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I confirm that I understand my coursework needs to be submitted online via Google Classroom under the relevant module page before the deadline in order for my assignment to be accepted and marked. I am fully aware that late submissions will be treated as non-submission and a marks of zero will be awarded.

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1 Introduction

This is an individual course of the software engineering module that carries 35% grades of our total grade. This coursework is mainly about creating a online system for McGregor Institute of Botanical Training which is an Ireland based training institute located at Godawari, Lalitpur which has been operating in Nepal since 7 years. It provides different undergraduate and postgraduate courses specializing in agriculture along with horticulture specializations and is affiliated to Dublin City University.

Now our job is to design and implement a proper system for the McGregor institute that has functionalities like register, join the program, purchase plant, payment, etc.

1.2 Methodology

Software development methodologies are frameworks or models that guide the software development process and define the roles, responsibilities, activities, and deliverables of the software development team. Methodologies provide structured frameworks for planning, executing, and managing projects, which leads to better utilization of resources and streamlined workflows (geeksforgeeks, 2024).

For the development of our system, we will be using the agile methodology because of its flexible and reliable nature. Agile methodology will make the development process of our system much smoother.

2 WBS & Gantt Chart

2.1 Work Breakdown Structure

WBS is one of the most important project management documents that integrates scope, cost and schedule baselines ensuring that project plans are in alignment. It achieves this by breaking work into smaller, more manageable, and approachable tasks (WorkBreakdownStructure.com, 2024).

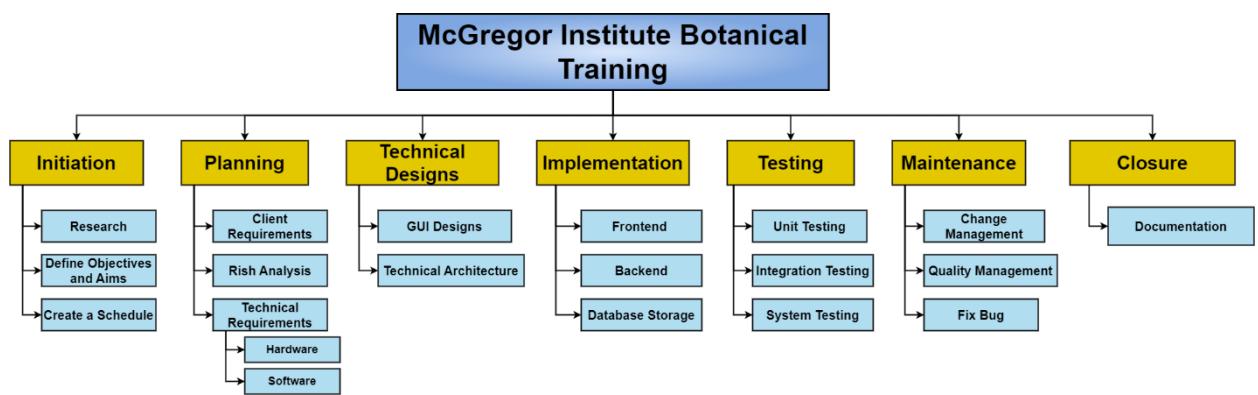


Figure 1: WBS.

2.2 Gantt Chart

Gantt Chart is a project management tool that allows project managers to create a project schedule. It allows us to easily map out project plans by organizing project tasks on a visual timeline. It is very important for keeping track of the progress in our project (Project Manager, 2024).

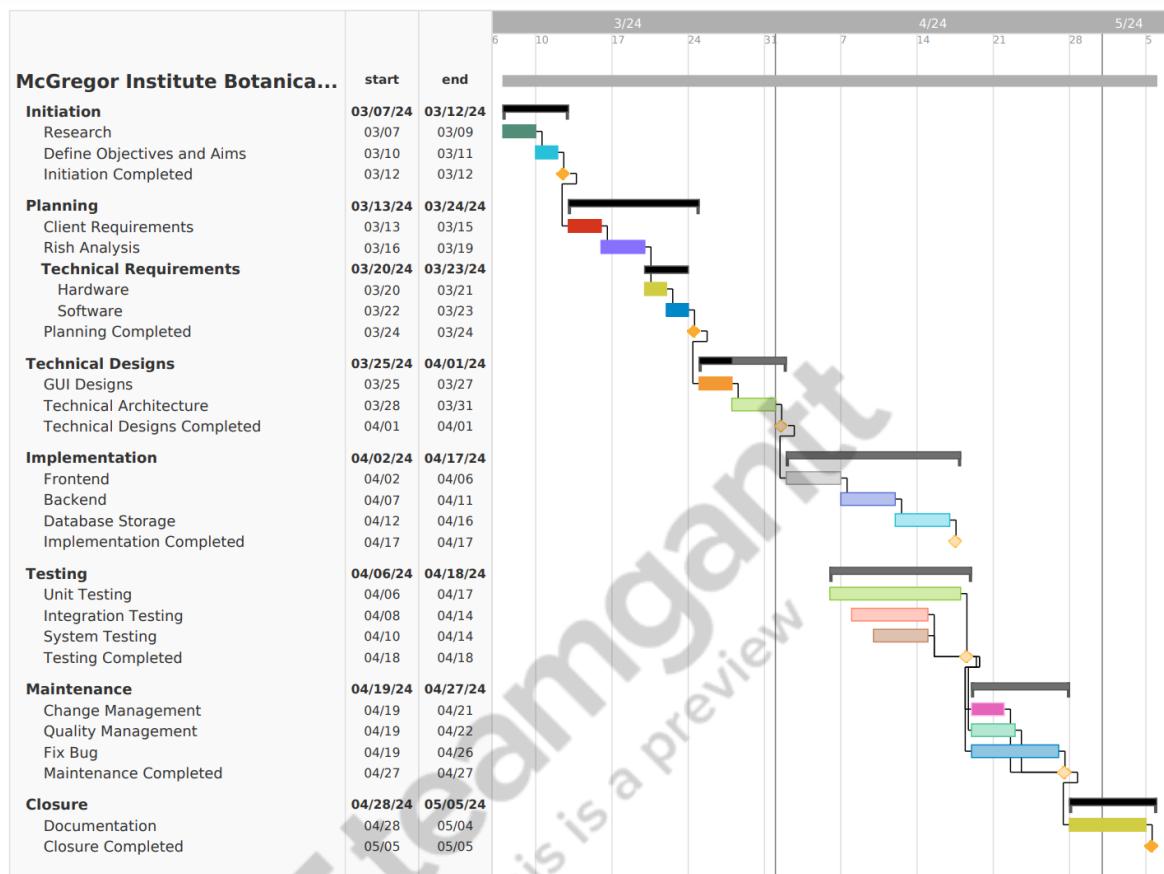


Figure 2: Gantt Chart.

3 Use Case

3.1 Use Case Diagram

Use case diagram is helps to set the context of all the roles (human and other systems) who interact with or get value from the system. It is useful for visualizing the functional requirements of a system from the perspective of its users (SpaxSystems, 2024).

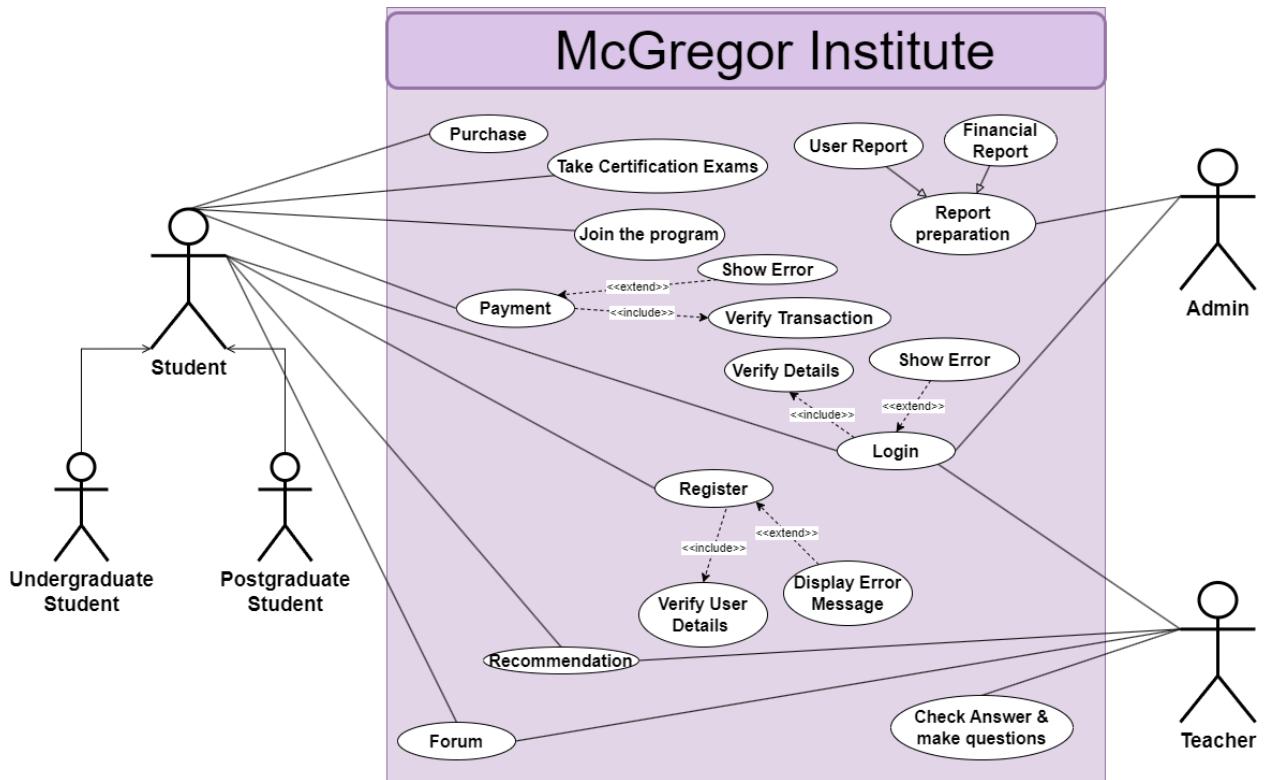


Figure 3: Use Case Diagram.

3.2 High level Use Case

- i) **Name:** Register
Actors: Student, Teacher
Description: The teacher and student both should first register in the system and create an account to use it.

- ii) **Name:** Login
Actors: Student, Admin, Teacher
Description: All the users should login to the system to use it.

