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A Survey on Interviewing and Proctoring System

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ABSTRACT: Artificial intelligence (AI) has gained increasing traction in the realm of hiring due to its potential for providing a more effective and impartial evaluation of candidates. However, existing AI based interviewing methods often encounter biases and limitations in fully assessing a candidate's suitability for a position. To address these issues, our project proposes an AI-based interviewing and proctoring system that combines sophisticated natural language processing with proctoring technologies like computer vision and machine learning. The proposed system aims to conduct virtual interviews with candidates and evaluate their responses in real-time. To ensure fairness and integrity, the proctoring component of the system will also monitor the candidate's behavior during the interview, including identifying any unauthorized materials to ensure that the candidate is fully focused on the interview process. Furthermore, the proposed system also considers the cost-effectiveness and efficiency of the recruitment process. The future scope of the project includes real-world implementation and validation of the proposed system, integration with existing HR systems, exploration of advanced AI techniques, expansion to other domains, and addressing ethical considerations. Further research, development, and refinement of the proposed model can contribute to enhancing the recruitment process by leveraging AI technologies to improve candidate evaluation, fairness, and efficiency in the hiring process.

Keywords: Machine learning, Computer Vision, Natural Language Processing

I. INTRODUCTION

In order to stop cheating during online exams, AI-based proctoring uses artificial intelligence to anticipate, flag, and record even the smallest discrepancies and suspicions. Eye movements that indicate distraction, the candidate being invisible, the detection of an unauthorized device, the presence of another person, etc. are just a few of the numerous AI flags. Similar to a human proctor, AI-based proctoring involves evaluating a test-behavior, taker's surroundings, and movement. In AI-based proctoring, an expert-trained AI algorithm is used to anticipate, flag, and record even the tiniest discrepancies and suspicions. Distracted eye movements, the candidate not being visible, partial visibility, the detection of an unauthorized device, the presence of another person, the speaker not being visible on the camera, opening any unauthorized website, etc. are some examples of AI flags. To keep the exam's integrity, they use video, audio, and various anti-cheating features. A teacher can Monitor students in person and utilize all their senses during traditional proctored exams conducted at examination centers. They can effectively oversee the smooth functioning of the event by attentively noting the auditory cues and physical movements of the students. With the absence of the instructor's physical presence, online exams entail reduced levels of supervision. Movement and sound detection should be facilitated by a good remote online proctoring system.

II. LITERATURE SURVEY

A literature survey on interviewing and proctoring systems would typically involve a comprehensive review of existing research and publications related to the technology, methodologies, challenges, and advancements in these areas.

Aditya Nigam & Prathamesh Churi et al., [1] - A Systematic Review on AI-based Proctoring Systems: Past, Present and Future(2021): This paper is a comprehensive literature survey on the use of artificial intelligence (AI) in proctoring systems for online exams. The authors conducted a systematic search of Scopus,

Web of Science, and ERIC repositories to identify relevant papers published between 2015 and 2021. After screening and selecting 43 papers, they addressed four primary research questions focusing on the existing architecture of AI-based proctoring systems, parameters, trends and issues to be considered for their development and future scope. The authors found that AI-based proctoring systems have the potential to improve the efficiency and accuracy of proctoring in online exams. Nevertheless, they also pinpointed various problems and hurdles linked to these systems, encompassing worries about security and privacy, ethical dilemmas, confidence in AI-driven technology, absence of adequate training, and exorbitant expenses.. The authors concluded that ethical justification of AI-based proctoring systems requires rigorous efforts to balance their benefits and risks. They also highlighted the need for further research to address the identified issues and explore new technologies that could impact online education and proctoring systems in the future.

Manav Motwani, Nikhil Nagdev, Anjali Yeole, et al., **[2] - AI-Based Proctoring System for Online Tests(2021) :** The authors present an AI-based integrated system to prevent cheating in online exams. The system uses machine learning algorithms to detect fraudulent activities and stores the proof. The authors conducted a literature survey to identify the existing solutions for remote proctoring and their limitations. They found that manual proctoring is time-consuming, costly, and prone to errors, while automated proctoring systems lack the ability to detect sophisticated cheating methods. The proposed system aims to overcome these limitations by using AI-based techniques to monitor student activities and detect cheating. The system includes features such as facial recognition, eye- tracking, and noise detection to ensure the authenticity of the exam environment. The researchers conducted tests to assess the system's effectiveness and discovered its proficiency in detecting cheating was notably high. Nonetheless, they also pinpointed certain drawbacks of the system, including the necessity for top-tier cameras and stable internet access, as well as the risk of false positive results. Overall, the paper contributes to the literature on AI-based proctoring systems for online exams by proposing a novel system that addresses the limitations of existing solutions.

