

Automated Online Exam Proctoring

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ABSTRACT

Through PARIKSHA, our website for conducting online assessments, we have developed an online platform with the common problems faced by students and teachers today in mind. Students and teachers can take advantage of the user-friendly and feature-rich experience and educational institutions can efficiently manage their on-premises hardware resources with our work on PARIKSHA. We used Flask and Jinja for web development, trained and integrated AI models for automated in vigilance, built a P2P video call system using WebRTC, and built a hybrid model of on premises and cloud for deployment. From our own experiences such a platform is the need of the hour which could outlast its usefulness in the current digital-only mode of education and find its way into the market of online certification exams, online degree programs and much more. Currently in the prototype stage, with more work on the system it can be quickly made into a fully functional service.

Keyword: Online exam proctoring, user verification, phone detection, test activation and deactivation, result in graphical format.

1. INTRODUCTION

Exams are a critical component of any educational program, and online educational programs are no exception. In any exam, there is a possibility of cheating, and therefore its detection and prevention is important. Educational credentials must reflect actual learning in order to retain their value to society. Assessing the understanding and knowledge of students is an integral part of every education system and conducting examinations has been one of the most preferred ways of doing that. The COVID-19 pandemic has made it difficult to do so in a way that is accessible to the students, fair in the undertaking and can help the educators assess the class on a group as well as individual level. The online medium of education took a lot of time and effort on the educators' end to implement to reflect their physical counterpart, but a few things have still not transitioned and online exams are one of them. During the initial time the tools and platforms used for this purpose were the ones designed for survey and feedback tasks. A lot of companies and developer then started to work on those tools to improve the experience of teachers and students. New startups and platforms also emerged catering to this market but all of them only focused on certain aspects and none provided a complete suite of features. We discovered some gaps in the process based on our experience, did technical and market research, and started working on PARIKSHA. With the rapid development of online learning in the past decade, online exams and tests are becoming increasingly popular for course instructors to assess the knowledge of students [11]. For example, Massive Open Online Courses (MOOCs) such as Coursera and EdX often require students to pass a series of online exams before they can gain a final course certificate. Meanwhile, conventional universities also continue to expand their online course programs and hold online exams for students [22]. Such a trend is further significantly accelerated from 2019 due to the COVID-19 lockdown, and most schools and universities have switched to embrace online teaching and online exams. However, one major challenge for online exams is how to proctor online exams in a convenient, efficient and reliable manner. Prior research [16, 30–Page 2 32] has shown that online exams are vulnerable to cheating behaviors. According to the survey by King and Case [16], about 74% of students in 2013 reported that it is easy to cheat in online exams and nearly 29% of the students indicated that they cheated in online exams. These cheating behaviors can damage the credibility of online exams, which makes online exam proctoring crucial for MOOCs platforms and universities to further expand the application and usage of online exams. Different from traditional exams with on-site proctoring, online exams lack face-to-face interactions. It brings trouble to the proctoring of online exams and various types of cheating behaviors may occur in online exams [38]. For example, students may type

the questions into the browser and search for possible solutions from the Internet. They may also send messages to a third party (e.g., friends) to ask for help by using their mobile phones or chat apps on the computer. Without face-to-face interactions in online exams, it is not an easy task to identify such cheating behaviors. To enable effective proctoring, existing online exams usually ask the students to use webcams to monitor and record their activities during the exams [2, 13, 20, 25, 29]. Accordingly, a set of preliminary studies on the proctoring of online exams have been conducted based on such kinds of settings.

2. WORKING :

The proposed system work as follows:

This project is an attempt to ease the process of online assessment for students, teachers, and educational institutions by solving the common problems they face using web, AI, and cloud architectures. Using the AI models developed and trained by us, tests of hundreds of students can be conducted at once with the presence of as low as one manual invigilator at the same time and still be free of any UFM. On the detection of any suspicious activity, unlike many other similar systems which expel the students, our system generates flags and when the number of flags crosses a set threshold the invigilator is notified via our socket system about the student so they can see the live video feed of those students using the WebRTC video communication system that we developed. With the carefully designed UI and UX of our website the tasks from account creation to activating and attempting tests are simplified for all stakeholders involved. The frontend of PARIKSHA is made using HTML, CSS and JS with popular frameworks and libraries like Bootstrap. This was done to give us the maximum amount of control over the UI and not be constrained on anything framework-specific for working on the UX. Then Jinja templating engine was used as we used Flask for the backend of the website. Features like E mail verification, handling routes, performing checks and validations and, the performance analytics sections are part of the backend made using Python.

