Development of a Webportal for Competitive Exam Assesment

A project submitted in partial fulfilment of the requirement for the

Degree of Master of Computer Application

Of

Jadavpur University

By

Sk Saifuddin Ali

Registration Number:149894 of 2019-2020

Examination Roll Number: MCA2360044B

Under the Guidance of

Dr. Nibaran Das

Professor

Department of Computer Science and Engineering

Jadavpur University, Kolkata-700032

India

November, 2023

FACULTY OF ENGINEERING AND TECHNOLOGY
JADAVPUR UNIVERSITY

CERTIFICATE OF RECOMMENDATION

This is to certify that the project entitled "**Development of a Webportal for Competitive Exam Assesment** " has been satisfactorily completed by **Sk Saifuddin Ali** (University Registration No.:149894 of 2019-2020, Exam Roll No.:MCA2360044B). It is a bonafide piece of work carried out under my guidance and supervision and be accepted in partial fulfilment of the requirement for the Degree of **Master of Engineering in Computer Science & Engineering in Department of Computer Science and Engineering, Faculty of Engineering and Technology, Jadavpur University, Kolkata 700032**.

_____

Dr. Nibaran Das (Thesis Supervisor)
Professor
Department of Computer Science and Engineering,
Jadavpur University, Kolkata-700032.

Countersigned

_____

Prof. Nandini Mukhopadhyay
Head, Computer Science and Engineering,
Jadavpur University, Kolkata-700032.

_____

Prof. Saswati Majumdar
Dean, Faculty of Engineering and Technology,
Jadavpur University, Kolkata-700032.

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CERTIFICATE OF APPROVAL

This is to certify that the project entitled "**Development of a Webportal for Competitive Exam Assesment** " is a bonafide record of work carried out by Sk Saifuddin Ali in partial fulfilment of the requirements for the award of the degree of Master of Engineering in Computer Science & Engineering in the Department of Computer Science and Engineering, Jadavpur University during the period of 2019 to 2022. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn there in but approve the thesis only for the purpose for which it has been submitted.

_____

Signature of Examiner
Date:

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Signature of Supervisor
Date:

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DECLARATION OF ORIGINALITY AND COMPLIANCE OF ACADEMIC ETHICS

I hereby declare that this project entitled "**Development of a Webportal for Competitive Exam Assesment** " contains literature survey and original research work by the undersigned candidate, as part of his Degree of Master of Engineering in Computer Science & Engineering.
All information in this document has been obtained and presented in accordance with academic rules and ethical conduct.
I also declare that, as required by these rules and conduct, I have fully cited and referenced all materials and results that are not original to this work.

Name: Sk Saifuddin Ali
University Registration No. : 149894 of 2019-2020
Examination Roll No. : MCA2360044B

Project Title: Development of a Webportal for Competitive Exam Assesment

Signature:

_____

Date:

_____

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Sk Saifuddin Ali
University Registration No. : 149894 of 2019-2020
Examination Roll No. : MCA2360044B
Master of Computer Application
Department of Computer Science and Engineering
Jadavpur University

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CHAPTER 1

INTRODUCTION

Education is undergoing a paradigm shift with the integration of technology, and the assessment process is no exception.Digital tools have made it possible to conduct competitive exams in a more efficient, scalable, and secure manner.This project , titled ”Development of a Web Portal for Competitive Exam Assessment,” aims to create a website that helps students evaluate their performance on competitive exams. It is a new way to assess students.

1.1 Discuss about the problem

Competitive exams face significant challenges such as manual evaluation processes, logistical complexities, and security concerns. This leads to inefficiencies and biases in the assessment process, prompting the need for a modernized solution.

The manual processes involved in traditional assessment methods often result in delays, errors, and increased administrative burdens. The lack of automation can also lead to challenges in maintaining the integrity and fairness of the assessment

process.

1.2 Existing available system

The current landscape of competitive exam assessment includes a mix of traditional pen-and-paper methods and online platforms. While online platforms address scalability, they often face challenges related to security, user authentication, and varied user experiences.

Online platforms, while scalable, may encounter issues such as data security concerns, potential technical glitches, and variations in the user experience. Recognizing the limitations of these existing systems highlights the opportunity for improvement.

1.3 Limitation of the systems

Traditional assessment systems are hampered by manual processes, leading to delays in result processing, increased potential for errors, and difficulties in scaling to accommodate a large number of examinees. Online platforms, while addressing scalability issues, may face challenges related to data security, user authentication, and overall user experience.

The limitations of existing systems underscore the need for a comprehensive solution that not only automates the assessment process but also addresses security concerns, improves user experience, and ensures scalability.

1.4 Objective

The primary objective of the project is to develop a robust web portal for competitive exam assessment. Specific objectives include:

i. Implementing a user-friendly and intuitive interface using React for front-end development.

ii. Developing a scalable and efficient backend using Node.js to handle user requests, manage databases, and facilitate communication between the front end and other components.

iii. Utilizing MongoDB as the database system, providing a flexible and scalable solution for storing and retrieving data.

iv. Creating a secure and well-structured database schema with an ER diagram to ensure data integrity.

v. Designing a data flow diagram to illustrate the flow of information within the system.

vi. Defining functional and non-functional requirements to guide the development process.

vii. Conducting thorough testing, including unit testing, integration testing, and system testing, to ensure the reliability and effectiveness of the web portal.

viii. Deploying the web portal to a production environment, ensuring a seamless transition and optimal performance.

ix. Implementing modules for administrators, students, and teachers to manage exams, assess performance, and provide feedback.

1.5 Contribution

The project's contributions include:

i. Introducing automation to streamline the assessment process, reducing manual effort and minimizing errors.

ii. Enhancing the overall security of the assessment system to ensure the integrity of exam results.

iii. Improving the user experience for all stakeholders by providing an intuitive and user-friendly interface.

iv. Facilitating scalability to accommodate a growing number of users without compromising system performance.

v. Offering a comprehensive solution that addresses the shortcomings of existing systems.

CHAPTER 2

EXISTING TECHNIQUES

The existing landscape of assessment techniques involves traditional manual evaluation and emerging technologies like automated assessment using machine learning algorithms.The project adopts automated assessment techniques to overcome the limitations of manual evaluation. This involves leveraging React for a dynamic and responsive user interface, Node.js for a scalable and efficient backend, and MongoDB for flexible and scalable data storage.

India hosts numerous competitive exams and Olympiads by various organizations, aiming to enhance academic excellence, critical thinking, and talent identification in various subjects. Here we explore some of the organizations, exams, resources, recommended books, duration, question paper patterns, and limitations.

