Process MeNtOR 3.0

McBal Demographic Analysis Application (MDAA)

Requirements Model

Version:	2.0
Print Date:	
Release Date:	
Release State:	Initial
Approval State:	Draft
Approved by:	
Prepared by:	Henry So, Jacob Chun, Samuel Su, Yan Qing Niu
Reviewed by:	
Path Name:	
File Name:	SRS-Part-2.pdf
Document No:	1

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Document Change Control

Version	Date	Authors	Summary of Changes
1.0	2/1/2021	Henry So, Jacob Chun, Samuel Su, Yan Qing Niu	Initial edits of Introduction, Business Scenario Model, Domain Model, Activities Plan
1.1	2/4/2021	Henry So, Jacob Chun, Samuel Su, Yan Qing Niu	Use case models completed
1.2	2/7/2021	Henry So	Gantt Chart added, minor revision to entire document
1.3	2/7/2021	Henry So, Jacob Chun, Samuel Su, Yan Qing Niu	Completed Domain Model, revised Table of Contents, added product backlog
2.0	2/27/2021	Henry So, Jacob Chun, Samuel Su, Yan Qing Niu	Revision to product backlog/sprint backlog. Completed Sequence Diagrams
2.1	2/28/2021	Henry So, Jacob Chun, Samuel Su, Yan Qing Niu	Completed Activity Diagrams
2.2	3/1/2021	Henry So, Jacob Chun, Samuel Su, Yan Qing Niu	Devised Test Cases, Completed Non-Functional Requirements, revised Table of Contents, updated Gantt chart, formatted SRS document.

Document Sign-Off

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Contents

1 Introduction

1.1 Purpose

This document details the requirements of a demographic statistical analysis application that utilizes data from the World Bank's data repository. It outlines the details and various scenarios relevant to the development of the application, business scenarios, use cases, domain models, and interaction hierarchy of the entire system. It details all non-functional requirements of the application including hardware, hardware interfaces, development environments, network, and operational parameters. Further, it outlines the development activities schedule for the application.

1.2 Overview

The goal of this project is to implement an application system that enables users to analyze and visualize key data metrics derived from the World Bank's data repository.

Data acquisition from the World Bank's data repository is retrieved via remote issuing HTTP GET requests from the McBal Demographic Analysis Application (MDAA). This functionality is enabled through Java's native URL and HttpURLConnection libraries. The data is programmatically fetched using the World Bank's API and indicator IDs for selective environmental and health data appropriate to MDAA. Upon being fetched, JSON files will be processed using Gson, an open-source Java library developed by Google. This will enable the system to deserialize the JSON files into Java objects. Once deserialized, various metrics will automatically be processed and visualized for user analysis.

The overarching goals of this system are to: a) enable the retrieval of demographic and other data for one selected country from the World Bank's data repository; b) process the data using different types of analyses; c) render the retrieved data or the processed data using appropriately selected visualization mediums such as bar charts, line graphs, scattered plots, and pie charts.

Additionally, non-functional requirements like hardware interfaces, system interfaces, networking, reliability, and maintainability are examined carefully within this document.

1.3 References

Eclipse: http://www.eclipse.org/downloads/index.php
Gson: https://sites.google.com/site/gson/gson-user-guide
JSON: https://www.w3schools.com/js/js_json_intro.asp
GANTT: http://wiki.phprojekt.com/index.php/Gantt-diagram
Java URL: https://docs.oracle.com/javase/7/docs/api/java/net/URL.html
HttpURLConn: https://docs.oracle.com/javase/8/docs/api/java/net/HttpURLConnection.html
Gantt Chart Software: https://www.teamgantt.com/
UML Diagram Builders: https://www.umlet.com/
UML: https://en.wikipedia.org/wiki/Unified_Modeling_Language
Domain Model: https://en.wikipedia.org/wiki/Domain_model
Scrum: https://www.scrum.org/
Project specification document: Restricted access through OWL CS 2212B site

2 Business Scenario Model

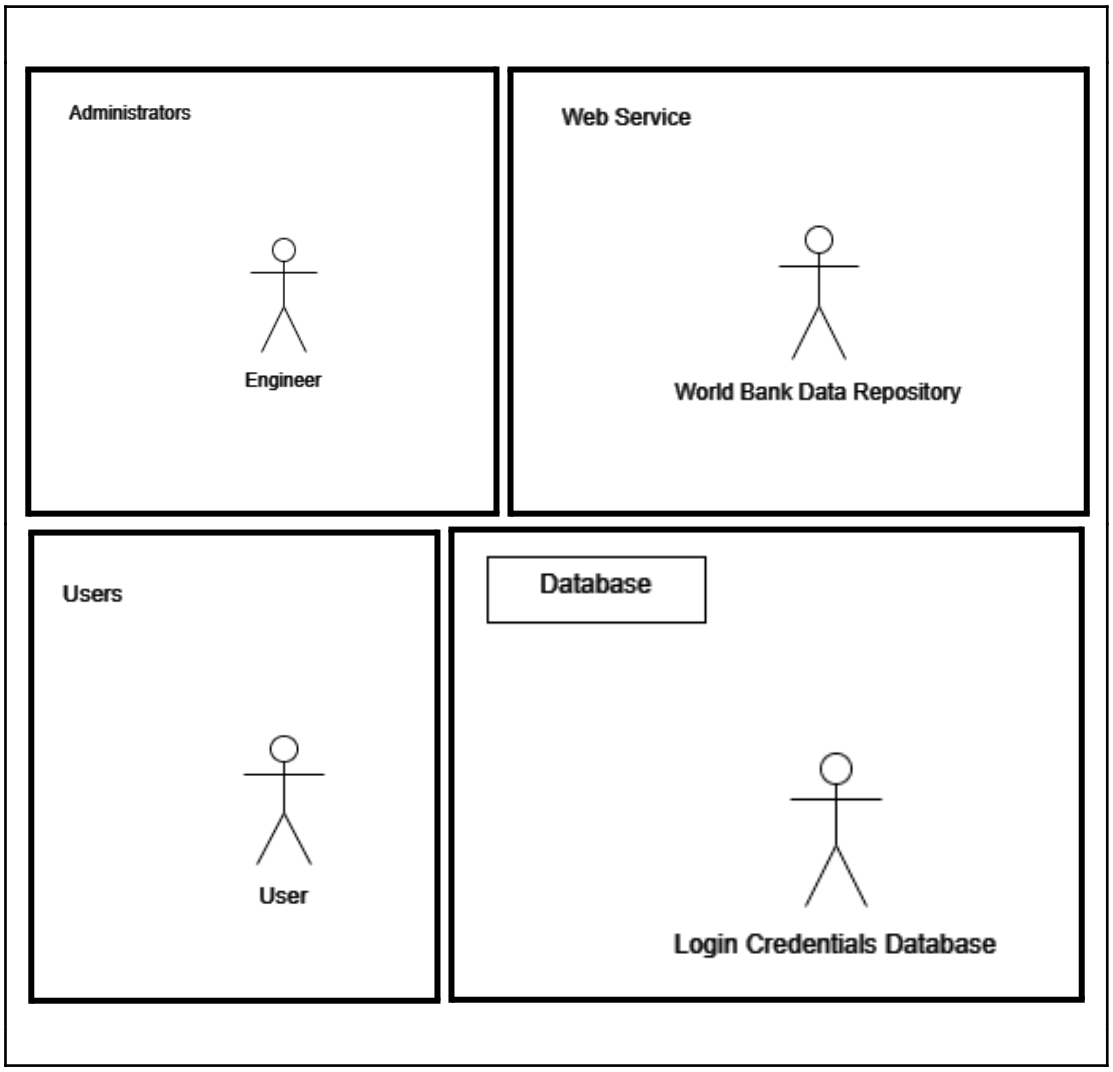
2.1 Actors

2.1.1 Overview

The actors in our system include end users of software, application administrators, and the World Bank data repository. End users exist in an interactive environment in which they can render data fetched from the World Bank data repositories for proper analysis. Application administrators have full access (read, write, execute permissions) to allow for application maintenance. The World Bank data repositories source environmental and health data from numerous countries and timeframes.

2.1.2 Actor Diagram

This figure represents every actor that will be interacting with our system. The three groups our actors can be classified in are administrators, web services and users. The diagram below shows the specific actor in each category.



2.1.3 Actor Definitions

User

Description	The User is someone who will interact with the system through an interface. They are human actors and are classified as an User when they use the software. The role of this actor, when taking into account the system, is to request information on pre-selected analyses from the web service and viewing the resulting data in our interface.
Aliases	End User
Inherits	None
Actor Type	Active Actor
Contact Person	
Contact Details	

Administrator

Description	The Administrator has the goal of creating, and maintaining the system. They are human actors whose objective is ensuring a stable launch, and the maintaining/updating of the software.
Aliases	Engineers
Inherits	None
Actor Type	Active Actor
Contact Person	
Contact Details	

Web Server

Description	The Web Service is used by the software to collect the information that the user requests. It is external from the software and will only execute when called by the software. Then, the web service will respond with the desired data to be displayed by the system.
Aliases	World Bank Data Repository
Inherits	None
Actor Type	Passive Actor
Contact Person	
Contact Details	

Database

Description	The Database is used by the software to store and retrieve information that requires persistent storage such as user settings and login info. It is external from the software and will only operate when called by the software. The application will submit queries to the Database inorder to store / retrieve information.
Aliases	System’s Storage, Application Storage, Login Credentials Database
Inherits	None
Actor Type	Passive Actor
Contact Person	
Contact Details	

2.2 Use Case Descriptions

This section documents the complete business scenarios within the scope of this project.

2.2.1 XXXX-0001 The user logs into the system

In this business scenario, User (User A) uses the system to initially log into their account. User A's credentials will then be verified by the system as valid or invalid.

Goal in Context:

This scenario pertains to the initial start up of the system. When the application is opened, User A will be greeted with a login window where they can input their username and password. The system will invoke a query to the database inorder to verify User A's credentials. If the combination of username and password is not correct or no such user exists in the system's database, a pop-up window or a notification in the form will notify them that there is an error with the provided credentials and the application will terminate. If the username-password combination is correct, then the main UI of the application is displayed.

Actors:

The actors associated with this business scenario are as follows:

1. User (User A)

The details of the above mentioned actors can be found in Section 2.1.3 (Actor Definitions).

Preconditions:

Before this scenario can be performed:

1. User A must have valid registered account in the system's database in order to be authenticated successfully
2. The system's database must be functioning

Trigger:

This use case will be triggered every time the application is opened.

Scenario Text:

1. User A opens the application
2. Application initializes and pop-up window is displayed
3. User A supplies login information
   - 3.1. Query system's database for corresponding username
   - 3.2. Verify User A's password
   - 3.3. Display error and terminate if incorrect
4. Display the application's main UI

Alternative Scenario Courses:

None.

Constraints:

None.

Questions:

None.

2.2.2 XXXX-0002 Selecting the analysis type to be performed

In this business scenario, User (User A) uses the system to select a specific analysis type to be performed on the chosen data.

Goal in Context:

This scenario pertains to a User's analysis selection. This scenario requires that the user must first select the country for which they like to fetch, process, and visualize data. User A will then select the specific type of analysis to perform from a drop-down menu of available types. The system verifies to see if the chosen type is different from the one previously selected. Once an analysis type that is different from the previous selection is chosen, the list with the viewers for this analysis type is reset.

Actors:

The actors associated with this business scenario are as follows:

1. User (User A)

The details of the above mentioned actors can be found in Section 2.1.3 (Actor Definitions).

Preconditions:

Before this scenario can be performed:

1. The World Bank's API must be on and functioning

Trigger:

This use case will be triggered every time a User chooses to select an analysis type.

Scenario Text:

1. Select the desired country and years for analysis
   - 1.1. Uses the *Selecting a country to fetch and visualize data for* scenario
   - 1.2. Uses the *Selecting the years for which the analysis type is to be performed* scenario
2. Select an analysis type
   - 2.1. Check to see if the analysis type is different
     - 2.1.1. If it is different from the previous, empty viewers
     - 2.1.2. If it is the same as the previous, keep current viewers

Alternative Scenario Courses:

None.

