Online Proctoring System

(Online Exam Surveillance)

T. R. Deshmukh[1], A.T. Awaghade[2], D. A. Bombe[3], K. D. Takawane[4]

Department of Computer Engineering

[1, 2, 3, 4]Aissms's Ioit, Pune

Abstract-*Online education is helping students and institutions worldwide to access knowledge base of wide variety. This form of learning and education is increasing rapidly, Evaluation and proctoring for the online courses has become a major bottleneck for scalability of such learning systems. Manual human supervision is a common approach for exam proctoring and evaluation where examiner needs to be present in the testing environment or needs to monitor testing environment of a test taker visually and acoustically through a webcam. In our proposed system, we present a completely automated, exam proctoring solution that requires no human involvement. The system integrates all the inputs to process and estimate the variety of events, behaviors and patterns typically associated with cheating. By combining continuous identity verification and automatic detection of malpractice or suspicious activities by a student, this system provides a scalable, online, completely automated, human interaction free proctoring system that can b e accessed by test takers and administrators to a truly efficient solution to conventional problem of online exam proctoring.*

Keywords-User verification, Gaze Estimation, Speech Detection, Face Detection, Proctoring System, Integrated System, Cheating Detection, Continues identity verification, Manual Check, Audio processing, Eye Blink detection.

I. INTRODUCTION

Online education is now an integral part of the higher education landscape. Online courses are allowing students worldwide to access the knowledge pool worldwide. In last few years, this form of learning has been growing rapidly with the evolving technologies. Sometimes, it is not possible for students to visit educational campuses or classrooms due to the geographical and time constraints. For these students on-line learning is very easy and convenient as learners can maintain their work life balance family and other obligations while pursuing a degree or any certification course. Today, it's estimated that about keeping these statistics in the mind, ensuring the integrity of these form of learning seems to be a tough task. Exams are integral part of any educational program. Online learning is not an exception to it, As Online education is quickly becoming a major phenomenon around the world, conducting exams online and maintaining its integrity has put forward many challenges. There is a possibility of cheating in any exam and hence preventing cheating is a major job to be done with online course. When exams are conducted in a conventional manner and supervised classroom environment, the students are monitored by a humans over the exams. This is very expensive, inconvenient and unreliable way to proctor the exams. In this paper, we present a completely automated Multimedia processing and analyzing system that covers an online exams proctoring solution that requires no human involvement. This system requires minimal hardware requirements of a computer such as webcam and microphone. This is unlike of almost all other existing systems which require additional webcams, gaze trackers or mini robots to be installed on students' computer while attempting the exam. Visual and acoustic inputs are received from the test takers and the system integrates all the inputs to process and estimate the variety of events, behaviors and patterns typically associated with cheating and forward it to the administrators of external review. Our system monitors such cues in the room where the test taker resides, using web cameras and a microphone. Camera is located above or integrated with the monitor facing

The test taker. The webcam also has a built-in microphone to capture any sound in the room. This system also captures the screenshots from a student's machine at random time to ensure integrity. Also any tab/window changes done while exam period are reported automatically to the administrators. Authentication of the identity of the test taker is an important and potentially expensive issue in online testing. In our system authentication is accomplished using the webcam and simple, reliable recognition techniques. This eliminates the need of expensive digital biometrics hardware.

II. RELATED WORK

Automated Online Exam Proctoring [2015] Proposes a fully automated online exam proctoring system collects a multimedia dataset composed of two videos and one audio along with label information of all cheating behaviors. It had some drawbacks such as; Student has to wear a wear cam while attempting the exam which is not commonly available with the students. Also system does not record any desktop screenshots. Though the proposed system automatically

detects the cheating incidents of a student, use of a Wear cam is an overhead in hardware requirements which makes it less scalable.

According to the Massive Open Online Proctor, Protecting the Credibility of MOOCs Certificates [2015] Automated supervising system. More precise data is collected as system is using multiples sensors like Webcam, gaze tracker, EEG sensor But were results to increasing the Cost of sensors, Increased processing time due to peer review. Use of costly sensors like gaze tracker and EEG scanner makes the system very expensive which is not readily available with test takers.

E-Invigilator: A Biometric-Based Supervision System for e-Assessments [2013] says they don't require authorization, Continuous verification through biometric sensors. However as it were not highly scalable and no particular audio sensors and processing Concerns do exist about scalability. Also, no manual verification available.

