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Assesment Proctoring system

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Abstract: ***This project introduces an AI Based Exam Proctoring System designed to maintain the integrity of online assessments by leveraging advanced technologies. The system employs a combination of artificial intelligence, machine learning, and computer vision techniques to monitor and secure online exams. Key functionalities include real-time video monitoring of test-takers, facial recognition, eye-tracking, and behavior analysis to detect any suspicious activities. The Online Proctoring System not only minimizes cheating but also reduces the administrative burden on educators by automating the proctoring process, allowing for scalable and efficient online assessments. In an era of remote learning, Assessment Proctoring System using AI/Ml is a vital tool for maintaining academic integrity and trust in online education. This project serves as a comprehensive guide for educators, institutions, and technologists interested in the development and deployment of effective online proctoring solutions. To implement this project, we leverage commonly available hardware components such as a webcam and a microphone which are connected to the student's PC or laptop. Real Time video processing capabilities are harnessed to continuously monitor the examination environment. Any suspicious activities or deviations from the expected behavior are promptly detected by the AI algorithm.***

Keywords: ***Cheating instances, Cheat-free assessment, Academic integrity, Remote proctoring, Webcam, Real-time video processing, Suspected cheating.***

I. INTRODUCTION

The rapid growth of online education has raised concerns about academic integrity in remote assessments. To address this challenge, the AI Based Exam Proctoring System has emerged as a crucial tool. This system leverages advanced technologies like artificial intelligence, machine learning, and computer vision to monitor and authenticate test takers during online exams. It ensures secure, reliable, and efficient assessments while respecting privacy and data protection. This report explores the architecture, functionalities, and ethical considerations of Online Proctoring Systems, offering insights for educators, institutions, and technology enthusiasts seeking to maintain academic integrity in the digital education era.

The AI-based exam proctoring system described here incorporates a multi-faceted approach to monitor and maintain the integrity of online exams. At its core, the system employs head pose estimation to analyses the orientation of individuals' heads in real-time. This process involves capturing images using the OpenCV library for Python and leveraging Media Pipe's face recognition module to detect and track faces. By calculating head angles using the Perspective-n-Point (PnP) algorithm, deviations from expected head positions can be identified, signaling potential irregularities during the exam. Furthermore, the system integrates speech detection capabilities to monitor audio inputs during exams. By analyzing spoken content in real-time, instances of unauthorized communication or external assistance can be detected, ensuring the integrity of the assessment process. Additionally, cheating behaviors detection algorithms are utilized to identify suspicious activities such as gaze deviations or attempts to access external resources. These algorithms, powered by machine learning techniques, enable the system to recognize patterns indicative of cheating behaviors, thereby enhancing the overall security of online exams. Through the seamless integration of computer vision, machine learning, and speech detection technologies, the AI-based exam proctoring system provides educators with a comprehensive toolset to uphold exam integrity in virtual learning environments. By leveraging open-source libraries such as OpenCV and Media Pipe, the system offers scalability and flexibility while maintaining robust performance.

II. NEED AND MOTIVATION

The motivation behind developing an AI-based exam proctoring system lies in addressing the growing demand for secure and reliable online assessment solutions in the field of education. With the increasing prevalence of remote learning and online exams, there is a pressing need to ensure the integrity of assessments and prevent academic dishonesty. Traditional methods of exam monitoring are often insufficient in the digital environment, prompting the exploration of innovative technologies such as artificial intelligence. By leveraging advanced techniques like head pose estimation, speech detection, and cheating behaviour detection, this system offers a proactive approach to maintaining exam integrity.

It provides educators with the means to detect and deter cheating behaviours effectively, fostering an environment of fairness and accountability in online assessments. Moreover, the development of such systems aligns with the broader trend of integrating technology into education to enhance learning outcomes and ensure equitable evaluation practices across diverse student populations. Ultimately, the motivation stems from the pursuit of academic excellence and the commitment to upholding the integrity of the educational process in the digital age.

