

# **Quiz Examination System**

**B.Sc. Level 2 Semester II PROJECT REPORT**  
**Course Code: CSE 252 Course Title: Application Development**  
**Sessional**

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## **Abstract**

The increasing demand for efficient, light-weight and user-friendly Quiz examination systems in a local network has driven the development of this project, an Quiz Examination System for Hajee Mohammed Danesh Science and Technology University (HSTU). This system aims to digitalize the examination process, use HSTU own campus server offering a seamless platform for both teachers and students. The system allows teachers to create, manage, and monitor quizzes, while students can take quizzes in real time with immediate performance feedback. Additionally, a help desk provides access to essential university information, including syllabus, teacher details, and course lists. Built using JavaFX, file management and socket programming, the application ensures secure communication between teachers and students, facilitating real-time interactions during quizzes. Key features include user authentication, quiz creation, automatic grading, and detailed result analysis presented through intuitive visual elements such as pie chart. The system is designed to enhance the examination process by automating marking, reducing human errors, and providing instant feedback. Although the current system uses file handling for data storage, future work will focus on integrating a relational database to improve accesses large data, data integrity, and performance. Additionally, plans for enhancing the user interface with modern styling techniques and expanding the system's features will further enrich the user experience. This project demonstrates the potential of using desktop applications for Quiz examinations, offering a flexible, secure, and user-friendly solution tailored to modern educational needs.

# **Introduction**

## **1.1 Background:**

The shift towards online education and assessments has become increasingly prevalent due to advancements in technology and the growing need for flexible, scalable, and accessible learning platforms. Traditional examination methods, though reliable, often involve significant logistical challenges, such as managing physical spaces, handling large volumes of paper-based exams, ensuring exam security, and requiring significant manpower to conduct and evaluate assessments. These methods can also be time-consuming, especially when it comes to grading and result processing. As educational institutions, particularly universities, are transitioning towards e-learning and digital platforms, the need for an Quiz examination system has become essential.

The "Quiz Examination System" developed for Hajee Mohammed Danesh Science and Technology University (HSTU) addresses these challenges by providing a user-friendly, efficient, and secure platform to manage both the teacher and student examination workflows. This project aims to digitalize the entire examination process, from quiz creation by teachers to student participation and automatic result calculation. The system's design ensures that both teachers and students can seamlessly interact with the application while providing a modern interface for exam administration.

### **1.1.1 Key Features of the System:**

- ✓ User Authentication
- ✓ Teacher Portal
- ✓ Student Portal
- ✓ Quiz and Result Management
- ✓ Help Desk

## **1.2 Problem Statement:**

Traditional examination methods, widely used in educational institutions, come with a host of challenges that limit their efficiency, security and user friendly. These methods typically require substantial manual effort for setting up physical exam venues, printing exam papers, and manually grading students' responses. The process is time-consuming, labor-intensive, and prone to human errors, especially during grading and result compilation. Furthermore, logistics such as managing exam schedules, assigning invigilators, and handling a large volume of answer sheets contribute to additional complexities.

With the growing reliance on digital solutions and online education, there is a clear need for an Quiz examination system that can automate and simplify these processes. Such a system can offer several advantages:

- Efficiency
- Accuracy
- Real-Time Feedback
- Accessibility

In summary, the need for an Quiz examination system arises from the inefficiencies and logistical challenges posed by traditional methods. A well-designed system can streamline exam management, enhance the accuracy of grading, and provide a better user experience for both students and teachers. This project, "Quiz Examination System," developed for Hajee Mohammed Danesh Science and Technology University (HSTU), seeks to address these issues by providing a digital platform for conducting and managing exams effectively.

## **1.3 Motivation:**

The increasing need for modernized, efficient, and scalable examination systems in educational institutions has become a driving force for the development of this project. Traditional exams often involve a lot of manual work, from setting up exam venues to grading papers, leading to inefficiencies and delays. These

challenges are especially pronounced in universities with a large number of students and diverse courses, such as Hajee Mohammed Danesh Science and Technology University (HSTU).

Several key factors motivated the creation of this Quiz Examination System:

- Administrative Efficiency
- Real-Time Feedback
- Fairness and Accuracy

These motivations reflect the broader trend toward digitizing education and assessments, where Quiz platforms offer solutions that are more flexible, time-efficient, and accessible. The development of this project aligns with the ongoing evolution in educational technologies, providing HSTU with a customized system that meets both student and institutional needs in a rapidly changing world.

#### **1.4 Objective:**

The primary objective of this project is to create a comprehensive, efficient, and user-friendly Quiz Examination System for Hajee Mohammed Danesh Science and Technology University (HSTU). The system is designed to streamline the entire examination process, providing a seamless experience for both teachers and students. Key objectives include:

- Efficient Exam Management
- Real-Time Participation for Students
- Result Generation
- User Authentication and Account Management
- Course and Faculty Information



## **Related Work**

### **2.1 Existing Work:**

#### **Literature Review:**

An Quiz Examination System, a Telegram Bot Quiz, Duolingo, and Google Forms, across various aspects. The Quiz Examination System is designed for academic quizzes with real-time teacher-student interaction in a university setting, running on a desktop-based platform with its own server. The Telegram Bot Quiz offers simple, message-based quizzes with minimal real-time interaction, designed for fun and chat-based testing. Duolingo focuses on language learning through interactive lessons and quizzes, providing real-time feedback and supporting multiple quiz types. Google Forms is a web-based platform for form-based data collection, including quizzes and exams, but lacks real-time interaction. While the Quiz Examination System and Duolingo provide real-time interaction and automatic grading, the Telegram Bot and Google Forms offer simpler interaction and grading mechanisms. Security is highest in the Quiz Examination System and Duolingo due to secure user sessions and authentication, while Telegram Bot and Google Forms have more limited security features.

### **2.2 Comparing with Existing Work:**

**Table 2.1 Difference among Quiz Examination System,Telegram Bot Quiz, Duolingo, Google Form**

<b>Features / Aspect</b>	<b>Quiz Examination System</b>	<b>Telegram Bot Quiz</b>	<b>Duolingo</b>	<b>Google Form</b>
<b>Purpose</b>	Designed for academic quizzes with a focus on real-time teacher-student interaction in a university setting.	Simple quizzes for chat-based interaction, often used for fun or simple testing.	Language learning platform with interactive lessons, quizzes, and tests.	Form-based data collection, often used for surveys, quizzes, and exams.

<b>Most Important</b>	Stored Our own(university) server	Third-party	Third-Party	Third-Party
<b>Platform</b>	Desktop-based application (JavaFX)	Messaging platform (Telegram bot)	Mobile/desktop web app and mobile app	Web-based, accessible on any browser.
<b>User Roles</b>	Teachers (quiz creators) and Students (quiz takers)	Admins (quiz creators) and Users (quiz takers)	Learners (students) and Duolingo teachers	Quiz creators and respondents (quiz takers)
<b>Real time Interaction</b>	Yes, real-time question distribution using socket programming	No real-time grading or interaction, just message-based quizzes	Yes, interactive real-time lessons and quizzes with instant feedback	No real-time interaction; responses are submitted at once and analyzed later
<b>Quiz Type</b>	Multiple choice, timer-bound quizzes, with plans for more types	Multiple choice and simple question-answer	Multiple choice, typing, listening, matching, etc., focused on language learning	Multiple choice, short answers, checkbox, dropdowns, and more
<b>Automatic Grading</b>	Yes, immediate feedback after quiz completion	Yes, but grading logic is simple	Yes, automated grading with complex algorithms based on user input	Yes, auto-grading for certain question types like MCQs and checkboxes
<b>Security</b>	Though our own server :User authentication, secure session management	Minimal security, as it's on messaging platforms	Account-based, secure user sessions	Limited security features based on Google's privacy policies

# Requirement Specification

## 3.1 Functional Requirements:

### 3.1.1 User Authentication:

#### Teacher Side:

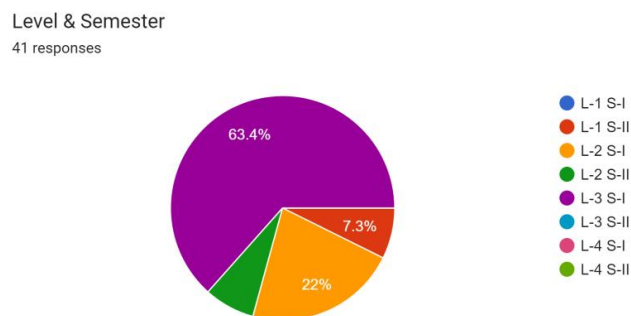
- Login and Signup functionality.
- Set up quiz (add questions, assign time limits, and quiz duration).
- View and manage quizzes.
- Monitor student submissions and results.