- iii) **Name:** Forum
Actors: Student, Teacher
Description: Teachers and students can engage in conversation through posts using the forum function provided by the system.

- iv) **Name:** Recommendation
Actors: Student, Teacher
Description: Students can ask teachers questions related to plants and the teachers can answer those questions using the recommendation function.

- v) **Name:** Purchase
Actors: Student
Description: Students can purchase the plants offered for sale using the purchase function.

- vi) **Name:** Join the program
Actors: Student
Description: Students can enroll in a program offered by the system and can study using the course materials provided by the teachers.

- vii) **Name:** Payment
Actors: Student

Description: Students can pay for the purchase they made using the payment function.

viii) **Name:** Take Certification Exam

Actors: Student

Description: After completing a course, students can take certification exams or mock tests using the system.

ix) **Name:** Check Answers and make questions

Actors: Teacher

Description: The teachers can make questions and upload it to the system, they can also download the answers given by the students in the exams and mark them.

x) **Name:** Report preparation

Actors: Admin

Description: The admin can use the user and financial information to generate a final report.

3.1 Expanded Use Case

An expanded use case is a description of how users will perform tasks on a system. It shows a user's point of view, a system's behavior as it responds to a request. Each use case is represented as a sequence of simple steps, beginning with a user's goal, and ending when that goal is fulfilled (Usability.gov, 2024).

i) Name: Payment

Actors: Student

Description: Students can pay for the purchase they made using the payment function.

Typical Course of Events:

Actor Action	System Response
1. Initiate payment.	2. Presents payment options.
3. Chooses a payment option.	4. Show the due amount and bill.
5. Pays the amount.	6. Verifies and sends a successful message.

Alternative:

- In line 5 user tries to pay the wrong amount and system sends an error message.

ii) Name: Login

Actors: Admin, Teacher, Student

Description: All the users should login to the system to use it.

Typical Course of Events:

Actor Action	System Response
1. Initiate Login	2. Presents the login form.
3. Fills the login form.	4. Verifies the data and allows access to the system.

Alternative:

- In line 3 user enters the wrong data and system sends an error message.

4 Collaboration Diagram

Collaboration Diagram represents the interaction of objects to perform the behavior of a particular use case or a part of use case (kanugargna, 2024).

Here is a collaboration diagram of the payment usecase.

The we know that the domain objects are:

- a) Bill
- b) Payment

Now, in figure

Creating Domain Objects

Creating the domain object in a figure first.



Figure 4: Creating Domain Objects.

Adding Controller Object

The use case name is payment so the controller object should also be payment.

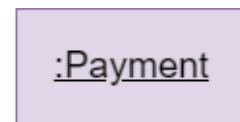


Figure 5: Adding Controller Object.

Adding Boundary Object

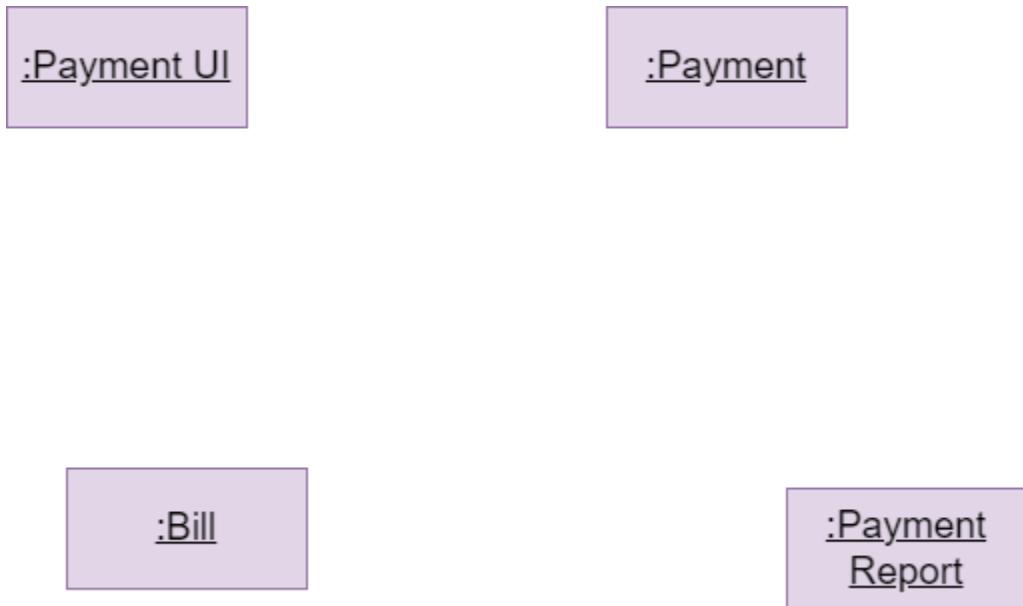


Figure 6: Adding Boundary Object.

Adding Actor

Now, Adding actor in the figure.

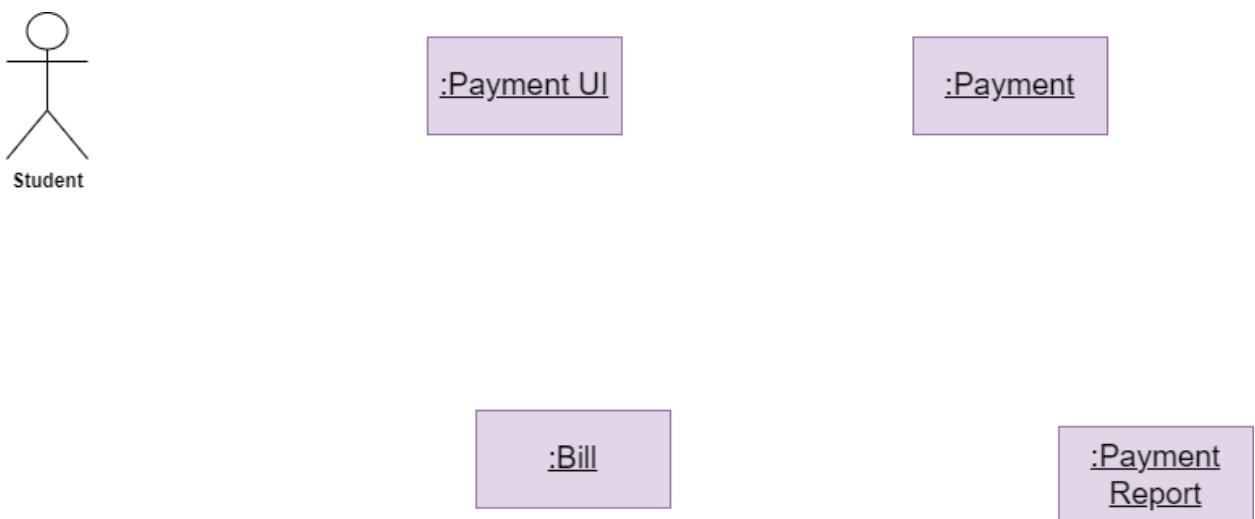


Figure 7: Adding Actor.

Adding connection between objects

Now, Connecting objects by drawing lines.

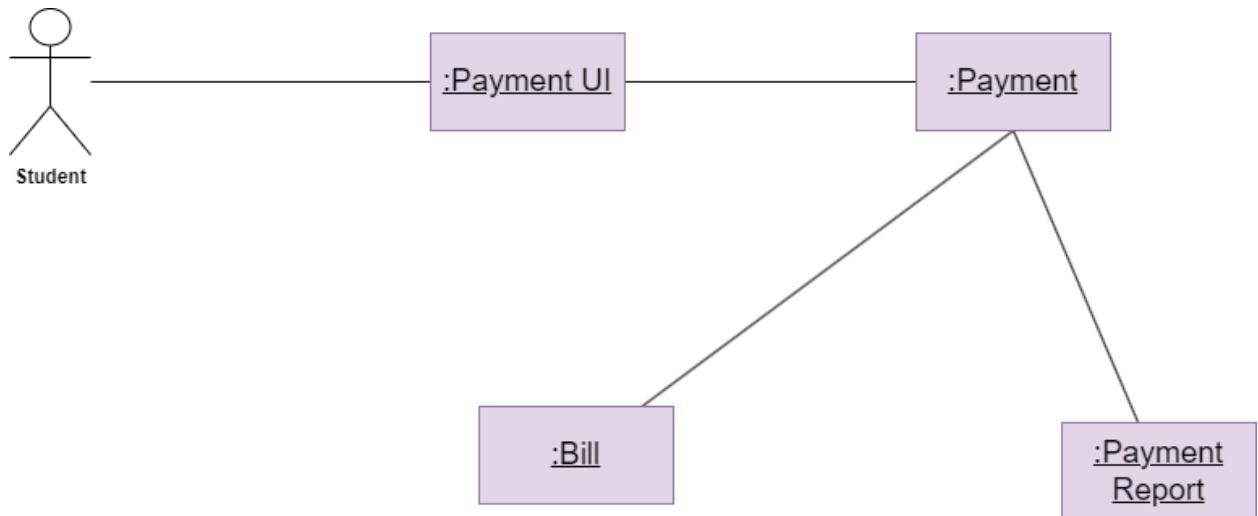


Figure 8:Adding connection between objects.

Adding messages

Now, adding the messages between objects.

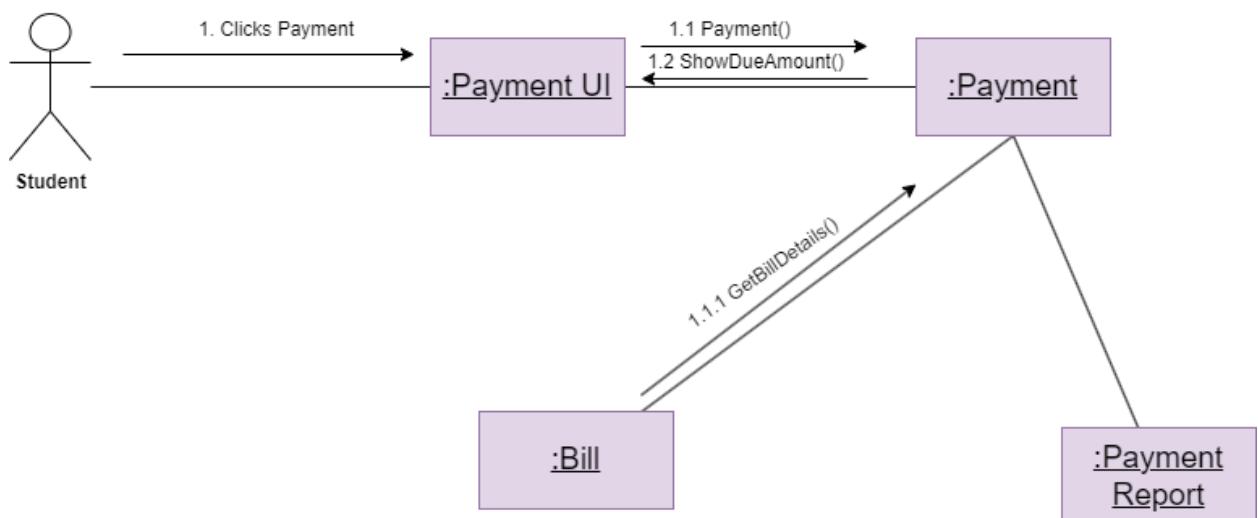


Figure 9:Adding messages.

