Web Based Student Facilitation System

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Project Detail

Type (Nature of project)	[ ] **D**evelopment [ ] **R**esearch [ ] **R&D**
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*The candidates confirm that the work submitted is their own and appropriate credit has been given where reference has been made to work of others

Plagiarism Free Certificate

This is to certify that, I am __**Hamza Mahmood**_____ S/D/o ___**Mahmood ul Hassan**____, group leader of FYP under registration no **CIIT/SP16-BSE-106/LHR** at Computer Science Department, COMSATS Institute of Information Technology, Lahore. I declare that my FYP proposal is checked by my supervisor and the similarity index is ________% that is less than 20%, an acceptable limit by HEC. Report is attached herewith as Appendix A.

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Abstract

This project is basically for Students who are seeking admissions in different schools, colleges and universities for graduation. The website will serve as a non-profit organisation which will provide single platform to students to get all the information about the major universities. It will provide all the information about the admission procedures, faculty, fee structure and their study scheme. Moreover, course related books will also be available for free and lecture notes of best teachers will also be available. Book solutions will also be there prepared by the experts of the related fields. Books of specific subjects will also be available and if someone wants to upload any book that can be helpful for someone, the system will give him/her facility to upload. System will also provide the information about the faculty of particular university and their lecture notes will also be available so that their students can download them.

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1 Chapter 1: Introduction

1.1 Introduction

A lot of such platforms are available in Pakistan that offer these kinds of services but the problem is that nothing is centralized. We can say that if a platform is offering universities information then books related and faculty related data is missing. Main aim of our website is to cover everything under one umbrella. Proper questionnaires, surveys will be conducted to get idea about the faculty of an institution and experts will give their views about the study scheme of that institute. Books of specific subjects will also be available and if someone wants to upload any book that can be helpful for someone, the system will give him/her facility to upload. System will also provide the information about the faculty of particular university and their lecture notes will also be available so that their students can download them. In the end we simply develop a system that will be something like all in one place.

1.2 Objective

Our product is to facilitate everyone and education related information should be easily available for everyone. No one should suffer because of lack of information or lack of resources. And that will lead us to our main objective of building a non-profit organization which will further in future facilitate every student by giving them the guidelines from the experts of their field.

1.3 Problem Statement

A lot of such platforms are available in Pakistan that offer these kinds of services but the problem is that nothing is centralized. We can say that if a platform is offering Universities information then books related and faculty related data is missing.

1.4 Assumption and Constraints

Assumptions of our project are:

- We assume the project to facilitate everyone and related information should be easily available for everyone.
- Our product will provide the books of specific subjects.
- If someone wants to upload any book that can be helpful for someone, the system will give him/her facility to upload.
- We will provide the information about the faculty of particular university.
- We will provide lecture notes of particular faculty so that their students can download them.

Whereas constraints are:

- Frequent advancement in tools and technologies forces us to follow latest versioning to keep our project up to date.
- Time, such as the date by which the project must be completed.
- Merging conflicts can be problematic sometime due to different ways of implementing same functionality and also while integrating different modules together.

1.5 Project Scope

Main problem that motivated us to develop this product is that students from other cities and overseas students can get all the information about different universities without physically visiting them. It will save everyone’s money and time. Secondly the students who can’t afford the books will be able to study them without any problem. No authentic source in Pakistan except HEC rates the universities depending on the student’s reviews, study scheme and other parameters.

2 Chapter 2: Requirement Analysis

2.1 Literature Review

There are various online websites available online that provide few functionalities similar to our project. They also but functionalities similar to our project but each of them has limitations in some area. The top websites with similar idea are Ilm Ki Dunya, TopUniversities.com, and Eduvision etc. *A* lot of such platforms are available in Pakistan that offer these kinds of services but the problem is that nothing is centralized.

- **TopUniversities.com:** This platform only provides top universities information gathered from unknown sources ranking websites.
- **Ilm Ki Dunya:** The building happens in a visual method. The platform supports all media types, with facilitation of importing of RSS, Twitter, or Google News and keywords, and real-time communication with users.
- **Eduvision:** Eduvision is Pakistan's Largest Career Counseling and Educational Guidance providing Organization established in 2001. Eduvision is a pioneer non-profit organization in the field of education. It promotes educational opportunities across national boundaries and serving students and organizations.

2.2 Stakeholders List

1. User
2. Admin
3. Development team

2.3 Requirement Elicitation

2.3.1 Functional Requirements

FR01: Register

Req. No.	**Functional Requirements**
FR01-01	The system shall display input fields (First Name, Last Name, City, Password, Email) to register user into the system.
FR01-02	The system shall display a success message after registering a user into the system.

FR02: Login

Req. No.	Functional Requirements
FR02-01	The system shall allow the user to login into the system by entering Email or Username and Password.
FR02-02	The system shall display a success message after login by the user.

FR03: Manage Universities Information

Req. No.	Functional Requirements
FR03-01	The system shall maintain all the data about the different universities.
FR03-02	The system shall maintain all the data about specific programs of a specific university.
FR03-03	The system shall allow user to view the information of the selected university.

FR04: Search Universities

FR04-01	The system shall allow the user to search universities.
FR04-02	The system shall allow the user to search universities by name.
FR04-03	The system shall allow users to search the universities by cities.
FR04-04	The system shall allow user to search the universities by his preferred program.
FR04-05	The system shall automatically show the list of all the universities when a user clicks search button.
FR04-05	The system shall display the list of universities according to the user preferences.
FR04-06	The system shall allow the user to select any university from the list.

FR05: Ranking of Universities

FR05-01	The system shall allow the user to view the latest rankings of universities.
FR05-02	The rankings will be based on the reviews from the students.
FR05-03	The system shall allow users to see the rankings of the universities according to his preferred program.
FR05-04	The system shall allow the user to view rankings according to his study level (BS/MS).
FR05-05	The system shall allow the user to view rankings based on his subjects of interest.
FR05-06	The system shall allow the user to select any university from the list.

FR06: Admissions

FR06-01	The system shall allow user to view the list of universities offering admissions.
FR06-02	The system shall display the list of universities offering admissions according to his study level.
FR06-03	The system shall display the list of universities offering admissions according to his subject of interest.
FR06-04	The system shall allow the user to select any university from the list.

FR07: Manage Universities

FR07-01	The system shall display all the related information about the selected university.
FR07-02	The system shall allow the user to view the basic overview of the selected university.
FR07-03	The system shall allow the user to view the admission criteria, banner, admission form and short description of specific university.

FR07-04	The system shall allow the user to view and download the admission form of the selected university.
FR07-05	The system shall allow the user to edit and delete the specific university from the dashboard.

FR08: Details of study schemes

FR08-01	The system shall provide the study schemes of the selected university.
FR08-02	The system shall allow the user to choose a specific program and see the study schemes, subjects of that program offered by the university.

FR09: Manage Faculties

FR09-01	The system shall provide the details of the faculty of the selected university to the user.
FR09-02	The system shall allow the users to select a specific program and see the faculty of that selected program.
FR09-03	The system shall allow the user to see the faculty available in the university for any specific subject.
FR09-04	The system shall allow the user to add faculty's name, teaching experience, photo and related programs.
FR09-05	The system shall allow the user to edit or delete the specific faculty.

FR10: Availability of books

FR10-.01	The system shall allow the user to download the books of the related courses.
FR10-02	The system shall allow the user to view and download the lecture notes of the teachers of any particular subject.

FR10-03	The system shall allow the user to upload any subject related books.
FR10-04	The system shall allow the user to upload the lecture notes of any subject.

FR11: Manage Cities

FR11-.01	The system shall allow the user to view the universities from specific city.
FR11-02	The system shall allow the user to add a specific city.
FR11-03	The system shall allow the user to edit or delete a city.

FR12: Manage Courses

FR12-.01	The system shall allow the user to view the programs from specific university.
FR12-02	The system shall allow the user to add a program name, credit hours and program level related to specific program.
FR12-03	The system shall allow the user to edit or delete a specific program.
FR12-04	The system shall allow the user to add the attachments related to specific programs.

FR13: Manage User's Roles

FR13-.01	The system shall allow the admin to add new user.
FR13-02	The system shall allow the admin to assign a specific role to user e.g. member, admin or moderator.
FR13-03	The system shall allow the user to edit specific user's role.
FR13-04	The system shall allow the admin to delete the specific user.

FR14: Manage Events

FR14-.01	The system shall allow the user to view the event related to specific university or city.
FR14-02	The system shall allow the user to add a new event.
FR14-03	The system shall allow the user to add the event information e.g. event's title, event's image, venue, start date, end date, city and speaker name.
FR14-04	The system shall allow the user to edit or delete the event.

FR15: Edit Profile

FR15-01	The system shall allow the user to edit the profile.
FR15-02	The system shall allow user to user to change name.
FR15-03	The system shall allow the user to change the profile picture.
FR15-04	The system shall allow user to user to change/reset password.

2.3.2 Non-functional Requirements

NFR01: Usability

NFR01-01	The system shall provide a uniform look which is easy to interact.
NFR01-02	The system shall follow website standards and should be consistent so that users can adopt the behaviour of system easily.
NFR01-03	The system shall provide use of icons and toolbars for ease of users.

NFR02: Efficient storage at backend

NFR02-01	The system shall provide storage to maintain all the data of different universities.
NFR02-02	The system shall have enough back up storage in case of uploading of data by any user.

NFR03: Accuracy of data

NFR03-01	The system shall provide accurate and unambiguous information.
NFR03-02	The system shall never display any false information that can lead to the loss of any user.

NFR04: Performance

NFR04-01	The system is based web and has to be run from a web server.
NFR04-02	The system shall take initial loading time depending on internet connection strength which also depends on the media from which the system is run.
NFR04-03	The performance shall depend upon hardware components of the client/customer.

NFR05: Web based product

NFR05-01	There are no memory requirements on customers system. All the data is stored online on servers.
NFR05-02	The computers must be equipped with latest web browsers such as Internet explorer, Google chrome or Mozilla Firefox.
NFR05-03	Response time for loading the applications should take no longer than one minute.

NFR05-04	Basic computer skills and web knowledge is required to use the system. If users have no knowledge or skillset, there is a tour guide for new users.

NFR06: Quality Assurance

NFR06-01	The system should be according to the standards and should meet all the McCall quality assurance factors.
NFR06-02	The minimum standard for quality of our system should be at least equal to the market standards.

NFR07: Defect maintenance

NFR07-01	System should be regularly checked for any kind of bugs.
NFR07-02	If user reports a bug or defect in the system it should be remove/resolve immediately for ease of users.

NFR08: Recovery from crash

NFR08-01	In case of occurrence of server/client crash, it must be recovered as soon as possible.

2.3.3 Requirements Traceability Metric

Requirements	**Actor**	**Team member**	**Priority**	**Use case ID**	**Use case diagram**
Login/Register	User, server	Hamza, Waqas	High	001	Figure 1
Maintain Universities information	User, server	Hamza	High	002	Figure 2
Search Universities	User, server	Hamza, Alamgir	High	003	Figure 3
Ranking of Universities	User, server	Waqas	Medium	004	Figure 4
Admissions	User, server	Hamza, Waqas	Medium	005	Figure 5
Manage Universities	User, server	Alamgir	High	006	Figure 6
Details of Study schemes	User, server	Waqas	Low	007	Figure 7
Manage Faculties	User, server	Alamgir, Waqas	Medium	008	Figure 8
Availability of Books	User, server	Alamgir, Hamza	High	009	Figure 9
Manage Cities	User, server	Waqas	Low	010	Figure 10
Manage Courses	User, server	Alamgir, Hamza	High	011	Figure 11
Manage User’s Roles	User, server	Hamza, Waqas	High	012	Figure 12
Manage Evets	User, server	Alamgir	Medium	013	Figure 13
Edit profile	User, server	Waqas	Medium	014	Figure 14

Table 1: Requirement Traceability Matrix

2.4 Use case descriptions

Use case ID 001	**Use case Name: Register**
Priority: High	
Actors: User, Server	
Use Case Summary	This use case allows the user to register with the system.
Pre-condition:	The user must not be registered already.
Normal Course of Events	**Alternate Path**
1. The use case starts when the user wants to register with the system.	
2. The user visits the website and clicks on “register as a user” button.	
3. The system takes the user to a new page to fill the form.	
4. The user fills in the required information	
5. The user submits the information by pressing the submit button.	
6. The system verifies if all of the information has been provided.	5a. The system finds some information missing. 5b. The user is required to fill in the missing fields.
7. The system checks the information and checks if the user is not already registered.	6a. The user has already been registered.
8. The user doesn’t already have an account.	7a. The user has already been registered.
9. The system presents a welcome message to the user and taken to the management panel.	
Post Conditions	
1.User got registered	
Use Case Cross References	
Includes	None
Extends	User Login
Exceptions	

Table 2: Use Case of Register

Use case ID 002	**Use case Name: Login**
Priority: High	
Actors: Property Dealers	
Use Case Summary	This use case allows User to login into the system.
Pre-condition:	The user must already be registered.
Normal Course of Events	**Alternate Path**
1. The use case starts when the user wants to Login with the system.	
2. The user visits the website and clicks on “Login” button.	
3. The system redirect user to a new page to fill username/ password.	
4. The user fills in the required information	
5. The user press login button to precede.	
6. The system verifies if all of the information has been provided.	5a. The system finds some information missing. 5b. The user is required to fill in the missing fields.
7. The system checks the information and checks if user is not registered.	
8. The user doesn’t already have a user account.	7a. The user has already been not registered. 7b. User is notified and asked to register.
9. The system presents a welcome message to the user and taken to the management panel.	
Post Conditions	
1.User will redirect to main page	
Use Case Cross References	
Includes	None
Extends	Home Screen.
Exceptions	

Table 3: Use case of Login

Use case ID 003	**Use case Name: Manage Universities information**
Priority	**High**
Actors:	User, Server
Use Case Summary	The system shall allow the user to view the list and overview of the universities.
Pre-condition:	Users must have access to the internet and website.
Normal Flow of Events	**Alternative Path**
1. The use case starts when the user wants to use the system.	1a**:** Some users may want to just visit the website.
2. The user will view the list of universities.	2a. An error message will be shown if the user is not connected to the internet.
3. User can select and check the details of any university by clicking on the name of the university.	
4. User can view the details in a new webpage.	
5. This use case ends.	
Exceptions / Alerts	
1. If the user does not connect to internet system will not show any information.	
Post Conditions	
Step#	**Description**
User can now view the main page of the website.	
Use Case Cross References	
Includes	
Extends	None

Table 4: Use case of Manage Universities Information

Use case ID 004	**Use case Name: Search Universities**
Priority **High**	
Actors: User/Server	
Use Case Summary	User can search the universities by typing the name of the universities or by selecting the city.
Pre-condition:	User must have access to the internet and to the main web page.
Normal Flow of Events	**Alternative Path**
1. This use case starts when the user wants to search any university by its name or city.	
2. The user can select the city from the toolbar.	2a. User can choose different cities from the toolbar.
3. User can type the name of the university in the search field.	
4. Users can click on the search button to search the specific university.	
5. This use case ends.	
Exceptions / Alerts	
1. User can only search a valid and existing university. **2.** One city can be selected at a time.	
Post Conditions	
Step#	**Description**
User can now see the list of universities related to his/her search.	
Use Case Cross References	
Includes	
Extends	None

Table 5: Use case of Search Universities

Use case ID 005	**Use case Name: Ranking of Universities**
Priority **Medium**	
Actors: User, Server	
Use Case Summary	The users are allowed to see the ranking of the universities based on different surveys and valid sources.
Pre-condition:	User must have access to internet and to the main web page.
Normal Flow of Events	**Alternative Path**
1.This use case starts when the users want to view the rankings of the universities.	
2.Users can choose any university from the ranking list.	
3. User can also view the rankings based on his subject of interest.	
4. Users can also view the rankings based on level of studies (Bs/Ms/PhD).	5a. User should use a valid level of study.
5. This use case ends.	
Exceptions / Alerts	
1. Only one level of studies can be selected at a time. **2.** Only one preferred program can be selected at a time.	
Post Conditions	
Step#	**Description**
User can now view the rankings of the universities based on his preferences.	
Use Case Cross References	
Includes	
Extends	None

Table 6: Use case of Ranking of universities

Use case ID 006	**Use case Name: Admissions**
Priority	**Medium**
Actors:	User/Server
Use Case Summary	This use case allows user to see the list of universities that are offering admissions in his/her selected program or level of studies (BS/MS/PhD).
Pre-condition:	User must have connected to internet and to the main web page.
Normal Flow of Events	**Alternative Path**
1. This use case starts when the user wants to see the list of the universities that are offering admissions.	
2.The use case start by searching the universities by clicking on the search area on the main screen.	
3. Users can narrow down the list of universities by selecting his/her preferred program or level of studies.	
4. This use case ends.	
Exceptions / Alerts	
1.Only one level of studies can be selected at a time. **2.**Only one preferred program can be selected at a time.	
Post Conditions	
Step#	**Description**
User can now view all the universities that are offering admission according to his/her preferences.	
Use Case Cross References	
Includes	
Extends	None

Table 7: Use case of Admissions

Use case ID 007	**Use case Name: Manage Universities**
Priority	**High**
Actors:	User, Server
Use Case Summary	Once the user selects any university from any list whether it’s from the search list or ranking list or admission list the system will open a new page displaying the details of that university.
Pre-condition:	User must have access to internet and any list of universities.
Normal Flow of Events	**Alternative Path**
1. This use case starts when the user wants to see the details of any particular university.	
2. The user can select any university and see it’s details by clicking on the name.	
3. User can view university admission form, banner, application form of that university and see the admission criteria.	
4. User can also download the application form if he/she wants to apply.	
5. This use case ends.	
Exceptions / Alerts	
1.User cannot access more than one university at a time within the same webpage.	
Post Conditions	
Step#	**Description**
User will be able to get an overview of the university and download the application form.	
Use Case Cross References	
Includes	
Extends	None

Table 8: Use case of Manage Universities

Use case ID 008	**Use case Name: Details of study schemes**
Priority	**Low**
Actors:	User/Server
Use Case Summary	After selecting a university and preferred program the user can see the study scheme of that specific program offered by the university.
Pre-condition:	User must have access to internet and selected any university.
Normal Flow of Events	**Alternative Path**
1. This use case starts when the users want to see the study scheme of the selected program from the selected university.	
2. Users can see the study scheme by clicking on the “Study Scheme” button.	
3. User can also see the fee structure of that program in the study scheme.	
4. This use case ends.	
Exceptions / Alerts	
1. User cannot select multiple programs at a time.	
Post Conditions	
Step#	**Description**
User will now be able to see the study scheme and fee structure of the selected program.	
Use Case Cross References	
Includes	
Extends	None

Table 9: Use case of Details of Study Scheme

Use case ID 009	**Use case Name: Manage Faculties**
Priority	**Medium**
Actors:	User, Server
Use Case Summary	When the user has selected a specific program from a specific university this use case will allow him/her to see the faculty of that program available in the university.
Pre-condition:	User must have an internet connection and must have selected any program from any university.
Normal Flow of Events	**Alternative Path**
1. This use case starts when the user wants to see the faculty of his/her selected program.	
2. Users can view the faculty of selected program by clicking on the “Faculty” button.	
3. User can view qualification, teaching experience, picture of any particular faculty member and his areas of expertise.	
4. User can edit or delete the faculty information	4a. User must be an admin
5. This use case ends.	
Exceptions / Alerts	
1.User cannot select multiple programs at a time.	
Post Conditions	
Step#	**Description**
User can view the list of faculties of that program and get an overview about them.	
Use Case Cross References	
Includes	
Extends	None

Table 10: Use case of Manage Faculties

Use case ID 010	**Use case Name: Availability of books**
Priority	**High**
Actors:	User, Server
Use Case Summary	After selecting the details of faculty, the user can download the books and lecture notes of any faculty member.
Pre-condition:	User must have selected the details of university
Normal Flow of Events	**Alternative Path**
1. This use case starts when the user wants to download the books and lecture notes of any faculty.	
2. The user can download the books by clicking on the “download” button.	
3. The user can download the lecture notes by clicking on the “download” button.	
4. This use case ends.	
Exceptions / Alerts	
1. None.	
Post Conditions	
Step#	**Description**
Books and lecture notes of any faculty member will be downloaded.	
Use Case Cross References	
Includes	
Extends	None

Table 11: Availability of Books

Use case ID 011	**Use case Name: Manage Cities**
Priority	**Low**
Actors:	User, Server
Use Case Summary	User can manage cities by adding or deleting the cities
Pre-condition:	User must have selected the Manage cities.
Normal Flow of Events	**Alternative Path**
1. This use case starts when the user wants to manage cities by clicking on “Manage Cities” option.	
2. The user can add new city by clicking on the “add new city” button.	User must be an admin.
3. After clicking button user can add new city and click on the “add city” button.	
4. User can edit or delete the city by clicking on “edit or delete” button.	4a. User must be an admin.
5. This use case ends.	
Exceptions / Alerts	
1. None	
Post Conditions	
Step#	**Description**
Books and lecture notes of any faculty member will be downloaded.	
Use Case Cross References	
Includes	
Extends	None

Table 12: Use Case of Manage Cities

Use case ID 012	**Use case Name: Manage Courses**
Priority	**High**
Actors:	User, Server
Use Case Summary	After selecting the manage course user can add new course, update or delete existing course.
Pre-condition:	User must have added cities and universities.
Normal Flow of Events	**Alternative Path**
1. This use case starts when the user wants to manage cities by clicking on “Manage Courses” option.	
2. The user can add new city by clicking on the “add new course” button.	
3. After clicking button user can select city, add title, select course level, select university and add picture of city.	3a. city is not added 3b. university is not added
4. User can add attachments to course.	
6. After clicking the “Add new course” button course will be added.	
5. This use case ends.	
Exceptions / Alerts	
1. City must be added before. 2. University must be added before.	
Post Conditions	
Step#	**Description**
New course will be added	
Use Case Cross References	
Includes	
Extends	None

Table 13: Use case of Manage Courses

Use case ID 013	**Use case Name: Manage User's Roles**
Priority	**High**
Actors:	User, Server
Use Case Summary	After selecting the manage user's role admin can add new role or update existing user roles.
Pre-condition:	Admin must be logged in.
Normal Flow of Events	**Alternative Path**
1. This use case starts when the user wants to manage cities by clicking on "Manage User' Role" option.	
2. The user can add new user by clicking on the "add new user" button.	
3. After clicking button user can select user roles as admin, member or moderator.	
4. User can edit or delete users by clicking on the Edit or Delete button.	
6. After clicking the "Add new User" button user will be added.	
5. This use case ends.	
Exceptions / Alerts	
1. user must be a admin to edit or delete a user role.	
Post Conditions	
Step#	**Description**
New user will be added	
Use Case Cross References	
Includes	
Extends	None

Table 14: Use case of Manage User's Roles

Use case ID 014	**Use case Name: Manage Events**
Priority	**Medium**
Actors:	User, Server
Use Case Summary	After selecting the manage events can view or add new events by clicking on the events button in the main menu.
Pre-condition:	Admin must be logged in.
Normal Flow of Events	**Alternative Path**
1. This use case starts when the user wants to manage cities by clicking on “Manage Events” option.	
2. The user can add new user by clicking on the “add new event” button.	
3. After clicking button user can add event title, start/end date, speaker name, venue and picture.	
4. User can edit or delete events by clicking on the Edit or Delete button.	
6. After clicking the “Add new Event” button event will be added.	
5. This use case ends.	
Exceptions / Alerts	
1. None.	
Post Conditions	
Step#	**Description**
New event will be added.	
Use Case Cross References	
Includes	

Extends	None

Table 15: Use case of Manage Events

Use case ID 015	**Use case Name: Edit Profile**
Priority	**Medium**
Actors:	User, Server
Use Case Summary	User can change his name, reset password and update profile picture by clicking on the “edit profile” button.
Pre-condition:	User must be logged in.
Normal Flow of Events	**Alternative Path**
1. This use case starts when the user wants to edit profile by clicking on “edit profile” option.	
2. After clicking user can reset password, update profile picture and change his name.	
3. After entering information user will select the “Save” button to save changes.	
4. After clicking the button changes will be made.	
Exceptions / Alerts	
1. None.	
Post Conditions	
Step#	**Description**
Profile will be updated.	
Use Case Cross References	
Includes	
Extends	None

Table 16: Edit Profile

2.5 Use case design

The Use case diagram of complete system is:

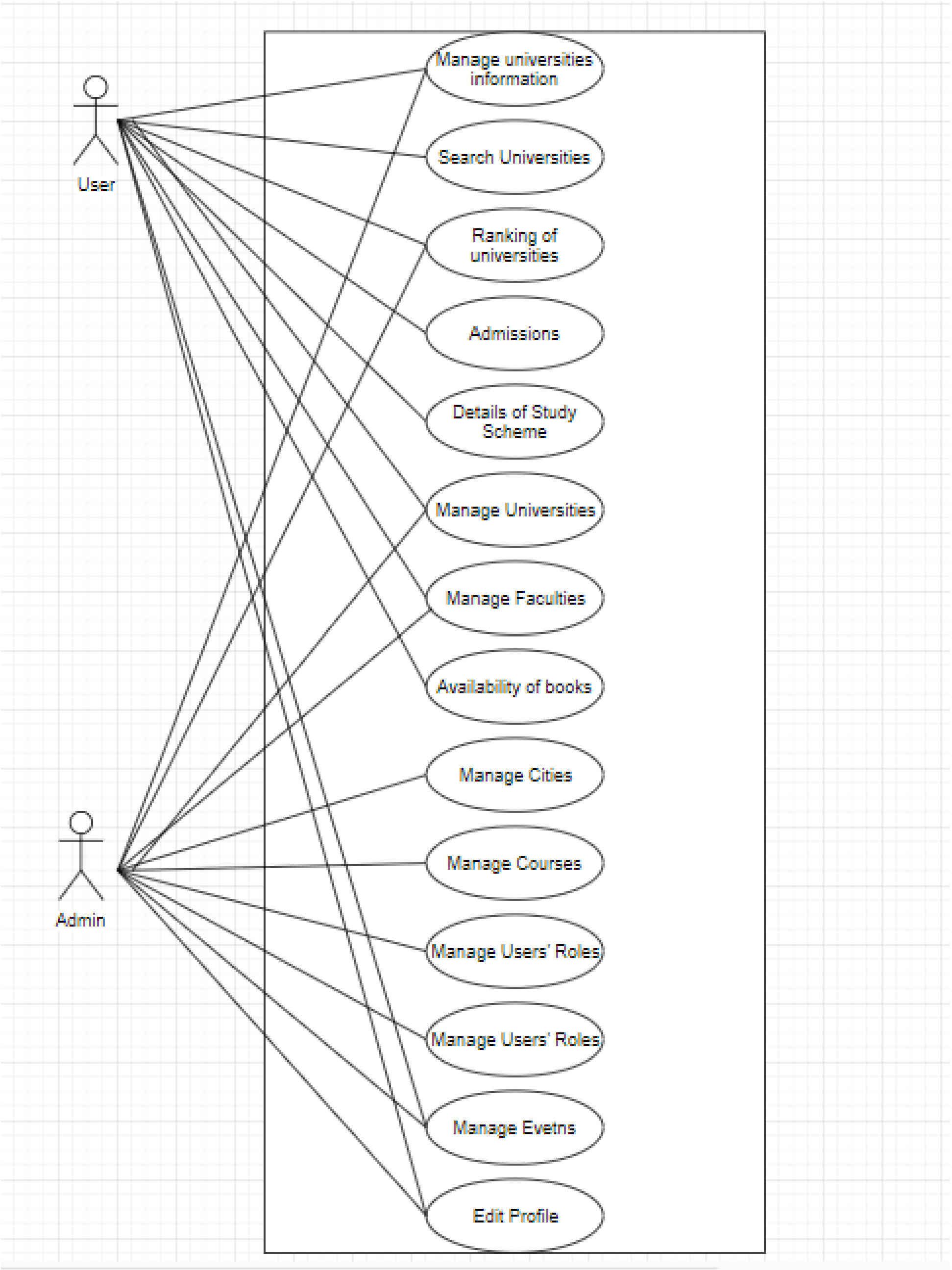


Figure 1: Use case model of system

1. Manage Universities Information

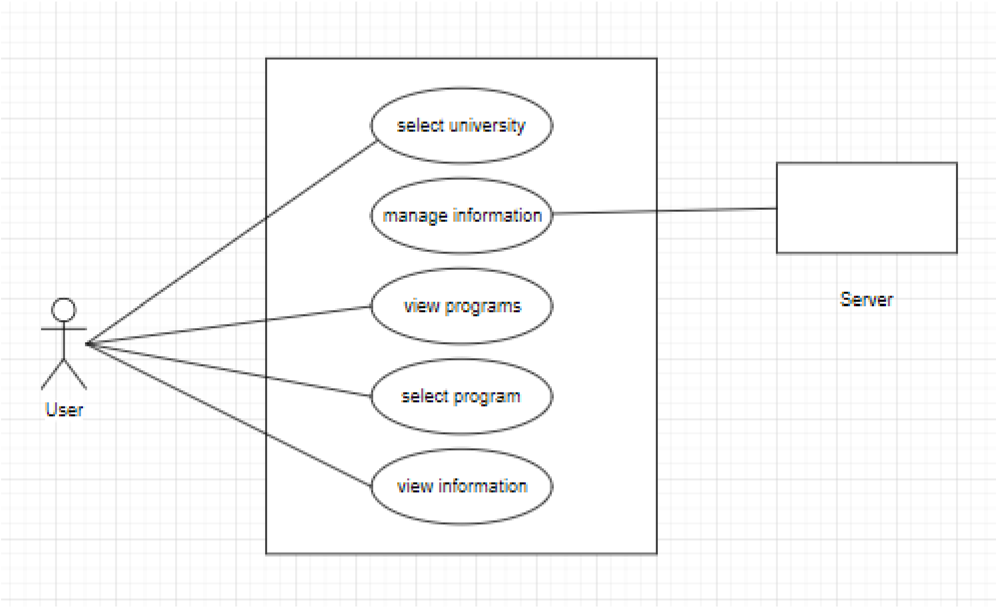


Figure 2:Use case of Maintain Universities Information

2. Search Universities

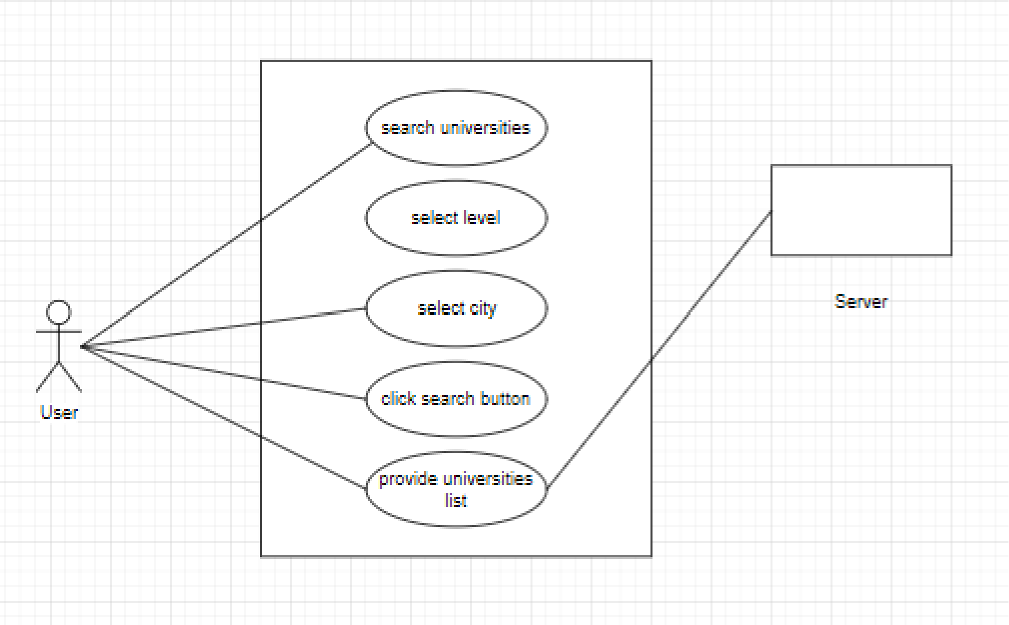


Figure 3: Use case of Search Universities

3. Rankings of Universities

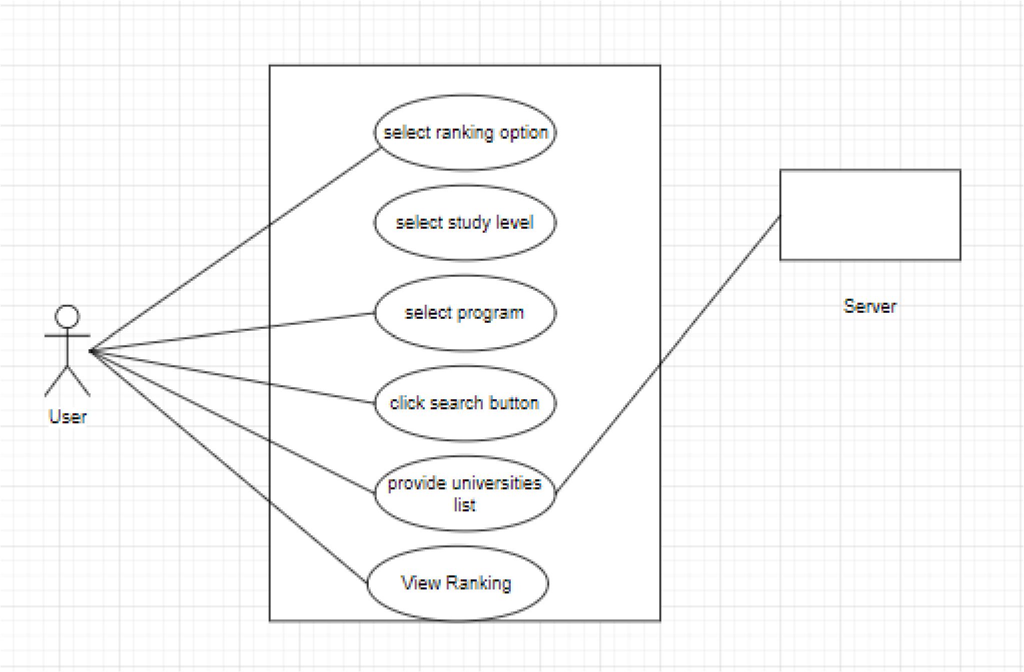


Figure 4: Use case of Ranking of Universities

4. Admissions

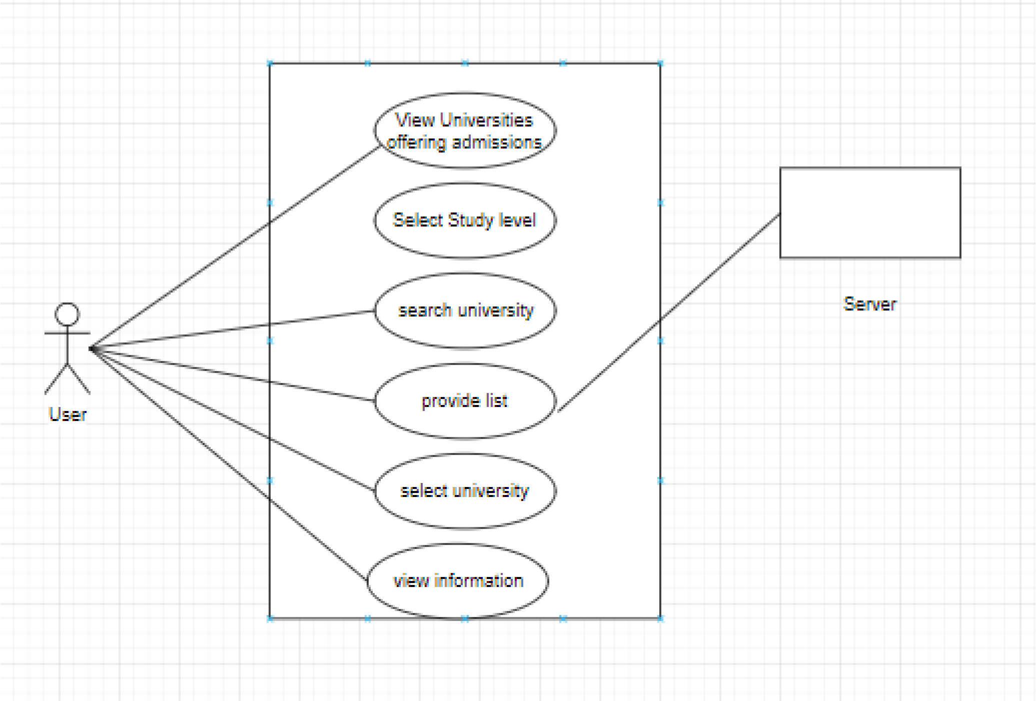


Figure 5: Use case of Admissions

5. Manage Universities

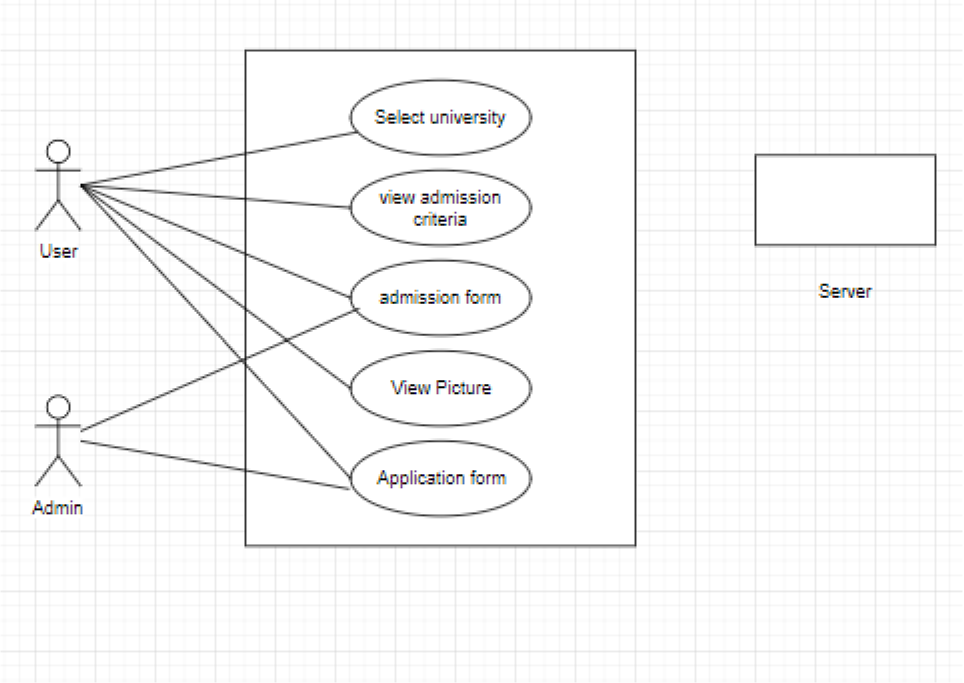


Figure 6: Use case of Manage Universities

6. Details of Study Scheme

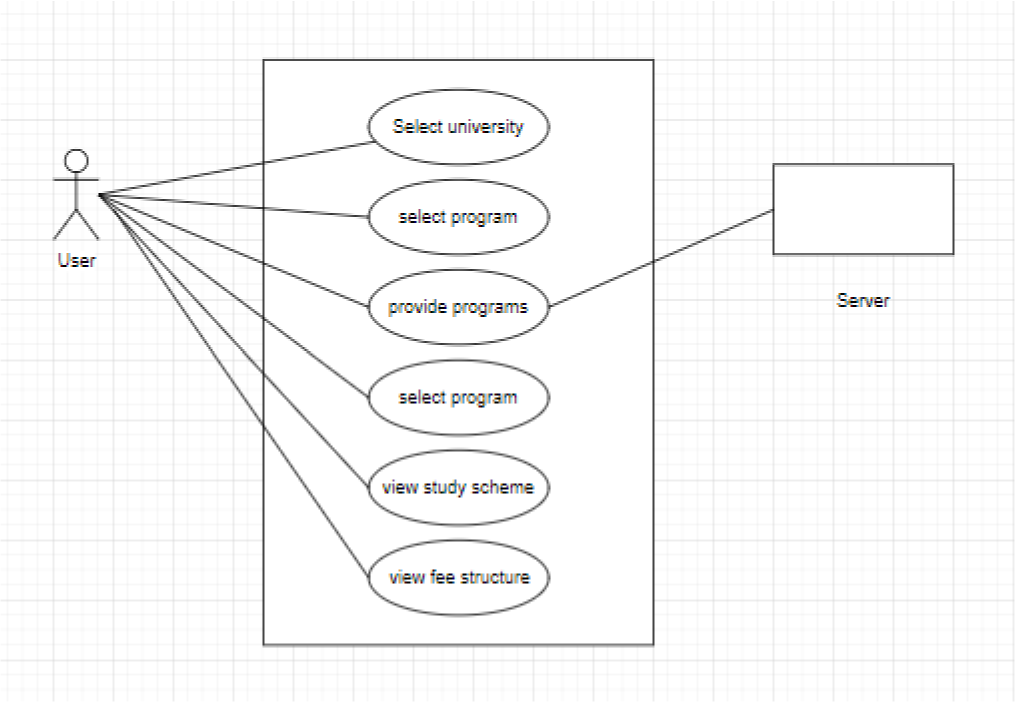


Figure 7: Use Case of Details of Study Scheme

7. Manage Faculties

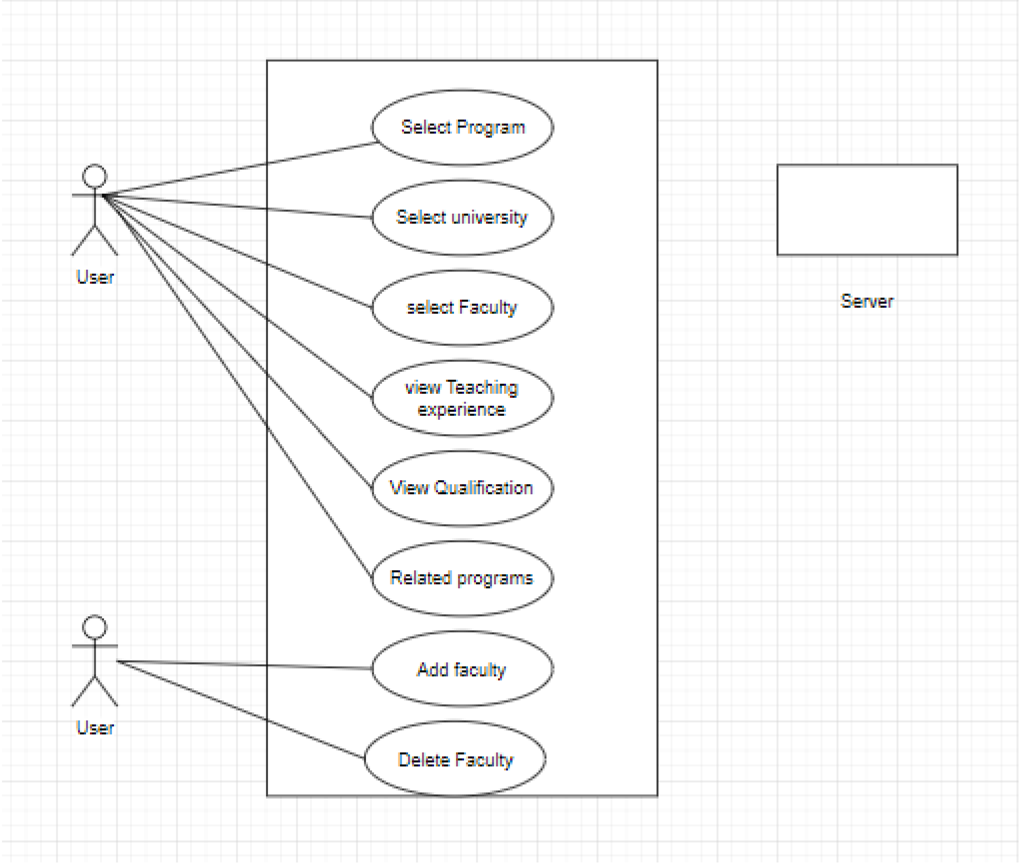


Figure 8:Use Case of Manage Faculties

8. Availability of Books

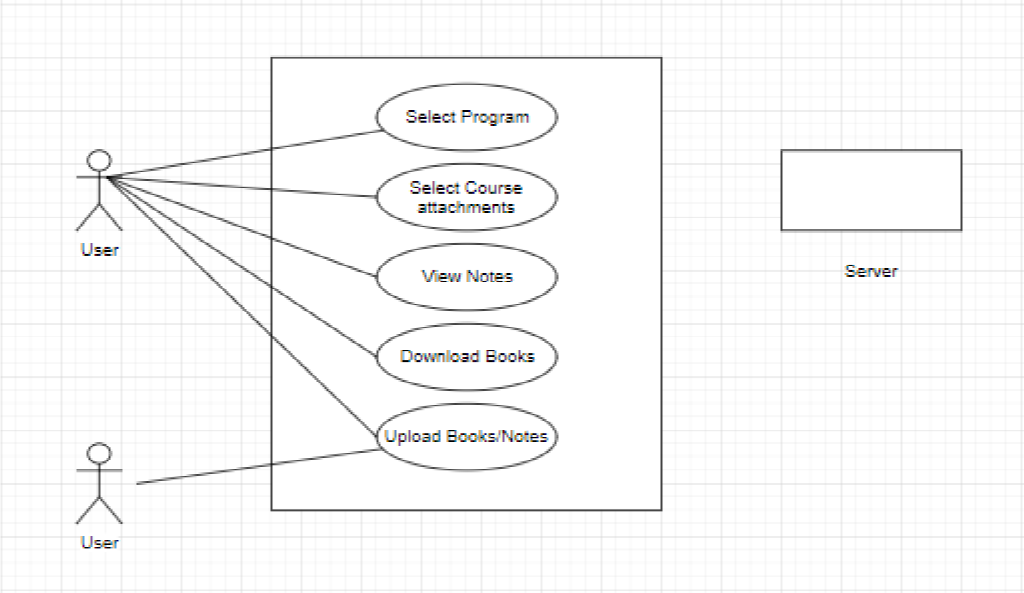


Figure 9: Use Case of Availability of Books

9. Manage Cities

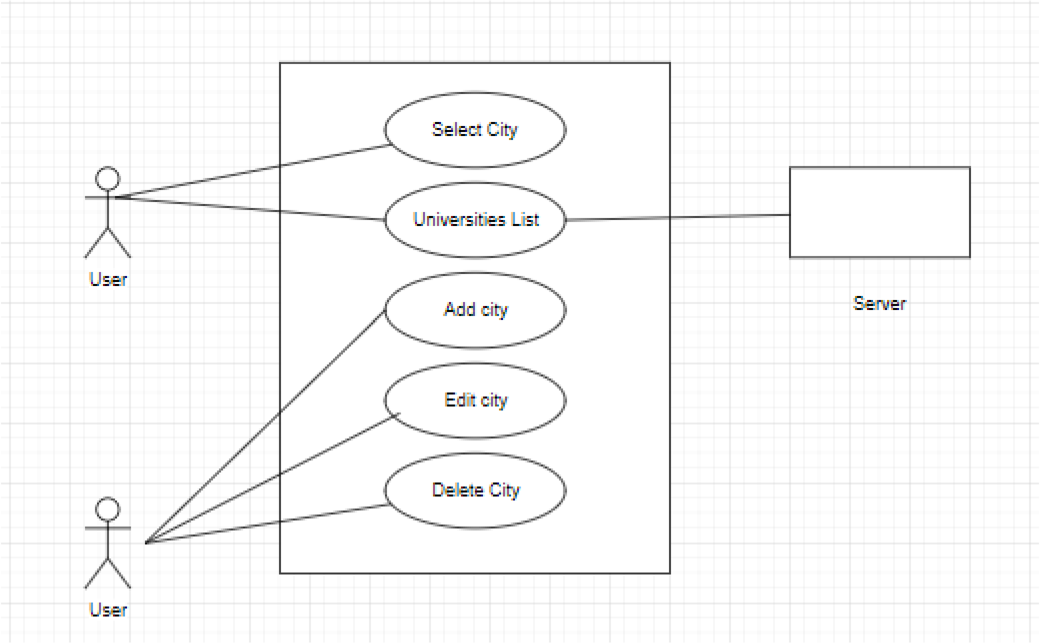


Figure 10: Use case of Manage Cities

10. Manage Courses

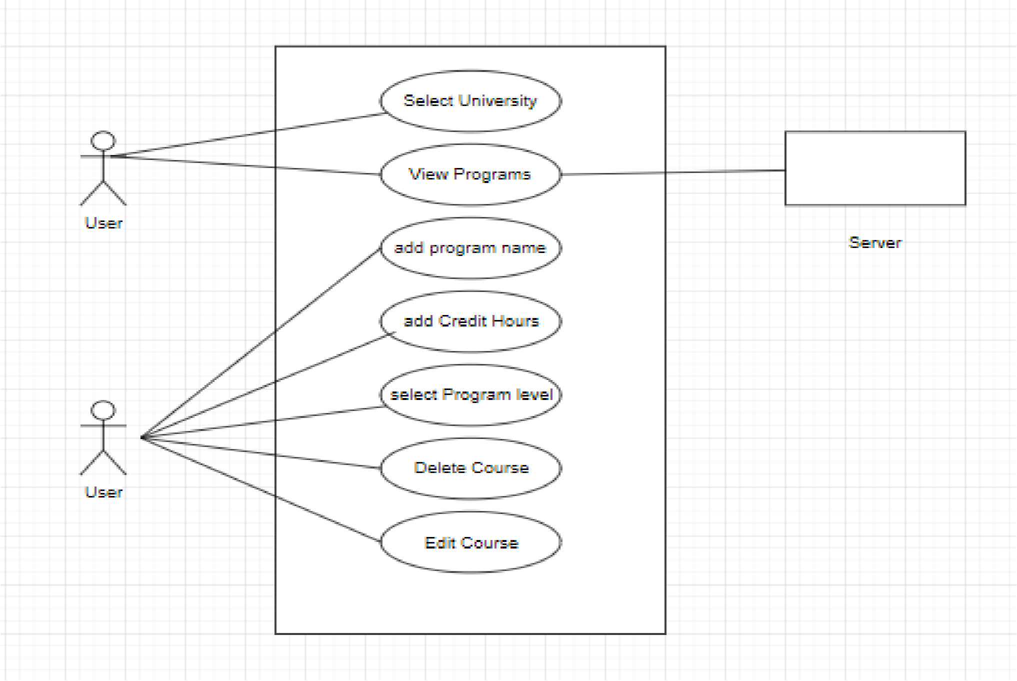


Figure 11: Use case of Manage Courses

11. Manage User’s roles

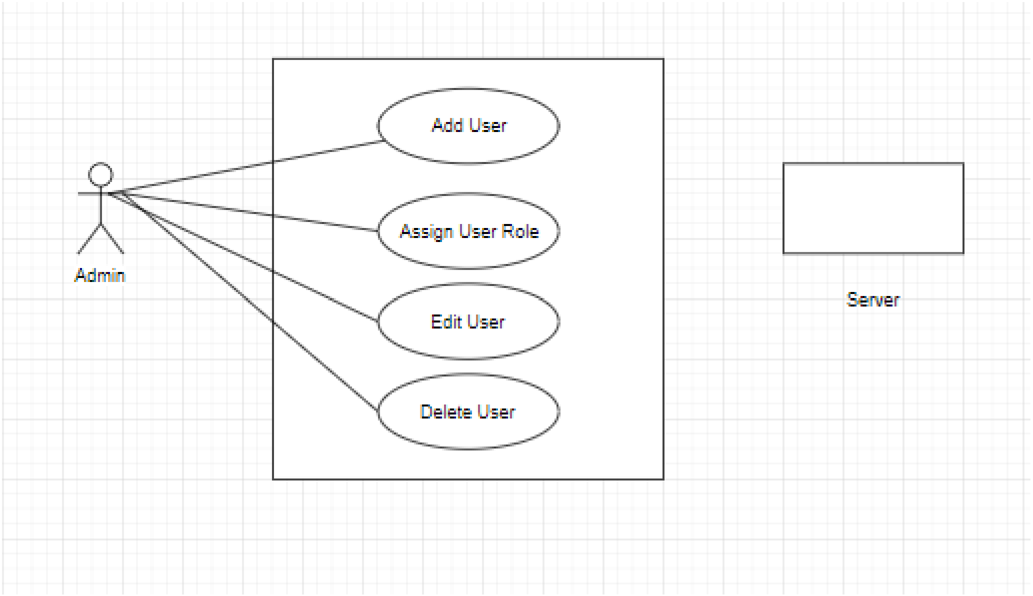


Figure 12: Use case of Manage user's Roles

12. Manage events

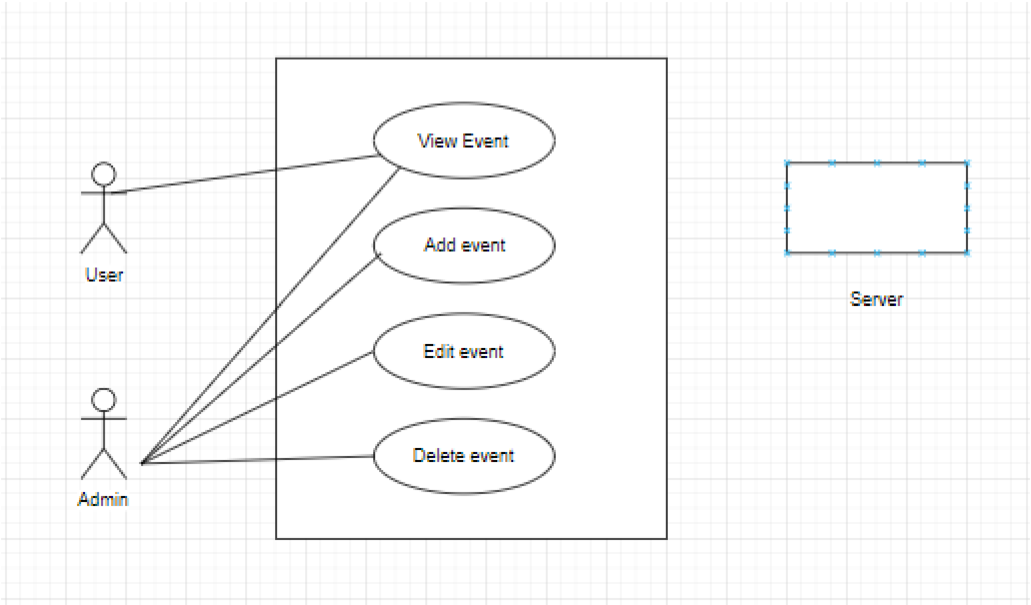


Figure 13: Use case of Manage Events

13. Edit profile

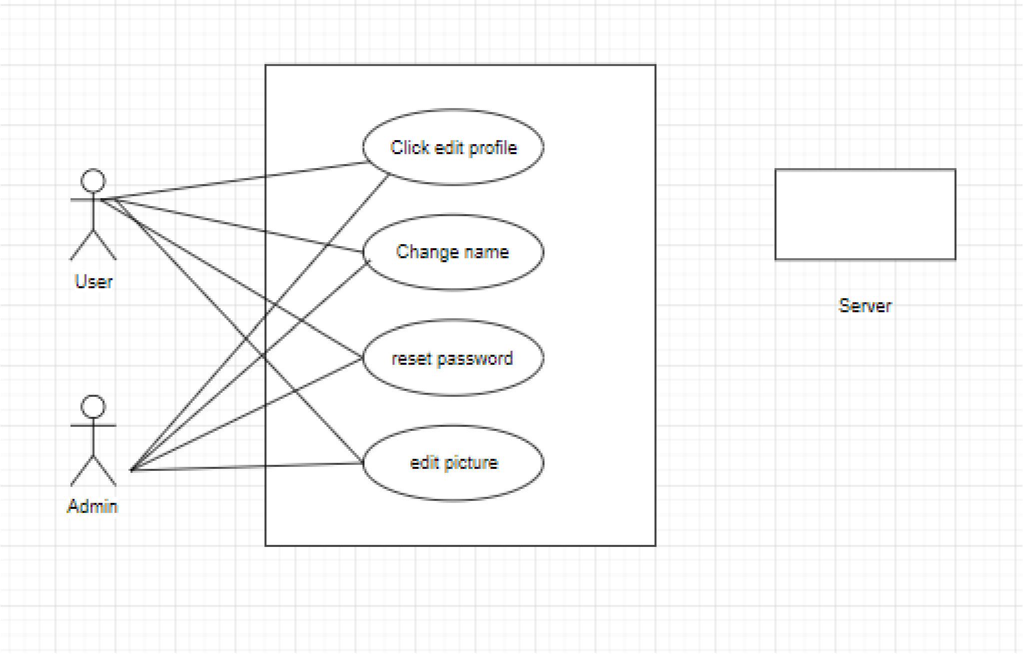


Figure 14: Use case of Edit Profile

2.6 Software development lifecycle model

Agile Model

Agile model because it promotes continuous iteration of development and testing throughout the software development lifecycle of the project. Both development and testing activities are concurrent unlike the Waterfall model.

