# *Trust in the Digital Age: Building a Framework for Secure and Student-Centric Online Proctoring*

**[1] Shaik. Kalesha Vali, [2] Kalakonda. Akshay, [3] Jayanth Satya Siva Durga Swamy Nama,**

**[4] Chukka. Hari Venkatesh, [5] Jonnalagadda. Surya Kiran**

[1,2,3,4,5] Department of Computer Science and Engineering, Koneru Lakshmaiah Education Foundation, Vaddeswaram, A.P., India-522502.

[1] skkalesha332@gmail.com,[2] akshaykalakonda2003@gmail.com,[3] jayanthnama06@gmail.com, [4] chukkaharivenkatesh2004@gmail.com,[5] kiransurya93@kluniversity.in

**Abstract:**

**The COVID-19 pandemic has caused a quick change to online learning, making it important to study how it affects students' academic experiences. This multi-faceted study examines various aspects of online learning across different disciplines and regions, aiming to provide valuable insights into its efficacy, challenges, and potential for future education systems. Through diverse methodologies including surveys, qualitative interviews, statistical analyses, and experimental approaches, the research delves into factors influencing student stress, learning outcomes, and satisfaction with online platforms. Additionally, it explores innovative solutions such as project-based learning integration, cheating detection mechanisms, and proctoring methods to address the evolving landscape of digital education. By synthesizing findings from a range of studies conducted worldwide, this paper contributes to a deeper understanding of the pandemic's impact on higher education and offers recommendations for enhancing online learning experiences in the post- pandemic era.**

**Keywords: Online exams, Fair assessments, Avoidance of cheating, Distance learning, and Academic Integrity, Integrity, Confidentiality, Cheating Detection Mechanisms.**

## I. INTRODUCTION

In the COVID-19 period, a new framework for online tests has been implemented, which is a significant step forward in adapting to the evolving nature of education and assessment. Using the Django framework, an application has been created to meet the challenges posed by the pandemic. This new approach is intended to ensure the legitimacy, safety, and trustworthiness of online exams while providing administrators and students with an easy-to-use interface.

Digital signatures are employed to improve the authentication process. A private key is given to the end user upon registration. After that, both keys are stored in the database and used to authenticate users when they log in. Live photo verification, a cutting-edge biometric authentication technique designed to authenticate test takers in real-time, is a crucial part of the system. Customers are requested to provide a live snapshot, which is then analysed by sophisticated facial recognition software. One can ensure the security of the testing process and resist efforts at impersonation by comparing this live image with previously taken pictures. Strict privacy controls are also put in place to protect users' biometric information and adhere to privacy and data protection regulations.

The framework offers an in-depth approach for overseeing online tests, elegantly fusing technology, and security protocols. This solution provides a stable and adaptable platform for securely giving exams as educational institutions and corporations adjust to the complications of distance learning and assessment. With an emphasis on user privacy, authenticity, and integrity, our system raises the bar for tests conducted online both during and after the present pandemic.

In closing, the Django-developed online testing system, which has been improved with digital signatures and real-time photo verification, exhibits security and versatility amidst the corona virus pandemic. This approach, which

places an enormous value on user privacy and identification, provides businesses and institutions an appealing choice as they navigate the transition to remote learning and assessment. The platform focuses on adaptability and reliability in order to provide a seamless testing experience while adhering to stringent privacy regulations.

The framework creates a higher standard of credibility and dependability for assessments conducted online in these unsettling digital times, preserving trust through and beyond the present difficulties. By identifying key challenges and opportunities inherent in virtual assessment environments, this framework aims to provide practical guidelines for universities navigating the complexities of online assessment adoption. By elucidating the intricate interplay between technology, education, and security, the study aims to inform policy decisions and institutional strategies aimed at ensuring equitable and high-quality education in the digital age.

