

Senior Design Project Report
CSE 499B
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Title: Online Class & Examination Monitoring Platform



North South University

Department of Electrical and Computer Engineering

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Letter Of Transmittal

September, 2021

To

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Through

Dr. Mohammad Ashrafuzzaman Khan

Assistant Professor,

Department of Electrical and Computer Engineering,

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Dhaka, Bangladesh

Subject: Senior Design Project (CSE499A+B) report submission

Dear Sir,

With due respect, we would like to submit our report on “**Online Class & Examination Monitoring Platform**” as a part of our BSc program. The report talks about the video conferencing system as well as the Online Examination Monitoring and how we have worked on it to make it better not only for the students but also for the teachers.

This report is prepared as a requirement of the Capstone Design Project CSE499A & 499B, a two- semester-long senior design course. This course involves multidisciplinary teams of students who build and test custom-designed systems, components, or engineering processes. We would like to request you to accept this report as partial fulfillment of the Bachelor of Science degree under the Electrical and Computer Engineering Department of North South University.

Sincerely Yours,

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Declaration

This is our truthful declaration that the “Online Class & Examination Monitoring Platform” we have prepared under the supervision of Dr. Mohammad Ashrafuzzaman Khan, Department of Electrical and Computer Engineering, North South University, Dhaka, Bangladesh is not a copy of any other online class and examination monitoring platform previously made by any other team. We also express our honest confirmation in support of the fact that the said “Online Class & Examination Monitoring System” has neither been used before to fulfill any other course related purpose nor it will be submitted to any other team or authority in future in accordance with the course curriculum of the Department for the Bachelor of Science in Computer Science and Engineering program.

Approval

The capstone project report entitled “Online Class & Examination Monitoring Platform” by Md Sharif Hossain (ID#1712336642), Kazi Moshir Rahman (ID#1712832642), Rubaida Ferdous (ID#1711126042) and Galib Faruk Gani (ID#1531012642) of the Department of Electrical and Computer Engineering, North South University, Bangladesh is approved in partial fulfillment of the requirement of the Degree of Bachelor of Science in Computer Science and Engineering on September, 2021 and has been accepted as satisfactory.

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Acknowledgement

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Abstract

Most educational institutions and business organizations conduct their activities over online meeting platforms like Google Meet or Zoom in this pandemic situation. But these applications only provide a meeting platform. The host needs to monitor the members manually. In the online examinations, teachers need to monitor the students' activities one to one by themselves.

We are planning to build a platform that will provide a more audited video conferencing service. This project's primary purpose is to periodically identify the meeting members by pre-given face recognition data and confirming if the person in front of the camera is the authentic one or not. Also, it will provide one step more fair exam policies. We have built two kinds of student evaluation systems: MCQ and written exam. During both types of exams, clipboards and right-click buttons of the mousepads of user computers will be deactivated so that no one can copy the questions. Also, the system will notify the host if someone minimizes or leaves the exam tab or go to another tab. The overall system gives a fairer examination conducting policy than the regularly practising ones.

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CHAPTER 1: INTRODUCTION

1. Introduction

1.1 Problem Analysis

Terms like "Online education", "Education from home" or "Work from home" are being more popular since 2020. All educational institutions are closed physically from March 2020 till now. Many of these institutions are conducting their classes and assessments online. They mostly use "Zoom" or "Google Meet" as video conferencing for taking classes, Google Forms and Google Classroom for taking examinations or class assessments. These technologies are helping unexplainably for online classes and assessments. In these platforms, the host or the teacher needs to monitor the students manually. In the online examinations, teachers need to monitor the students' activities one to one by themselves. There exist a lot of holes for plagiarism and sharing assessment answers between classmates. Even there are possibilities of attending one student's examination by another person. So, it was the demand of time to make a better platform for conducting online classes and assessments.

