

Real-Time Online Examination and Intelligent Proctoring System using AI

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Abstract

The field of digital education has grown rapidly in recent years and therefore the need for secure and efficient online examination systems has also increased. The core purpose of this paper istoevaluateaReal-TimeOnlineExamination&ProctoringSystemdevelopedtoallow students to sit their exams from virtually anywhere while maintaining academic integrity throughout the process. The system incorporates advanced technologies such as artificial intelligence (AI) and machine learning (ML) combined with real-time monitoring of student behaviour using webcams, microphones and screen tracking mechanisms; all of which will helpidentifyinstancesofmalpracticeduringexaminationsandhelppreventthem. The proposed system will contain several modules including; User Authentication, Exam Management, Live Proctoring and Automated Evaluation. Algorithms based on AI technology will analyse student’s facial movements, eye gaze and other behaviours to identify any possible attempt at cheating. The system also includes additional security features such as browser lockdown and encrypted data transmission during the examination process to ensure that the integrity of the examination process is maintained.

Keywords — Online Examination System, Real-Time Proctoring, Artificial Intelligence (AI), Machine Learning (ML), Academic Integrity, Remote Assessment, Browser Lockdown, Facial Recognition, Behavior Analysis, Automated Evaluation, Secure Authentication, E-Learning.

INTRODUCTION

The growth of online education has completely changed how learning is delivered worldwide. With more people using online tools to learn, the need for an online examination system that is both secure and effective has increased significantly. Traditional types of testing require students to be physically present and require human beings to watch students take their tests, causing tests to take longer to administer, use more resources to operate, and have a higher chance of making a mistake or detecting cheating compared to using an automated way of conducting examinations.

Online examination systems give students

the ability to take tests from any location, there by increasing the level of convenience and ease of access for them to take tests. However, these systems also create many challenges for schools and students, including maintaining academic integrity, verifying that students are who they say they are, and preventing students from cheating during their test.

I. LITERATURESURVEY

1. M. Alsabhan (2020)-Automated Online Exam Proctoring System Using AI:

The author introduced an AI-based proctoring system for online examinations that includes facial recognition and

monitoring to identify and detect various types of cheating behavior. M. Alsabhan's proctoring system captures images of students being tested and monitors their activity during the exam period (i.e., coughs, fidgets, and other movements). The study primarily focuses on detecting students' faces (recognition) but does not address more intensive methods of monitoring such as: recording audio, alerting in real time, etc.

2. R. Kumar and S. Verma (2020) – Machine Learning Approach for Student Monitoring:

The researchers developed a system for monitoring students during online exams using machine learning to model the behavioral patterns and activities of students on the website, and using anomalies in these models to detect unusual or unexpected student behavior. However, this system lacks the ability to provide a controlled browser environment for protecting students from cheating and does not employ multiple modalities for monitoring, thereby limiting the ability of this system to effectively prevent malpractice during the testing process.

3. A. K. Jain et al. (2019) – Online Examination System with Facial Recognition:

This study proposed an online examination system with a facial recognition component that allows only authorized students to access the system while taking a test. However, there was no continuous monitoring, and it does not capture or monitor cheating at any time during tests.

4. Rekha and R. Parvathi (2020) – AI-Based Smart Proctoring System:

In their research, the authors created a smartphone app that utilizes AI technologies to monitor students through the use of web cameras. The system can

identify head movements away from their centre point and analyze other characteristics about students' head movements to determine whether or not they may be engaging in cheating behavior.

I. EXISTING SYSTEM

Online examination systems currently available for students are essentially web-based and allow students to take their exams remotely using devices that have an internet connection.

The majority of existing systems include the standard features of user login, the ability to see the question paper, management of the timer, as well as auto-evaluation of the objective-type questions. Some systems even provide simple proctoring features, such as monitoring of the student through a webcam over the course of the exam and recording the screen or both webcam and screen during the examination.

Most current systems have a single, proctoring format (e.g., video recording or taking an image of the student @ specific intervals). A handful of more advanced systems may use facial recognition to verify a student's identity when the exam begins. Continuous authentication of the student once the exam has begun and real-time behavior analysis of the student is typically limited or not present at all.

The majority of existing systems employ a human proctor to monitor multiple students and consequently may result in inefficiency due to human error.