Final Collaboration Diagram

Here is the final collaboration diagram of the payment use case.

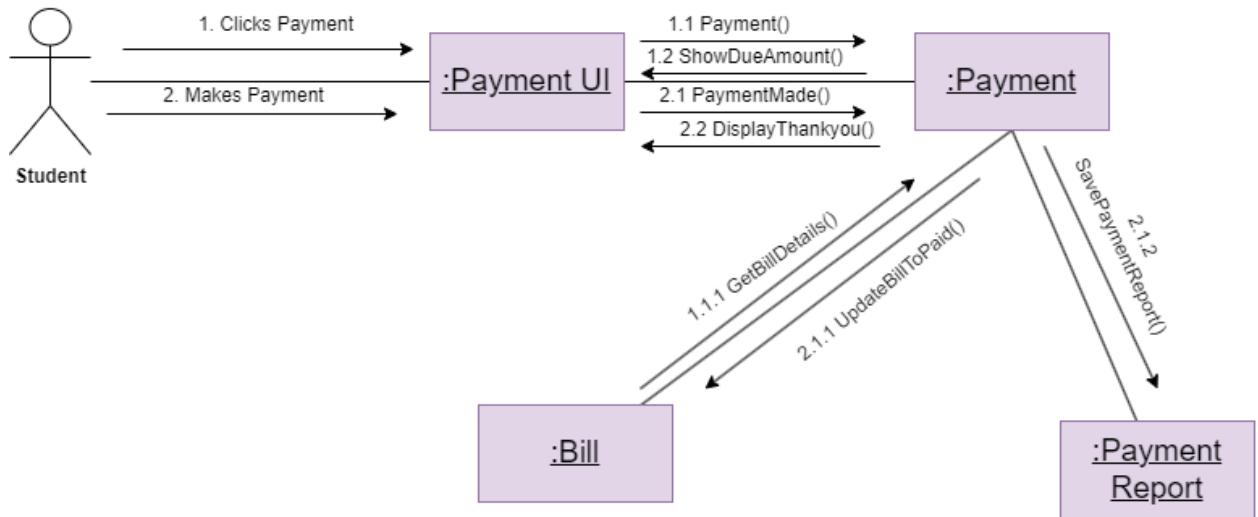


Figure 10:Final Collaboration Diagram.

5 Sequence Diagram

A sequence diagram is an interaction diagram that details about the operation that is carried out. It shows the interaction between the objects in the context of collaboration (kanugargna, 2024).

Control Object lifeline.

We know payment is the control object.

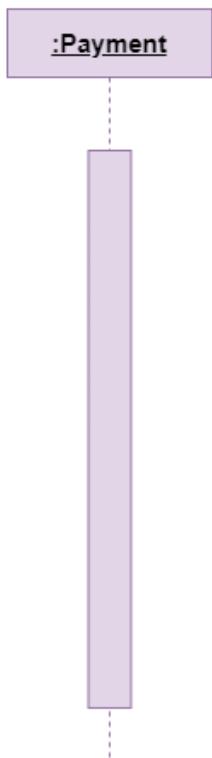


Figure 11:Adding control object lifeline.

Boundary Object lifeline

Now adding boundary object.

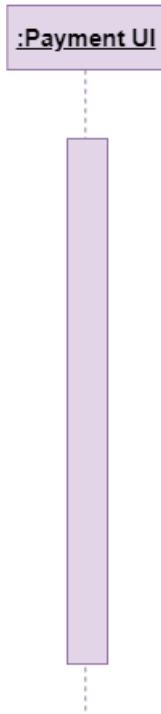


Figure 12: Adding boundary object lifeline.

Actor lifeline

Now adding Actor lifeline in the figure.

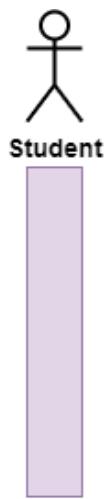


Figure 13: Adding Actor lifeline.

Adding Messages

Now adding messages between objects and actor.

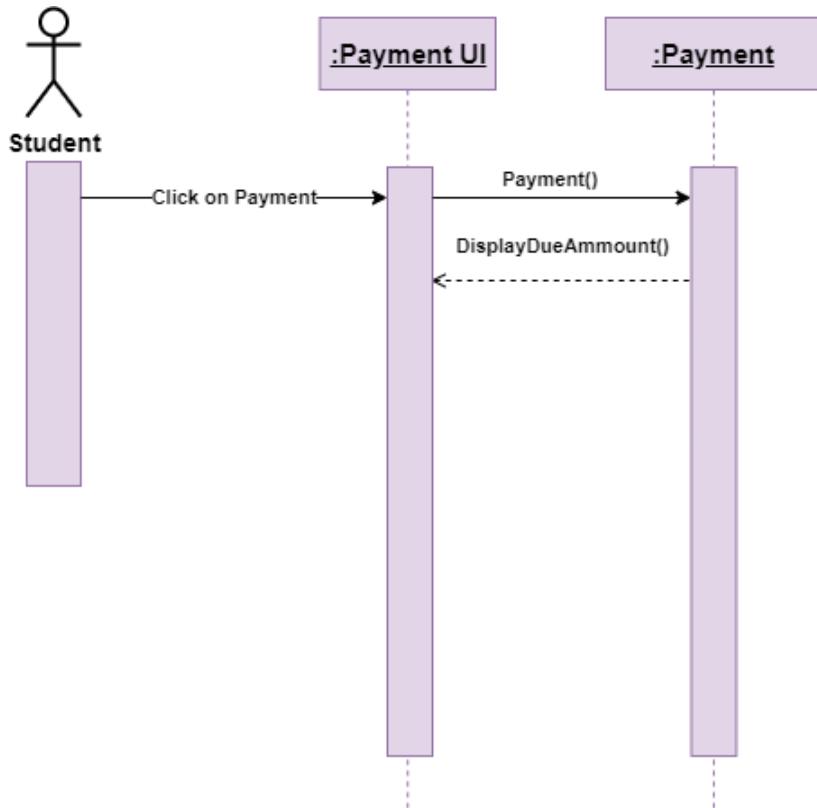


Figure 14: Adding Sequence Diagram message.

Drawing Object lifeline

Now adding domain object lifeline in the figure.

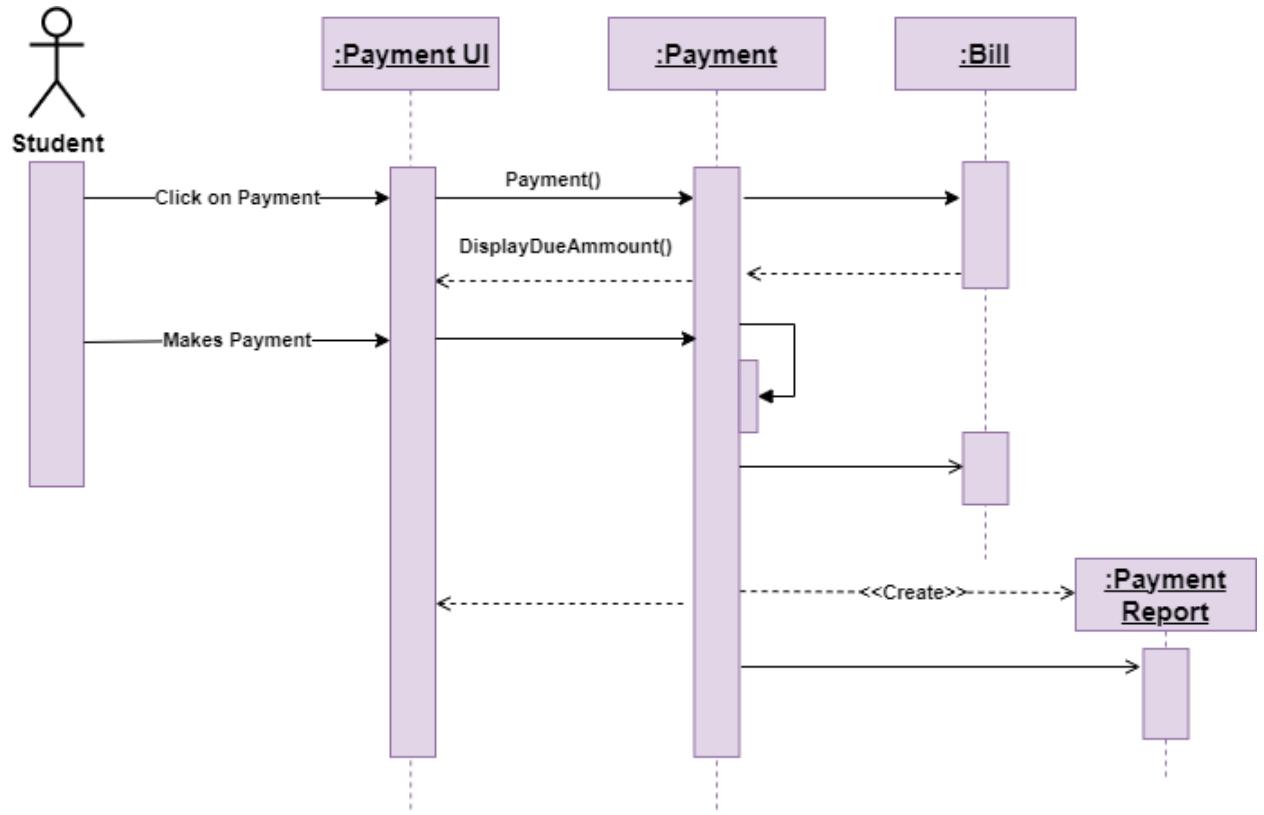


Figure 15:Drawing Object lifeline.