III. SURVEY OF LITRATURE

The global pandemic has necessitated a transformative shift in the field of education, compelling the traditional teaching paradigm to give way to online teaching and blended learning models. A significant challenge in this transition is the efficient monitoring of remote online examinations, a crucial factor influencing the scalability of online evaluation within the education system. Conventionally, human proctoring has been the prevalent method, either requiring learners to take tests at designated examination centres or visually monitoring them by instructing the activation of their cameras [1]. However, this approach is not without limitations, primarily due to its dependence on trained supervisors who continuously monitor the videos and audios of all test-takers through webcams, making it both costly and potentially ineffective. In response to the drawbacks of human proctoring, we have developed an automated online proctoring system that is not only cost-effective but also nonintrusive and adaptable to various testing scenarios [2]. The absence of a physical invigilator is a significant hurdle in the online mode, making online proctoring services increasingly popular. Moreover, the demand for AI-powered proctoring solutions is on the rise. This project introduces a strategy to eliminate the need for a physical proctor during tests by implementing a multi-modal system [3]. A pivotal aspect of online learning today is the verification of the identity and proctoring of online students. This becomes particularly crucial for online certification and accreditation, where training organizations must ensure that students completing the learning process and obtaining academic credits are indeed the ones who registered for the courses [4]. Our multi-modal system addresses these challenges effectively, providing a comprehensive solution for identity verification and online proctoring in the realm of modern education.

IV. METHDOLOGY

1) Live Proctoring
2) AI-Powered Behavior Analysis
3) Real-time Alerts and Reporting
4) Integration with Learning Management Systems
5) Continuous Improvement

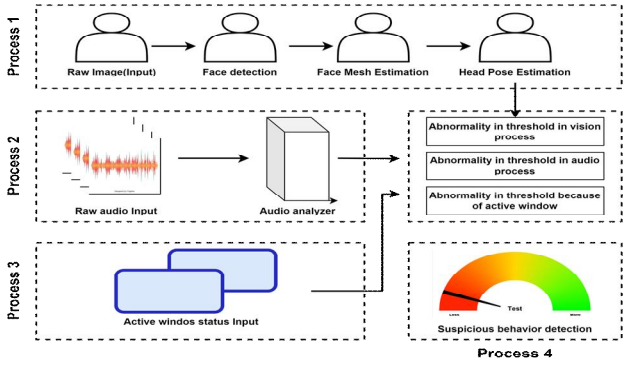

Fig.4.1 Block Diagram

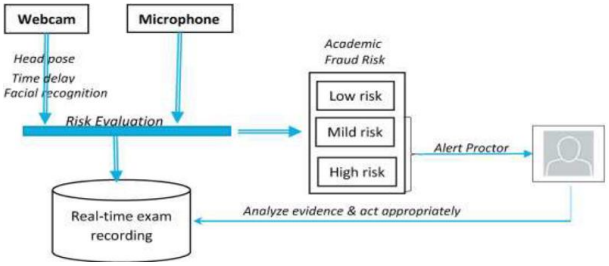

Fig.4.2 Activity Diagram

1) Webcam and Microphone: These tools capture the student's activity during the exam.
2) Head Pose: This refers to the position and orientation of the student's head us detected by the webcam.
3) Academic Fraud Risk: This refers to the likelihood that the student is cheating on the exam.
4) Risk Evaluation: This refers to the process of assessing the student's activity to determine the risk of academic fraud.
5) Low Risk, Mild Risk. High Risk: These labels indicate the different levels of risk that the system might detect.
6) Alert Proctor. This refers to a notification that is sent to a human proctor if the system detects a high risk of academic fraud.
7) Real-time exam recording: This refers to the fact that the student's activity is being recorded throughout the exam.
8) Analyze evidence & act appropriately: This refers to the steps that a proctor might take if they are alerted to apotential case of academic fraud.