## II. LITERATURE SURVEY

### *A. Title: Causes of higher levels of stress among students in higher education who used eLearning platforms during the COVID-19 pandemic*

In this paper mainly focused on the students who are involved in the stress due to sudden changes in academic environment, family, and personal factors Collect data from 12 Indian institutions, selecting 800 student email IDs randomly from 1,000 provided. Determine that academic changes, family, and personal factors induce higher stress than cognitive and social elements, addressing post-outbreak psychological shifts. Used PLS-SEM to explore the connections between stress factors and their influence on students' stress experiences**.**

### *B. Title: The Effectiveness and Efficiency of Google Classroom as an Alternative Online Learning Media to Overcome Physical Distancing in Lectures Due to the Covid-19 pandemic: Student Perspectives*

In this research, the focus is to evaluate the effectiveness and efficiency of the Google Classroom online learning application during the COVID-19 pandemic, specifically from the viewpoint of students. With 120 respondents from the UNESA electrical engineering department, the study examines aspects such as time availability efficiency, ease of use of the Google Classroom interface, and the application's effectiveness in achieving learning objectives. The Likert scale was used to measure the attitudes, opinions, and perceptions of a person or group of people about social phenomena in online learning. The conclusion highlights students' positive reception of Google Classroom for online learning and proposes its potential for blended learning post-pandemic.

### *C. Title: Experiences with Online Education During the COVID-19 Pandemic–Stricken Semester*

The objective of the paper is to analyze the experiences with online education during the COVID-19 pandemic, particularly focusing on the impact of online education on students' final grades and studying habits. Additionally, the paper aims to provide insights into the potential of online education and the pros and cons of this mode of learning. It does mention the use of several platforms for the analyzed academic course, including Moodle, YouTube, Slack, and Microsoft Teams.

### *D. Title: Paradigm shifting of education system during COVID-19 pandemic: A qualitative study on education components*

The study seeks to investigate pandemic-driven changes in education via qualitative interviews (IDI, KII) with 15 participants, specifically examining the transition from traditional to online education and advocating for policy adjustments in Bangladesh. Calculated the mean and standard deviation and normal distribution. Tau B of Kendall’s correlation matrix and Logistic regression model. Used to calculate how much change in grades.

### *E. Title: Factors affecting digital education during COVID-19: A statistical modelling approach*

Examine and determine what factors are most important in online learning during the coronavirus epidemic, paying particular attention to the difficulties that students have in a digital learning environment. Utilizing information gathered from some of students via a structured questionnaire, conducted an exploratory analysis to learn more about the variables influencing digital education. The frameworks are Null Hypothesis, Alternative Hypothesis, Statistical analysis, Model fitting tests, EFA Assessment, correlation

### *F. Title: Assessing the students' readiness for E-Learning during the Covid-19 pandemic: A case study.*

This study assesses E-learning readiness among Health Faculty students at Isfahan University of Medical Sciences during coronavirus, exploring its correlation with demographics. Focusing on the widespread shift to

virtual learning, the research identifies strengths and weaknesses in E-learning readiness among Iranian higher education students, especially in health. The results aim to offer insights into student preparedness for E-learning, guiding interventions to enhance adaptability in virtual education.

*G.* ***Title: College Students Online Education Evaluation Through SWOT Analysis During COVID-19.***

This study aims to assess the impact of the coronavirus pandemic on college education by conducting a SWOT analysis of the shift to online learning. It identifies internal and external factors influencing online education and proposes improvement strategies. Using subjective weight and fuzzy MARCOS, the research aims to provide effective coping strategies for enhancing the online learning experience in the post-pandemic era. The objective is to contribute insights for improving higher education and fostering a sustainable society through innovative approaches to online learning. SWOT matrix, SWOT-fuzzy AHP-MARCOS.

*H.* ***Title: Impacts of the Covid-19 Pandemic on Life of Higher Education Students: Global Survey Dataset from the First Wave.***

The objective was to assess the impact of the coronavirus pandemic on higher education students' lives through a large-scale global survey conducted between May 5 and June 15, 2020. Covering socio-demographic, academic, emotional, and life aspects, the survey collected 31,212 responses from 133 countries. The goal was to analyze the relationships between socio-demographic factors and various elements of student life, providing valuable insights for researchers and policymakers in formulating strategies to support students during and beyond the pandemic.