An Autonomous Articulating Desktop Robot for Proctoring Remote Online Examinations [2013] mentions about Continuous identity verification as well as simplified authentication. Both visual and acoustic sensors for better results. Results in some additional proctoring robot required. Availability and cost of additional hardware. As the proposed system needs additional proctoring robot to be installed on the system, it increases the hardware overhead and makes the system less scalable was been the disadvantage.

Advanced Recognition Techniques for Human Computer Interaction [2010], this paper describes the System that focuses on the hand gesture recognition. Reduced processing time and higher reliability due to the use of Kalman-filtering process, Hidden Markov models and graph matching algorithms. But having some limitations, that only hand gestures are recognized, none of the acoustic inputs have been thought of. Also not of much use for Exam proctoring system. However, used algorithms can be evolved and used for betterment of our proctoring system.

Heuristic based online proctoring system [2015], Proposes a fully automated online exam proctoring system. Processes visual, acoustic inputs. Also detects active window changes. However system is unable to detect any minor changes on the screen such as overridden window or pop-ups. This system removes the necessity of having a proctor but has some loopholes which can be overcome in our proposed system.

III. METHODOLOGY

Algorithms

For algorithmic approach towards this system, there are three major aspects which we need take in consideration viz. Features, Security and Technology. Proposed system has multidimensional scope in all the three mentioned aspects.

Various features like image processing, video processing, audio processing and remote method invocation are supposed to be implemented in order to achieve desired results. As it a completely automated system which collects all of the proctoring data which may include student's personal data, Security measures should be practiced in development and application phases of the proposed system. Technical specification used in all of the phases of development have to capable enough to handle all of the complex data processing and result generation. Also, developed system should work perfectly fine on the computer with basic technical specifications as the end users will mostly be the college students who normally use PCs with average specifications.

1) Haar-cascade algorithm(Viola-Jones) for image processing:-

Viola-Jones detector, or hierarchical boosted cascade detectors that use Haar-like features, trained on eye images. It is the same machinery used in Viola-Jones face detector, but trained for eyes. OpenCV has it implemented. That is, they have the Haar detector which you can use it for face detection, or eye, or mouth, etc. by using the appropriate XML file that contains the appropriate parameters that come from training. Training of the system is done by using a set of labelled images containing faces using the AdaBoost learning algorithm.

Let's look at the 3 key contributions of the **Viola-Jones object detection framework**:

1. Integral images for rapid feature computation.
2. Adaboost to create strong classifiers (also known as feature selection).
3. Combine selected features into a cascade structure to get a cascade classifier.

Input:

Set of N positive and negative training images with their labels $(\mathbf{x}^i, y^i)$. If image i is a face $y^i = 1$, if not $y^i = -1$.

- Initialization: assign a weight $w_1^i = \frac{1}{N}$ to each image i.
- For each feature f_j with $j = 1, \ldots, M$

1. Renormalize the weights such that they sum to one.

2. Apply the feature to each image in the training set, then find the optimal threshold and polarity θ_j, s_j that minimizes the weighted classification error. That is

$$\theta_j, s_j = \arg\min_{\theta, s} \sum_{i=1}^{N} w_j^i \varepsilon_j^i$$

where

$$\varepsilon_j^i = \begin{cases} 0 & \text{if } y^i = h_j(\mathbf{x}^i, \theta_j, s_j) \\ 1 & \text{otherwise} \end{cases}$$

3. Assign a weight α_j to h_j that is inversely proportional to the error rate. In this way best classifiers are considered more.

4. The weights for the next iteration, i.e. w_{j+1}^i are reduced for the images i that were correctly classified.

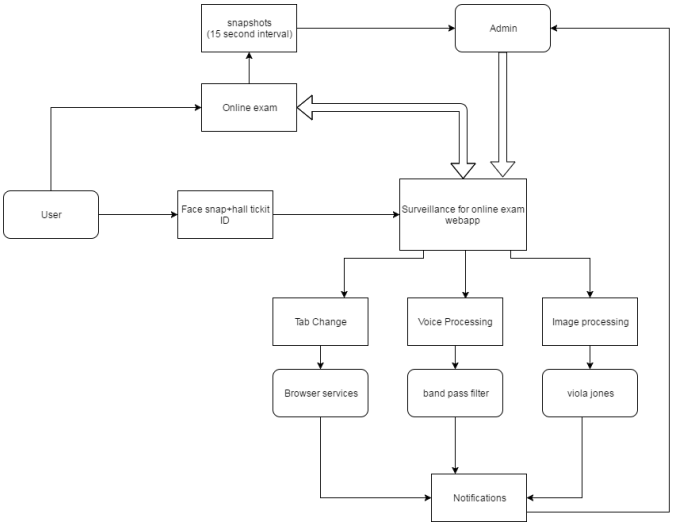
3. Set the final classifier to

$$h(\mathbf{x}) = \operatorname{sign}\left(\sum_{j=1}^{M} \alpha_j h_j(\mathbf{x})\right)$$

Audio Processing:

Pass band filter and frequency matching is use for voice processing. We will set the threshold value for voice if it go above that range then it will give notification to students and admin.