V. IMPLEMENTAION

The head pose estimation, we use OpenCV library for python for images capture and prepossessing. The MediaPipe library by Google is used for face recognition. It is an open-source ML library for various computer vision applications. We use the face recognition module to detect the face in the captured image. Then we use the PnP library to calculate the angle of the head and use that data to get the head angle data. We apply a threshold to the angle of the head pose on the X and Y axis such as if the user looks beyond the threshold, then it is detected as looking beyond the screen

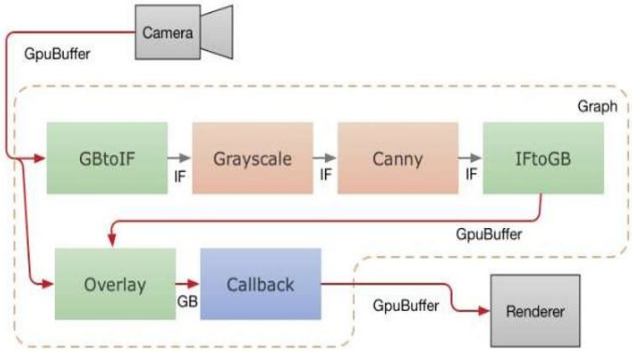

Fig 5.1 Face recognition algorithm

The graph represents the weightage for a conditional algorithm used in suspicious behavior detection. It evaluates different inputs, including previous cheating instances, X-axis and Y-axis movements, and audio anomalies, to determine a final cheat percentage. A value of 0 indicates normal behavior, while 1 signifies suspicious activity. The system applies biases to these inputs, progressively increasing the cheat percentage when multiple suspicious behaviors are detected. The color-coded representation highlights low (green), moderate (yellow), and high (red) probabilities of cheating. Unlike step-function approaches, this algorithm ensures a continuous, real-time update of the cheat percentage, making it effective for monitoring and detecting suspicious activities dynamically.

Previous Cheat	X axis	Y axis	Audio cheat	Final Cheat Percentage
0	0	0	0	0
0	0	0	1	0.2
0	0	1	0	0.2
0	0	1	1	0.4
0	1	0	0	0.1
0	1	0	1	0.4
0	1	1	0	0.15
0	1	1	1	0.25
1	0	0	0	0
1	0	0	1	0.55
1	0	1	0	0.55
1	0	1	1	0.85

Fig 5.2 Weightage for conditonal algorithm

VI. RESULT AND ANALYSIS

This figure represents a head pose estimation system implemented using computer vision techniques. The system detects and tracks facial landmarks, as seen in the red dots over the subject's face. The detected face is processed in real-time, likely using a Python-based framework such as OpenCV and Dlib or Mediapipe, to estimate the head's orientation. The For suspicious behaviours detection we used different flags pertaining to different inputs and these flags are then fed into a conditional algorithm which has set biases for different inputs. When a condition is satisfied, the resulting percentage output is added with a factor to the previous percentage to make the resulting percentage by time graph more continuous and not be in a step graph. When the suspicious percentage is above the set threshold then it is detected as cheating. The output is then plotted in a graph with time on X-axis and the percentage on Y-axis. The graph is continuous, which means it will update progressively as time goes by.

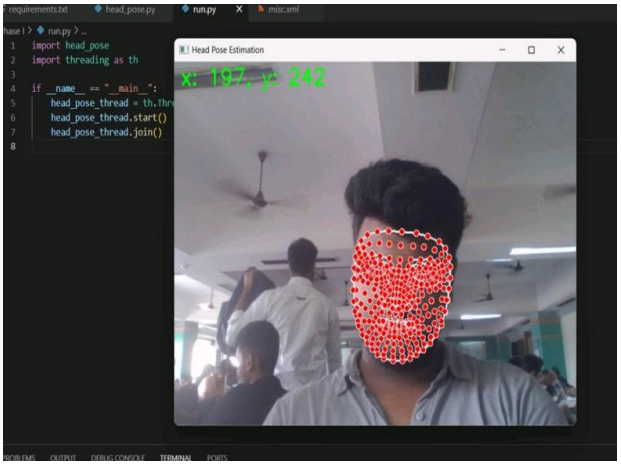

Fig 6.1 Result of head pose

The graph illustrates suspicious behaviour detection by tracking cheat probability over time, providing insights into behavioural trends. Initially, the probability remains near zero, indicating normal behaviour. However, as time progresses beyond 75 units, a gradual rise is observed, suggesting increasing instances of detected anomalies such as irregular head movements or gaze shifts. Around the 150–175 time mark, a sharp spike occurs, signifying a critical period where multiple suspicious activities are detected simultaneously, likely crossing a predefined threshold for cheating detection. The fluctuations in this region indicate dynamic adjustments, where the system continuously reassesses the probability based on real-time data. A slight decline towards the end suggests that either the behaviour normalized or the system adjusted its detection sensitivity.