II. PROPOSED SYSTEM

The Real-Time Online Exam and Proctoring System being created utilizes a secure, scalable, and efficient method of conducting remote assessments. The system's innovative integration of technology will include artificial intelligence (AI) and machine learning

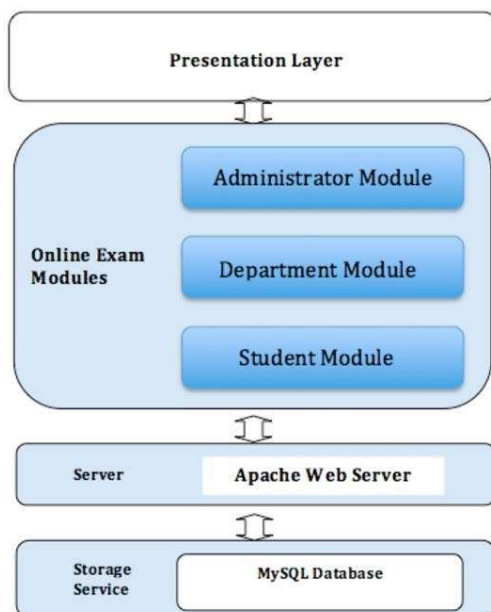
(ML), delivering ongoing observation and intelligent assessment of the behaviour of students during exams. This system features an entirely automated proctoring mechanism and tremendously reduces the number of persons involved in the proctoring process while still maintaining high levels of accuracy and reliability.

The proposed system consists of three different modules: User Authentication, Exam Management, Live Proctoring and Automated Evaluation. The user authentication module is responsible for verifying the candidate's identity through their unique login credentials, and through the use of facial recognition technology, both before and throughout the course of their examination. The live proctoring module provides a continuous surveillance feed of the candidate using a webcam, microphone, and/or screen capture tool. The integrated algorithms will analyze the candidate's facial expressions, eye movement, head position, and what is in the background of the candidacy to determine if they are behaving suspiciously, i.e., looking away from the screen, having multiple people in close proximity, or using

browser lockdown functionality that will restrict access to other tabs, applications, and/or websites outside of the browser during the examination process. The audio monitoring capability of the proctoring system will be used to detect any sounds or discussions taking place in the candidate's environment during the examination process that are out of the ordinary.

1) Advantages

- Maintains academic honesty through continuous observation
- Utilizes artificial intelligence to identify instances of academic dishonesty
- Monitors students via webcam, microphone, and screen capture
- Uses facial recognition for secure verification of students' identity
- Reduces the need for human involvement and reduces the likelihood of supervisor errors
- Allows for remote exams regardless of student location
- Provides automated reports for evaluation
- Applicable to a large number of students
- Transmits data securely and encrypted



III. SYSTEM ARCHITECTURE

The system architecture of the proposed real-time online examination and proctoring system shown in figure 1.

unauthorised devices.

The proposed system will also contain

2) Figure1: SystemArchitecture

At the User Layer, there are two main users of the system; students and administrators (instructors). The students will access the system via the web-based interface to sign into the system, take exams, and submit their results. The administrators will utilize a central dashboard to manage exam creation, schedule, and monitor the available to the administrators via the Admin Dashboard. This layer includes additional equipment (e.g., webcam, microphone) that may be utilized to facilitate real-time proctoring of students.

The Application Layer is the core processing unit of the RTOEPS. The Application Layer contains a variety of modules (e.g., Authentication Module, Exam Management Module, Proctoring Module, and Evaluation Module). The authentication module provides verification of the user's identity based upon their login credentials as well as facial recognition. The Proctoring Module of the Application Layer provides for the continual capture of video, audio, and screen activity during the examination process for analysis by Artificial Intelligence (AI) and machine learning algorithms to determine any indication of suspicious behavior.

IV. METHODOLOGY

The overall Methodology of real-time online examination and proctoring system is shown in figure 2.

Figure2:Methodology

1. Overview of System:

The Online Examination & Proctoring System is a secure examination administered remotely via Artificial Intelligence and Machine Learning Technologies, while monitoring users bodily movements when taking online exams through the use of the webcam,

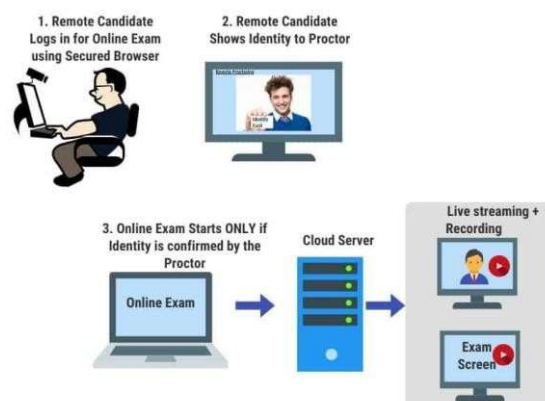
microphone, and screen by still analysing behaviour during their exams. This system has user identification modules, examination management modules, real-time proctoring, and auto-marking features all ensuring the entire process of examinations are errorless and reliable.