#### Student Side:

#### Survey Form Link:

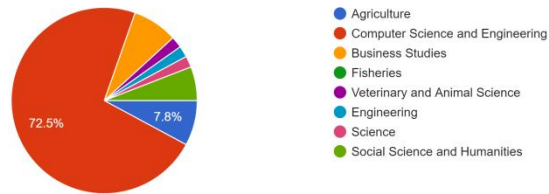
[https://docs.google.com/forms/d/e/1FAIpQLSfKXnYM8qW8nweGSyd\\_k7R71is3f13wOod1y\\_n1yAWfZW9J\\_1A/viewform](https://docs.google.com/forms/d/e/1FAIpQLSfKXnYM8qW8nweGSyd_k7R71is3f13wOod1y_n1yAWfZW9J_1A/viewform)

## Survey Result:



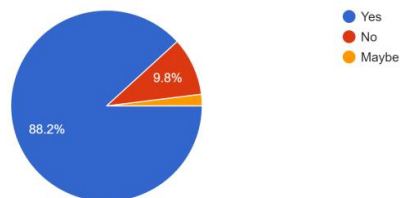
**Fig 3.1 Responses Level & Semester**

Faculty  
51 responses



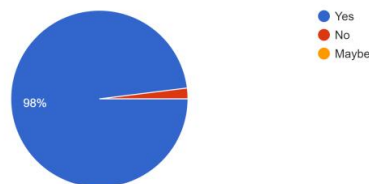
**Fig 3.2 Responses Faculty**

Do you think Online Examination System is helpful in case of Multiple Choice Quiz Examination?  
51 responses



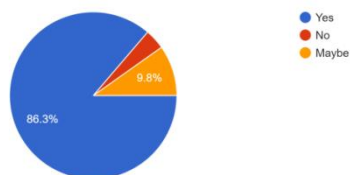
**Fig 3.3 Question 1**

Instant evaluation is an important feature of Online Examination System. Do you think getting instant result is helpful?  
51 responses



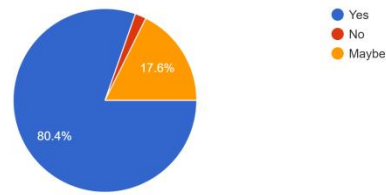
**Fig 3.4 Question 2**

Do you think the timer feature in Online Examination System can be useful for ensuring equal amount of time for every student?  
51 responses



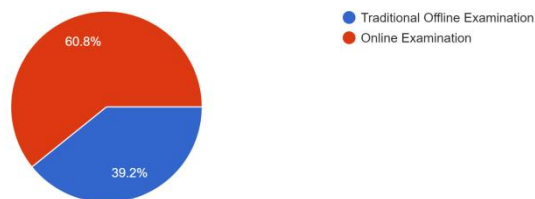
**Fig 3.5 Question 3**

There are already many third party Online Examination System available. Yet we are developing our own Online Examination System with a vision of full...o them. Do you think this is an important feature?  
51 responses



**Fig 3.6 Question 4**

Which one do you think is best in the modern era of 2024 ?  
51 responses



**Fig 3.7 Question 5**

### **Valuable Comments:**

What features can make the Quiz Examination System more useful for Teachers and Students?[28 responses]

- Web cam on
- Comment box for direct interaction
- Different questions for different student
- Timing
- Teachers will have not to do that they do in offline examination like individually going to the students for sign. However students will be benefited for hassle free exam. The main thing is that in this Quiz system the developers must restrict the examine who tries to copy or duplicate the answers throughout various online media.
- all most every this is here
- Recheck option Result Publish on date
- Easy scheduling

- video feature so that no one can cheat
- No time limit
- Practice sheet or tips
- Instant question and answer after exam. And answer explanation can make Quiz examination system useful.
- Honesty
- Explanation of answer will be more helpfull to minimize the lackings and it will also help to know the unknown.
- I have no idea
- Keep good internet connection
- Camera on system should be available so that student will be in the eye of teacher
- Login and Signup functionality.
- View available quizzes.
- Attend quizzes with a time limit.
- View past result.

**Table 3.1 Survey Result**

<b>Question</b>	<b>Options</b>	<b>Responses</b>
Level & Semester	L-1 S-I (7.3%), L-1 S-II (22%), L-2 S-I (63.4%)	41 Responses
Faculty	Agriculture (7.8%), CSE (72.5%), Business Studies (7.8%), Others	51 Responses
Do you think Quiz Examination System is helpful in case of Multiple Choice Quiz Examination?	Yes (88.2%), No (9.8%), Maybe	51 Responses
Instant evaluation is an important feature of Quiz Examination System. Do you think getting instant result is helpful?	Yes (98%), No, Maybe	51 Responses
Do you think the timer feature in Quiz Examination System can be useful for ensuring equal amount of time for every student?	Yes (86.3%), No (9.8%), Maybe	51 Responses
There are already many third-party Quiz Examination Systems available. Do you think this is an important feature?	Yes (80.4%), No (17.6%), Maybe	51 Responses
Which one do you think is best in the modern era of 2024?	Traditional Offline (39.2%), Quiz Examination (60.8%)	51 Responses

**Login and Account Creation:**

The application provides an authentication system where both teachers and students can log in with their unique credentials (username and password). If a user does not have an account, they can create a new one by entering their details, such as name, email, and password, which will be securely stored for future access.

### **Teacher and Student Roles:**

Upon login, users are classified into two roles—teachers and students. Teachers have extended privileges, such as quiz management and result tracking, while students primarily interact with the examination interface.

### **Session Management:**

Once authenticated, users can securely access their respective functionalities, and session management ensures that sensitive information, such as quiz settings and student answers, remains private and secure.

## **3.1.2 Quiz Management (For Teachers):**

### **Creating Quizzes:**

Teachers can create new quizzes by defining the number of questions, inputting the question text, adding four multiple-choice options, and specifying the correct answer. A timer can also be set for each question to impose time limits.

### **Updating and Deleting Questions:**

The quiz management system allows teachers to edit previously added questions, modifying text, options, or the timer if necessary. Additionally, teachers can delete questions that are no longer relevant, ensuring that the quiz content remains up-to-date.



**Managing Question IDs:**

Each question is assigned a unique ID, which can be used by the teacher to update or delete specific questions easily. The ID-based system makes it convenient to manage large question banks efficiently.

**Preview and Finalization:**

Before starting the quiz, the teacher can preview all questions to ensure correctness. Once satisfied, they can finalize the quiz and lock the questions to prevent further changes while the exam is in progress.

**3.1.3 Examination Process (For Students):****Quiz Participation:**

Students can participate in quizzes after they are initiated by the teacher. The quiz interface presents one question at a time, along with four multiple-choice options. The interface is designed to be intuitive and user-friendly, ensuring smooth navigation during the exam.

**Answer Submission and Timer:**

Each question is timed, and students must submit their answers before the timer expires. The timer ensures that the quiz simulates real exam conditions, adding a level of challenge and time management.

**Real-Time Feedback:**

As students submit their answers, they receive immediate feedback on whether their answer is correct or incorrect. This feedback enhances the learning experience by helping students understand their mistakes in real time.

**Auto-Submission:**

If the timer expires before a student submits an answer, the system automatically submits the answer (or leaves it blank) and proceeds to the next question, ensuring that no extra time is allotted unfairly.

**3.1.4 Result Tracking (For Teachers and Students):****Student Performance Tracking:**

Once a student completes the quiz, the system calculates their score based on the number of correct answers and the time taken to complete the quiz. This score is then displayed to the student along with a summary of their performance.

**Teacher's Overview:**

Teachers have access to a detailed report of each student's performance, which includes individual scores, the time taken for each question, and the overall time spent on the quiz. This information allows the teacher to analyze student performance and provide personalized feedback.

**Result History:**

Both students and teachers can access previous quiz results. This historical data helps students track their progress over time and allows teachers to monitor overall class performance.

**3.1.5 Help Desk:****University Information:**

The application includes a section where students and teachers can access general information about the university. This includes a brief description of the university's history, mission, and key facilities, helping new users familiarize themselves with the institution.

**Teacher Details:**

A dedicated section provides information about the faculty members, including their names, departments, contact information, and office hours. This feature helps students easily reach out to their teachers for academic support or inquiries.

**Course Lists:**

A comprehensive list of courses offered by the university is available within the application. Each course listing includes the course name, code, description, and assigned instructors. This helps students quickly identify the courses they are enrolled in or interested in taking.

**3.2 Non-Functional Requirements:****3.2.1 Scalability:****Support for Concurrent Users:**

The system must be designed to handle multiple students taking exams simultaneously without degrading performance. This involves implementing efficient socket programming techniques to manage multiple client connections concurrently, ensuring that the server can handle numerous student requests in real time.

**Load Balancing:**

As the number of users grows, consider incorporating load balancing strategies, which can distribute user connections across multiple server instances. This ensures that no single server is overwhelmed, providing a smooth experience for all users.

**Database Optimization:**

When utilizing a database for storing user data, questions, and results, optimizations such as indexing can be implemented to speed up data

retrieval processes. This is crucial when multiple users are accessing the same database simultaneously.

### **3.2.2 Security:**

#### **User Credential Management:**

The application must implement secure practices for storing user credentials. This can include hashing passwords using secure algorithms (e.g., bcrypt) and utilizing salting techniques to protect against rainbow table attacks. Additionally, user sessions should be managed securely to prevent unauthorized access.

#### **Data Encryption:**

Communication between the client and server should be encrypted using protocols such as TLS (Transport Layer Security) to ensure that data transmitted over the network is secure. This prevents eavesdropping and tampering with sensitive information, such as exam questions and student answers.

#### **Access Control:**

The application should implement role-based access control (RBAC) to restrict functionalities based on user roles. For example, only teachers should have access to quiz management features, while students should only access their exam interface.

### **3.2.3 Usability:**

#### **User-Friendly Interface:**

The application should prioritize an intuitive and visually appealing interface for both teachers and students. This includes clear navigation paths, logical workflows, and visually distinct buttons for different actions (e.g., starting a quiz, submitting answers).

### **Accessibility Features:**

The interface should be designed with accessibility in mind, ensuring that all users, including those with disabilities, can effectively use the application. This can involve using high-contrast color schemes, ensuring text is readable, and providing keyboard navigation options.

### **User Documentation and Help:**

Providing comprehensive documentation, including tutorials and FAQs, can enhance usability. In-app help features can guide users through various functionalities, making it easier for them to navigate the application and perform tasks efficiently.

## **3.2.4 Performance:**

### **Real-Time Feedback:**

The system should be optimized to provide real-time feedback without noticeable delays. This can be achieved by ensuring that socket communication is efficient, minimizing latency in data transmission between the client and server.

### **Efficient Resource Management:**

The application must efficiently manage system resources, such as memory and CPU usage, especially when handling multiple connections. Implementing proper threading techniques for handling client requests can help maintain performance.

### **Response Time Metrics:**

Establishing performance benchmarks, such as acceptable response times for user actions (e.g., loading the quiz, submitting answers, retrieving results), can help ensure that the application meets performance standards. Continuous monitoring and optimization can be conducted based on user feedback and performance metrics.