Final Sequence Diagram

Here is the final sequence diagram of the payment use case.

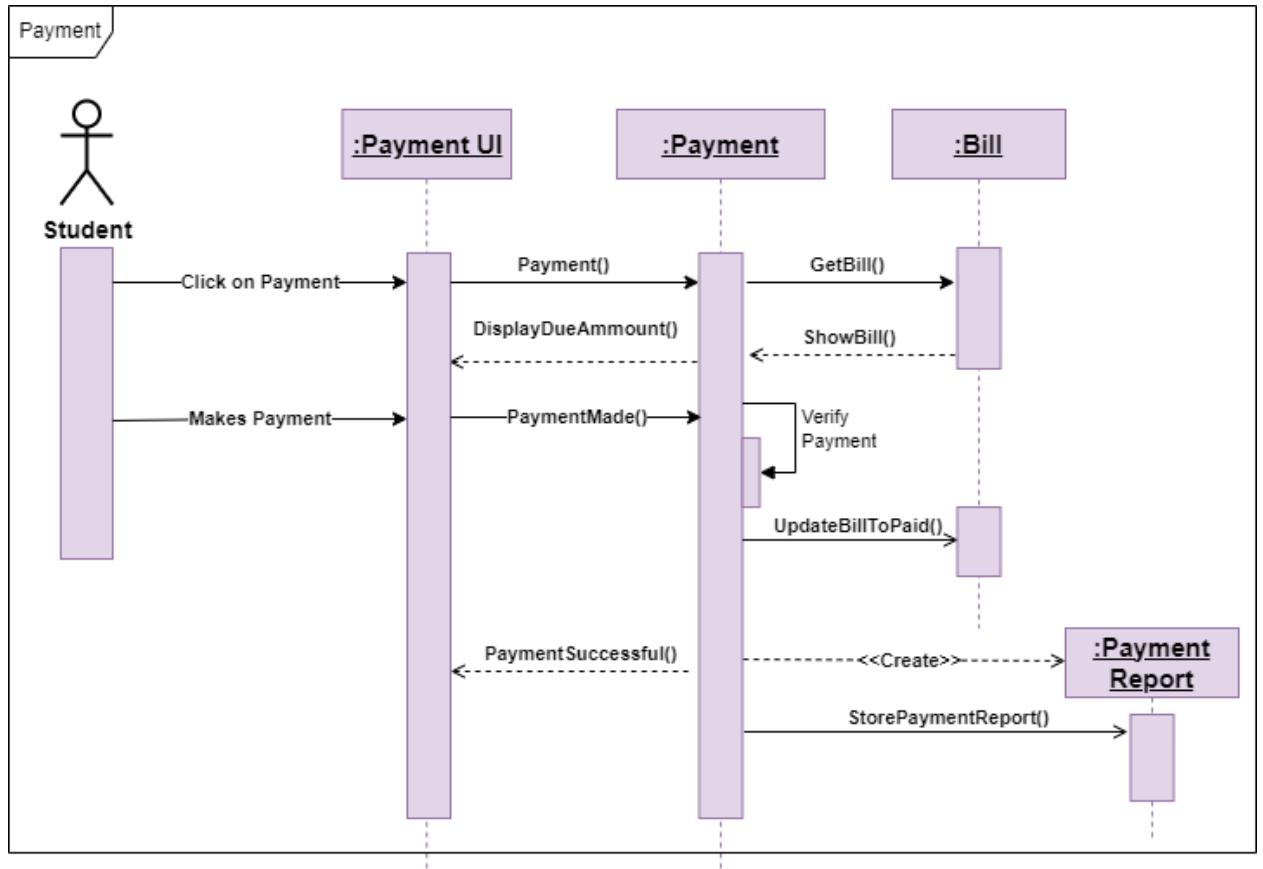


Figure 16:Final Sequence Diagram.

6 Class Diagram

Class diagrams are the blueprints of a system or subsystem. Class diagrams are used to model the objects that make up the system, to display the relationships between the objects, and to describe what those objects do and the services that they provide (IBM, 2021).

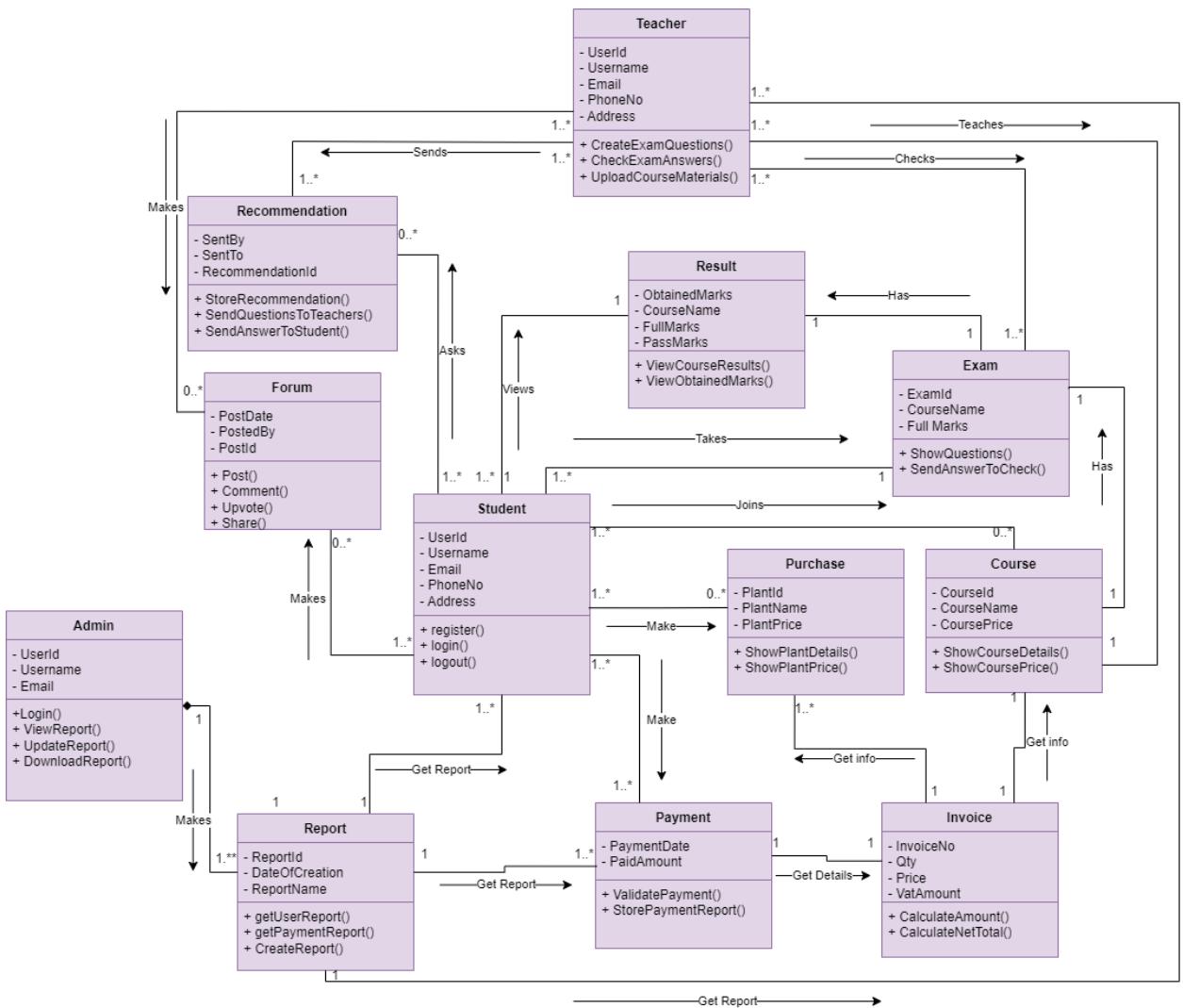


Figure 17: Class Diagram.

7 Further Development

i) Architectural Choice:

- Embrace the Model-View-Controller (MVC) architecture for separating concerns and facilitating maintainability.
- Utilize frameworks like Spring MVC for Java or Django for Python to streamline MVC implementation.
- Design the View layer to handle user interface rendering and interaction.

ii) Design Pattern:

- Promote code reusability and simplify data persistence operations.
- Implement the Factory Method pattern to encapsulate object creation and provide flexibility in object instantiation.
- Use the Observer pattern for efficient communication between components.

iii) Development Plan:

- Use python Django for backend development.
- Use React.js for frontend development.
- Utilize Oracle Sql as the database management system.
- Prioritize implementation of user registration, authentication, course enrollment, plant purchase, and forum functionalities.

iv) Testing Plan:

- Implement unit tests for individual components and modules.
- Conduct security testing to identify and mitigate potential vulnerabilities such as SQL injection, cross-site scripting (XSS), and authentication bypass.
- Conduct performance testing to assess system responsiveness and scalability under varying loads.

v) Maintenance Plan:

- Establish regular software updates and patches.
- Assign a dedicated support team for handling user inquiries, bug reports, and feature requests.
- Conduct periodic code reviews and refactoring sessions to maintain code quality.

8 Prototype

Here is a prototype for the homepage of the system. Anyone can access this page but to use the functionalities the user must log in first.

