University of Mumbai

Edumate – Assisting Teachers

Submitted in partial fulfillment of requirements

For the degree of

Bachelors in Technology

by

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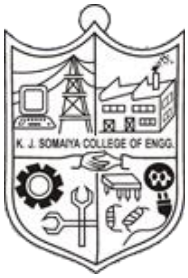

Department of Computer Engineering
K. J. Somaiya College of Engineering, Mumbai-77
(Autonomous College Affiliated to University of Mumbai)

Batch 2019 – 2023

K. J. Somaiya College of Engineering, Mumbai-77

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DECLARATION

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Dedicated to

My family and friends

Abstract

Although teaching is one of the most important professions in terms of changing society, the nation, and the world as a whole, it is still not given the respect it deserves. The occupation that produces leaders, entrepreneurs, social activists, and professionals is often downplayed by many. Teachers in India face many challenges that should be addressed and offered solutions. The non-teaching tasks that are often handed over to the teachers in schools are loaded with surveys, documentation, typed exam papers, scorecard preparations, admissions, and much more. These jobs can be easily and efficiently automated, and teachers would get ample time to prepare for their lessons.

The objective of this project is to create a system that can help teachers perform different tasks with just a few clicks instead of long manual procedures. The project is divided into different modules, and each module simplifies one of the lengthy and time-consuming tasks carried out by teachers. The project will give teachers and students a web interface where they can do their work. This interface will be accessible from any device that can connect to the internet, such as a mobile, laptop, etc.

The project will help in reducing the overhead of additional tasks managed by the teachers by providing a software emulation of the tasks. This methodology will also help in contributing to the green industry initiatives by reducing manual paper work and providing a solution to each problem requiring paper work by using a software feature where tasks can be easily performed efficiently with only a few clicks. Students will also benefit as they will get all the curriculum-related activities in one place. Institution management will also benefit as instead of handling the large amount of paper work, they will just have to manage the infrastructure of the product to carry out all the tasks.

***Key words*:** Peer grading, Project Tracking, Assignment Plagiarism, Face Detection, Smart Attendance, YOLOv4, Performance Analytics.

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Chapter 1

Introduction

This chapter provides the introduction to the project. We will be describing the background, motivation, and scope of the project. This chapter will be the pre-analysis stage, in which the reasons for undertaking the project will be explained.

1.1 Background

In ancient India, the Gurukula system of education required students to go to the home of a teacher (Guru) and request to be instructed. If the guru accepted him as a pupil, he would remain at the guru's residence and assist with all household duties. In the 1830s, Lord Thomas Babington Macaulay was the first to introduce the modern education system to India, which included the English language. The curriculum was limited to "modern" disciplines like science and mathematics, while metaphysics and philosophy were deemed unnecessary. Teaching was confined to classrooms, and the connection with nature and the intimate relationship between teacher and student were severed. This, however, was the situation prior to the pandemic, and after the pandemic, everything has drastically changed. The educational system has been changed such that it can now accommodate dispensing instruction to pupils without any interruptions in the event of future occurrences.

The teaching industry after the pandemic is moving towards the area of virtualization, where all the activities are carried out without any physical objects. Due to a great boost in technology, students are becoming more familiar with the online platforms for performing various activities. This shift will help institutes to carry out all the activities online where instead of managing a big load of papers, they will just have to manage the deployed infrastructure. Pandemic has also opened a new branch of delivering content, which is nothing but online teaching and also another way of taking exams. Since the development of technology, integrated learning has remained a consistent educational trend. You can utilize both face-to-face and eLearning training methods with this method. Student-centered education or Personalized learning provides students with opportunities to express their opinions and make decisions. In other words, they can learn at their own tempo. When incorporating gamification in teaching and learning, learners will be inspired and motivated to complete their duties. This is not a novel trend in education. However, it is always emphasized in education.

1.2 Motivation

Although teaching is one of the most significant professions in terms of societal, national, and global change, it is not accorded the respect it merits. Many undervalue the profession that produces social activists, entrepreneurs, leaders and professionals. Teachers in India are confronted with a number of issues that should be addressed and given solutions. The non-teaching duties that are frequently assigned to instructors in schools include:

- Surveys
- Documentation
- Written examinations
- Preparation of the Scorecard

These tasks can be simply and effectively automated, allowing instructors ample time to prepare lessons. Teachers can deliver education more effectively throughout the academic year if they use this time to develop and assemble the essentials for devising innovative teaching strategies. Teachers frequently face problems such as taking attendance, creating and accepting submissions, forming project teams, and so on. For all this, teachers have to put in additional time and effort, which can be used in other work like efficient and innovative teaching, so we are providing a solution to most of the problems faced by teachers. There must be a system that should be developed that provides an efficient and easy-to-understand simulation of the problems defined above, which nowadays are mainly done manually. Because education systems have two sides, one for teachers and one for students, Students also face problems while doing various activities related to submissions, peer grading, examinations, etc. As a result, the system's development should take into account the perspectives of both teachers and students. Teachers should benefit from a reduction in the overhead of non-teaching tasks, and students should benefit by getting all the institutionally related activities in one place.

This methodology will also help in contributing to the green industry initiatives by reducing manual paper work and providing a solution to each problem requiring paper work by using a software feature where tasks can be easily performed efficiently with only a few clicks. Students will also benefit as they will get all the curriculum-related activities in one place. Institution management will also benefit as instead of handling the large amount of paper work, they will just have to manage the infrastructure of the product to carry out all the tasks.

1.3 Project Scope

A system for the collection, integration, processing, maintenance, and dissemination of data and information to support decision-making, planning, policy analysis and formulation, monitoring, and management at all levels of an education system is defined as an educational institute management system. It is a collection of people, models, technology, processes, methods, procedures, rules, and regulations that work together to provide education leaders, decision-makers, and managers at all levels with a comprehensive, integrated set of relevant, unambiguous, reliable, and timely data and information to help them carry out their responsibilities. The entire system will be mainly divided into 2 parts: one will be allocated to the teachers, and the other will be for students. All the teachers' related activities like creating assignments, grading assignments, creating teams for a project, taking exams, taking attendance, etc. a software simulation of all this will be created and will be presented to the teacher in an easy-to-use format. On the other hand, students will be able to mark their attendance, submit assignments, access course documents, etc. All these features will be accessible to students.

Objectives:

- To develop a mechanism that can help teachers to take attendance automatically with just a few clicks and help students to mark attendance using their handheld devices.
- Teachers will get an interface to create assignments, and students will be able to submit the assignments.
- Teachers will have the option to use peer grading for grading the assignments, and students will get a chance to learn about grading systems by grading the assignments of others.
- To assist teachers with uploading the reference materials and making announcements that will be accessible to students who are enrolled in the particular course.
- Creating quizzes and allowing students to take them with the facility of cheating detection which will help teachers monitor the student activities during quizzes.
- To provide a feature that will help in checking similarities between the uploaded assignments by the students, which will assist teachers in checking plagiarism.
- Assisting teachers in forming the teams for the projects and tracking project status.
- To create a novel smart attendance system and publish a research paper in an internationally renowned journal.

1.4 Description of the project undertaken

All the sections mentioned above describe the current position of the education system and the various challenges faced by all the actors who are directly or indirectly associated with it. The project that we will be developing will basically provide a solution to all the problems described. The virtualization of all the activities related to education has been in demand after the pandemic because, before the pandemic, every activity was carried out using manual processes and in a face-to-face manner. However, after the massive evolution of the pandemic, the work culture in education systems has changed drastically, and the project that we are developing also depicts the workings of education-related activities after the pandemic. Edumate is an innovative education institution administration system that offers instructors and students a seamless digital experience, thereby streamlining administrative and academic tasks.

We are developing a progressive web-based system that will provide functionalities to ease the complex work carried out by students and teachers. Teachers carry out many activities on a regular basis, from taking attendance to preparing student marksheets, and all of these were done in traditional education systems using lengthy paperwork. So the system that we are developing will provide teachers with an interface where they can carry out the activities with just a few clicks, which will also give them better manageability of all the operations as, at any point in time, they can modify their work created, which was very complex in the traditional systems. Edumate offers a variety of features to simplify and optimize instructors' workloads. They can create virtual classrooms, assignments, and schedules with simplicity, as well as post announcements and updates, administer exams, and grade assignments. In addition, Edumate offers attendance tracking, peer evaluation, group work collaboration, plagiarism detection, analytics, and administration features to improve teaching efficiency and productivity. With Edumate, instructors are able to devote more time to instruction and less time to administrative and secretarial duties.

Now coming to the students' part, they will be provided with an interface from which they can access all the activities related to their curriculum. They will have quick access to everything from marking attendance to getting their marksheets. In traditional systems, students have to perform all the activities by going to multiple places in the institution, which is very time-consuming. With the system that is developed, their time won't be wasted; they can just log in to the system and then do all the work. Edumate provides students with an intuitive interface that makes learning and submitting assignments simple and convenient. Students can attend virtual classrooms, submit

assignments, take exams, and receive teacher feedback and evaluations. Additionally, Edumate offers attendance monitoring, peer evaluation, group work collaboration, plagiarism detection, and analytics to assist students in achieving academic success.

1.5 Summary

In this chapter, we have briefly discussed what we will be developing at the end. The first thing required to create a project is an idea, that comes from the identification of problems, so we have gone through many domains and their related problems, and then by observing the problems in the education system, we have chosen that domain. Then we identified some challenges that are faced by the students and teachers and decided to create a system that will help them carry out activities efficiently. In this chapter, we have mentioned what we will be developing, and in the next chapter, we will describe all the research that has been carried out, which will give us the methodology for how to implement some parts of the system efficiently.

Chapter 2

Literature Survey

This chapter presents some of the main concepts and ideas that we will be using to develop the core components of our project. These methods are represented in the form of research papers that have be congregated from various reputed journals.

2.1 Table of Literature Survey

Paper title	Author	Publishing year	Algorithm(s) used
IBAtS - Image Based Attendance System: A Low Cost Solution to Record Student Attendance in a Classroom	Setia Budi, Oscar Karnalim, Erico D. Handoyo, Sulaeman Santoso, Hapnes Toba, Huyen Nguyen, Vishv Malhotra	2018	Haar Cascade Face detection, Non detected face selection.
Mobile Attendance using Near Field Communication and One-Time Password	John Jacob, Kavya Jha, Paarth Kotak, Shubha Puthran	2015	One time password, Bluetooth, NFC
Document Similarity Based on Concept Tree Distance	Praveen Lakkaraju, Susan Gauch, Micro Speretta	2018	Vector Space Classifier
Effective Learning through Peer Assessment using Peergrade tool	Dr. Deepak Sharma, Dr. Manish Potey	2018	Job allocation
Standalone application and Chromium Browser Extension - based system for online Examination Cheating Detection	Samadhi Kariyawasam, Anjana Lakshan, Anuranaga Liyanage, Kaveesha Gimbana	2022	K-nearest neighbor (KNN), Convolution Neural Network (CNN)

Table 1 : Literature Review Summary

2.2 Analysis

IBAtS - Image Based Attendance System:

Budi, S., et al. (2018) presented IBAtS (Image Based Attendance System) as a low-cost approach for documenting student attendance via the use of face identification algorithms. The approach is intended to enhance time efficiency and minimize staff burden, eventually improving the dependability of the attendance record. The suggested method comprises four steps, beginning with a lecturer capturing class images that encompass the full class attendance. IBAtS then uses a face detection algorithm to find faces in each shot. The suggested approach is resistant to false negatives and false positives. False positive detections are unimportant in terms of attendance registration as long as no student claims the misidentified items as their face. False-negative detections have an effect on pupils who are unable to record their attendance because their faces were not detected. To remedy this problem, affected students might use a mobile application (IBAtS for students) to alert the professor in charge. As a result, the lecturer must manually find the students' faces and finish the attendance registration.

Each detected face is returned to the pupils, who can then register their presence by selecting their own face. Interested stakeholders (e.g., lecturers, students, and department director) can monitor the attendance report in real-time as the semester progresses. As the primary interfaces for interacting with the proposed system, mobile applications were developed for both students and faculty. To evaluate IBAtS, five factors were proposed: time efficiency, staff-workload, implementation cost, human error, and student acceptability. IBAtS outperforms conventional practices and effectively manages fake attendance, a problem that the majority of attendance systems were unable to solve.

The robust framework of the IBAts system will be used as a baseline for our proposed smart attendance model. The handling of false positives and negatives would be emulated in addition to the location and one-time password validations to withhold sanctity of the attendance records.

Mobile Attendance using Near Field Communication and One-Time Password:

Jacob, J., et al. (2015) introduce a College M-Attendance system supported by Near Field Communication (NFC) for University Students. Near Field Communication (NFC) is one of the newest radio communications technologies, and as a subset of RFID technology, it is expanding at an astounding rate. NFC technology enables communication between two devices in a fragment of a second, which is the quickest method available. It has numerous uses in Mobile Communications and transactions. A College M-Attendance system supported by NFC for University Students is discussed as a potential application of this technology. The proposed infrastructure replaces manual roll calls, making it forgery-resistant. It provides parents and teachers with information regarding students' attendance. The marking of attendance is fast, unsupervised, and employs a One-Time Password (OTP) to increase system security and eliminate the possibility of proxy attendance. The paper discusses NFC as a technology that is more secure and convenient than Bluetooth, as well as the proposed framework of the M-Attendance system that takes advantage of this advantage.

The handling of false negatives in our smart attendance system could be streamlined and fastened by using the proposed NFC technologies. The one-time password methodology would be utilized as it improves the security of the smart attendance system.

Document Similarity Based on Concept Tree Distance:

The Web is transitioning swiftly from the era of search engines to the era of discovery engines. In contrast to search engines, discovery engines help you uncover items you did not realize existed. Typical discovery methods consist of automatically distinguishing and displaying objects comparable to those the user has previously viewed. A precise method for identifying similar documents is essential to this strategy. In this study, we present a novel method for locating comparable papers based on a conceptual tree-similarity measure. Using the concept relationships obtained from a classifier, each document is represented as a concept tree. Then, to compute similarities between concept trees, a tree similarity measure based on tree edit distance is used. Experiments conducted on documents from the CiteSeer collection demonstrated that our method outperformed conventional vector space-based document similarity.
The paper's approach is divided into three steps:

1. Tree Classification Module: - Training and classification are the two phases of classification. A vector space classifier and the ACM's classification hierarchy are implemented in this scenario. The algorithm used in this instance is tree edit distance. The edit distance between two trees A and B is the minimum cost of transforming A into B via a series of fundamental operations such as node insertion, deletion, and substitution.
2. Tree Builder Module: This module takes the idea vectors from the preceding module as input and constructs the associated weighted concept tree.
3. Tree Matching Module: The Tree Matching Module is responsible for matching concept trees using the Tree Edit Distance method. This algorithm computes the cost of transforming one concept tree into another using operations with their own associated costs. The greater the similarity between two trees, the less it will cost to transform between them. We examine three operations for modifying an idea tree: node insertion, deletion, and replacement.

Effective Learning through Peer Assessment using Peergrade tool:

This paper gives an overview of certain issues encountered while performing a peer assessment. The number of parameters to take into consideration while doing peer assessment or while creating a system that provides the peer grading facility is also mentioned in the paper. This was basically an analysis paper that described the different functionalities available in the peer-grade tool, which is available as a web application. The methodology of the application was also mentioned in this paper, along with screenshots of how it is actually carried out in the system. This paper describes the methodology as follows: first, the teachers will create the assignments; after that, students will submit all the assignments. After all the submissions, teachers will have the option to start the peer grading process, which will just assign peers' assignments to the students to grade. Then students can grade the assignments, and after that, peers can provide feedback on the marks given.