Science Olympiad Foundation (SOF):

SOF offers Olympiad exams at two levels in various subjects like General Knowledge, Mathematics, Science, English, Commerce, and Social Studies, allowing students to showcase their knowledge and skills in specific academic disciplines.

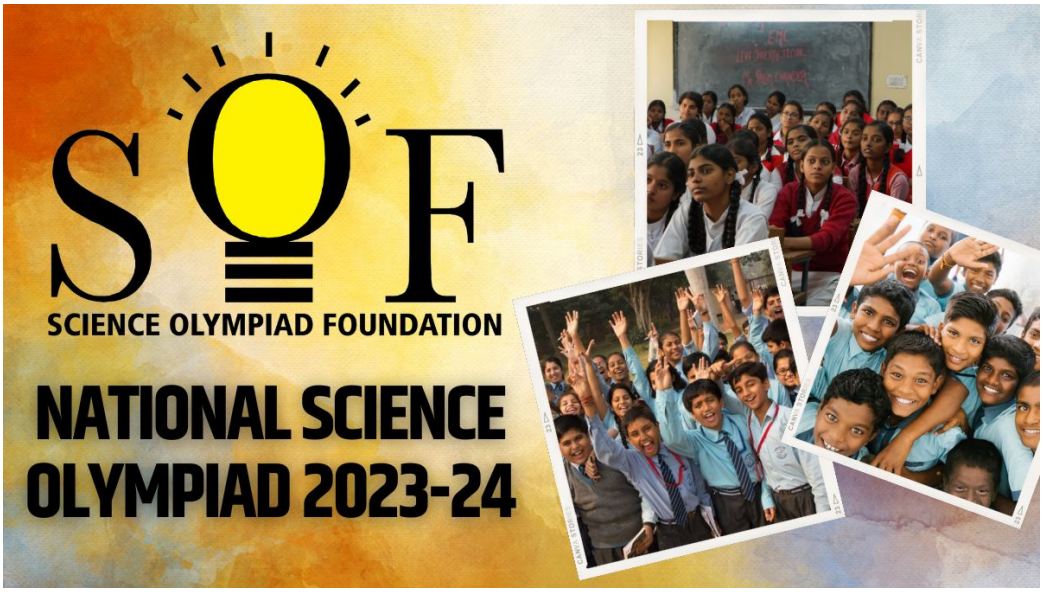

Figure 2.1: Science Olympiad Foundation

The foundation conducts the following Olympiads:

i. SOF National Cyber Olympiad

ii. SOF National Science Olympiad

iii. SOF International Mathematics Olympiad

iv. SOF International English Olympiad

v. SOF International Commerce Olympiad

vi. SOF International General Knowledge Olympiad

vii. SOF International Social Studies Olympiad

CHAPTER 3

PRESENT WORK

3.1 Front End

The front end of the web portal is developed using React, a JavaScript library for building user interfaces. React's component-based architecture allows for the creation of modular and reusable UI components, enhancing maintainability. The use of React ensures a responsive and interactive user interface, providing a seamless experience for users across different devices.

The React components are designed to be modular and reusable, promoting a consistent and efficient development process. The user interface is crafted to be intuitive and aesthetically pleasing, ensuring a positive experience for both administrators and end-users.

3.2 Back End

Node.js is employed for the backend development, serving as the server-side framework.Node.js is known for its efficiency in handling asynchronous operations,

making it well-suited for scalable and real-time applications. Express.js, a minimal and flexible Node.js web application framework, is utilized to create robust APIs and manage routes.

The backend is designed to handle various functionalities, including user authentication, exam creation, question management, and result generation. Node.js allows for the efficient processing of user requests, ensuring a smooth and responsive user experience.

3.3 Database Description

MongoDB, a NoSQL database, is chosen for its flexibility and scalability. The database stores user information, exam details, questions, and results. The schemaless nature of MongoDB allows for dynamic data storage, accommodating changes and additions to the data structure without significant alterations to the database.

The database design is carefully crafted to ensure data integrity and efficient retrieval. Collections are organized to store information related to users, exams, questions, and results. Indexing and querying strategies are implemented to optimize data retrieval and processing.

We have discussed all the database tables and records used for this project implementation.

TABLE NAME: REGISTRATION

Here, I used a registration table and stored registration number as a primary key (not null).

Field Name	Data Type	Key
Name	Varchar	Not Null
Email Id	Varchar 2(25)	Primary Key
Password	Varchar 2(20)	Not Null

Table 3.1: Student Registration Database

TABLE NAME: LOGIN

Here, I have created another table name(login) here login id denotes as a mandatary field (Must be required) and password (Not null). After registering, a student can able to login this system using valid user id and password.

Field Name	Data Type	Key
Email Id	Varchar 2(25)	Primary Key
Password	Varchar 2(20)	Not Null

Table 3.2: Student Login Database

TABLE NAME: STUDENT

Here, I have created a student table for store all information of student.

Field Name	Data Type	Key
Name	Varchar	Not Null
Email Id	Varchar 2(25)	Primary Key
Password	Varchar 2(20)	Not Null

Table 3.3: Student Database

TABLE NAME: ADMIN

Here, I have created an Admin database table and record (Admin id & password).Admin

can able to login system using valid id and password. And overall system managed by admin.

Field Name	Data Type	Key
Email Id	Varchar 2(25)	Primary Key
Password	Varchar 2(20)	Not Null

Table 3.4: Admin Database

TABLE NAME: SUBJECT

Here, I have Created a subject table to store all details of subject.

Field Name	Data Type	Key
Subject-ID	Varchar 2(20)	Primary Key
Subject-Name	Varchar 2(20)	Not Null

Table 3.5: Subject Database

TABLE NAME: EXAMINATION

Here, I have Created an examination table to store all details of exam

Field Name	Data Type	Key
Exam-ID	Varchar 2(10)	Not Null
Exam-Date	Varchar 2(20)	Not Null
Exam-Time	Time	Not Null

Table 3.6: Examination Database

TABLE NAME: Result

Here, I have used a table called result to show the student's id and their result in descending order.

Field Name	Data Type	Key
Subject-ID	Varchar 2(20)	Primary Key
Result-Desc	Varchar 2(20)	Not Null

Table 3.7: Result Database

TABLE NAME: QUESTION BANK

Here, I have Created a question bank table to store all details of question.