Agile model uses an incremental approach where a sample prototype is discussed with the customer or in our case with the Supervisor. The idea is to maintain product's quality in the entire phase of development.

Why Agile Model?

- Agile Methodologies have overcome the traditional methods of waterfall model by becoming flexible, fast, lean, responsive, and consistent.
- Agile method focuses on people and is more communication-oriented
- Agile methods are tested in a dynamic environment and prove to be very flexible by adapting to the change happening in the business.
- Agile methods include regular inspection in a disciplined manner, which consequently improves the leadership qualities to boost the teamwork.
- Agile method follows best practices that help in getting high-quality software very quickly.

3 Chapter 3: System Design

3.1 Work breakdown structure

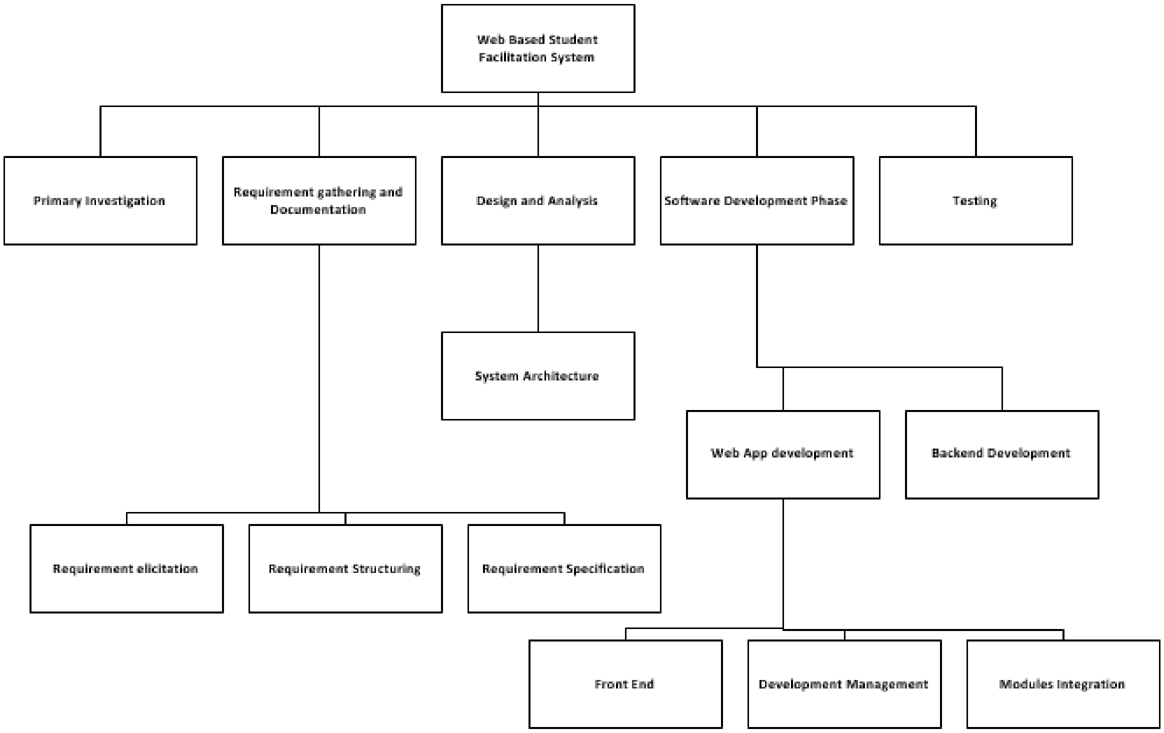


Figure 15: WBS

3.2 Activity diagrams

1. Manage Universities information

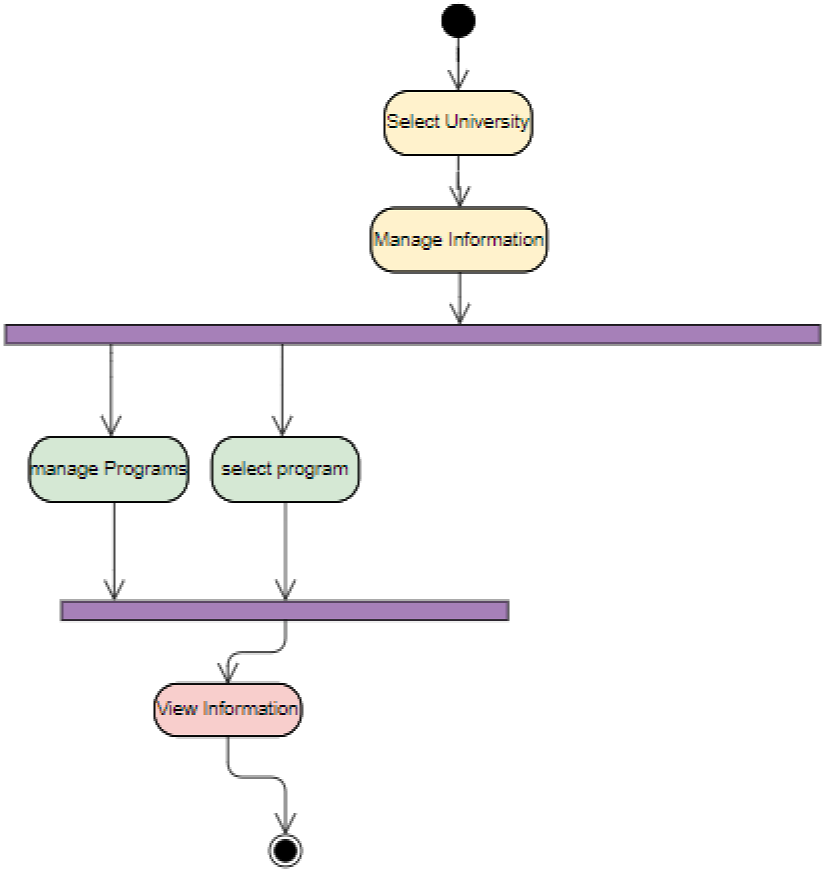


Figure 16: Activity of Manage Universities Data

2. Search Universities

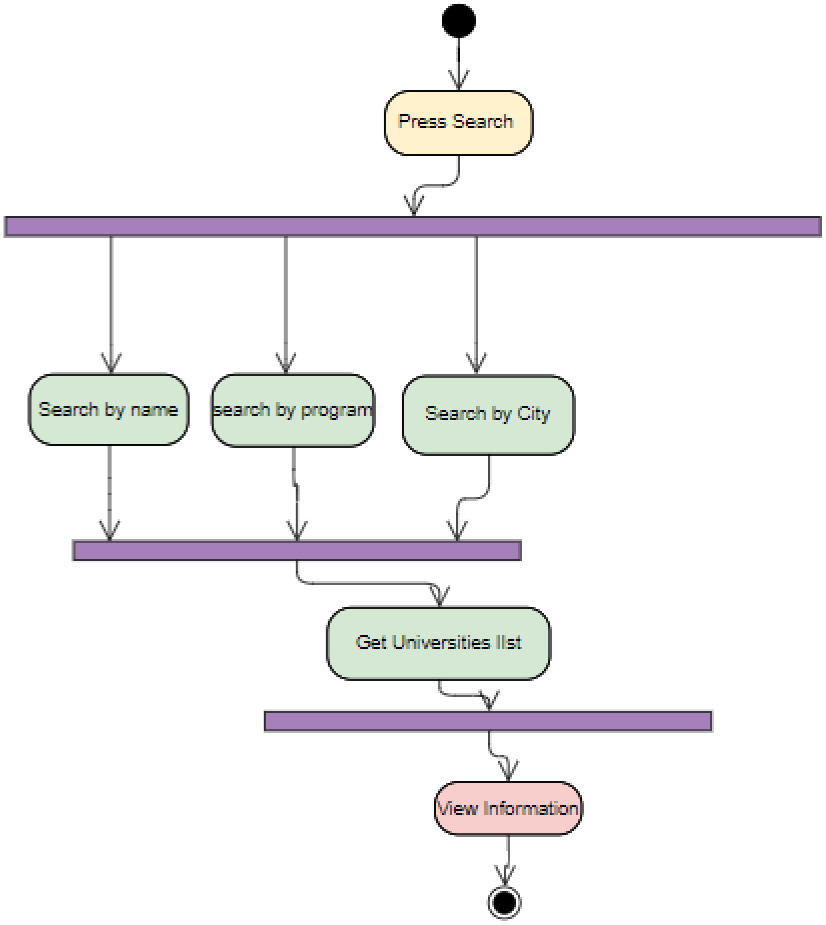


Figure 17: Activity of Search Universities

3. Ranking of Universities

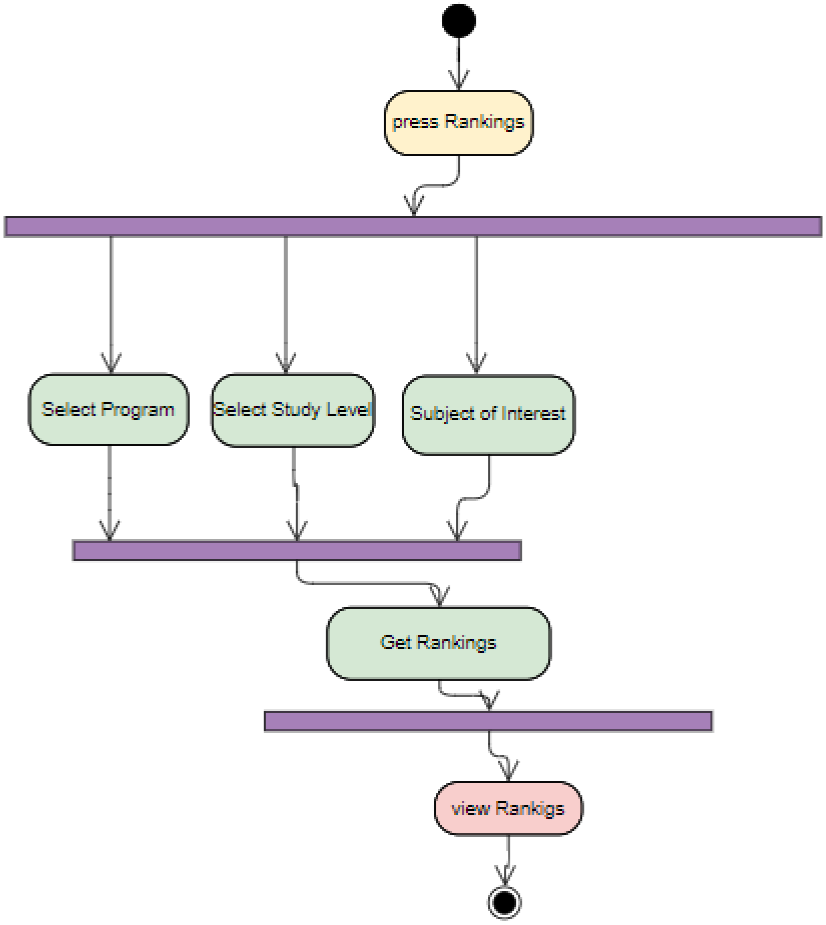


Figure 18: Activity of Ranking of Universities

4. Admissions

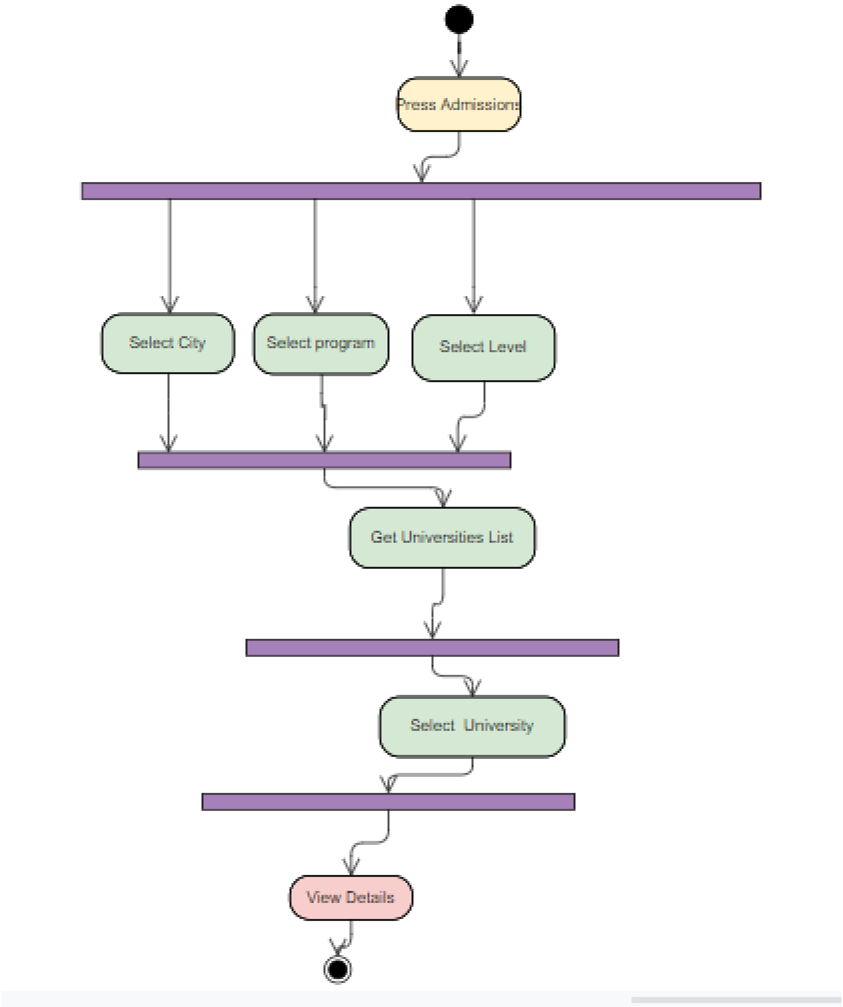


Figure 19: Activity of Admissions

5. Manage Universities