2. Data Preprocessing

Before Used in Analysis, the information from webcam and audio together with the Screen Activity is subject to pre-processing, which entails, de-noising of audio, extraction from the video of an individual image (frame) from the video stream, and normalization of Input Data so to produce Analytically Accurate Results. Irrelevant or excessive amounts of data will be filtered out when identifying required features such as facial landmarks, eye gazed direction, and motion will all increase the performance of AI detection models based upon the given Criteria.

3. AI-Based Proctoring Model

This system uses AI algorithms together with ML algorithms to provide real-time analysis of behaviours exhibited by students. Through the utilisation of facial recognition software for detecting individuals or eye tracking software for locating a person's eyeball direction or object detection for finding anomalous behaviour (eg; looking off a screen and turning head to someone else) this system consistently learns and improves as it continues to monitor for commonality of exits and then it identifies irregularities within the student's behaviour during each



examination process..

Real-Time Monitoring and Alert System

At the time of testing, all video, audio, and screen activities will continue to be monitored by the system. Any behaviours that occur that may indicate abnormal behaviours such as head shakes, background noise, or screen changing will cause a real-time alert to be generated, along with an evidence capture of the action, and sent to the dashboard of the administrator for examination and investigation.

4. Evaluation and Report Generation

Objective answers will be evaluated and stored securely following the completion of the exam. The objective to generate reports will include an incident(s) flagged with timestamps and performance metrics to allow instructors to make fair and transparent decisions about how students performed and/or were suspected of cheating.

VI. INTELLIGENT PROCTORING ANALYSIS

The Intelligent Proctoring Analysis module plays a key role in maintaining the online testing process's integrity and fairness. The Intelligent Proctoring Analysis module uses AI, ML, and webcam-related data from students to monitor student behaviour continuously and provide detections of suspicious behaviour and minimize malpractice through real-time detection. The system uses face recognition/face detection technologies to verify a candidate's identity remotely throughout the testing period to ensure that only an authorized student is present by detecting any number of individuals or by not identifying that an individual is there.

Additionally, the module uses eye tracking and head pose tracking to verify a candidate's attention to their computer could be considered indicative of cheating behaviour.

Further methods used in the intelligent proctoring module include audio analysis and background noise detection to detect unusual sounds or activities, such as having conversations or providing outside assistance to a student. Additionally, the system's screen monitoring system will track activities, such as switching between browser tabs, launching unauthorised applications, or attempting to duplicate any information on the computer screen. Each of the above applies as input to the AI model for classification of the student's behaviour as either being normal or suspicious.

VIII. ADMIN MODULE

The Admin Module serves as the main hub for controlling the entire Real-Time Online Examination and Proctoring System. It is responsible for the control of the entire operation, all the system, the users, the exam itself, and the proctoring system. The administrator can perform anything, set up security, and ensure proper functioning.

At the start, the admin can manage the users who are added, modified or deleted either the student or the examiner. The module will allow only the allowed users to enter the system with the authentication. Furthermore, the admin can schedule the exam; these parameters could include when the exam should take place, the length of the exam, which subjects are tested on, and how many questions each student should receive.

One very important responsibility that is in the Admin Module is the control of the question paper. It allows the admin to create or modify questions in objective and descriptive format as a part of question bank and can be mixed up. To prevent cheating it is possible for the admin to mix up the question papers in order to make the

results of every user different from another. It also gives permission to include things like negative marking for answers, and limited time for answers to the question.

The Admin Module allows the Admin to control the entire examination and see the live video feed from each examination room and detect illegal behavior or actions from students through the real-time proctoring dashboard where the AI will generate an alert whenever an anomaly is found in any of the examinations and a warning to the respective student or can terminate the exam on behalf of the teacher.