For the implementation of our system, we have used the same concept but with some modifications. We have developed an algorithm that is based on probing mechanisms in hashing algorithms for assigning peer assignments. We will also take marks from the teachers for the assignment and calculate a weighted average of all the marks given on the assignment because peer grading can produce false results because students can cheat when grading their peers. We will also provide the analytical aspect to the teacher, where he will be able to see the deflection in the marks from teacher and student marks to see who has cheated in the peer grading.

Standalone Application and Chromium Browser extension-based System for Online Examination Cheating Detection

In 2021, approximately 73% of students have attempted to deceive on online examinations. This has generated debate regarding the validity of electronic examinations. This paper presents an automated system for detecting exam misconduct online. Presented is an analysis of prospective video and audio to detect the degree of deception.

Numerous extant proctoring systems derive features from audiovisual data by analyzing candidate behavior. Two cameras and a microphone make up the proposed automated system. It is capable of detecting non-eligible candidate involvement, face deception on eligible candidates, and dynamic human movement.

Historically, candidate verification for online examinations has consisted of using conventional methods to authenticate and identify candidates. Face masking is a potential means of deceiving the monitoring system, which is a significant issue that has not been addressed. Numerous studies have proposed analyzing and photographing the candidate's suspicious movements upon detection in the absence of third parties. Another study suggests detailed pipelines with user-device distance calculation, ocular monitoring, and head-pose estimation capabilities. This paper concentrates on addressing the aforementioned limitations and precisely detecting the level of deception by taking the following factors into account.

The aspects include User recognition, verification, and face spoofing detection, Dynamic human movement detection, Suspicions audio classification, and Browser manipulation detection.

2.3 Summary

As the first phase of the software development life cycle is requirements gathering, followed by analysis, this chapter focuses on these two phases of software development. We have reviewed a number of papers to obtain ideas for the implementation of various features for our project, and then selected a few of them for implementation. This chapter defines the papers to which we have referred and our analysis of those papers. Now that we have discussed the requirements analysis, we will move on to the design and development phase. The following chapter will define the technical aspects of the project. The design phase is illustrated with three diagrams, and the development phases' requirements and methodology are described.

Chapter 3

Project Design

This chapter presents the initial steps for starting the development of the project. The first section of this chapter defines the problem statement, which is followed by the design section, where some diagrams are shown to get information about the working of the system specifically. Then this chapter also describes some functional and non-functional requirements, out of which details of the implementation of functional requirements are presented in the next section.

3.1 Problem statement

Teachers face numerous obstacles that should be addressed and provided with solutions. The non-teaching duties frequently assigned to instructors are extremely time-consuming. These non-teaching duties can be simply and effectively automated, freeing up ample time for instructors to prepare lessons. A teacher faces various difficulties apart from teaching such as Keeping record of the attendance of the students, Assigning assignments to the students and collecting them and grade them, Check whether the students have not copied and then finally send the marks to the students, Conducting quiz and monitoring so that no one cheats, Creating student teams for a project and timetable generation. For all this, teachers have to put in additional time and effort, which can be used in other work like efficient and innovative teaching, so we are providing a solution to most of the problems faced by teachers. Our system is mainly developed to solve the problems of both the teachers and the students. Teachers will benefit from a reduction in the overhead of non-teaching tasks, and students will benefit by getting all the institutional-related activities in one place.

3.2 Block diagram

3.2.1 System design

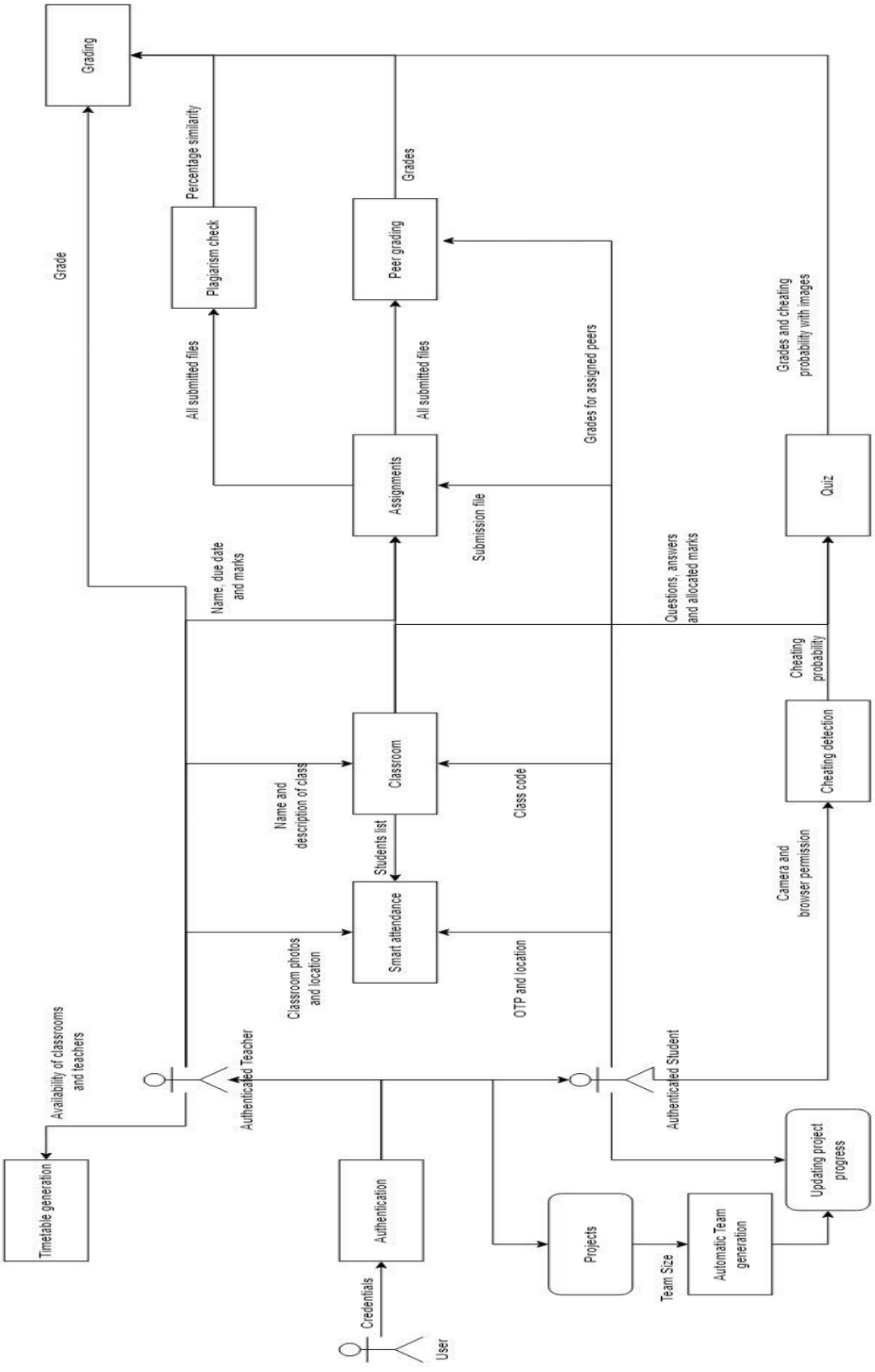

Figure 1 : System Design Diagram

3.2.2 Use case diagram

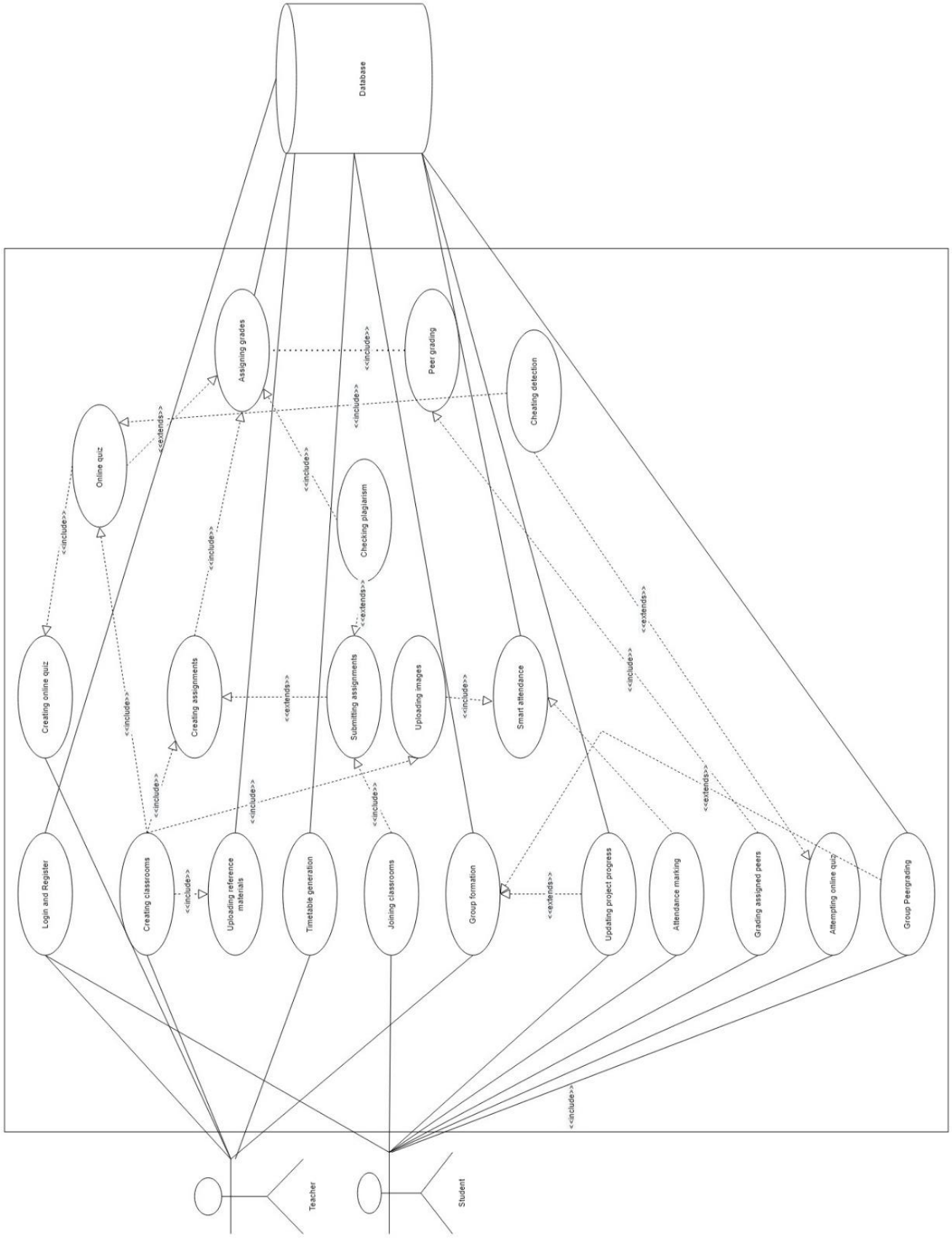

Figure 2 : Use Case Diagram

3.2.3 Activity diagram

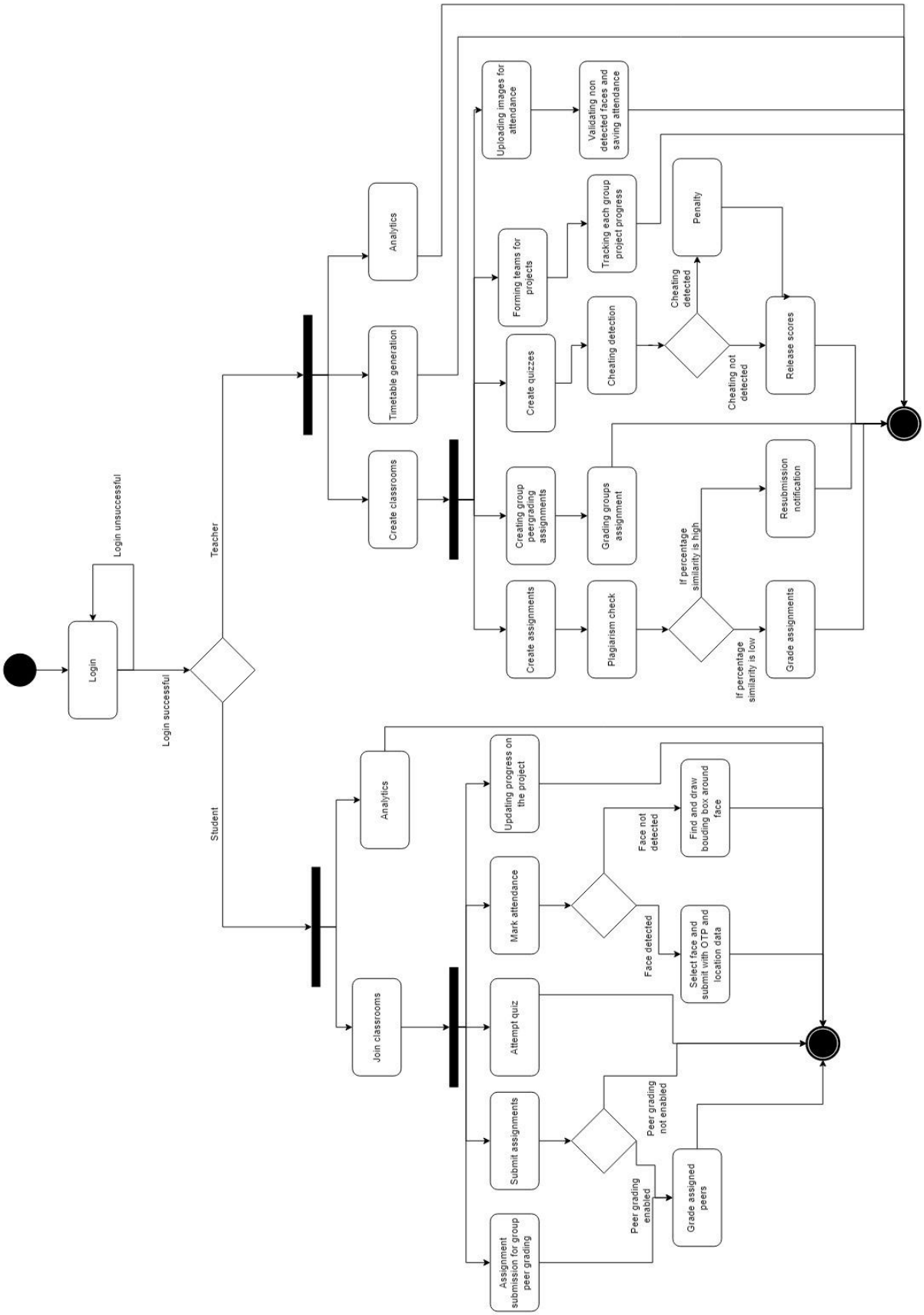

Figure 3 : Activity Diagram

3.3 Methodology

The system is mainly divided into three sections. These 3 sections represent different actors interacting with the system, i.e., teachers, students, and administrators. Teachers and student sections are connected to each other, and admin is connected to both teachers and students. The system will start with the authentication of the user, where the user has to provide an email address and password to get access to their part of the portal. After that, they can explore all the different functionalities available with the system.