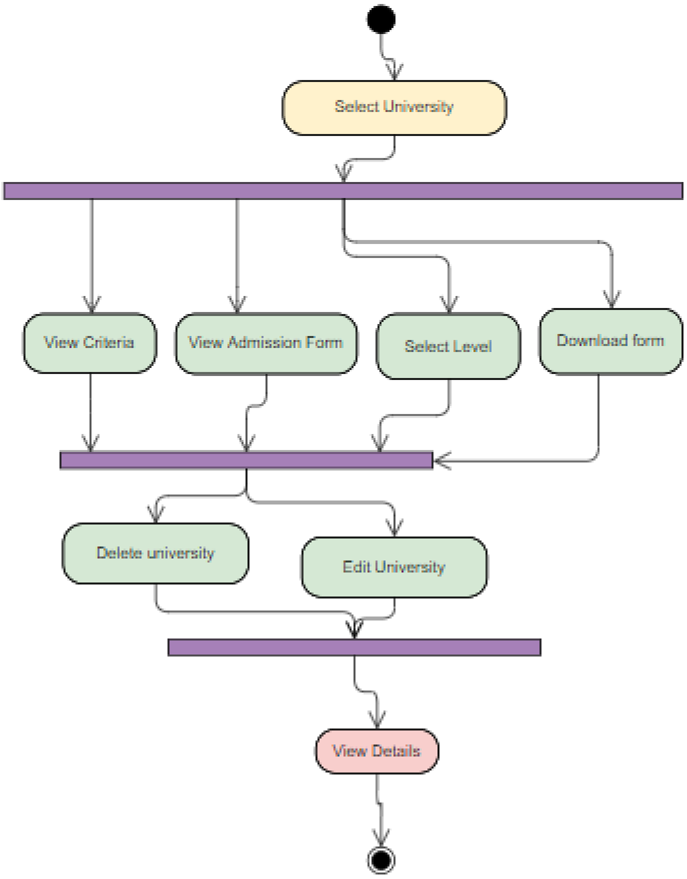


Figure 20: Activity of Manage Universities

6. Details of Study Scheme

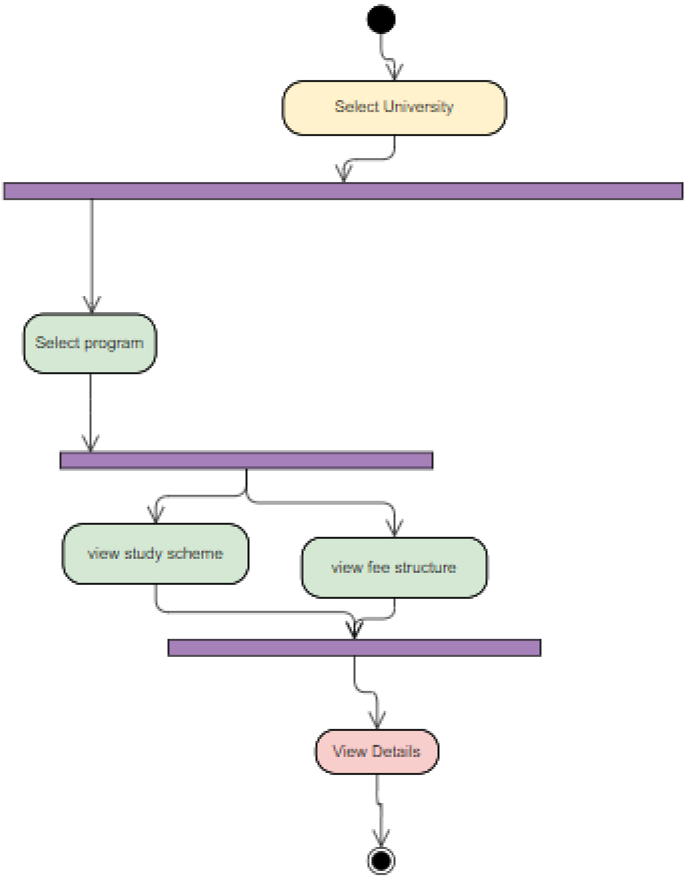


Figure 21: Activity of Details of Study Scheme

7. Manage Faculties

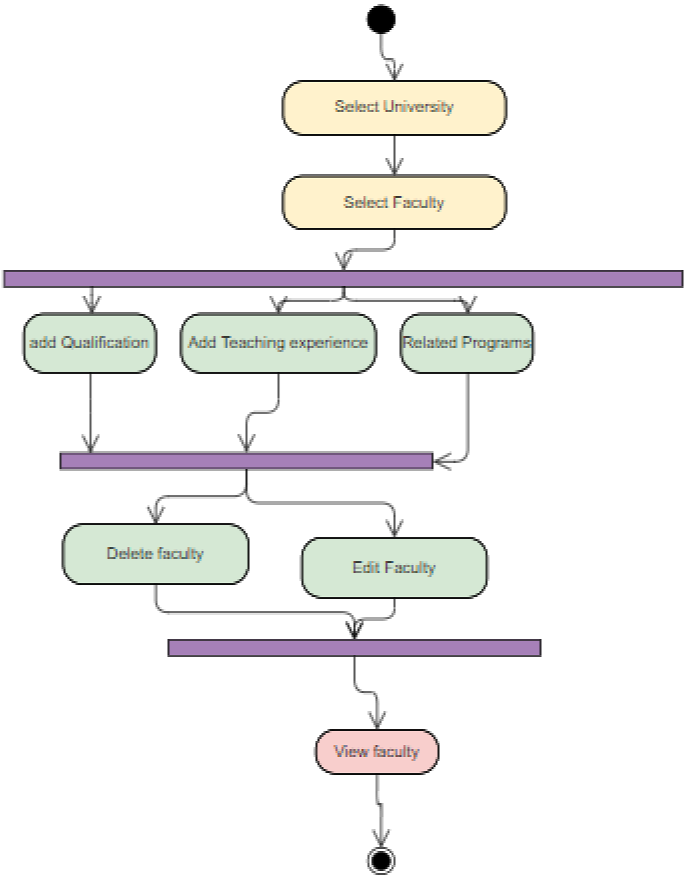


Figure 22: Activity of Manage Faculties

8. Availability of Books

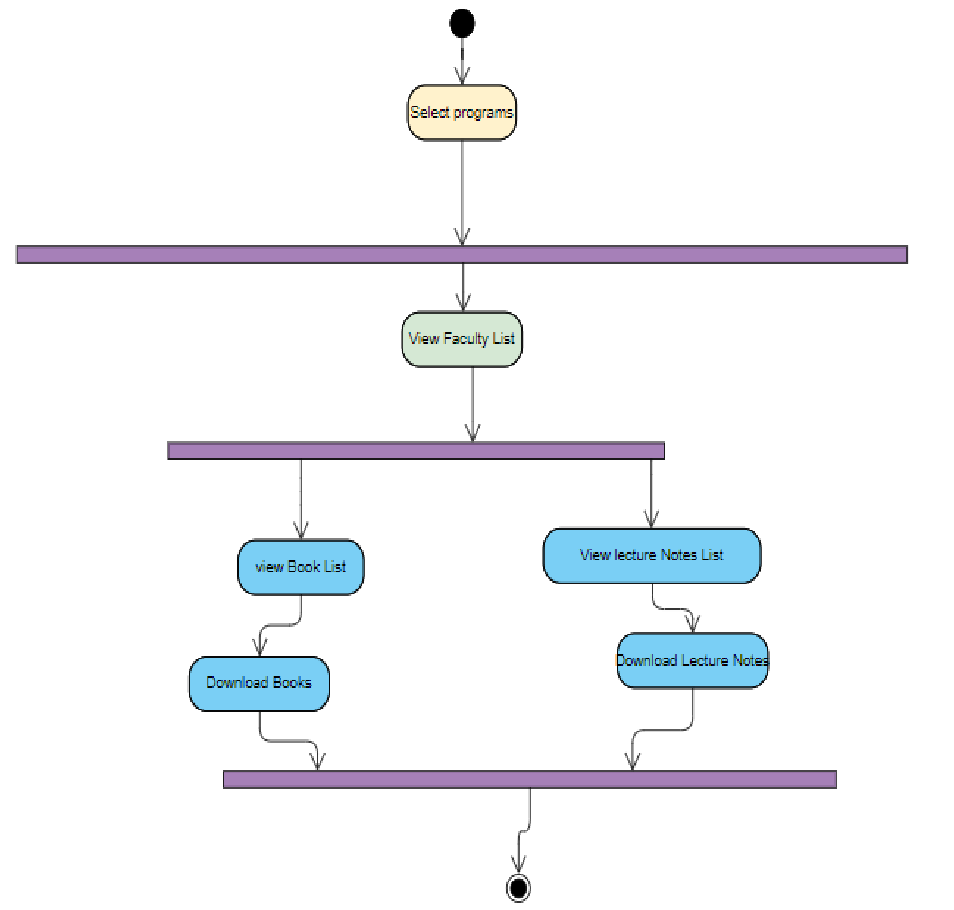


Figure 23: Activity of Availability of books

9. Manage Cities

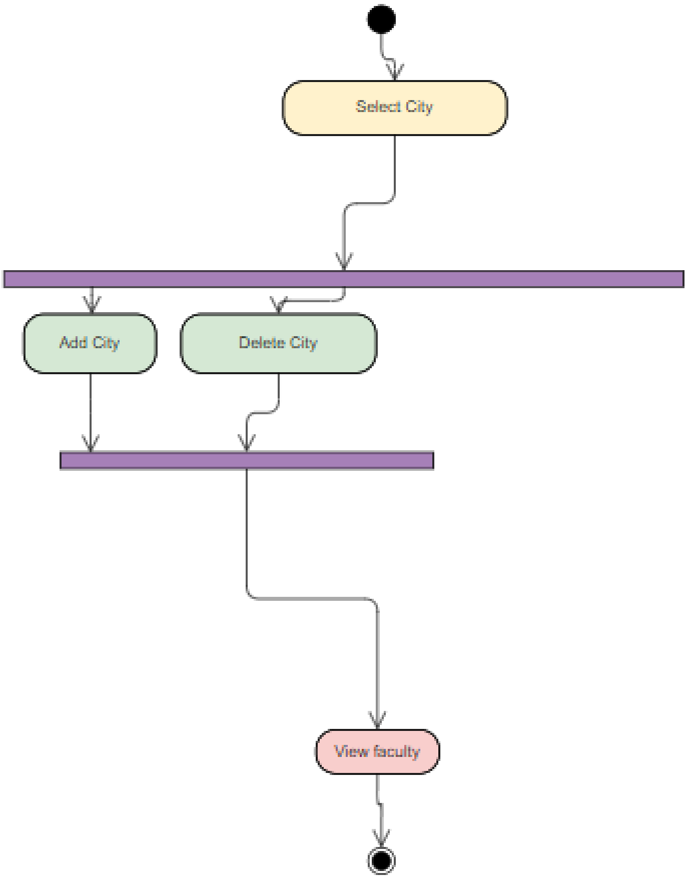


Figure 24: Activity of Manage Cities

10. Manage Courses

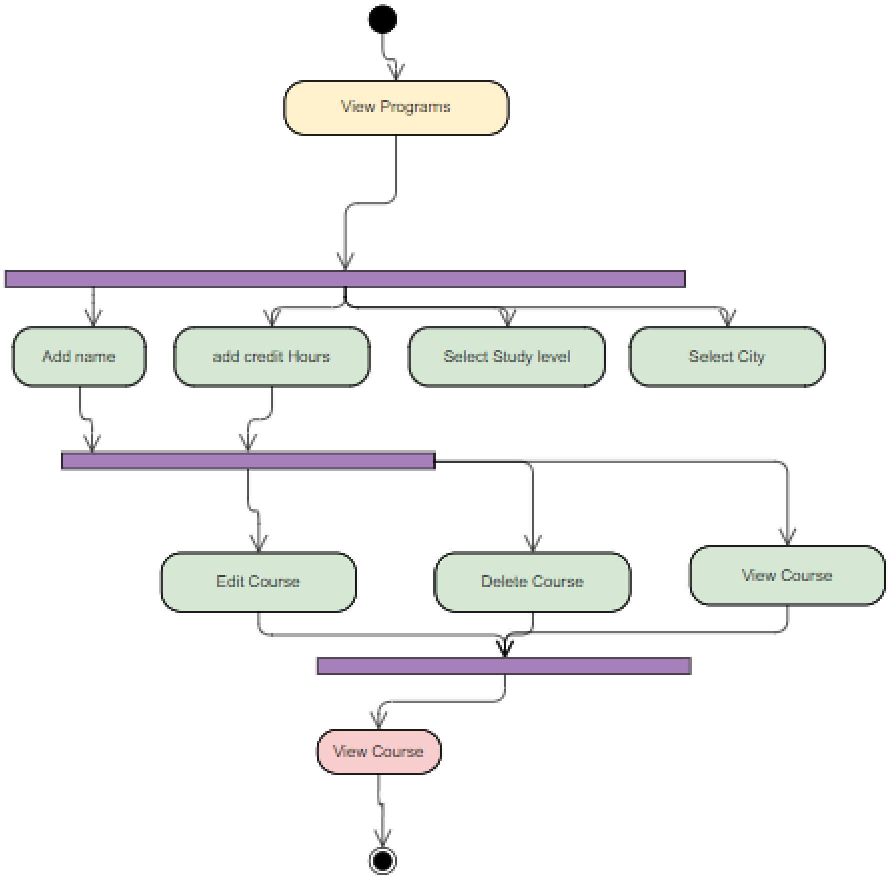


Figure 25: Activity of Manage Courses

11. Manage User’s Roles

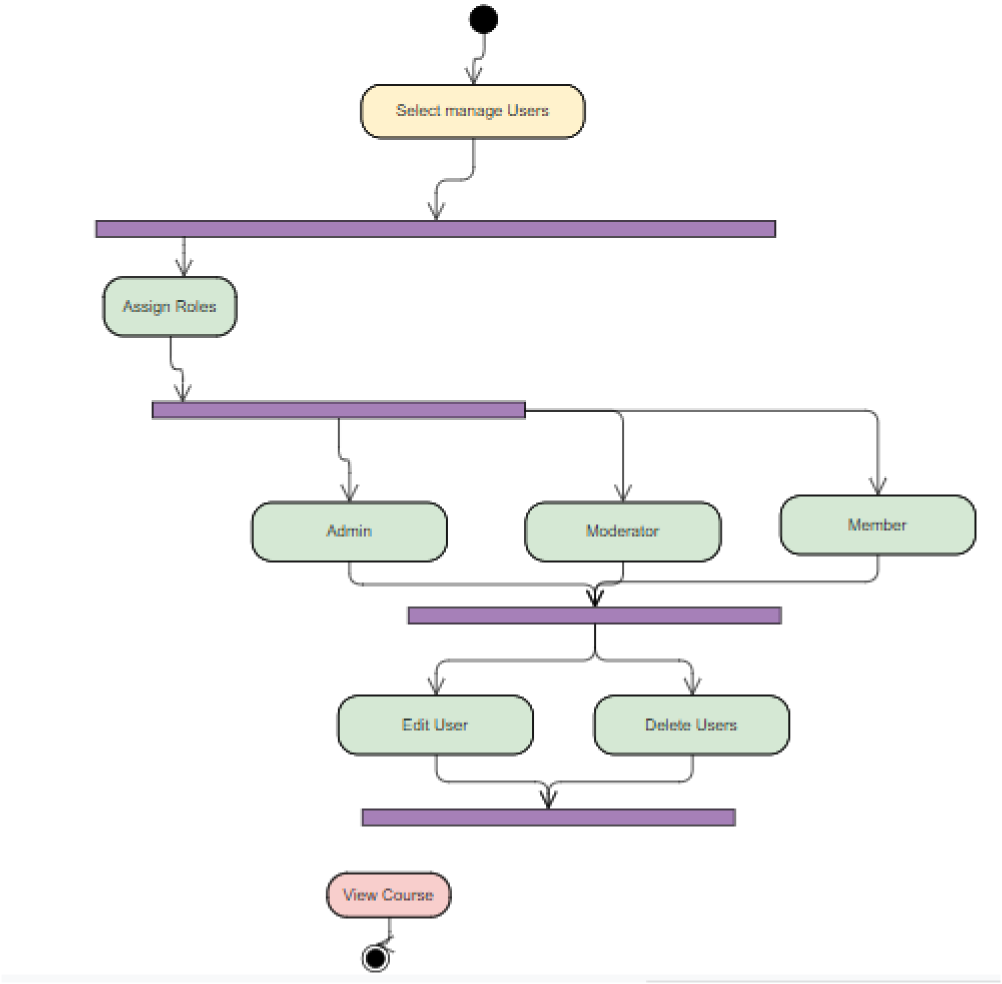


Figure 26: Activity of Manage User's Roles

12. Manage Events

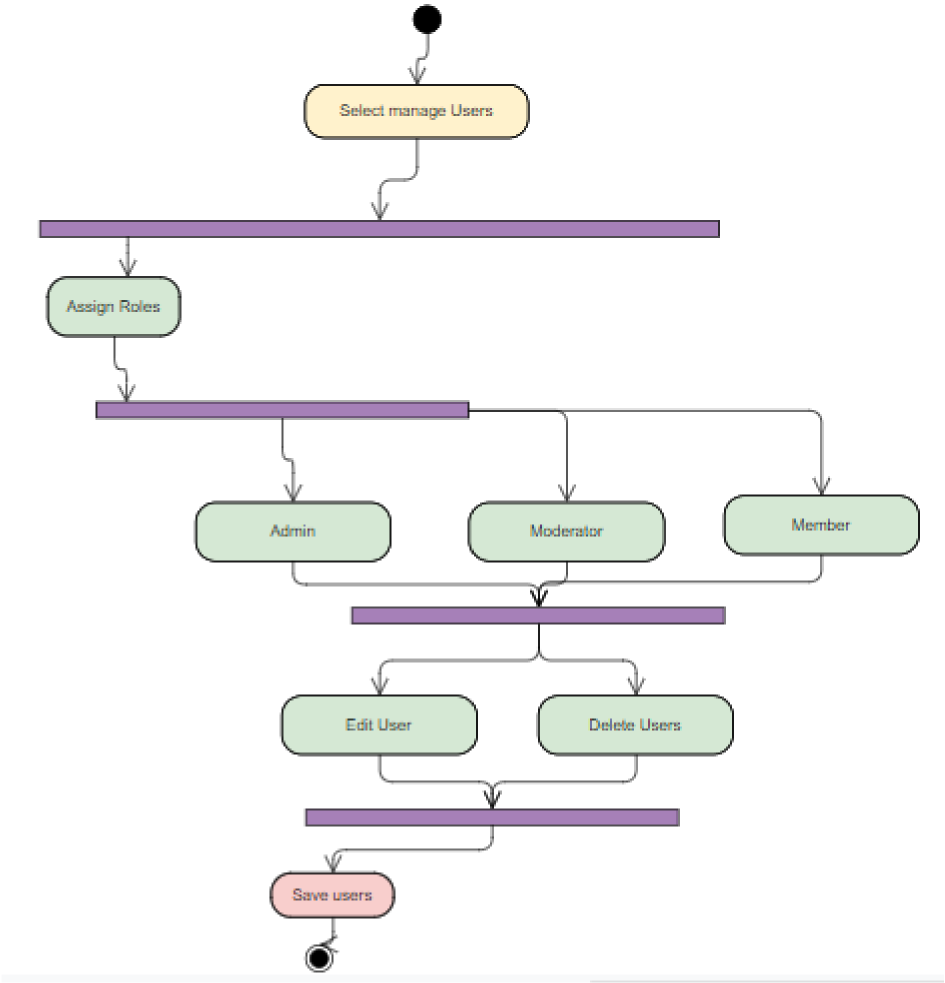


Figure 27: Activity of Manage events

13. Edit Profile

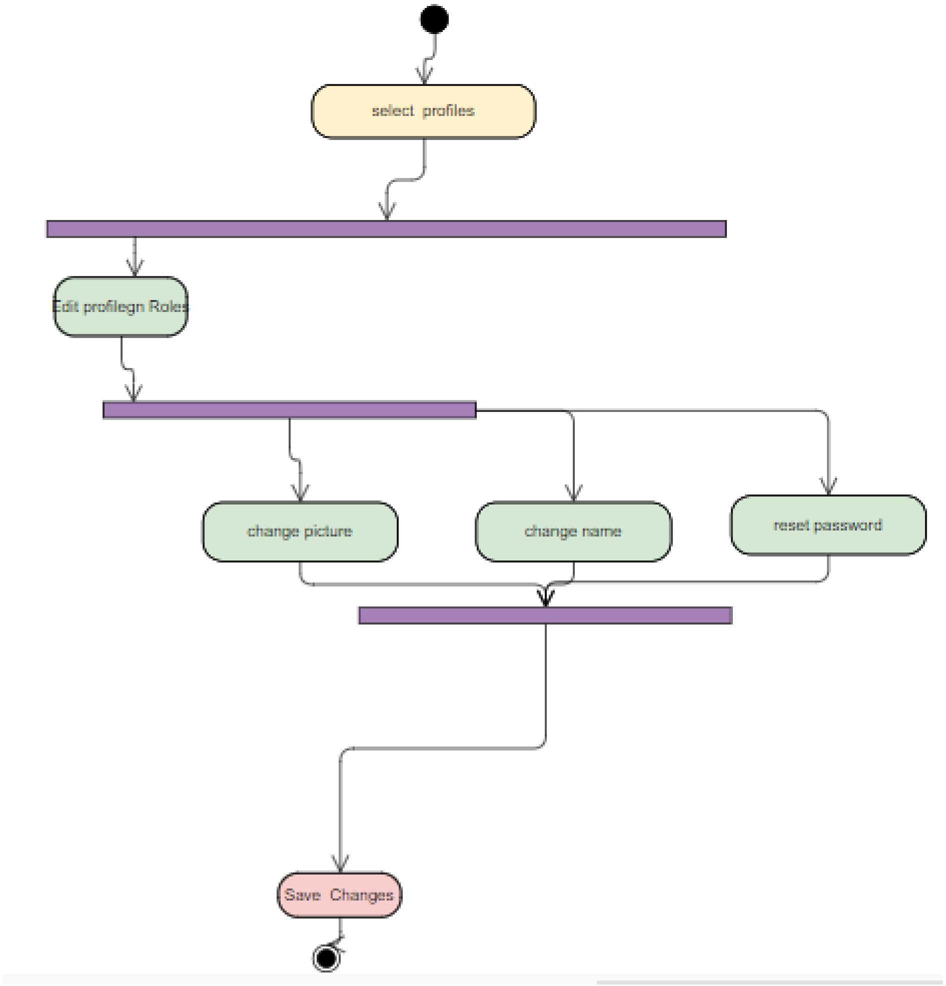


Figure 28: Activity of Edit Profile

3.3 Sequence diagram

1. Manage Universities Information

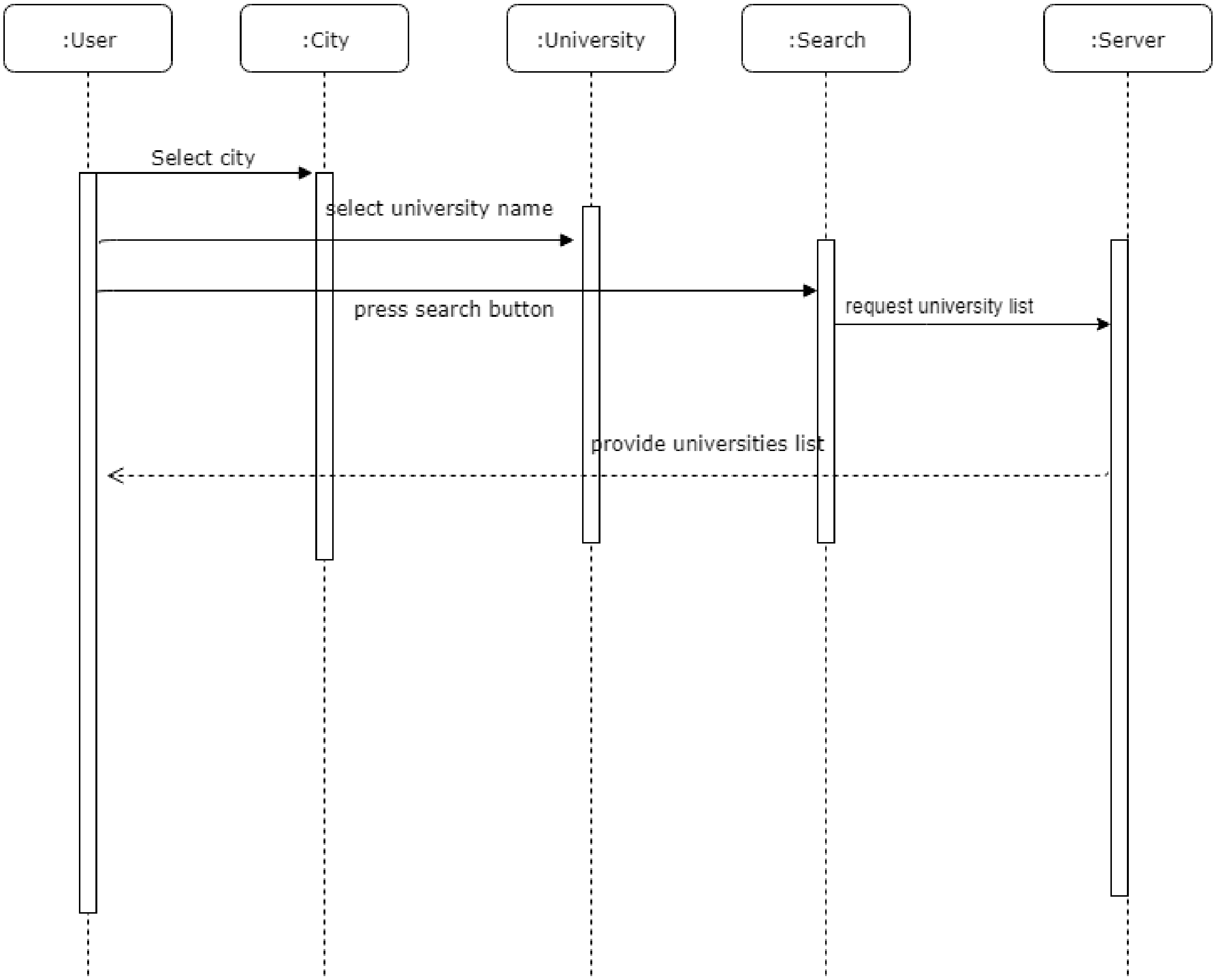


Figure 29: Sequence of Manage Universities Data

2. Search Universities

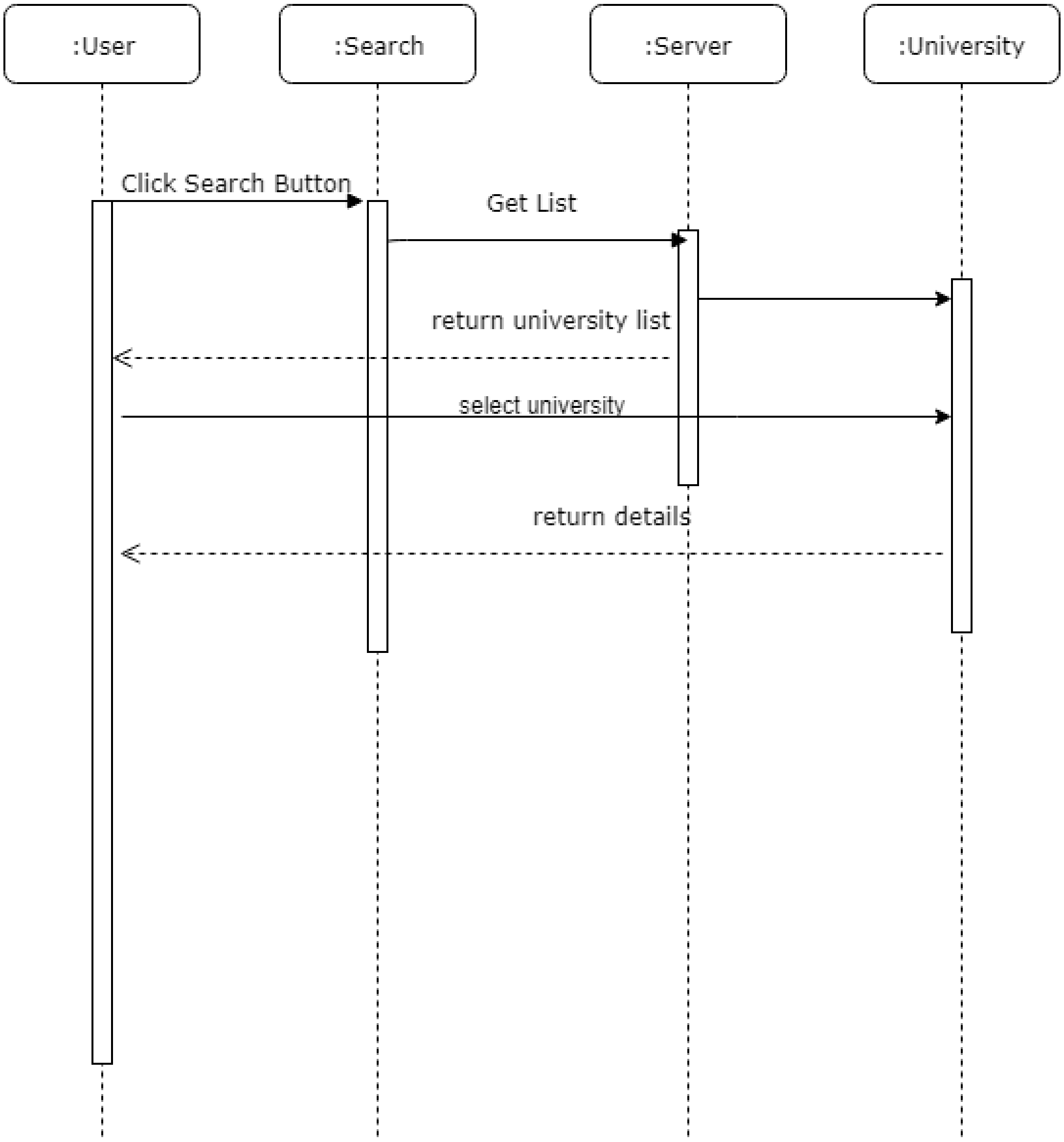


Figure 30: Sequence of Search Universities

3. Ranking of Universities

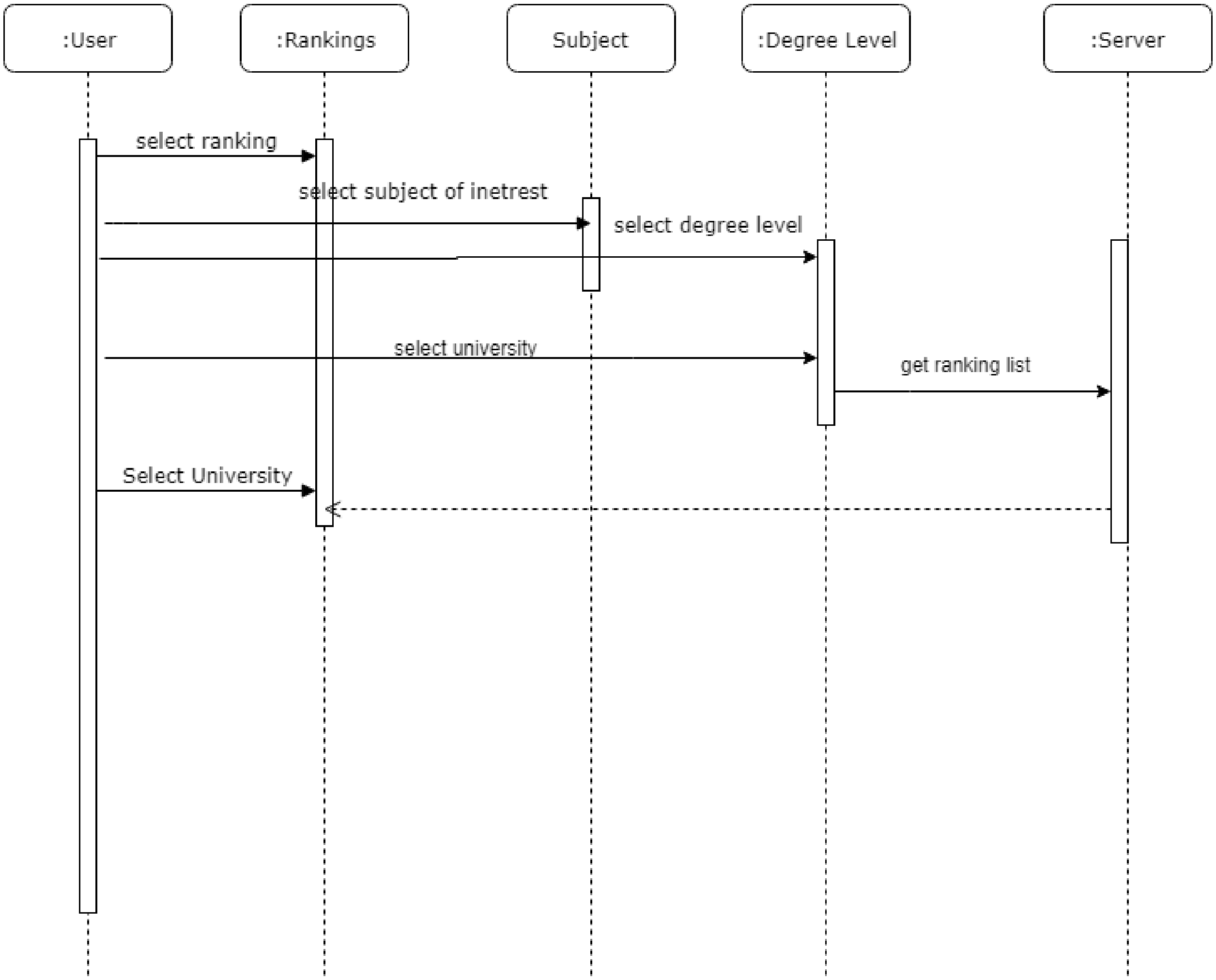


Figure 31: Sequence of Ranking of Universities

4. Admissions

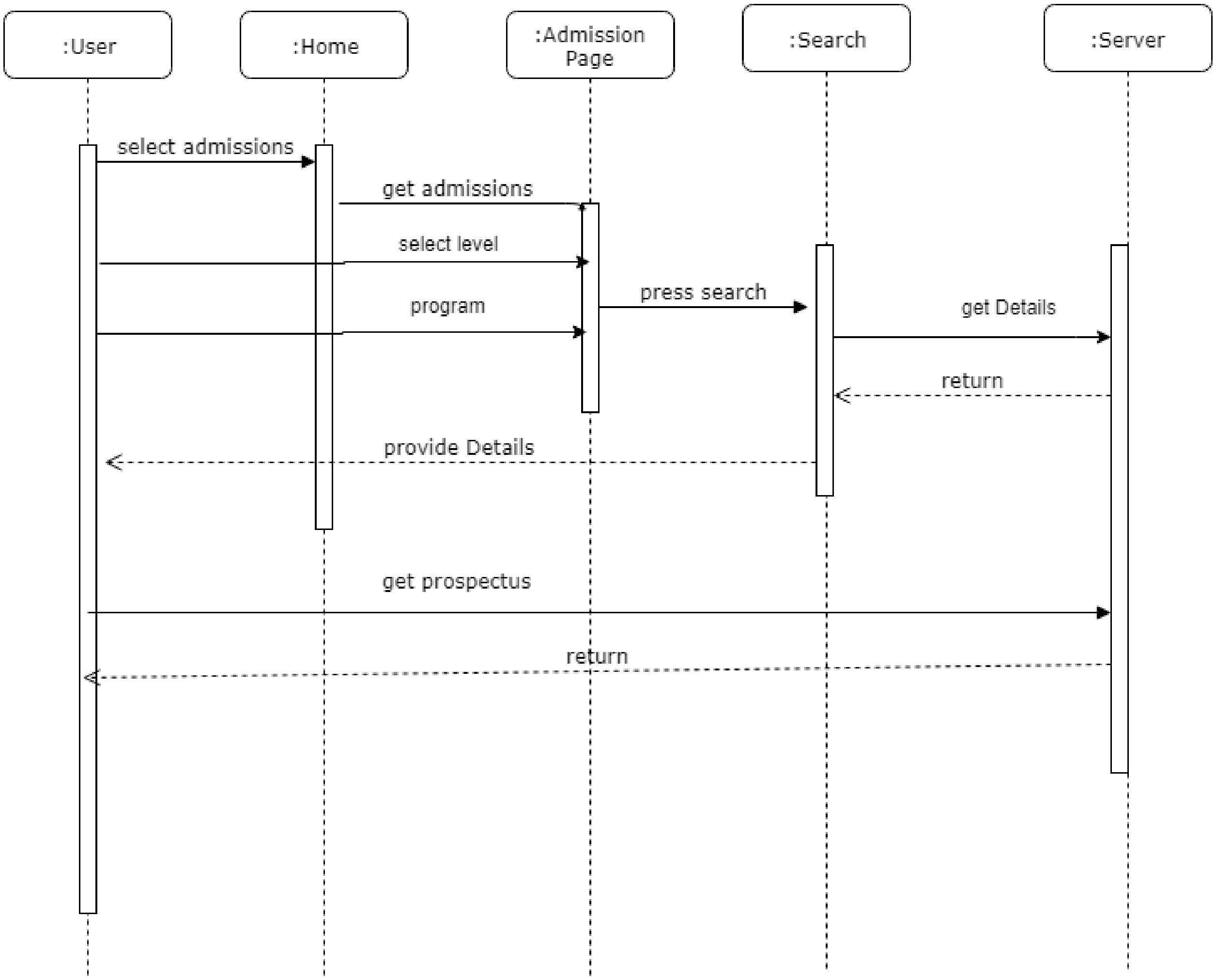


Figure 32: Sequence of Admissions

5. Manage Universities

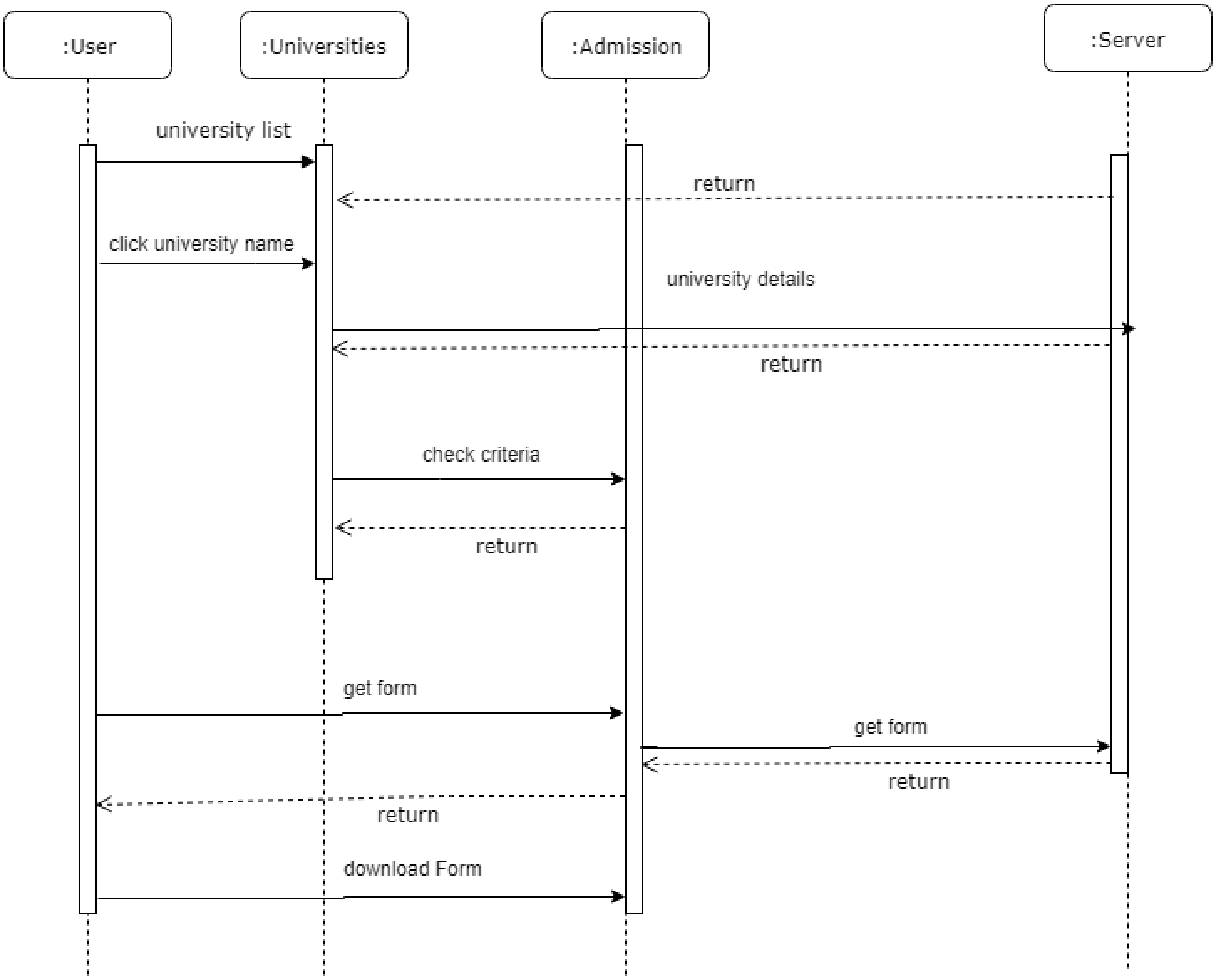