Field Name	Data Type	Key
Question-ID	Varchar 2(20)	Primary Key
Question-No	Varchar 2(20)	Not Null
Subject-ID	Varchar 2(20)	Primary Key
Question-Ans	Varchar	Not Null
Option	Varchar	Not Null

Table 3.8: Question-Bank Database

TABLE NAME: TEACHER

Here, I have Created a TEACHER table to store all information of teacher.

Field Name	Data Type	Key
Teacher-Name	Varchar 2(20)	Primary Key
Teacher-Email	Varchar 2(20)	Not Null
Teacher-Sub	Varchar 2(20)	Not Null

Table 3.9: Teacher Database

3.4 Entity Relationship Diagram(ERD)

The ER diagram illustrates the relationships between different entities in the database, such as 'User,' 'Exam,' 'Question,' and 'Result.' It highlights the connections and associations between these entities, aiding in the understanding of the database structure.

The ER diagram serves as a visual representation of the database schema, showcasing the relationships between entities and their attributes. This diagram is instrumental in ensuring a well-organized and normalized database structure.

Entities: Which is object or concepts that can have data stored about them. Entities refer to tablets used in database.

Attributes: Which are properties or characteristic of entities. An ERD attributes can be denoted as a primary key, which identifies a unique attribute, or a foreign key, which can be assigned to multiple attributes.

Relationship: between and among those entities.

Action: Which describe how entities share information in the database.

ERD SYMBOLS:

1. A rectangle defines entity.
2. An oval defines attributes.
3. A diamond defines relationship between two entities.
4. A arrow defines the direction of relation

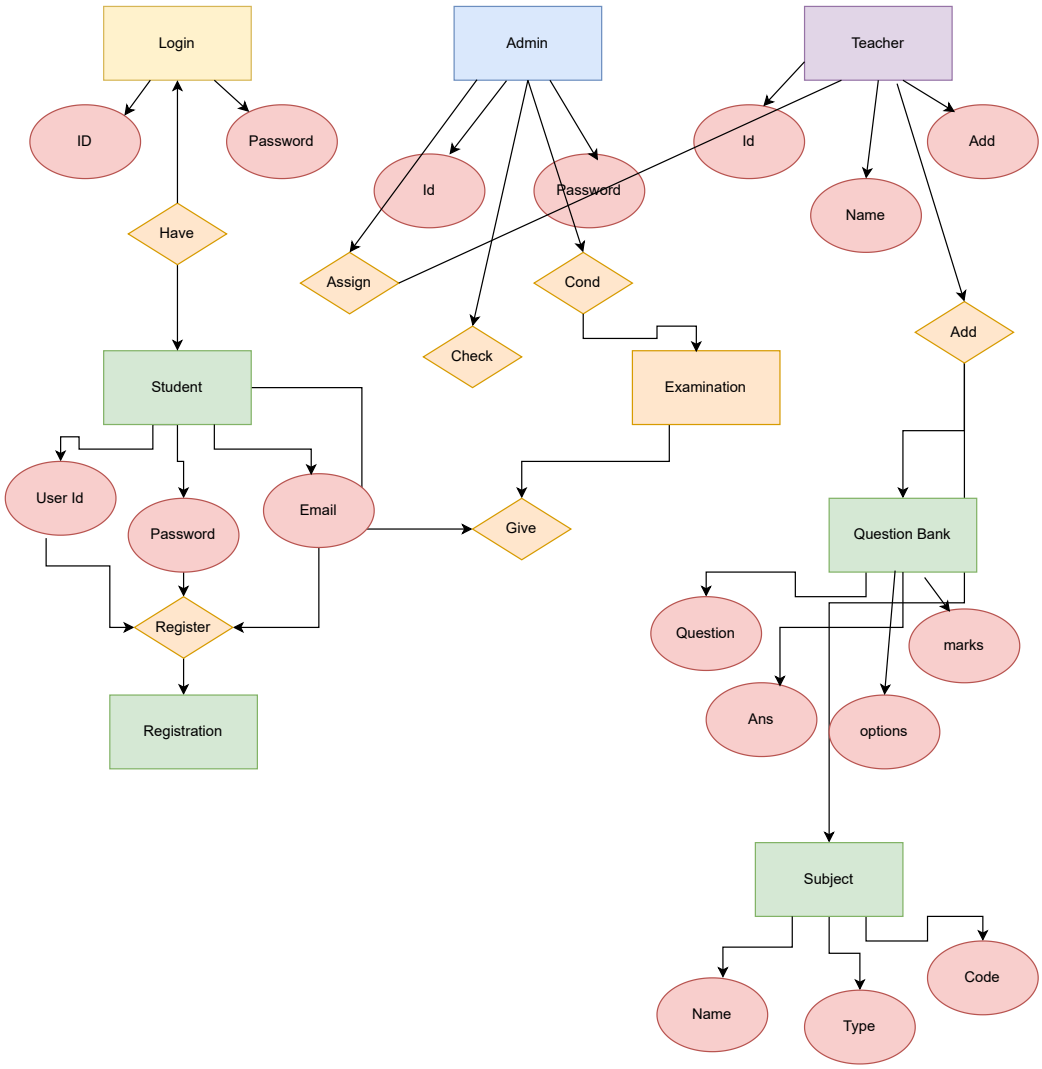

Figure 3.1: ERD for our Database

3.5 Data Flow Diagram

The Data Flow Diagram outlines the flow of information within the system, depicting interactions between components like the user interface, backend server, and database. It provides a visual representation of how data moves through the system during various processes, enhancing the understanding of system function-

ality.

The DFD illustrates the flow of data through the web portal, showcasing how user actions trigger processes and interactions between different system components. This diagram aids in the identification of data sources, processes, and destinations.