1.2 Related Works

- 1.2.1 **Traditional video conferencing platforms:** Google Meet, Zoom, Microsoft Teams, Skype, etc. platforms provide the features like video conferencing, on-call messaging, screen sharing or meeting recording. Most of them offer the same basic functions, like call encryption, support for up to 720p HD video. But there are no extra audits over the hosts to monitor them.
- 1.2.2 **Online form or examination related platforms:** Google form, Google doc, Socrative, etc., are being used to take online assessments or examinations. These platforms are suitable for collecting data as forms of writing documents. But they aren't much secured to conduct examinations.

1.2.3 Canvas Learning Management System: Canvas is a web-based learning management system or LMS. It is used by learning institutions, educators, and students to access and manage online course learning materials and communicate about skill development and learning achievement. It is full of tools and features to enhance your online course experience. As a student, one can view content created by the instructors and participate in course assignments and communications. The instructor will customize the learning experience in Canvas, so each class may look different.

Canvas can detect cheating in online exams and tests by using both technical and non-technical methods. Technological tools used include proctoring software, lockdown browsers, and plagiarism scanners. Non-technical methods used include comparing answers and exchanging questions.

Recently, North South University has been contracted with Canvas Learning Management System for the first university in South Asia. NSU seems to implement many of its features soon. But the contract process is too costly to be followed by many other institutes.

1.3 Motivation

We have faced unfairness and complexities while attending online classes and examinations. Our honourable faculties face challenges too to monitor each student while conducting classes and assessments. From this experience, we decided to design a platform that will give a better online class and examination conducting platform.

1.4 Overview

This is the report of a project considering video conferencing and examination management for online classes and examinations. For the recent outbreak of covid-19 in 2020, all educational institutes face problems as they cannot take physical classes due to the fear of infection, which has somewhat pushed the educational institutes towards online classes, which has turned into a challenge. The use of online video conferencing systems was not that widespread in the educational system before, but video conferencing has incensed in huge numbers. The service has increased, that is true, but the problems stayed, and through this project, we are trying to overcome the issues. We have pointed out the difficulties that a lecturer faces while taking a class or an examination.

Several well-known systems or web applications like zoom, cisco WebEx, google meet, and the list goes on, but none of them is equipped with the proper tools to be present in this modern-day pandemic situation. We are working on such a web application that will host meetings like every other video conferencing system and reduce the work of the person who is hosting the class or exam. It will check if the person who is entering the meeting is the one intended to join the meeting or not by face detection, which will make the video conferencing system smarter and safer. Due to online classes, the teachers cannot concentrate on each student, and we have thought of it too. The system will check each minute if the student is there or not and is actually focused on the meeting. Further, we are trying to detect if students are on the same tab or not, which means the student cannot copy in the exam and we have also worked on activities monitoring on browser, which will make things more accessible from the teachers' side as they will get an alert when our system detects something unusual.

CHAPTER 2: METHODOLOGY

2. Methodology

2.1 Features

2.1.1 **Registration and Login:** Anyone can register into the platform using unique usernames and emails to get started using the features. Users can log into the system once they are done with registration. They can also reset the password if it is forgotten somehow.

2.1.2 **Course Management:** Users signed in as teachers can create courses and invite others (students) to collaborate under their supervision. Hosts can delete or terminate the courses once the purpose is completed.

2.1.3 **Video Conferencing:** Users or hosts can create meetings and invite members. Hosts can schedule meetings for specific times and can get reminders before the meetings. Members can join a pre-existing meeting using meeting links created and shared by hosts. Meeting members can exchange in call messages. The audio part is encrypted, and the video conference supports up to 720p HD video.

2.1.4 **Biometrically Identity Confirmation:** The users will need to provide live images of their faces to complete the user profiles. The system will re-verify every minute if the joined members are authentic ones according to the registered profile. If there is no match, a signal or an error message will be given to the host. A flag will be shown to the hosts if there is noticed something unwanted or unexpected.