Figure 33: Sequence of Manage Universities

6. Details of Study Scheme

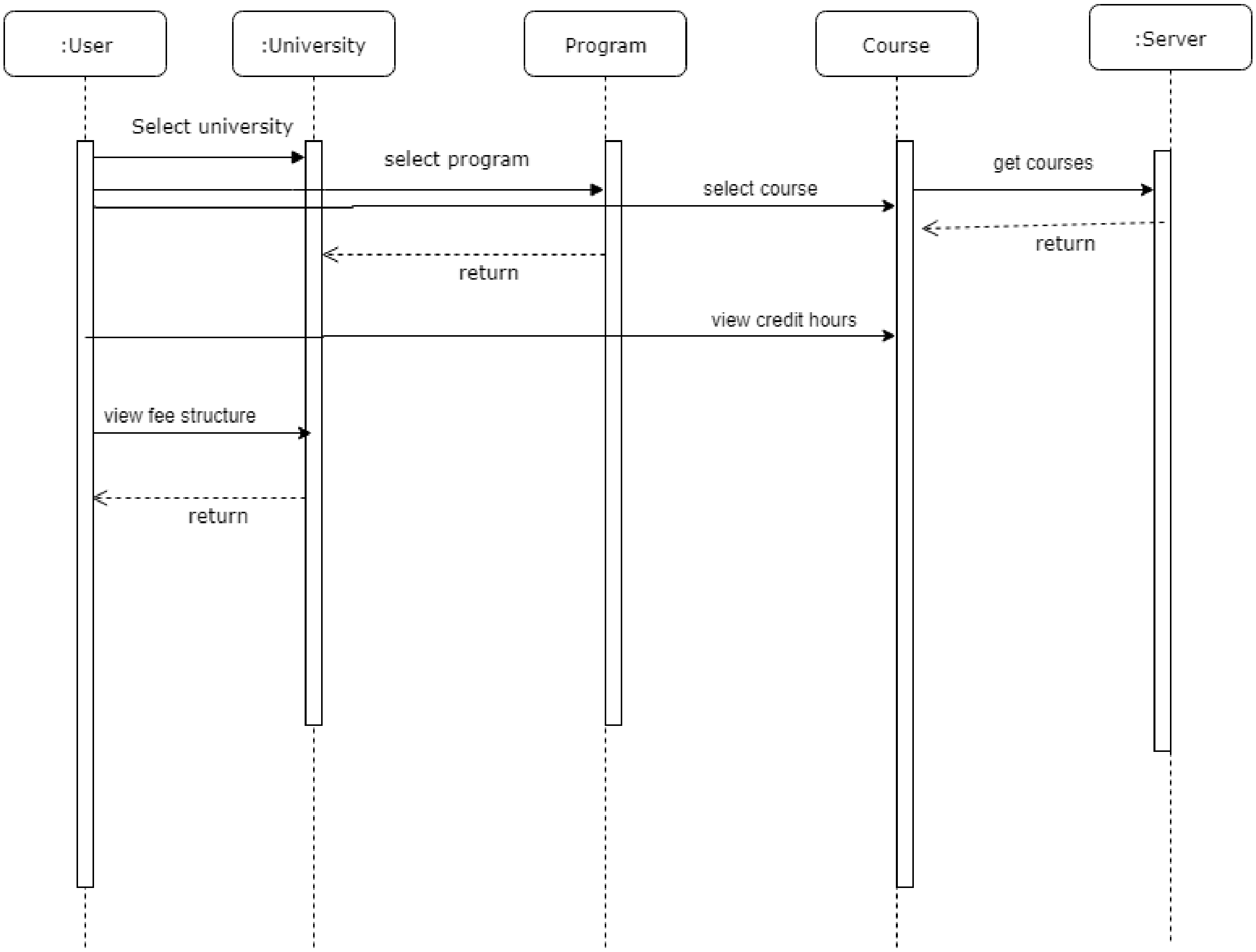


Figure 34: Sequence of Details of Study scheme

7. Manage Faculties

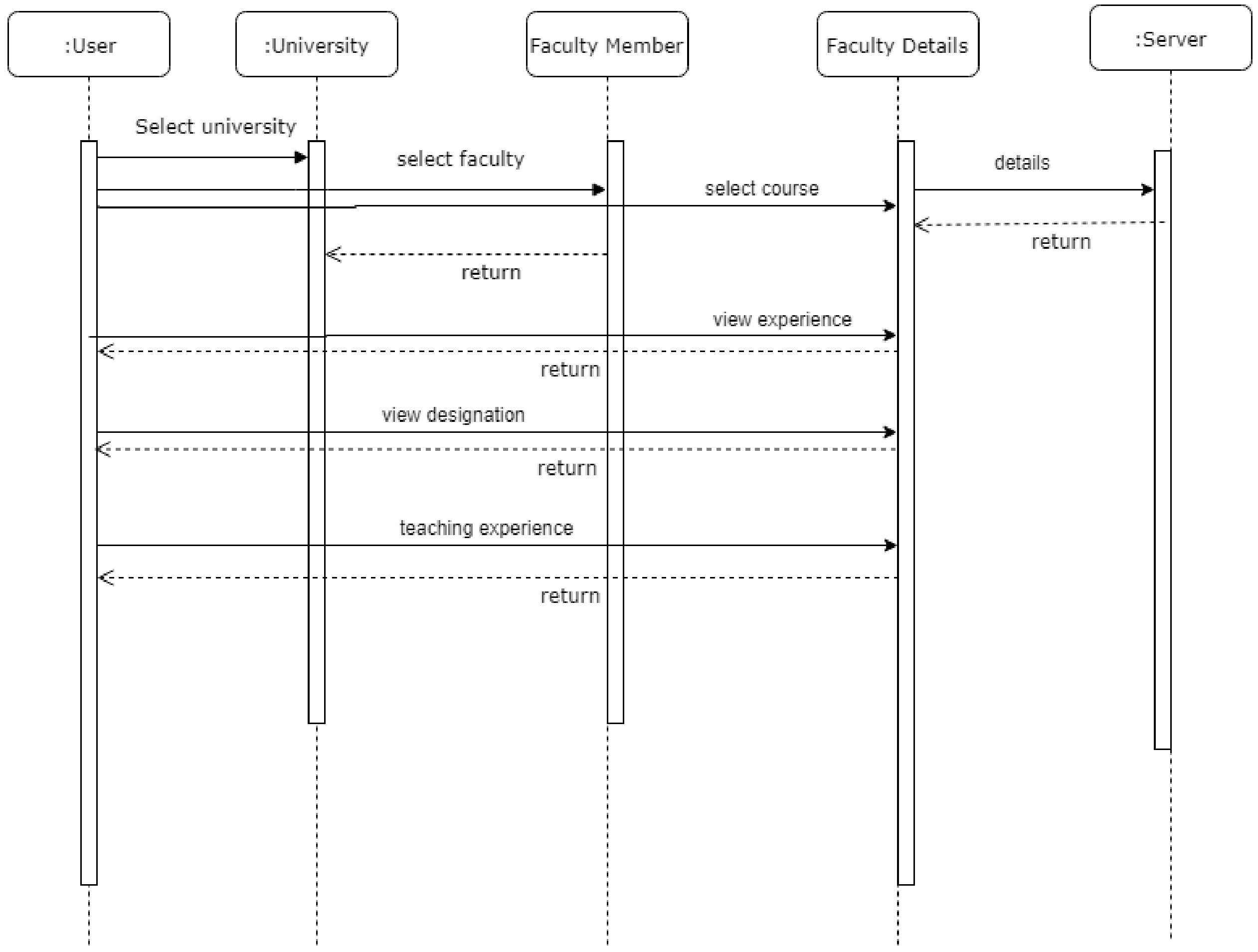


Figure 35: Sequence of Manage Faculties

8. Availability of Books

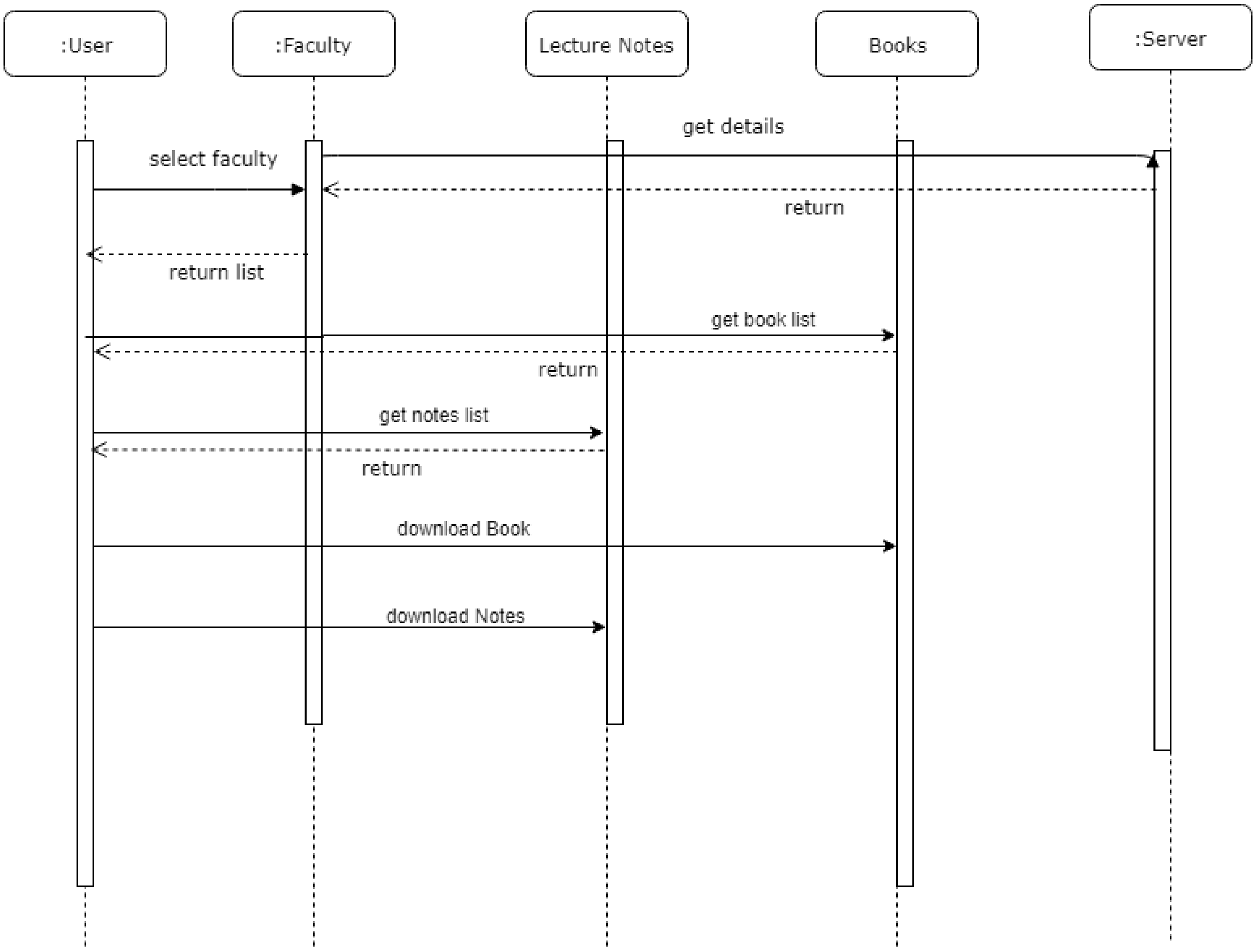


Figure 36: Sequence of Availability of Books

9. Manage Cities

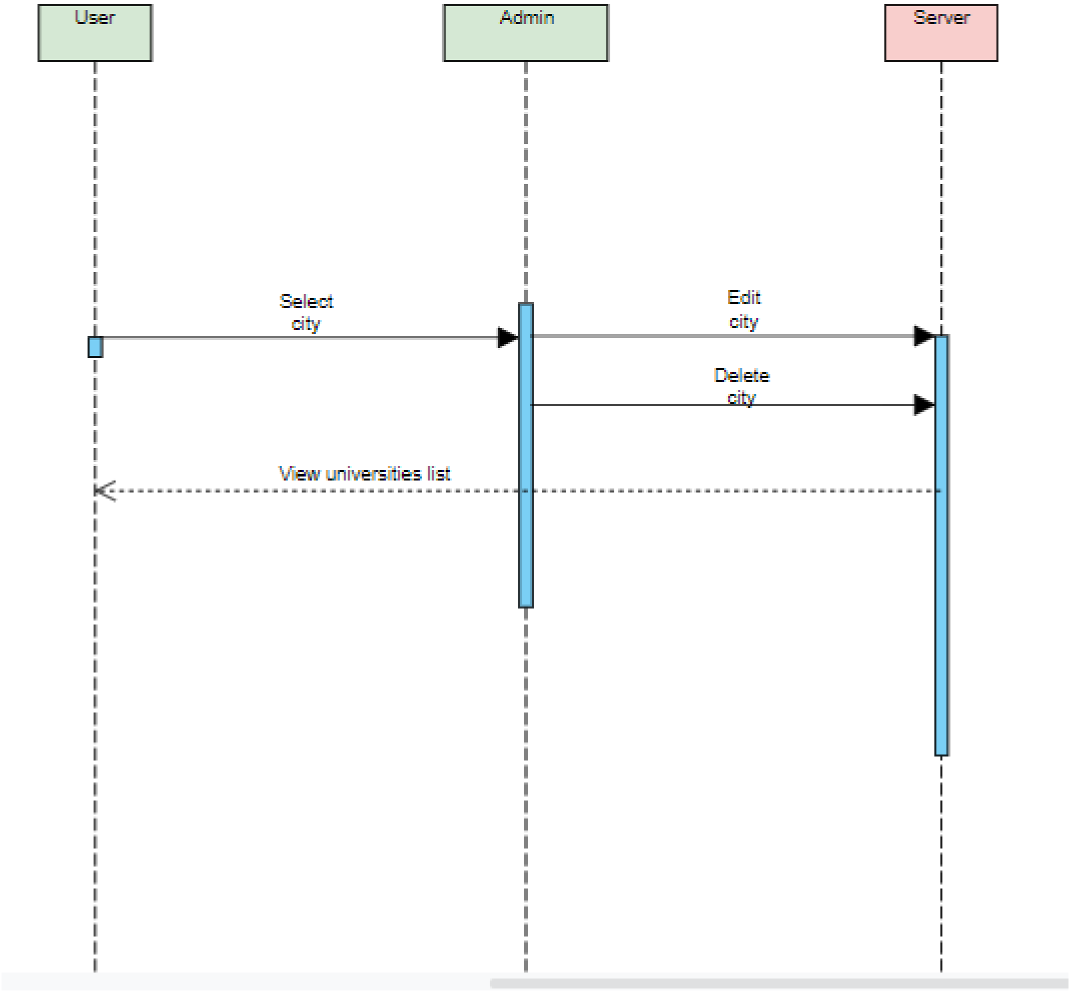


Figure 37: Sequence of Manage Cities

10. Manage Courses

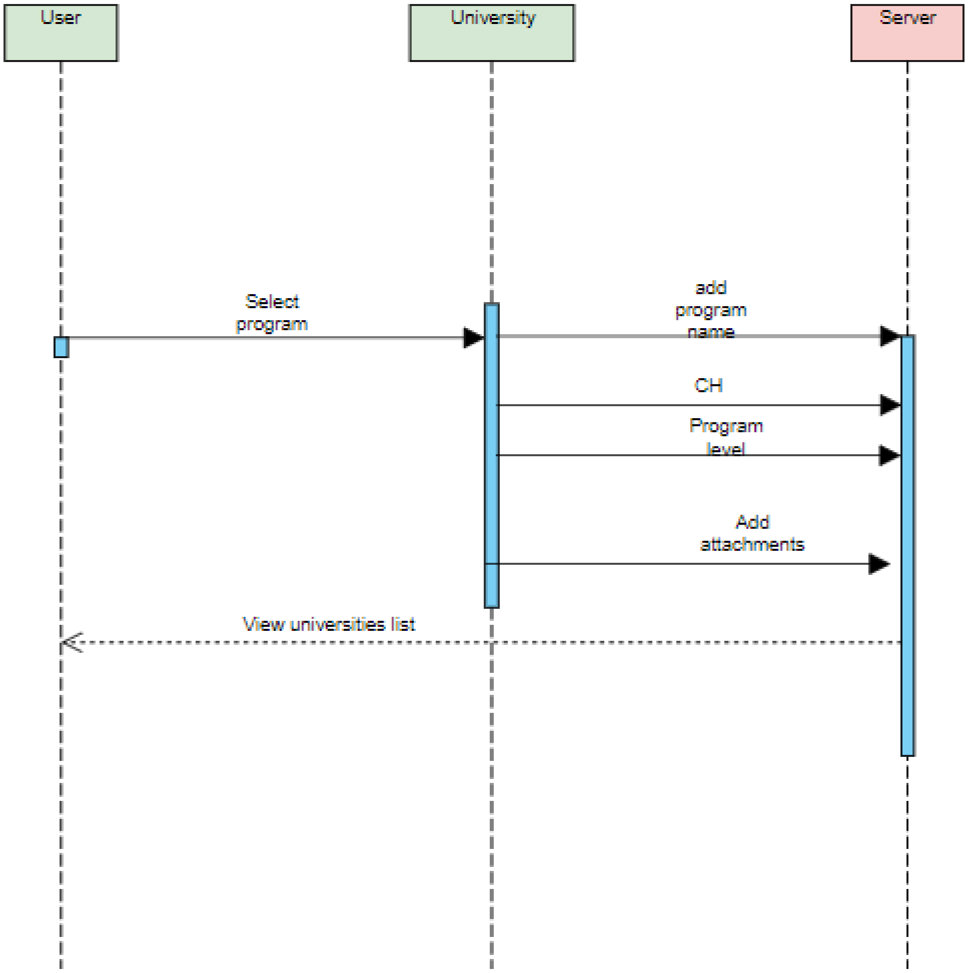


Figure 38: Sequence of Manage Courses

11. Manage User’s Roles

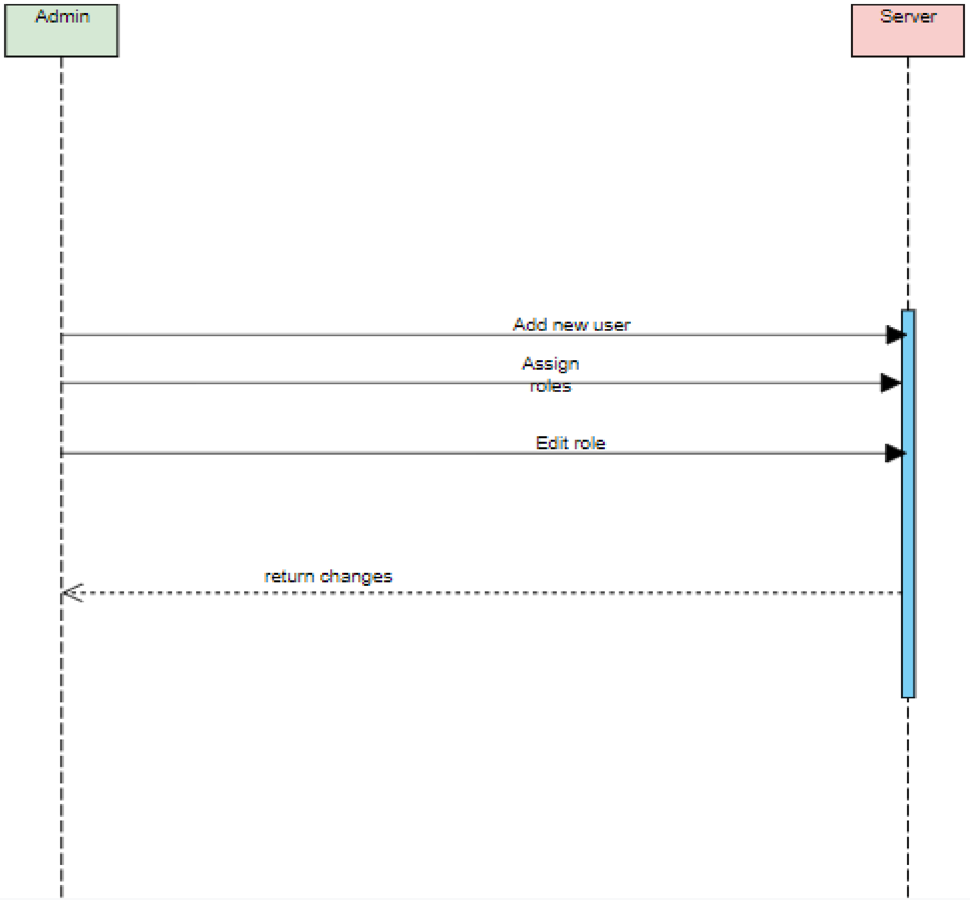


Figure 39: Sequence of Manage User's Roles

12. Manage Events

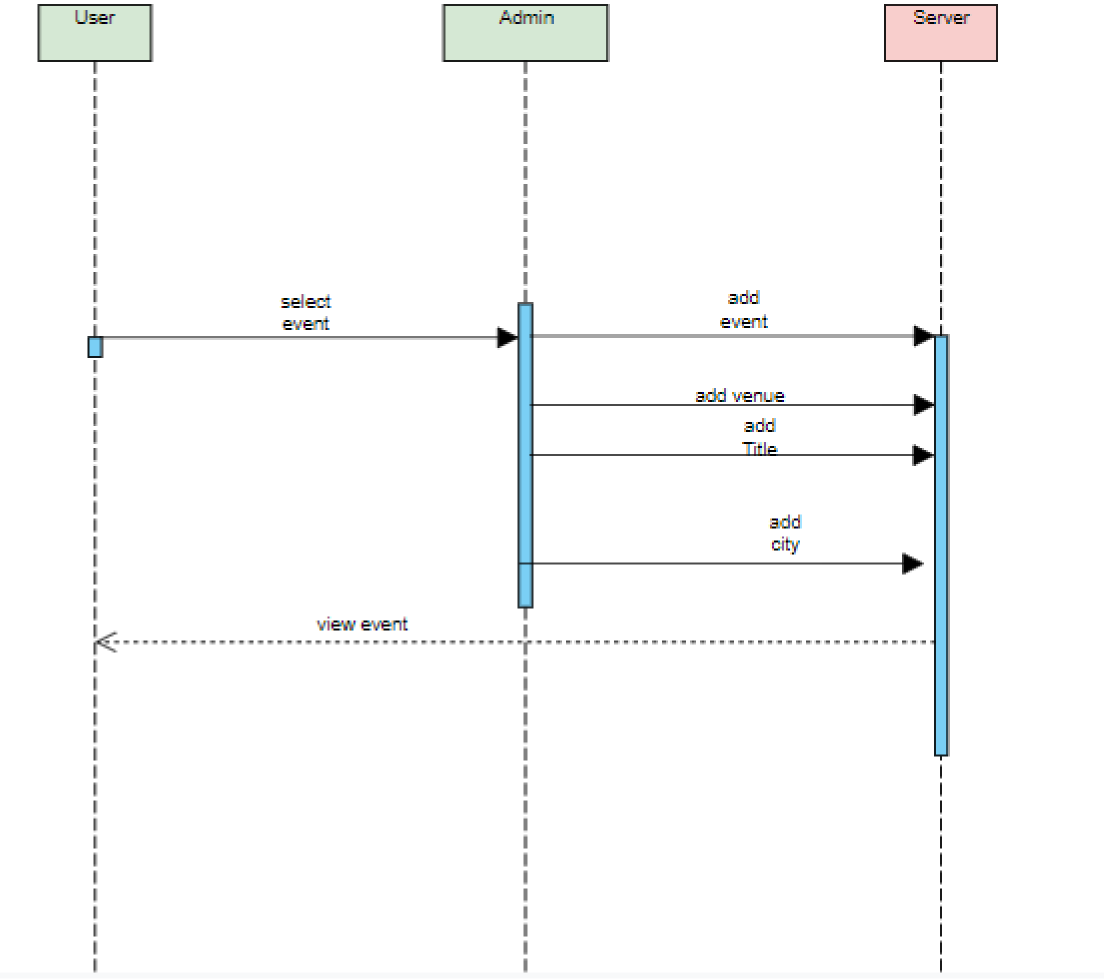


Figure 40: Sequence of Manage Events

13. Edit Profile

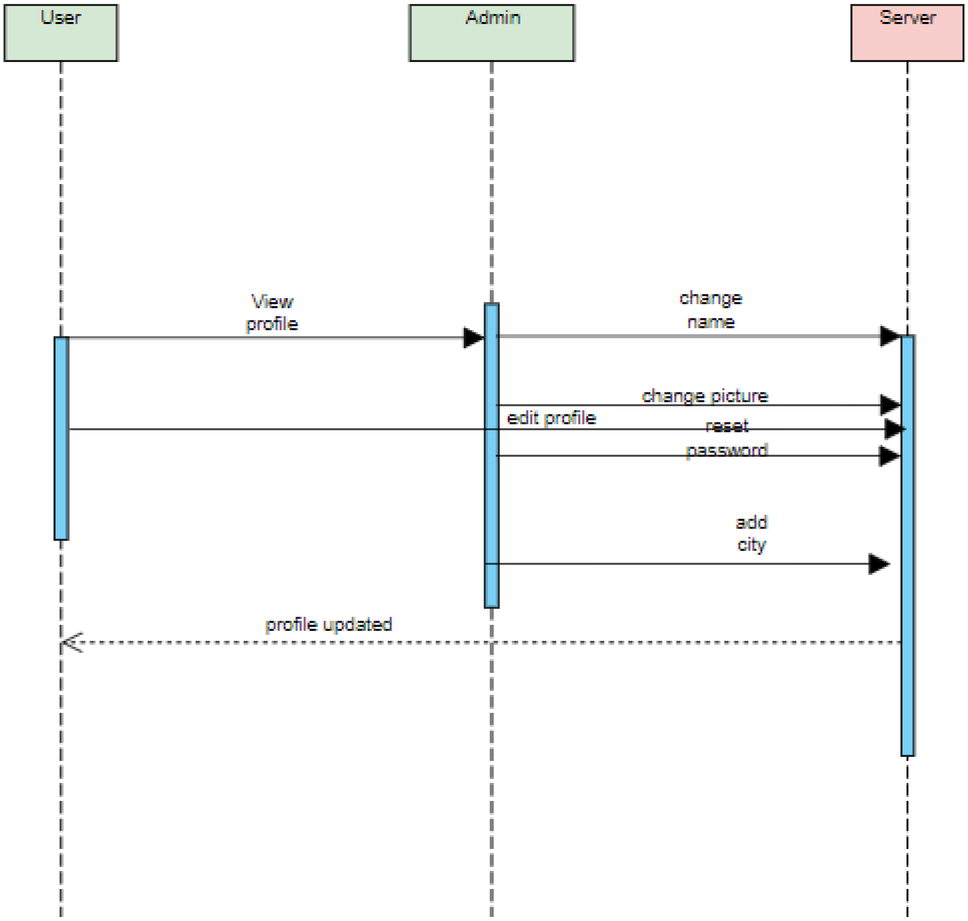


Figure 41: Sequence of Edit Profile

3.4 System architecture

Architecture of web-application (C#, Entity Framework, ASP.Net MVC 5 Framework Architecture)

3.5 Database Diagram

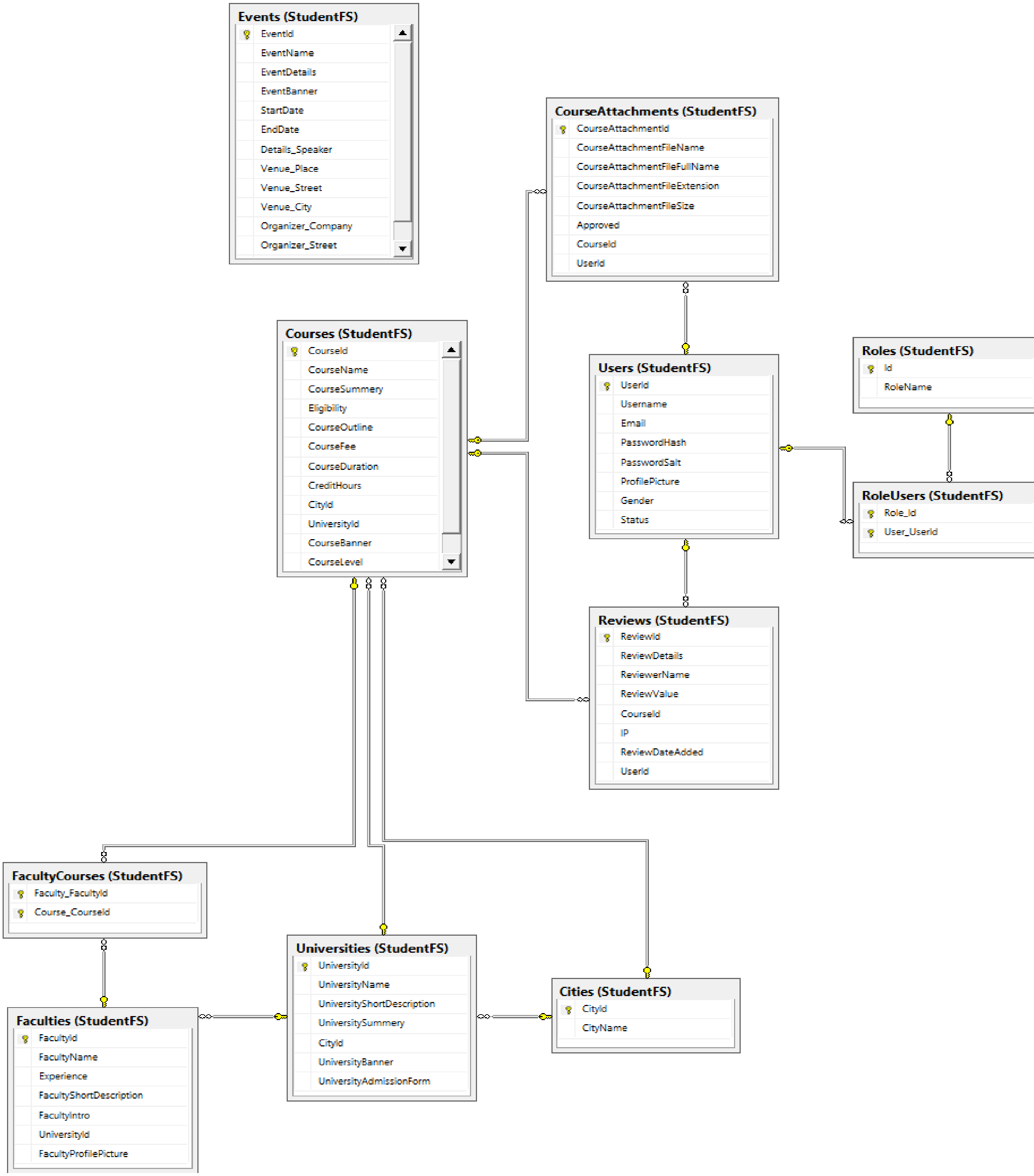
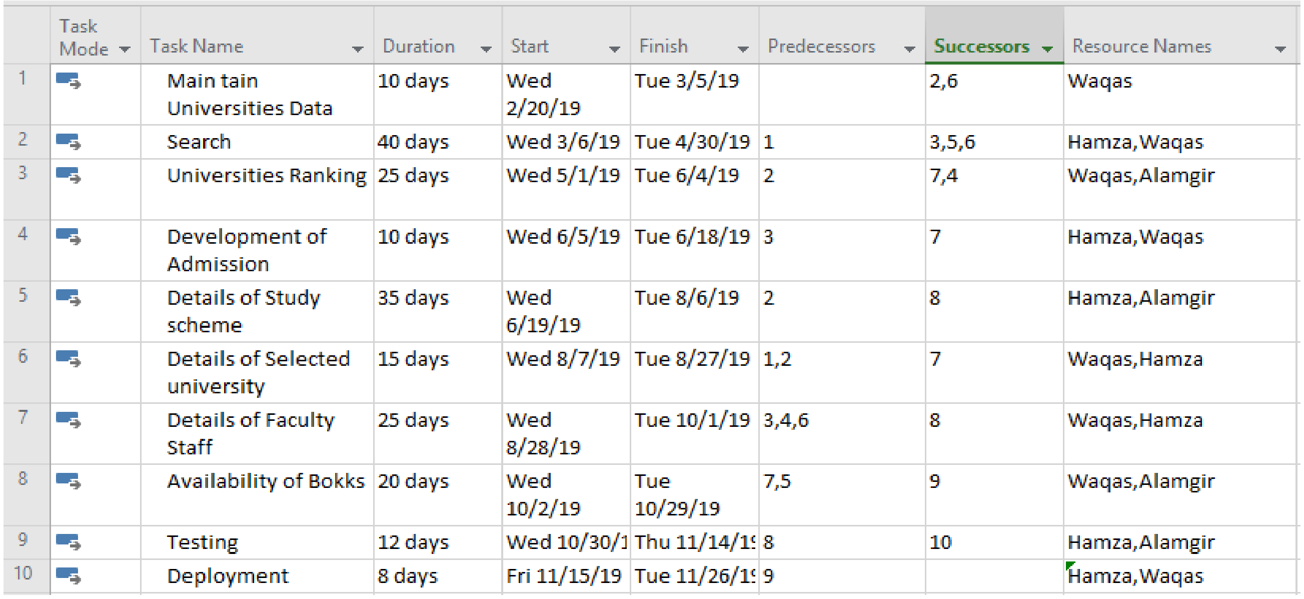


Figure 42:Database Diagram

3.6 Network Diagram



	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Successors	Resource Names
1		Main tain Universities Data	10 days	Wed 2/20/19	Tue 3/5/19		2,6	Waqas
2		Search	40 days	Wed 3/6/19	Tue 4/30/19	1	3,5,6	Hamza,Waqas
3		Universities Ranking	25 days	Wed 5/1/19	Tue 6/4/19	2	7,4	Waqas,Alamgir
