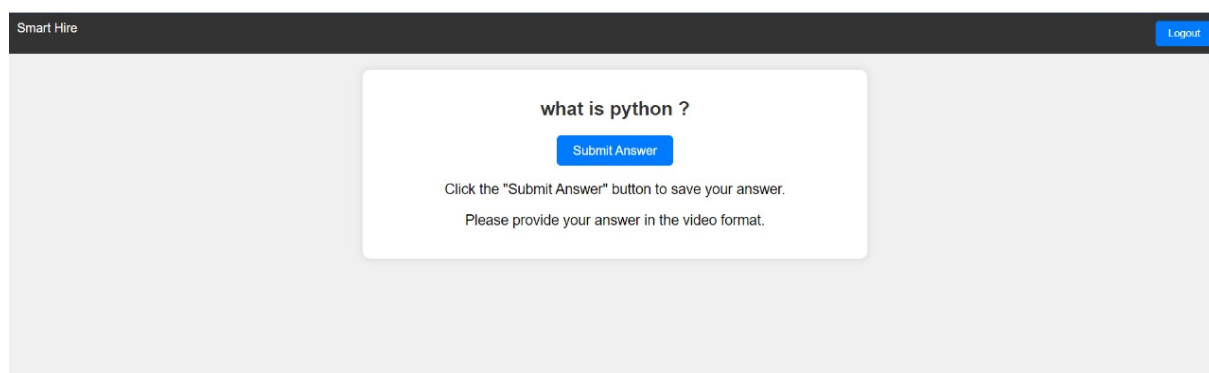
Figure 4.7: Question page for particular attempt

The questions posted by the respective employer is shown here which can be selected for attempting the answer The screen will be containing one question where the user will have to record the answer for each.
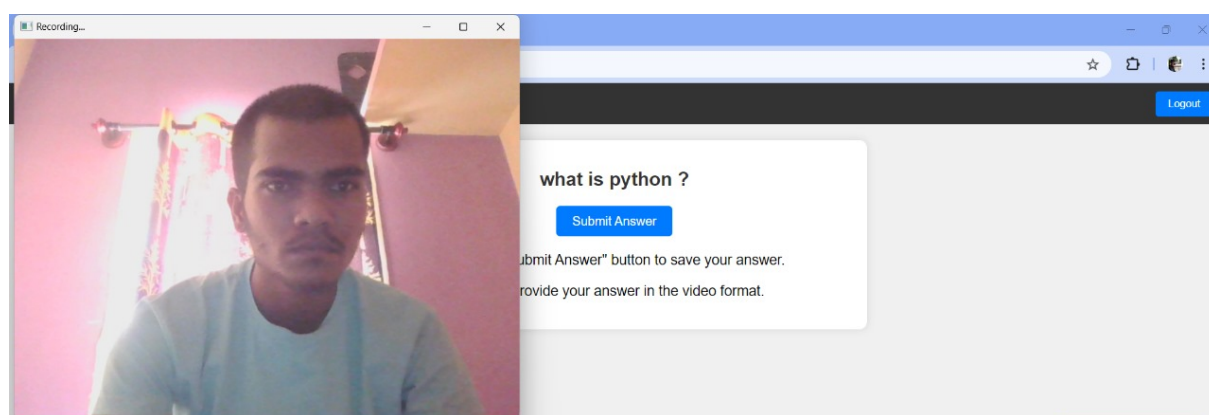
Figure 4.8: Online proctored recording

The above screen in the figure 4.8 is the snap shot of the interview recording taking place for particular question where the video audio and personality analysis is taking place.
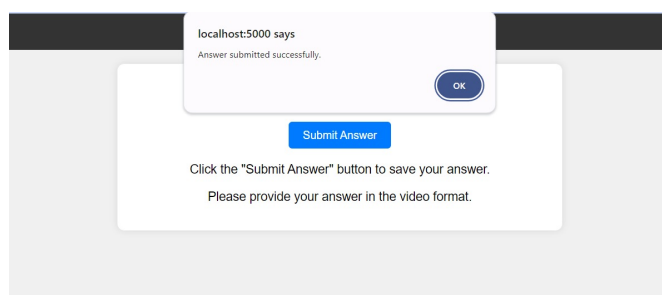
Figure 4.9: Successful answer submission page

Figure 4.10: Result analysis page with the personality graph

The result page is generated automatically and viewed by the interviewer where he gets the graph of the personality qualities like the confidence depicted by the interviewee for the each question.