The teacher has the role of initiating any process on the system, and after that, students can respond to that process. There are separate databases and modules created for the teachers and students. During interaction with the system, teachers have access to the student database, but vice versa is not possible. The teacher module is also connected to the machine-learning part of the system, which is used for plagiarism, cheating detection and smart attendance. All the request and response mechanisms are developed using simple HTTP requests where the payload from the frontend is sent to the server and then, after processing, the server will respond to the request with an appropriate payload that will be rendered on the frontend again. During processing, the server accesses the database as well as the machine learning component to perform the necessary functionality.

3.4 Requirements

3.4.1 Functional requirements

- **Marking attendance:** The developed system will assist teachers in creating the attendance for a particular lecture and that will be accessible to the students, and the authorized students will get an option to mark the attendance. After the stipulated time, the attendance marking option will be removed and the teachers will get access to download or view the attendance.
- **Creating and submitting assignments:** Teachers will have an option to create the assignments and the authorized students can submit assignments which will be visible to students and teachers. In the case of peer grading assignments, teachers and the students who are assigned to grade the assignments will have access to view and grade the assignments.
- **Uploading reference material and making announcements:** For scoring good marks in the exams, students must have all the reference materials to read that will be provided by

the teachers and that will be available to all the students. Teachers will also have the option to make announcements.

- **Online exams with cheating detection:** Due to the pandemic, another way of taking exams is also being explored. There are many platforms where the exams can be carried out, but that will require monitoring by the teachers. This overhead can be reduced by providing an inbuilt function which will help teachers to track student activities during exams and also help in finding any copy cases.
- **Plagiarism check:** It is very often that, for some reasons, students may submit other students' assignments. It is very difficult and time-consuming for the teachers to find these copy cases, so the developed system will provide a facility to check the similarities between the documents.
- **Project Tracking:** There are various ways other than written and oral examinations to evaluate the students' performance. One of the ways is by assigning them projects that will require students to work in teams. Teams created by teachers are assigned checkpoints which the students can update and the teacher can track the progress of the project.
- **Scheduling:** There are times when teachers wish to plan so many events for the future week or month, providing students the information about each activity one by one could take a lot of time. To get around this, teachers will be able to make a timetable that can be distributed to students for extended periods of time, which will cut down on the amount of work and give students a quick rundown of all upcoming activities.
- **Peer Grading:** A teacher can facilitate peer grading for an assignment or project they assign. Students can then view and evaluate the work of their classmates using a rubric or teacher-supplied guidelines. Peer grading allows students to view and remark on the work of their classmates, as well as assign a grade or score based on the provided rubric or guidelines. This feedback is then shared with the student whose work was submitted, along with the grade or score assigned by their peers.
- **Insights & Analytics:** The system also provides concise analytics to both the instructors and the students for viewing pending tasks, attendance logs, performance in quizzes and grades of submitted assignments which provides insights to students and teachers on the aspects they need to improve.

3.4.2 Operating environment

- Stable internet connection.
- GPS of the phone must be in working condition.
- Any handheld device (mobile phones) with browser compatibility.
- A laptop or desktop computer with any operating system having browser compatibility.

3.4.3 Assumptions

- Users interacting with the system will have a stable internet connection.
- While forming the teams for some projects, students have some similarities in their skill sets based on that the team formation will be carried out.
- Students have the required tools to convert their assignment files into the format accepted by the system.
- Teachers and students have the tools to open the assignment documents, which are in a specific format determined by the system.
- Students interacting with the product have a system that has browser support (file access, camera access, etc).
- The classrooms have proper light conditions, so that whenever a teacher clicks a picture for attendance, a clear picture is obtained from which the number of students is easily calculated at the backend.

3.4.4 Dependencies

- **Cloud services:** Users' traffic on the system may increase instantaneously, so infrastructure should be deployed on the cloud in such a way that there shouldn't be any problem with system lagging.
- **Databases:** For development purposes, the databases will be created on the local system, but for deployment (if required), databases should be created on some standard platforms for easy operations.
- **OS and browser support:** For development, testing, as well as in the operations phase of the project, OS and browser support are very much required. Development needs good and

efficient OS support for faster creation of the project, and a browser will be required for testing and operations purposes.

- **Draftable API:** It is a document comparison API that allows users to compare files in various formats like PDF, Word, Excel, and PowerPoint, providing an automated and efficient way of comparing documents. We have used draftable API to enhance the similarity score predictions with visual side by side differences between the pair of documents in a user friendly and informative interface.
- **Adobe PDF Embed API**: It is a tool that allows users to embed PDF files on their websites, providing a seamless and interactive PDF viewing experience for users. We have used the adobe API to display the assignments that are submitted by the students in the project.

3.4.5 Interfaces

User Interfaces

- The users will be interacting with the systems using this interface and will get a smooth experience of the system.
- A pleasant UI will be developed so the users interacting with the system will feel less strain on their eyes and brains.
- There will be similarities in the design of every section created for the portal (for both the teachers and the students).
- When the project is in the operations phase, it can be used by users on any device, so the UI developed will be responsive and users will get the same experience while interacting with the system from any device of any size and configuration.
- The components used to show the functionality to the user will be named and designed in such a way that they are self-descriptive. The terms used will be general and all the types of users will be familiar with them.
- Users do not have to go through different sections and also don't have to click on many buttons. The developed system will require minimal effort from users to test and use any functionality.

Hardware Interfaces

- Taking attendance of the students will require interaction with the hardware as teachers have to take a picture of the entire class. For that reason, camera accessibility is required and the developed system will have efficient interactions defined with the camera of the device in use.
- All the other interactions with the hardware will be carried out by the operating system on the device (interactions including the installation of some specific frameworks/tools for development, databases, etc).

Software Interfaces

- The MySQL client will provide the interface to the database created. This interface will require a username and password for communication. The server must establish a communication link with the databases by providing the credentials in the request which will be sent for establishing the communication link, and after the authorisation of the request, the MySQL will respond by providing the communication link.
- For testing API's (application programming interfaces), the tool named POSTMAN is required, which will help us perform different functionalities of the system without using the user interface. This interface will not require any credentials to interact; it will only require the exact URL name with its parameters and the response of any request will be obtained on the POSTMAN itself.
- Any user interface developed can be seen through any standard web browser having support for displaying pages developed using HTML, CSS, and other web development frameworks. Web browsers will be the primary interface through which any user will interact with the system.
- For development purposes, GitHub will be required as a code storage and project activity tracker tool. Every developer interacting with the codebase must have GitHub support and an account to create, manage, delete, and perform various operations with the codebase. This will also track the contributions of every developer interacting with the codebase.
- A standard code editor will be required for the development of the system (VS code in our case). Developers must have an editor installed on their machines to work with the codebase.

- The system will be developed using the Django framework and the database used will be MySQL, so the developers' machines must have all the prerequisites installed on their machines to work with Django and MySQL.

Communication Interfaces

- The feature using e-mail support will use SMTP (Simple Mail Transfer Protocol).
- An HTTP request will be used for communication with the Django backend (server).

3.4.6 Non-functional requirements

Performance requirements

- The downtime of the system should be close to zero. Users must get access to the system whenever and wherever they want.
- The developed system must be fast, durable, and should give a hassle-free experience to users.
- Every functionality provided in the system should work without any delays, and the developed system should be able to handle large volumes of users.

Safety requirements

- Only authorized teachers and students must get registered on the system.
- The entire systems datastore and codebase should be available to authorized personnel only for safety and security of the user data and the systems codebase.
- To avoid any type of password attack, users should change their passwords every 6 months.

Security requirements

- Users' confidential information stored on the system must be encrypted for data privacy and standard encryption and decryption algorithms should be used.
- Communication between any two parties, such as a server and a frontend or a server and a database, should require authentication of both parties so that any external, unauthorised user does not have direct access to the system's resources.
- Databases and the codebase will be held only by the admin of the institution, who must have credentials to access the same, and these credentials should also be stored in an encrypted manner.

3.5 Summary

This chapter was all about the preprocessing required to start the development of the project. The coding cannot be started without the design and proper flow of the system, and both of these components are briefly discussed in this chapter. The conditions under which the system will operate and the requirements that it must meet are also mentioned. This chapter was created with the help of a literature review. For creating the different diagrams, figma is used, which makes the designing process much easier. Now in the next chapter, we have provided the details about how each and every component of our system will be implemented. The next section is in accordance with the coding of the system, as each and every step mentioned is just converted to programming language syntax, which will carry out the work.

Chapter 4

Implementation

This chapter provides each and every detail for implementing the different functionalities of the system. Each and every feature description, the sequence of activities carried out by the user and system, and the requirements are described in this section. This section also provides a detailed testing report of the system. Some screenshots are also included, which describe the visual demo of the system. This section also covers the test reports.

4.1 System features

Login / Register

Description: The admin should only have access to register new students and teachers. The data should be stored in the database in a secure manner. After the registration is successful, users should have access to their accounts using the credentials provided by the admin. For security purposes, users should be able to change their password immediately after first login. This should be the first feature through which a user gets entered into the system.

Activity sequence:

1. The admin will have a list of teachers and students that should be registered on the system.
2. The admin will have access to view the register section of the portal and there they will have to enter the credentials asked for.
3. After the registration, the admin will receive the credentials of each user, which have to be distributed to each student in the institution.
4. Users can log in to the system using credentials provided by the admin.
5. Users have to change

Requirements:

1. Admin must have a list of all the authorized teachers and students.
2. Admin must have credentials to access the register section of the system.
3. Students and teachers should be registered first before logging in to the system.

Creating classrooms

Description: In an institution, there may be many students and teachers. Each teacher may handle one or more groups of students, so the system should allow teachers to create the classroom and also provide a facility to add students into that classroom. Each student should be notified after being added to the classroom. This classroom acts as a virtual version of the actual classroom, where all the activities will be carried out in a single place.

Activity sequence:

1. The teacher will navigate to the creation of the classroom section where details of the classroom will be added.
2. A code should be generated after the creation of the classroom, which should be provided to the students by the teacher.
3. Students can use that code to join the classroom.

Requirements:

1. The teacher must be logged into the system to create the classroom.
2. Students must be logged into the system to join the classroom.

Creating assignments

Description: A teacher can easily evaluate the students' performance by taking the assignments from the students. For this section, a teacher has to enter the details of the assignment, such as the maximum marks, whether peer grading is enabled or not, etc. After the creation of the assignment, the students should get access to submit the assignment.

Activity sequence:

1. The teacher navigates to the assignment creation section and enters the details mentioned on the screen.
2. The teacher should have an option to set the deadlines for the assignments.
3. Students who are part of that classroom in which the assignment is created will be notified.

Requirements:

1. A classroom must be created by the teacher before creating the assignment.
2. At least one student should be there who is a member of the classroom.

Submitting assignments

Description: After the assignments are created by the students, it is the students' responsibility to submit the assignments on time. For simplicity, assignments can be taken in a particular file format(pdf). The students have to convert the assignment file formats (if required) before submitting the assignments.

Activity sequence:

1. Students will access the assignment which was created by the teacher.
2. They will upload their assignments by converting the file into the specified format.
3. After submission, the teacher will have access to the assignments submitted by students.

Requirements:

1. An assignment must be created in the classroom.
2. Students must have the required tools to convert the assignment in the specific format mentioned in the assignment.
3. Teachers and students must have the tools to open the assignment files.

Peer grading

Description: A student always has a query about how the marks are deducted from his or her assignment. This query can be easily resolved by allowing students to grade other students' assignments based on some criteria defined by the teacher. Through this methodology, the students will learn the skill of evaluating another student's performance. For this feature to work, a teacher must enable peer grading while creating the assignment**.**

Activity sequence:

1. The teacher will just click the button to execute peer grading.

2. The backend will assign different assignments to students to grade.
3. Students will grade the assignments based on certain criteria (assignments should not contain students' names to avoid cheating).
4. After the students have given their grades, the teachers will also enter their grades for the assignments submitted by the students.
5. Assignments Final grades will be calculated by a weighted average of all the grades on that assignment.

Requirements:

1. Peer grading must be enabled while creating the assignment.
2. All the assignments should be submitted before starting the process of peer grading.
3. Grading criteria should be explained to the students before starting the peer grading process.
4. All the assignments should be graded before the teacher starts grading. This will give the teacher a fair idea of how the other students have graded the assignment.

Project Tracking

Description: Edumate simplifies academic project development by allowing instructors to construct projects in virtual classrooms and specify the number of students in each group. The system automatically establishes groups, while the instructor creates project milestones. As they work, students collaborate and update the checkpoints, while instructors monitor their progress. Students improve their cooperation, communication, and collaboration skills with Edumate, resulting in improved project outcomes and a more engaging learning environment.

Activity sequence:

1. The teacher creates a project and specifies the number of students required per cohort in the virtual classroom and distributes project milestones.
2. Edumate forms groups of students automatically based on the teacher's specifications.
3. Students work collaboratively on the project, updating the milestones as they progress.
4. Teacher can monitor the groups' progress using the dashboard.

Requirements:

1. All the students should have joined the classroom.

Uploading reference materials

Description: To score good marks, students must have all the content related to the syllabus. This content will be provided by the teachers in the reference material section of the classroom. This content will be available to all the students who are members of the classroom.

Activity sequence:

1. Teachers will navigate to the reference material section in the classroom.
2. Teachers will upload the reference material, which will be available to all the students in that classroom.

Requirements:

1. A classroom must be created.
2. The system should have access to the teachers' devices' file system.
3. At least one student should be there who is a member of the classroom.

Making announcements

Description: The classroom created will act as a software emulation of the actual classroom, so much like making announcements in the actual classroom, the teachers should be able to make announcements in the classroom created on the system. These announcements will contain mainly text data. This announcement will be visible to all students who are members of the classroom.

Activity sequence:

1. Teachers will navigate to the announcements section on the classroom created.
2. Teachers will write and publish the content that has to be announced.
3. Students who are members of the classroom can view these announcements by logging into their account.

Requirements:

1. A classroom must be created.
2. The system should have access to the teachers' devices' file system.
3. At least one student should be there who is a member of the classroom.

Checking plagiarism

Description: Teachers should be provided with an option to detect copy cases in assignment submissions. This feature will reduce the overhead of teachers by automatically checking the similarities between the assignments submitted by the students. Based on the results from this module, the teachers can identify the copy cases. This module may work in sequence with the peer grading module as before applying peer grading plagiarism check will be done.

Activity sequence:

1. Teachers will create the assignments and students will submit their assignments.
2. Teachers can start the plagiarism check process by logging into their account.
3. The files submitted by students for a specific assignment will be compared, and files that are extremely similar will be reported to the teacher.

Requirements:

1. An assignment must be created by the teacher.
2. All the students in the classroom must submit their assignments.
3. The format of all the files submitted by the students should be the same.

Creating Quiz.

Description: Due to the pandemic, another way of taking exams is being explored, which is nothing but online exams. This feature should provide teachers a way to create online quizzes that will be accessible to all the students who are a part of the classroom. Teachers should be able to set the deadline for exams as well.

Activity sequence:

1. Teachers should be able to create online exams by logging into their accounts.
2. Details such as the questions, answers, duration, and deadline will be provided by the teacher and the quiz will be published.

3. This quiz will be accessible to all the students who are part of the classroom, and the students can take the quiz in the time line set by the teachers.
4. Answers given by the students should be stored in the database and should be accessible only to the teacher who created the quiz.

Requirements:

1. A classroom must be created.
2. At least one student should be there who is a member of the classroom.

Cheating detection in online quiz

Description: Online exams have advantages as well as disadvantages. As instructors only have a partial view of the pupil, the primary disadvantage of online exams is the surveillance difficulties. Due to the fact that the camera cannot capture all of the students' actions, it is simple to cheat. There are various characteristics which are associated with the student when it tries to cheat. These characteristics can be tracked and the system must be able to make predictions about whether the student is giving exams without cheating or not. The teacher will be notified via email if the student is found cheating during the quiz.