After the completion of the exam, it allows the Admin to control or view the final reports. The evaluation of objective questions will be automated and also will provide the student's reports in a simple format. Finally it gives access to view and evaluate recorded exam reports and details to ensure a fair exam and accurate grading.

IX. AUTOMATED ALERT SYSTEM

The Automated Alert System is an integral part of a real-time online examination and intelligent proctoring system responsible for detecting, analyzing, and responding to potentially suspicious behavior. It aids in the security of the examination by providing real-time notifications based on rule-based conditions and machine learning-based behavioral analysis.

The primary aim of the Automated Alert System is to monitor candidates by constantly observing their behavior in real-time from a variety of data sources including video, audio, and screen activity. In order to monitor the behavior and detect various suspicious activities like multiple faces being present, absence of a candidate, unusual head movements, usage of external device, etc., the system utilizes a combination of computer vision and pattern recognition algorithms. The system analyzes the audio to detect any

surrounding voices and irregular sound patterns that are indicative of unfair means.

The Automated Alert System functions using a combination of rule-based mechanisms and machine learning algorithms. The rule-based detection component includes conditions such as switching of browser tabs, minimizing the examination window, lack of activity, etc. The machine learning algorithms, on the other hand, utilize historical behavioral patterns of the candidate to detect abnormalities. Such a hybrid approach ensures both accuracy and adaptability of the detection process.

X. RESULTS AND DISCUSSION

The designed real time online exam and smart proctoring system was tested in order to evaluate the system efficiency, reliability and integrity of exams. Automated monitoring, ML based alertness and smart exam management system components are being simulated in examination scenario.

The experimental outcome demonstrates that the system is performing efficiently on the real-time monitoring as per requirement. The video and audio monitoring systems successfully captured the events with no considerable delay throughout the exam session. The lockdown on the browser effectively disabled other options of the browser such as navigation which prohibited use of unauthorized resources.

The Automated alert system successfully predicted the abnormal events like multiple face detection, not in view, erratic head movements etc. The rules based and ML based method of alerting helped reducing the false alerts. The alerts were raised and passed onto admin dashboard in real time.

XI. CONCLUSION

The paper describes a real-time online examination and intelligent proctoring system intended to offer a secure, fair, and efficient means of evaluation in a digital setting. This paper combines multiple

advanced techniques like artificial intelligence, machine learning, and real-time monitoring with each other and addresses the drawback of current traditional online examination methods.

From the results obtained from the proposed system it has been shown that the system helps in increasing the exam integrity through real-time audio, video and screen surveillance along with a built in system which alerts for any unauthorized activities in real-time. The utilization of machine learning algorithms has not only reduced the amount of false alerts but also increased the detection accuracy of malpractice. Features like browser lockdown, secured authentication and auditing ensure robustness of the security aspect.

Also the operational efficiency of the system is increased as the system provides features for automated evaluation, alerts, administration panel, etc. The system can be made scalable as it offers good performance even with simultaneous user access which is important for large scale examinations in academics and profession.

Overall, the system presented offers a secure, reliable and an intelligent means of delivering an online examination that does not only reduce the involvement of human factor but also maintains the transparency and validity. Further work could be on enhancing the behavioral detection models, implementation of advance biometric authentication and on optimizing the system for different real-world scenarios.

XII. FUTURE WORK

The presented real-time online examination and intelligent proctoring system has a lot of improvement over the existing systems but there is still some room for advancement to extend its capabilities and strength.

A good way to extend the present system in future will be to implement advanced biometric authentication methods like

facial recognition, finger-print scanning, iris scanning, to provide stronger user identity authentication and stop the impersonation from others. Along with these we can use multi-factor authentication methods.

Machine learning and deep learning models used for the behavioral analysis in the current system need to be refined for more advanced detection of different cheating patterns. More sophisticated algorithms, such as convolutional neural networks (CNNs) and recurrent neural networks (RNNs), should be integrated in the system to effectively distinguish between different behavioral anomalies that may not be straightforward for the system to identify as cheating. False positives caused by external factors such as light, background noise etc. Should also be minimized.

We can integrate adaptive and individualized proctoring mechanisms within the system so that the level of monitoring sensitivity varies on the basis of candidate's behavior to achieve balance between monitoring stringency and user's convenience.

Further research may also be focused towards developing sophisticated analytic and report generation tools using big data techniques which will provide better insight into student's performance, trends of examination and efficiency of the system. This may be used by educational institutions for informed decision making.

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