iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** I **Month of publication:** January 2026

DOI: https://doi.org/10.22214/ijraset.2026.77120

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue I Jan 2026- Available at www.ijraset.com

Privacy-Preserving On-Screen Activity Tracking in E- Learning

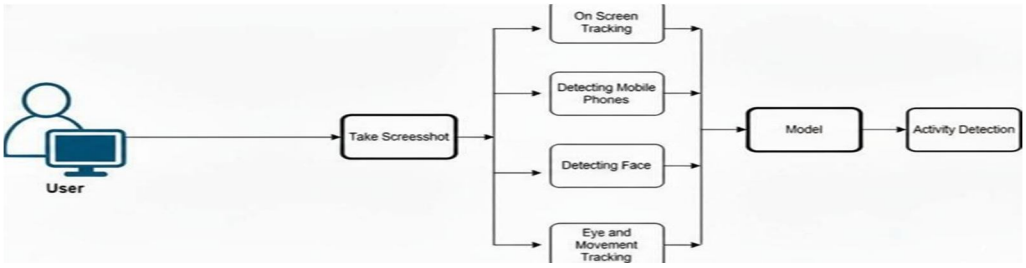
Dr. Dewanand Meshram[1], Satyam Kale[2], Harish Mengade[3], Swaraj Aghav[4], Sanika Ahire[5]
[1]*Professor, Department of Information Technology, RMD Sinhgad School of Engineering, Pune, Maharashtra, India*
[2, 3, 4, 5]*Student, Department of Information Technology, RMD Sinhgad School of Engineering, Pune, Maharashtra, India*

Abstract: ***The rapid growth of online education has made effective proctoring systems essential to maintaining academic integrity and ensuring fair exams and online learning. Conventional proctoring methods like in-person invigilation are not feasible for online exams and e-learning. To address this issue, an automated proctoring method based on computer vision is proposed. This system tracks and analyzes applicant behavior throughout online learning and testing using advanced computer vision algorithms. A webcam and microphone are used by the Automated Proctoring System to continuously monitor the test environment. The Automated Proctoring System uses a webcam and screen recorder to monitor the test environment in real time. Computer vision algorithms are used to identify and monitor the examinee's face, gaze direction, eye movements, body posture, and suspicious activities. Machine learning models identify unusual patterns of behavior, such as continually turning away from the screen or showing many faces in the camera frame. These abnormalities cause the examiners to receive alerts for further inquiry. The proposed method aims to enhance exam security and e-learning by mitigating academic dishonesty, including cheating, impersonation, and unauthorized aids. It uses computer vision to provide a scalable and non-intrusive method of monitoring online assessments and e-learning.***

I. INTRODUCTION

There is an urgent need for robust protections to preserve academic integrity during online exams, particularly with the growth of remote learning and online education. Two key concerns in online exam environments are ensuring that candidates adhere to the necessary examination criteria and maintaining a fair testing environment. Traditional in-person proctoring methods are impractical in online environments due to logistical constraints and privacy concerns. Because of this, automated proctoring systems that monitor and administer online exams using computer vision techniques have grown in popularity. This research suggests an Automated Proctoring System that uses cutting-edge computer vision algorithms to efficiently track and examine how candidates behave during online tests. This system may detect and identify suspicious activities, abnormal gaze patterns, and other behaviors that might point to possible academic dishonesty by utilizing computer vision technologies. The goal is to give educational institutions and online learning environments a non- intrusive, scalable, and effective way to maintain academic integrity. In this paper, we provide a comprehensive analysis of the Automated Proctoring System, describing the machine learning models used for anomaly detection, the behavior analysis methodology, and the underlying computer vision algorithms. We highlight the system's ability to resolve issues with academic integrity and uphold fairness for all applicants, which eventually helps to establish the legitimacy of online learning. The technical details of the suggested Automated Proctoring Systemwill be covered in detail in the following parts, which will also include the system's design, deployment, and assessment to confirm how well it monitors and upholds the integrity of online tests. To guarantee that the system complies with ethical standards and privacy laws, ethical issues pertaining to data protection and the reduction of false positives will also be covered.