Activity sequence:

1. Teachers will start the exam, and all the students taking the exams should be notified about the camera access.
2. While taking the exams, students' activities will be tracked, which will be used for making predictions about whether the student is cheating or not.
3. The systems backend should use the information from the above step and be able to create the logs of the results which will be available to the teachers only.

Requirements:

1. Students must have active internet connection.

Taking students attendance

Description: Attendance has a significant impact on the class process and effects student grades based on the authenticity of attendance marking, which necessitates greater accuracy and flexibility from lecturers and students. Conventional methods of recording classroom attendance, such as roll call and sign-in sheets, have been demonstrated to be inefficient in terms of time and

staff-workload. Additionally, they are susceptible to human error and fraudulent attendance, which introduces inaccuracy to the recorded data. Students register their attendance by simply distinguishing their visage on the records, which is a cost-effective and time-saving method. Web applications will serve as the primary interfaces for students and instructors to interact with the system. The system is designed to handle both the false positive and false negative of the face detection model. Incase if the student face is not detected automatically by the system the student has a provision where can select the image and crop his face and send it to the teacher to mark his/her attendance.

Activity sequence:

1. The instructor logs into the attendance system and navigates to the desired course.
2. The instructor captures images of each row of pupils in the classroom using a smartphone or tablet and enters the attendance start and end datetimes.
3. Images are uploaded to the system's backend and stored using the file names in the database. The file name has a specified secret convention to avoid any conflicts.
4. The backend system employs face detection algorithms to detect and identify each unique face within the uploaded images.
5. The system generates an OTP, class images with detected faces surrounded by numbered bounding frames, and a numbered catalog of cropped faces from these images.
6. The instructor then shares the OTP to all present students so they can begin recording their attendance.
7. Students use their own devices to navigate to the correct course in the attendance system and input the one-time password (OTP) provided by the instructor to begin recording their attendance.
8. Students then identify their face from the displayed list of faces by locating their position in the class photo and matching their face from the list using the provided bounding box number.
9. The pupil may only indicate attendance once and only between the start and end dates and timings. In order to prevent mis-clicks, the students can also view a catalog of previously marked features alongside the names of their classmates who marked them.
10. If a student's face is not detected, they can locate it in the uploaded images and outline it with a rectangle. This can be done only once if the pupil has not yet marked attendance.

11. The teacher will receive a notification regarding the student's impending attendance and will examine the images of the bounding box drawn by the student.
12. The teacher authorizes the student's attendance if he or she has a valid visage.
13. If a student is unable to mark his or her attendance, he or she may report to the teacher, who can mark attendance by inputting the students' roll numbers. Teachers can also remove attendance records if they receive complaints or suspect misbehavior.
14. For future reference, attendance data is stored securely in the backend system.

Requirements:

1. A classroom course must be created.
2. The teacher and the students' must be signed in on the system.
3. The teacher must provide permissions to access their devices' camera.

Group peer grading

Description: The system provides a feature where the peer-grading module can also be used for group assignments. In this section, the teacher will create group assignments by providing the number of students in the group and then the number of peers to grade. After that, the system will automatically create groups and allow students to submit their assignments. After the assignments are submitted by all the groups, teachers can start peer grading, which will assign students to grade each other's assignments. Students will then have the option to grade each other's assignments and also provide feedback on them.

Activity sequence:

1. The teacher creates group assignments by providing details such as name, description, due date, number of students in each group, number of peers assigned, and maximum marks.
2. Students will have the option to submit the assignments.
3. After all the assignments are submitted, the teacher will have the option to start the peer-grading process, which will assign each student to grade other assignments.
4. Students will have the option to peer grade assignments submitted by their classmates.
5. The teacher can use the grades and feedback given by students on assignments to grade groups' assignments.

Requirements:

1. The students must have joined the classroom.

4.2 Implementation screenshots

Home page

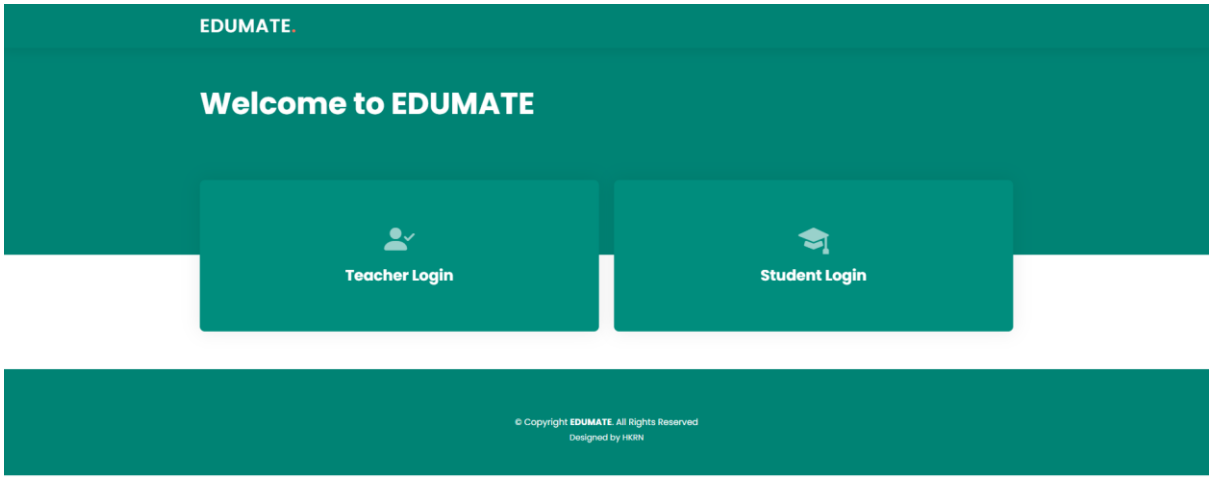

Figure 4: Edumate Home page screenshot

Login page

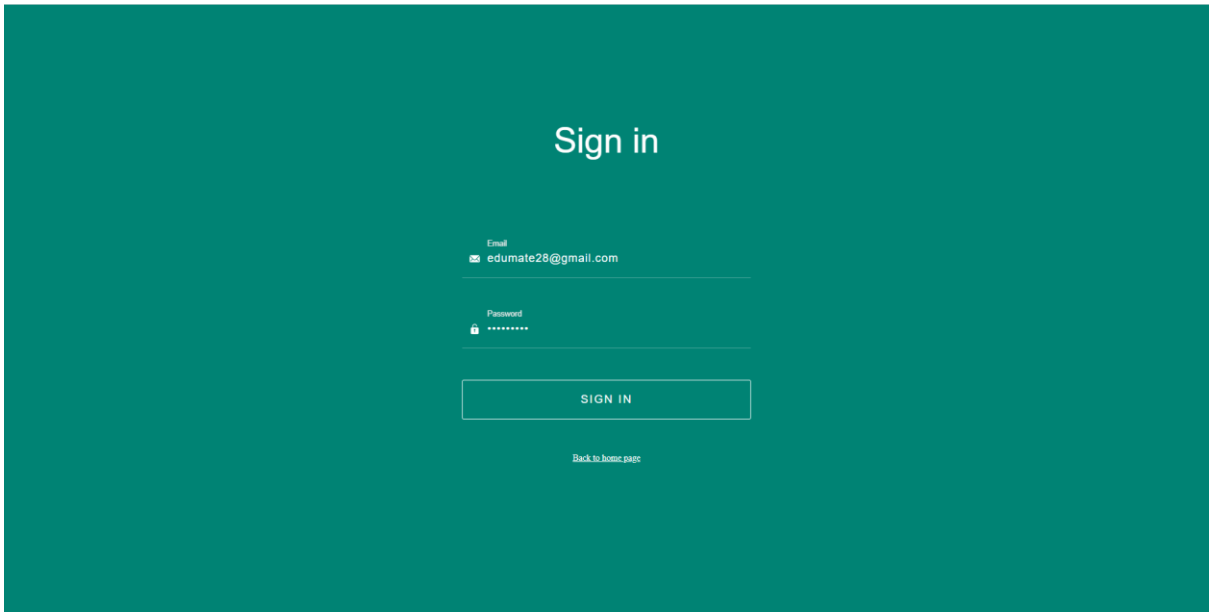

Figure 5: Login page screenshot

Classroom page

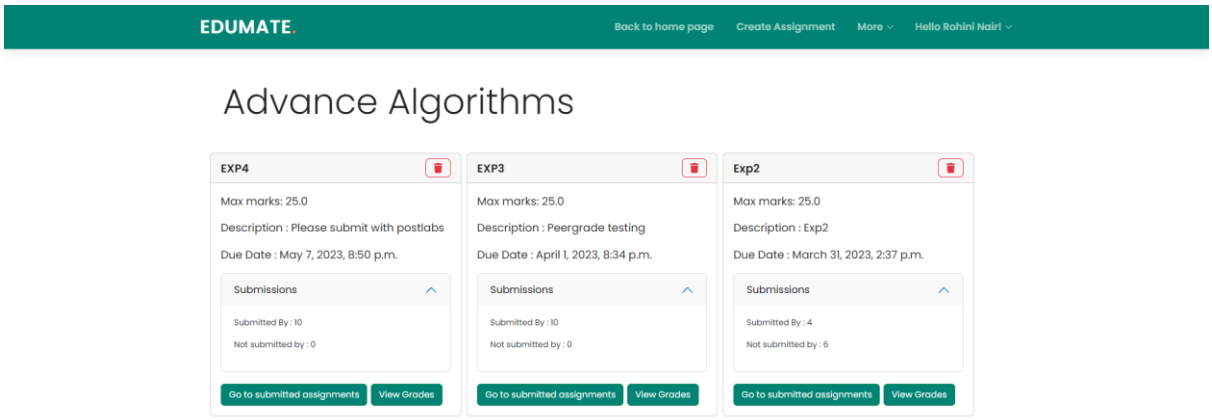

Figure 6: Classroom list page screenshot

6.Teacher Analytics

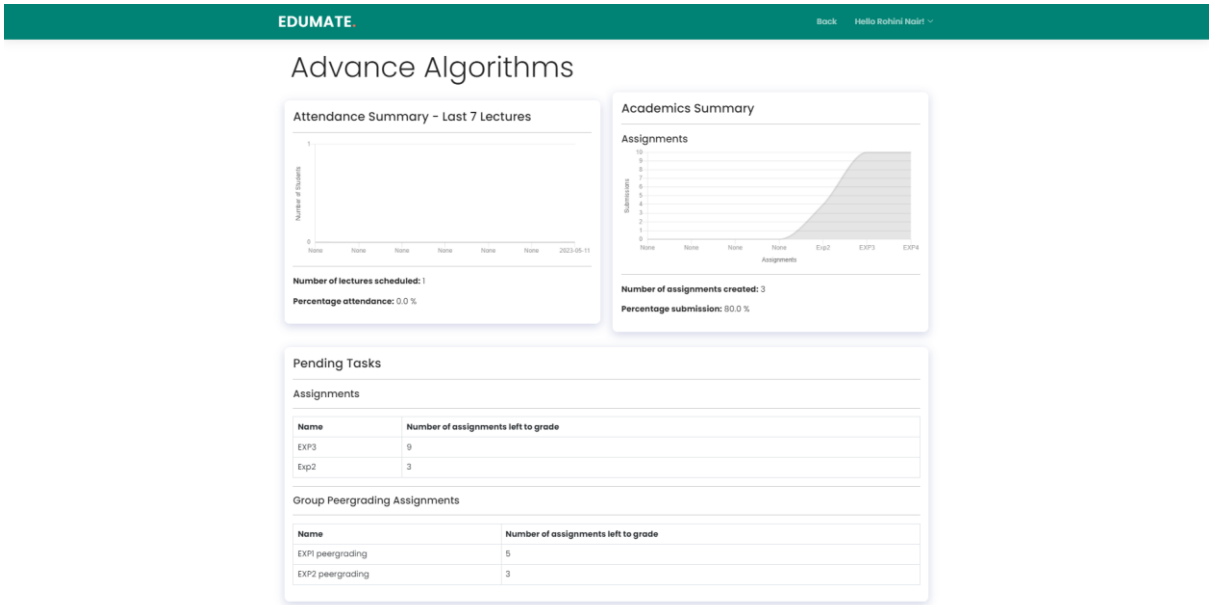

Figure 7 : Teacher analytics dashboard screenshot

Teacher Individual Assignments page

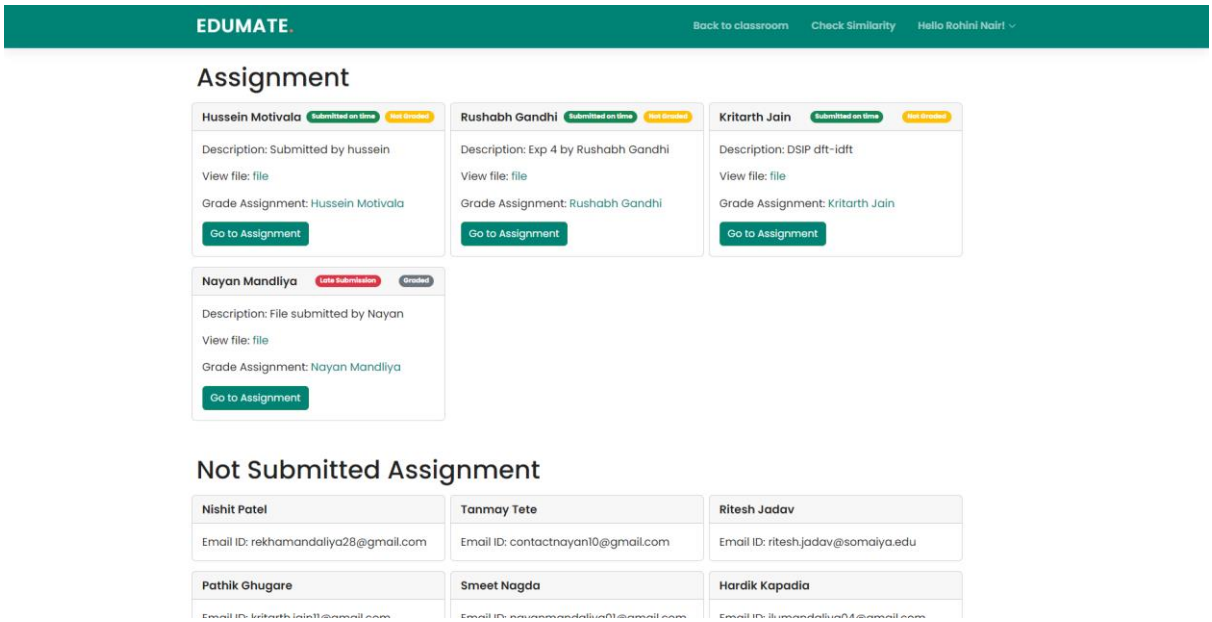

Figure 8 : Teachers assignment list page screenshot

Individual students submission

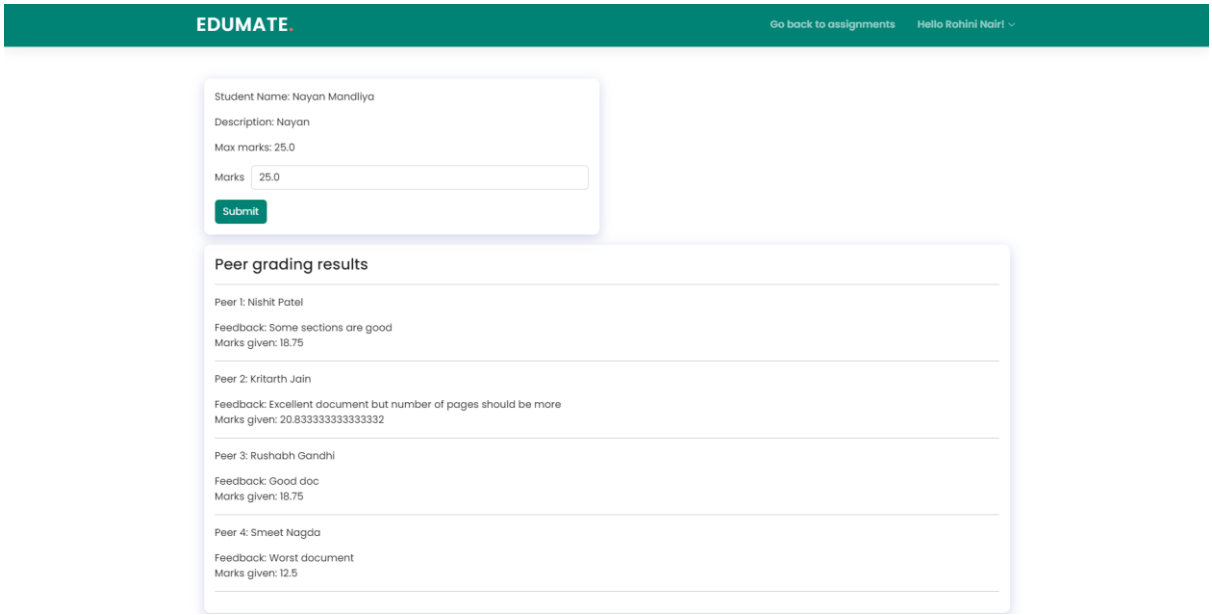

Figure 9 : Students assignment submission page screenshot

Similarity check

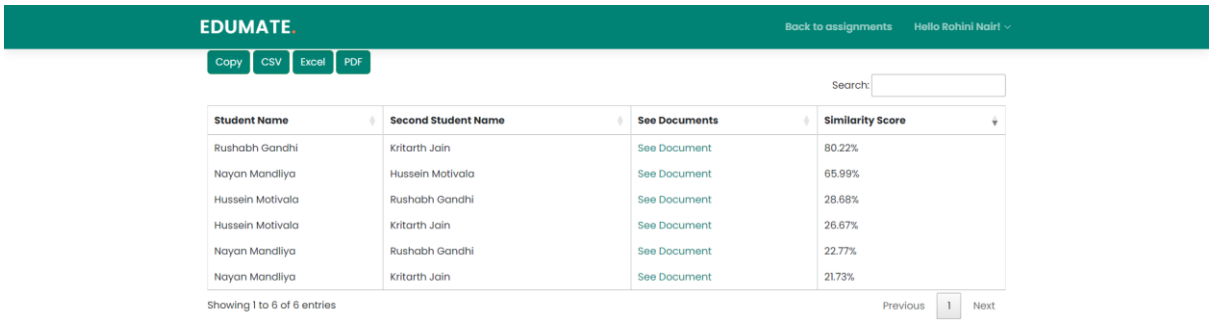

Figure 10 : Assignment plagiarism check page

Grades page teacher side

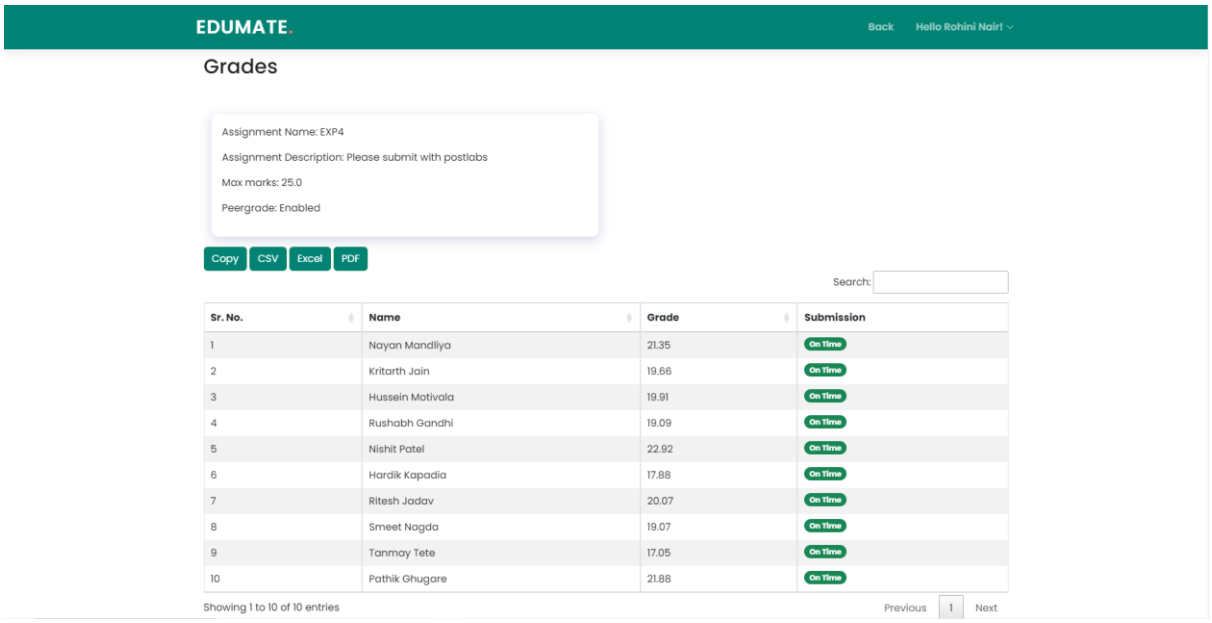

Figure 11 : Teacher grading page screenshot

Reference materials page

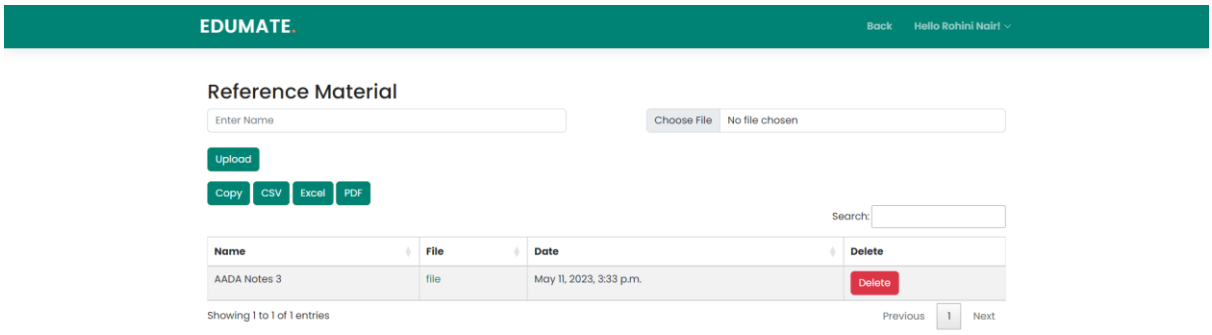

Figure 12 : Classroom reference material page screenshot

Announcements on teacher side

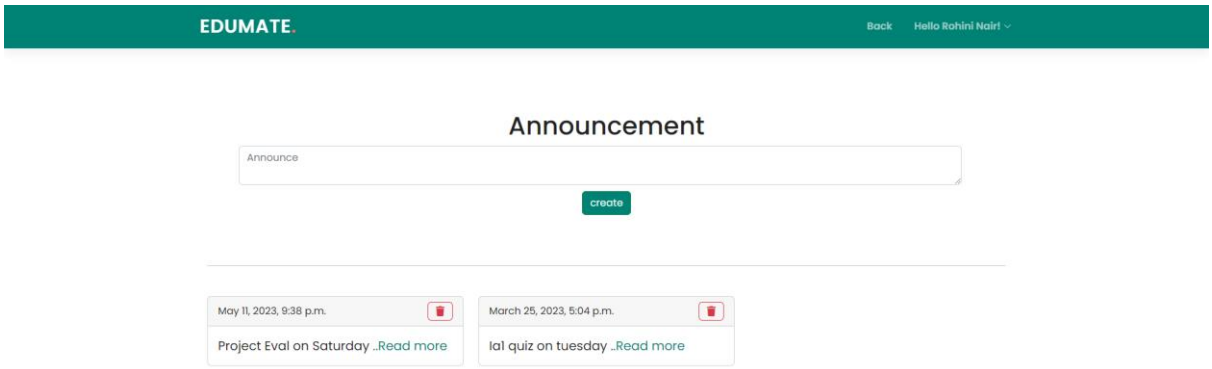

Figure 13 : Class announcements page screenshot

Schedule on teacher side

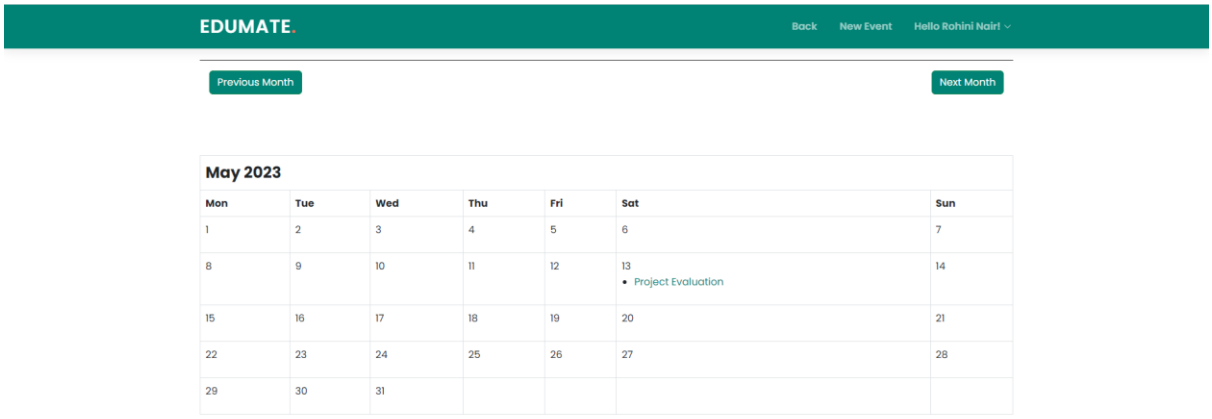

Figure 14 : Class schedule page screenshot

Create quiz

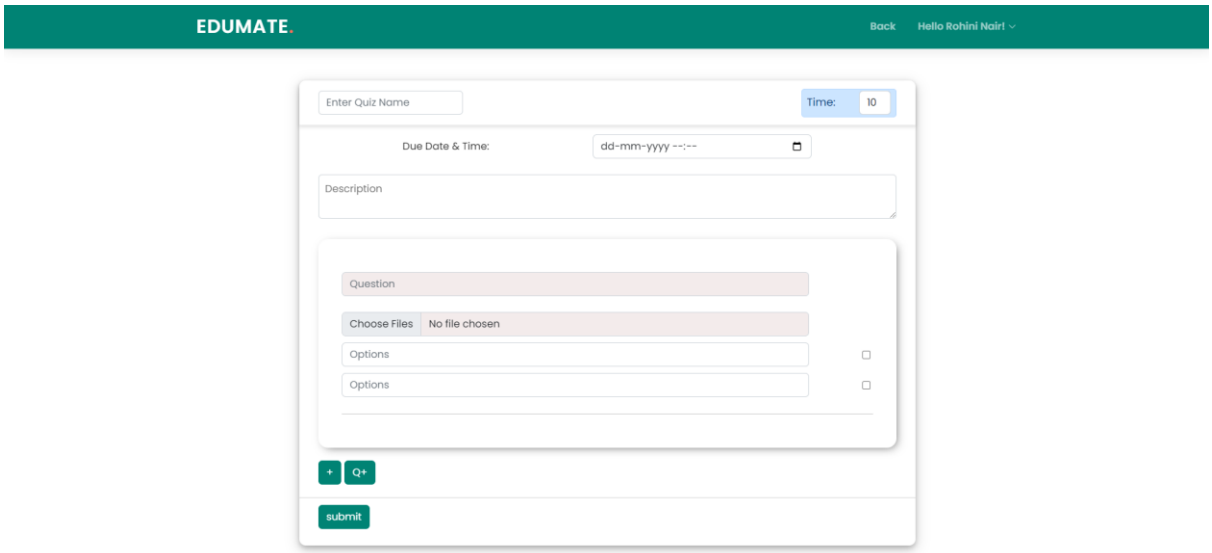

Figure 15 : Create quiz page screenshot

Attendance dashboard for teachers

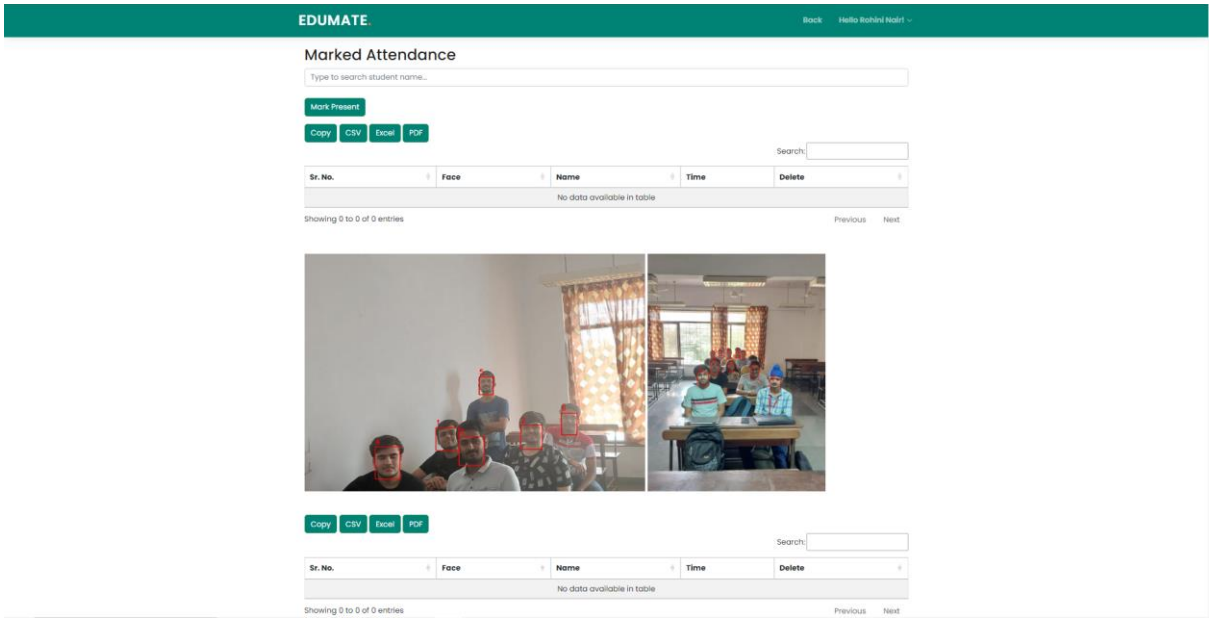

Figure 16 : Teacher attendance dashboard screenshot

Project tracking with checkpoints

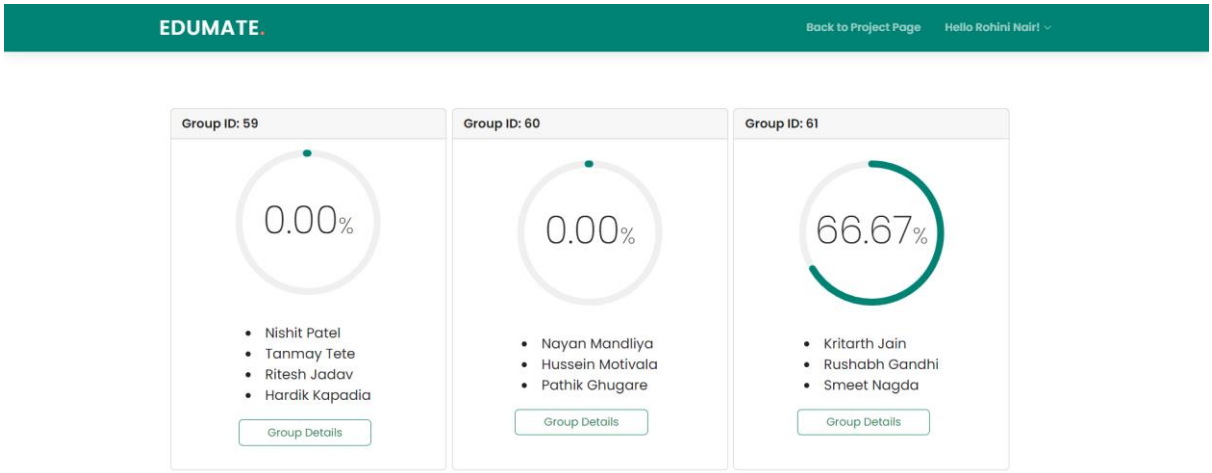

Figure 17 : Project tracking page screenshot

Group peer grading experiment

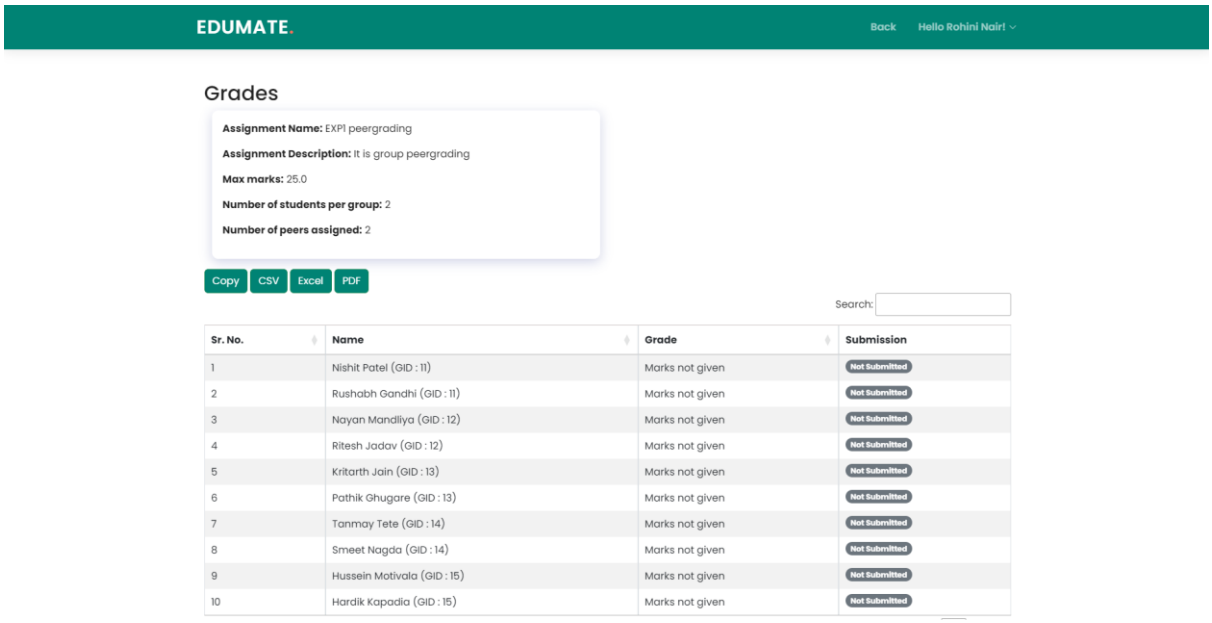

Figure 18 : Group peer grading page screenshot

Student analytics page

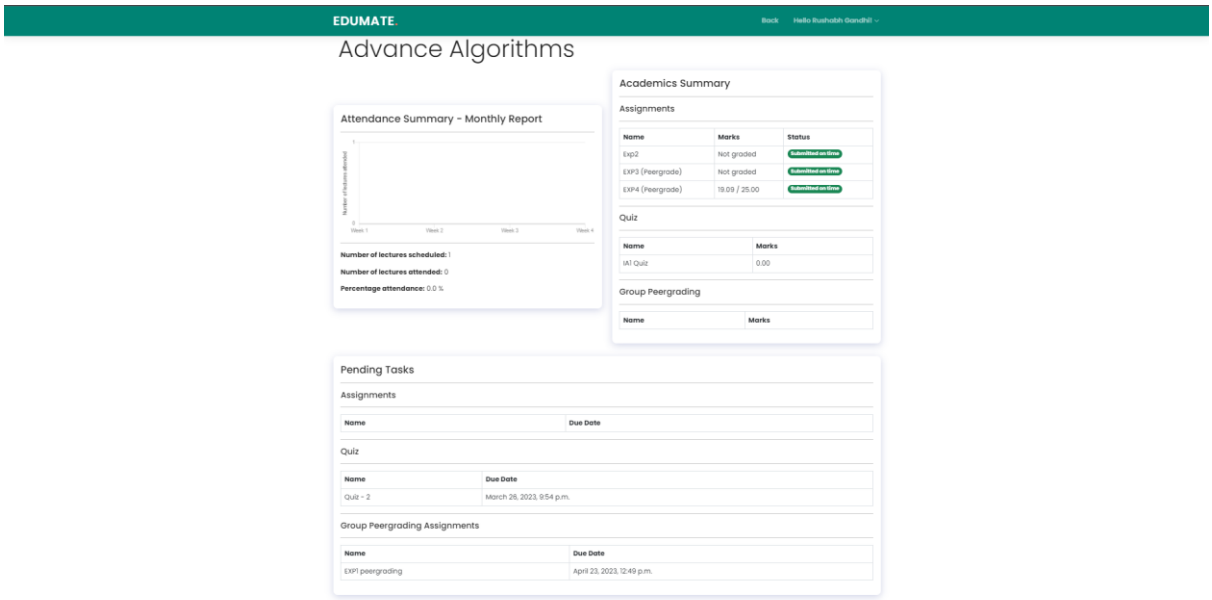

Figure 19 : Students analytics dashboard

Attempt quiz

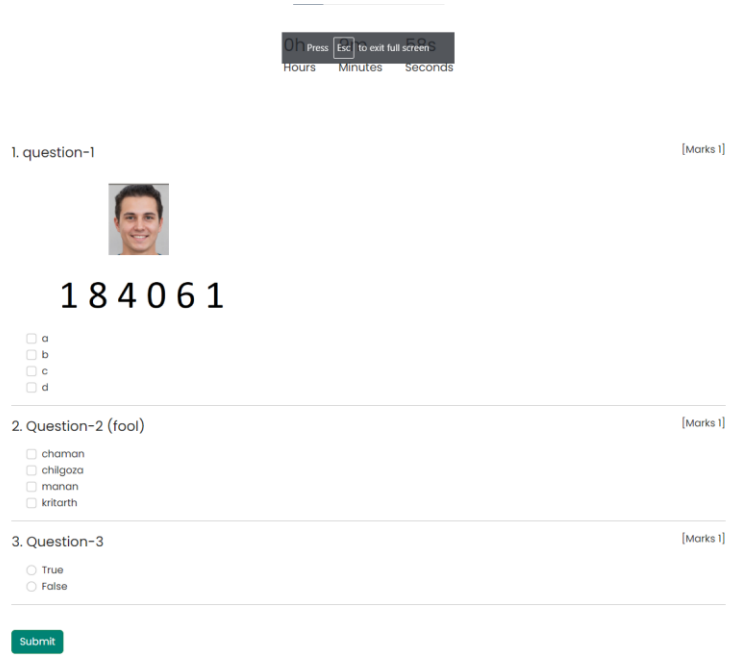

Figure 20 : Attempt quiz screenshot

11. mark attendance page

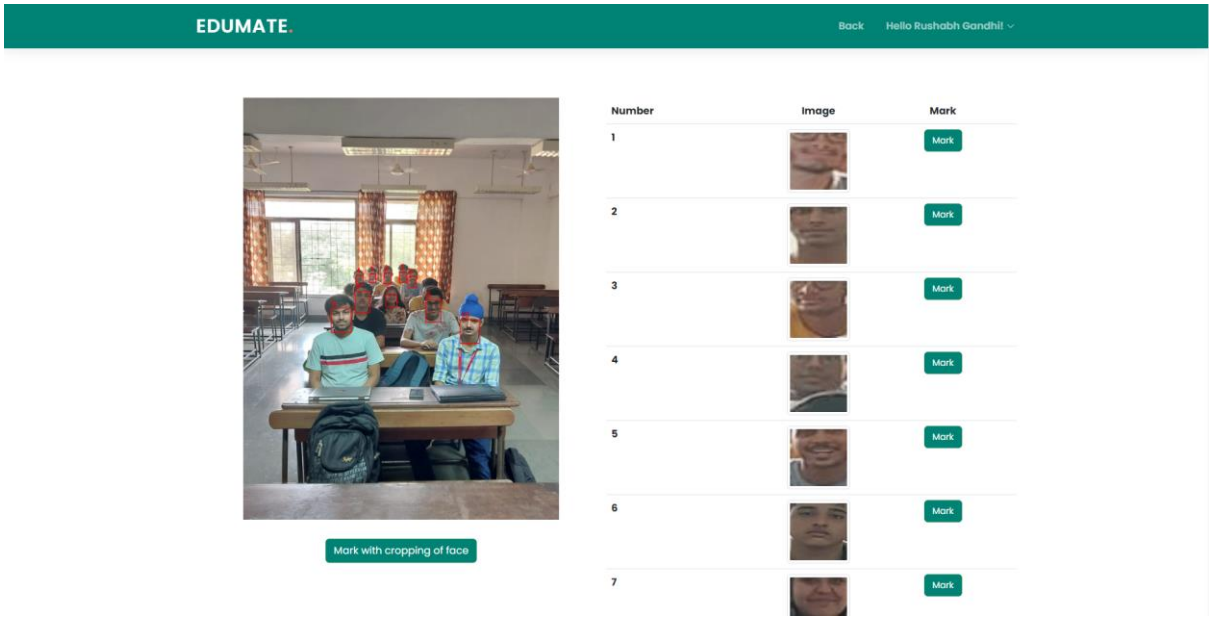

Figure 21 : Mark attendance page screenshot

Cropping UI

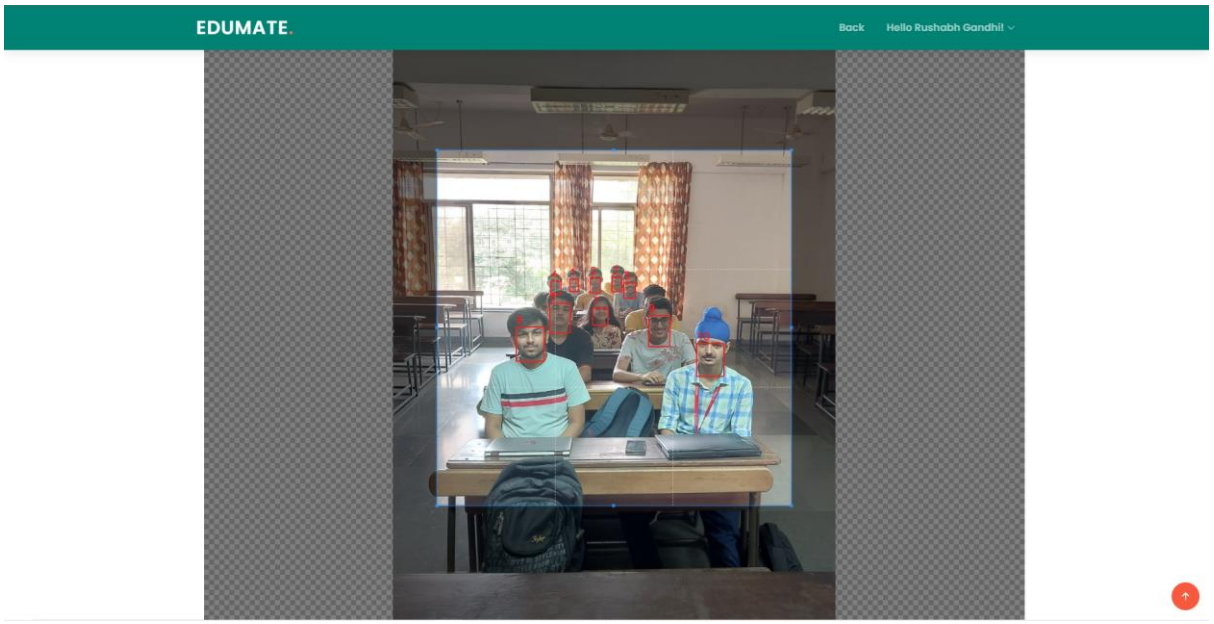

Figure 22 : Undetected face cropping page screenshot

4.3 Testing report

Test case No: 1

Test Scenario: To authenticate admin with email and password.

Test Steps: 1) Admin will navigate to the register url.

2) Admin will be asked to enter their email and password.

3) After authentication, admin will be redirected to the registration page.

Prerequisites: Admin credentials must be manually entered into the system.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
Email and password of the admin.	1) If the credentials are correct then redirection to register page. 2) If the credentials are incorrect then redirection to the same page with a prompt showing incorrect credentials.	1) On correct credentials, the admin was redirected to the register page; on incorrect credentials, an alert was displayed displaying the incorrect credentials.	**P**