Constraints:

None.

Questions:

None.

2.2.3 XXXX-0003 Selecting a country to fetch and visualize data for

In this business scenario, the User (User A) selects a country from a drop-down menu. The country selected then returns the matching data to the analysis type chosen (if available).

Goal in Context:

This scenario covers User A's interaction with the country drop-down menu. The drop-down menu contains all the countries in the world. For this particular use case, User A selects a country from a list of countries for the data they want to fetch (and optionally process). If the chosen type of analysis is not available for the country, the application will report a message that allows User A to acknowledge that data fetching and or processing is not available for the selected country. Otherwise, if the chosen type of analysis is available for the selected country, then data fetching can proceed. The text file that contains types of analysis and the country for which the analysis should not be available will assist the system in determining whether or not data processing and or fetching is available for the selected country.

Actors:

The actors associated with this business scenario are as follows:

1. User

The details of the above mentioned actors can be found in Section 2.1.3 (Actor Definitions).

Preconditions:

1. User A must be logged in successfully
2. The analysis type to be performed must be selected

Trigger:

The use case is invoked when User A selects a country from the drop-down menu.

Scenario Text:

1. Select the drop-down menu to expand the list of countries
2. Select the desired country from the drop-down menu
3. Application checks if the desired country is available to process and fetch the data for the analysis type chosen (see *Section 2.2.2: XXXX-0002 Selecting the analysis type to be performed* for more information on selecting analysis type)
   3.1. If the check is invalid, Alternative Scenario 1 occurs and the use case scenario ends. Otherwise..
4. Proceed with data processing and or fetching (check is valid)

Alternative Scenario 1:

1. The application will report an error message to User A to acknowledge that data processing and or fetching is not available for the country selected given the type of analysis

Constraints:

None.

Questions:

None.

2.2.4 XXXX-0004 Selecting the years for which the analysis type is to be performed

In this business scenario, the User (User A) selects the years for which the analysis type is to be performed. The application checks whether or not the years selected are valid selections for the selected type of analysis. If invalid, User A is prompted to select different start and end years.

Goal in Context:

This scenario covers User A's interaction with the start year drop-down menu and end year drop-down menu. The drop-down menus contain a list of years that User A can pick a timeframe from. The system will check whether the start and end year are valid selections given the selected type of analysis. If the years selected are not valid for the chosen type of analysis, a message is displayed to User A to prompt them to select different start and end years.

Actors:

The actors associated with this business scenario are as follows:

1. User (User A)

The details of the above mentioned actors can be found in Section 2.1.3 (Actor Definitions).

Preconditions:

1. User A must be logged in successfully
2. The analysis type to be performed must be selected

Trigger:

The use case is invoked when User A selects a timeframe from the two drop-down menus (the From drop-down menu and the To drop-down menu)

Scenario Text:

1. Select the From drop-down menu to expand the list of years
2. Select the year that will dictate the start year
3. Select the To drop-down menu to expand the list of years
4. Select the year that will dictate the end year

5. Application checks if the start and end year are valid selections for the selected type of analysis (see *XXXX-0002 Selecting the analysis type to be performed* for more information on selecting analysis type)
    5.1. If the selections are invalid, Alternative Scenario Course 1 occurs

Alternative Scenario Course 1:

1. If invalid, a message is displayed and the user is prompted to select different start and end years (see *XXXX-0002 Selecting the analysis type to be performed* for more information on selecting analysis type)

Constraints:

None.

Questions:

None.

2.2.5 XXXX-0005 Adding visualization graphs to display the obtained/computed data

In this business scenario, the user (User A) has selected the data, country, and timeframe, as covered in *2.2.2, 2.2.3,* and *2.2.4*, and is adding new graphs for the obtained or computed data.

Goal in Context:

This scenario covers User A adding additional graphs (or *viewers*) to the display. User A selects from a dropdown list of possible viewers to be used for visualizing the data. Prior to adding, the system checks if the selected *viewer* is compatible with the chosen analysis. If it is incompatible, a message is shown. Otherwise, the *viewer* is added to the list of *viewers* on screen.

Actors:

The actors associated with this business scenario are as follows:

1. User (User A)

The details of the above mentioned actors can be found in Section 2.1.3 (Actor Definitions).

Preconditions:

1. User A has successfully logged in.
2. User A has successfully chosen the data, country, and timeframe to be shown.

Trigger:

User A selects either the drop-down menu or the “+” button

Scenario Text:

1. User opens drop-down menu
2. User selects viewer from drop-down menu
3. User selects “add” (or “+”) button

4. System checks if selected viewer is compatible with selected data
5. System adds viewer to visualization list

Alternative Scenario Courses:

1. Incompatible graph type for data selected
   1.1. System prints error message

Constraints:

None.

Questions:

None.

2.2.6 XXXX-0006 Removing visualization graphs to display the obtained/computed data

In this business scenario, the user (User A) has selected the data, country, and timeframe, as covered in *2.2.2*-*2.2.4*, and is removing graphs for the obtained or computed data.

Goal in Context:

This scenario covers User A removing graphs (or *viewers*) from the list of graphs to be displayed. User A selects from a dropdown list of possible viewers for visualization of the data. Prior to removing, the system checks if the selected *viewer* is already in use. If it is not in use, a message is shown. Otherwise, the *viewer* is removed from the list of *viewers* on screen.

Actors:

The actors associated with this business scenario are as follows:

1. User (User A)

The details of the above mentioned actors can be found in Section 2.1.3 (Actor Definitions).

Preconditions:

1. User A has successfully logged in.
2. User A has successfully chosen the data, country, and timeframe to be shown.

Trigger:

User A selects either the drop-down menu or the “-” button

Scenario Text:

1. User opens drop-down menu
2. User selects viewer from drop-down menu
3. User selects “minus” (or “-”) button
4. System checks if selected viewer is compatible with selected data
5. System removes viewer from visualization list

Alternative Scenario Courses:

1. Selected viewer is not in visualization list
    1.1. System prints error message

Constraints:

None.

Questions:

None.

2.2.7 XXXX-0007 Performing the analysis

In this business scenario, the system will use the given country, type of analysis, and time frame to request the corresponding information from the web service. After receiving the information, the system processes the data in order to be correctly displayed.

Goal in Context:

This scenario is associated with the reception of the required information and the processing of said information. This use case is initiated once the user presses the "Recalculate" button. This must be done after the user selected the country, type of analysis and time frame. The system will invoke a request to the web service, which will result in the web service sending the information back to the system. Once received, the system will convert the data into a more usable form, in order to be displayed.

Actors:

The actors associated with this business scenario are as follows:

1. Web Service
2. User

The details of the above mentioned actors can be found in Section 2.1.3 (Actor Definitions).

Preconditions:

Before this scenario can be performed:

1. User must have logged in successfully
2. User must have selected the country
3. User must have selected the type of analysis
4. User must have selected the time frame
5. User must have pressed the "Recalculate" button
6. Web service must be on and running

Trigger:

This use case will be triggered when the user presses the "Recalculate" button

Scenario Text:

1. User presses “Recalculate” button
2. Get information using the *Strategy* (see **Strategy design pattern**)
   2.1. Get the country chosen by the user
   2.2. Get the start and end year chosen by the user
   2.3. Get the analysis type chosen by the user
3. Send data request to web service
4. Use calling strategy to obtain and hold the data
5. Process the received data to be use in graph
6. Data is then kept in the model (see ***Observer design pattern***)

Alternative Scenario Courses:

1. Analysis is not possible
   1.1. Use pop up message to indicate analysis is not possible
2. Analysis not possible for all selected years
   2.1. Compute and process data only for useable years
   2.2. Data is then kept in the model (see ***Observer design pattern***)

Constraints:

None.

Questions:

None.

2.2.8 XXXX-0008 Displaying the results

In this business scenario, the system will use the data received by the web service, after any needed processing, and display the data to the user by using graphs.

Goal in Context:

This scenario is the final use case and pertains to displaying the information selected by the user through use of graphs. Once the data from the web service has been extracted and processed, the system will display the report in the sufficient number of graphs (depends on the analysis).

Actors:

There are no actors associated with this business scenario.

Preconditions:

Before this scenario can be performed:

1. User must have logged in to the system successfully
2. User must have selected the analysis type, country and time frame
3. User must have selected the viewer
4. Analysis from the World Bank Data Repository retrieved.

Trigger:

Analysis requested by the user successfully received.

Scenario Text:

1. Use requested analysis to identify the number of series of data to produce

2. Use data from *XXXX-0007 Performing the analysis* to display information on graph(s)

Alternative Scenario Courses:

None.

Constraints:

None.

Questions:

None.

2.3 Use Case Diagrams

This section presents the business scenarios of the subject area in a graphical form.