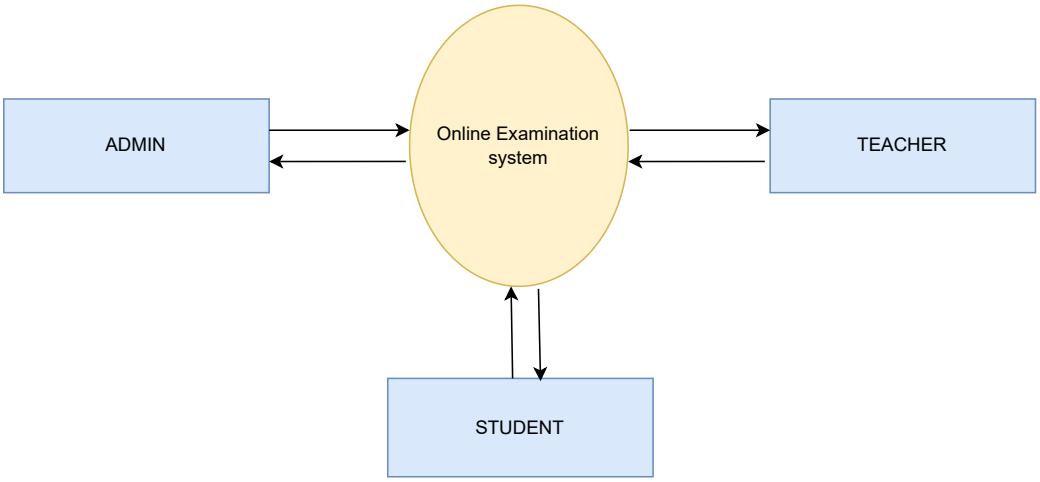

Figure 3.2: Level 0 DFD

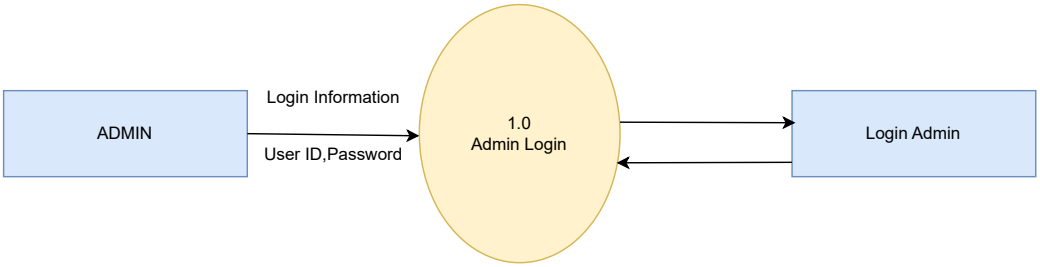

Figure 3.3: Level 1 DFD Admin

Admin can login to system by entering user ID and password as shown in 3.3

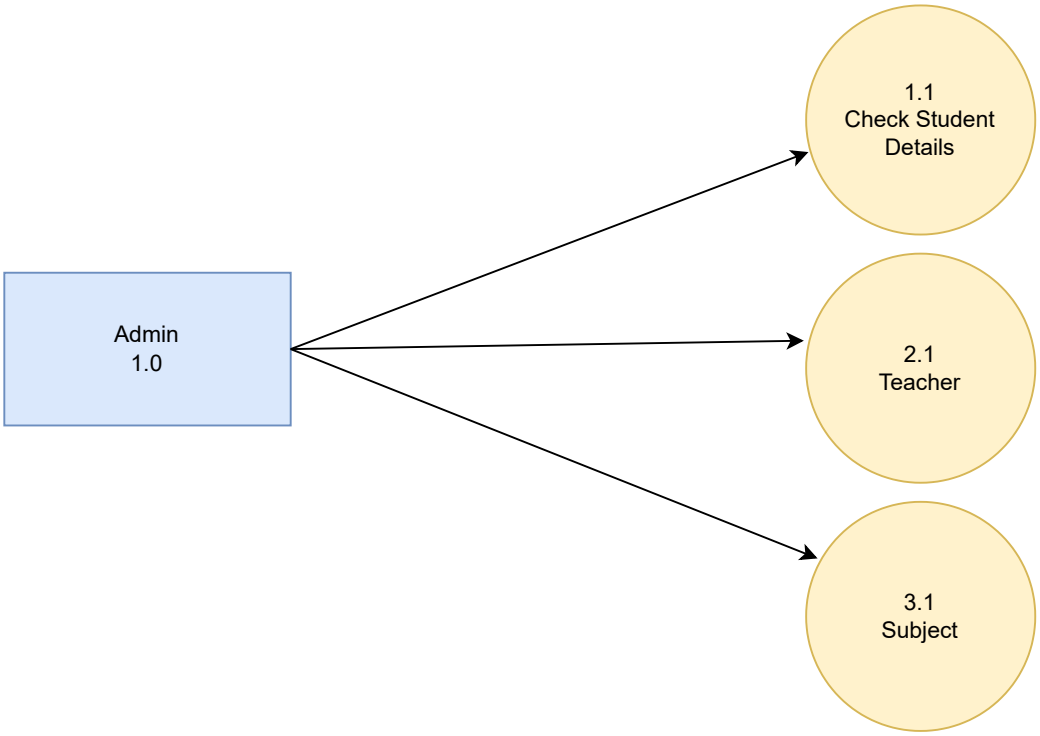

Figure 3.4: Level 2 DFD Admin

Admin Second Level (Figure 3.4) After logging in to the admin system, all the tasks to be performed are shown in DFD format. For example, after logging in,the admin can view all the information of the student, assign the teacher, upload the subject.

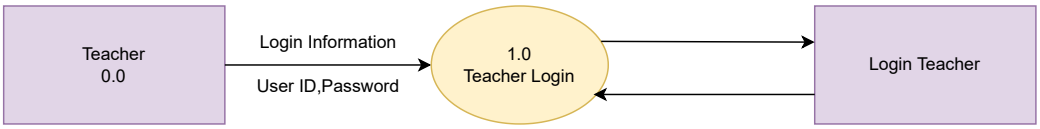

Figure 3.5: Level 1 DFD Teacher

In Teacher's First Level DFD, how a teacher can login to the system by entering the user ID and password is shown in Figure 3.5.