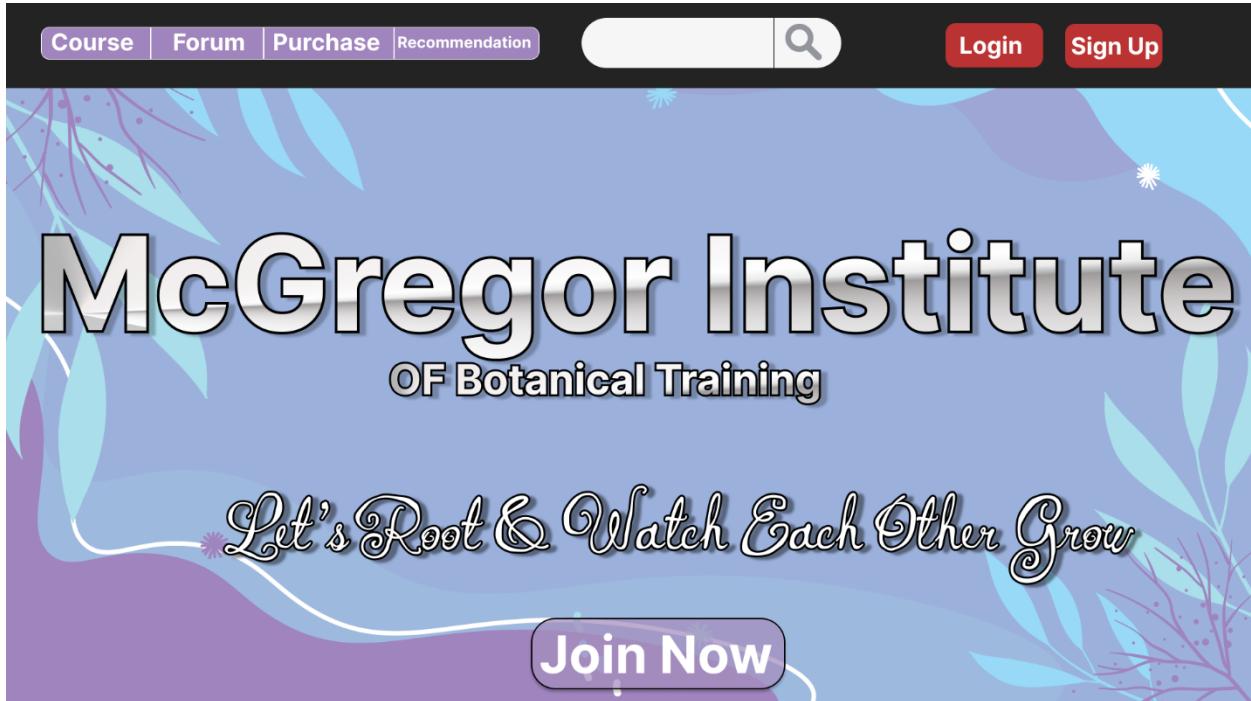
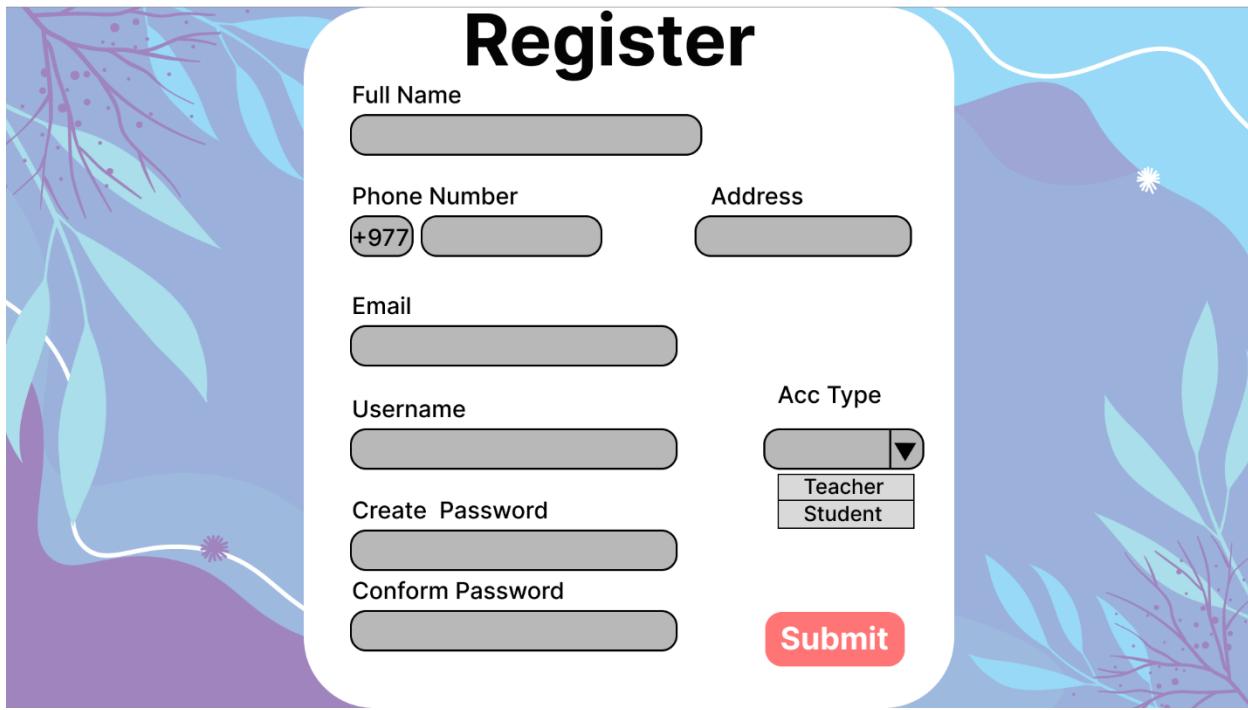


Figure 18: Homepage prototype.

This is the register page prototype after clicking on Sign up the system presents a form to fill. After filling the form the system creates a new account for the users using the provided details in the form.



Register

Full Name

Phone Number

+977

Address

Email

Username

Create Password

Conform Password

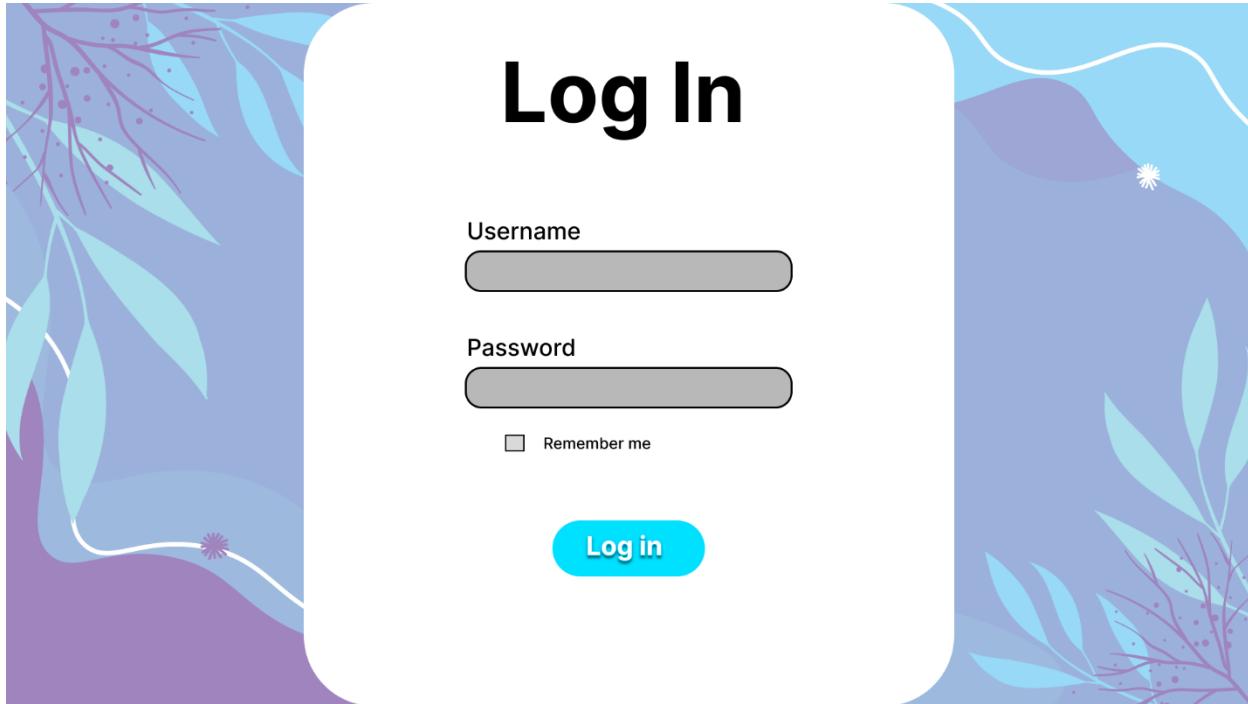
Acc Type

Teacher
Student

Submit

Figure 19: Registration form prototype.

This is the login page of the system users can login by entering their username and password.



Log In

Username

Password

Remember me

Log in

Figure 20:Login form prototype.

This little dashboard shows the notification sent by the system. The announcements made by the teachers or admin are also displayed here.

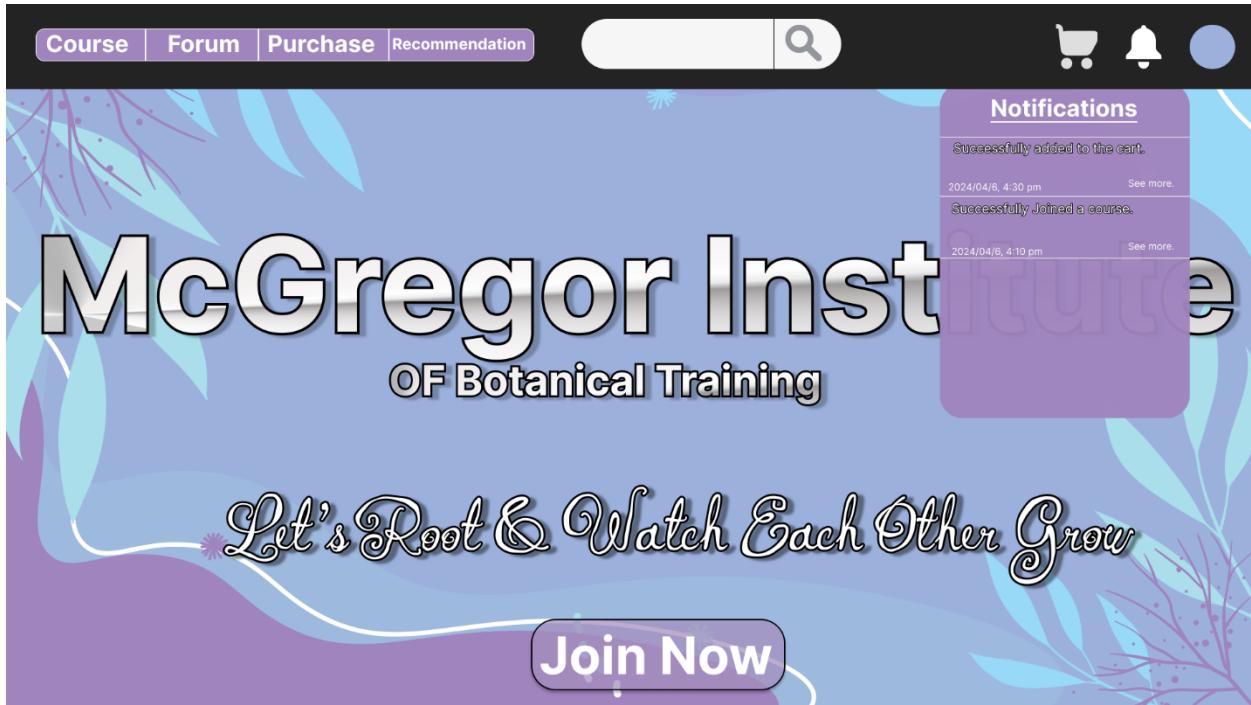


Figure 21:Notification prototype.