II. ARCHITECTURE



©IJRASET: All Rights are Reserved

III. LITERATURE SURVEY

Jay Mayekaretal: In this paper, In this paper, we have proposed and implemented an automated proctoring system using computer vision techniques. The system helps in conducting examinations by fair means and hence, maintains its integrity. This study demonstrates how to avoid cheating in online examinations by employing semi-automated proctoring based on vision and audio capabilities, as well as monitoring several students.

Simon Wenig et al: In this paper, a simulation framework for MMC-based multi terminal HVDC systems is presented. The selected modeling concept offers insight into global arm quantities, considered asessential parameters to investigate transient system controllability. Besides the featureto handle unbalanced voltage conditions in one of the interfaced ac networks, this control approach facilitates active regulation strategies of all converter arm energies to keep the system within a predefined operating area during and subsequent to dynamic events.

Aiman A Turani et al: In this work, In this paper, we have focused on the limitations and concerns regarding the online proctoring. The twomain concern sweretest integrity and student performance. Avoiding frauds and cheating attempts within online proctoring sessions without affecting test- taker's performance is considered to be very challenging. We suggested using the 360- degree security camera over the webcam for improving the proctoring process.

Asep Hadian Sudrajat Ganidisastra et al: The evaluation results have shows us that incremental training has a better performance compared to batch training in speed and dataset size. The decrease of training speed and dataset size is not givinga negative influence on the accuracy rate, on the contrary, the proposed method will result in smaller storage space, smaller memory usage, and faster training speed. On theother hand, the face detection method can result in better face recognition accuracy.

Sarthak Maniar et al: In this paper, we have proposed and implemented anautomated proctoring system using computer vision techniques. The system helps in conducting examinations by fair means and hence, maintains its integrity. This study demonstrates how to avoid cheating inonline examinations by employing semi- automated proctoring based on vision and audio capabilities, as well as monitoring several student satonce. However, if there is a person sitting behind the laptop, the student can communicate with that person by reading the question. This can be catered by having a 360 degree camera monitoring the whole room of the student.

Renuka Devi et al.: This paper deals with designing an approach wherein it tries to detect any abnormal behaviors present in the videos. The system first works by detecting all students present in the video. After detecting all the students, it tracks the detected students throughout the course of the video. The features of the tracked students are calculated using HoG feature descriptor and then sent to the K-Nearest Neighbor classifier. The classifier is pre- trained to detect normal or abnormal actions. System is made to be adaptable to lots of different conditions as in, a user can choose the behaviors that they want the system to detect and train the system specifically for that.

Yousef Atoumet al: This paper presents a multimedia analytics system for online exam proctoring, which aims to maintain academic integrity in e-learning. The system is affordable and convenient to use from the text taker's perspective, since it only requires having two in expensive camera sand a microphone. With the captured videos and audio, we extract low-level features from six basic components: user verification, text detection, speech detection, active window detection, gaze estimation, and phone detection.

Yusep Rosmansyah et al: In this paper, online learning or e-learning has become increasingly popular and evolved. Many academic institutions use the Learning Management System (LMS) as a mediumfor delivering e-learning. A vital feature in such a system is the electronic examination (e-exam), where verifying student's authentic competence is a challenge. This paper aims to present countermeasures for impersonation attacks. This research was a more focused effort and a continuation of previously owned one and many others found in works of literature.

The method of protection is presented in the form of an attack-defense tree model.

Aditya Nigam et al.: In this paper, online testing is the next wave of adoption after online learning which has seen a significant rise in demand due to the problems posed by the ongoing COVID-19 Pandemic. OPS do not claim to be completely fool proof but are rapidly changing the adoption of online testing from home, a scenario that previously would have been thought to be preposterous amongst the masses.

Tejaswi Potluri et al.: The main objective of this paper is to develop a well-rounded automation system that is capable of helping the proctor to monitor the students attending an online examination. Out of the several proposed features of the system, our paper has developed the ability to do multiple person detection, face spoofing, and head pose estimation.