I. ***Title: Machine Learning for Strategic Decision Making during COVID-19 at Higher Education Institutes***

This study investigates the use of machine learning in strategic decision-making in higher education. It emphasizes how important stakeholder involvement is as well as how important it is to use efficient computational methods. If computers and data aren't used, decision-making can be quite slow.

J. ***Title: Exploring the impact of cyberbullying and cyberstalking on victims' behavioural changes in higher education during COVID-19:***

This study examines cyberstalking and cyberbullying in higher education, with a victim's perspective in mind. During epidemic, Based on conducted a survey of faculty and staff at an English institution to learn more about how outside factors, policy changes, and rising internet usage affect virtual communication. The Electronic Use Pursuit Behavioural Index was incorporated.

*K.* ***Title: Towards effective and efficient online exam systems using deep learning-based cheating detection approach***

This research says how to detect cheating using deep-learning concepts. By integrating front and back camera-based detection along with speech analysis, cheating behaviour can be identified in real-time. The system's effectiveness is demonstrated through high accuracy achieved via a decision-level fusion rule, providing a robust solution to maintain exam integrity in online learning environments.

*L.* ***Title: Can we stay one step ahead of cheaters? A field experiment in proctoring online open book exams***

This study examines the impact of proctoring methods on exam scores in face-to-face and online classes. Results indicate a significant score difference between proctored and non-proctored exams, with online exams showing a smaller impact from web-based proctoring compared to face-to-face proctoring. Factors such as test anxiety and collaboration among peers may influence these disparities, highlighting challenges in maintaining academic integrity in online assessments.

*M.* ***A secure online exams conceptual framework for South African universities***

This study addresses security concerns in South African universities regarding online assessments amid resource limitations. Through a review of academic fraud literature, it proposes a tailored framework to enhance online exam security, offering vital guidelines for adoption in higher education institutions

## III. METHODOLOGY

The technique consists of a methodical process that starts with the careful selection of pertinent articles on the selected subject, which are obtained from databases and scholarly sources. Following a thorough analysis, these gathered papers are thoroughly examined to extract important lessons and spot developing patterns, offering a strong basis for additional research. The topic is decided upon using information gleaned from the article analysis, guaranteeing scholarly relevance and compliance with study goals. After that, a precise problem statement is produced, outlining the particular topic that the study aims to investigate. The research approach is informed by a comprehensive literature assessment that consolidates existing information. The study framework is then developed and implemented using the suggested approach, which incorporates insights from the literature survey.

There are two modules:

**Admin Module**: In this module, the admin can register the students and fetch their IP address. Check the exam solutions of a particular student and can grade the student.

**Student/User module:** In this the user should first pass through an authentication system which is a combination of IP checking and the digital Signature later the student will allow for writing the exam.

Algorithm-1

1: **Create** a socket object `s` using `socket.socket(socket.AF_INET, socket.SOCK_DGRAM)`
2: **Connect** to a public server using `s.connect(("8.8.8.8", 80))`
3: **Retrieve** the local IP address with `s.getsockname()[0]`
4: **Handle** potential `socket.error` exceptions using a `try-except` block
   - **Set** `user_ip` to `None` if an error occurs
5: **Return** the retrieved `user_ip` address

Figure 2: Algorithm: Retrieve Local IP Address

Using a UDP socket, a public DNS server connection attempt, and the extraction of the local IP address from the socket's information, this Python code effectively finds the local IP address of a machine. Robustness is ensured by error handling, which also returns the obtained IP.