2.1.5 **Online Examination Monitoring:** This is one of the most key features of the project. Overall Examination Monitoring is conducted via several parts:

2.1.5.1 *Setting up an MCQ question set:* A host can create an MCQ question set with options as well as correct answers, which will be automatically

evaluated from the system. The questions will be shuffled and time-bounded for the students.

2.1.5.2 Clipboard and keyboard freezing during MCQ exams: If a host wants to take an MCQ exam, the browser will freeze the clipboard, right selection button and keyboard. The exam system will need only the left selection key. As a result, no student can directly copy the question.

2.1.5.3 Separate written examination system: If a host wants to take a written exam, s/he can post a set of questions. There will be answer scrips and word limiting options in the answer bar. Students cannot copy the questions like the MCQ module, and if any student minimizes the exam tab, the host will be notified.

2.1.5.4 Activities monitoring: We have used Page-Visibility-APIⁱ using JavaScript, which will allow us to take necessary action if a webpage is minimized or a new tab is opened in the browser. By using this, we have minimized the plagiarism options during the examination.

2.2 Used Platforms

2.2.1 React Framework: Reactⁱⁱ is a free and open-source front-end JavaScript library for building user interfaces or UI components. It is maintained by Facebook and a community of individual developers and companies. React can be used as a base in the development of single-page or mobile applications. We used React framework in our video conferencing and related tools.

2.2.2 Frappe Framework: Frappeⁱⁱⁱ is a full-stack, batteries-included web framework written in Python and JavaScript with MariaDB as the database. The framework that powers ERPNext is pretty generic and can be used to build

database-driven apps. We have used Frappe to integrate our different modules in one platform as it supports both Python and JavaScript.

2.2.3 Visual Studio Code editor: Visual Studio Code^{iv} is a streamlined code editor with support for development operations like debugging, task running, and version control. It aims to provide just the tools a developer needs for a quick code-build-debug cycle and leaves more complex workflows to fuller featured IDEs, such as Visual Studio IDE. Its features include support for debugging, syntax highlighting, intelligent code completion, snippets, code refactoring, and embedded Git. This is a potent code editor. We have used VSC as the core editor for all frameworks and platforms.

2.2.4 DNN: A deep neural network (DNN)^v is an artificial neural network (ANN) with multiple layers between the input and output layers. Different neural networks always consist of the same components: neurons, synapses, weights, biases, and functions. We have used DNN for our face recognition module.

2.2.5 OpenCV: OpenCV^{vi} is the huge open-source library for computer vision, machine learning, and image processing, and now it plays a significant role in real-time operation, which is very important in today's systems. Using it, one can process images and videos to identify objects, faces, or even handwriting of a human. We have used DNN and OpenCV together for our face recognition module and integrating it.

2.2.6 GitHub: GitHub^{vii} is a web-based platform used for version control. Git simplifies the process of working with other people and makes it easy to collaborate on projects. Team members can work on files and easily merge their changes with the master branch of the project. We have used GitHub for version controlling, collaborating and submitting our works in this project.

2.3 Team contribution

This project needed more research time as well as hard coding. We needed to use open-source solution parts for our project. Teamwork helped to research from the vast source of the internet and find a considerable solution set.

Work distribution: Md Sharif Hossain (SH), Kazi Moshiur Rahaman (KR), Rubaida Ferdous (RF), Galib Faruk Gani (GG)

Tasks	Responsibilities
Problem analysis	GG, RF, SH, KR
Project proposal	GG, RF, SH, KR
Related works analysis	RF, SH, KR
Solution analysis	GG, RF, SH, KR
Workflow and sub-tasking	RF, SH, KR
Functional analysis and use case diagram	RF, SH, KR
Video conference analysis	GG, RF, SH, KR
Video conference implementation	SH, KR
Face recognition analysis	GG, RF, SH, KR
Face recognition implementation	SH, KR
Login-Registration system	SH, KR
Examination module analysis	GG, RF, SH, KR
Examination module implementation	SH, KR
Browser Tab monitoring	SH, KR
Dashboard and Mother Platform	GG, RF, SH, KR

Integrating sub-modules	GG, RF, SH, KR
Project report and presentation	GG, RF, SH, KR

CHAPTER 3: RESULTS

3. Result Analysis

3.1 Works done over the course

We have started the course CSE499A in Spring 2021, and we are continuing CSE499B in Summer 2021. Over these two semesters, we have tried to implement and launch a practical demo for our project. The features and implementations that worked partially or fully are described below.