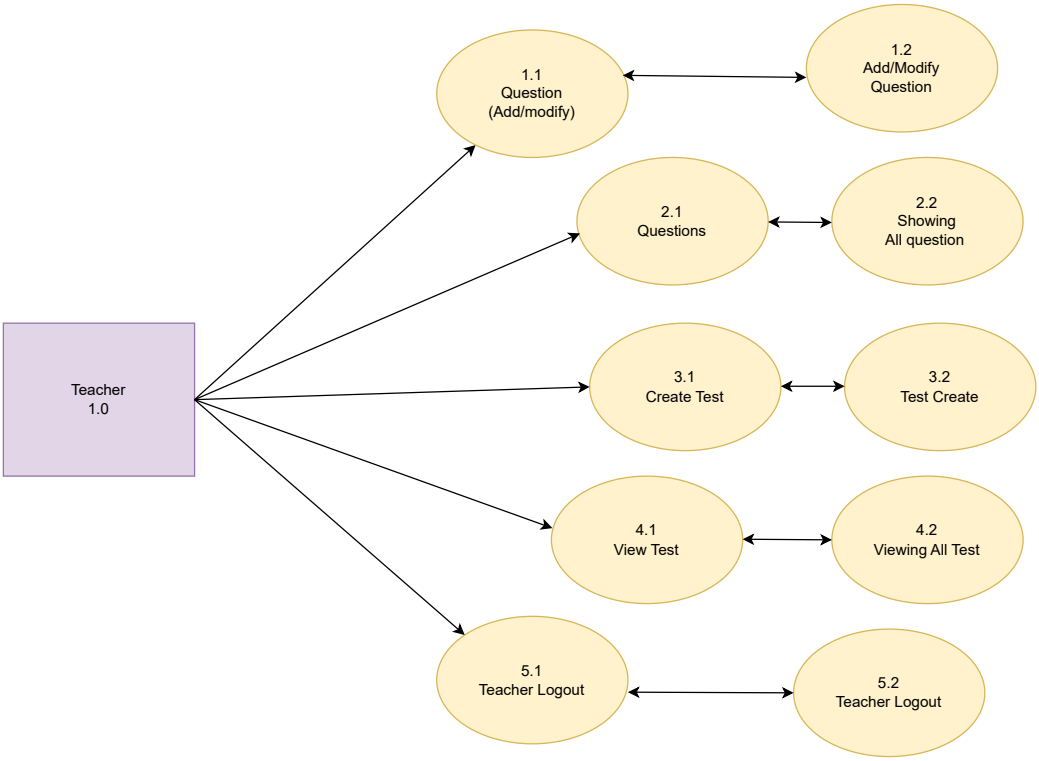

Figure 3.6: Level 2 DFD Teacher

Everything that the teacher can do after logging in to the system is shown in Figure 3.6. For example, exam schedule (time) can be selected, subject can be assigned, question add, mark evaluate / per question, result can be declared.

Figure 3.7: Level 0 DFD Student

Student's Zero (Figure 3.7) Level DFD shows how a student can register with his / her information.

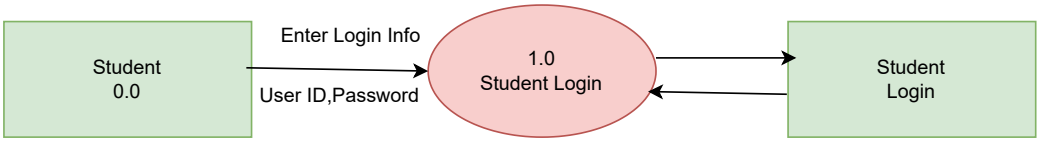

Figure 3.8: Level 1 DFD Student

Student First Level DFD, how a Student can login to the system by entering the user ID and password is shown in Figure 3.8.

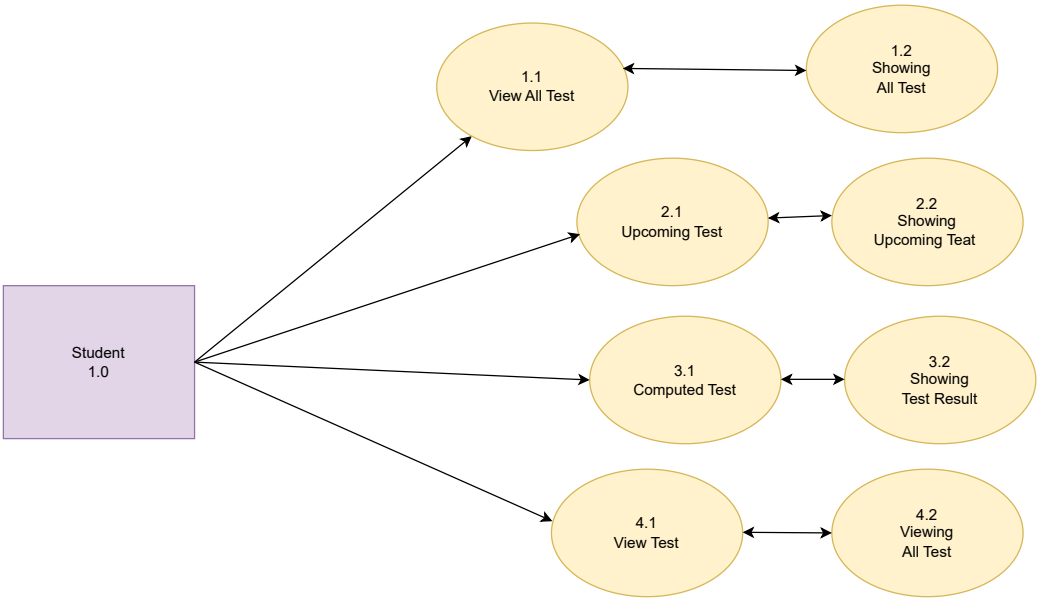

Figure 3.9: Level 2 DFD Student

The Second level DFD of the student shows in Figure 3.9 how the student can login to the system, take the exam, see the result, select the time.

3.6 Functional Requirement

The functional requirements of the web portal are detailed in the Functional Requirements Specification (FRS) document. Key functional requirements include:

3.6.1 User Registration and Authentication

Users can create accounts securely and log in using authentication protocols.

3.6.2 Exam Creation

Administrators can create and manage database,also add and delete subjects.

3.6.3 Question Bank Management

Teachers can add, edit, or remove questions from the question bank.

3.6.4 Automated Evaluation

The system automatically evaluates exams based on predefined criteria and scoring rules.

3.6.5 Result Generation

Instantaneous generation of results with detailed feedback for students.

Each requirement is accompanied by specific functionalities, user stories, and acceptance criteria, guiding the development process effectively.

3.7 Non-Functional Requirement

Non-functional requirements focus on aspects such as system performance, security, scalability, and usability. Key non-functional requirements include:

3.7.1 Performance

The system should handle a minimum of 1000 concurrent users without significant decreases in response time.
Page load times should be within acceptable limits for optimal user experience.

3.7.2 Security

User authentication must use secure protocols, such as HTTPS, to protect login credentials during transmission.
Access controls should restrict unauthorized access to sensitive data and functionalities.

3.7.3 Scalability

The system should be designed to scale horizontally to accommodate an increasing number of users and exams.

3.7.4 Usability

The user interface should be intuitive, with clear navigation and accessible features for users of all technical proficiencies.

These requirements guide the development team in ensuring that the web portal not only meets functional expectations but also adheres to industry standards for security and performance.