4		Development of Admission	10 days	Wed 6/5/19	Tue 6/18/19	3	7	Hamza,Waqas
5		Details of Study scheme	35 days	Wed 6/19/19	Tue 8/6/19	2	8	Hamza,Alamgir
6		Details of Selected university	15 days	Wed 8/7/19	Tue 8/27/19	1,2	7	Waqas,Hamza
7		Details of Faculty Staff	25 days	Wed 8/28/19	Tue 10/1/19	3,4,6	8	Waqas,Hamza
8		Availability of Bokks	20 days	Wed 10/2/19	Tue 10/29/19	7,5	9	Waqas,Alamgir
9		Testing	12 days	Wed 10/30/1	Thu 11/14/1	8	10	Hamza,Alamgir
10		Deployment	8 days	Fri 11/15/19	Tue 11/26/1	9		Hamza,Waqas

Figure 43: Network 1

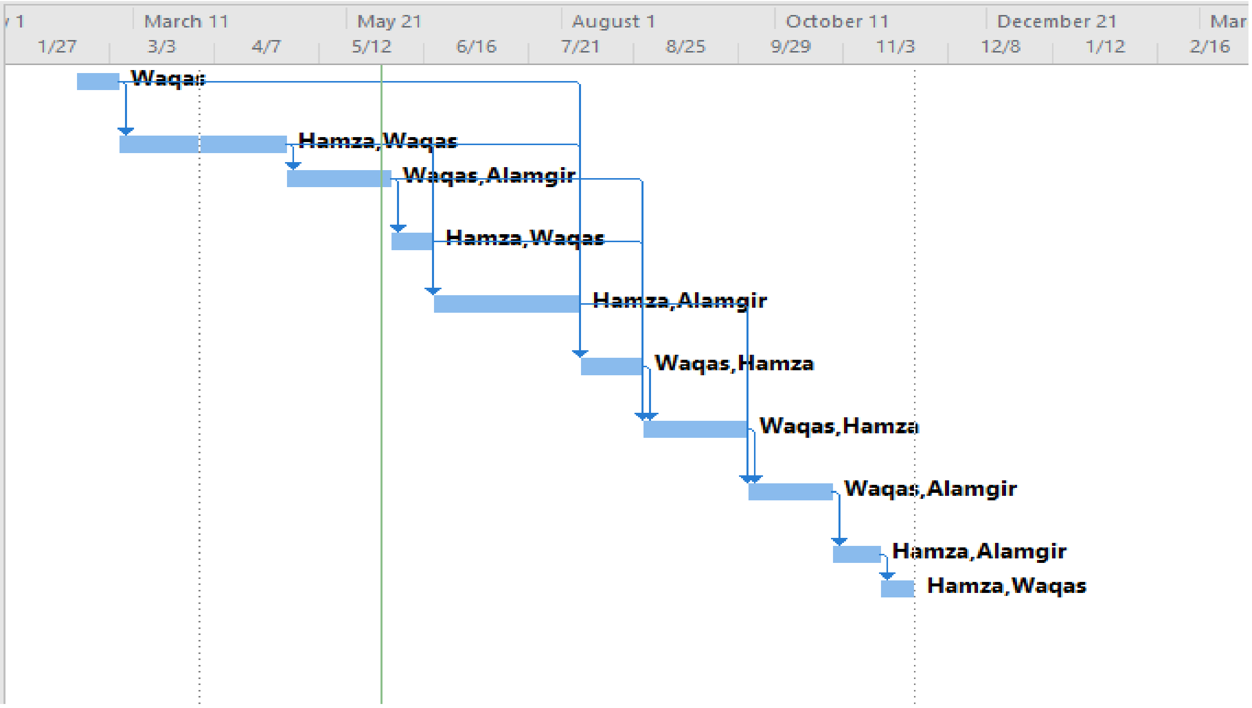


Figure 44: Network 2

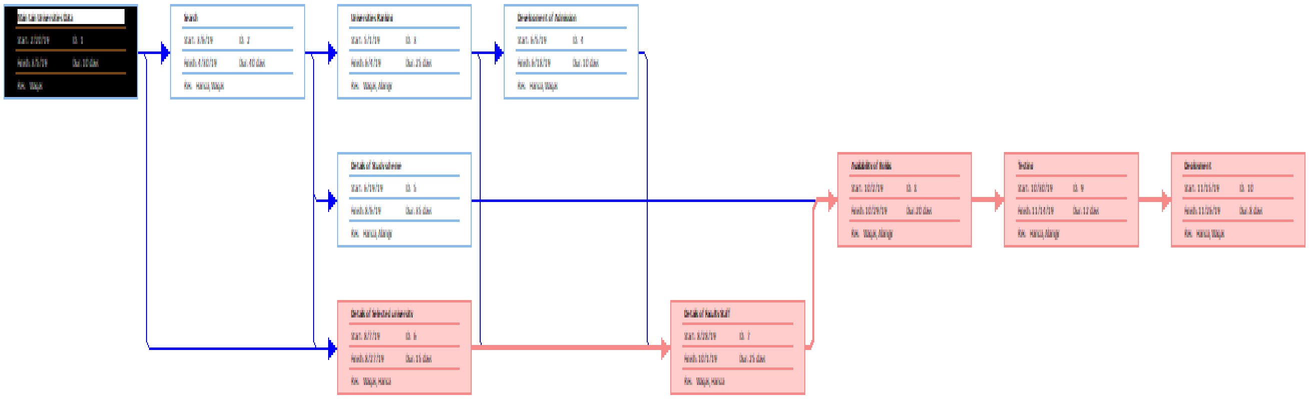


Figure 45: Network 3

Critical
Critical Milestone
Critical Summary
Critical Inserted
Critical Marked
Critical External
Project Summary
Noncritical
Milestone
Summary
Inserted
Marked
External
Highlighted Critical

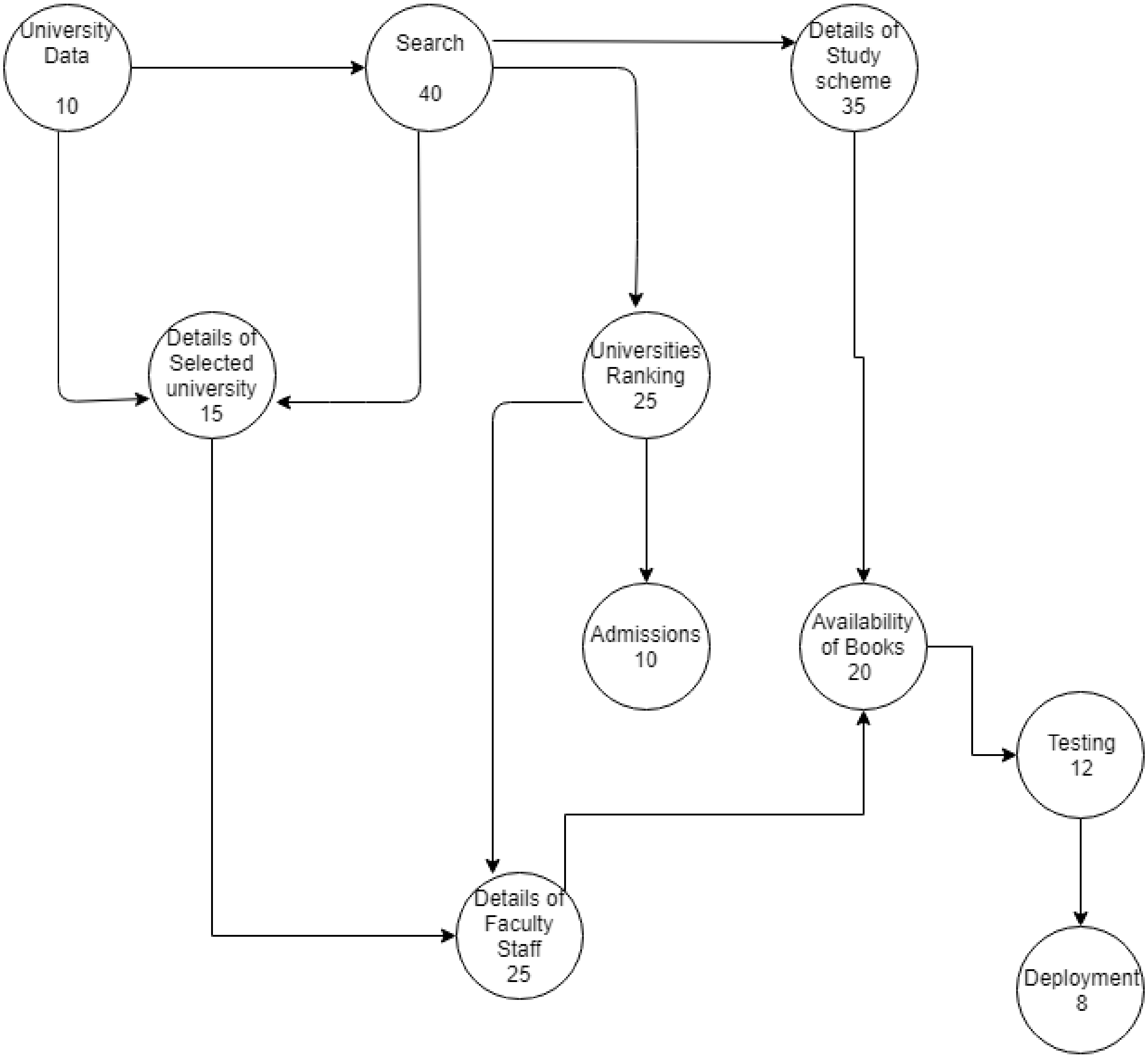


Figure 46: Activity on arrow

Critical path:

The critical path is: Maintain university data→ Search → universities ranking →Details of Faculty Staff → Availability of Books→ Testing → Deploy = 140

All other paths:

1. Maintain University data → Search → Universities Ranking → Admissions
2. Maintain University data → Details of Selected University→Details of faculty Staff → Availability of Books →Testing → Deploy
3. Maintain University data → Search → Details of Study Scheme →Availability of Books → Testing → Deploy