## **System Development**

### **4.1 Development Tools:**

#### **4.1.1 Languages: Java**

##### **Overview:**

Java is a versatile, object-oriented programming language widely used for building platform-independent applications. Its robust standard library and strong community support make it an ideal choice for developing desktop applications.

##### **Advantages:**

- **Cross-Platform Compatibility**
- **Rich Ecosystem**
- **Strong Typing and Exception Handling**

#### **4.1.2 GUI Framework: JavaFX**

##### **Overview:**

- JavaFX is a modern framework for building rich desktop applications with graphical user interfaces. It provides a wide range of UI controls, graphics, and media capabilities.

##### **Advantages:**

- **Rich UI Components**
- **FXML for Layout Design**

### **4.1.3 Development Environment: IntelliJ IDEA**

#### **Overview:**

- IntelliJ IDEA is a powerful Integrated Development Environment (IDE) for Java development, known for its intelligent code assistance and productivity features.

### **4.1.4 Helper: Scene Builder**

#### **Overview:**

- Scene Builder is a visual layout tool for JavaFX applications, allowing developers to design user interfaces by dragging and dropping UI components onto a canvas.

#### **Advantages:**

- **Visual Design**
- **FXML Generation**
- **Preview Functionality**

### **4.1.5 File Handling**

#### **Overview:**

- File handling in Java involves reading from and writing to files, essential for managing user data, quiz questions, and results within the application.

**Fig 4.1: Entering Information**

#### Implementation:

- **User Data Storage:** User credentials and profile information can be stored in a secure file management system.

```

a  teacherEmailPassword.txt x
ramiz111
01959433800
Male
October 30, 2024
sultan555
01959433800
Female
October 30, 2024
aaaa555
0155151
Male
October 29, 2024

```

**Fig 4.2: Storing data in a .txt file**



- **Quiz Questions Management:** Quiz questions, including IDs, text, options, and correct answers, can be stored in structured files. This allows teachers to easily update or add questions as needed.
- **Results Storage:** After quizzes, student results (scores, time taken) can be logged into a file for later analysis and feedback, ensuring that both students and teachers can track performance history.

#### 4.1.6 Socket Programming

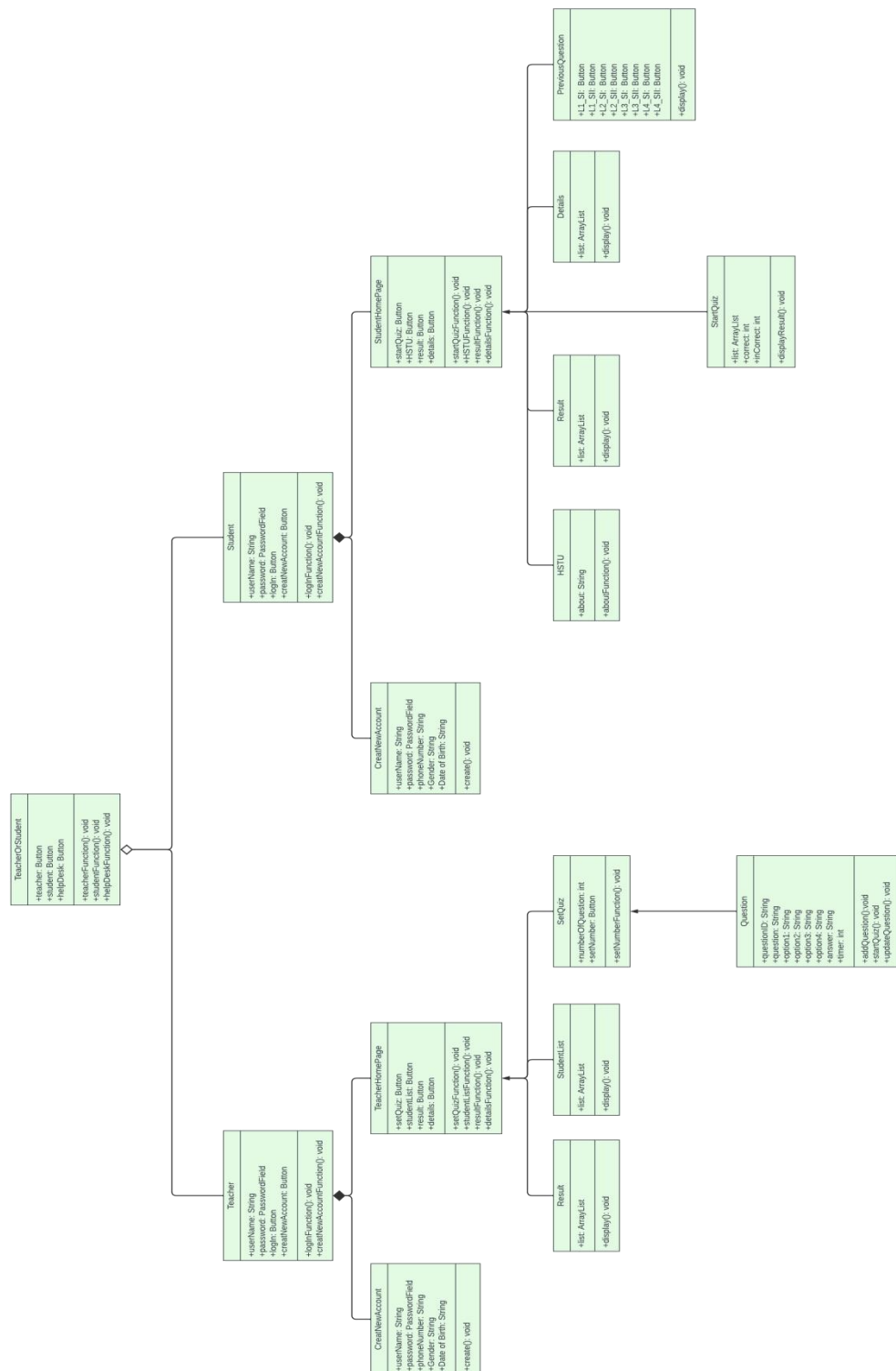
##### Overview:

- Socket programming enables real-time communication between the teacher's server and student clients. This is crucial for implementing the live interaction needed for quizzes.

##### Implementation:

- **Client-Server Model:** The application employs a client-server architecture, where the teacher's application acts as the server, sending quiz questions to multiple student clients, who connect to it via sockets.
- **Real-Time Data Transfer:** Using Java's Socket and ServerSocket classes, the application can transmit data (quiz questions and answers) in real time, ensuring that students receive updates promptly.
- **Handling Multiple Connections:** To support multiple students simultaneously, the server can create separate threads for each client connection, allowing for concurrent processing and smooth communication without delays.

## 4.2 System Design:



**Fig 4.3 UML(Unified Modeling Language)**

#### 4.2.1 Home Page:

##### Overview:

- The home page serves as the initial interface for users, providing options for teachers and students to navigate to their respective sections.

##### Design Components:

- **Buttons:**

Two primary buttons:

- I. **Teacher:** Navigates to the Teacher Login page.
- II. **Student:** Navigates to the Student Login page.

- **Visual Elements:**

- I. Incorporate appealing graphics and branding (e.g., the university logo) to enhance the visual appeal.
- II. Use contrasting colors for buttons to make them easily distinguishable.

- **Responsive Design:**

- I. Ensure the layout adapts to different screen sizes to accommodate various desktop resolutions.

#### 4.2.2 Login Page:

##### Overview:

The login page is crucial for user authentication, allowing both teachers and students to access their respective functionalities.

## **Design Components:**

### **Input Fields:**

Username and password fields for user credentials.

### **Buttons:**

**Login:** Validates user credentials and directs to the appropriate section.

**Create Account:** Navigates to an account creation page for new users.

### **Feedback Mechanism:**

Display error messages (e.g., incorrect username/password) and success messages to guide users.

### **Security Features:**

Implement password masking in the input field and include an option to show/hide the password for user convenience.

### **Accessibility Features:**

Provide keyboard navigation and ensure that labels are associated with input fields for screen reader compatibility.

### 4.2.3 Teacher's Section:

#### Overview:

The teacher's section allows educators to manage quizzes and monitor student performance effectively.

#### Design Components:

##### Buttons:

**Set Quiz:** Opens a quiz setup interface for entering question details.

**View Student List:** Displays a list of students registered for the quiz, including their performance metrics.

**Check Results:** Provides access to view overall results from past quizzes.

##### Quiz Setup Interface:

- Input fields for specifying the number of questions, questions' text, options (A, B, C, D), correct answers, and timing settings for each question.
- Option to preview questions before saving.
- Capability to update or delete existing questions.

##### Visual Elements:

- Use tables or lists to present the student list and quiz results for clarity.
- Incorporate graphs (e.g., bar charts) for quick performance insights.

### **Notifications:**

Inform the teacher of successful quiz setup, question updates, or errors in input through visual or audio cues.

### **4.2.4 Student's Section:**

#### **Overview:**

The student's section allows learners to take quizzes and view their performance, fostering an interactive learning experience.

#### **Design Components:**

##### **Buttons:**

- **Start Quiz:** Initiates the quiz interface where students can answer questions.
- **View Past Results:** Displays a history of completed quizzes and scores.
- **University Information:** Provides details about the university, such as courses offered and faculty information.

##### **Quiz Interface:**

- Presents questions one at a time, with multiple-choice options.
- Include a timer to indicate remaining time for answering each question.
- Option to navigate back and forth between questions.

##### **Performance Feedback:**

- Upon quiz completion, display performance metrics (e.g., score, time taken) with visual aids like pie charts to illustrate correct vs. incorrect answers.

- Provide personalized feedback and suggestions for improvement.