This is the purchase plant page of the system, this page shows all the available plants for sale with their price, description, sold number and rating.

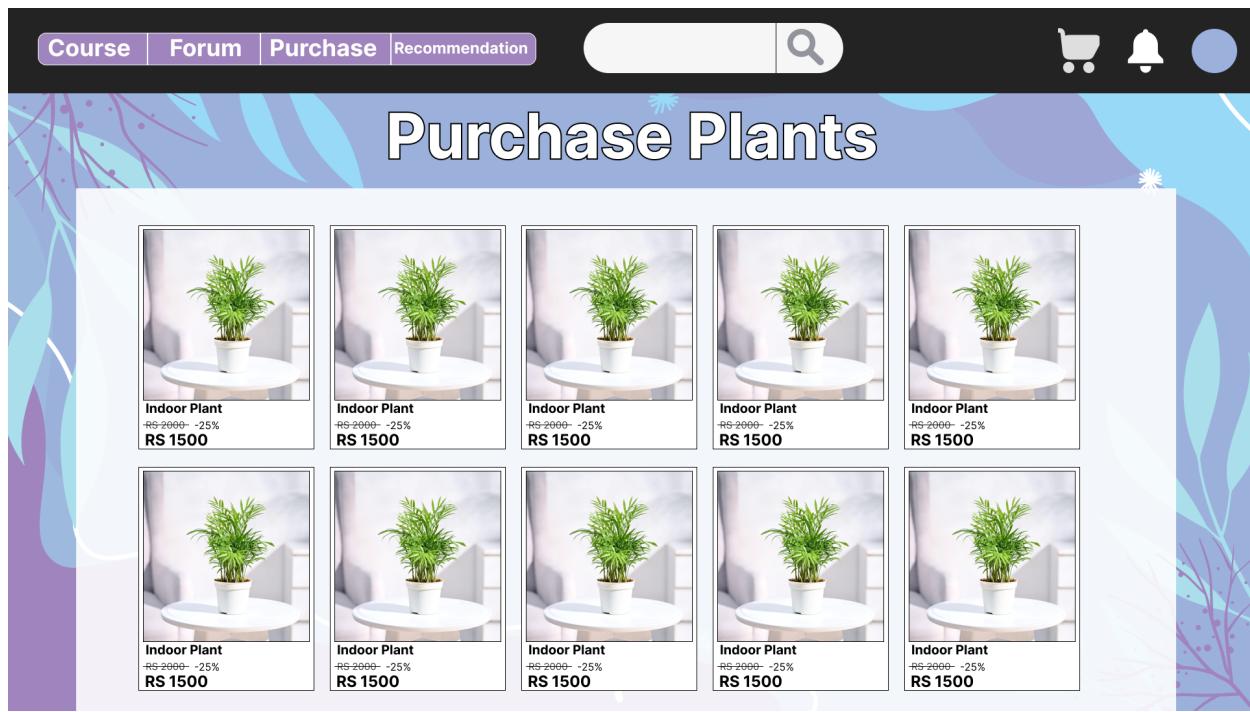


Figure 22:Purchase plant prototype.

This is the join a program page of the system. It shows all the available courses a student can join with their description, price and rating.

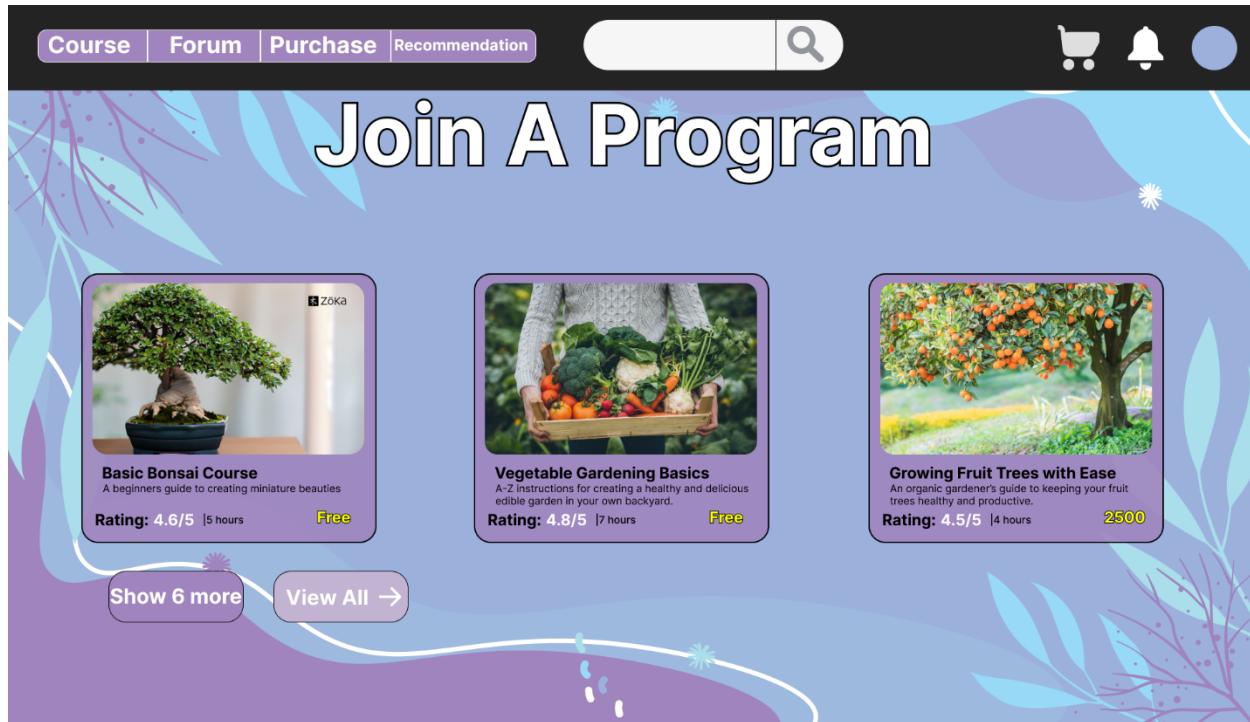


Figure 23:Join a program prototype.

This is the payment page of the system, users can choose the payment method from this page and make payment for their purchase.

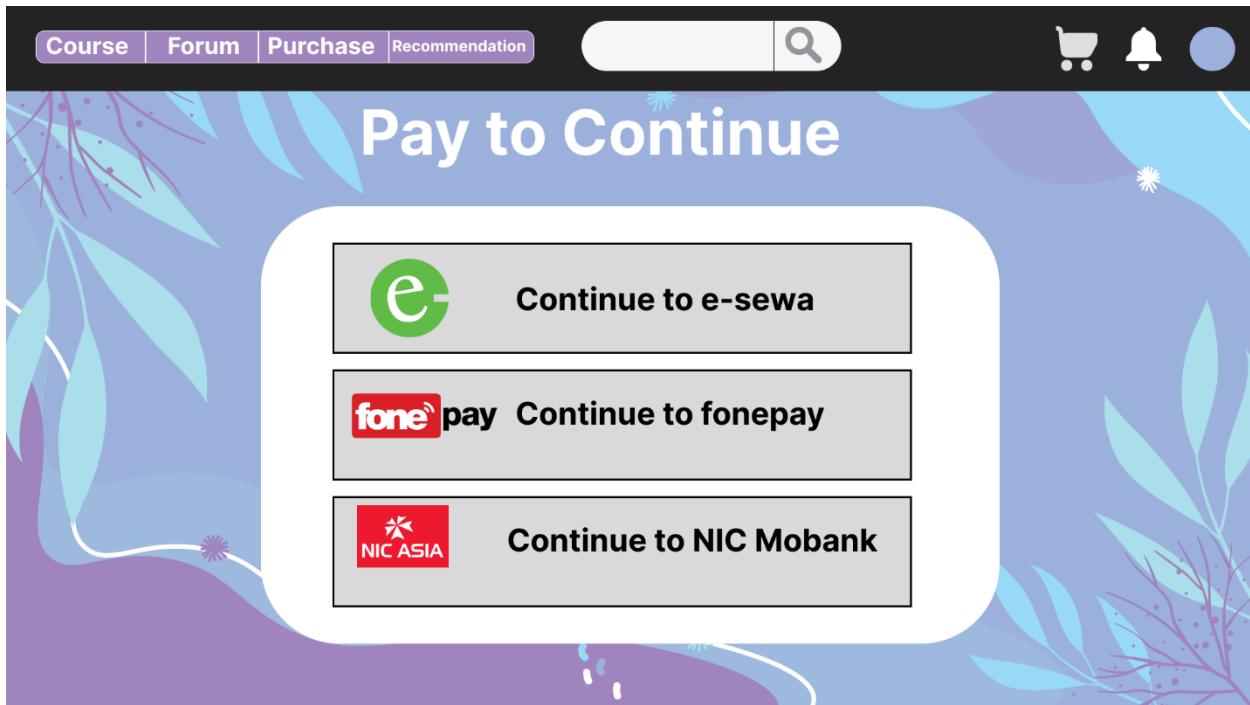


Figure 24:Payment prototype.

This is the ask recommendation page of the system, students can ask experts for recommendations from this page.