3.7 Collaboration diagram

1. Manage universities Information

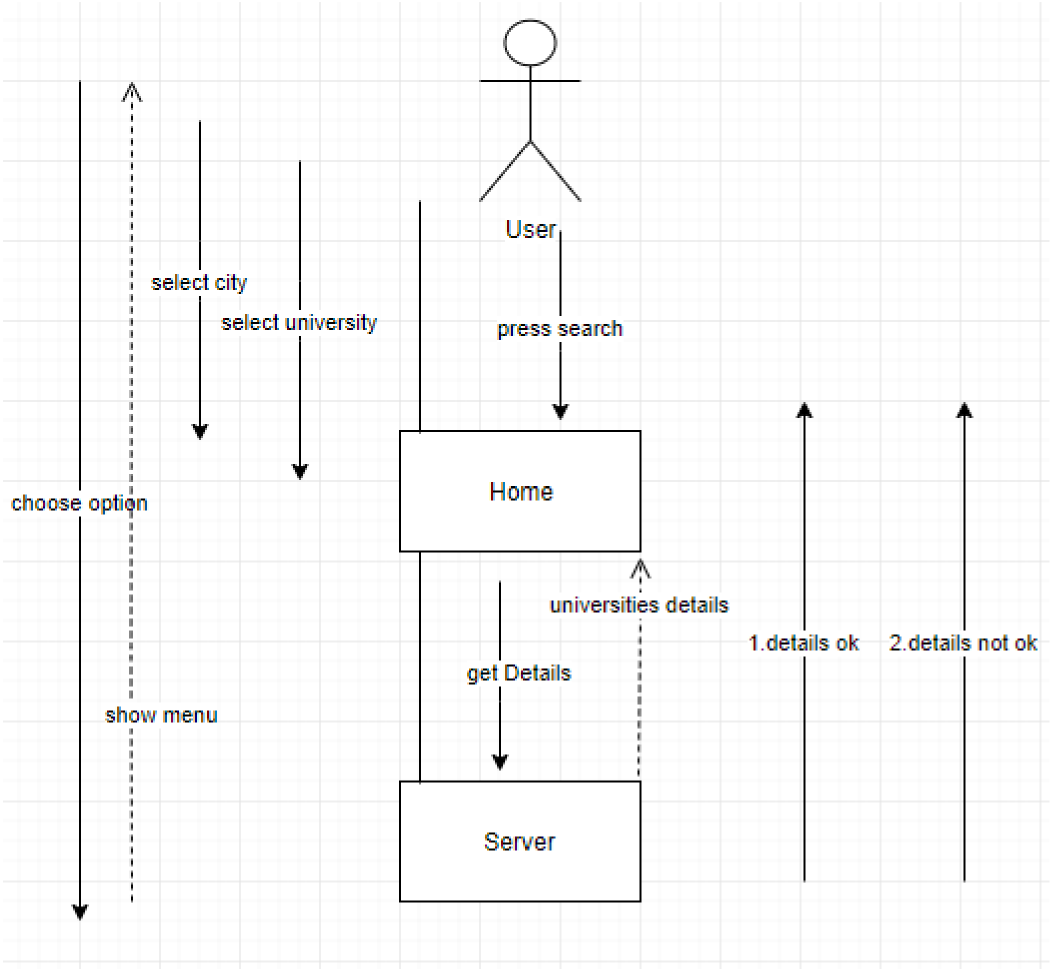


Figure 47: Collaboration of Manage universities data

2. Search Universities

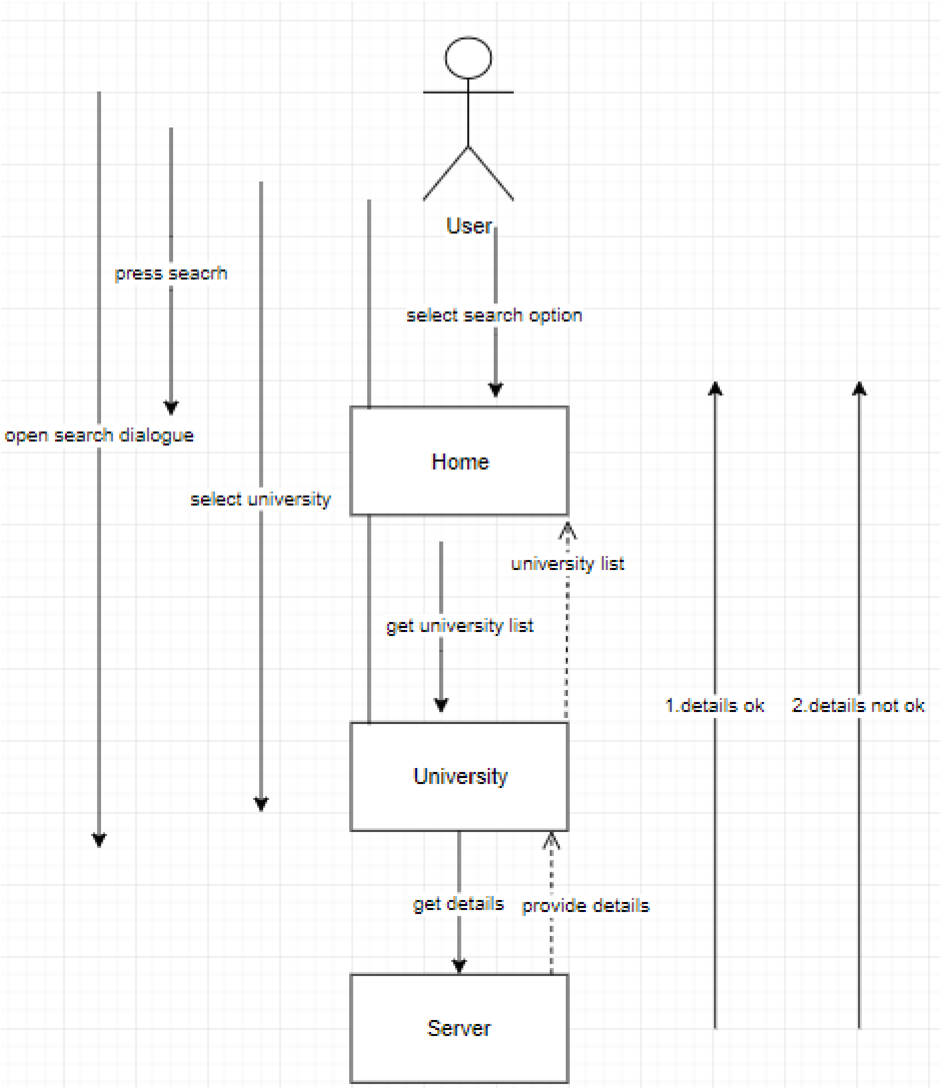


Figure 48: Collaboration of Search universities

3. Ranking of Universities

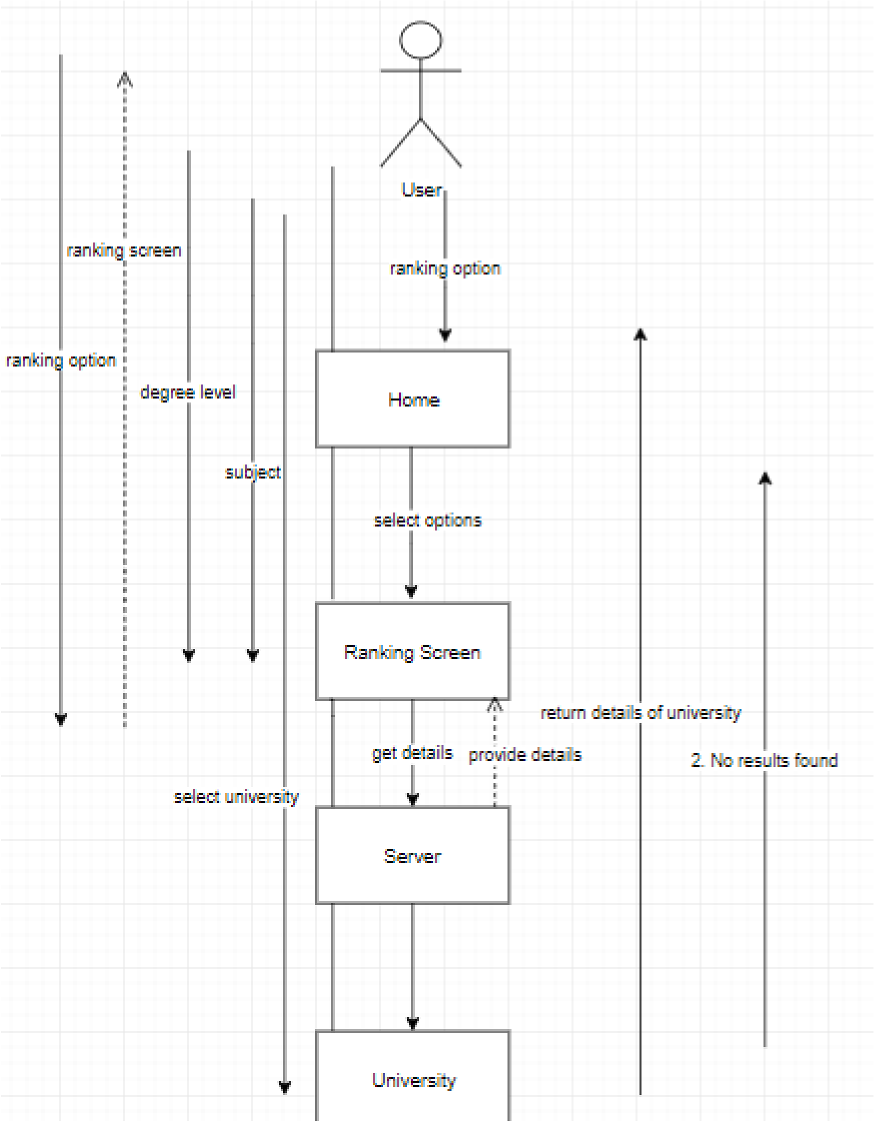


Figure 49: Collaboration of Ranking of universities

4. Admissions

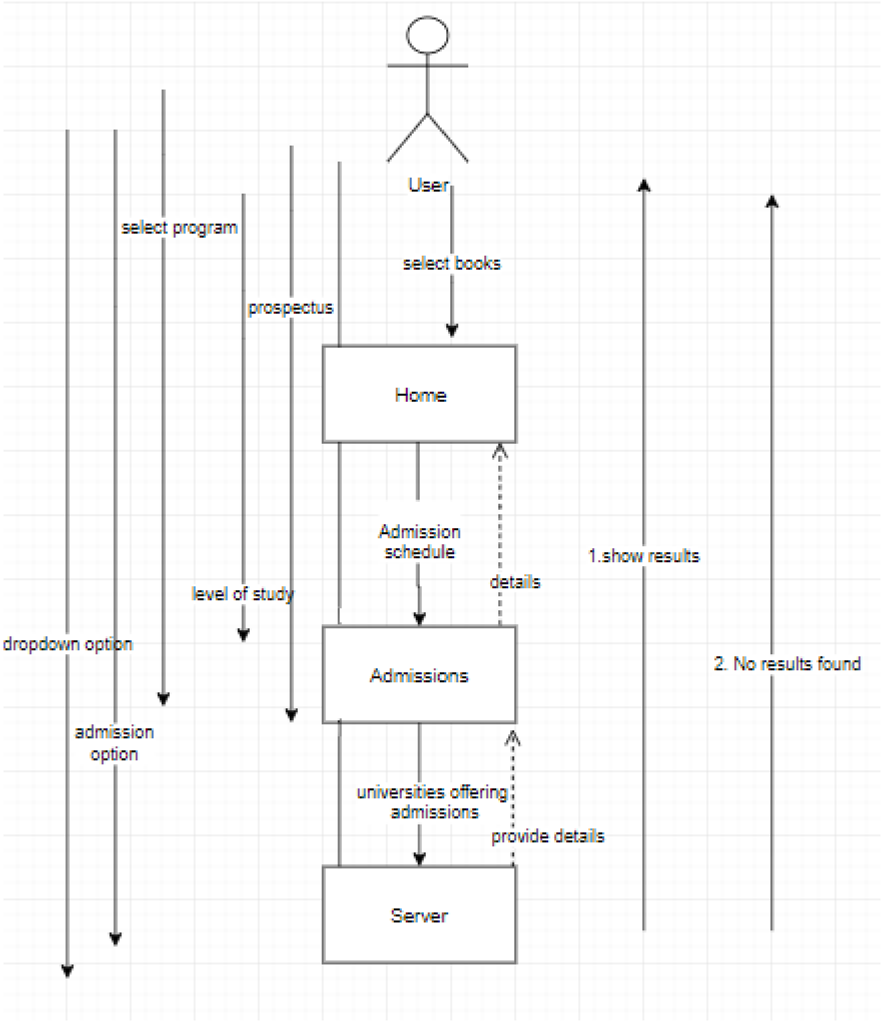


Figure 50: Collaboration of Admissions

5. Manage Universities

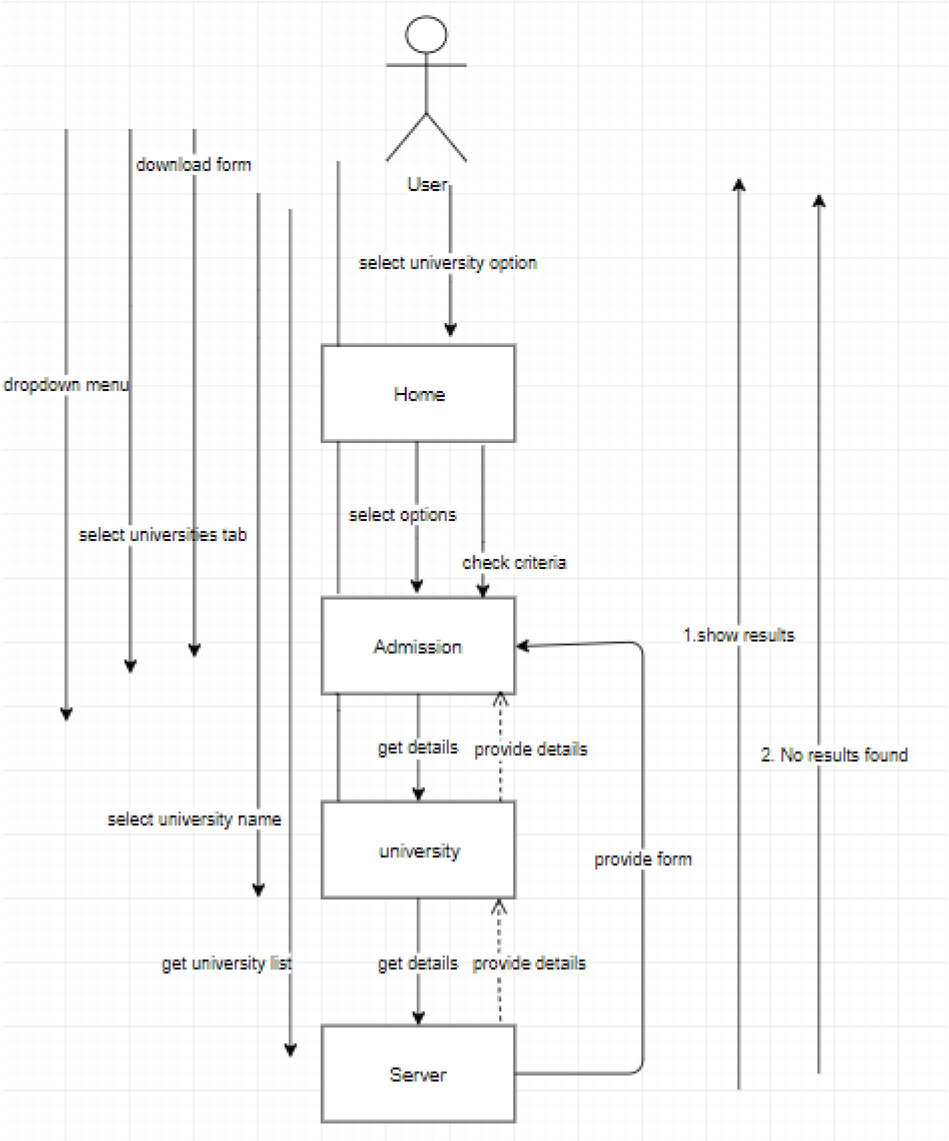


Figure 51: Collaboration of Manage universities

6. Details of Study Scheme

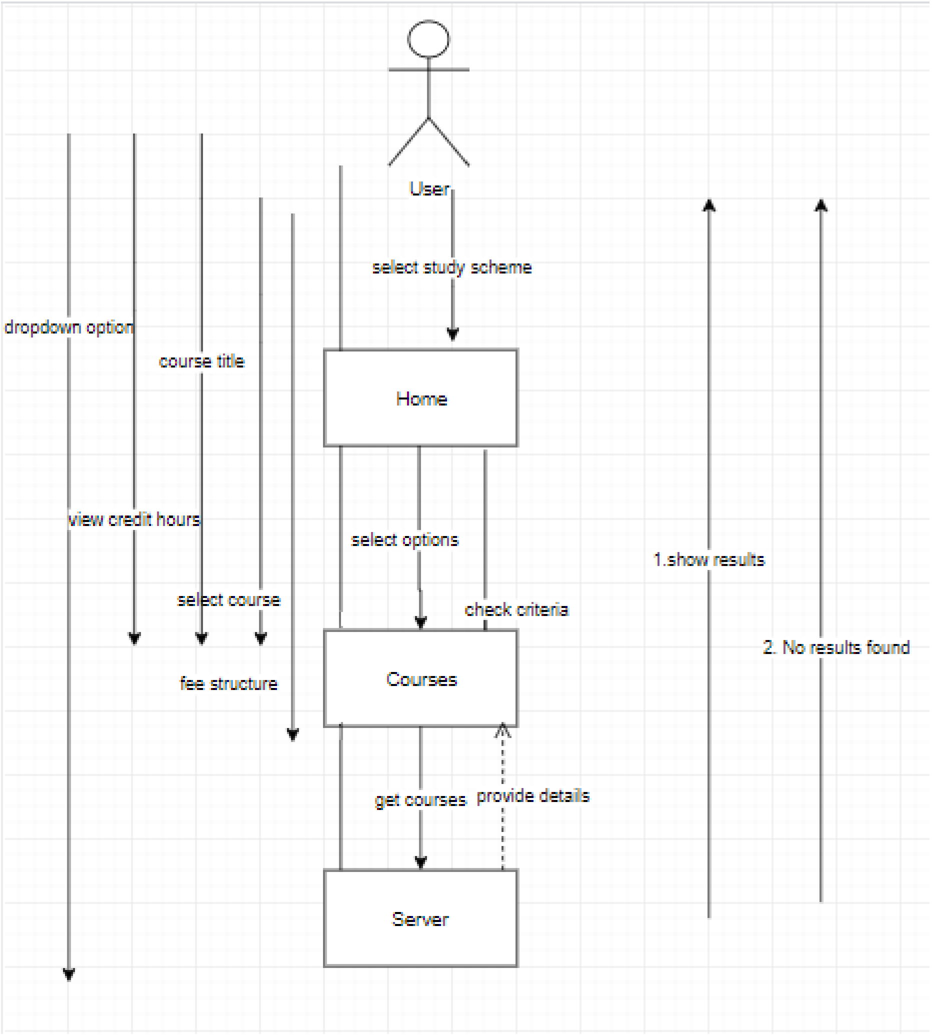


Figure 52: Collaboration of Details of study scheme

7. Manage Faculties

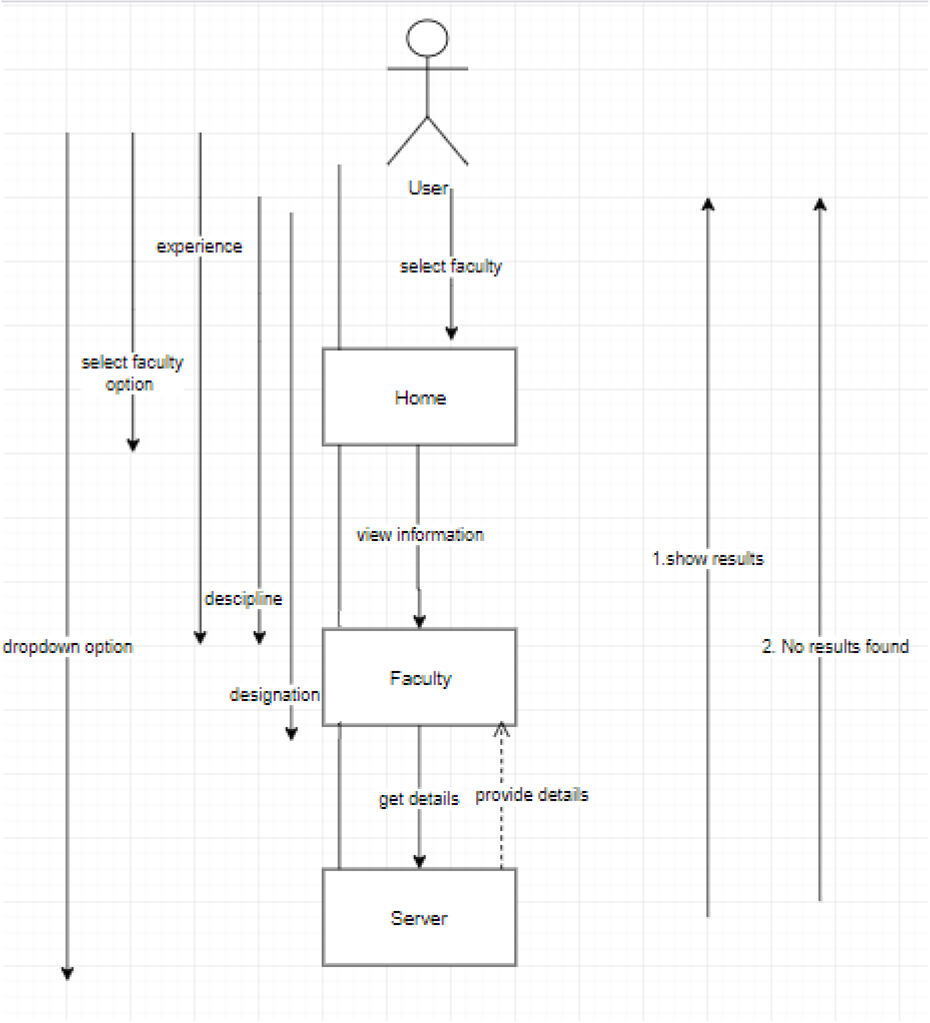


Figure 53: Collaboration of Manage Faculties

8. Availability of Books

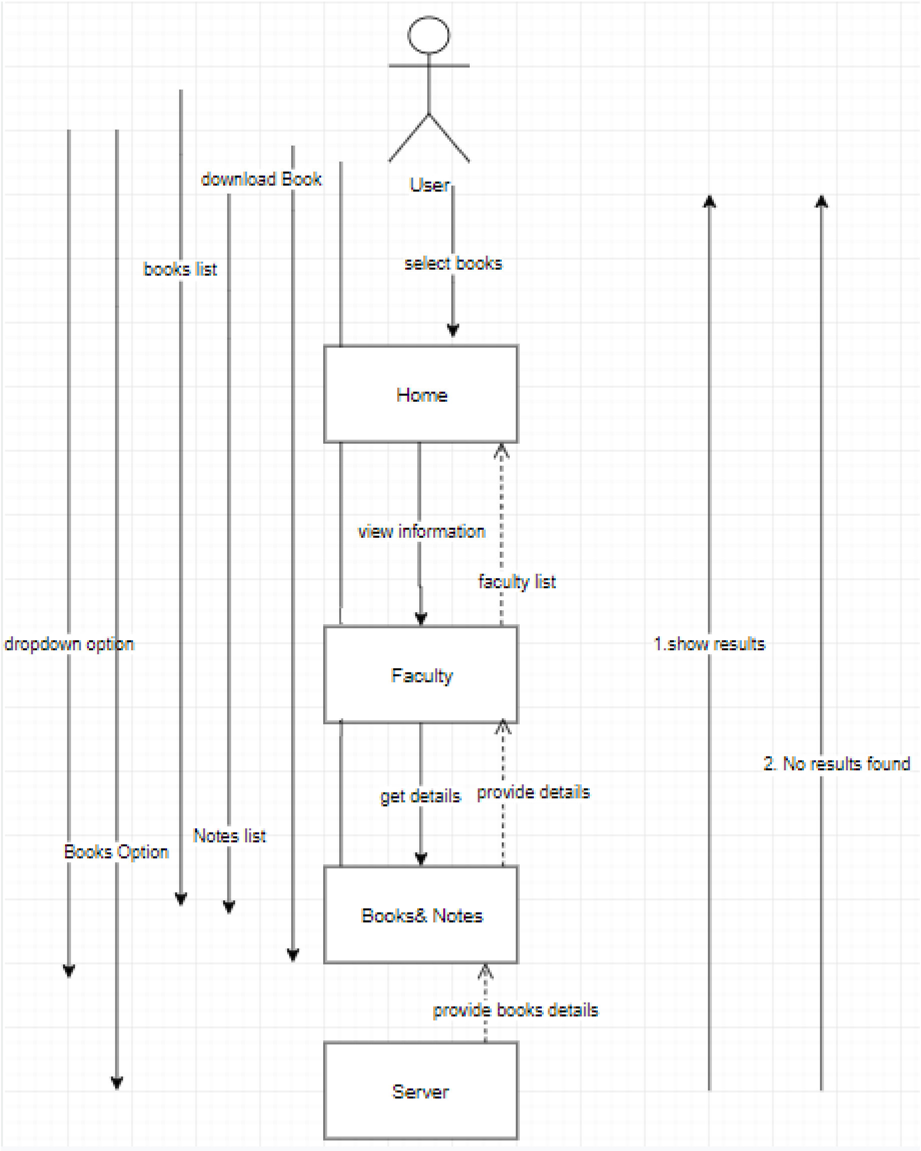


Figure 54: Collaboration of Availability of Books

9. Manage Cities

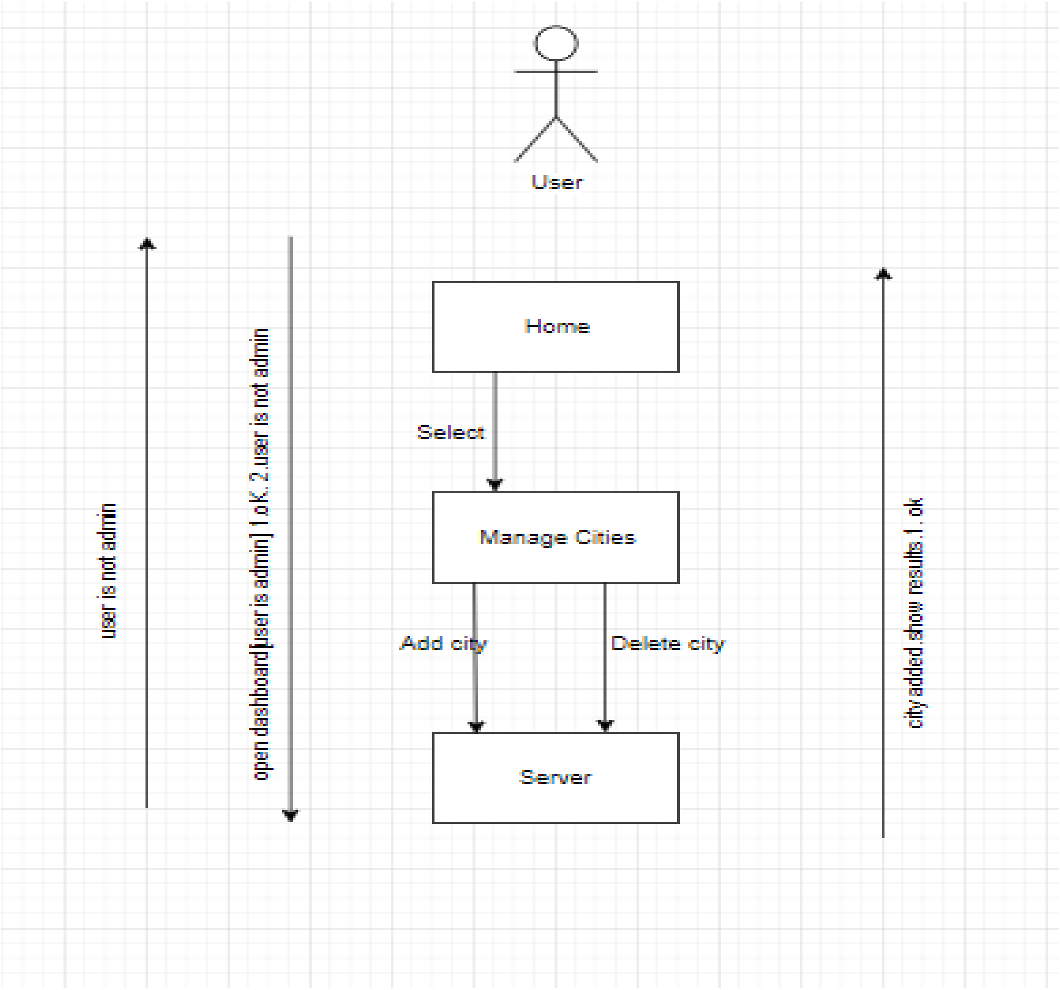

User
Home
Select
Manage Cities
Add city
Delete city
Server
user is not admin
open dashboard[user is admin] 1.oK. 2.user is not admin
city added.show results.1. ok