Test case No: 2

Test Scenario: The admin will get a form to register a user, where it will be asked to share the user's name, email, and type, and after successful registration, data must be stored into the database.

Test Steps: 1) Admin will be shown the form after redirecting from the authentication.

2) Admin have to enter the name, email, and type of user.

3) Press the register button.

Prerequisites: Admin must be authenticated by providing an email and password.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
Name, email, and type of user (teacher or student)	1) If one of the fields is not entered, then an alert must be shown informing to enter all the fields. 2) If all the fields are filled out, clicking the "Register" button should add the user's information to the right database table with the autogenerated password. 3) If the user type selected was teacher, then the teacher table will be updated with the information. 4) If the user type selected was student, then the student table will be updated with the information.	1) On entering all the details, the information is stored in the correct database with a random autogenerated password. 2) If any of the fields value is not specified, an alert is shown.	**P**

Test case No: 3

Test Scenario: Teacher logging in using the credentials created by the admin**.**

Test Steps: 1) The teacher will click on the teacher login link from the home page.

2) The teacher will be redirected to the teacher login page.

3) The teacher will have to enter their email and password and then press the login button.

Prerequisites: Teachers credentials must be created by the administrator.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
Email and password	1) If any of the fields are empty, an alert will appear asking you to fill all the fields. 2) If wrong information is entered, an alert is shown with the information invalid credentials. 3) When a teacher logs in for the first time, they should be sent to a page where they can change their password. Otherwise, they should be sent to the home page for the teachers section. 4) A session must be generated at the server which will store the user info who is logged in.	1) On entering the correct credentials, the teacher is redirected to the change password page if the login is for the first time, or else the teacher is redirected to the home page of the teachers section. 2) On entering incorrect credentials or leaving any of the fields empty, an alert is shown displaying invalid credentials or please enter all the fields, respectively. 3) A session is created which stores the user name, email and id associated with it.	**P**

Test case No: 4

Test Scenario: The teacher changing the password associated with the account.