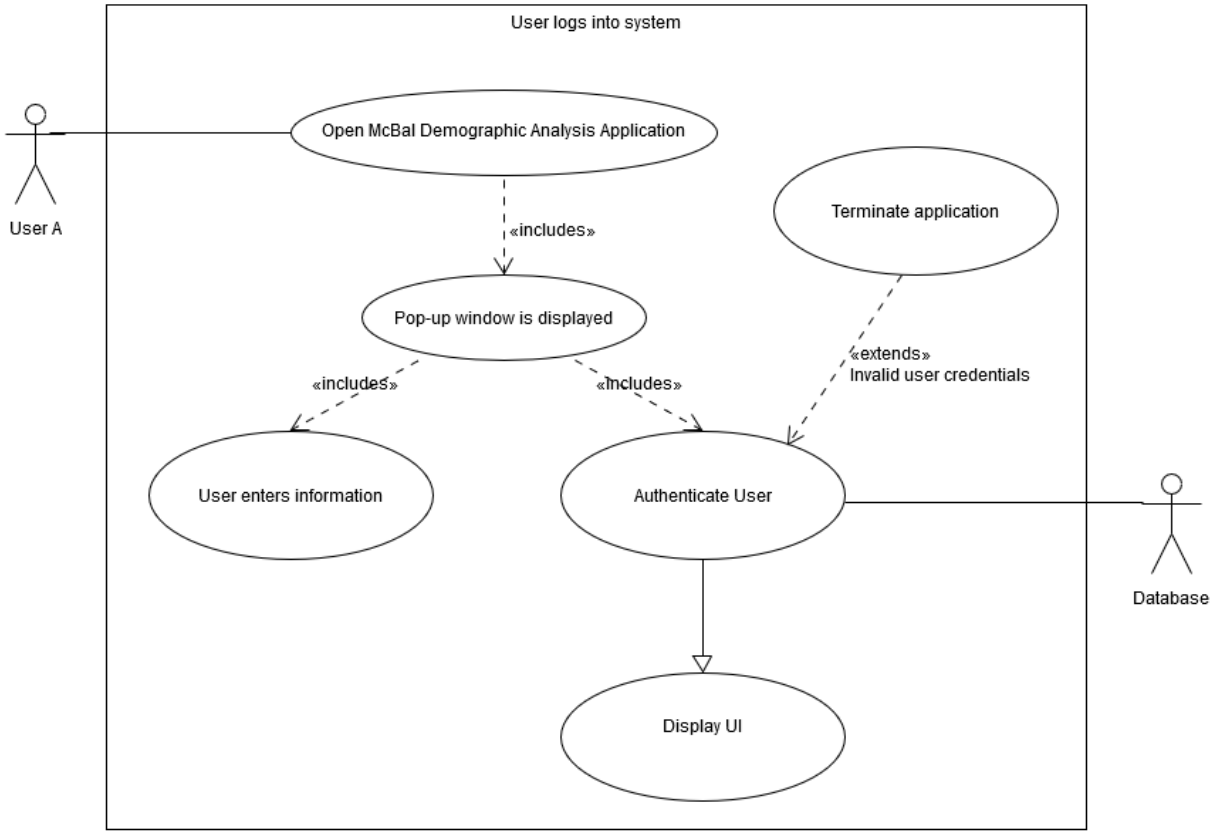


Fig 2.4.1 Use case diagram depicting the user login functionality case XXXX-0001

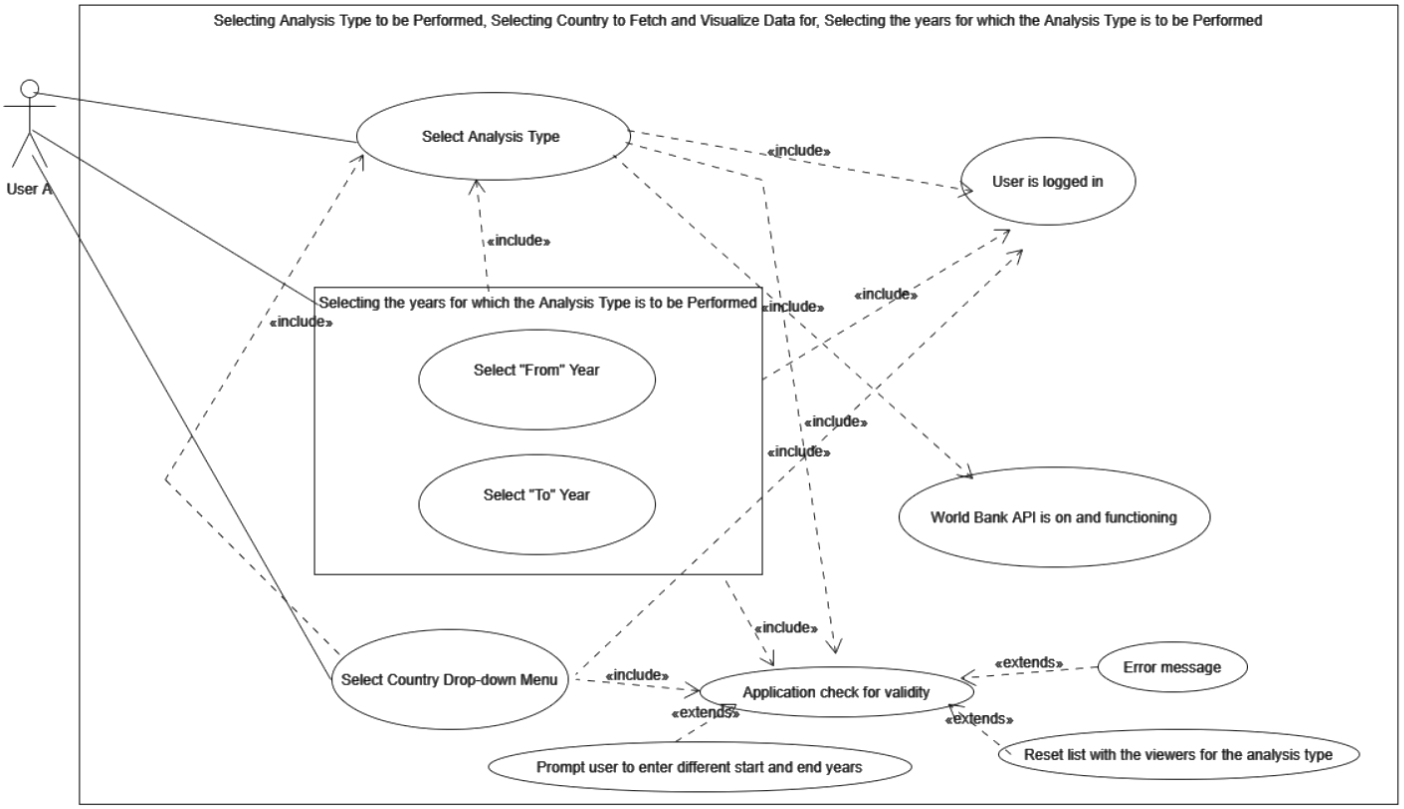


Fig 2.4.2 Use case diagram depicting system behavior associated with use cases XXXX-0002, XXXX-0003, XXXX-0004

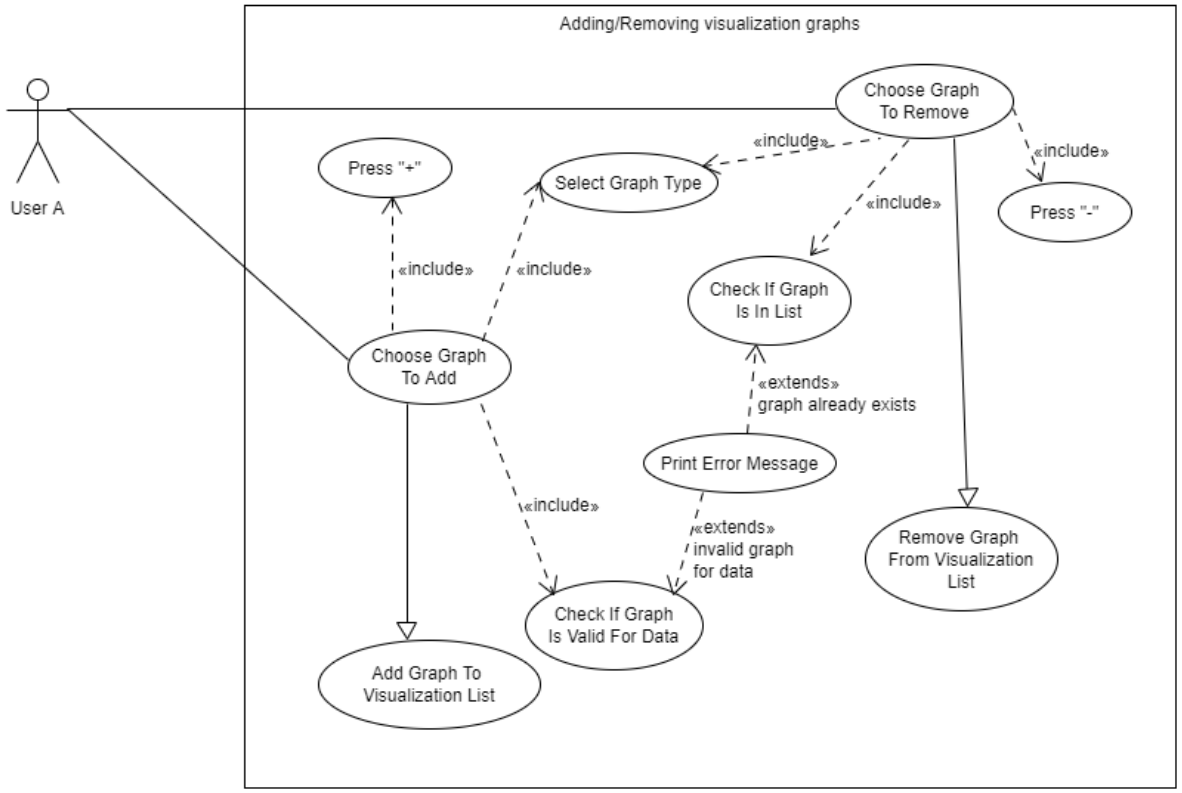


Fig 2.4.3 Use Case Diagram for Use Case XXXX-0005 and Use Case XXXX-0006

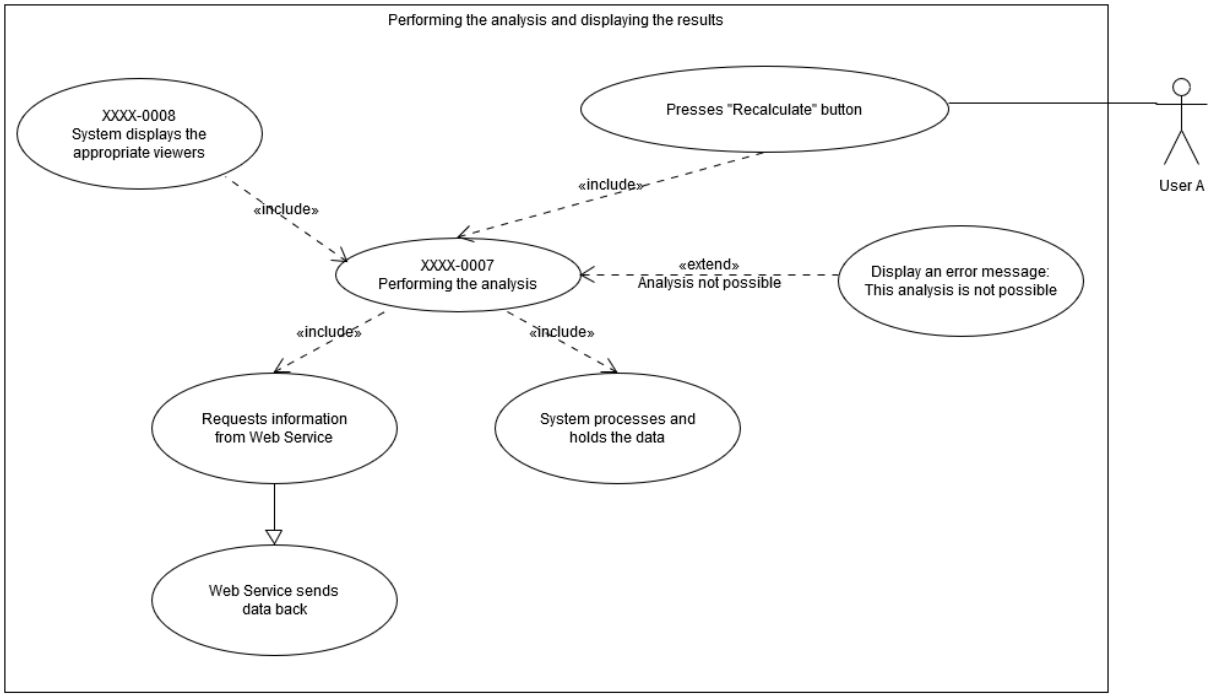


Fig. 2.4.4 Use Case Diagram for Performing the analysis and Displaying results, Use Case XXXX-0007 and Use Case XXXX-0008