Figure 55: Collaboration of Manage Cities

10. Manage Courses

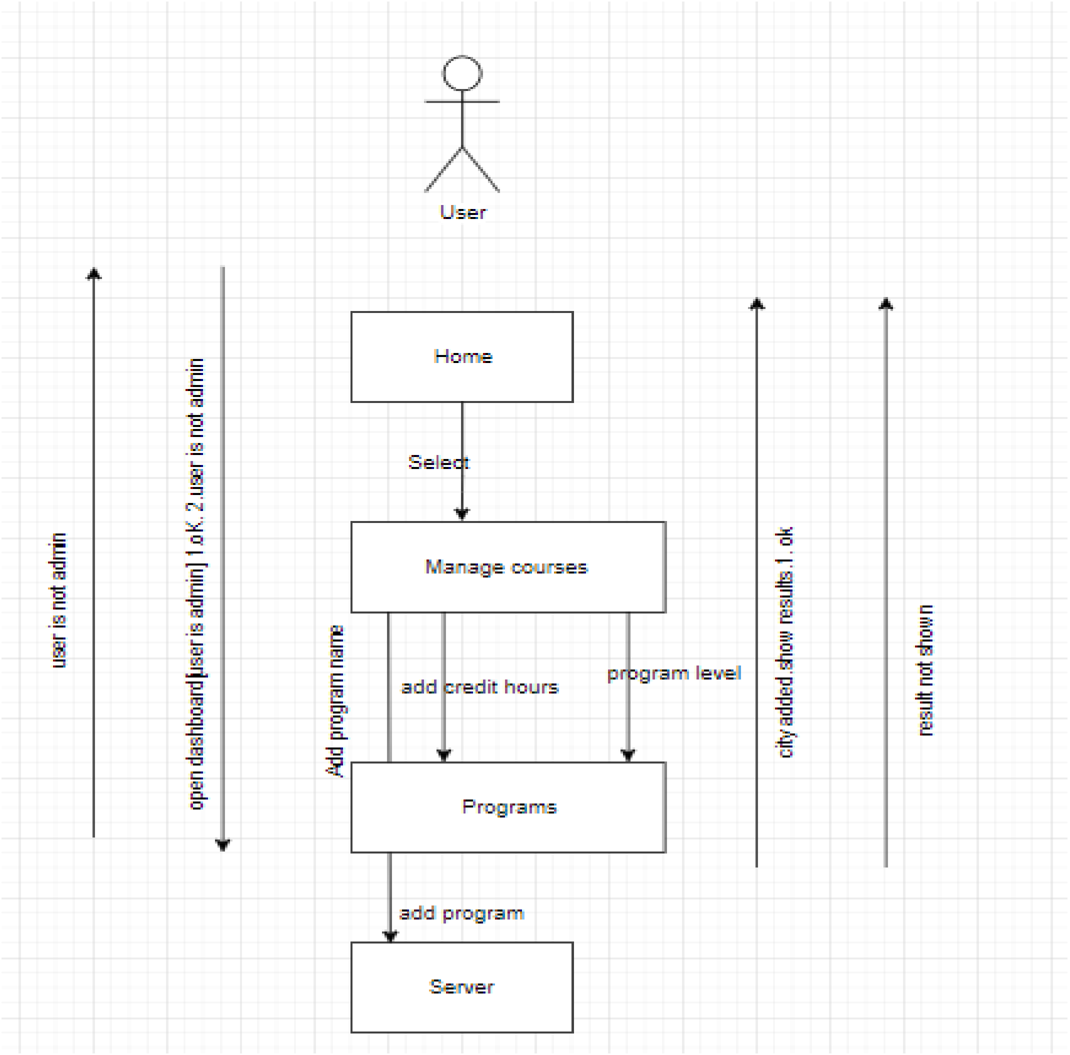


Figure 56: Collaboration of Manage Courses

11. Manage User Roles

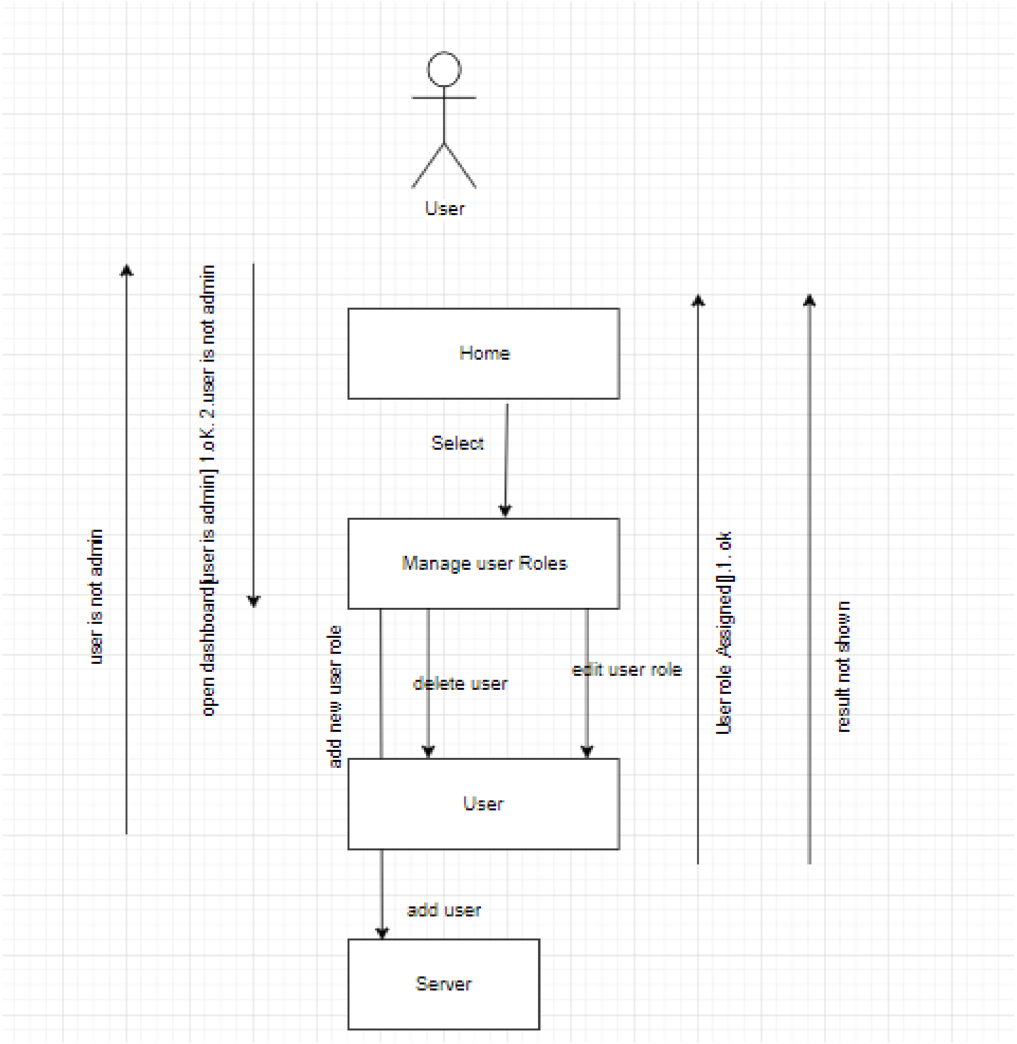


Figure 57: Collaboration of Manage User Roles

12. Manage Events

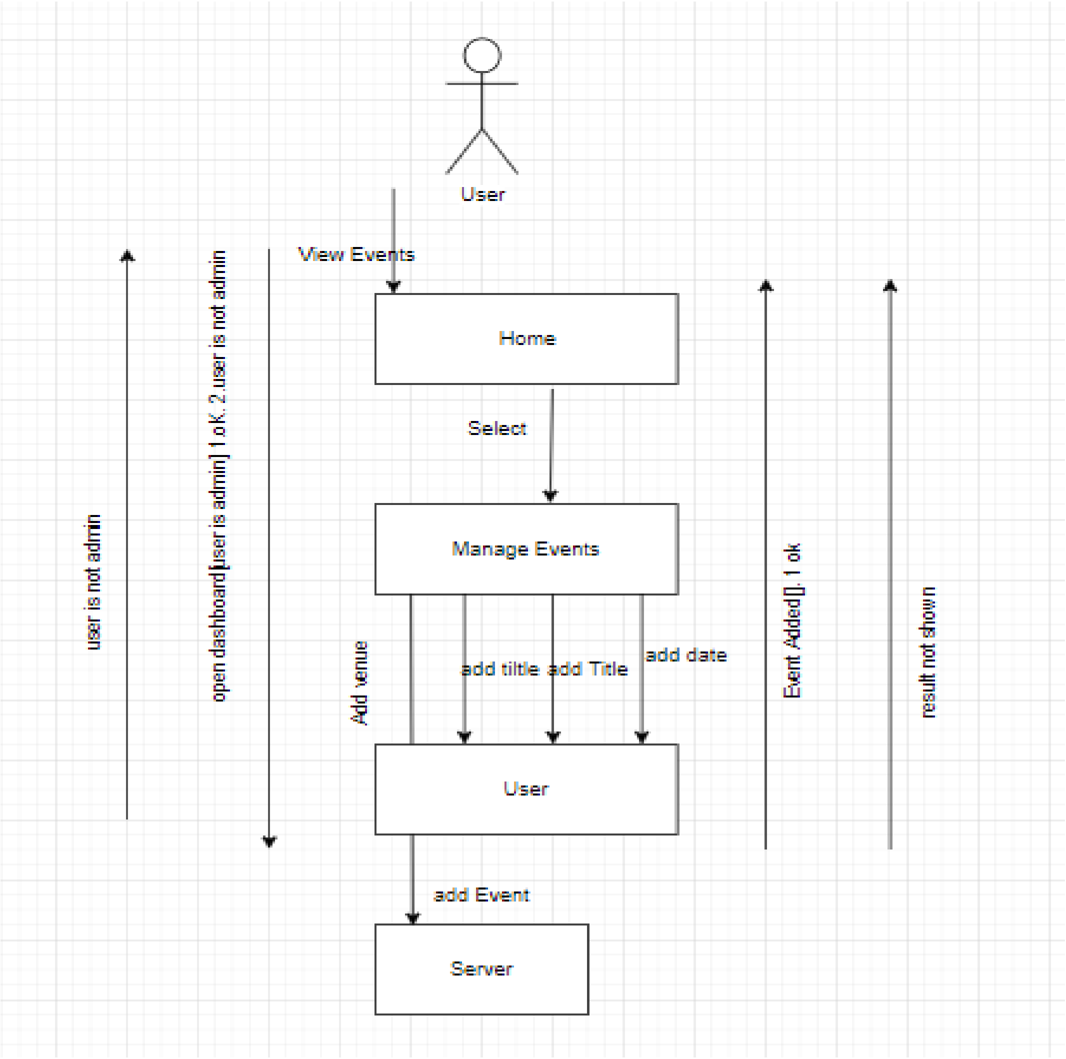


Figure 58: Collaboration of Manage Events

13. Edit Profile

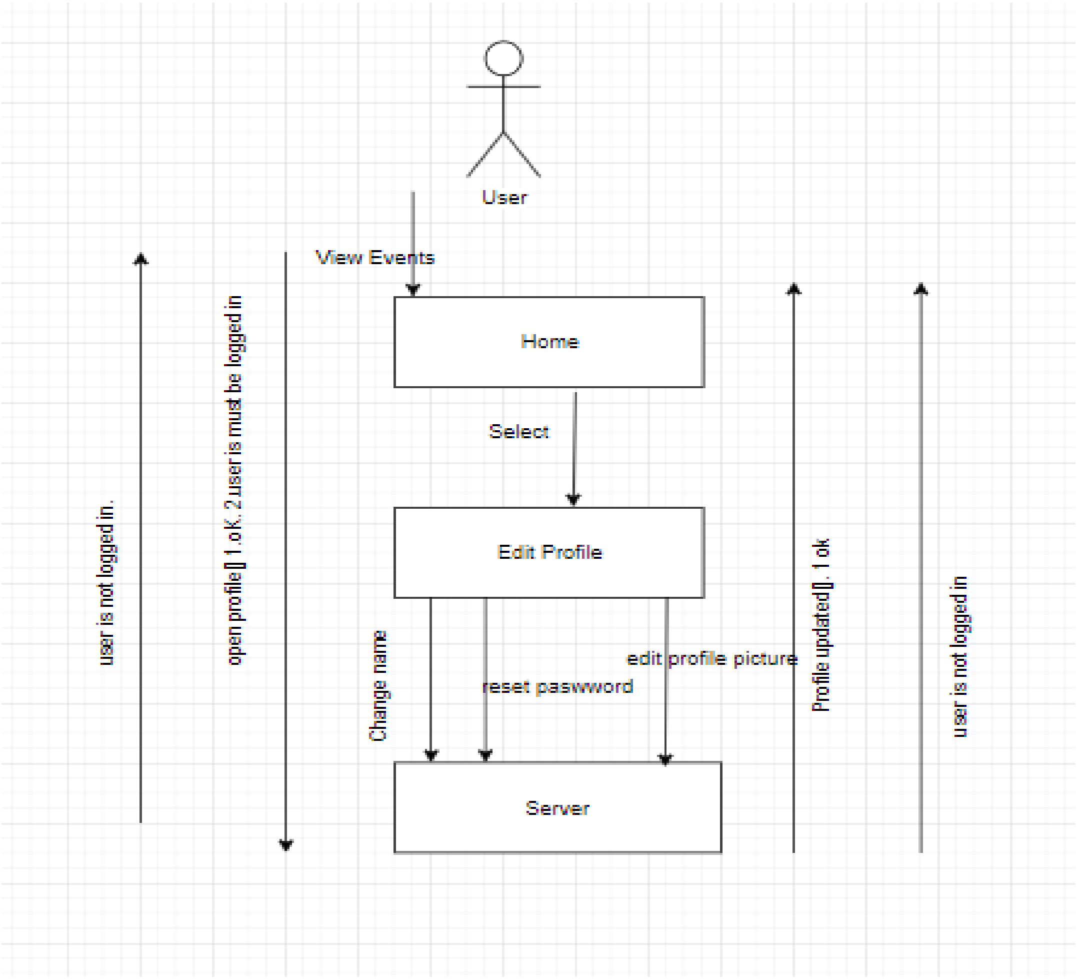


Figure 59: Collaboration of Edit Profile

4 Chapter 4: Testing

4.1 Test Cases

Test case is a sequence of steps involving inputs, execution of the condition and expected results or output, it determines whether the software satisfies the required conditions and is free of errors.

Test Case ID	TC-01			
Test Case Name	Register a user			
Designed by	Waqas		**Executed by**	Hamza
Designed Date	3/11/19		**Execution Date**	2/12/19
Description	The user needs to get registered in order to use the system.			
Pre-condition	The user must have internet and registration form access.			
#	**Actions**	**Test Data**	**Expected Result**	**Actual Result**
1	User will navigate to site and click on the Sign-up button.	1. Site URL 2. Sign up Button	User will be directed to sign up form	Sign up form is displayed
2	Enter valid Name	Name: User1		
3	Enter valid Email	Email: user1@site.com		
4	Enter valid Password	Password: *****		
5	Confirm valid Password	Password: *****		
6	User click on “Create Account” button	Button: Create Account	Account will be created	User is registered
Status	Pass			
Post-condition	User can login and access the system			

Table 17: Register

Test Case ID	TC-02		
Test Case Name	Login		
Designed by	Alamgir	**Executed by**	Waqas
Designed Date	3/11/19	**Execution Date**	2/12/19

Description	The registered user can log in to the system.			
Pre-condition	The user must be registered.			
#	**Actions**	**Test Data**	**Expected Result**	**Actual Result**
1	Navigate to the login page	Login Page URL	Login form will appear	Login page is opened
2	Enter valid user name	Name: User1		
3	Enter valid password	Password: *****		
4	Click on Login Button	Button: Login	User will be logged in	User is logged in and site is accessible
Status	Pass			
Post-condition	User can access the system functionalities.			

Table 18: Login

Test Case ID	TC-03			
Test Case Name	Search Universities			
Designed by	Hamza	**Executed by**	Waqas	
Designed Date	3/11/19	**Execution Date**	2/12/19	
Description	The user can search the universities by selecting city and program from the dropdown menu.			
Pre-condition	The user must be logged in to the system.			
#	**Actions**	**Test Data**	**Expected Result**	**Actual Result**
1	User can search any university with the specific city and program.	Search Bar	Universities should be filtered out	Search results are filtered
2	Select any university	Selected university	User can select the university	Selected University is opened
Status	Pass			
Post-condition	University list is shown and specific university page is opened.			

Table 19: Search Universities

Test Case ID	TC-04

Test Case Name	Ranking of Universities			
Designed by	Waqas	**Executed by**	Hamza	
Designed Date	3/11/19	**Execution Date**	2/12/19	
Description	The user can view the program ranking based on the user reviews.			
Pre-condition	The user must be logged in to the system.			
#	**Actions**	**Test Data**	**Expected Result**	**Actual Result**
1	User can search any university with the specific city and program.	Search Bar	Universities should be filtered out	Search results are filtered
2	User can view universities list based on the user reviews on programs	Main page	Universities best rated according to programs are filtered out	Search result are filtered
3	Select any university	Selected university	User can select the university	Selected University is opened
4	User can select best rated program	Program selected	User can view program's page	Programs page with information is opened.
Status	Pass			
Post-condition	University program is shown and specific program page is opened.			

Table 20: Ranking of Universities

Test Case ID	TC-05			
Test Case Name	Admissions			
Designed by	Alamgir	**Executed by**	Hamza	
Designed Date	3/11/19	**Execution Date**	2/12/19	
Description	The user can view the universities list offering admissions according to his study level.			
Pre-condition	The user must be logged in to the system.			
#	**Actions**	**Test Data**	**Expected Result**	**Actual Result**
1	User can search specific university.	Search Bar	Universities should be filtered out	Search results are filtered

2	User can select study level	graduation, undergraduate etc	Level is selected	Study level selected
3	User can select specific program	Software Eng.	User selected program	Program selected
4	Press search button	Search result page	Universities list is filtered out	List filtered out.
5	User can select particular university from the universities list	Selected university	User can select the university	University main page is opened
Status	Pass			
Post-condition	University program is shown and specific program page is opened.			

Table 21: Admissions

Test Case ID	TC-06			
Test Case Name	Manage Universities			
Designed by	Waqas		**Executed by**	Alamgir
Designed Date	3/11/19		**Execution Date**	2/12/19
Description	The user can manage the universities related information.			
Pre-condition	The user must be on the admin to edit content.			
#	**Actions**	**Test Data**	**Expected Result**	**Actual Result**
1	User can select the Manage universities	1. Dashboard	User can press the Manage university button.	User selected the manage universities button.
2	User can add new university	1. Manage universities page.	User can select the add new university button	Add new button is clicked and new page opened.
3	User can add university name.			
4	User can add university banner			.
5	User can add admission criteria			
6	User can click the add new university.	Universities page	User select the ADD button to add new university	User selected the ADD button and university is added

Status	Pass
Post-condition	New university is added.

Table 22: Manage Universities

Test Case ID	TC-07			
Test Case Name	Details of Study Scheme			
Designed by	Hamza		**Executed by**	Waqas
Designed Date	3/11/19		**Execution Date**	2/12/19
Description	User can select the specific program and see the study schemes, subjects of that program offered by the university.			
Pre-condition	The user must be logged in.			
#	**Actions**	**Test Data**	**Expected Result**	**Actual Result**
1	User can select the particular university	1. universities list page	Selected university	University page is opened
2	User can select the program	1. BSSE	Program is selected	Program page is open and can view the study schemes
3	User can view the view the fee structure	1.Program page	Fee structure tab will be clicked	Fee structure tab is clicked
4	User can view the course offered in the program	1.Program page	Course tab will be selected	Courses tab will be opened.
5	User can click the add new university.	Universities page	User select the ADD button to add new university	User selected the ADD button and university is added
Status	Pass			
Post-condition	Study scheme is show to the user.			

Table 23: Details of Study Scheme

Test Case ID	TC-08
Test Case Name	Manage Faculties

Designed by	Waqas	**Executed by**	Alamgir
Designed Date	3/11/19	**Execution Date**	2/12/19
Description	The user can manage the universities related information.		
Pre-condition	The user must be an admin to edit content.		

#	Actions	Test Data	Expected Result	Actual Result
1	User can select the Manage Faculties	1. Dashboard	User can press the Manage Faculty button.	User selected the manage Faculties button.
2	User can add new Faculty	1. Manage Faculties page.	User can select the add new Faculty button	Add new button is clicked and new page opened.
3	User can add university name.			
4	User can add university Picture			.
5	User can add qualification			
6	User can add teaching experience			
7	User can add expertise			
8	User can click the add new faculty.	Faculties page	User select the ADD button to add new faculty	User selected the ADD button and university is added

Status	Pass
Post-condition	New Faculty is added.

Table 24: Manage Faculties

Test Case ID	TC-09
Test Case Name	Availability of Books

Designed by	Alamgir		**Executed by**	Hamza
Designed Date	3/11/19		**Execution Date**	2/12/19
Description	User can view and download the lecture notes of the teachers of any particular subject			
Pre-condition	The user must be logged in.			
#	**Actions**	**Test Data**	**Expected Result**	**Actual Result**
1	User can select the particular program	1. Program page	User can press the particular program	User selected the specific program.
2	User can view the lecture notes	1. Attachment tab	User can select the attachment tab to view content	Attachment tab is open
3	User press the Download button	2.Attachment tab	Select the Download button	Download button is pressed
4	User can upload the particular file.	2. File Select	User will select the file	.file is selected and uploaded
Status	Pass			
Post-condition	The notes are upload and will be review by the admin..			

Table 25: Availability of Books

Test Case ID	TC-10			
Test Case Name	Manage Cities			
Designed by	Waqas		**Executed by**	Alamgir
Designed Date	3/11/19		**Execution Date**	2/12/19
Description	User can view the universities from specific city and admin can add new cities.			
Pre-condition	The user must be an admin to edit content.			
#	**Actions**	**Test Data**	**Expected Result**	**Actual Result**
1	User can add new city	1. Manage Cities	User can press the Manage cities button.	User selected the manage cities button.
2	User add the new city	1.Manage cities page	User can select the add new cities button	Add new button is clicked and new page opened.

3	User can add city name.			
4	User edit the city			.
5	User can delete the city			
6	Press Add button	Manage cities page	Select the add button	The new city is added and redirected to manage cities page.
Status	Pass			
Post-condition	New Faculty is added.			

Table 26: Manage Cities

Test Case ID	TC-11			
Test Case Name	Manage Courses			
Designed by	Hamza		**Executed by**	Waqas
Designed Date	3/11/19		**Execution Date**	2/12/19
Description	User can view the programs from specific university. User can add new course, edit or delete particular program.			
Pre-condition	The user must be an admin to edit content.			
#	**Actions**	**Test Data**	**Expected Result**	**Actual Result**
1	User can select the Manage courses	1. Dashboard	User can press the Manage courses button.	User selected the manage courses button.
2	User can add new course	1. Manage course page.	User can select the add new course button	Add new button is clicked and new page opened.
3	User can add program name.			
4	User can add banner			.

5	User can enter credit hours			
6	User can enter fees			
7	User can select program level			
8	User can click the add new course.	Course page	User select the ADD button to add new course	User selected the ADD button and course is added
Status	Pass			
Post-condition	New course is added.			

Table 27: Manage Courses

Test Case ID	TC-12		
Test Case Name	Manage User Roles		
Designed by	Waqas	**Executed by**	Alamgir
Designed Date	3/11/19	**Execution Date**	2/12/19
Description	User can delete or edit user roles.		
Pre-condition	The user must be an admin to edit content.		

#	**Actions**	**Test Data**	**Expected Result**	**Actual Result**
1	User can select the Manage User Roles	1. Dashboard	User can press the Manage User Roles button.	User selected the manage user role button.
2	User can assign new user role	1. Manage user roles page.	User can select the add new user roles button	Add new button is clicked and new page opened.
3	User select multiple roles	2. member	User will select roles from dropdown.	The option is selected
Status	Pass			
Post-condition	New role is assigned.			

Table 28: Manage User Roles

Test Case ID	TC-13		
Test Case Name	Manage Events		
Designed by	Alamgir	**Executed by**	Waqas
Designed Date	3/11/19	**Execution Date**	2/12/19
Description	User can view the event related to specific university or city. User also can edit or delete the event		
Pre-condition	The user must be an admin to edit content.		

#	Actions	Test Data	Expected Result	Actual Result
1	User can select the Manage events	1. Dashboard	User can press the Manage events button.	User selected the manage events button.
2	User can add new event	1. Manage event page.	User can select the add new event button	Add new button is clicked and new page opened.
3	User will enter event name.			
4	User will enter event image.			.
5	User will enter start/end date.			
6	User will enter venue name			
7	User will enter city			
8	User can click the add new event.	event page	User select the ADD button to add new event	User selected the ADD button and event is added

Status	Pass
Post-condition	New event is added.

Table 29: Manage Events

Test Case ID	TC-14			
Test Case Name	Edit Profile			
Designed by	Alamgir	**Executed by**	Waqas	
Designed Date	3/11/19	**Execution Date**	2/12/19	
Description	User can edit his profile			
Pre-condition	The user must be logged in.			
#	**Actions**	**Test Data**	**Expected Result**	**Actual Result**
1	User can select the edit profile.	1. Dashboard	User can press the edit profile button.	User selected the edit profile button.
2	User can change name			
3	User can change/reset password			
4	User will change profile picture			.
8	User can click the update profile button.	2.profile page	User select the update button to update the profile.	User selected the update button and profile is updated
Status	Pass			
Post-condition	Profile is updated.			

Table 30: Edit Profile

4.2 Unit / integration / acceptance testing

4.2.1 Unit testing

Unit testing is software testing technique in which individual/independent units of system are tested. This testing technique confirms that the unit is working properly as per requirement. This testing technique is at first level of software testing.

The units/modules that we are going to test are:

- Universities module
- Admissions module
- Add new city
- Add new university
- Add new program
- Manage Events
- Mange user
- User Roles unit
- Search unit
- Manage Faculties
- Application form unit
- Books/Notes Download units.
- Book/unit upload unit.
- Delete user unit
- Course attachment's unit
- Update profile unit
- Authorization unit

4.2.2 Integration testing

Integration testing is a software testing technique in which individual/independent units are combined together and tested as a module. The purpose of this testing technique is to ensure the data communication between the integrated modules.

In this testing phase we are going to test the logics or actions that the player is able to perform.

- Manage programs
- Manage cities
- Manage universities
- Login/signup unit
- Manage faculties
- Course unit

4.2.3 System testing

System testing is a software testing technique in which the entire system is tested as a whole. The aim of this technique is to find any bug, error or missing requirements in a system. The testing may include the overall testing of system functionality without checking code (Black box testing) and also considering the code quality during testing of system functionality (White box testing).

4.2.4 Acceptance testing

Acceptance testing is a technique in which system is tested for acceptability. In acceptance testing, system’s functionality is compared with business requirements to decide whether the system is acceptable for delivery or not. Acceptance criteria is built on the basis of user need and business requirement. This criterion is the basis for the acceptance of system.

5 Chapter 5: Conclusion

5.1 Problems faced and lessons learned

The main problem we faced in this project was of collecting data. We collected data about different courses of multiple universities of Pakistan. The data was not available properly on the websites of the universities. We have to physically visit different universities to find the related data. Some universities didn’t have the study scheme for their courses available on their websites and some didn’t have proper and enough information about their faculty staff. The collection of books and course related notes was also a big hassle because we had to collect them individually from the students of different universities. Creating diagrams was also a difficult task. We learn that learning new Technologies was time taking process. The main lesson we learned that these types of projects requires huge skills of data base management and research. More than 50% of work needed in these types of project is to collect data, manage data, maintain data and availability of data. So, these types of projects can be done if you have great knowledge and skills about the data bases.

5.2 Project summary

Main aim of our product is to cover everything under one umbrella. In our project user can manage universities, manage programs and edit profile. Books of specific subjects will also be available and if someone wants to upload any book that can be helpful for someone, the system will give him/her facility to upload. System will also provide the information about the faculty of particular university and their lecture notes will also be available so that their students can download them. The product will serve as a non-profit organisation which will provide single platform to students to get all the information about the major universities. It will provide all the information about the admission procedures, faculty, fee structure and their study scheme. System will provide the facility to users to update their profiles. Students can also get the information related to events of specific universities or city.

5.3 Future work

Till now we only focused on few major cities of Pakistan. In future, we want to go on and add multiple major cities of Pakistan in our project so that it can be more efficient and effective for the students. We also want to go deeper and focus on the “subjects” of different programs in different universities and share the books and lecture notes of the subjects instead of whole programs. We also want to add a feature of comparing different programs of the different universities so that the student can compare.

6 References

1. Altexsoft Software & Engineering. (2019, 8 22). Retrieved from Altexsoft Software & Engineering: https://www.altexsoft.com/whitepapers/quality-assurance-quality-control-and-testing-the-basics-of-software-quality-management/

2. c-sharpcorner. (2019, 1 20). Retrieved from c-sharpcorner: https://www.c-sharpcorner.com/article/models-in-asp-net-mvc5-using-entity-framework/

3. EasyQA. (2019, 7 15). Retrieved from EasyQA: https://geteasyqa.com/qa/best-test-case-templates-examples/

4. Eduvision. (2019, 1 31). Retrieved from Eduvision: https://www.eduvision.edu.pk/

5. Entity Framework Tutorial. (2019, 7 12). Retrieved from Entity Framework Tutorial: Entity Framework Tutorial

6. guru99. (2019, 6 11). Retrieved from guru99: https://www.guru99.com/levels-of-testing.html

7. ilmkidunya. (2019, 1 5). Retrieved from ilmkidunya: https://www.ilmkidunya.com/

8. Software Testing Fundamentals. (2019, 8 23). Retrieved from Software Testing Fundamentals: http://softwaretestingfundamentals.com/acceptance-testing/

9. Software Testing Help. (2019, 8 24). Retrieved from Software Testing Help: https://www.softwaretestinghelp.com/what-is-integration-testing/

10. Top Universities. (2019, 5 4). Retrieved from Top Universities: https://www.topuniversities.com/

11. Visual Paradigm. (2019, 3 23). Retrieved from Visual Paradigm : https://www.visual-paradigm.com/

12. Wikipedia. (2019, 2 29). Retrieved from Wikipedia: https://en.wikipedia.org/wiki/ASP.NET_MVC