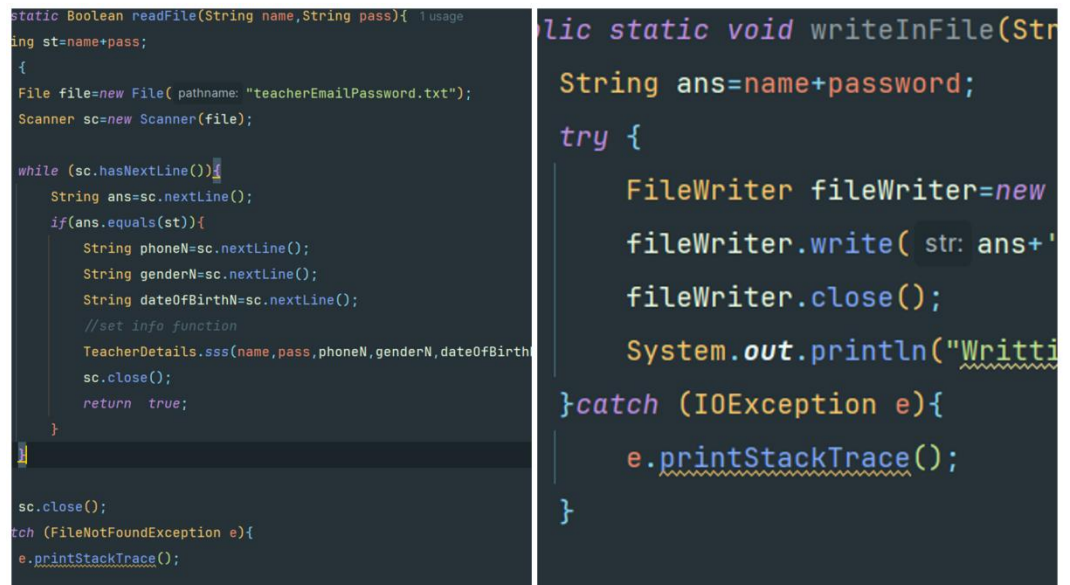
### Visual Elements:

- Maintain a consistent and engaging theme with appropriate color schemes and fonts to enhance readability.
- Ensure that the interface is intuitive, with clear labels and navigation paths.

## 4.3 Additional Considerations for System Design:

### 4.3.1 Data Management:

Design a database schema or file structure to store user accounts, quiz questions, answers, and results securely. Ensure efficient retrieval and updating mechanisms.



```

static Boolean readFile(String name,String pass){
    String st=name+pass;
    {
        File file=new File( pathname: "teacherEmailPassword.txt");
        Scanner sc=new Scanner(file);

        while (sc.hasNextLine()){
            String ans=sc.nextLine();
            if(ans.equals(st)){
                String phoneN=sc.nextLine();
                String genderN=sc.nextLine();
                String dateOfBirthN=sc.nextLine();
                //set info function
                TeacherDetails.sss(name,pass,phoneN,genderN,dateOfBirthN);
                sc.close();
                return true;
            }
        }

        sc.close();
        catch (FileNotFoundException e){
            e.printStackTrace();
        }
    }
}

public static void writeInFile(String name,String password){
    String ans=name+password;
    try {
        FileWriter fileWriter=new FileWriter("teacherEmailPassword.txt");
        fileWriter.write( str: ans+' ');
        fileWriter.close();
        System.out.println("Written successfully");
    }catch (IOException e){
        e.printStackTrace();
    }
}

```

**Fig 4.4: Read & Write Operation**

#### **4.3.2 Socket Communication:**

Implement real-time socket communication to allow instant feedback and interaction during quizzes, especially when students submit answers.

#### **4.3.3 Error Handling:**

Include comprehensive error handling throughout the application to manage unexpected inputs, connection issues, or data retrieval failures gracefully.

#### **4.3.4 Testing and Debugging:**

Plan for testing the application, including unit tests for individual components and integration tests for the overall system, to ensure all functionalities work as intended.

#### **4.3.5 User Documentation:**

Develop user guides and help documentation to assist users in navigating the application and troubleshooting common issues.

### **4.4 Step-by-Step Development:**

#### **Step 1: Creating the GUI**

**Overview:** Design the user interface for both teachers and students using JavaFX and Scene Builder to ensure a modern and user-friendly experience.

#### **Tasks:**

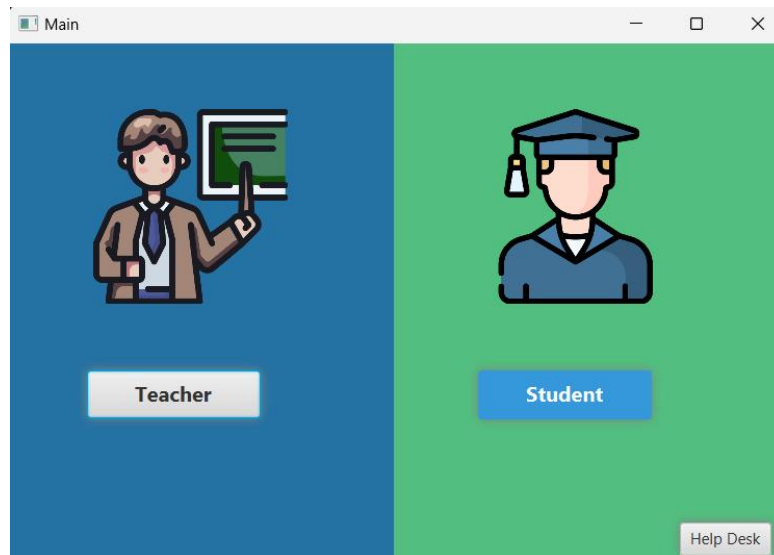
##### **I. Setup Project:**

- ◆ Create a new JavaFX project in IntelliJ IDEA.
- ◆ Include the JavaFX library in your project dependencies.



## II. Home Page:

- ◆ Use Scene Builder to design the home page layout.
- ◆ Add buttons for "Teacher" and "Student" with distinct styles.



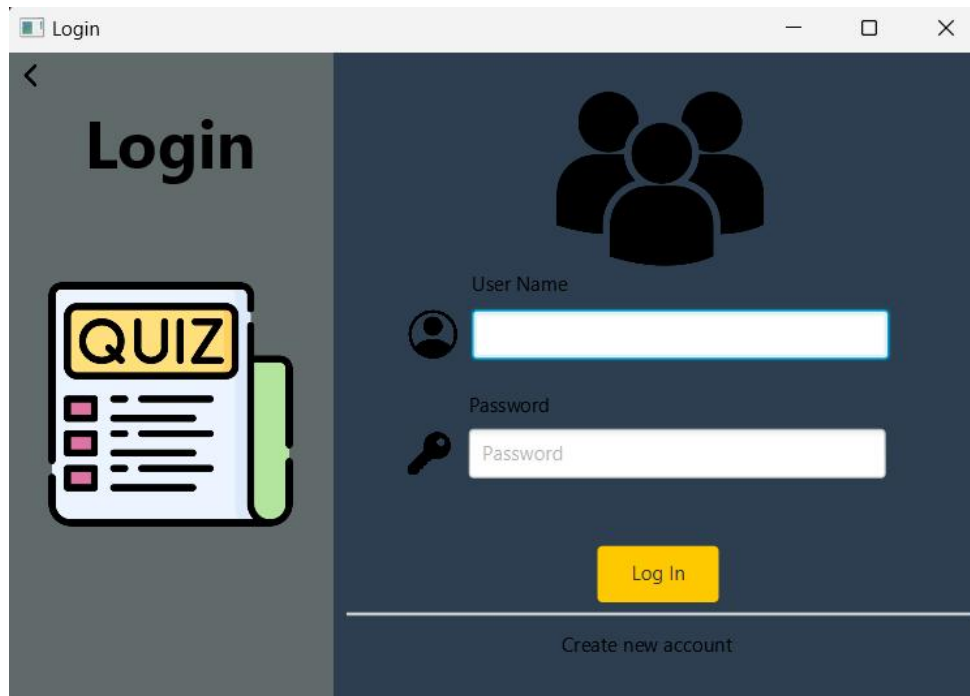
**Fig 4.5: Homepage**

## III. Login Pages:

- ◆ Design separate FXML files for teacher and student login pages.
- ◆ Include input fields for username and password, along with buttons for login and account creation.

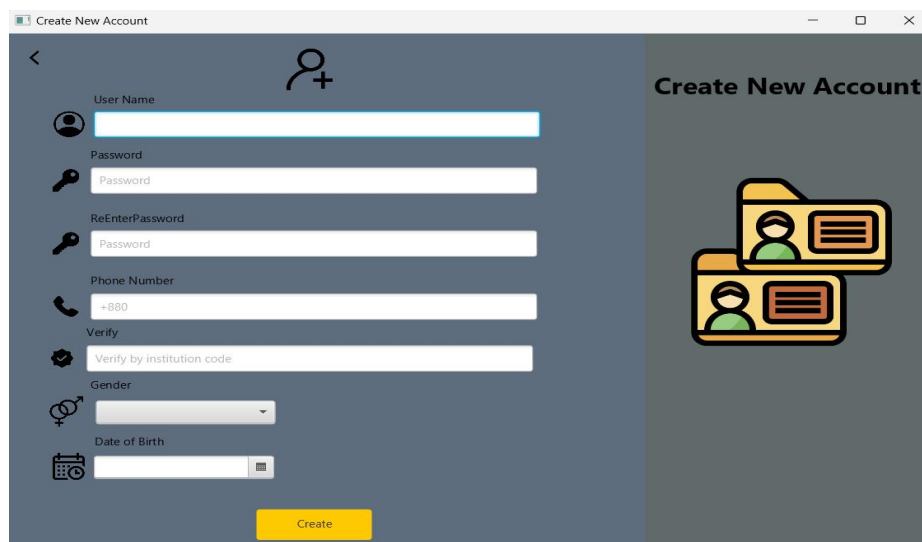
## IV. Teacher's Interface:

- ◆ Create a layout for the teacher's section with buttons for setting quizzes, viewing student lists, and checking results.
- ◆ Design the quiz setup interface with fields for entering question details, options, and timers.