3.8 Testing

3.8.1 Unit Testing

Individual components and functions undergo unit testing to ensure they perform as expected.
Automated testing tools, such as Jest for JavaScript, are utilized to streamline the unit testing process.

3.8.2 Integration Testing

The interactions between different components are tested to identify and resolve issues related to data flow and communication.

3.8.3 System Testing

The entire system is tested to verify that it meets specified requirements and functions as an integrated whole.
Test cases cover scenarios such as user registration, exam creation, question evaluation, and result generation.
Extensive testing ensures the reliability and effectiveness of the web portal, with a focus on detecting and addressing issues at different levels of development.

3.9 Deployment

The deployment process involves transferring the web portal from the development environment to a live production environment. This process is executed systematically to minimize downtime and ensure a seamless transition.

3.9.1 Environment Configuration

Set up the production server environment, including configuring the web server, database server, and necessary security measures.

3.9.2 Code Deployment

Transfer the latest codebase to the production server, ensuring that all dependencies are correctly installed and configured.

3.9.3 Database Migration

Apply any necessary database schema changes and migrate existing data to the production database.

3.9.4 Testing in Production

Conduct final testing in the live production environment to identify and address any issues specific to the deployment environment.

3.9.5 Monitoring and Optimization

Implement monitoring tools to track system performance, identify potential issues, and optimize configurations for production-level traffic.

3.9.6 User Communication

Inform users about the successful deployment, any new features, and any temporary changes in the user experience during the transition.

3.9.7 Experiment Result

This section contains some screenshots of the component of the system.