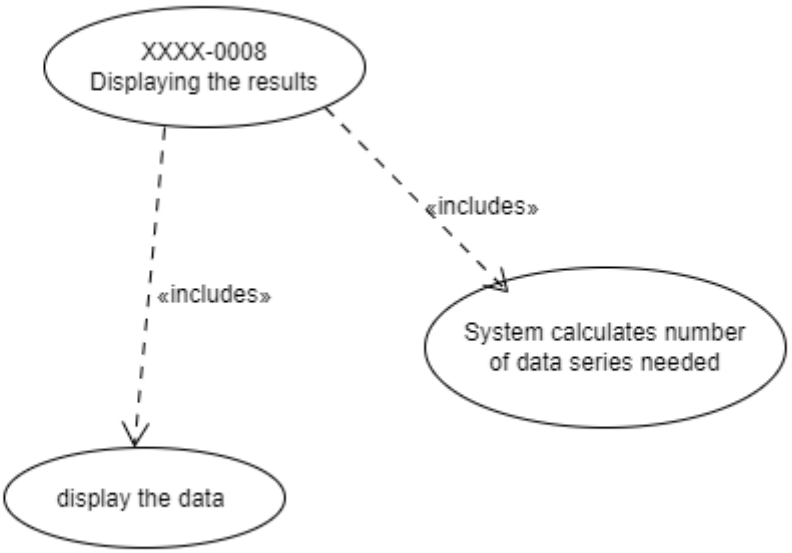
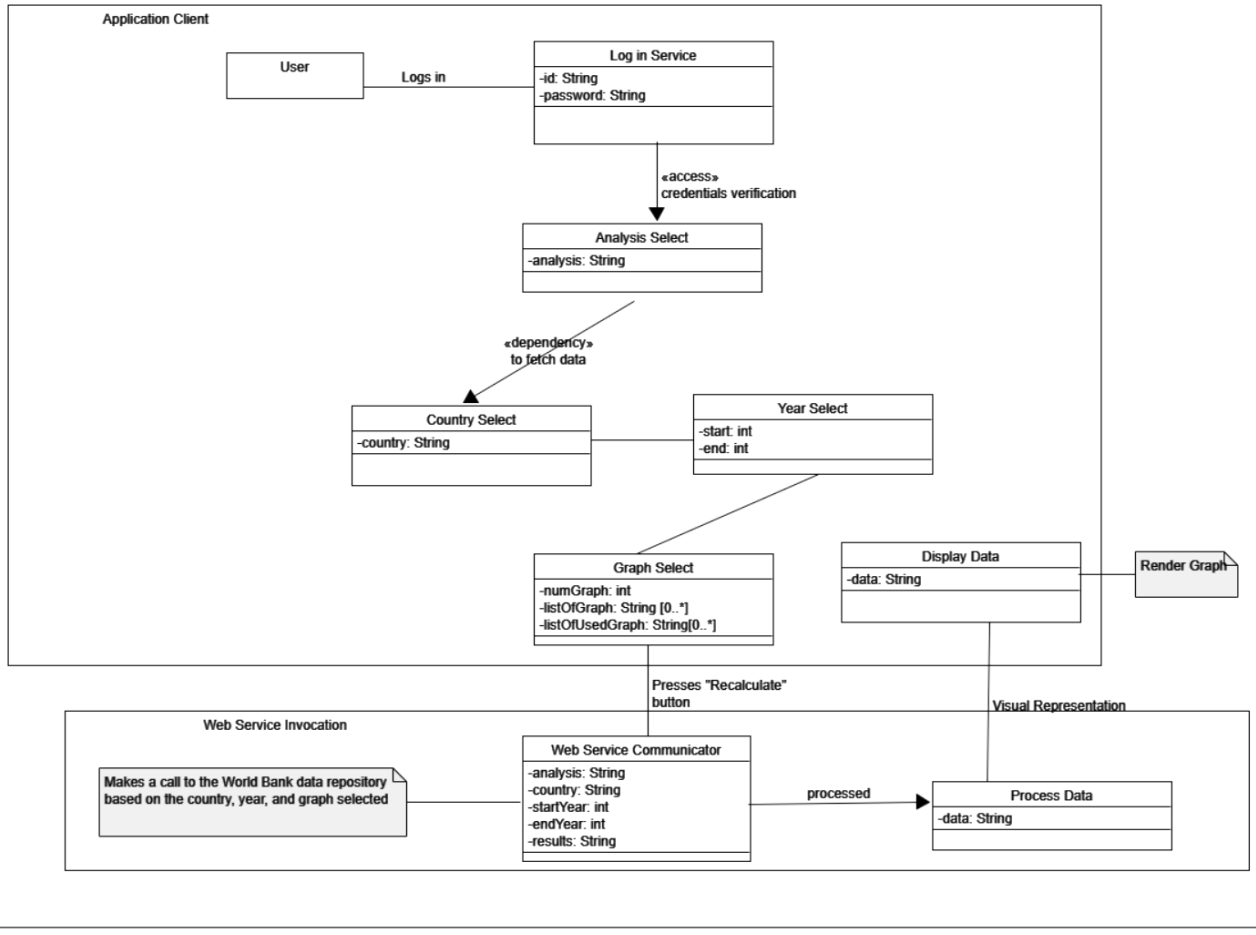


Fig. 2.4.5 Use Case diagram for Displaying the results, Use Case XXXX-0008

3 Domain Model

3.1 Domain Model Class Diagram



The domain model class diagram for the SIP-based Communication System appears above.

3.2 Domain Model Class Definitions

3.2.1 Log In Service

Description	This object represents the software's log in capabilities. The user must log in with a pre-established username and password that will be stored inside our database. A pop-up window will request the user for their credentials before showing the software's main UI. Application will terminate if incorrect.
Attributes	id: String password: String
Responsibilities	This service must be able to take the given id and password, and check if they are registered within the database. The user must be registered beforehand to use the software.
Business Rules	**N/A**

3.2.2 Analysis Select

Description	This operation allows the user to select the type of analysis they want. As shown with the diagram above, this must be done before selecting any other changeable variable (country or year). The user can select the analysis through a menu and this object will hold the requested analysis.
Attributes	selected: String
Responsibilities	This object is responsible for finding the countries available for the requested analysis. Also, this object must hold the requested analysis and must be able to give the analysis to other objects if needed.
Business Rules	**N/A**

3.2.3 Country Select

Description	This operation allows for the user to select a country to analyze. This is done through a drop-down menu listing all countries that can be chosen for the selected analysis. After the user chooses a country, the choice is stored in this object.
Attributes	selected: String
Responsibilities	This object is responsible for using available countries, as found in *analysis select*, and only showing those within the menu. Also, this operation must hold the requested country and must allow other objects or classes to refer to its variables if needed.
Business Rules	**N/A**

3.2.4 Year Select

Description	This object represents the ability to select the start and end year. The user can select a starting year, as well as an ending year, through two menus. The object will then hold the requested analysis.
Attributes	start: int end: int
Responsibilities	This operation must be able to hold the requested years and must allow other objects or classes to refer to its variables if needed.
Business Rules	**N/A**

3.2.5 Graph Select

Description	This object allows the user to add or remove the graphs shown in the viewer. The user can select the types of graphs shown on the software through a menu. After, the object will have buttons to add the graph selected to the viewer, or remove said graph.
Attributes	listOfUsedGraph: String[0..*] listOfGraph: String[0..*] numGraph: int
Responsibilities	This operation should have a menu to select the type of graph the user wants and buttons to add/remove the graph. Also, this object but be able to hold the currently used graphs so they could be removed after. Another responsibility this object has, is the ability to wipe clean the used graphs and remove them from the viewer if and only if the analysis is changed.

Business Rules	**N/A**

3.2.6 Web Service Communicator

Description	This operation requests data from the web service based on the options the user selected, and holds the received from the web service. This object is able to request and hold the user selected variables from objects before and to use them to request data from the web service.
Attributes	analysis: String country: String startYear: int endYear: int results: String
Responsibilities	This object is responsible for requesting and holding the values selected by the user. This object associates with the web service by sending a data request, and holding any data that the web service returns. This object must also be able to give the results to other objects, if needed.
Business Rules	**N/A**

3.2.7 Process Data

Description	This operation takes the data given to us by the web service and changes it, in order to be displayed in the graphs by the viewer.
Attributes	data: String
Responsibilities	This object must be able to process the data into usable values for the graphs/viewer. This operation must hold the data and processed data, and has to be able to give it to other objects if needed.
Business Rules	**N/A**

3.2.8 Display Data

Description	This object displays the processed data through use of graphs. The object will take the processed data from the previous object and use the values to create the requested graphs. From there, the graphs will be shown on the viewer, with the correct number of series of data.
Attributes	data: String
Responsibilities	This operation must be able to request and receive the processed data from another object. This object must be able to correctly identify the number of series of data that has to be displayed. This operation must render the selected graphs with the processed data onto the viewer correctly.
Business Rules	**N/A**