3.1.1 Login-Registration module: The project includes a registration and login module developed in JavaScript and MySQL databases. The registration module works fine. The database connection is valid and up to date. Currently, the self-registration of students is turned off. Only teachers can register and can add students. Previously added students can log in and join classes and examinations.

3.1.2 Video Conferencing module: A video conferencing tool has been added to conduct online classes. We used React framework to implement the video conferencing in the initial stage, but later we used Google Meet API, which is more convenient but complimentary. The video conferencing system includes services like screen sharing, on-call messages, video recording, raising hands, scheduling meetings, inviting people, etc.

3.1.3 Course Management module: Teachers can manage the courses they want to conduct. They need to create a course, plan the schedules, fixing a meeting, invite or add students to successfully running the courses. They can create an examination set like an MCQ quiz set, add questions with options, select the correct answer, and keep it stored for later use. The quiz will be auto evaluated once the students submit their answers.

3.1.4 Examination Monitoring module: The examination monitoring module is divided into two major parts. One recognizes users' identity each minute, and

the other monitors if the users switch browser tab or use any other application.

Both of the parts work independently, and the report is notified to the teacher or host. These modules are merged in the Frappe framework using JavaScript and Python programming languages.

3.1.5 Face Recognition module: We have used Python dataset to recognize the faces of the students. The system will pre-record sample face pictures of the users while completing profiles. Then it will match the sample pictures with the live video of the users. The system will notify the host if there is any mismatch.

3.1.6 Integration: All the modules described above were merged and integrated into a single platform in the Frappe framework. We have used Oracle Virtual Box to integrate these. The integration part was one of the most challenging parts of this project.

3.2 Future works

The practically implemented project is just a beta version of the overall theoretical project. It can be modified further. More features could be added as well as the existing features could be improved too. Some potential modifications are mentioned below.

3.2.1 Better Front-End: The implemented project has an average quality front-end design that is user-friendly and satisfying moderately. We have a plan to improve the front-end design and make it more user-friendly and easier to use in the future.

3.2.2 Monitoring activities over video conference: Current version of the project recognizes the faces over examination time only. In future, we want to implement this feature over video conferencing also.

- 3.2.3 **Plagiarism Detection:** All the answers received from the student's written examination could be auto-checked if there is any plagiarism. We have a plan to implement this feature in the next possible version of this project.
- 3.2.4 **Study Community:** As this is an educational platform, a study community among the students could be built through this platform. We will research further on this feature in future.

CHAPTER 4: CONCLUSION

4. Conclusion

4.1 Discussion

Over the previous two semesters, our team put our best effort to successfully implement the practical project. There were very difficulties, two of us got covid affected. It was challenging to co-operate and collaborate online.

Among all the difficulties, we got successful in implementing the basic demo. All the modules run independently. After implementation, there were minor issues to run page visibility API and face recognition together. For a weak front-end design, it might seem a bit complex to the end-user. We hope to overcome these issues in the next version.

4.2 Conclusion

The main motive of this project was to help the teachers with online classes and altogether form a better system that can be of better use in the current situation of the covid outbreak, as we are relatively new to this outbreak and online classes. I believe this new system that we are working on and the extra features that we are putting in the system will help the host/user now in the situation and be of greater use after the pandemic.

5. References

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- ⁱ <https://stackoverflow.com/questions/32092246/detect-if-your-website-run-in-background>
 - ⁱⁱ <https://reactjs.org>
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 - ^{vii} <http://github.com>