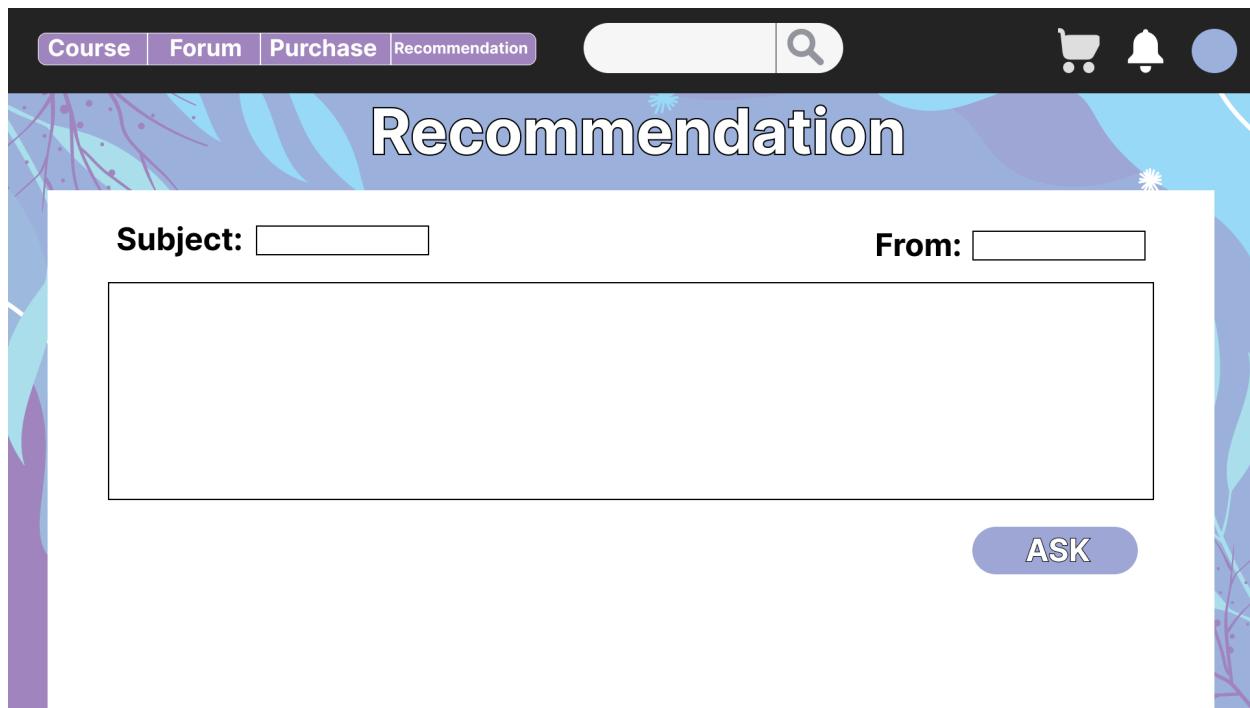


Figure 25: Ask Recommendation prototype.

This is the give recommendations page of the system, experts can send recommendations or answer the questions asked by the students.

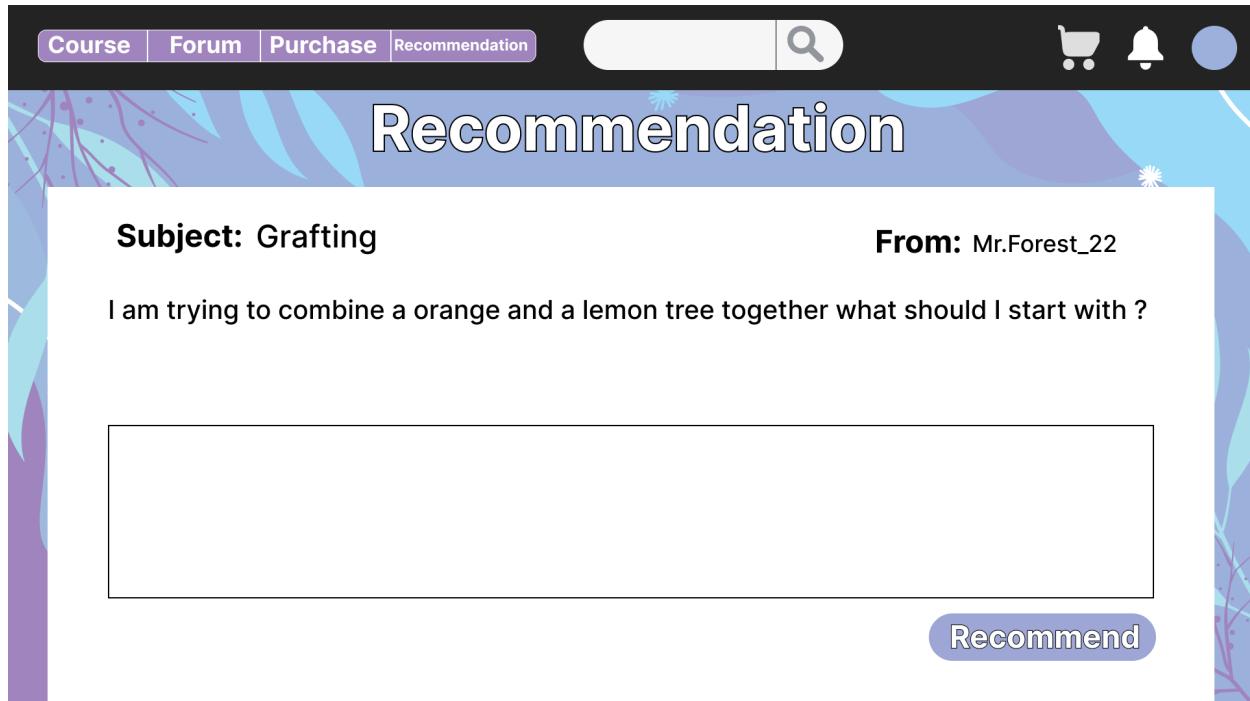


Figure 26:Give prototype.

The small dashboard in the right shows the additional functions of the system. This is from a student account so it shows certification, mock test, check results.

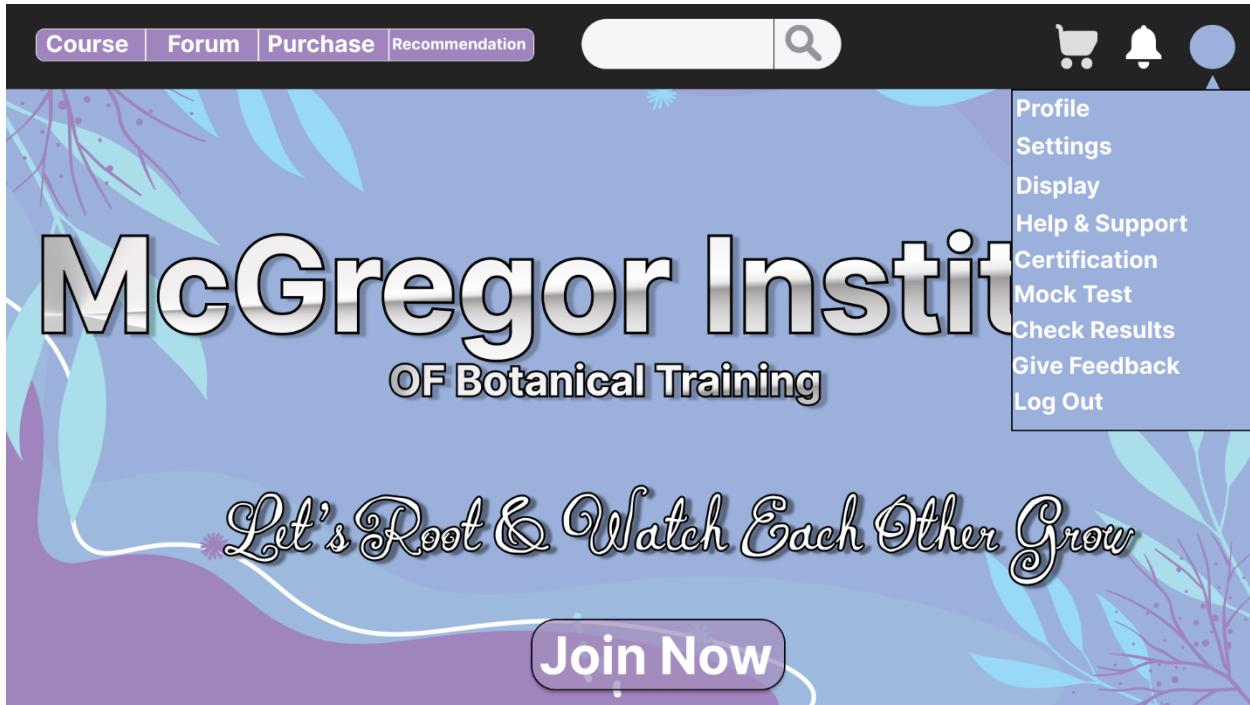


Figure 27:Additional functions prototype.

This is the exam initiation page of the system, students can start the exams from this page they can also select the course and exam type from this page.

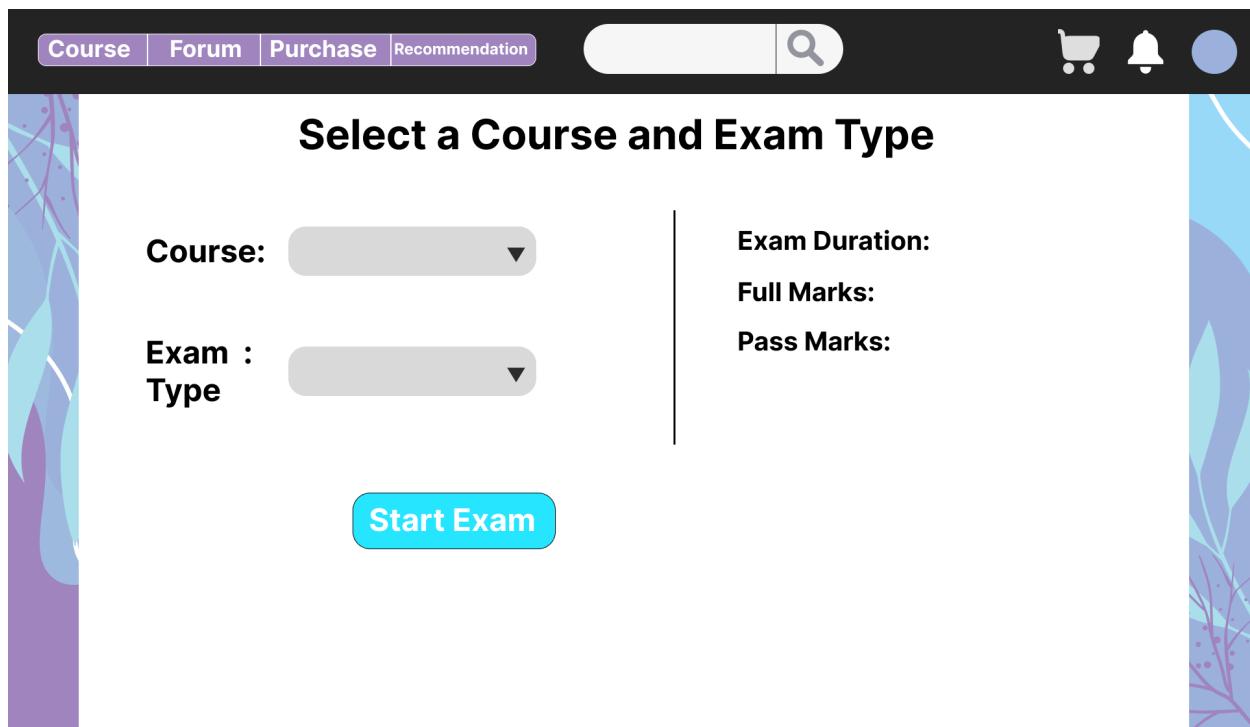


Figure 28:Initiate Exams prototype.