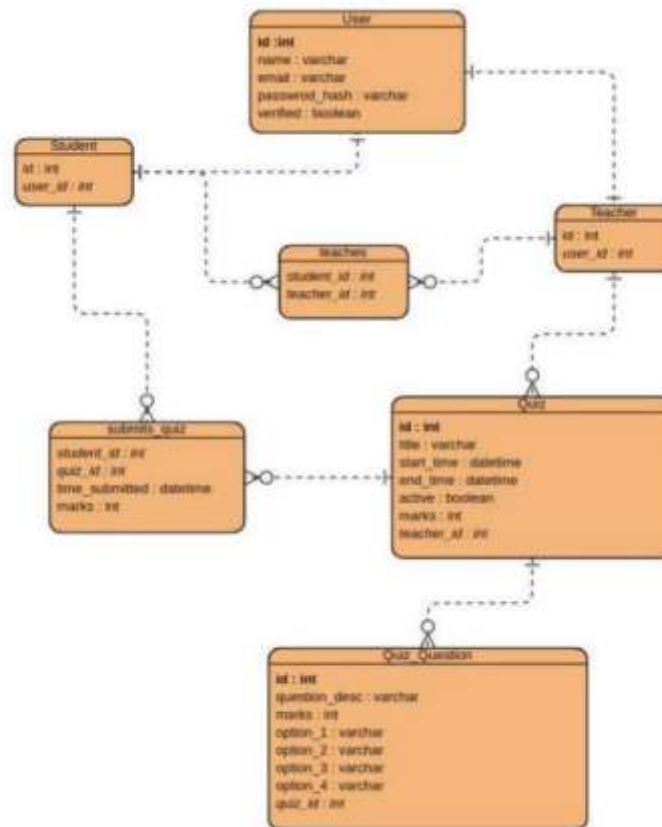
METHODOLOGY

2.1 Users and roles:

| User | Description |
|-----------|---|
| Developer | A capstone team member or mentor who is tasked with developing the website, creating initial deep learning models, and do the deployment. |
| Teacher | Would first create a teacher account, create tests, activate them, access the results, and analytics. |
| Student | Would first create a student account, attempt tests, view previous results. |

2.2 Use Case Diagrams:

3. DATA ARCHITECTURE :



4. LITERATURE REVIEW:

4.1 Online proctoring makes use of virtual tools for monitoring activities for assessing the students appearing for exams. Such exams are generally happening online and remote location so that any student from any location can give exams to ensure the integrity. Online proctoring system focusses on two major components viz. Web camera for recording the video of the student appearing for the exam which can be later on viewed by examiner/proctor. Examiner/proctor can potentially look at any mischievous things, cheating happening during exam or not.

4.2 The second component is locking which prevent students from opening other tabs in the web browsers. This is also known as Computer or Browser Lockdown. There are various technological advancements that have occurred in online proctoring system. The (Hussein et al., 2020) exclusively covers and overview of proctoring tools. An investigative study was conducted on proctoring system and its evaluation proposes an intelligent online proctoring system. The said proctoring system is based upon audio and video parameters. Human proctoring is the most common approach of validating online exams nowadays, by monitoring the test taker visually and acoustically via a webcam. In order to access its performance and contrast with our OEP system, we conduct an experiment imitating a human proctoring system, similar to the services offered by ProctorU. All testing videos used in our system were provided to three different people with experience in teaching, along with a graphical user interface (GUI) designed to manually record the cheating instances

4.3 This project is an attempt to ease the process of online assessment for students, teachers, and educational institutions by solving the common problems they face using web, AI, and cloud architectures. Using the AI models developed and trained by us, tests of hundreds of students can be conducted at once with the presence of as low as one manual invigilator at the same time and still be free of any UFM. On the detection of any suspicious activity,

unlike many other similar systems which expel the students, our system generates flags and when the number of flags crosses a set threshold the invigilator is notified via our socket system about the particular students so they can see the live video feed of those students using the WebRTC video communication system that we developed. With the carefully designed UI and UX of our website the tasks from account creation to activating and attempting tests are simplified for all stakeholders involved. The frontend of PARiKSHA is made using HTML, CSS and JS with popular frameworks and libraries like Bootstrap. This was done to give us the maximum amount of control over the UI and not be constrained on anything framework-specific for working on the UX. Then Jinja templating engine was used as we used Flask for the backend of the website. Features like E-mail verification, handling routes, performing checks and validations and, the performance analytics section are part of the backend made using Python.