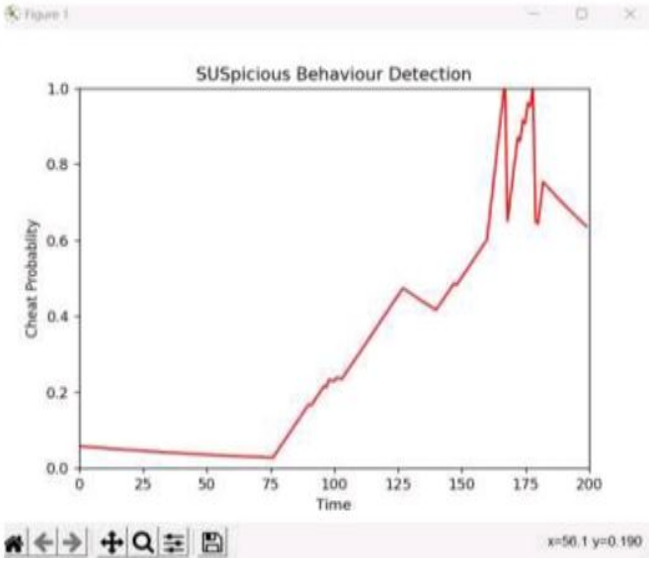

Fig 6.2 Result of suspected behaviour detection

VII. FUTURE SCOPE

The future scope of AI-based exam proctoring systems extends beyond their current capabilities, emphasizing continuous refinement of algorithms and machine learning models to enhance accuracy, efficiency, and adaptability. As these systems evolve, the integration of advanced biometric authentication methods, such as facial recognition, voice analysis, and fingerprint verification, will further strengthen security measures, ensuring that only authorized individuals participate in examinations. Additionally, incorporating multi-modal sensor technologies, such as eye tracking, keystroke dynamics, and behavioral analytics, will significantly improve the system's ability to detect and respond to various forms of cheating with greater precision. Beyond security enhancements, AI-driven proctoring systems must also address concerns related to scalability, personalization, and inclusivity, allowing educational institutions to tailor the technology to their unique requirements. This customization ensures compatibility with different exam formats, institutional policies, and accessibility standards, making online assessments more reliable and fair. Moreover, advancements in data analytics and AI-driven insights can provide educators with a deeper understanding of student behavior, cognitive engagement, and test-taking patterns, contributing to improved assessment methodologies. As online education continues to expand globally, ensuring seamless integration with learning management systems (LMS) and compliance with data privacy regulations will remain key challenges. Addressing these aspects will help foster trust among students and educators while maintaining academic integrity. In the long run, AI-based proctoring has the potential to revolutionize digital assessments, offering a balance between security, user experience, and ethical considerations, making examinations more accessible, unbiased, and technologically advanced in the digital era.

VIII.CONCLUSION

This system is one of the popular revisited topics due to the pandemic and the need for people to conduct online tests. The system aimed to detect whether the user is showing suspicious paper using video and audio output. During the making of the system, we used various machine learning algorithms for head pose detection and successfully implemented head pose estimation using computer vision as well as speech detection using a microphone. We successfully developed a system that can detect suspicious behavior, and it is a lightweight, low-resource-consuming system. The integration of advanced algorithms enhances its efficiency, ensuring real-time monitoring without significant computational overhead. Additionally, the system is designed to be scalable, allowing institutions to implement it across various online examination platforms. Future improvements can focus on increasing detection accuracy by incorporating eye-tracking and facial expression analysis. Ensuring privacy and ethical considerations remains a crucial aspect, requiring continuous refinements in data handling and security measures. Moreover, adaptive learning mechanisms can be implemented to improve the system's detection capabilities over time..