Algorithm-2

1: **Retrieve** user's public key from the `Aps` model using username
2: **if** user does not exist **then**
3: **Return** HTTP Bad Request with "User not found"
4: **end if**
5: **Call** `verify_signature(username, signature, public_key)`
6: **if** signature is valid **then**
7: **Create** session and redirect to 'home'
8: **else**
9: **Return** HTTP Bad Request with "Invalid digital signature"
10: **end if**
11: **if** HTTP request method is not POST **then**
12: **Render** login form
13: **end if**
14: **Decode** signature and public_key from base64
15: **Remove** PEM header and footer from public_key
16: **Load** public key using `serialization.load_pem_public_key`
17: **Encode** username to bytes for verification
18: **Verify** signature with `public_key_obj.verify` using specified padding and hash
19: **if** verification succeeds **then**
20: **Return** True
21: **else**
22: **Catch** exception, print error, and **return** False
23: **end if**

Figure 3: Algorithm: User Authentication with Digital Signature Verification

To authenticate users, this algorithm retrieves their public key, compares it to the supplied digital signature, and, if successful, creates a session. It responds appropriately to errors pertaining to invalid signatures, non-existent users, and improper HTTP methods.

## IV. BLOCK DIAGRAM

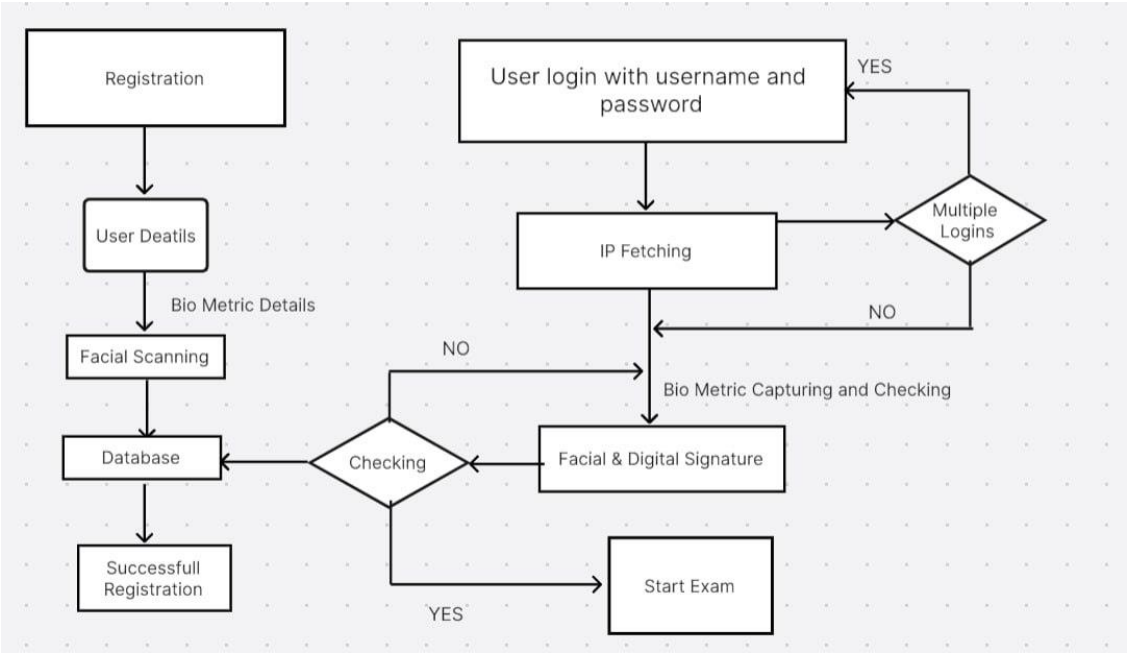


Figure 4: Structure of Implementation

1. Implementing the Biometric Exam Registration Process. The biometric exam registration process can be implemented by following these key steps:
2. System Development: Develop a system to handle user registration, login, and biometric data capture. This system will include functionalities for user interface, data storage, and integration with biometric scanning devices.
3. User Registration: Design a registration module where users create accounts with usernames, passwords, and personal details. This module should also handle capturing and storing initial biometric data (facial scan and potentially digital signature).
4. Login and Authentication: Implement a login mechanism where users authenticate themselves using their credentials. Upon successful login, the system should fetch the user's IP address for security purposes.
5. Biometric Verification: During the first login or upon request, the system will initiate facial scanning. If successful, it will proceed to capture and verify the user's live biometric data (e.g., fingerprint) against the stored data in the database.
6. Registration Success/Failure: If both facial recognition and biometric verification are successful, the user's registration is complete, and they can proceed with the exam. Any failed attempts at facial scanning or biometric verification will terminate the process.
7. This implementation ensures a secure and user-friendly registration experience for biometric exams.