©IJRASET: All Rights are Reserved

IV. EXISTING SYSTEM

Distance learning has entered a new phase with the introduction of COVID-19. Learning has been moved to apps like Google Meet, Microsoft Teams, Zoom, and others when schools and institutions have closed. The majority of institutions have updated their courses to match the times. The virtual method of learning caused students' practical knowledge to decline, and they started attending lectures only for the sake of doing so. The results came as a surprise even though their grades and scores ought to be dropping in light of everything. Fantastically, everything turned around. Many pupils fared better than they did on average. This is because there has neverbeen a way to do a formal evaluation in the online learning environment without utilizing unfair methods. A method that can aid in assessing unfair strategies utilized by students is needed to address the current issue. When it comes to online exams, the use of proctoring techniques is a significant challenge for the research community.

V. PROPOSED SYSTEM

The proposed system introduces a privacy-preserving on-screen activity tracking model that uses computer vision and machine learning to maintain fairness in online examinations and E-learning. It automatically monitors students through their webcam and microphone, analyzing facial expressions, head and eye movements, and on-screen activities to identify suspicious behavior. The system also converts audio into text to detect possible communication during exams. By combining face detection, gaze tracking, and activity recognition, it accurately detects cheating attempts without requiring human invigilators. It ensures data privacy by processing information locally and sharing only essential results securely. Overall, the system offers a secure, scalable, and non-Intrusive approach to uphold academic integrity in e-learning environments.

VI. CONCLUSION

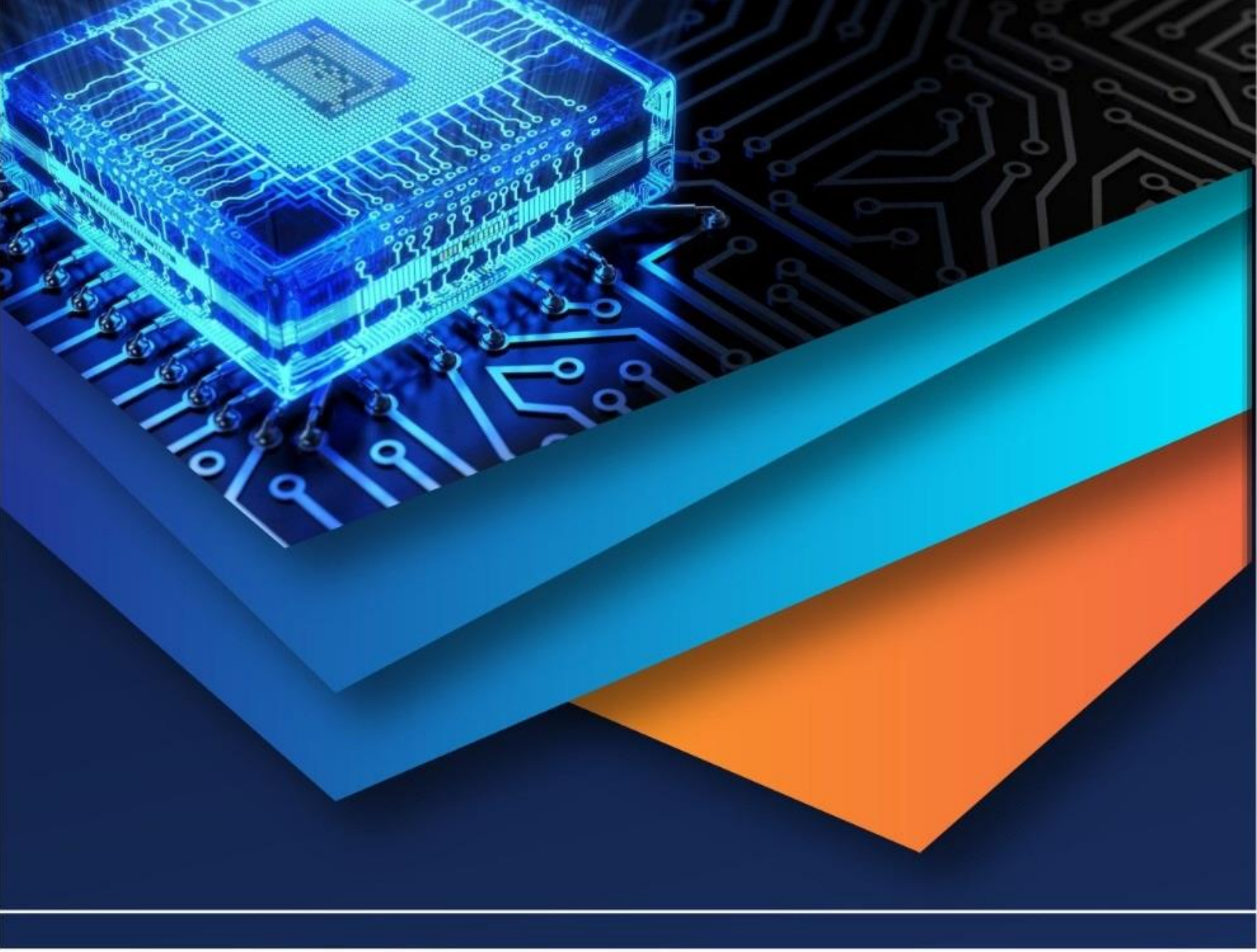
The study concludes that automated proctoring systems using AI and computer vision are effective in maintaining fairness during online exams and E-learning. These systems can detect cheating by analyzing a student's face, eye movement, and behavior in real time. They provide a smart, scalable, and privacy-friendly way to monitor exams without human invigilators. Overall, such technology helps improve academic integrity and ensures trust in online education.