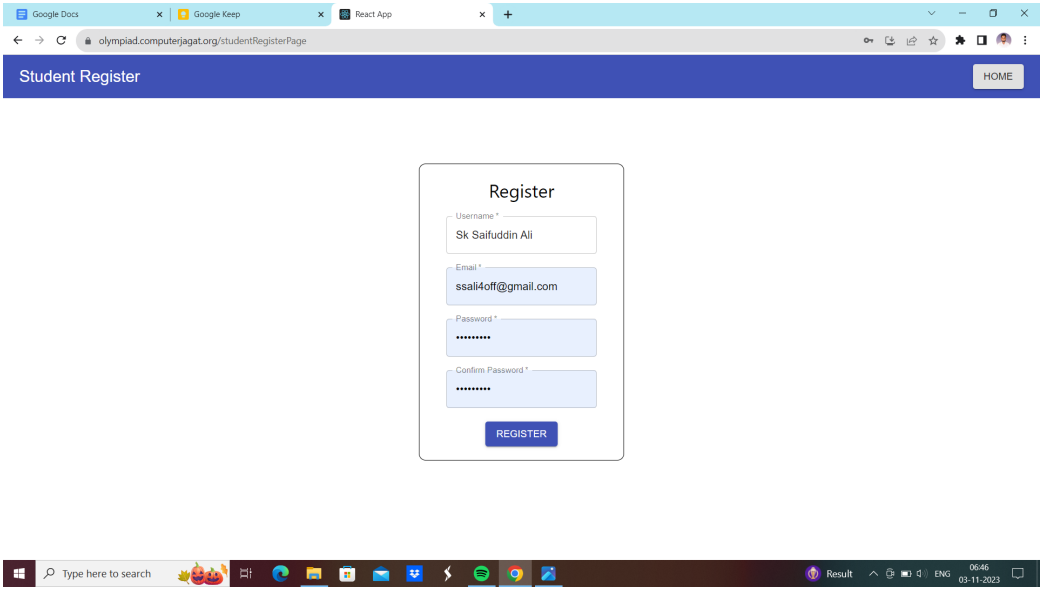

Figure 3.10: Student Registration Page

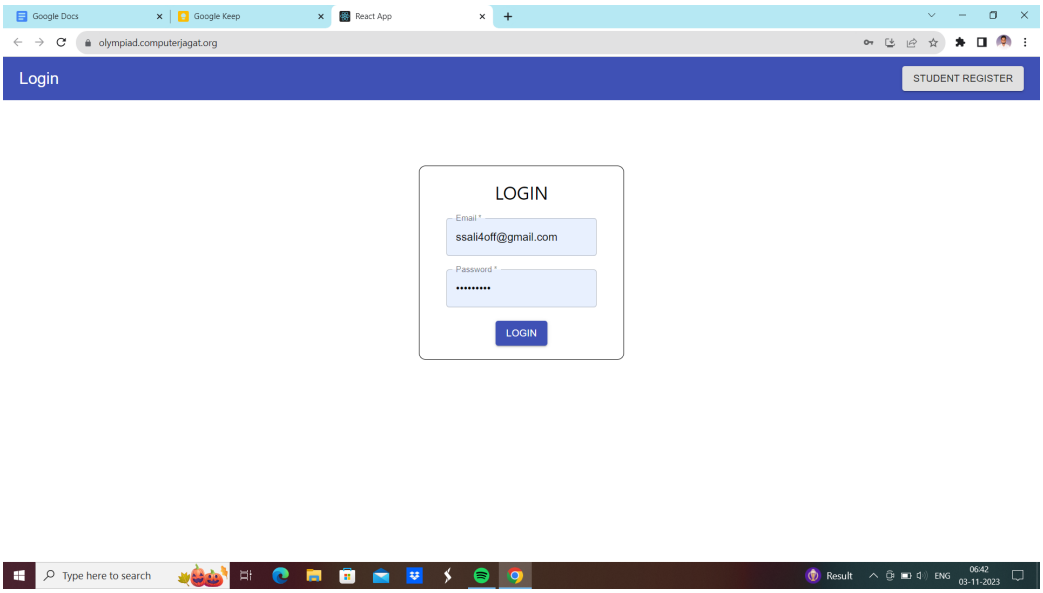

Figure 3.11: Student Login Page

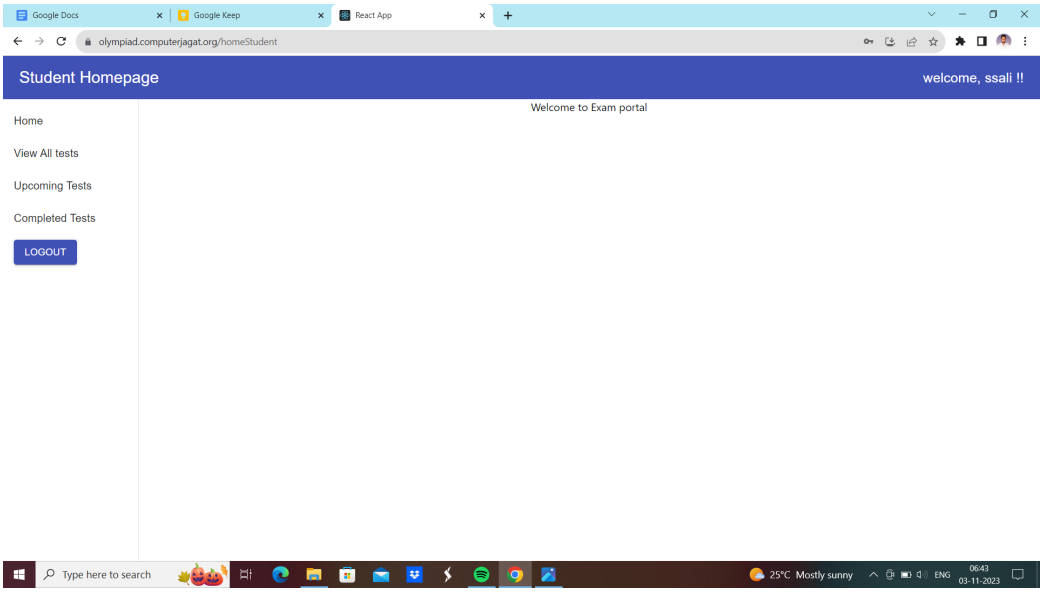

Figure 3.12: Student Home Page

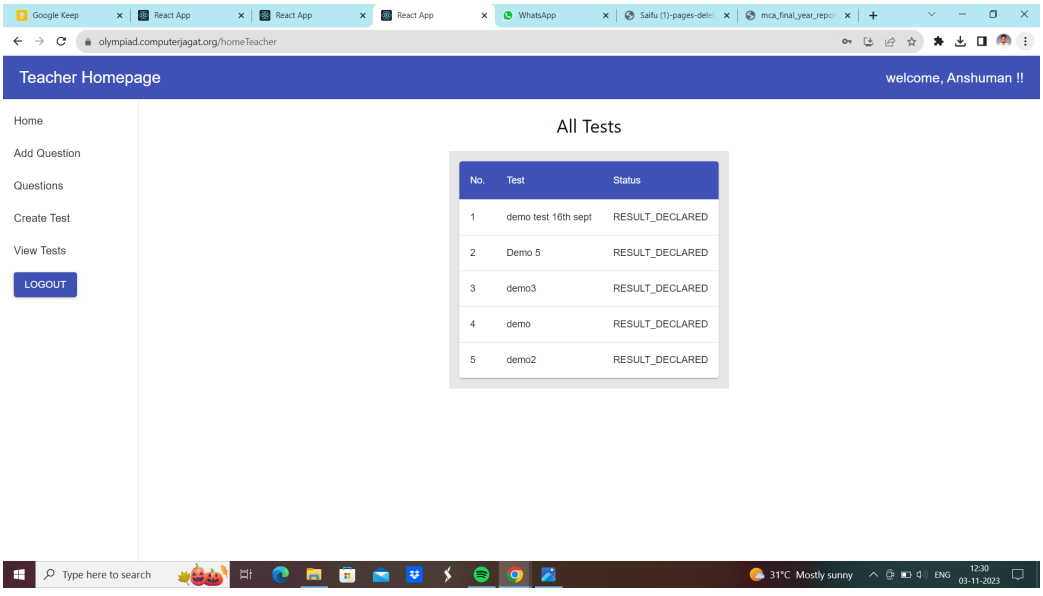

Figure 3.13: Teacher Home Page

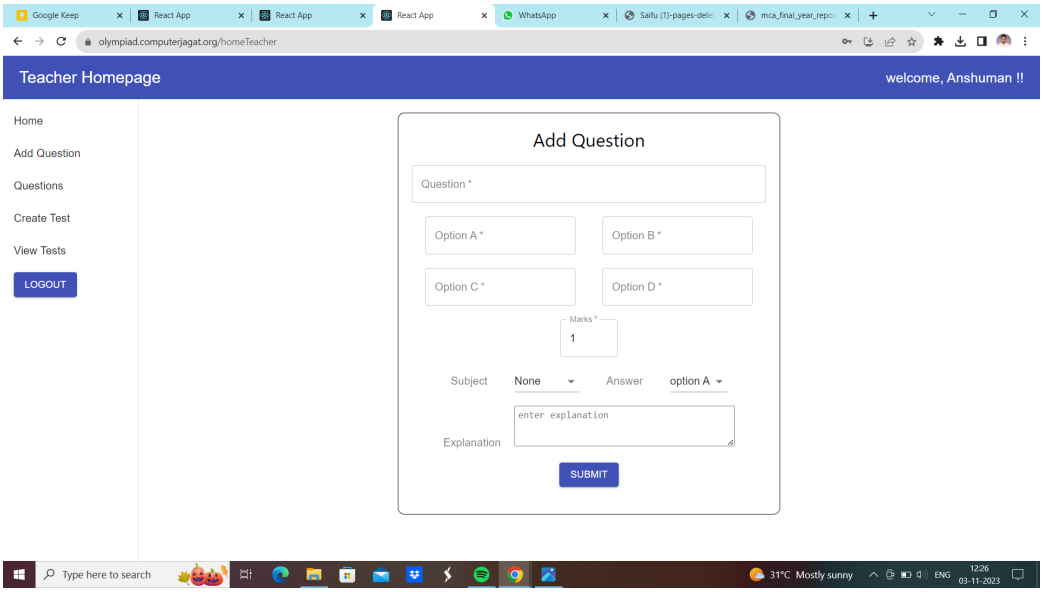

Figure 3.14: Question Adding Page

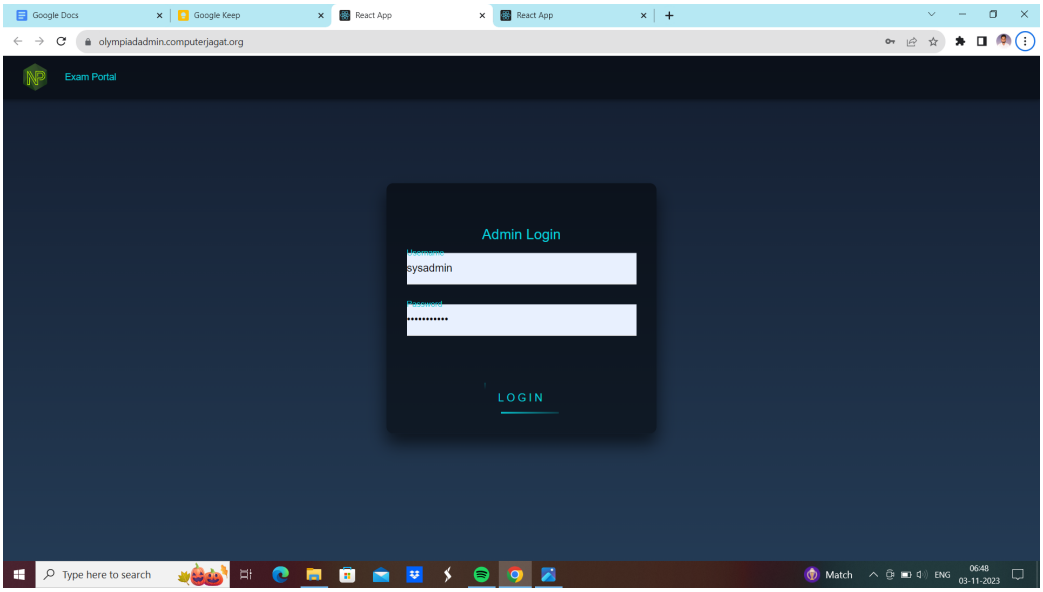

Figure 3.15: Admin Login Page

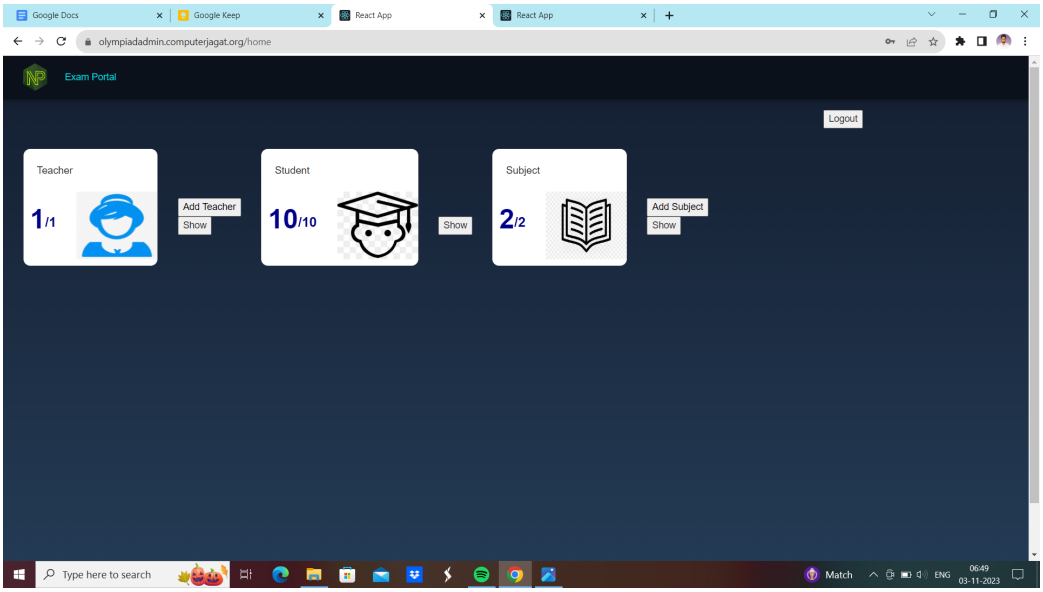

Figure 3.16: Admin Home Page

3.10 Admin Module

The Admin Module serves as the central control panel for system administrators, providing access to critical functionalities for managing users, exams, and system configurations.

3.10.1 User Management

Admins can add, edit, or deactivate user accounts, manage user roles, and reset passwords.

Access logs and activity history are available for auditing purposes.

3.10.2 Exam Creation and Management

Admins can create new exams, define question parameters, and set rules for scoring.

Exam schedules, venues, and other logistical details can be configured through the admin interface.

3.10.3 Question Bank Management

Admins have the ability to add, edit, or remove questions from the question bank, ensuring a diverse set of questions for exams.

3.10.4 Result Analysis

Comprehensive analytics tools allow admins to analyze exam results, identify trends, and gain insights into student performance.

3.11 Student Module

The Student Module provides students with a user-friendly interface for exam registration, participation, and result viewing.

3.11.1 User Registration

Students can create accounts, providing necessary information for identification and communication purposes.

3.11.2 Exam Registration

Students can view available exams, register for upcoming assessments, and receive confirmation of their registration.

3.11.3 Taking Exams

The interface for taking exams is intuitive, with features for answering questions, navigating between questions, and submitting answers.

3.11.4 Result Viewing

Instantaneous display of exam results with detailed feedback on performance in each section.

3.12 Teacher Module

The Teacher Module empowers educators with tools for managing exams, evaluating student responses, and providing feedback.

3.12.1 Question Bank Access

