**2.1 Review of Related Literature**

**2.1.1 Implementation of facial recognition and live monitoring**

Facial recognition technology and live monitoring systems play critical roles in maintaining the integrity of online exams. These technologies, leveraging advancements in computer vision and machine learning, authenticate users and identify suspicious behaviors, thereby bolstering the security of online assessments.

Studies emphasize the significance of facial recognition technology within online proctoring systems [1]. They propose practical approaches to enhance accuracy and efficiency while minimizing computational costs and processing time. These approaches streamline the training process, resulting in improved accuracy rates without unnecessary preprocessing steps.

Innovations like YOLO-face [2] offer real-time face detection capabilities, overcoming challenges in detecting faces of different sizes and orientations. By optimizing detection frameworks and refining regression techniques, YOLO-face achieves higher accuracy and reliability, making it suitable for online proctoring applications.

Automated proctoring systems, such as ProctorEx [3], employ facial recognition, and gaze tracking monitoring to detect suspicious activities during exams. This comprehensive monitoring approach enables educators to identify cheating behaviors, ensuring fairness and transparency in online assessments.

Integrating facial recognition into online proctoring systems is essential for maintaining exam integrity [4]. By analyzing facial features and movements in real-time, researchers aim to enhance the effectiveness of online proctoring systems in detecting and preventing cheating behaviors.

The application of facial recognition technology enhances exam security and reliability [5]. By integrating facial recognition with online proctoring systems, researchers aim to provide a secure solution for online assessments while upholding academic integrity.

Online proctoring systems leveraging simple techniques for face recognition and behavior detection demonstrate high accuracies [6]. These systems utilize straightforward algorithms to detect faces and monitor behaviors, thereby enhancing the security and reliability of online assessments.

Automated online exam proctoring platforms integrate facial recognition, and gaze tracking monitoring to detect cheating behaviors [7]. By monitoring student behavior in real-time, these platforms enhance exam integrity and maintain the value of academic assessments.

**2.1.2 Integration of Real-time behavior monitoring**

Real-time behavior monitoring is crucial for maintaining academic integrity in online exams. Various studies have explored the implementation of real-time monitoring features, such as students taking screenshots during online exams and switching tabs to look for answers, in order to ensure the integrity of examinations.

1. The Sikoola application employs real-time monitoring features such as camera surveillance and color-coded question indicators to ensure exam integrity. By leveraging real-time monitoring, Sikoola enhances the effectiveness of online proctoring systems in detecting and preventing academic dishonesty.

[9] Understanding user experiences with online examinations and proctoring systems helps address challenges in maintaining academic integrity and evaluating the effectiveness of proctoring systems in deterring cheating. By exploring user perceptions and behaviors, researchers can identify areas for improvement in online proctoring systems and enhance their overall effectiveness.

[10] Clear guidelines and training programs are essential for effective behavior monitoring and deterring cheating in online assessments. By providing educators with the necessary tools and resources, institutions can promote academic integrity and create a fair testing environment for all students.

[11] Virtual proctoring plays a vital role in upholding academic integrity in online education, providing technology-driven solutions to enhance monitoring capabilities. By leveraging advanced technologies such as screenshot and tab-switching detection, virtual proctoring systems can effectively detect and prevent cheating behaviors during online exams.

[12] An innovative approach integrates screenshot detection into online proctoring systems to provide secure solutions for addressing challenges in remote learning. By monitoring students' activities in real-time, including the capture of screenshots, educators can identify and prevent cheating behaviors, thus ensuring the integrity of online assessments.

[13] Existing online proctoring systems with tab-switching detection capabilities emphasize the significance of real-time monitoring and privacy considerations. By detecting changes in students' browser tabs, these systems can identify potential cheating behaviors and take appropriate actions to maintain exam integrity.

**2.1.3 Utilization of Plagiarism Checker**

The surge in online education has accentuated the necessity for measures to uphold academic integrity, particularly in online examinations. This review delves into recent studies that underscore the utilization of plagiarism detection tools within online proctoring systems as a pivotal strategy to combat academic dishonesty effectively.

Several studies have addressed the imperative of integrating plagiarism detection tools into online proctoring systems to safeguard the integrity of online assessments. For instance, [14] presents the implementation of an intelligent online proctoring system (IOPS) with a focus on real-time plagiarism detection. By adopting a B/S architecture and employing C and Python for server-side implementation, the system demonstrates efficacy in maintaining exam integrity, as evidenced by its successful pilot application at Peking University.

Similarly, [15] proposes an optimization-based approach for distanced online testing (DOT), which strategically integrates plagiarism detection algorithms to mitigate collusion during online exams. By optimizing question sequences and synchronizing delivery, DOT minimizes collusion potential, thus bolstering exam integrity amidst the challenges posed by the COVID-19 pandemic.