**Fig 4.6 Teacher Account Login Page**

**If Teacher want to create new account:**



**Fig 4.7 Teacher Account Sign up Page**

## **V. Student's Interface:**

- ◆ Design the student interface with buttons for starting quizzes, viewing results, and accessing university information.
- ◆ Create a quiz-taking interface that displays one question at a time and provides options for answers.

The screenshot shows a web browser window titled 'Login'. The page has a green sidebar on the left with a back arrow and a 'Login' title. Below the title is a 'QUIZ' icon. The main content area is blue and features a group of three people icon. Below this icon are two input fields: 'User Name' and 'Password'. A yellow 'Log In' button is positioned below the password field. At the bottom of the main area, there is a link that says 'Create new account'.

**Fig 4.8 Student Account Login Page**

**If student want to create new account:**

The screenshot shows a web browser window titled 'Create New Account'. The page has a blue sidebar on the left with a back arrow and a user icon. The main content area is blue and features a sign-up form with the following fields: 'User Name', 'Password', 'ReEnterPassword', 'Phone Number', 'Verify' (with a sub-label 'Verify by code'), 'Gender' (with a dropdown menu), and 'Date of Birth' (with a calendar icon). A yellow 'Create' button is at the bottom of the form. The right sidebar is green and contains the title 'Create New Account' and an icon of two user cards.

**Fig 4.9 Student Account Sign up page**

### **Considerations:**

- ◆ Maintain consistent styling across the application.
- ◆ Use layouts like VBox, HBox, and GridPane for a responsive design.

## **Step 2: Developing User Authentication**

**Overview:** Implement user authentication to ensure that only registered users can access the application.

### **Tasks:**

#### **I. User Registration:**

- ◆ Create an interface for account creation, prompting users for necessary details (username, password, role).
- ◆ Implement input validation to ensure data integrity (e.g., checking for existing usernames).

#### **II. Storing Credentials:**

- ◆ Use file handling (e.g., FileReader and FileWriter) to store user credentials securely in a file.

#### **III. Login Functionality:**

- ◆ Implement logic to read user data from the file during login attempts.
- ◆ Validate credentials against stored data, providing feedback for incorrect entries.

### **Considerations:**

- I. Ensure security measures are in place to protect user information.

**II. Handle exceptions gracefully during file operations.**

### **Step 3: Implementing Quiz Functionality**

**Overview:** Enable teachers to create and manage quizzes, including adding, updating, and deleting questions.

#### **Tasks:**

##### **I. Setting Quiz Questions:**

- ◆ Create a form for teachers to input question ID, text, multiple-choice options, and correct answers.
- ◆ Implement input validation to ensure all fields are filled out correctly.

##### **II. Updating and Deleting Questions:**

- ◆ Provide options to edit or remove existing questions.
- ◆ Implement search functionality to locate questions by ID for easy management.

##### **III. Data Management:**

- ◆ Using File handling

#### **Considerations:**

- I. Ensure that quiz questions are unique and well-formatted.
- II. Implement error handling for data operations.

## **Step 4: Integrating Socket Programming**

**Overview:** Enable real-time communication between the teacher (acting as a server) and students (clients) using socket programming.

### **Tasks:**

#### **I. Server Setup:**

- ◆ Create a `TeacherServer` class that listens for incoming connections from student clients.
- ◆ Implement functionality to handle multiple client connections concurrently (consider using threading).

#### **II. Client Setup:**

- ◆ Develop a `StudentClient` class that connects to the teacher's server.
- ◆ Implement methods for sending answers and receiving questions in real time.

#### **III. Communication Protocol:**

- ◆ Define a simple protocol for communication .
- ◆ Implement logic to broadcast quiz questions to all connected students when the quiz starts.

### **Considerations:**

- I. Ensure thread safety when managing multiple client connections.
- II. Handle disconnections gracefully, providing feedback to users.

### **In Depth:**

Socket Programming mainly operated by two class.

- ◆ **ServerSocket**(for Sever-side)
- ◆ **Socket**(for communicate with server and client)

Used different classes and methods:

- In **ServerSocket** class:

**ServerSocket serverSocket = new ServerSocket(12345);**

Here, 12345 is a port number of server to connect client.

**Note: Port number 0 to 1023 is reserved,you can't use these number.Example: HTTP: 443**

- **accept():** This method waits for connecting or listening from client.After connected by clients, it creates an object of **Socket** which is used for communicating.This method operate inside **while(true)** loop for continuously listen for incoming client connection.

**Socket socket=serverSocket.accept();**

- **ObjectInputStream class:** This class is used for read data from client. But firstly data come/ serialized as byte data(Binary form) then **Object class** convert/deserialized it object from and lastly it convert in text form by **InputStreamReader**.

- **ClientHandler Class:** The **ClientHandler** class is responsible for reading incoming data from the client socket, processing it, and sending back the appropriate response.

**ClientHandler clientHandler=new ClientHandler(clientSocket,questions)**

**clientHandler.start()**

- **Start():** This method started threading and call actually **run()** method in client side

- **ObjectOutputStream:** This class is for sent data to the client or server(e.g., questions)

```

ObjectOutputStream out=new
ObjectOutputStream(clientSocket.getOutputStream());

Out.writeObject(questions)

```

This sends the entire list of questions from the server to the client. The client can then receive and deserialize this object.

- **List<Question>:** Java's collection framework and represents an ordered collection of objects. A list allows duplicate elements and maintain the order in which elements are inserted. Here we can use some function(e.g., get(), add(), remove()).

```

List<Question> question =new ArrayList<>();

Questions.add(new Question("-----?"));

```

**In this Project:**

**a)Firstly at Set Question Number Page,then execute this code:**

```

questionCountLabel = new Label("Number of Questions:");

    questionCountLabel.setFont(Font.font("Arial", 16));

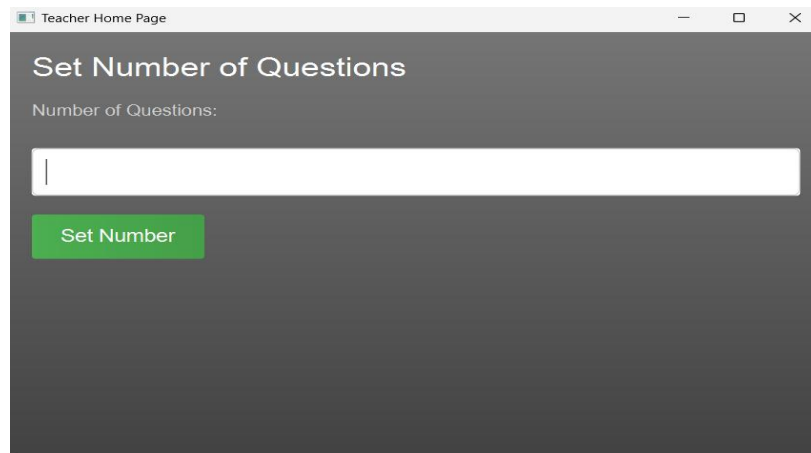
    questionCountLabel.setTextFill(Color.LIGHTGRAY); // Light gray text
color

    HBox labelBox = new HBox(questionCountLabel);

    labelBox.setPadding(new Insets(0, 0, 10, 0));

```





**Fig 4.10 Set Question Number**

**b) Entry a number, then execute this code(Call OpenQuestionDetails):**

```

    Button setNumberButton = new Button("Set Number");

    setNumberButton.setFont(Font.font("Arial", 18));

    setNumberButton.setStyle("-fx-background-color: linear-gradient(to right, #4CAF50,
#45A049); -fx-text-fill: white; -fx-padding: 12px 24px; -fx-border-radius: 5px;");

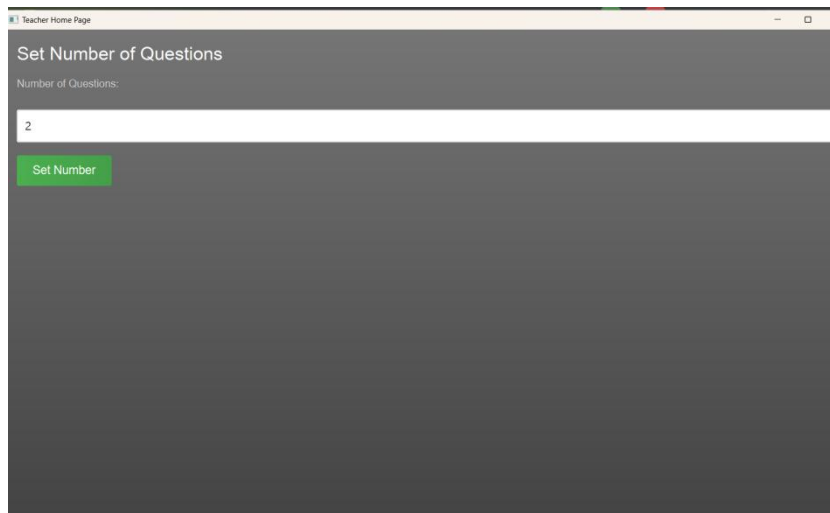
    setNumberButton.setOnAction(e -> {

        int questionCount = Integer.parseInt(questionCountField.getText());

        openQuestionDetailsPage(questionCount, primaryStage);

    }); // Suppose Question number set 2, so questionCount for openQuestionDetailsPage is 2

```



**Fig 4.11 Entry of the question number**

**C) After calling `openQuestionDetailsPage`, we can see:**

**Note: There is Add Question Button is Enabled and Start Quiz Button is Disabled.**

It's disabled until required question number don't match with current question.