Helaine M Alessio,Nancy Malay, et al., [3] - Examining the Effect of Proctoring on Online Test Scores(2017) : This study is conducted to compare the results of online tests conducted with and without proctoring software in an online education setting. The expansion of digital learning has ushered in a new era of possibilities and hurdles, with one prominent obstacle being the apprehension surrounding compromised academic honesty stemming from undetected cheating. In response to this challenge, the development of proctoring software has emerged as a solution to thwart academic dishonesty. A study encompassing 147 students across various segments of an online course was conducted, where nearly half underwent examinations without proctoring, while the remainder utilized online proctoring software. The results reveal that students utilizing proctoring software achieved, on average, scores 17 points lower and allocated significantly less time to tests in comparison to their counterparts taking un-proctored examinations. Grade disparities and variations in time usage were observed across different exams and within sections of the same course. The study raises implications for addressing integrity concerns, managing test score disparities, and ensuring the validation of student knowledge in online classes, suggesting the need for strategic interventions in online education.

Anjali Rajendra, Pawar Reena Vishwas, Khopkar, et al., [4] - Online Exam Proctoring(2022) : The authors conducted a literature survey to identify the existing solutions for online exam proctoring and their limitations. They found that manual proctoring is time-consuming, costly, and prone to errors, while automated proctoring systems lack the ability to detect sophisticated cheating methods. The proposed system aims to overcome these limitations by using AI-based techniques to monitor student activities and detect cheating. The authors conducted a comparative analysis of various online exam proctoring tools and identified their strengths and weaknesses. They found that the existing solutions lack the ability to detect sophisticated cheating methods, such as the use of multiple devices or the presence of other individuals in the exam environment. The writers introduced an innovative framework employing artificial intelligence (AI) methodologies for identifying such intricate cheating tactics. Their extensive examination of literature encompasses an in-depth review of current studies on online exam invigilation and the drawbacks associated with existing methods. Their proposition adds to the existing body of literature by tackling the shortcomings of current solutions and presenting a fresh perspective on online exam supervision.

Shakti Priya Saurav, Pranay Pandey, Shubham Kr Sharma, et al., [5] - AI Based

Proctoring(2021) : The paper discusses the significant advancements in educational technology, particularly the widespread adoption of online learning by schools and universities in recent years. Amidst the COVID-19 pandemic, students are finding greater freedom in structuring their study routines, while educational institutions are increasingly adopting AI-driven proctoring tools. This passage highlights an examination of contemporary proctoring platforms employing artificial intelligence, machine learning, and deep learning technologies. The authors conducted a comprehensive search for publications from 2016 to 2022 in databases like Web of Science, Scopus, and IEEE archives, identifying 41 relevant publications. The study examines critical elements including the existing methodologies utilized in AI-driven proctoring systems, the algorithms and techniques applied, datasets employed, and methods for detecting cheating. Through the analysis, it becomes apparent that there is a deficiency in the training provided for implementing these technologies. Significantly, the research highlights the limited exploration of Machine Learning or Deep Learning-powered proctoring systems.. The research emphasizes a technological perspective, particularly in detecting cheating within AI-based proctoring systems, and includes recently launched technologies that could significantly impact online education and proctoring systems.

Rajalakshmi, T. Ramesh, S. Ganesh Ram, M. Dharmendra, et al., [6] - New Features for Webcam Proctoring Using Python and OpenCV(2022) : The researchers conducted an extensive examination of available literature to pinpoint the advantages and obstacles associated with employing AI-driven proctoring systems for online examinations. They proposed a novel system that uses Python and OpenCV to develop new features for webcam proctoring, including facial recognition, eye- tracking, and noise detection. The authors discussed the trends and issues associated with AI- based proctoring systems, such as the need for rigorous testing and evaluation, and the potential impact of AI on online education. The literature survey concludes with a discussion of future directions for research, including the need to balance the benefits and risks of AI-based proctoring systems and to explore new technologies that could impact online education and proctoring systems in the future. The suggested system adds to the body of knowledge by tackling the constraints found in current solutions and introducing an innovative method for webcam monitoring utilizing Python and OpenCV.

Chowdhury Md. Mizan, et al., [7] - Real-time Face Recognition System using Python and OpenCV(2020) : The paper presents a review of the existing literature on face detection and recognition using OpenCV and Python. The authors conducted a literature survey to identify the existing solutions for face detection and recognition and their limitations. They found that traditional face detection and recognition methods are prone to errors and lack the ability to detect sophisticated cheating methods. The proposed system aims to overcome these limitations by using OpenCV and Python to develop a novel face detection and recognitionsystem. The authors conducted a comparative analysis of various face detection and recognition algorithms and identified their strengths and weaknesses. They found that the existing solutions lack the ability to detect faces in real-world scenarios, such as varying lighting conditions and facial expressions. The intended system seeks to overcome these drawbacks by leveraging OpenCV and Python to create a dependable system for detecting and recognizing faces. The authors' review of related studies offers a thorough examination of current research pertaining to face detection and recognition employing OpenCV and Python, along with identifying shortcomings in existing methodologies. The proposed system adds to this body of literature by tackling the shortcomings observed in current approaches and offering a fresh perspective on face detection and recognition through the utilization of OpenCV and Python.