4 Sequence and Activity Diagrams

4.1 Sequencing Diagrams

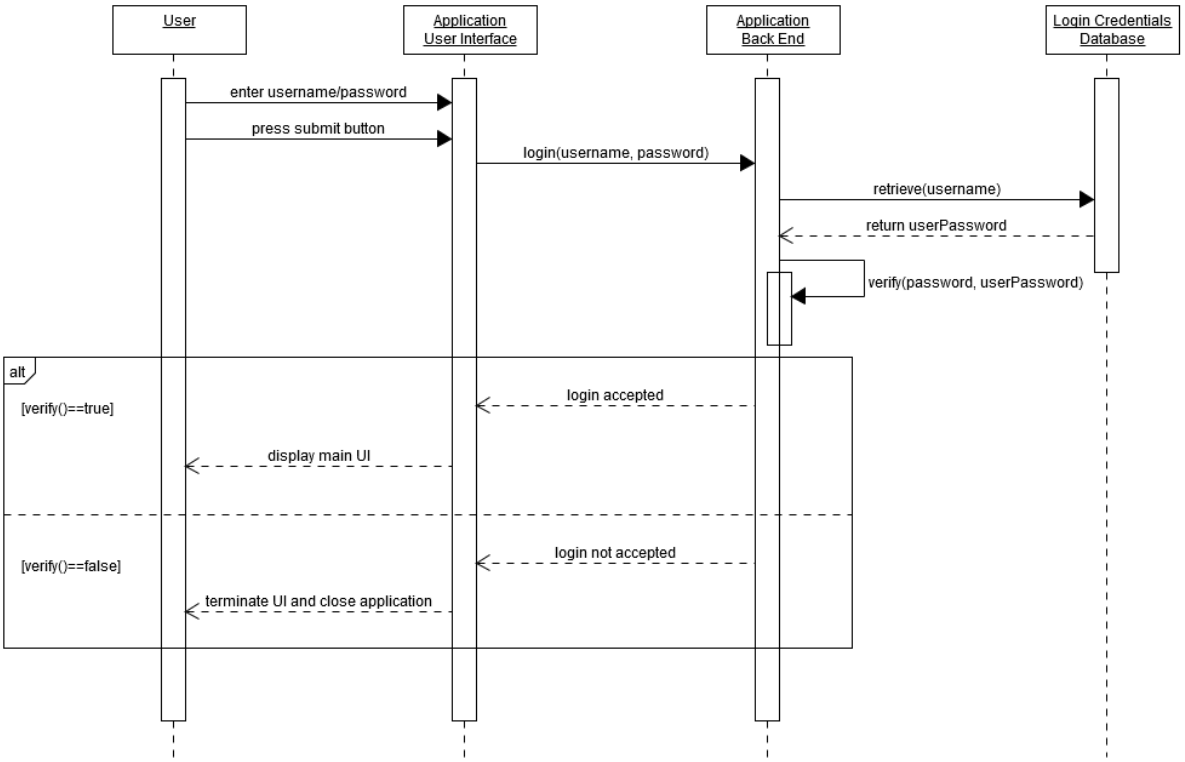


Fig 4.1.1: Sequence Diagram for Use Case XXXX-0001: Logging into System

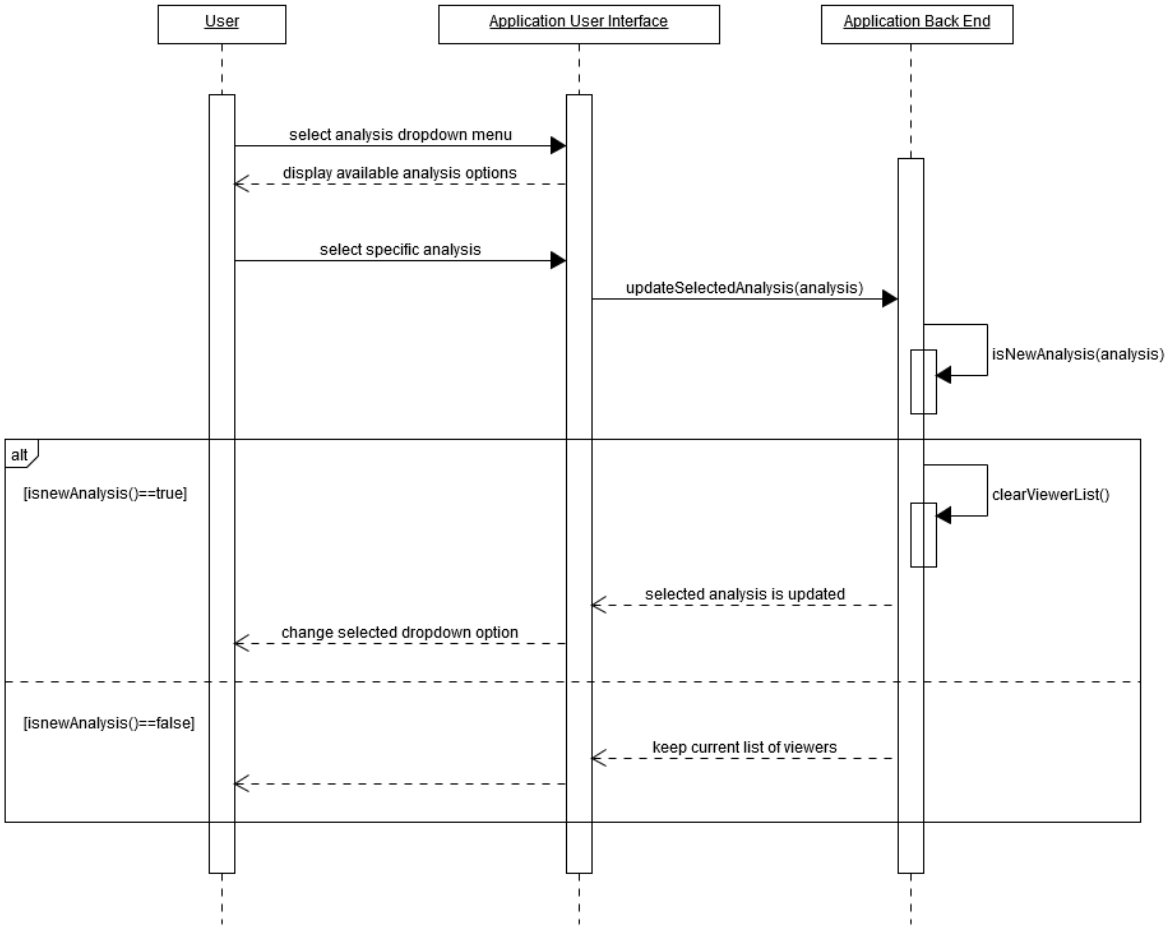


Fig 4.1.2: Sequence Diagram for Use Case XXXX-0002: Analysis Selection

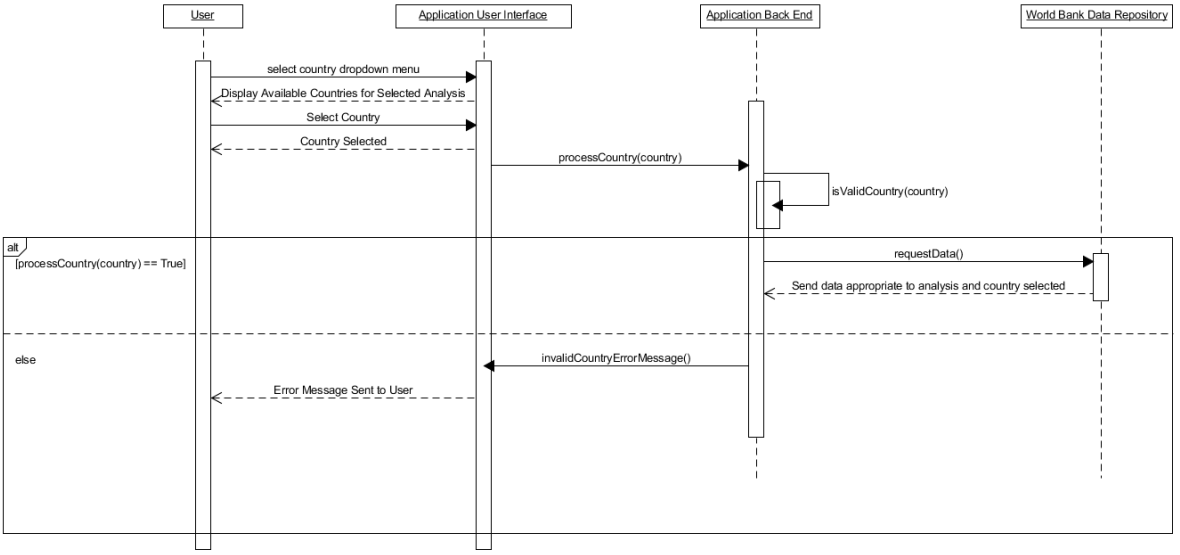


Fig 4.1.3: Sequence Diagram for Use Case XXXX-0003: Country Selection

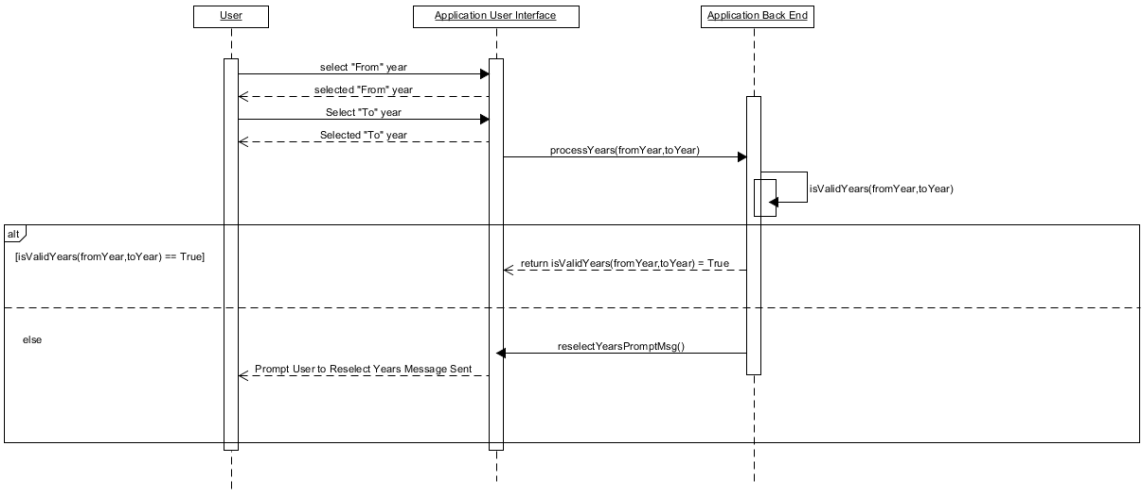


Fig 4.1.4: Sequence Diagram for Use Case XXXX-0004: Time Frame Selection

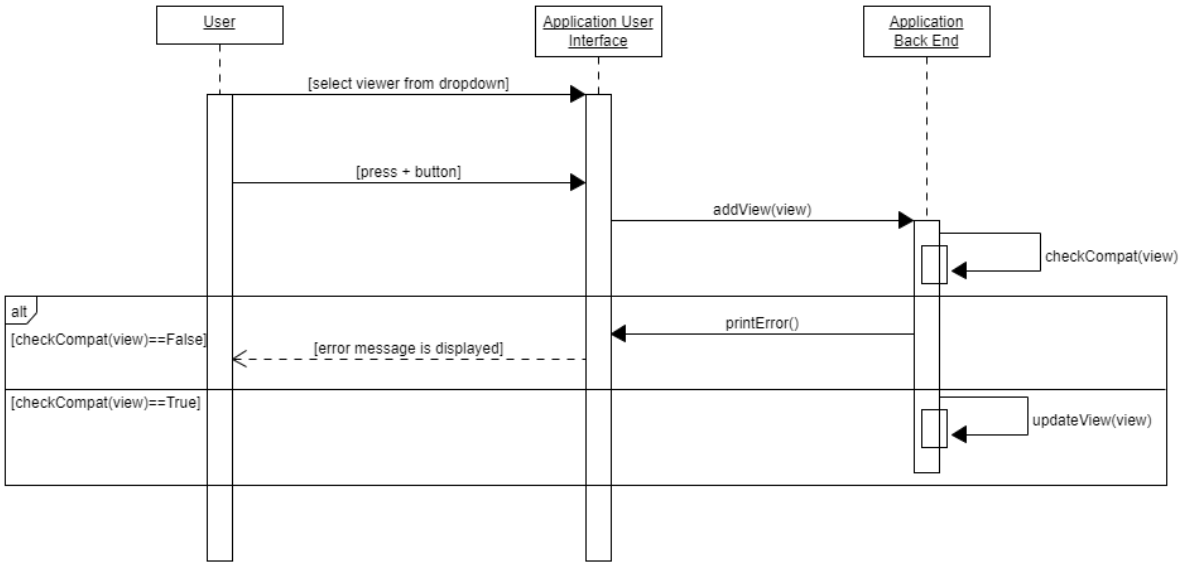


Fig 4.1.5: Sequence Diagram for Use Case XXXX-0005: Adding Visualization Graph

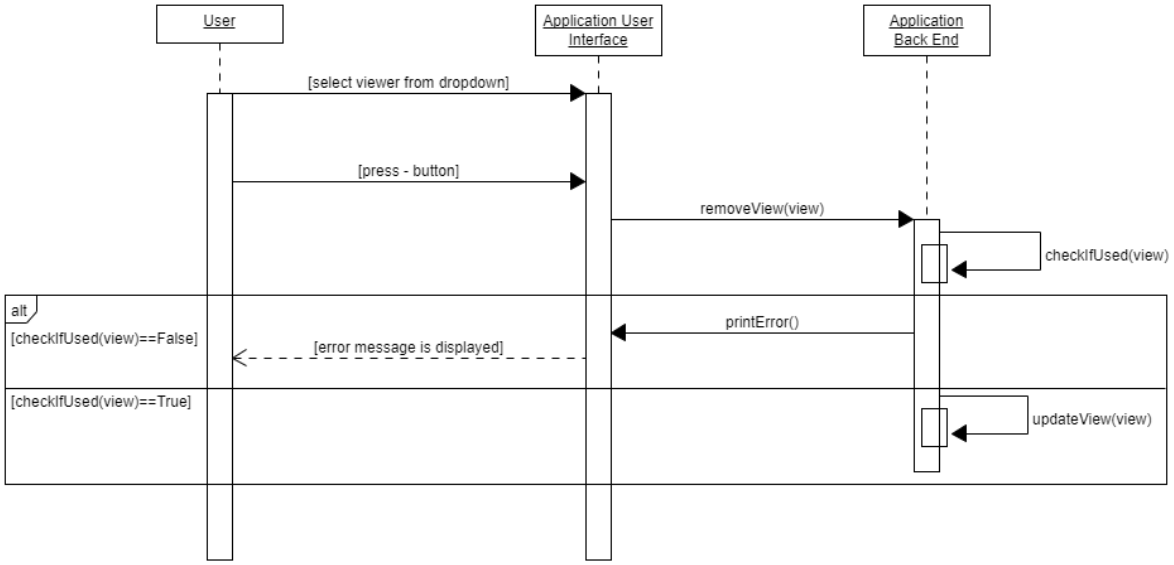


Fig 4.1.6: Sequence Diagram for Use Case XXXX-0006: Removing Visualization Graph

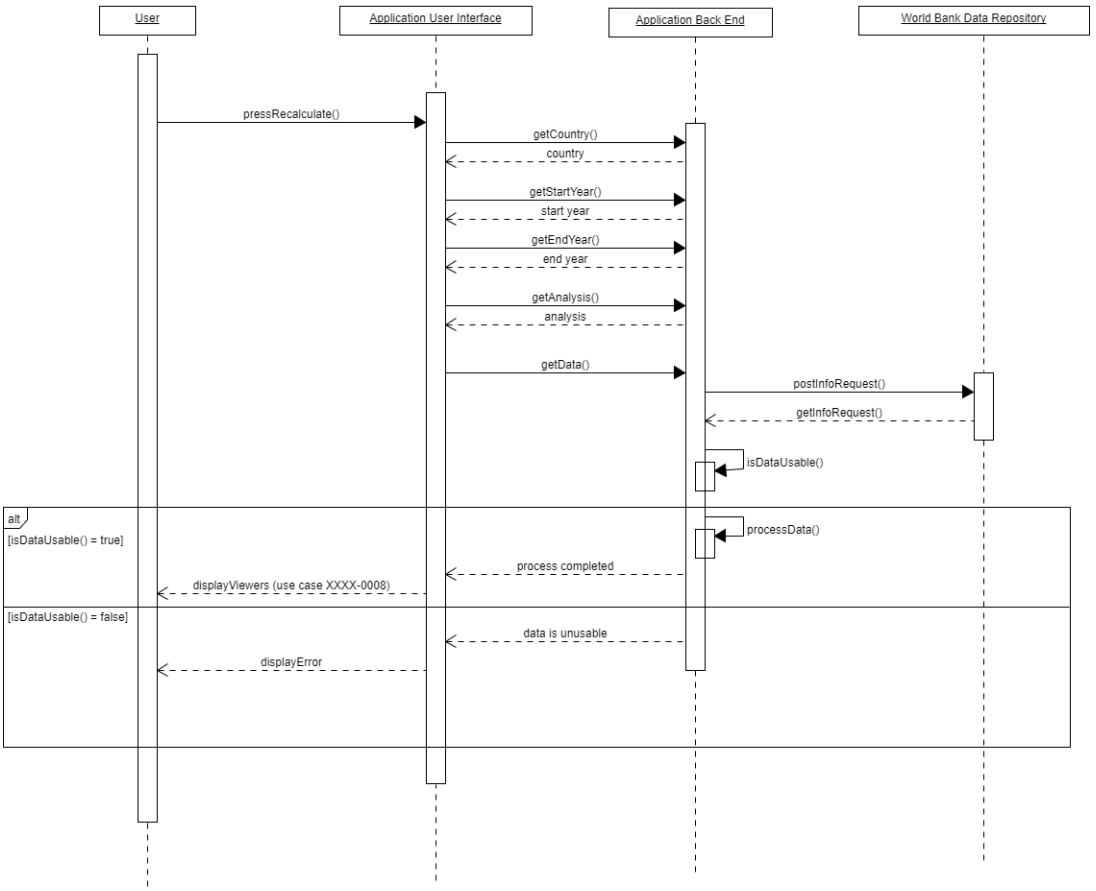


Fig 4.1.7: Sequence Diagram for Use Case XXXX-0007: Performing Analysis

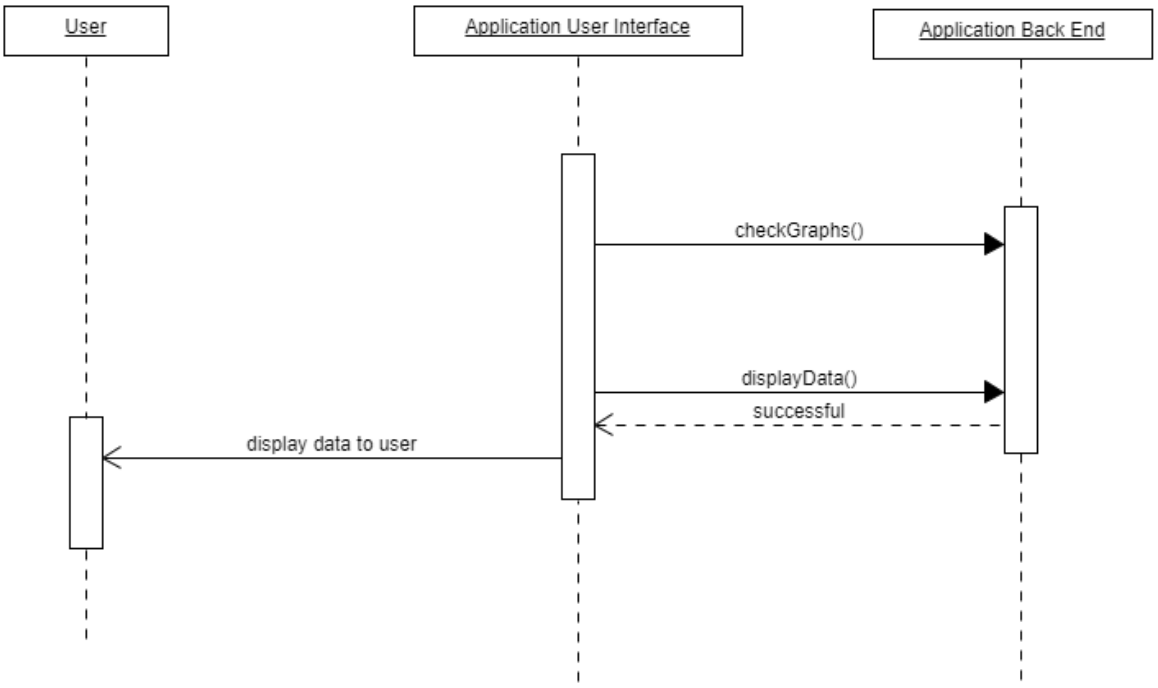


Fig 4.1.8: Sequence Diagram for Use Case XXXX-0008: Data Display

4.2 Activity Diagrams

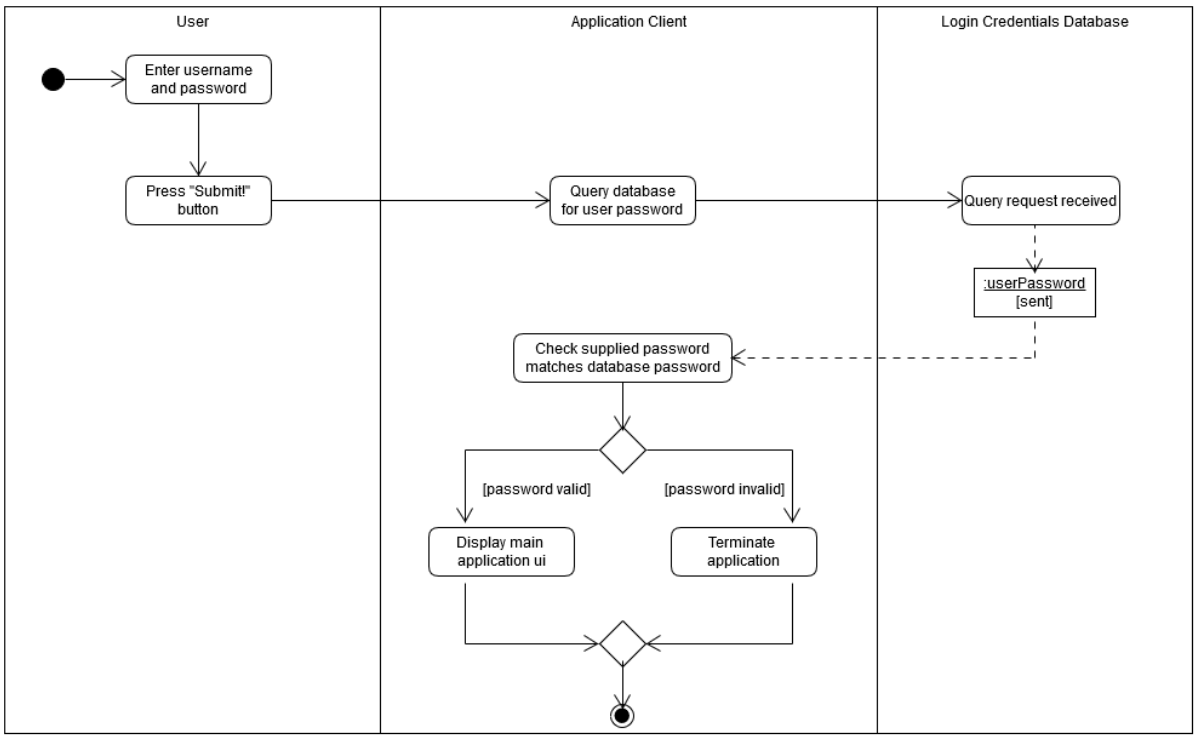


Fig 4.2.1: Activity Diagram for Use Case XXXX-0001: Logging into System

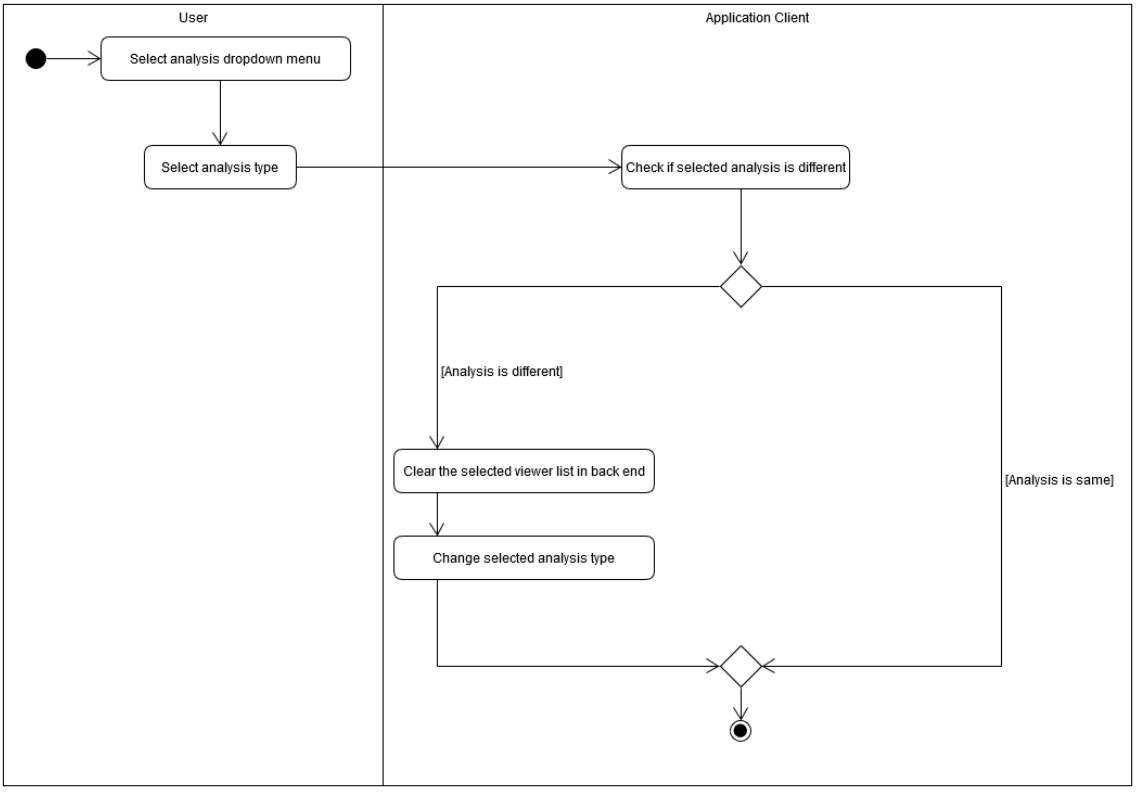


Fig 4.2.2: Activity Diagram for Use Case XXXX-0002: Analysis Selection

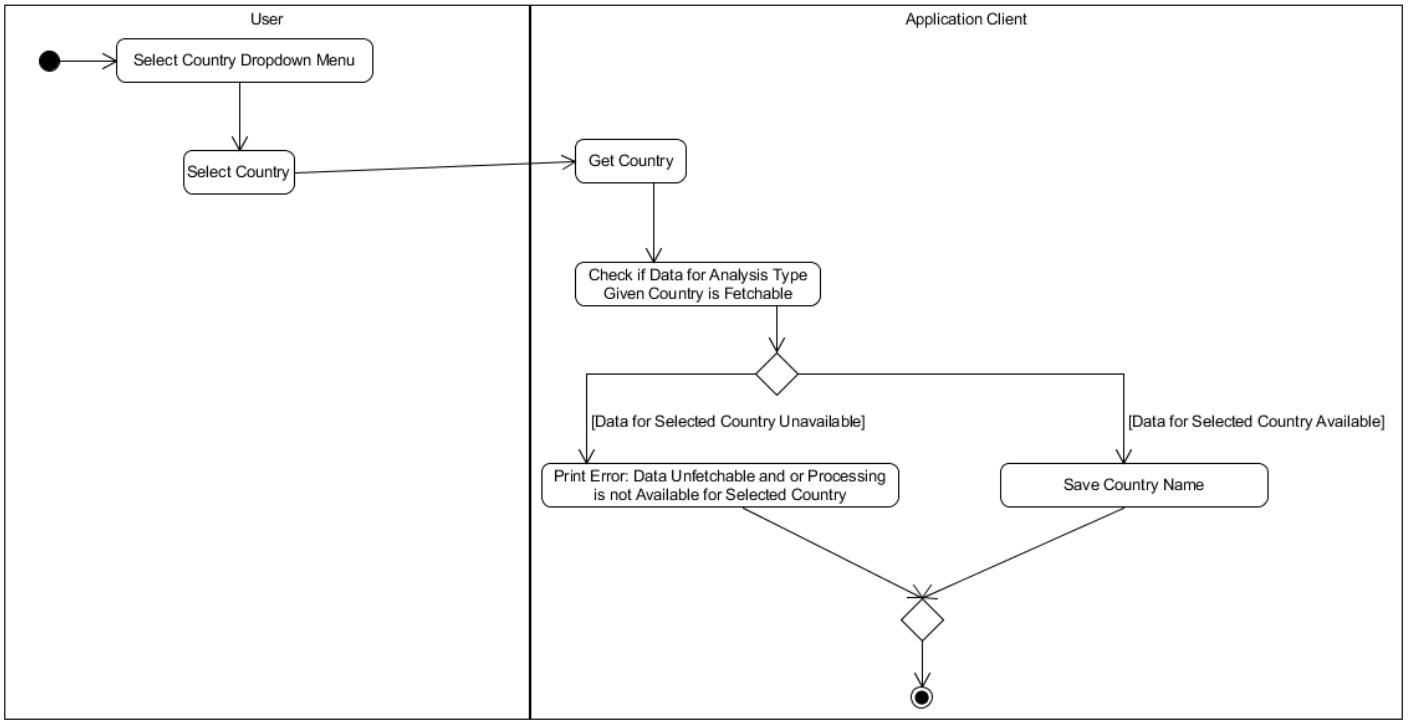


Fig 4.2.3: Activity Diagram for Use Case XXXX-0003: Country Selection

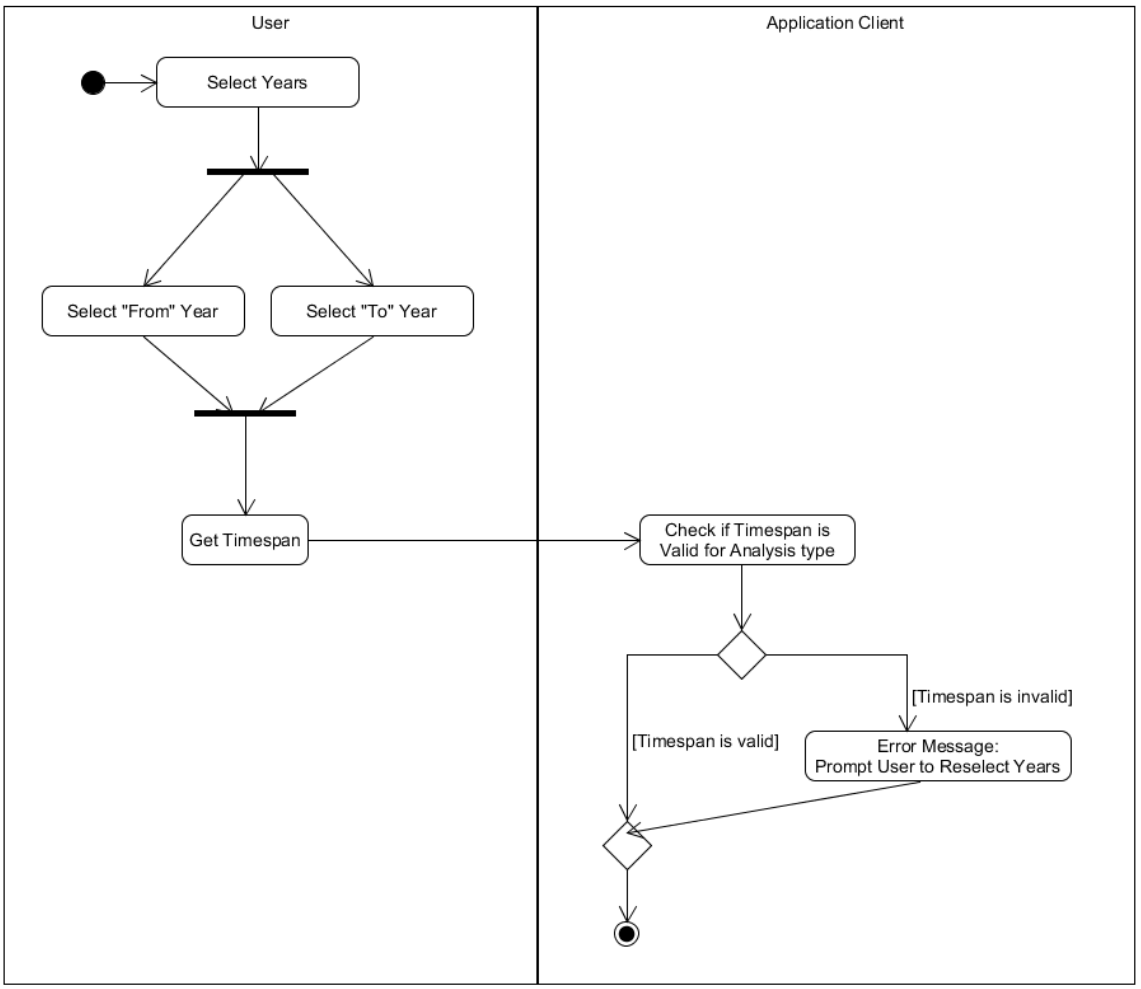