REFERENCES

[1] Jay Mayekar1, Shubham Pal2, Aditya Pandey3, Bikra Pani4, Prof. Preeti Mishra5, "AUTOMATED PROCTORING SYSTEM",
[2] International Research Journal of Engineering and Technology (IRJET) e- ISSN: 2395-0056 Volume:10Issue:04|Apr2023.
[3] SimonWenig,MichaelSuriyah, Freiber Rojas, Kevin Schonleber, Thomas Leibfried, "Simulation Framework for DC Grid Control and ACDC Interaction Studies Basedon Modular Multilevel Converters", @IEEE 2016.
[4] Aiman A Turani, Jawad H Alkhateeb, Abdul Rahman A. Alsewari, "Students Online Exam Proctoring: A Case Study Using 360 Degree Security Cameras",2020EmergingTechnology in Computing, Communication and Electronics (ETCCE)
[5] Asep Hadian Sudrajat Ganidisastra, Yoanes Bandung, "An Incremental Training on Deep Learning Face Recognition for M-Learning Online Exam Proctoring", The 2021 IEEE Asia Pacific Conference on Wireless and Mobile (APWiMob)
[6] "Automated Proctoring System using Computer Vision Techniques", Conference Paper · July 2021.DOI: 10.1109/ICSCAN53069.2021.9526411
[7] Renuka Devi, Gowri Srinivasa, "Detection of anomalous behavior in an examination hall towards automated proctoring", https://www.researchgate.net/publication/321260760,2017.
[8] Yousef Atoum, Liping Chen, Alex X. Liu, Stephen D. H. Hsu, and Xiaoming Liu, "Automated Online Exam Proctoring", ACCEPTED WITH MINOR REVISION BY IEEE TRANSACTION ON MULTIMEDIA, DEC 30, 2015
[9] Yusep Rosmansyah,"Impersonation Attack-Defense Tree", https://doi.org/10.3991/ijet.v15i19.12699
[10] Aditya Nigam, Rhitvik Pasricha, Tarishi Singh, Prathamesh Churi, "A Systematic Review on AI-based Proctoring Systems: Past, Present and Future" , Education and Information Technologies(2021)26:6421– 6445,2021.
[11] Tejaswi Potluri1 & Venkatramaphanikumar S1 &Venkata Krishna Kishore K1, "An automated online proctoring system using attentive-net to assess student mischievous behavior", Multimedia Tools and Applications (2023) 82:30375–30404,2023.
[12] A. Sun and X. Chen, ''Online education and its effective practice: A research review,'' J. Inf. Technol. Educ., Res., vol. 15, pp. 157–190, May 2016.
[13] I. E. Allen and J. Seaman, ''Digital learning compass: Distance education enrollmentreport,''BabsonSurveyRes. Group, Wellesley, MA, USA, Tech.Rep. 2017-1, 2017.
[14] S. I. U. Rehman, H. S.Ullah, and A. Akhtar, ''Consumption of social media and academic performance: A cross- sectional survey of perception of students in KP universities,'' Global Mass Commun. Rev., vol. 4, pp. 57–71, 2020.
[15] I. K. Sohail and N. A. Nabaz, ''The influence of social media on student's academic performance: A case study of Lebanese French University,'' Mod. Manag. Theory Pract., vol.25, no.2,pp. 117–127, 2019.
[16] J. Goet, ''Impact of social media on academic performance of students,'' KIC Int. J. Social Sci. Manage., vol. 1, no. 1, pp. 35–42, Dec. 2022.
[17] S. I. U. Rehman, H. S. Ullah, and Akhtar, ''Consumption of social media and academic performance: A cross-sectional survey of perception of students in KP universities,'' Global Mass Commun. Rev., vol. 5, no. 4, pp. 57–71,Dec.2020.[8]C.LiandF. Lalani, The COVID-19 Pandemic has Changed Education Forever. This is How, vol. 29. Geneva, Switzerland: World Economic Forum, 2020.