Figure 4.11: Accuracy graph generated for each question

The video recorded in the earlier stage is separated and broken down in audio and visuals where audio is matched with keywords given by employer for accuracy.

4.2 Testing

The system designed and built is undergone successful unit and integration testing to make sure the quality of the product built is in alignment with the Current market standards

4.2.1 Unit Testing:

Unit testing focuses on verifying the functionality of individual components or units of the system. For AI-enhanced Interview Monitoring and Personality Analysis, unit testing ensures the reliability and accuracy of specific functionalities. Here's how unit testing can be approached for this project:

Case 1 : Personality Prediction Algorithm Testing: Project built Confirms the precision of the machine learning calculations utilized for identity expectation. Test distinctive scenarios to guarantee that the expectations adjust with anticipated identity traits.

Case 2: Video and Audio Analysis Testing: Test the calculations mindful for analyzing video and sound information. Guarantee that the examination precisely gauges certainty levels and gives significant insights.

Case 3 :Malpractice Detection Testing: Approve the adequacy of the misbehavior discovery instrument. Test scenarios to guarantee that occurrences of negligence are precisely distinguished and flagged.

Case 4 : HR Interface Testing: Guarantee that the HR interface capacities easily and gives a user-friendly involvement. Test the interface for convenience, responsiveness, and legitimate show of candidate profile summaries.

Case 5: Database Interaction Testing: Test the interaction between the framework and the database. Confirm that information is put away accurately and recovered precisely amid candidate evaluations.

4.2.2 Integration Testing :

- **Networking and Employee page Integration:** Test the integration between the AI-powered platform where the recruiter will be adding the question and the same content needs to be displayed in the user page or the Interviewee page

- **Search and Attempt page Integration:** Test the integration between the search functionality for the employee where he can search for different set of questions and attempt page designed for each question generated.

- **The video Recording page and Analysis model Integration:** Test the integration between video recording model and the analysis model where the live video of the interviewee is broken down for the personality analysis and voice is analysised for the accuracy.

4.2.3   Test Cases :

User Authentication:

- **Test Case:** Verify that users can log in with valid credentials.

- **Preconditions:** User credentials (username/email and password) are valid.

- **Preconditions:** User credentials (username/email and password) are valid.

- **Test Steps:**

  - Enter valid username/email and password which was set during Registration.

  - Click on the login button.

- **Expected Output:** User is successfully logged in and directed to the dashboard of Employee/Employer as per choice.

- **Pass Criteria:** User is logged in without encountering any errors.

Question List Generation:

- **Test Case:** Verify that the system generates proper list of Questions as posted by Recruiters.

- **Preconditions:** The system is operational and has access to relevant data for generation.

- **Test Steps:**

  - Trigger the successful employee login and select the recruiter.

- **Expected Output:** The system generates a list of Questions posted by the selected recruiters. Each Question includes details such as name of recruiter,question and start attempt etc.

- **Pass Criteria:** questions are passed from recruiter page successfully based on the algorithm without encountering any errors.

Attempt Functionality:

- **Test Case:** Verify that the attempt feature retrieves camera and starts recording.

- **Preconditions:** camera recording are available in the system.

- **Test Steps:**

    - Initiate the attempt

    - Ensure Proper Sunlight available when camera opens for recording

- **Expected Output:** Attempt button leads to the opening of the camera and candidate gets to record the answer which will be submitted for the analysis.

- **Pass Criteria:** Attempt button works well and camera recording starts.

Single Candidate Validation:

- **Test Case:** Verify that candidate follows the ethical practise while recording answer.

- Preconditions: camera recording are available.

- **Test Steps:**

    - Scan the background for any other person or suspicious sound.

- **Expected Output:** The scanned background should be intimidated in the Candidate report which will be generated notifying any other presence

- **Pass Criteria:** Valid tickets are successfully validated without errors.

AI Based personality and accuracy analysis:

- **Test Case:** Verify that the model designed does the proper analysis of personality and the user answer accuracy.

- **Preconditions:** The video recording of the candidate reciting the answer for the questions asked.

- **Test Steps:**

    – Candidate record the answer for the question

    – breaking down of recording into video and audio.

    – video sent for personality model for prediction.

    – audio sent for Trained model for prediction.