Fig 4.2.4: Activity Diagram for Use Case XXXX-0004: Time Frame Selection

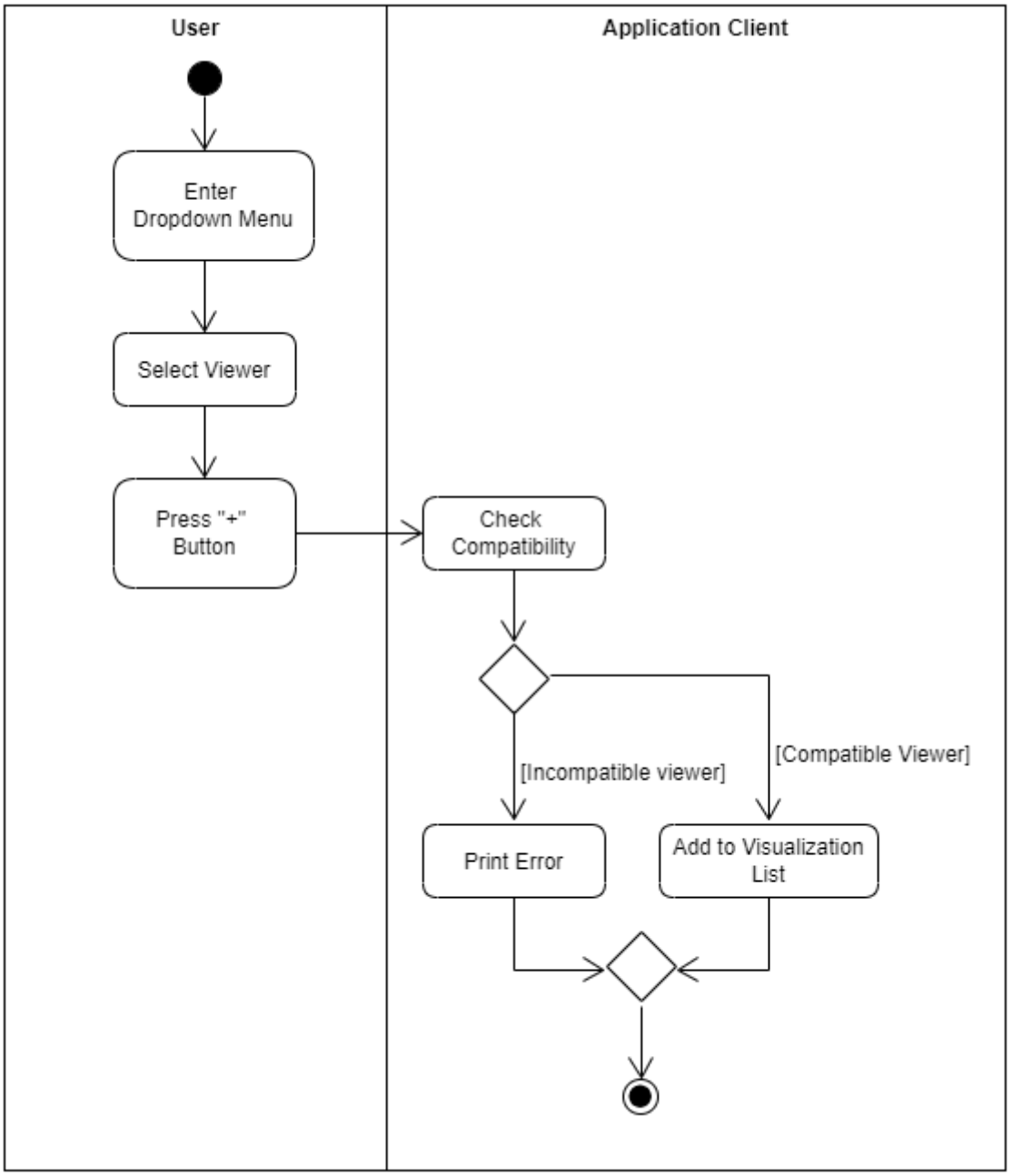


Fig 4.2.5: Activity Diagram for Use Case XXXX-0005: Adding Visualization Graph

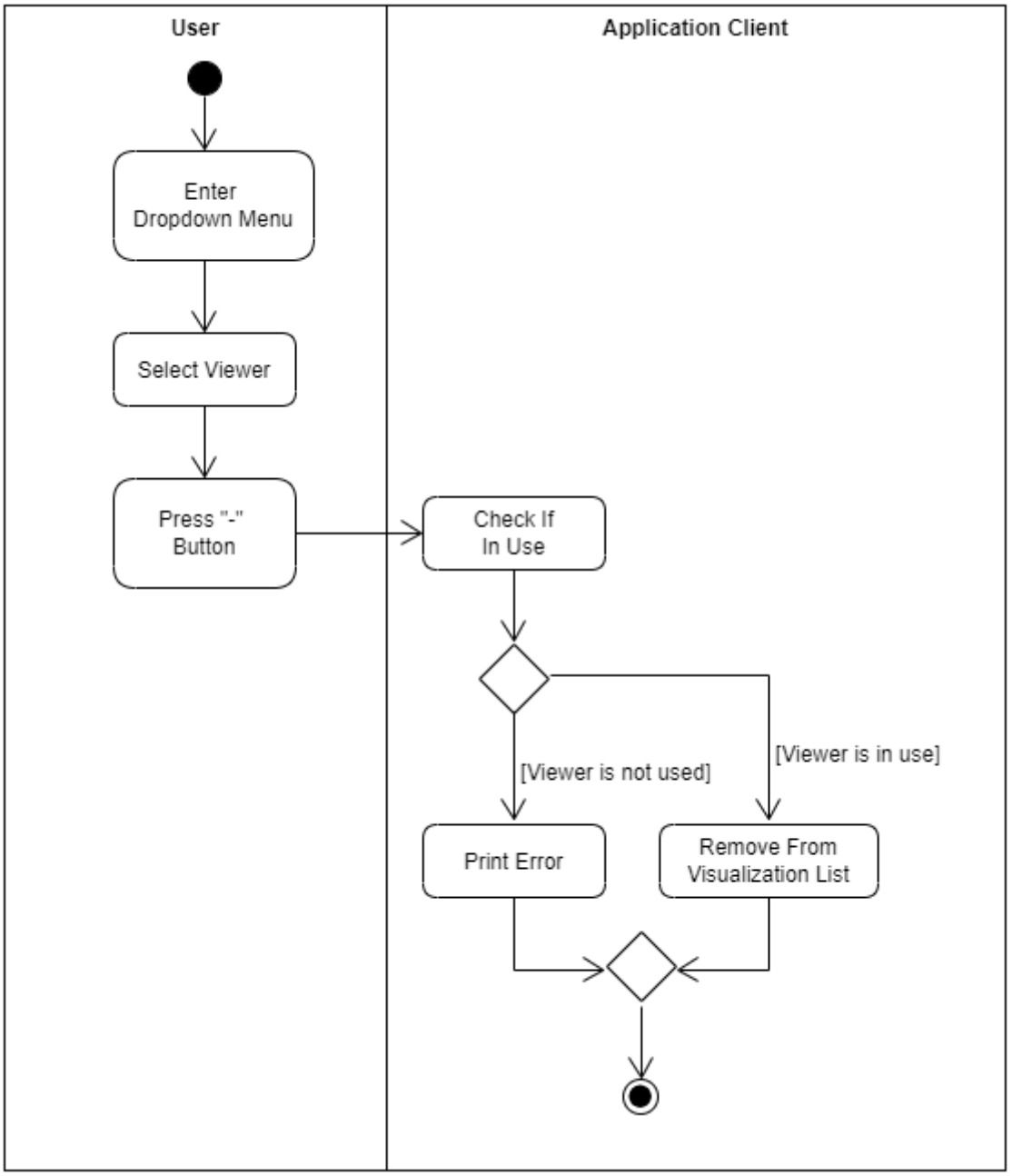


Fig 4.2.6: Activity Diagram for Use Case XXXX-0006: Removing Visualization Graph

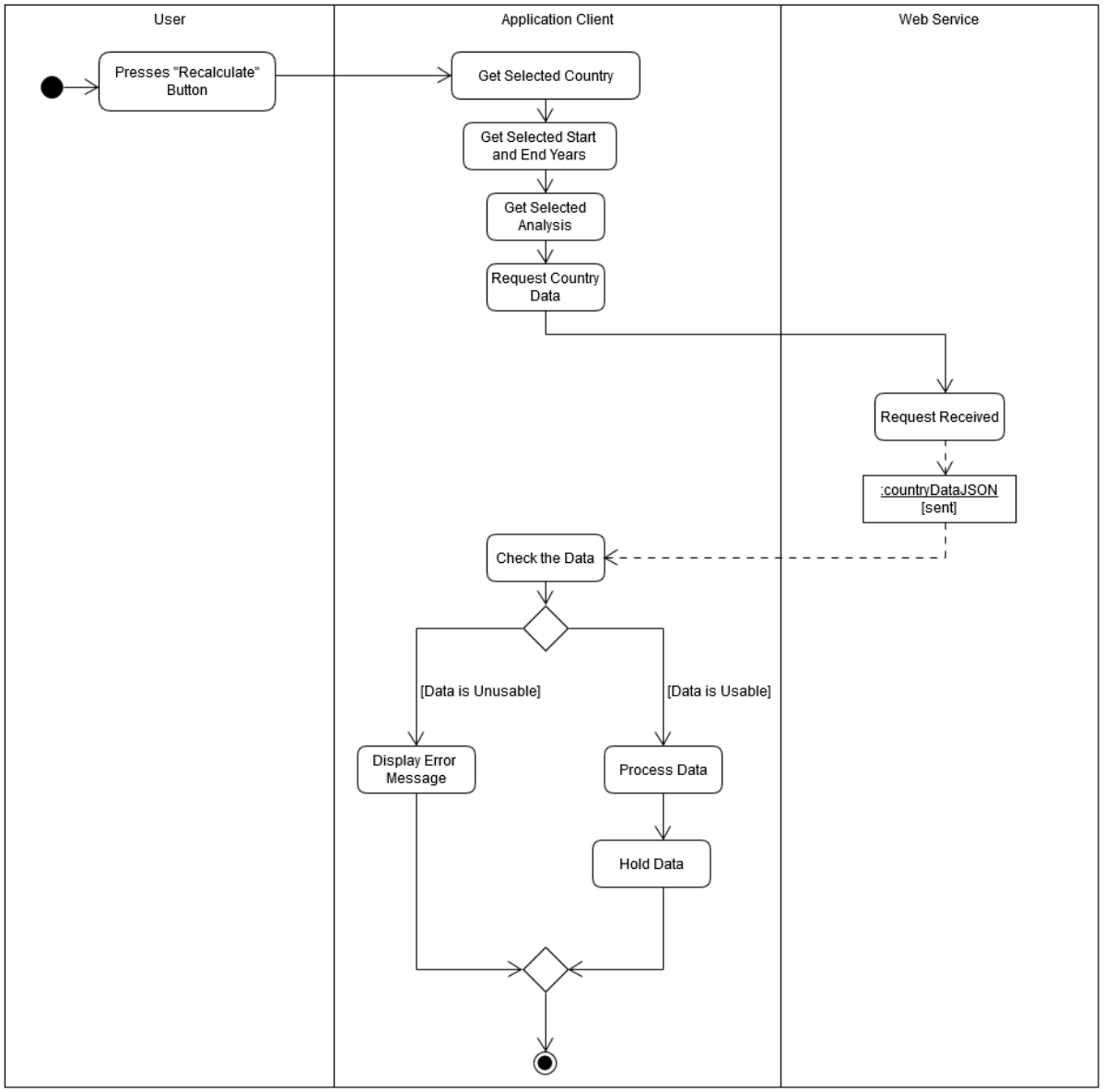


Fig 4.2.7: Activity Diagram for Use Case XXXX-0007: Performing Analysis

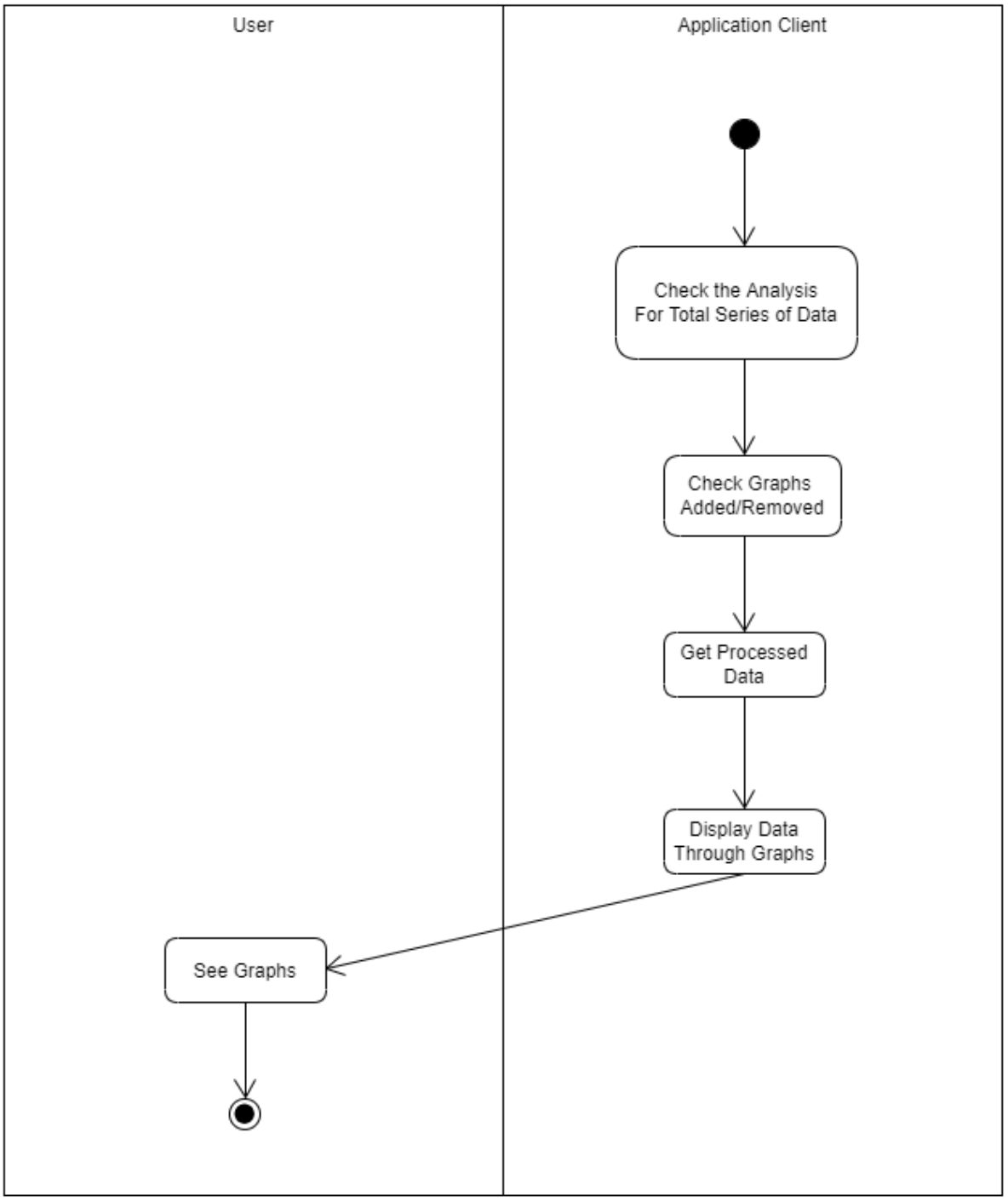


Fig 4.2.8: Activity Diagram for Use Case XXXX-0008: Data Display

5 Non-Functional Requirements Specification

5.1 Overview

The non-functional requirements of the system comprises utilities, environments and other specifications that are necessary for the smooth operation of the system as a whole. This includes interfaces, development environment, capacity specifications, network and operational parameters.

5.2 Enabling Technologies

5.2.1 Target Hardware & Hardware Interfaces

Any hardware system used must have the proper architecture to compile Java code into machine-readable byte code. Additionally, interfaces such as a display/monitor and input devices are required. These are required to ensure proper interaction with the application can be enabled. Given the low-power consumption nature of the application, the system only needs a 1 Ghz processor and 1GB of RAM to function.