Indrashis Das, Bharat Sharma, Siddharth S., et al., [8] - An Examination System Automation Using Natural Language Processing(2019) : The examination system uses natural language processing (NLP) to automate the evaluation of descriptive-type answers. The authors conducted a literature survey to identify the existing solutions for automated essay scoring and their limitations. They found that traditional automated essay scoring systems rely on predefined rules and lack the ability to understand the context and meaning of the text. The proposed system aims to overcome these limitations by using NLP techniques to analyze the text and evaluate the answers. The researchers conducted tests to assess the system's effectiveness and discovered that it attained remarkable precision in assessing descriptive responses. However, the authors also identified some limitations of the system, such as the need for a large dataset of sample answers and the potential for bias in the evaluation process. Overall, the paper contributes to the literature on

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automated essay scoring by proposing a novel system that uses NLP techniques to analyze the text and evaluate the answers.

Taskeen Fatima, Farooque Azam, Abdul Wahab Muzafir, et al., [9] - A Systematic Review on Fully Automated Online Exam Proctoring Approaches(2022) : The literature survey is a systematic review of fully automated online exam proctoring approaches. The researchers undertook an extensive examination of available literature to pinpoint the advantages and obstacles associated with the utilization of AI-driven proctoring systems for remote examinations.. They discussed various fully automated online exam proctoring approaches, including facial recognition, eye-tracking, and noise detection. The authors identified several trends and issues associated with AI-based proctoring systems, such as the need for rigorous testing and evaluation, and the potential impact of AI on online education. The authors emphasize the importance of ensuring the security, privacy, and ethical use of AI- based proctoring systems in online exams.

Seife Dendir, R.Stockton Maxwell, et al., [10] - Cheating in Online Courses: Evidence From Online Proctoring(2020) : The authors conducted a systematic literature review and narrowing down to relevant ones after applying inclusion and exclusion criteria. The analysis categorizes proctoring into three main types: live online supervision, recorded and later reviewed, and fully automated systems. It presents a comparison of online exam methods and technologies spanning from 2017 to 2021, uncovering five prominent strategies for deterring cheating and highlighting 14 key techniques, with Natural Language Processing (NLP) emerging as a commonly employed method. Ten datasets, encompassing both public and private sources, are identified. The research delves into 20 different tools designed for preventing cheating, encompassing 23 tools identified from existing literature. It scrutinizes the factors influencing adoption and the worldwide uptake of online anti-cheating solutions across various nations. Lastly, it assesses the overall expenses associated with e-learning infrastructure, particularly concerning exam administration, by juxtaposing essential adoption factors with prominent features of online exams.

PAPER	YEAR OF PUBLICATION	TECHNOLOGY/METHODOLOGY	PROS	CONS
[1]	2021	ASP.net, Artificial Intelligence, Machine Learning, Deep learning, Python, OpenCV	Provides a comprehensi ve review of AI-based proctoring systems, their applications, and potential future.	The proposed Proctoring Systems Past, Present and Future may not cover all recent developmen ts in the field.
[2]	2021	Artificial Intelligence, voice recognition, computer vision	Develops an AI-based proctoring system for online tests that can detect cheating and ensure fairness.	May raise privacy concerns and require further testing for accuracy.
[3]	2017	Bayesian Information Criterion (BIC), video monitoring, automated proctoring software	Can be done remotely, allowing for flexibility in testing times and locations.	Requires access to specific equipment (e.g. webcam, microphone) and a stable

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				internet
[4]	2022	Python, Flask, MySQL, Bootstrap	Provides a more secure testing environme nt by preventing cheating and academic dishonesty	Technical issues or glitches can disrupt the exam and cause frustration for students.
[5]	2020	Artificial Intelligence and Machine Learning algorithms, keystroke patterns, biometric authentication, such as facial recognition.	Programme d to adapt to different exam formats and requirement s, allowing for a customized and flexible proctoring.	Can lead to a lack of understanding individual circumstances , such as technical difficulties or personal emergencies during the exam.
[6]	2019	Python, OpenCV, computer vision	Provides a more secure testing environme nt by preventing cheating and academic dishonesty.	May require substantia l computin g resources, potentiall y leading to increased system requirements
[7]	2018	Face Detection, Face Recognition, OpenCV	It has Potential to be more scalable and cost- efficient compared to conventio nal proctoring approach.	Requires access to specific equipment and a stable internet connection, which may not be available for all students.
[8]	2017	Natural language processing, machine learning	It can offer immediate responses to students, allowing them to promptly grasp and improve upon their errors, thereby enriching the learning journey.	May face challenges in evaluating subjective or nuanced aspects of student responses, such as creativity or critical thinking.