5. CHALLENGES AND LIMITATIONS:

Online proctoring allows teachers to facilitate remote examination and minimize academic misconduct. The system would either use webcams to monitor students' test surroundings or integrate software's into their computers to control the use of other online sources while taking exams. Proctoring can also involve human participation - for example, online proctors who are present to supervise students' performance remotely.

- The current system is very time consuming.
- To take exam of more candidates more invigilators are required but no need of invigilator in case of online examination.
- The chances of paper leakage are more in current system as compared to proposed system.
- Result processing takes more time as it is done manually.

6. EXPECTED RESULT:

- Problems faced by students, teachers, and educational institutes in this regard fit into the recurring themes of questionable fairness, difficulty in managing the online tools and services, understanding the outcomes of evaluations, student data privacy, and stability issues with the platforms. With PARiKSHA we set out to solve these problems of online examinations and develop a unified platform that can provide an array of features that would generally take users multiple.



- During the initial time, the tools and platforms used for this purpose were the ones designed for survey and feedback tasks. A lot of companies and developers then started to work on those tools to improve the experience of teachers and students. While things have changed a lot from that time the feel and functionality are noticeably similar. It is still difficult for a lot of educators and students to navigate through and get their work done on a lot of platforms. We designed the UI and UX of PARiKSHA to maximize the ease of every component of the process and keep it feature-rich at the same time.

- The number of students to be evaluated in a short amount of time leaves no option but to use the popular tools along with a video feed of the students to monitor them. This becomes problematic due to the high student: teacher ratio. It is often not possible to have enough number of invigilators if the batches have to make of hundreds of

students. We designed an alert system for invigilation that uses AI models developed and trained by us for monitoring the students and notifying the invigilator to focus on a specific student if any suspicious activity is detected.

- There are a lot of institutions that have some tech infrastructure in place in form of their own servers or intranet for reasons like student data privacy and speed and were actively encouraging the use of technology in routine instruction and assessment even before the same was mandated due to the pandemic. Still, their systems have not been able to cope with the high amounts of traffic. Moreover, the loss of hours that is caused due to regular maintenance activities has forced them to seek options that contradict their initial position. Using Google Cloud Platform's (GCP) suite of services we developed a hybrid model of deployment of PARiKSHA that can exist on both the physical hardware as well as cloud and switch between the two when the need arises.
- During the development of PARiKSHA under the Design Thinking and Innovation course offered by CSE Bennett University, we learned a lot about not only the technical work that goes into developing tools that are used in real-world, but also about understanding the problems and needs of the customers and analyzing the market trends and positioning our product.

7. CONCLUSION:

Our original goals for this project was to make a unified online assessment platform with the biggest feature as the hybrid AI model that would automatically invigilate a large number of students giving a test and alert the teachers if any suspicious activity pertaining to cheating on the test is detected. Acquiring enough data to train such a model turned out to be a big challenge and although h at the end we were able to train the models and integrate them into one, the accuracy of the system remains very low to be ideal for production. We pivoted a bit and worked on the hybrid cloud model deployment of the PARiKSHA.

Our solution delivered primarily consisted of a fully featured website along with the AI models trained by our team, the video conferencing tool for manual invigilation and a teacher alerting system in case of any cheating action detected by the AI system.

Our system has been combined with a secure browser to prevent cheating. This project does not eliminate the need for a proctor as he is required to perform certain operations. There are certain ways to cheat like a person sitting behind the laptop communicating with the test-taker by writing. To completely stop cheating we would need external hardware like a spectacle camera to cover the whole field of view of the test-taker and apply computer vision on its feed. We can avoid mal practices by achieving the required conditions through our system.

This has become a best suitable method for the examiners to examine the student's activities. In this system, we don't use any other languages, other than python. We are implementing our system at a great extent this would be much helpful for us. We make an accurate report and find the fraudulent things. Our system will help to reduce the chances of cheatings by the test takers.

We ensure a clear vision on the online examinations. This semi automate proctoring based on vision and audio-based capabilities are used to prevent cheating in online exams and monitor multiple students at a time. This system is made up of the following factors such as Quality management, available information, external conditioning, trust, perceived compatibility, usefulness, attitude and intention. Thus, in general terms, it can be said that this is intended to change the vision of institutions dedicated to online monitoring regarding e proctoring and to encourage the use of this system in their places, allowing complete remote monitoring.

8. REFERENCES:

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