[18] E. Vayena, A.Blasimme, and I. G. Cohen, ‘‘Machine learning in medicine: Addressing ethical challenges,’’ PLOS Med., vol. 15, no. 11, Nov. 2018, Art. no. e1002689. [16] B.Imlerand, M.Eichelberger, ‘‘Using screen capture to study user research behavior,’’Library Hi Tech, vol. 29,no. 3, pp. 446–454, 2011.
[19] P. Krieter and A. Breiter, ‘‘Track every move of your students: Log files for Learning Analytics from mobile screen recordings,’’ in Proc. Die 16. E- Learning Fachtagung Informatik (DeLFI), 2018, pp. 1–12.
[20] B. J. Ferdosi, M. Sadi, N. Hasan, and M. A. Rahman, ‘‘Tracking digital device utilization from screenshot analysis using deep learning,’’ in Proc. Int.Conf. DataSci. Appl.(ICDSA),vol.1.Singapore:Springer,2023,pp.661–670.
[21] C. Dwork, ‘‘Differential privacy,’’ in Proc. Int. Colloq. Automata, Lang., Program. Berlin, Germany: Springer, 2006, pp. 1–12.
[22] X. Yi, R. Paulet, E. Bertino, X. Yi, R. Paulet, and E. Bertino, ‘‘Homomorphic encryption,’’ in Tutorials on the Foundations of Cryptography. Cham, Switzerland: Springer, 2014.
[23] O. Goldreich, ‘‘Secure multi- party computation,’’ Manuscript. Preliminary version, vol. 78, no.110, pp.1–108, 1998.
[24] J. Konečný, H. B. McMahan, F. X. Yu, P. Richtárik, A. T. Suresh, and D. Bacon, ‘‘Federated Learning: Strategies for improving communication efficiency,’’ 2016.
[25] M. Abadi, A. Chu, I. Good fellow, H. B. Mc Mahan, I. Mironov, K. Talwar, and L. Zhang, ‘‘Deep learning with differential privacy, ’’in Proc. ACM SIGSAC Conf. Comput. Commun. Secur. New York, NY, USA: ACM, 2016, pp. 308–318.
[26] W. Dai, S. Wang, H. Xiong, and X. Jiang,‘‘Privacypreservingfederatedbig data analysis,’’ inGuide to Big Data Applications. 2018, pp. 49–82.
[27] H. B. McMahan, E. Moore, D. Ramage, S. Hampson, and B. A. y. Arcas, ‘‘Communication-efficient learning of deep networks from decentralized data,’’ 2016, arXiv:1602.05629.
[28] S.J.Panand, Q.Yang,‘‘Asurveyon transfer learning,’’IEEETrans.Knowl. DataEng.,vol.22,no.10,pp.1345– 1359, Oct. 2009.
[29] K. R. Varshney, ‘‘Trustworthy machine learning and artificial intelligence,’’XRDS,Crossroads,ACM Mag.Students, vol. 25, no.3, pp. 26–29, Apr. 2019.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)