- **Expected Output:** Accurate analysis of the user personality while answering the question and accuracy report of the answer given and actual answer

- **Pass Criteria:** report is successfully generated in the recruiter page

Chapter 5

Conclusion

This project embodies a transformative approach to revolutionizing traditional recruitment. By combining advanced technologies such as machine learning, video analytics, and tone analysis, the project aims to automate and optimize the entire recruitment process. Expected results align with the overarching goals and promise an efficient and streamlined recruiting workflow, accurate personality predictions, comprehensive trait analytics, and a user-friendly application for HR and recruiting teams. Anticipated impact includes rapid scalability to process larger volumes of candidates, automated communication, and generation of concise and clear candidate profiles. Ultimately the platform aims to improve the hiring experience for both employers and candidates, ushering in a new era of efficiency, objectivity, and satisfaction in recruiting.

Scope for future work

There are several opportunities to build AI-enhanced interview monitoring and personality analysis. Firstly, there's a significant opportunity to enhance the accuracy and depth of personality projections by employing increasingly complex machine learning algorithms and combining data from external sources, such as online assessments or social media profiles.

Another fascinating area for future study is to expand analysis skills beyond audio and video to include text-based communication and body language analysis. The possibilities for developing AI-enhanced Personality Analysis and Interview Monitoring are numerous. First off, there's a big chance to improve personality forecasts' precision and richness by utilizing more sophisticated machine learning algorithms and incorporating data from other sources, including social media accounts or online tests. Furthermore, the incorporation of real-time feedback systems in interviews has the potential to enhance engagement and assessment outcomes by offering prompt insights to both recruiters and candidates.

Another exciting area for future research is extending analysis skills beyond audio and video to additional modalities including text-based communication and body language analysis. Integration with existing Learning Management Systems could speed up the transition from candidate assessment to on boarding and training, improving the overall recruitment process. It could be even more effective if recruiters had the ability to customize the system to fit their own hiring requirements and corporate culture.

Monitoring the success and performance of hired individuals over time based on preliminary tests and assessments may yield insightful data that will help to improve the hiring procedure in the long run.

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Appendices

Appendix A

Code Snippets

A.1   Code Snippet - Employee Module Registration

```
templates > <> employee.html > ⊘ html > ⊘ head > ⊘ style > ⧉ .body-class
1   <!DOCTYPE html>
2   <html lang="en">
3   <head>
4       <meta charset="UTF-8">
5       <meta name="viewport" content="width=device-width, initial-scale=1.0">
6       <title>Welcome, Employee</title>
7       <style>
8           .body-class {
9               font-family: Arial, sans-serif;
10              background-color: #f0f0f0;
11              margin: 0;
12              padding: 0;
13              display: flex;
14              flex-direction: column;
15              align-items: center;
16              justify-content: center;
17              height: 100vh;
18          }
19
20          .container {
21              text-align: center;
22              background-color: #fff;
23              padding: 20px;
24              border-radius: 10px;
25              box-shadow: 0 0 10px rgba(0, 0, 0, 0.1);
26          }
27
28          h1 {
29              color: #333;
30          }
31
32          p {
33              color: #666;
34              margin-bottom: 20px;
35          }
```

Figure A.1: Employee.html

A.2   Code Snippet - Main program App.py

```python
 1  from flask import Flask, render_template, request, redirect, url_for, session
 2  from flask_sqlalchemy import SQLAlchemy
 3  import cv2
 4  import moviepy.editor as mp
 5  import speech_recognition as sr
 6  import pyaudio
 7  import wave
 8  from vaderSentiment.vaderSentiment import SentimentIntensityAnalyzer
 9  import json
10  from flask_migrate import Migrate
11  import smtplib
12  from email.mime.text import MIMEText
13  from email.mime.multipart import MIMEMultipart
14
15  app = Flask(__name__)
16  app.secret_key = 'your_secret_key'
17  app.config['SQLALCHEMY_DATABASE_URI'] = 'sqlite:///example.db'
18
19  db = SQLAlchemy(app)
20  migrate = Migrate(app, db)
21
22  class User(db.Model):
23      id = db.Column(db.Integer, primary_key=True)
24      username = db.Column(db.String(50), unique=True, nullable=False)
25      password = db.Column(db.String(50), nullable=False)
26      type = db.Column(db.String(20), nullable=False)
27      questions = db.relationshi      onAnswer', backref='employer', lazy=True)
28
29  class QuestionAnswer(db.Model):
30      id = db.Column(db.Integer, primary_key=True)
31      question = db.Column(db.String(255), nullable=False)
32      answer = db.Column(db.Text, nullable=False)
33      employer_id = db.Column(db.Integer, db.ForeignKey('user.id'), nullable=False)
34
35  class QuestionResult(db.Model):
36      id = db.Column(db.Integer, primary_key=True)
37      user_name = db.Column(db.String(50), nullable=False)
```