Test Steps: 1) The teacher is redirected to the "Change Password" page upon logging in for the first time.

2) The teacher provides the new and confirm new passwords and clicks the update button.

Prerequisites: Teacher must be logged in for the first time.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**

New and confirm new passwords	1) If any of the password fields entered are empty, an alert must be displayed, indicating that please enter all the fields. 2) If both fields are entered but are different, then an alert must be displayed, indicating that both passwords should match. 3) If both the fields are entered and are the same, then the password associated with the user must be changed in the database, and after this, the teacher must be redirected to the home page of the teachers section.	1) If any of the fields are empty, then an alert is shown. 2) If both fields have different values, then the alert is shown. 3) If both the fields have the same value, then the password is changed in the database, and the teacher is redirected to the home page.	**P**

Test case No: 5

Test Scenario: Creation of the classroom by the teacher.

Test Steps: 1) The teacher just has to enter the name of the classroom that he or she wants to create.

2) Press the "Create" button.

Prerequisites: Teacher must be logged in.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
Name of the classroom	1) If the create button is pressed without entering the name of the classroom, then a tooltip must be shown displaying the classroom name as the required field. 2) If the name is entered and the Create button is pressed, the name of the classroom	1) An alert is shown when pressing the create button without entering the name of the classroom. 2) If the name of the classroom is entered, then on pressing the create button, the classroom is created with a unique code and is also shown on the same page.	**P**

	must be stored in the ClassTeachers database. 3) A unique code must be generated after successful creation of the classroom, and this code will also be stored in the database. 4) The created classroom must be shown on the same page.		

Test case No: 6

Test Scenario: Creation of the new assignment in a particular classroom.

Test Steps: 1) The teacher must navigate to a particular classroom.

2) The teacher must click "Create Assignment" from the navigation menu.

3) Enter the details, like the name of the assignment, description, maximum marks, and information about whether to create peer grading or not and then press create button.

Prerequisites: A classroom must be created before creating an assignment.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
Name, description, marks, and peer-grading status of the assignment and the count of students that have submitted and not submitted the assignments	1) The teacher must navigate to a particular classroom from the home page, where all the assignments created for that classroom must be shown and on pressing create assignment modal should open. 2) All the details must be entered (mentioned in the test data), and after pressing the "create assignment" button, that assignment must be added to the assignments in that	1) Modal displayed when navigating to create assignment. 2) Tooltip displayed on pressing create assignment without entering values in all the fields. 3) The assignment is created and visible on the same screen. 4) The assignment layout also shows the number of students in that particular classroom who have submitted the assignment and the	**P**

	classroom and appear on the same page. 3) If any of the details are not entered, a tooltip must be visible, displaying "Enter value in this field."	ones that are yet to submit the assignment.	

Test case No: 7

Test Scenario: Making an announcement in the classroom that will be visible to all the students that are present in that classroom.

Test Steps: 1) Navigate to make an announcement from the navigation menu.

2) Enter the announcement details.

3) Press the Create button.

Prerequisites: A classroom must be created before making an announcement.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
Details of the announcement	1) On the announcements page, all the announcements that have been previously made must be available; on pressing "read more" on any of the announcements, a modal window should open that will show the entire announcement. 2) If the details are entered into the "make announcement" input, then if the "create" button is pressed, the announcement must be added to the database and it should also be shown on the same page; if the details are not entered, then the teacher must be notified about the same.	1) All the announcements are visible on the page with a modal opening upon pressing "read more. 2) Announcements are stored in the database upon entering the form's details. 3) A notification is sent to the teacher if the teacher presses the create button accidentally.	**P**

Test case No: 8

Test Scenario: Deleting the announcement.

Test Steps: 1) Navigating to the announcements section.

2) Pressing the delete button on any of the announcements available.

Prerequisites: An announcement should be there so that it can be deleted.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
None	1) On pressing the announcement delete button, the announcement must be removed from that page as well as from the database.	1) Announcement deleted from the database as well as removed from the page	**P**

Test case No: 9

Test Scenario: Creating and updating an event in the schedule section.

Test Steps: 1) The teacher should navigate to the schedule section.

2) There, the calendar will be shown, which will show all the events that are scheduled.

3) To create an event, new event from the navigation menu must be pressed, which will open a new page where all the details, such as the event description and date, will be entered.

4) The teacher can also navigate to other months by using the links provided in the section just below the header.

5) To update an event, the teacher must press the event in the calendar, which will open the event update page.

Prerequisites: The classroom must be created before creating the schedule for the classroom.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
Event data and date	1) On navigating to the schedule section, all the events that are scheduled	1) All the events that were previously scheduled are available	**P**

	are shown in the calendar and also links to navigate to different months should also be made available. 2) To create an event, the teacher must navigate to the new event, which should open a new page. 3) The details of the event, including the event date, must be entered to create the event, and after submission, the event must be added to the calendar as well as the database. 4) If any of the fields, such as the data or date, are empty and submit is pressed, an alert must be made indicating please enter both the values. 5) For updating any event information, that event must be selected in the calendar shown, which will show the update event page. 6) The teacher may edit the details and again press Enter, which will update the event information. No new events must be created; only the existing event must be edited.	in the calendar, and links to navigate to different months are also working fine. 2) On navigating to the new event section, a page is shown that takes event data and a date, and by providing details, they get added to the database as well as the calendar. 3) On pressing the submit button without entering the data or the date, an alert is shown. 4) Navigating to a particular event shows an event update page where the information about the event is already entered and there is an option to modify that. 5) If the information is modified and the submit button is pressed, the information gets updated and no new events are created.	

Test case No: 10

Test Scenario: Deleting the classroom.

Test Steps: 1) Navigate to the home page of the teachers' section.

2) Press the delete icon associated with the class to delete that class.

3) Press delete on the modal that pops up.

Prerequisites: A classroom must exist so that it can be deleted.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
None	1) A classroom is a collection of all the functionalities that are used	1) The classroom gets deleted with all the information that is directly related to that particular classroom.	**P**

	by the teacher, so when deleting the classroom, all the elements that come under the classroom must be deleted. 2) The assignments, schedule, announcements, quiz, attendance, peer-gradings, and plagiarism check—all this information must be deleted from the database on deleting the classroom.		

Test case No: 11

Test Scenario: Grading assignments submitted by students.

Test Steps: 1) The teacher should navigate to a particular assignment by just clicking any one of the assignments available.

2) The teacher will be redirected to the assignments page, where all the students who have submitted their assignments will be shown.

3) The teacher will get an option to navigate to the file that is submitted by the students, as well as an option to grade the assignment.

4) On navigating to the assignment file, the submitted file will be shown.

5) On navigating to the grade assignment section, the teacher will get a form to enter the marks for the student's assignment, and submitted assignments will also be seen on that page.

Prerequisites: Assignments must be created, and at least one student must have submitted the assignment.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
Marks for the submitted assignment	1) Navigating to a particular assignment should show all the assignments that are submitted by the students, along with information such as the name of the student, a	1) Assignment details are shown properly, and navigating to a particular assignment also shows all the student's information that has	**P**

	description of the assignment submitted by the student, and the option to view the submitted assignment as well as the option to grade the assignment. 2) View assignment should only show the assignment file with options to print or save. 3) Grading the assignment should redirect to a new page where, on one side, a form should be shown that will show the name, description, maximum marks, and an input field to enter the marks, and on the other hand, it should show the file that has been submitted by the student. 4) The input for marks should have the value pre-filled if the assignment is already graded; otherwise, it should show an empty input field. 5) Inputted marks must be less than the maximum marks allocated to the assignment. 6) On entering the marks and pressing enter, the marks must be updated in the database.	submitted the assignment with sufficient information. 2) View assignment opens a new tab where the file submitted with the assignment is shown and all the options that are compatible with the browser are also shown. 3) Navigating to grade the assignment opens a new page where the details of the assignment and the assignment file itself are shown. 4) Input to enter is pre-filled if the marks are already given; otherwise, it is empty. 5) If the entered marks are greater than the maximum marks, an alert is shown; otherwise, the marks are updated in the database.	

Test case No: 12

Test Scenario: Student logging in using the credentials created by the admin**.**

Test Steps: 1) The student will click on the student login link from the home page.

2) The student will be redirected to the student login page.

3) The student will have to enter their email and password and then press the login button.

Prerequisites: Students credentials must be created by the administrator.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
Email and password	1) If any of the fields are empty, an alert will appear asking you to fill all the fields. 2) If wrong information is entered, an alert is shown with the information invalid credentials. 3) When a student logs in for the first time, they should be sent to a page where they can change their password. Otherwise, they should be sent to the home page for the students section. 4) A session must be generated at the server which will store the user info who is logged in.	1) On entering the correct credentials, the student is redirected to the change password page if the login is for the first time, or else the teacher is redirected to the home page of the students section. 2) On entering incorrect credentials or leaving any of the fields empty, an alert is shown displaying invalid credentials or please enter all the fields, respectively. 3) A session is created which stores the user name, email and id associated with it.	**P**

Test case No: 13

Test Scenario: The student changing the password associated with the account.

Test Steps: 1) The student is redirected to the "Change Password" page upon logging in for the first time.

2) The student provides the new and confirm new passwords and clicks the update button.

Prerequisites: Student must be logged in for the first time.

Test Data	Expected Results	Actual output	Test status (P / F)
New and confirm new passwords	1) If any of the password fields entered are empty, an alert must be displayed, indicating that please enter all the fields. 2) If both fields are entered but are different, then an alert must be displayed, indicating that both passwords should match. 3) If both the fields are entered and are the same, then the password associated with the user must be changed in the database, and after this, the teacher must be redirected to the home page of the students section.	1) If any of the fields are empty, then an alert is shown. 2) If both fields have different values, then the alert is shown. 3) If both the fields have the same value, then the password is changed in the database, and the student is redirected to the home page.	**P**

Test case No: 14

Test Scenario: Student entering the code provided by the teacher to join the classroom.

Test Steps: 1) Student must login with the credentials given by the admin, and after logging in, a redirection will be made to the student's home page, where the student will have the option to join the classroom.

2) The student has to enter the code given by the teacher and then press the join button.

Prerequisites: A classroom must be created by the teacher, and the student must be logged in.

Test Data	Expected Results	Actual output	Test status (P / F)
Code of the classroom	1) The student should login with the credentials given by the admin, and then, on successful login, the student will be	1) All the classrooms that the student has joined before are visible on the home page after a successful login.	**P**

	redirected to the home page, where all the classrooms that the student has joined must be shown. 2) A small form to enter the classroom code will be provided to the student to join the classroom. 3) If the student presses the join button after entering the code, an alert must be displayed if the code is incorrect. 4) If the code entered is correct but the student has already joined that classroom, then an alert must be shown. 5) If the code entered is correct and the student has not joined the classroom before, then student information should be added to that classroom, and the student should have access to all the contents of that classroom. 6) The joined classroom should be shown on the home page.	2) An alert appears when the student enters an incorrect code or the code for a classroom that the student has already joined. (3) If the code is correct and the student hasn't joined the classroom, the student gets access to the classroom, and student information is added to the database. 4) A newly joined classroom is also shown upon successful joining of the classroom.	

Test case No: 15

Test Scenario: Student accessing the announcements that are made in the classroom.

Test Steps: 1) The home page of the student shows all the classrooms that the student has already joined.

2) When navigating to a particular classroom, students will get the option to view all the announcements that are made by the teacher from the navigation menu.

Prerequisites: Students must join a classroom to view all the announcements that are made in the classroom.

Test Data	Expected Results	Actual output	Test status (P / F)
None	1) When navigating to a particular classroom, all the assignments that are created in that classroom must be shown. 2) Students should get an option in the navigation menu to view all announcements that are made in that particular classroom. 3) All the announcements should be shown in stripped form, and on clicking "read more", a modal should open that would show the entire announcement.	1) All the assignments are visible after navigating to a particular classroom. 2) Announcement link shown in the header section 3) The Announcements section shows all the announcements that are made in the classroom in a stripped-down format, and on pressing "read more," a modal pops up that shows the entire announcement.	**P**

Test case No: 16

Test Scenario: Student accessing the schedule section which shows the events that are created by the teacher in the classroom.

Test Steps: 1) The student navigates to the schedule section from the link on the navigation menu.

2) A calendar should be shown with all the events scheduled and links to navigate to different months.

3) Click on any of the events, and that should show you information about the entire event.

Prerequisites: The student must already be in the classroom to see all the events that are scheduled.

Test Data	Expected Results	Actual output	Test status (P / F)
None	1) A calendar should be shown with navigation links to move to different calendar months.	1) The calendar shown when navigating to the schedule section and links to navigate to different months are also working fine.	**P**

	2) On pressing any of the events, a modal window should pop up, which should show information about the event.	2) On clicking an event, a modal is shown that displays information about the event.	

Test case No: 17

Test Scenario: Student submitting an assignment created in the classroom.

Test Steps: 1) The student navigates to a particular assignment from all the assignments available.

2) The student has to enter all the details shown there and then submit the assignment file (only PDF as of now).

Prerequisites: The student must already be in the classroom to see all the assignments that are scheduled and also to submit assignment.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
Description and assignment file (PDF only as of now)	1) When students click on a particular assignment for submission, an assignment submission page should be shown. 2) On that page, the name of the assignment, its description, and the marks allocated for that assignment must be shown. 3) A form must be given to the student to submit the assignment, where the student will enter the small description and the file of the assignment (as of now, a pdf). 4) If any of the fields are not entered, then an alert must be shown.	1) An assignment submission page is shown after navigating to a particular assignment where the information about the assignment is visible. 2) A form is available to submit the assignment with its description. 3) On successful submission, the data is stored in the database, and the information about the assignment is also shown on the teacher's side.	**P**

	5) If all the fields are entered, then assignment information should be stored in the database, and the assignment should be available in the assignments section on the teacher's side.		

Test case No: 18

Test Scenario: Peer-grading process initiation from the teacher side.

Test Steps: 1) The teacher should create an assignment with peer grading checked.

2) After the submission of all the assignments, the teacher will get the option to start peer grading.

3) On pressing the button, students will be assigned to grade one another's assignments.

Prerequisites: Teacher must create an assignment with the "peer grading" checkbox checked.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
For creating the assignment: name, description, maximum marks, and the peer grading checkbox value. For peergrading: None	1) The teacher must create an assignment with the "peer grading" check box checked to allow students to grade each other's assignments. 2) Peer grading should not be started if all the students in the classroom have not submitted the assignment. 3) If all the assignments are submitted, the teacher should have the option to start the peer-grading process. 4) The peer-grading process should assign each student two assignments of their batchmates (both should be different).	1) An alert is shown if the peer-grading process is started without all the students having submitted the assignment. 2) If all the assignments are submitted, the peer-grading process assigns each student two assignments and also gives the student the option to grade the assignments.	**P**

	5) Upon successful distribution of all assignments, students must get the option to grade their peers by just going through the PDF file that was submitted.		

Test case No: 19

Test Scenario: Grading peers in accordance with the assignments given out through the peer-grading process.

Test Steps: 1) Students must navigate to their assignment section by going to the particular assignment.

2) If the assignment is submitted by the student, then they must have the option of grading the assignments of their assigned peers.

3) The student should enter the marks in the form given.