## V. IMPLEMENTATION

A. Used framework and packages:
   1. Django is the web framework used for our work, known for its rapid development and clean, pragmatic design, making it ideal for building robust web application.
   2. Python 3.11 is used because of its better syntax, additional features, and increased performance, which make it appropriate for today's development requirements.
   3. A powerful library for cryptographic operations, such as the creation and validation of digital signatures, is the Python cryptography module. RSA encryption and decryption are implemented with the help of this package. It secures the integrity and confidentiality of data by securely encrypting and decrypting the public key using RSA after receiving the user ID as input.

B. For Backend:
   The application used the mysqlclient package to record IP addresses, student information, face data, and digital signature details. This package offers an interface for effective communication with MySQL databases, making it possible to store and retrieve important data in a safe and dependable manner. The program guarantees reliable database operations and efficient data management by utilizing mysql.

## VI. DISCUSSIONS

*A. Problem Statement identified:*

A significant problem with online tests surfaced during the pandemic: there was no assessment fairness, and the system did not differentiate between pupils who performed well academically and those who did not. This situation highlights the need for a more equitable and sophisticated approach to online evaluation techniques. Since students may use a variety of strategies to obtain an unfair advantage, worries about widespread cheating can be the reason for the unfairness of online exam evaluations. In order to address these issues, it is necessary to put strong mechanisms in place that discourage cheating while maintaining the fairness of assessment procedures for all students.

*B. Advantages:*

- Live photo verification and digital signatures improve authentication and reduce fraud and illegal access.
- Administrators and students alike gain from the user-friendly design, which guarantees accessibility for people with varying levels of technical proficiency.
- Tight privacy controls encourage compliance with laws, encourage user trust, and improve the testing process.

*C. Disadvantages:*

- Including features like real-time photo verification and digital signatures may be technologically challenging and require significant expenditures in money.
- The accuracy and reliability of technologies like facial recognition are critical to the system's performance, notwithstanding the possibility of sporadic mistakes or technological issues.
- Concerns concerning approval and privacy may arise from individuals who have reservations about the collection and storage of biometric data for authentication purposes.

*D. Scope of Improvement:*

It's unclear, but it provides an insight into internet testing during the pandemic. Further information is required regarding the operation of features such as digital signatures and live photo checks, in addition to investigating other techniques to deter cheating. Examples from real life would make the practical uses of these strategies easier to understand.

*E. How to Improve*

It is imperative to conduct more research on the efficacy of online testing techniques. It would be really helpful to get insights from colleges or universities that have used these techniques. It's also crucial to come up with non-technological alternatives for cheating prevention. Students' and educators' opinions may offer insightful viewpoints. To guarantee clarity for all readers, use simple explanations and examples.

## VII. CONCLUSION

Finally, a thorough and rigorous investigation of the selected subject is guaranteed by the methodical approach used in this research endeavor. An aligned study topic and a well-defined issue statement were finalized with the help of our careful selection and analysis of pertinent articles, which provided insightful information and highlighted important trends. During the implementation phase, when the suggested methodology was put into practice, the comprehensive literature review offered a solid theoretical framework. We were able to get useful data and wise conclusions by using this methodical technique, which helped to expand the body of knowledge in the discipline. The suggested system also provides a strong means of guaranteeing the confidentiality and security of online tests since it incorporates geolocation services, fingerprint and facial identification, audio and video testing, and login authentication.