Figure A.2: AI model Code for analysis

A.3   Code Snippet - Login page

```html
 1  <!DOCTYPE html>
 2  <html lang="en">
 3  <head>
 4      <meta charset="UTF-8">
 5      <meta name="viewport" content="width=device-width, initial-scale=1.0">
 6      <title>Login</title>
 7      <style>
 8          body {
 9              font-family: Arial, sans-serif;
10              background-color: #f9f9f9;
11              margin: 0;
12              padding: 0;
13          }
14          .container {
15              width: 400px;
16              margin: 50px auto;
17              padding: 20px;
18              background-color: #fff;
19              border-radius: 8px;
20              box-shadow: 0 0 10px rgba(0, 0, 0, 0.1);
21          }
22          h2 {
23              text-align: center;
24              margin-bottom: 20px;
25          }
26          form {
27              width: 100%;
28          }
29          label {
30              display: block;
31              font-weight: bold;
32              margin-bottom: 5px;
33          }
34          input[type="text"],
35          input[type="password"],
36          select {
37              width: 100%;
```

Figure A.3: login.html

Self-Assessment of Project

Table 5.1: Self Assessment of Project

	PO PSO	Contribution from the project	Level
	Self Assessment of Project		
1	Engineering Knowledge: Knowledge of mathematics, engineering fundamentals engineering specialization to form of complex engineering problems	Utilizing advanced technologies such as blockchain and AI, the project demonstrates the practical application of mathematical and engineering principles in optimizing event management processes, showcasing interdisciplinary approaches to real-world challenges in event coordination .	
2	System Analysis: Identity, formulate, research literature, and analyse engineering problems to derive substantiate conclusions by first principles of mathematics, natural and engineering science	Applying principles of mathematics and engineering science, the project formulates solutions for event coordination challenges through systematic research and analysis, deriving substantiated conclusions. .	
3	Design/development of solutions: Design solutions of complex engineering problems, design system components or process that meet the specified process with appropriate consideration for the public health, safety and the cultural and environmental considerations.	Successfully designed user-centric solutions considering scalability and security.	

5	Modern tool usage: Create, insert and apply appropriate techniques, resources and modern engineering and tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	Leveraged advanced tools like Python,Flask and MySQL for platform optimization.	4
6	The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.	Assessed societal impacts and ensured ethical engineering practices in platform development.	4
7	Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	Considered sustainability in platform design and deployment	3
8	Ethics: Apply ethical principles and commit to professional ethics and norms of the engineering practice.	Committed to ethical principles, prioritizing user privacy and data security.	4
9	Individual and Team Work: Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.	Demonstrated effective collaboration and teamwork among project members	4

10	Communication: communicate effectively on complex engineering activities with the engineering community and with the society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	Maintained clear communication with team-members and Faculty guide throughout the project ensuring the quality of the project	3
11	Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	Managed project tasks effectively within budget and time constraints.	4
12	Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadcast context of technological change.	Engaged in continuous learning to adapt to technological advancements	4
13	PSO1: Computer-based systems development: Ability to apply the basic knowledge of database systems, computing, operating systems, digital circuits, microcontrollers, computer organization and architecture in the design of computer-based systems.	The project has been made with proper understanding of the software development tools and technologies assuring the standard of the project.	4

14	PSO2: Software development: Ability to specify, design, and develop projects, application software, and system software by using the knowledge of data structures, analysis, and design of algorithms, programming languages, software engineering practices, and open-source tools.	In this project, we add value to the development of software by providing an Hiring platform that can provide scope fot the hiring of employees.	4

15	PSO3: Computer communications and Internet applications: Ability to design and develop network protocols and internet applications by incorporating the knowledge of computer networks, communication protocol engineering, cryptography and network security, distributed and cloud computing, data mining, big data analytics, ad hoc networks, storage area networks and wireless sensor networks.	The project showcases proficiency in computer communications and internet applications by integrating knowledge from computer networks, communication protocol engineering, network security, and distributed computing. It involves designing secure communication systems	4

Level	Grade
poor	1
average	2
good	3
vgood	4
excellent	5