This is the question paper page of the system, it shows the questions during exam. Students can give exams in this way.

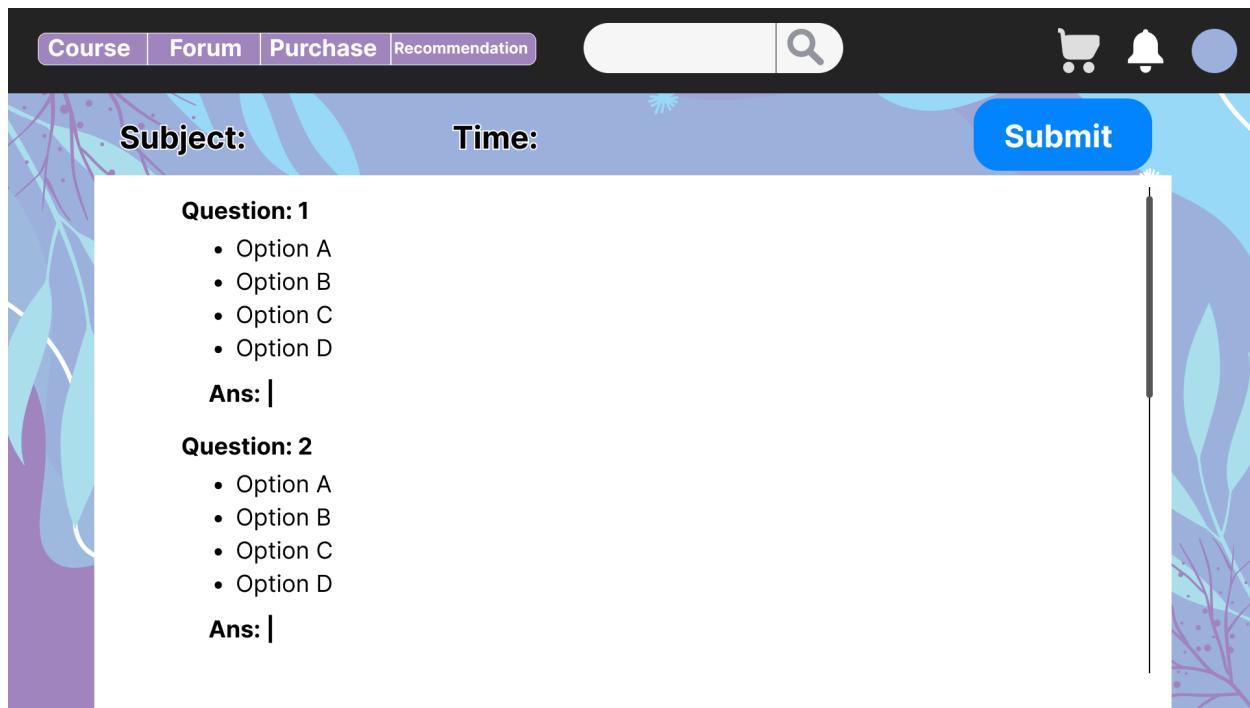


Figure 29: Exam questions prototype.

This is the forum page of the system users can engage in conversations with each other using posts from this page.

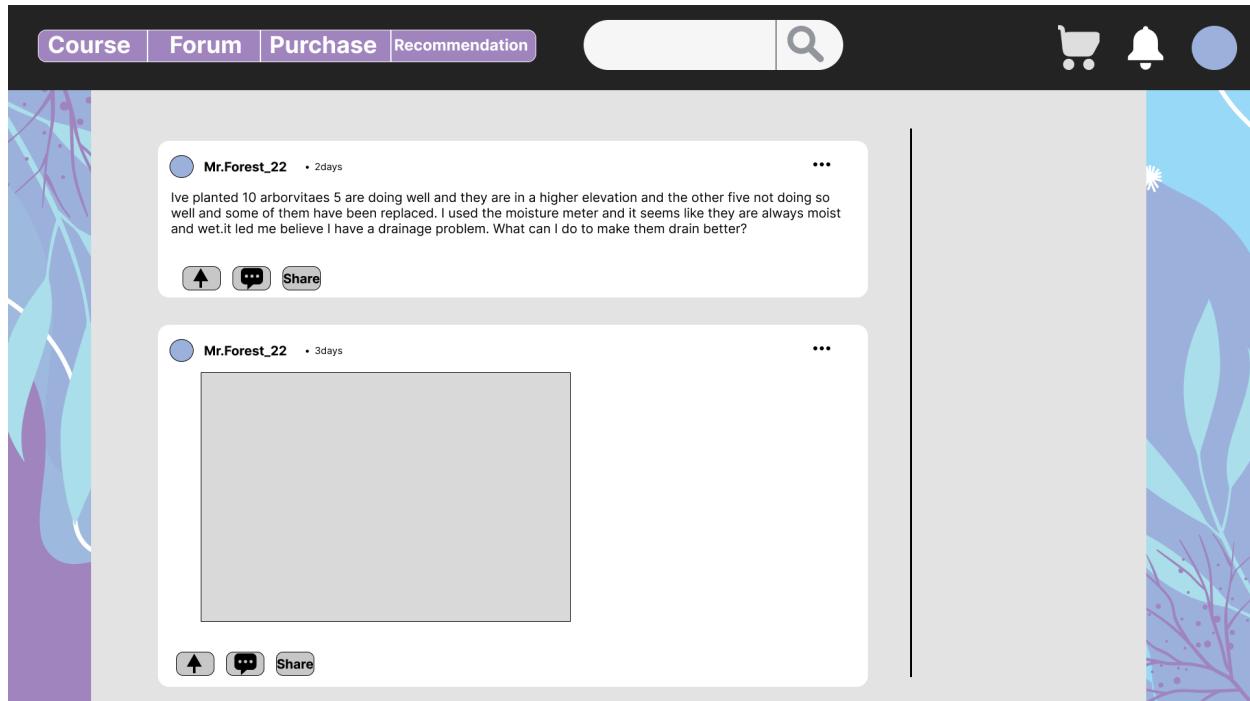


Figure 30:Forum prototype.

The small dashboard in the right shows the additional functions of the system. This is from a teacher account, so it shows upload questions, download answers, give marks.



Figure 31:Teacher functionalities prototype.

This is the report preparation page of the system, admin can create report using user report and financial report using this page.

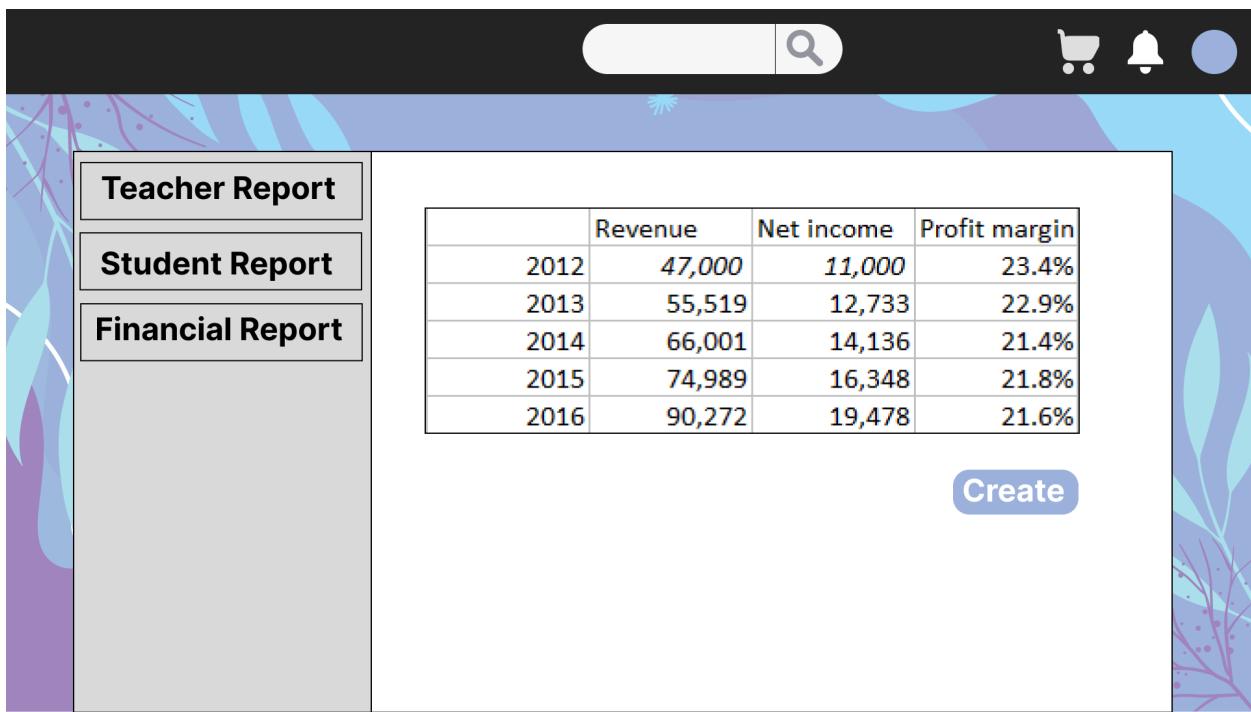


Figure 32: Create report prototype.

9 Conclusion

This coursework was a more challenging than the last one. The scenario was the same, but we had to implement more diagrams and designs in this. We had to learn about WBS, Gantt chart, sequence diagrams, collaboration diagrams during the completion of this coursework. We also had to create prototypes of the systems pages. Creating the class diagrams were also challenging at first.

In conclusion, I learned a lot during this project. I now know a lot more about software engineering and project management. It was very challenging to complete this project, but I received a lot of help from my tutors, lecturers and seniors which made this project possible without them I would be able to complete this project and I would like to thank all of them.

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