## REFERENCES

[1] Robert Selvam, D., Xavier, S., Kasinathan, P., Ahmad Wadaan, M., Farooq Khan, M., & Santha Kumar David, M. (2023). Causes of higher levels of stress among students in higher education who used eLearning platforms during the COVID-19 pandemic. Journal of King Saud University - Science,35(4),102653. https://doi.org/10.1016/j.jksus.2023.102653

[2] Rohman, M., Baskoro, F., & EndahCahyaNingrum, L. (2020). The effectiveness and efficiency of Google classroom as an alternative online learning media to overcome physical distancing in lectures due to the COVID-19 pandemic: Student perspectives. 2020 Third International Conference on Vocational Education and Electrical Engineering (ICVEE). https://doi.org/10.1109/icvee50212.2020.9243258

[3] Kolar, P., Turcinovic, F., & Bojanjac, D. (2020). Experiences with online education during the COVID-19 pandemic–stricken semester. 2020 International Symposium ELMAR. https://doi.org/10.1109/elmar49956.2020.9219045

[4] Alam, M., Al-Mamun, M., Pramanik, M. N., Jahan, I., Khan, M. R., Dishi, T., Akter, S. H., Jothi, Y. M., Shanta, T. A., Mitra, S., & Hossain, M. J. (2022). Paradigm shifting of education system during COVID-19 pandemic: A qualitative study on education components. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.4075512

[5] Arora, M., Goyal, L. M., Chintalapudi, N., & Mittal, M. (2020). Factors affecting digital education during COVID-19: A statistical modeling approach. 2020 5th International Conference on Computing, Communication and Security (ICCCS). https://doi.org/10.1109/icccs49678.2020.9277370

[6] Dehghan, H., Esmaeili, S. V., Paridokht, F., Javadzade, N., & Jalali, M. (2022). Assessing the students' readiness for E-learning during the COVID-19 pandemic: A case study. Heliyon, 8(8), e10219. https://doi.org/10.1016/j.heliyon.2022.e10219

[7] Wang, H., Wu, J., Muhedaner, M., & Maihemuti, S. (2022). College students online education evaluation through SWOT analysis during COVID-19. IEEE Access, 10, 88371-88385. https://doi.org/10.1109/access.2022.3198082

[8] Aristovnik, A., Keržič, D., Ravšelj, D., Tomaževič, N., & Umek, L. (2021). Impacts of the COVID-19 pandemic on life of higher education students: Global survey dataset from the first wave. Data in Brief, 39, 107659. https://doi.org/10.1016/j.dib.2021.107659

[9] Ahmed, A. S., & Malik, M. H. (2020). Machine learning for strategic decision making during COVID-19 at higher education institutes. 2020 International Conference on Decision Aid Sciences and Application (DASA). https://doi.org/10.1109/dasa51403.2020.9317042

[10] Bussu, A., Pulina, M., Ashton, S., & Marta Mangiarulo. (2023). Exploring the impact of cyberbullying and cyberstalking on victims' behavioural changes in higher education during COVID-19: A case study. International Journal of Law, Crime and Justice, 75, 100628. https://doi.org/10.1016/j.ijlcj.2023.100628

[11] Kaddoura, S., & Gumaei, A. (2022). Towards effective and efficient online exam systems using deep learning-based cheating detection approach. Intelligent Systems with Applications, 16, 200153. https://doi.org/10.1016/j.iswa.2022.200153

[12] Vazquez, J. J., Chiang, E. P., & Sarmiento-Barbieri, I. (2021). Can we stay one step ahead of cheaters? A field experiment in proctoring online open book exams. Journal of Behavioral and Experimental Economics, 90, 101653. https://doi.org/10.1016/j.socec.2020.101653

[13] Ngqondi, T., Maoneke, P. B., & Mauwa, H. (2021). A secure online exams conceptual framework for South African universities. *Social Sciences & Humanities Open*, *3*(1), 100132. https://doi.org/10.1016/j.ssaho.2021.100132