**Code:**

```
if (currentQuestion == questionCount) {  
  
    addButton.setDisable(true);  
  
    startQuizButton.setDisable(false);  
  
    } else {  
  
        clearFields();  
  
    }
```

Teacher Home Page

Question ID

Question

Option 1

Option 2

Option 3

Option 4

Answer

Timer (seconds)

Add Question

Start Quiz

**Fig 4.12 Question Set Window**

- After set a question, it will be refresh for next question:

**Code:**

```
private void refreshQuestionIdComboBox() {

    Platform.runLater() -> {

        questionIdComboBox.setItems(FXCollections.observableArrayList(getQuestionIds()));

    });

}
```

- If any field is blank then it will show error notification.

Question ID

Question

Option 1

Option 2

Option 3

Option 4

Answer

Timer (seconds)

Add Question

Start Quiz

Select Question ID to Update

Update Question

Validation Error

Please fill in all fields correctly.

OK

**Fig 4.13: Error notification for blank field**

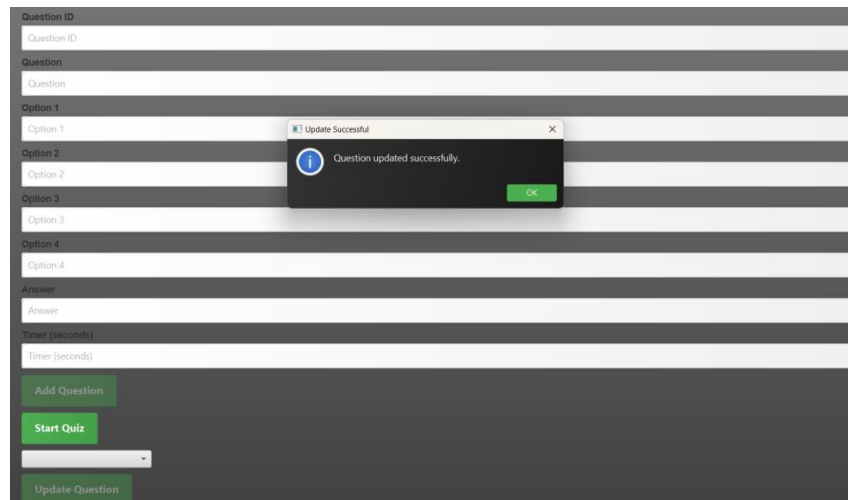
**Code:**

```
if (!isValid) {  
    showAlert(Alert.AlertType.WARNING, "Validation Error", "Please fill in all fields correctly.");  
}
```

➤ If we want to update any question:

**Code:**

```
private void updateQuestion() {  
    if (!validateFields()) {  
        return; }  
  
    String id = idField.getText();  
  
    String questionText = questionField.getText();  
  
    String option1 = option1Field.getText();  
  
    String option2 = option2Field.getText();  
  
    String option3 = option3Field.getText();  
  
    String option4 = option4Field.getText();  
  
    String answer = answerField.getText();  
  
    int timer = Integer.parseInt(timerField.getText());  
  
    for (Question q : questions) {  
        if (q.getId().equals(id)) {  
            q.setQuestionText(questionText);  
  
            q.setOption1(option1);  
  
            q.setOption2(option2);  
  
            q.setOption3(option3);  
  
            q.setOption4(option4);  
  
            q.setAnswer(answer);  
  
            q.setTimer(timer);  
  
            break; } }  
}
```



**Fig 4.14: Question update notification**

**D) Now all set, we can see Start Quiz Button is enabled, Add Question button is disabled.**



**Fig 4.15: Enabled Start Quiz button**

➤ **After Clicking Start Quiz Button:**

```
private void startQuiz() {
    // Send questions to students via socket
    new Thread(() -> {
        try (ServerSocket serverSocket = new ServerSocket(12345)) {
            while (true) {
```

```

        Socket clientSocket = serverSocket.accept();

        ObjectOutputStream out = new ObjectOutputStream(clientSocket.getOutputStream());

        // String message="Student! Are you ready";

        // out.writeObject(message);

        out.writeObject(questions);

        clientSocket.close();

    }

} catch (IOException e) {

    e.printStackTrace();

}

}).start();

// Show confirmation window

Platform.runLater() -> {

    Alert alert = new Alert(Alert.AlertType.INFORMATION);

    alert.setTitle("Quiz Information");

    alert.setHeaderText(null);

    // alert.setContentText("Student! are you ready");

    alert.setContentText("Questions are ready. Please start the exam.");

    alert.showAndWait();

    // Clear fields and update UI elements if needed

    clearFields();

    addButton.setDisable(true);

    startQuizButton.setDisable(true);

});

}

```

The image shows a quiz interface with a dark grey background. At the top, there is a red bar labeled "Question ID". Below it, a "Question" field is visible. The interface lists four options: "Option 1", "Option 2", "Option 3", and "Option 4". Below the options is an "Answer" field. At the bottom, there is a "Timer (seconds)" field. A modal dialog box titled "Quiz Information" is centered on the screen, displaying the message "Questions are ready. Please start the exam." with an "OK" button. At the bottom of the interface, there are three green buttons: "Add Question", "Start Quiz", and "Update Question".

**Fig 4.16: Start Quiz and server on**

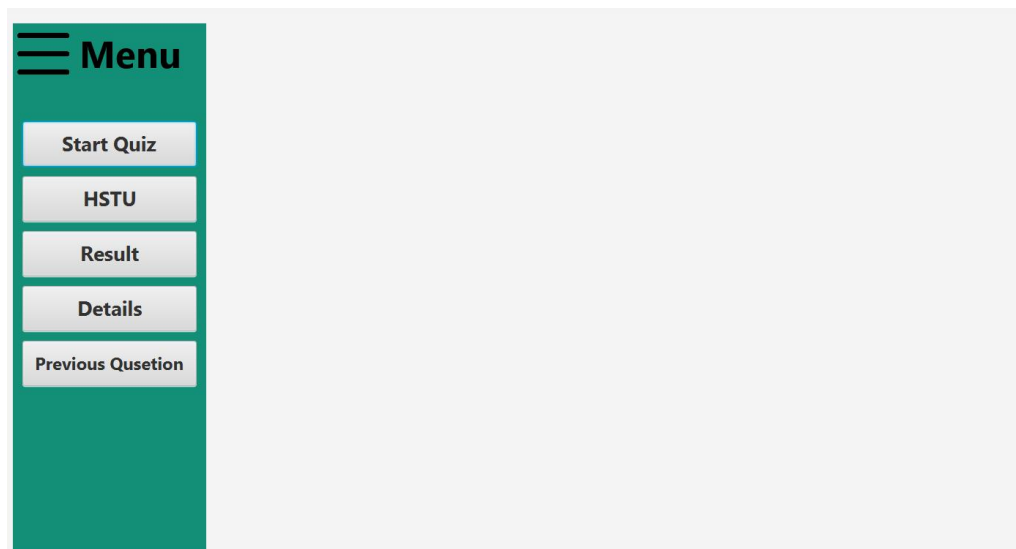
## Student Client:

### In Socket Class:

```
Socket socket=new socket("localhost",12345);
```

```
[localhost=127.0.0.1]
```

### A) After Student Login:



**Fig 4.17: After successful student login**

➤ **Click Start Quiz Button:**

**Code:**

```
// Fetch questions from server

new Thread() -> {

    try (Socket socket = new Socket("localhost", 12345)) {

        ObjectInputStream in = new ObjectInputStream(socket.getInputStream());

        // String message = (String) in.readObject();

        //System.out.println("Message: "+message);

        questions = (List<Question>) in.readObject();

        startTime = System.currentTimeMillis();

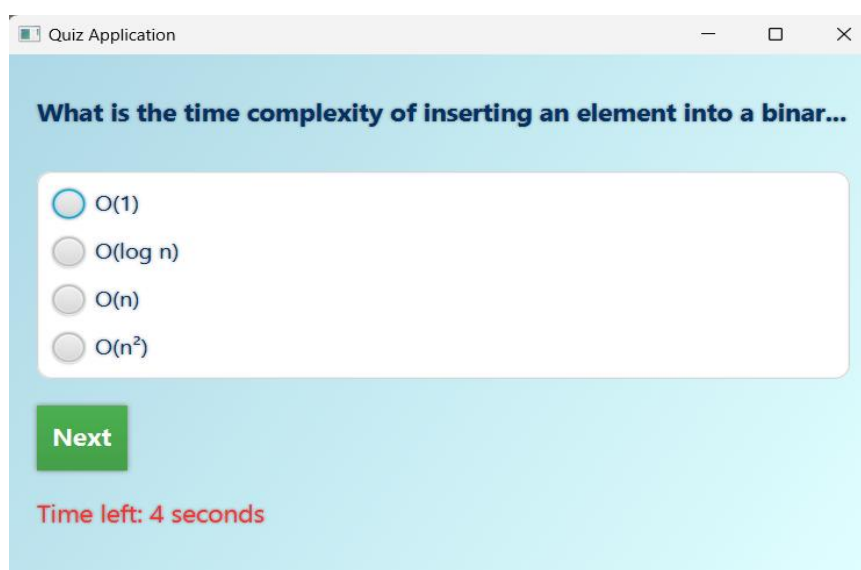
        Platform.runLater() -> showQuestion(layout, primaryStage));

    } catch (Exception e) {

        e.printStackTrace();

    }

}).start();
```