Prerequisites: Students must turn in their work first so that their peers can grade it and so that they can grade their peers.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
Marks given to two assigned peers	1) If the assignment is not submitted by the student, then the assigned peer's information should not be shown. 2) If the assignment is submitted by the student, then the assigned peer's assignment file with the description of the assignment must be shown (without the name of the student). 3) Each student will grade two assignments by entering the marks into the input field provided. 4) If the marks entered are greater than the maximum marks, then an alert must be shown to the student indicating that the entered marks	1) Peer grading information is shown if the assignment has already been submitted by the student, and nothing is shown if the assignment has not been submitted. 2) If the marks entered for the assignments are greater than the maximum marks, an alert is shown. 3) If the marks entered are in range, then they are stored in the database, and the marks given are available on the teacher's side.	**P**

	must be less than the maximum marks. 5) If the marks entered are less than or equal to the maximum marks, then the marks entered by the student must be stored in the database, and the teacher must be able to see the marks given by the students.		

Test case No: 20

Test Scenario: Quiz Creation by Teacher

Test Steps: 1) The teacher should have a classroom created inside which a quiz can be created.

2) After navigating to the quiz page the teacher has to input the following:-

- Quiz name
- Quiz description
- Quiz time
- Quiz Date
- Questions and their corresponding answers

3) On pressing the create button the quiz will be available to all the students in that particular class.

Prerequisites: The teacher has to create a classroom in order to create a quiz.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
For creation of the quiz with all the necessary data.	A new quiz should be created and displayed to the teacher with all the information as entered by the teacher to cross check.	A new quiz is created with all the necessary information that the teacher has entered.	**P**
Create quiz without inputting the time of the quiz	If a quiz is created without entering the time then a default quiz time should be taken as 10 mins.	Quiz is created with a time of 10 mins if a custom time is not mentioned by the teacher.	**P**
If the date is not mentioned by the teacher.	There should be an error requesting the teacher to	As of now there is no such proper error shown, instead the page gives a	**F**

	input a date before the quiz can be created.	default Django error which is not self-explanatory for a non-developer.	

Test case No: 21

Test Scenario: Quiz Creation by Teacher with image questions

Test Steps: 1) The teacher should have a classroom created inside which a quiz can be created.

2) After navigating to the quiz page the teacher has to input the following:-

- Quiz name
- Quiz description
- Quiz time
- Quiz Date
- Questions and their corresponding answers
- The questions in this case are images that the teacher can upload from their systems

3) On pressing the create button the quiz will be available to all the students in that particular class.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
For creation of the quiz with all the necessary data.	A new quiz should be created and displayed to the teacher with all the information as entered by the teacher to cross check.	A new quiz is created with all the necessary information that the teacher has entered.	**P**
If the teacher wants images as the question	The teacher should have an option to choose the type of the question, either image or Text.	The teacher can either enter text or can leave the text input blank and choose an image from the image input and then can provide answer options to the question.	**P**

Test case No: 22

Test Scenario: Quiz Creation by Teacher with questions having multiple select answer type.

Test Steps: 1) The teacher should have a classroom created inside which a quiz can be created.

2) After navigating to the quiz page the teacher has to input the following:-

- Quiz name
- Quiz description
- Quiz time
- Quiz Date
- Questions and their corresponding answers
- The answers in this case can be more than one option provided by the teacher.

3) On pressing the create button the quiz will be available to all the students in that particular class.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
Teacher creates a quiz having more than one option as the correct answer	Teacher should be able to select multiple options and mark them as correct answers of multiple questions	The teacher gets a checkbox in front of each question which can be checked or unchecked indicating whether the option is a correct choice or not.	**P**
If teacher wants to have multiple correct choice for image questions	The same as above applies here as well.	The same as above applies here.	**P**

Test case No: 23

Test Scenario: Answering Quiz by the student

Test Steps: 1) The teacher should have a classroom created inside which a quiz is created.

2) On navigating to the quiz page the student will be able to view the name and details of quiz with a start quiz button available.

3) On pressing the start button the student will be redirected to the quiz page.

Test Data	Expected Results	Actual output	Test status (P / F)
The student only be able to answer the quiz if he starts the quiz before the deadline.	The student should be restricted from answering the quiz once the deadline is over.	The answer quiz button disappears when the deadline is completed.	**P**
The student should be able to view the questions and options.	The questions and the options should be visible to the student.	The student is displayed all the questions and able to view the related options below the questions along with all the image questions.	**P**
The student should be able to answer the quiz	The student should be able to answer the quiz	The student is given option to select the correct answer and checkbox for multiple answer correct.	**P**

Test case No: 24

Test Scenario: Quiz timer and auto submission

Test Steps: 1) The teacher should have a classroom created inside which a quiz is created.

2) On navigating to the quiz page the student will be able to view the name and details of quiz with a start quiz button available.

3) On pressing the start button the student will be redirected to the quiz page.

Test Data	Expected Results	Actual output	Test status (P / F)
The quiz timer should start on click of start button.	The student should be able to see the timer on starting the quiz.	The timer is visible on the top of the answer quiz page with the quiz time set by the teacher for the quiz	**P**
Auto-submission of quiz	The quiz should be automatically submitted on end of timer.	The quiz is automatically submitted after the end of timer and the options marked by the student are considered for grading.	**P**

Test case No: 25

Test Scenario: Cheating prevention and detection for quiz.

Test Steps: 1) The student can navigate to the quiz page inside the classroom to view the ongoing quizzes.

2)The student can start the quiz by clicking on start quiz button.

3) Once the quiz has started the student is not allowed to comeback or cheat in the quiz.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
Cheating prevention.	The student should not be able to switch tabs while answering the quiz.	The quiz opens up in full-screen mode and also does not allow the user to exit the full screen mode.	**P**
Cheating detected warning to the user.	The first time the cheating is detected the user is warned for it.	The user is given an alert on screen change or tab change during the quiz.	**P**
Auto-submission of quiz when cheating is detected.	The quiz should be automatically submitted on any tab change or screen change by user.	The quiz is automatically submitted on window change or change in tab on the second time of detection of cheating.	**P**
Cheating Notification	The teacher should be notified for any cheating detected.	The Teacher is sent a mail for any cheating detected by the system.	**P**

Test case No: 26

Test Scenario: Marks allotment for answered quiz.

Test Steps: Once the quiz is answered it should be automatically graded and the student is able to view the marks on the review quiz page.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
Marks Calculation	The marks should be calculated according to the correct option given by the teacher.	The correct answer and the answered options by the student are compared for grading.	**P**

Partial marking.	The student should be allotted partial marks for multiple choice questions	A ratio is calculated considering the marks and number of correct options and the student is graded accordingly.	**P**

Test case No: 27

Test Scenario: Reviewing the answered quiz

Test Steps: 1) Once the student has answered the quiz he can navigate to the same quiz page to review the quiz and check the correct answers.

2) The student can click on the review quiz button to open the review page.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
The student should be able to view the questions and options.	The questions and the options should be visible to the student.	The student is displayed all the questions and able to view the related options below the questions along with all the image questions.	**P**
Total Marks	The student should be able to view the total marks graded to him/her.	The student is displayed the total marks allotted on the top of the page.	**P**
Correct options	The student should be displayed the correct options and the option marked by the student.	The student is displayed the correct options and the option marked by the student.	**P**
Individual Marks	The student should be displayed individual marks allotted for the question.	The student is displayed individual marks allotted for each question along with partial marks for multiple choice questions.	**P**

Test case No: 28

Test Scenario: Attendance initiation by the Teacher

Test Steps: 1) The teacher must login with her credentials to access the teachers portal and have a classroom created for which the attendance has to be initiated.

2) After navigating to the attendance page, the teacher has to input the following: -

- Attendance start time
- Attendance end time
- Class images with the faces of the students whose attendance is to be marked

3) On pressing the create button the attendances can be marked by all the students in that particular class.

Prerequisites: The teacher has to create a classroom in order to initiate the attendance.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
Attendance start time is not given	The attendance must be created with the start time as the current timestamp when the attendance was initiated.	A new attendance is created with the start time as the current time	**P**
Attendance end time is not given	If the attendance end time is not given then the attendance should end after a default 10 mins after the start time.	A new attendance is created with the end time as 10 mins after the start time.	**P**
If the start time is after the end time given	There should be an error requesting the teacher to input an end time that is greater than the start time	As of now there is no such proper error shown, instead the page gives a default Django error which is not self-explanatory for a non-developer.	**F**
If all the data is provided	1) The attendance should be initiated from the start time until the end time with all the faces detected and displayed with a mark attendance button each. 2) Also, an attendance code is generated which has to be entered by the students before marking the attendances.	A new attendance is initiated where students can mark their attendance by clicking the buttons next to their respective faces only within the time durations. The attendance is only visible when the correct corresponding code is entered.	**P**

Test case No: 29

Test Scenario: Attendance marking by the student with their face detected

Test Steps: 1) The student must login with their credentials to access the portal and have to be a part of the classroom which the attendance has to be marked.

2) After navigating to the attendance page, the student has to enter the attendance code given by the teacher to access that particular attendance.

3) On entering the correct code, the students can then find their face among the detected faces and mark their attendance.

Prerequisites: The student has to be a part of a classroom for which the teacher has initiated attendance in order to mark the attendance.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
Incorrect code is entered	An error message should be shown to prompt the student to enter the correct code	An alert is shown with the message that the code is incorrect	**P**
Correct code is entered and the student clicks the mark attendance button corresponding to their detected face.	The attendance of the student is marked and the face cannot be marked by any other student	The attendance is marked for the particular student and the button becomes unclickable with the students name who marked the attendance.	**P**
Correct code is entered but after the end time or before the start time.	There should be a message shown to the student that the attendance has expired and the attendances cannot be marked	The attendance faces are shown but the attendances cannot be marked.	**P**

Test case No: 30

Test Scenario: Attendance marking by the student with their face not detected

Test Steps: 1) The student must login with their credentials to access the portal and have to be a part of the classroom which the attendance has to be marked.

2) After navigating to the attendance page, the student has to enter the attendance code given by the teacher to access that particular attendance.

3) On entering the correct code, the student can draw a bounding box around their face in the class image to mark their attendance in case their face is not detected.

Prerequisites: The student has to be a part of a classroom for which the teacher has initiated attendance in order to mark the attendance.

Test Data	Expected Results	Actual output	Test status (P / F)
Bounding box drawn around the undetected face	The attendance for the student is marked	The attendance for the student is marked after the teacher reviews the drawn box.	**P**
Bounding box drawn around a non-face	The attendance should not be marked for the student	The attendance is not marked for the student as the teacher can review the box and invalidate the student's attendance	**P**

Test case No: 31

Test Scenario: Attendance marking by the teacher for a student present in class.

Test Steps: 1) The teacher has to navigate to the class for which the attendance has to be marked.

2) After navigating to the attendance page, the teacher has to select the students name from the drop down to mark the students attendance.

Prerequisites: The student has to be a part of a classroom for which the teacher has initiated attendance in order to mark the attendance.

Test Data	Expected Results	Actual output	Test status (P / F)
Non marked students name	The attendance for the student is marked by the teacher	The attendance for the student is marked	**P**
Students name for whom the attendance has already been marked	The attendance should not be double marked	The attendance for the student is not marked again and appropriate message is shown to the teacher	**P**

Test case No: 32

Test Scenario: Invalidating attendance marking by the teacher for a student not present in class.

Test Steps: 1) The teacher has to navigate to the class for which the attendance has to be marked.

2) After navigating to the attendance page, the teacher has to select the students name from the drop down to un-mark the student's attendance.

Prerequisites: The student has to be a part of a classroom for which the teacher has initiated attendance in order to mark the attendance.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
Non marked students name	A message is shown saying that the attendance was already unmarked.	The attendance remains unmarked	**P**
Students name for whom the attendance has already been marked	The attendance is invalidated	The attendance for the student is invalidated	**P**

Test case No: 33

Test Scenario: Creating group peer-grading assignments and assigning peers.

Test Steps: 1) The teacher has to navigate to group peer grading and create an assignment over there by providing the details required.

2) The system must create the groups automatically, and the teacher can view the groups created**.**

Prerequisites: 1) The teacher must be logged in.

2) There are at least two students in the classroom.

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
Name, description, due date, number of students per group, number of peers assigned and maximum marks of the assignment	Assignments created should be shown on the same page, and all the groups that are created must also be shown to the teacher. The teacher must get the option to start the peer-grading process after all the assignments are submitted.	Details of the assignment with the group details are shown properly.	**P**

Test case No: 34

Test Scenario: Students grade the assignments of their assigned peers.

Test Steps: 1) Students will have to navigate to the group peer-grading section.

2) Any member of the group must have submitted an assignment to grade their peers assignments.

3) Each student navigates to grade their assigned peers and then provides answers and feedback

Test Data	**Expected Results**	**Actual output**	**Test status (P / F)**
Assignment submission file, feedback and answers to the rubrics.	If the assignment is submitted by the group, then the student must get the option to grade others assignments. The student should enter feedback and also select the answers to the rubrics. Given feedback and answers should be converted to appropriate marks, and then they should be seen on the teachers' and assigned students sides.	Students got an option after submitting the assignment. Grades given by the student are also available wherever they are required.	**P**

4.4 Summary

This section lists and describes all the features that our system provides and also the test report. These are not the only hallmarks that our system shall possess, rather they are the most significant ones incorporated under which are the minor ones. We have also jotted down the activity sequence and requirements for each one of the mentioned features. All the requirements mentioned are from the software and project point of view rather than general. Deciding upon this information prior to starting the implementation is crucial for estimating the complexity, importance and time needed for each feature to be finished precisely. The test report includes a variety of tests conducted to determine the correctability of the system.

Chapter 5

Conclusions and future scope

This chapter provides the conclusion of our system and also gives a few ideas and features that could be added to our system once completed.

5.1 Conclusion

In conclusion, we have completed implementing the project in accordance with the timetable submitted at the start of the semester. Throughout the development of this project, we have acquired a vast amount of information regarding the inner workings of the education system in India and elsewhere. During the development of the web application, we also investigated emerging technologies such as Django, one of the most potent development tools.

The system offers an effective and streamlined solution for administering educational institutions, and its benefits to instructors and students are evident. The automation of numerous administrative and academic duties, such as project creation and peer evaluation, by Edumate saves instructors a substantial amount of time and effort. This allows them to concentrate more on instructing course material and interacting with students.

Edumate provides a seamless digital experience for students, allowing them to more easily access learning materials and interact with their instructors. Teamwork and collaboration are essential skills for success in the modern world, which are fostered by the platform. Edumate has the potential to revolutionize the education industry and meet the evolving demands of academic institutions. The system is highly flexible and can be tailored to satisfy the unique requirements of various educational institutions.

During the development of the system we have understood various popular terms in the web development industry and the e-school systems. During the analysis phase of our project, we realized the importance of reading technical papers for developing applications and how it simplifies application development. In addition, guidance from our mentor contributed to our development.

5.2 Future scope

- The developed project will not have the facility to take the lectures online, but it can be easily integrated as a component in the project.
- Top management level activities such as admissions, fees, etc. can also be provided so that a central point of interaction can be established between the students and the institutions.
- Gamification of the learning content can help students get in-depth knowledge of any concept. The software that assists teachers to convert their lectures into some sort of stories with anonymous characters will help students grasp the concepts faster.
- It is very evident that any course you take will require many applications that you have to install on your machine to complete the tasks assigned, so all those applications interfaces provided on the portal will reduce the overhead of students.
- Interfaces between the top management and the teachers can also be added to efficiently carry out management-related activities.
- To survive in the industry in any domain, one has to know about the recent inventions in that particular domain. A section on the portal can be added that gives information about the latest inventions, which will help both teachers and students to keep themselves updated.

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