Cheating in online exam, exacerbated by the transition to online learning, underscores the need for institutional measures such as integrating plagiarism detection tools into online proctoring systems, as highlighted in [16] this qualitative study elucidates faculty perspectives on contract cheating and emphasizes the pivotal role of plagiarism detection in mitigating this issue effectively.

Moreover, [17] presents an approach to detecting malpractice in e-exams by integrating plagiarism detection within online proctoring systems. Leveraging advanced machine learning techniques, the system analyzes students' visual focus of attention (VFOA) data, achieving robust detection performance specifically targeting plagiarism.

Additionally, [18] investigates the correlation between scores obtained in unproctored online exams and invigilated in-person exams, affirming the validity of unproctored online assessments. By integrating plagiarism detection, the study not only enhances the assessment value of online exams but also serves as a proactive measure to deter cheating.

However, while the integration of plagiarism detection tools into online proctoring systems is pivotal, it is not without its challenges. [19] critically examines prevailing assumptions and offers insights into more nuanced approaches to promoting academic integrity. Similarly, [20] synthesizes recent studies and technological developments aimed at enhancing academic integrity, advocating for a holistic approach that encompasses plagiarism detection alongside other strategies.

Furthermore, [21] presents enhancements to academic integrity in online proctoring through plagiarism detection, building on previous research insights and technological innovations.

In sum, the integration of plagiarism detection tools into online proctoring systems represents a crucial step towards preserving academic integrity in online learning environments. Future research should continue to explore innovative solutions and holistic approaches to combatting academic dishonesty effectively.

**2.1.4 Incorporation of time question Session**

Time management during online exams is essential for maintaining fairness and integrity in the assessment process. This section explores various studies and strategies related to the implementation of time question sessions in online examinations.

[22] The importance of structuring online exams to align with course learning goals while addressing the challenges of administering tests in an online environment. Emphasizing the need to assume online exams as open book, the study suggests designing questions that assess higher-order thinking skills rather than mere memorization. Additionally, it advocates for the use of quizzes for low-stakes assessments to reduce student pressure and minimize the likelihood of cheating.

[23] The utilization of per-question timers in online exams emerges as a promising strategy to enhance assessment integrity and effectiveness. By assigning specific time frames to individual questions, educators can create a more secure testing environment that accurately evaluates various skills. These timers promote cognitive agility, critical thinking, and efficient decision-making among students while discouraging cheating behaviors.

[24] The implementation of online proctoring systems, including AI algorithms, contributes to maintaining exam integrity in the digital age. Technologies such as per-question timers and browser proctoring enhance the security of online exams by preventing unauthorized activities and ensuring a fair testing environment.

[25] The user experience of online examinations and proctoring, highlighting challenges in maintaining integrity in distance learning environments. The study explores the use of proctoring systems, including time restrictions, to deter cheating behaviors. It emphasizes the importance of selecting proctoring systems based on criteria such as conformity, expandability, and integration with learning management systems.

**Synthesis of the Reviewed Literature**

The reviewed literature underscores the importance of integrating technological solutions to maintain academic integrity in online exams. Across various studies, the implementation of facial recognition technology, real-time behavior monitoring systems, plagiarism detection tools and questions timer emerges as pivotal strategies in combating academic dishonesty effectively.

Facial recognition technology, as discussed in [1]-[7], plays a crucial role in verifying student identities and detecting suspicious behaviors during online exams. Studies highlight the effectiveness of real-time monitoring features such as gaze tracking, browser monitoring, and facial recognition in enhancing exam integrity and preventing cheating behaviors.

Moreover, the integration of real-time behavior monitoring systems, as discussed in [8]-[13], provides educators with comprehensive tools to detect and prevent academic dishonesty. Technologies such as screenshot detection, tab-switching detection, and camera surveillance enable proactive monitoring of student activities, ensuring fairness and transparency in online assessments.

Additionally, the utilization of plagiarism detection tools within online proctoring systems, as explored in [14]-[21], addresses the growing challenge of contract cheating and plagiarism in online education. By leveraging advanced machine learning techniques and real-time analysis of student data, these tools enhance exam integrity and mitigate cheating behaviors effectively.

Furthermore, the incorporation of time question sessions, as discussed in [22]-[25], emphasizes the importance of time management in online exams. Strategies such as per-question timers and browser proctoring contribute to maintaining exam integrity by creating a secure testing environment and deterring cheating behaviors.

Overall, the reviewed literature highlights the significance of technological advancements in upholding academic integrity in online exams. Integrating facial recognition, real-time behavior monitoring, and plagiarism detection tools into online proctoring systems provides educators with robust solutions to combat academic dishonesty and ensure the reliability of online assessments.