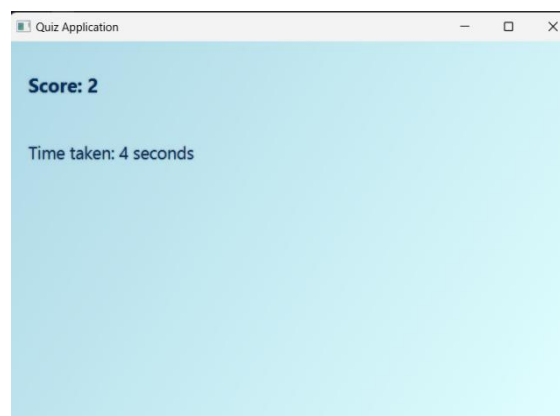


**Fig 4.18: Student participation in quiz**



### After Submission all questions:

```
private void showResults(VBox layout) {  
  
    long timeTaken = (endTime - startTime) / 1000;  
  
    Label scoreLabel = new Label("Score: " + score);  
  
    scoreLabel.setStyle("-fx-font-size: 20px; -fx-font-weight: bold; -fx-text-fill: #003366;");  
  
    scoreLabel.setEffect(new DropShadow(3, Color.GRAY));  
  
    scoreLabel.setPadding(new Insets(10, 0, 10, 0));  
  
  
    Label timeLabel = new Label("Time taken: " + timeTaken + " seconds");  
  
    timeLabel.setStyle("-fx-font-size: 18px; -fx-text-fill: #003366;");  
  
    timeLabel.setEffect(new DropShadow(3, Color.GRAY));  
  
    timeLabel.setPadding(new Insets(10, 0, 10, 0));  
  
    layout.getChildren().clear();  
  
    layout.getChildren().addAll(scoreLabel, timeLabel);  
  
    //set it to file  
  
    String time= String.valueOf(timeTaken);  
  
    String sscore= String.valueOf(score);  
  
    StudentFileHandling.appendedResult("result.txt",sscore,time); } }
```



**Fig 4.19: Quiz Result**

### **Threading:**

- Without threads, a server can handle only one client at a time. If a client sends a request, the server must wait for the client to finish before moving on to the next request.
- By using threads, each client connection is handled in its own thread. This means multiple clients can send requests to the server simultaneously, and the server can process all of them in parallel.

### **Execution order**

#### **Server-side:**

- The server waits for a client connection: `serverSocket.accept()` (Step 1).
- A `ClientHandler` object is created: `new ClientHandler(clientSocket, questions)` (Step 2).
- The `ClientHandler` constructor assigns socket and questions to instance variables (Steps 4, 5, 6).
- The `ClientHandler` thread is started by calling `clientHandler.start()` (Step 3).

#### **ClientHandler (thread):**

- The `run()` method of `ClientHandler` is executed (Step 7).
- An `ObjectOutputStream` is created to send data over the socket (Step 8).
- The list of questions is written to the output stream and sent to the client: `out.writeObject(questions)` (Step 9).
- The socket is closed: `socket.close()` (Step 10).

### **Step 5: Designing Results Display**

**Overview:** Create a results display interface for students to review their performance after completing a quiz.

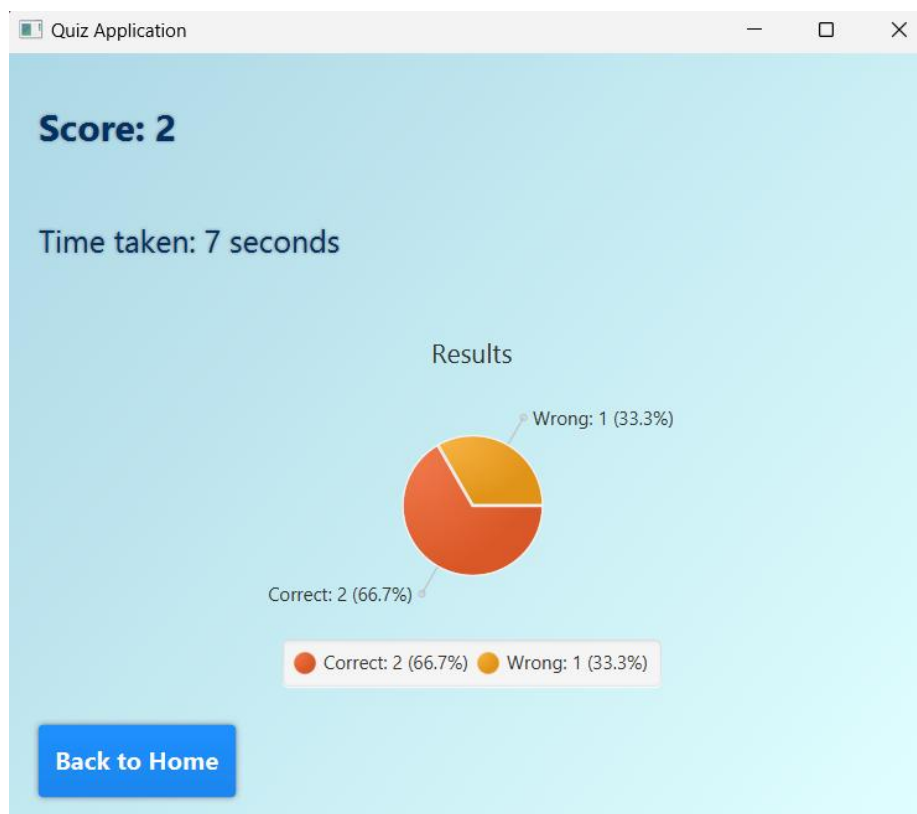
## Tasks:

### I. Results Interface:

- ◆ Design a results page that shows the student's score, time taken, and performance metrics.

### II. Data Visualization:

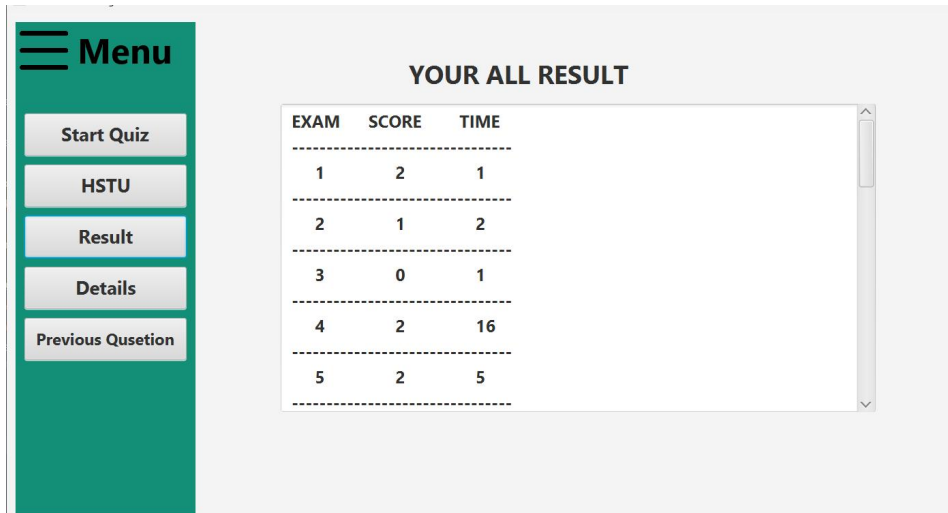
- ◆ Integrate JavaFX charts (e.g., PieChart, BarChart) to visually represent student performance (correct vs. incorrect answers).
- ◆ Display detailed feedback for each question, indicating whether the answer was correct or incorrect.



**Fig 4.20: detailed quiz result with pie chart**

### III. Previous Results:

- ◆ Implement functionality to store and retrieve past results of all past quizzes.



The screenshot shows a web application interface. On the left is a green sidebar with a 'Menu' header and five buttons: 'Start Quiz', 'HSTU', 'Result', 'Details', and 'Previous Qusetion'. The main area is light gray and contains a table titled 'YOUR ALL RESULT'. The table has three columns: 'EXAM', 'SCORE', and 'TIME'. It lists five rows of quiz results.

EXAM	SCORE	TIME
1	2	1
2	1	2
3	0	1
4	2	16
5	2	5

**Fig 4.21: All previous results**

### Considerations:

- I. Ensure that the results interface is intuitive and easy to understand.
- II. Provide options for students to review specific questions and answers.

## **Results and Discussion**

### **5.1 Application Overview:**

#### **5.1.1 System Functionality**

The application is a desktop-based quiz management system developed using JavaFX, incorporating socket programming for real-time interactions between teachers and students. The system provides a secure and intuitive platform for conducting quizzes, managing user accounts, and tracking performance.

##### **5.1.1.1 User Authentication:**

- I. **Secure Login:** Both teachers and students must log in to access their respective sections of the application. User credentials are securely stored and validated against encrypted passwords, ensuring data integrity and security.
- II. **Account Management:** Users can create new accounts with a simple registration process, which includes input validation to prevent duplicate usernames and ensure that all necessary information is provided.

##### **5.1.1.2 Quiz Management:**

- I. **Teacher Functionality:** Teachers can create, update, and delete quiz questions. They can set parameters for each question, including question text, multiple-choice options, the correct answer, and a timer for each question. This allows for tailored quizzes based on specific educational goals.
- II. **Question Storage:** Questions are stored in text files and used in program using file handling methods.

#### **5.1.1.3 Examination Process:**

- I. **Real-Time Interaction:** Using socket programming, the application facilitates seamless communication between the teacher and students during the exam. The teacher (server) can send questions to all connected students (clients) at once, ensuring everyone starts at the same time.
- II. **Student Interface:** Students receive questions and answer them in real time. The interface is designed to be user-friendly, with clear instructions and intuitive navigation. Once the quiz is completed, students receive immediate feedback on their performance.

#### **5.1.1.4 Result Tracking:**

- I. **Performance Feedback:** After completing the quiz, students can view their scores, time taken, and detailed feedback on their answers. This feature helps students understand their strengths and areas for improvement.
- II. **Data Visualization:** The application uses JavaFX charts to display results visually, providing a clear and engaging way for students to review their performance. For example, pie charts show the percentage of correct versus incorrect answers, while bar charts can illustrate performance trends over multiple quizzes.

### 5.1.2 Help Desk and Information:

**University Information:** The application includes a help desk feature that provides students with essential university information, such as a brief overview of the university, course lists, and teacher details. This helps create a holistic educational environment within the application.