Teachers can access the question bank, add new questions, edit existing ones, and categorize questions based on difficulty.

3.12.2 Exam Evaluation

The system automates the evaluation process, providing teachers with a quick overview of student performance.
Manual review options are available for certain question types or specific cases.

3.12.3 Feedback Provision

Teachers can provide individualized feedback to students, facilitating a constructive learning experience.

CHAPTER 4

CONCLUSION

In conclusion, the development of the web portal for competitive exam assessment using React, Node.js, and MongoDB represents a significant advancement in addressing the challenges associated with traditional assessment systems. The project introduces automation, improves security, and enhances user experience, contributing to a more efficient and reliable assessment environment.

The successful implementation of the web portal is a result of collaborative efforts, adhering to best practices in software engineering, database management, and user interface design. The positive impact on students, educators, and institutions underscores the project's significance in the educational technology landscape.

The use of React, Node.js, and MongoDB provides a solid foundation for scalability, adaptability, and future enhancements. Ongoing support, monitoring, and continuous improvement will be essential to ensure the sustained success and relevance of the web portal in the dynamic landscape of competitive exam assessment.

Future Work:

Looking ahead, there are several avenues for future development and enhancement

of the web portal:

i. Integration of Machine Learning: Implementing machine learning algorithms for adaptive testing, personalized feedback, and predictive analytics to enhance the assessment process.

ii. Collaboration Features: Introducing collaborative tools for teachers and students, facilitating group assessments and interactive learning experiences.

iii. Accessibility Improvements: Enhancing accessibility features to ensure that the web portal is usable by individuals with diverse abilities.

iv. Integration with Learning Management Systems: Collaborating with existing learning management systems to streamline data exchange and enhance interoperability.

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