Architecture



IV. DATA DESIGN

A description of all data structures including internal, global, and temporary data structures, database design (tables), file formats.

Internal software data structure

Data received from different input devices for single student is stored separately. MySQL stores data in distributed file system.

Global data structure

A structured dataset of students proctoring data with predefined labels are introduced for comparison purposes. With the help of which algorithms will be able to extract features from new datasets.

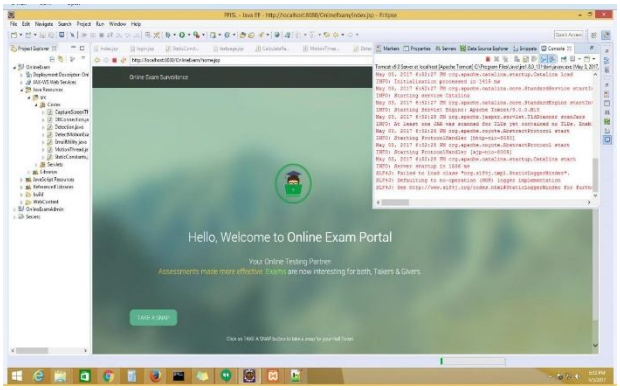
Temporary data structure

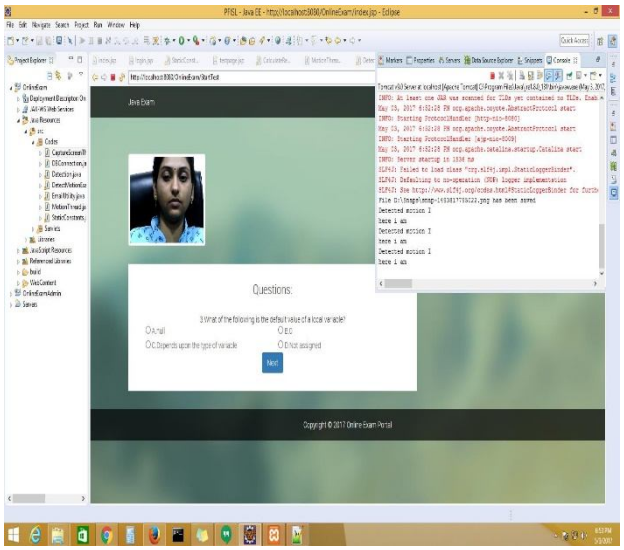
Datasets of proctoring data received from the students who have attempted the exam. Which will be once by the system and results will be given out.

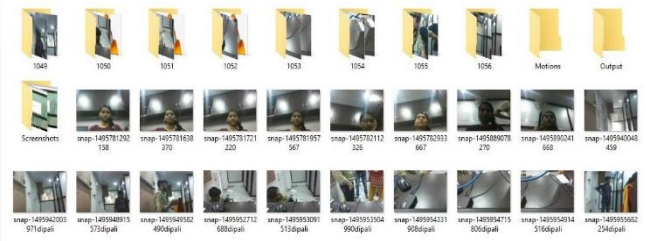
Database Description

Mainly, we are using MySQL database to store large sized multimedia data in a structured format.

V. RESULTS AND FINDINGS







VI. CONCLUSION

Our system for automatic online exam proctoring, which aims to maintain academic integrity in e-learning. Our system for online exam proctoring, which aims to maintain integrity in online courses. We have reviewed the available data on the prevalence of cheating. This system is affordable convenient and scalable to use from the student's as well as administrator's perspective, since it only requires web-cam and a microphone. With the captured videos and audio, we extract low-level features from six basic components: user authentication, text detection, speech detection, active window detection, gaze estimation. These features are then processed to acquire high-level features, and then are used for cheat detection and the results are then accessed for final manual review. With the applications of this system, students from the worldwide can be tested for academic integrity without hiring any human proctors or without any additional resources.

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