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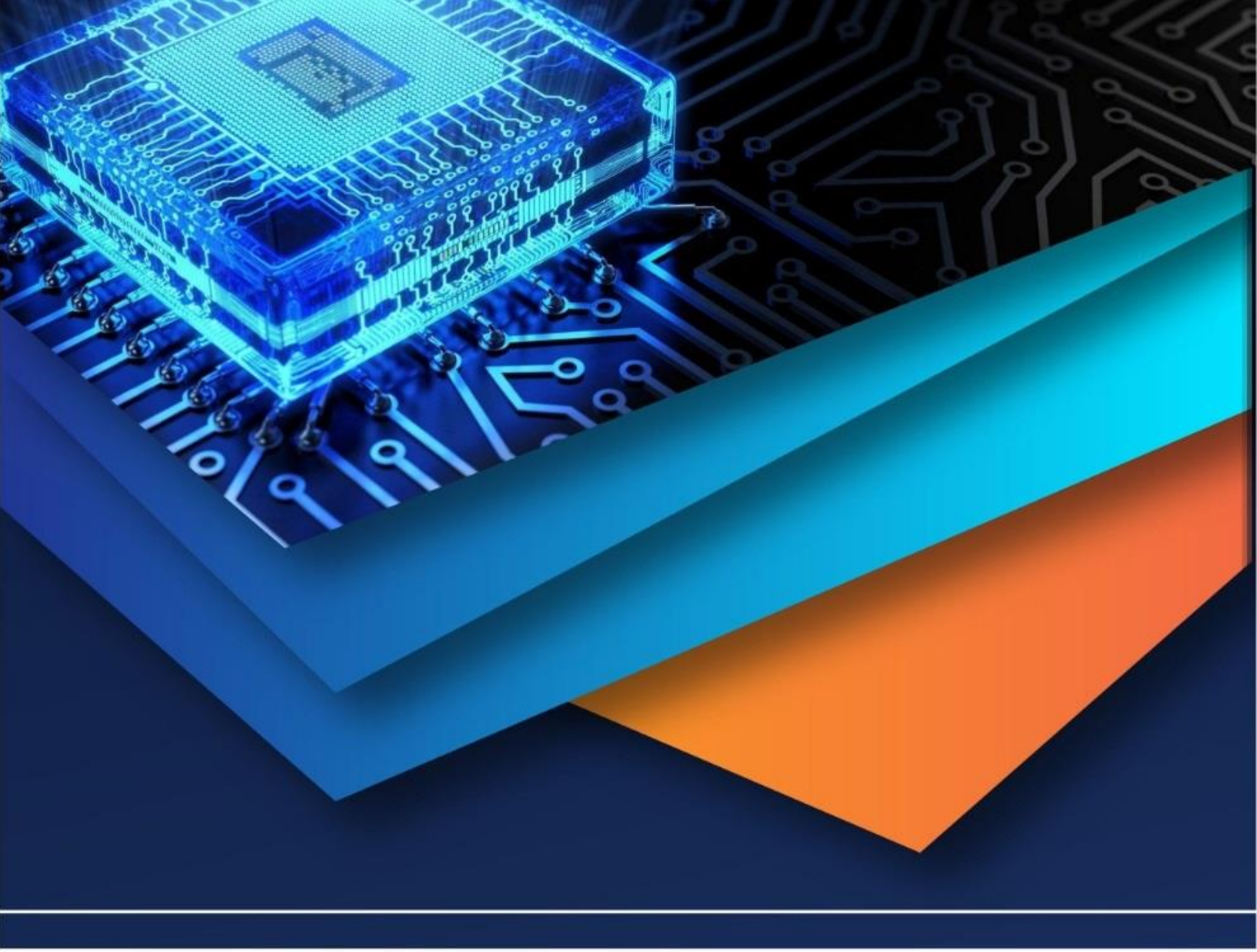

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