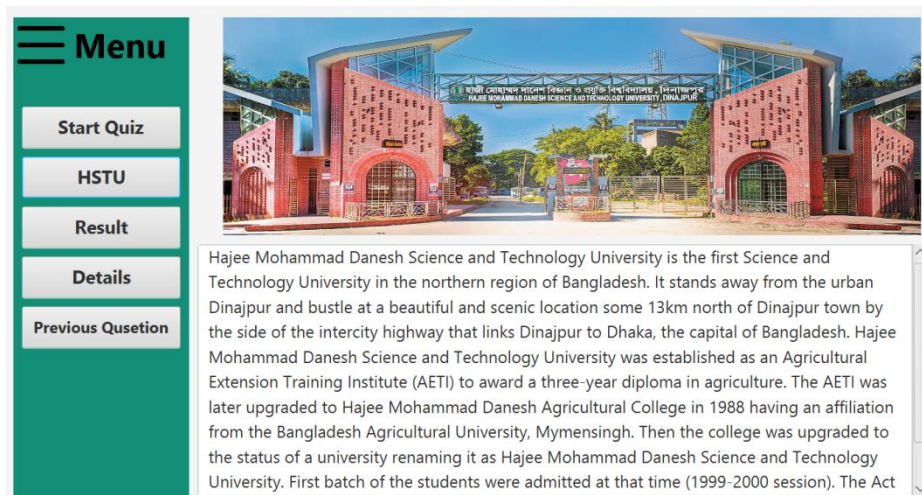


Fig 5.1: University information

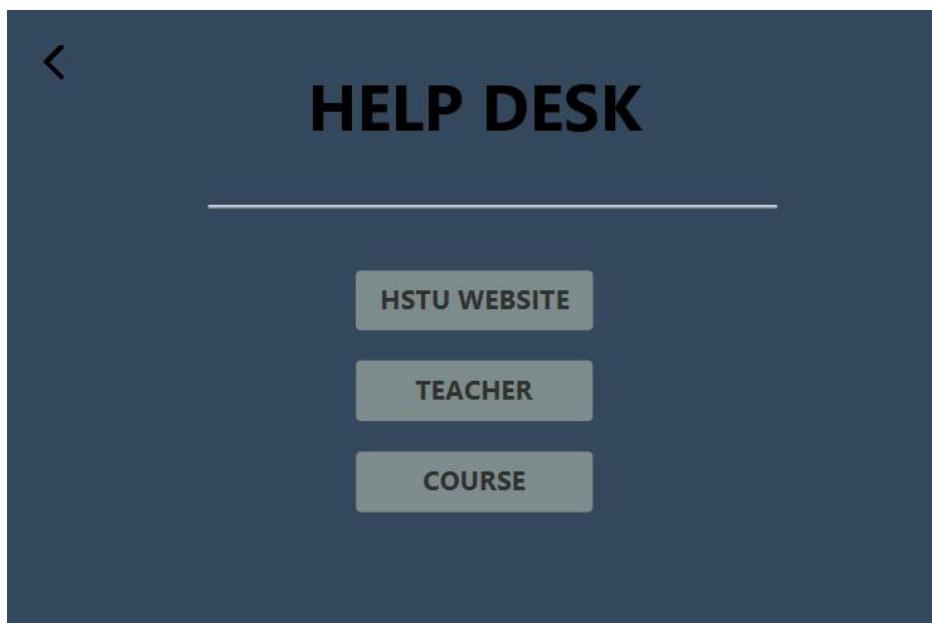


Fig 5.2: Help desk window

### 5.1.3 User Interactions

#### 5.1.3.1 Teacher Workflow:

- I. Log in to the teacher section.
- II. Create or manage quizzes, including adding questions and setting parameters.
- III. Start a quiz, monitoring student progress in real time.
- IV. Review student results after quiz completion, analyzing overall performance.

#### 5.1.3.2 Student Workflow:

- I. Log in to the student section.
- II. Start quizzes that are available.
- III. Answer questions in real time, receiving immediate feedback on their responses.
- IV. View past results and track performance over time.

### 5.1.4 Technical Architecture

#### 5.1.4.1 Frontend:

- I. **JavaFX:** The user interface is built using JavaFX, which provides rich graphical capabilities and allows for the creation of a modern, responsive design.
- II. **Scene Builder:** Utilized for drag-and-drop interface design, enhancing the development process and allowing for rapid prototyping of UI elements.

#### 5.1.4.2 Backend:

- I. **Socket Programming:** A server-client architecture facilitates real-time communication between teachers and students. The server manages connections and broadcasts quiz questions, while clients respond with their answers.



II. **File Handling:** User data, quiz questions, and results are managed through file handling, ensuring persistence of information between sessions. This includes secure storage of user credentials.

#### 5.1.5 Overall Benefits

I. **User-Friendly Interface:** The design prioritizes usability, with clear navigation paths for both teachers and students.

**Immediate Feedback:** Real-time feedback enhances the learning experience for students, allowing them to grasp concepts quickly.

### 5.2 Discussion:

The system provides an efficient solution for Quiz examinations at HSTU. However, using file management for storing data could become cumbersome with more users. Migrating to a database system could improve scalability. The system's real-time features through socket programming work well, ensuring an interactive experience.

## **Economic Analysis**

### **6.1 Cost Efficiency**

- **Reduced Administrative Costs:** The traditional examination process often incurs substantial administrative costs, including printing exam papers, managing exam venues, hiring invigilators, and manually grading exams. The Quiz Examination System can significantly reduce these costs by automating most of the exam-related processes, such as quiz creation, real-time participation, and result generation. This leads to cost savings for the university in terms of manpower, printing, and logistical arrangements.
- **Lowered Infrastructure Costs:** With online systems, there is less need for physical infrastructure such as examination halls. This can be particularly beneficial for educational institutions like Hajee Mohammed Danesh Science and Technology University (HSTU), where managing space for large numbers of students can be logistically challenging and expensive.

### **6.2 Time and Labor Savings**

- **Automation of Examination Processes:** Automating grading and exam management processes reduces the workload on teachers, enabling them to focus more on instruction and other educational activities. This increases productivity and lowers labor costs, as fewer resources are required to handle the logistics of exams.
- **Immediate Feedback:** The system's ability to provide real-time feedback allows students to understand their performance immediately. This reduces the need for manual result processing and increases efficiency in the learning process.

### 6.3. Improved Accessibility and Equity

- **Remote Accessibility:** By providing a platform that allows students to take exams from anywhere, the system increases accessibility to education, which could attract more students, including those from remote areas. Increased enrollment can lead to higher tuition revenue for the university.
- **Equal Opportunity for Students:** Features like real-time participation, automated grading, and time-bound quizzes ensure that all students are evaluated fairly. This can foster trust in the examination process, potentially improving the institution's reputation and attracting more students.

### 6.4 Potential Revenue Generation

- **Monetization Opportunities:** The system could be monetized by offering it as a service to other educational institutions or by integrating it with other online learning platforms. This could generate additional revenue streams for the university.

## **Conclusion**

### **7.1 Summary:**

The project has successfully developed a robust Quiz examination system utilizing JavaFX and socket programming. This system allows teachers to set quizzes and administer exams, while students can participate and receive real-time feedback on their performance. The core strengths of the system include:

- I. **Real-Time Interaction:** The application leverages socket programming to ensure that questions are delivered to students simultaneously, facilitating a smooth examination process.
- II. **User-Friendly Interface:** The design emphasizes ease of use, allowing both teachers and students to navigate through the application intuitively. Clear layouts and buttons guide users through the various functionalities.
- III. **Instant Feedback:** Students receive immediate results upon quiz completion, enabling them to understand their performance and areas for improvement right away.

### **7.2 Limitations**

Despite its strengths, the project faces certain limitations that may affect its long-term viability and user satisfaction:

#### **7.2.1 Data Storage:**

- I. Currently, the system relies on file handling for storing user credentials, quiz questions, and results. While this approach is straightforward, it poses challenges in terms of scalability and data integrity. As the number of users and quizzes increases, managing data through files could lead to performance bottlenecks, potential data corruption, and difficulties in handling concurrent access.

### 7.2.2 User Interface Customization:

- I. The current interface, while functional, lacks advanced styling and customization options. Enhancing the visual appeal through modern design techniques, such as CSS, could significantly improve user engagement and satisfaction. A more polished interface would also help convey a professional image of the application.

## 7.3 Future Work

To address the identified limitations and enhance the overall functionality and user experience of the application, several improvements are planned for future iterations:

### 7.3.1 Database Integration:

- I. Transitioning from file-based storage to a relational database (such as MySQL or PostgreSQL) will allow for better data management. This integration will provide:
  - **Improved Scalability:** A database can efficiently handle large volumes of data, supporting many simultaneous users without performance degradation.
  - **Data Integrity:** Databases provide mechanisms for enforcing data consistency and integrity, reducing the risk of data corruption.
  - **Advanced Query Capabilities:** Using SQL will enable complex queries and data analytics, allowing for better insights into student performance and quiz statistics.

### 7.3.2 Improved UI/UX:

- I. To create a more engaging and intuitive user experience, the following enhancements will be implemented:

- ◆ **Modern Styling Techniques:** Integrating CSS into the JavaFX application will allow for greater customization of the UI. This could include the use of responsive layouts, attractive color schemes, and hover effects to enhance interactivity.
- ◆ **User Testing:** Conducting usability testing with real users to gather feedback on the interface will help identify pain points and areas for improvement.

### 7.3.3 Expanded Features:

- I. To broaden the scope of the application and enhance its educational value, several features will be added:

- ◆ **Support for Various Question Types:** Introducing different formats such as fill-in-the-blanks, true/false questions, and essay-style questions will make quizzes more diverse and comprehensive.
- ◆ **Robust Result Analytics:** Implementing analytics tools that provide detailed insights into quiz performance will allow both teachers and students to track progress over time. This could include visualizations like histograms, average scores, and trends in performance across different subjects.