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[9]	2021	Artificial Intelligence, Machine Learning,	Can accommoda te a high volume of exams, making them suitable for institutions with a large number of students. limitations	Automated systems may produce false positives, flagging innocent behavior as suspicious.
[10]	2020	Artificial Intelligence, Machine Learning, NLP, Python and OpenCV	Includes identity verification measures, such as facial recognition or fingerprint scanning.	Can create a negative perception among students, who may view the technology as invasive and undermining trust in the learning process.

COMPARITIVE ANALYSIS :

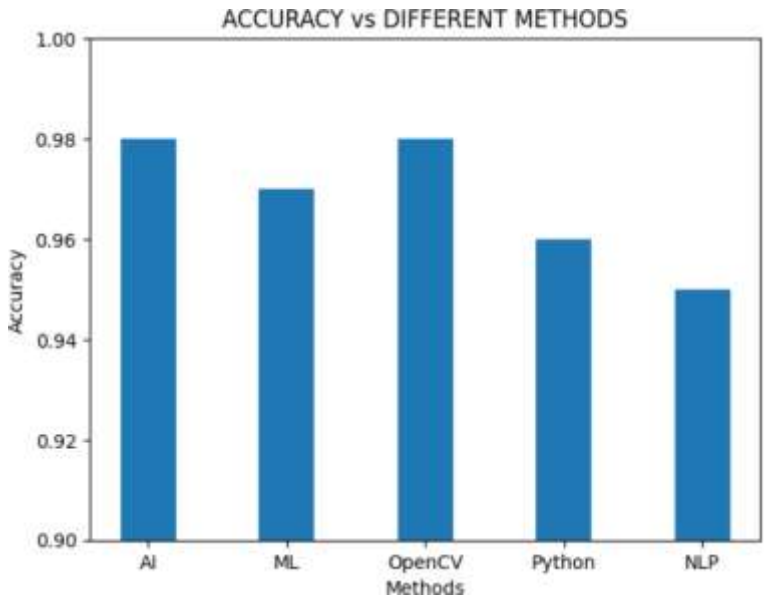

Figure 1 : Graph depicting Accuracy of different methods

Figure 1 is the comparison of various methods or technologies along with their corresponding accuracy scores visually represented through both a bar graph. In the bar graph, each method is depicted on the horizontal axis, while the vertical axis represents the accuracy scores. According to the data provided, Artificial Intelligence (AI) and Open CV exhibit the highest accuracy scores, both achieving a score of 0.980. Machine Learning (ML) closely follows with a score of 0.970, while Python and Natural Language Processing (NLP) demonstrate slightly lower accuracies of 0.960 and 0.950, respectively. In the corresponding table1, the same information is presented in a tabular format. The methods are listed in one column, and their accuracy scores are displayed in the adjacent column. This format allows for a clear and concise representation of the data, enabling easy comparison between the different methods and their respective accuracies. From the table, it is evident that AI and Open CV share the highest accuracy score of 0.980, while ML follows closely behind with a score of 0.970. Python and NLP exhibit slightly lower accuracies

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of 0.960 and 0.950, respectively. Both the bar graph and the table effectively convey the comparative performance of these methods in terms of accuracy, providing valuable insights into their respective capabilities.

Methods	Accuracy
Artificial Intelligence (AI)	0.980
Machine Learning (ML)	0.970
Open CV	0.980
Python	0.960
NLP	0.950

Table 1 : Accuracy of different methods

III. CONCLUSION

In our endeavor to develop a strong AI proctoring system, we have implemented various technologies such as Python, HTML, CSS, JS, and OpenCV methods. Our objective was to create a cost-effective solution that could automate the recruitment process while incorporating the latest AI and machine learning algorithms. To achieve this goal, we built OpenCV models that monitor the non-verbal communication of users during the assessment process. This includes features such as eye tracking, mouth tracking, head pose estimation, and audio recording. These models were designed to mimic the behavior of existing proctoring systems, but with greater accuracy and cost-effectiveness.

IV. FUTURE ENHANCEMENT AND SCOPE

The application of AI in Proctoring Systems holds immense potential for the future as cheating in online exams is a growing concern. Our focus has been on developing a Strong AI based Proctoring system that can significantly reduce the possibility of cheating. As for the expansion of our project, we plan to incorporate databases and enhance the complexity and accuracy of our openCV models through 55 techniques such as ensemble learning and deep learning. Our ultimate goal is to improve the performance of web applications, automate the recruitment process entirely, and eliminate the need for human intervention using Strong AI methods.

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