5.2.2 Target Development Environment

The system should be developed in a modern Windows environment using Java. Eclipse 3.1 will be used as the standardized Integrated Development Environment (IDE) for all coding related work.

5.2.3 System Interfaces

The World Bank provides for most data sets a unified API using REST calls. Sample code to submit GET requests to the API will be provided. This will be modified to support the returned JSON file, and to ensure the JSON is parsed correctly into a GSON object. Additionally, sample code will be provided to create the main application user interface. This will be modified accordingly to fit functional specifications outlined in this document.

5.3 Capacity Planning

5.3.1 Permanent Storage

In order to facilitate the implementation and usage of our Login Credentials Database, a permanent storage of 1GB will be reserved for it. Because the database implementation is a plain-text file, 1 GB will ensure enough space to store many different logins.

5.4 Network

The World Bank Data Repository is the only Web Service the system interacts with. As such, there are networking requirements. Since the system needs to interact with the World Bank, the system needs an internet connection. The network must allow requests to and from the Web Service for the system to properly receive information.

5.5 Workstations

The minimum system requirements and configurations for the computers used for the development, deployment, and execution of the system are:

A hard disk space of 128GB to install Windows, and a Java Virtual Machine. A processor speed of 1GHz and 1GB of RAM is sufficient for functionality. A display setting of 1280 x 800 resolution is sufficient. The workstation should also include a pointer device, keyboard and an internet connection. The keyboard is required to log into the system and the pointer (eg. mouse) is used to select the analysis options in the System. An internet connection is required to communicate to the Web Service, allowing the System to send and receive information.

5.6 Operational Parameters

5.6.1 Useability

The System should be easily learnable by the average user. The GUI has intuitive menus that allow for easy selection. Also, the System will display meaningful error messages that will help the user with future selections. The System's buttons are meaningful and usable by most computer users.

5.6.2 Reliability

The backup and recovery functions of the system will consist of immediate saves to the credentials database should it be edited. The system should always be available to the user. However, should the system run out of memory or a runtime error occurs, then the system should restart as the amount of data held in the system is minimal - data queries to the World Bank Data Repository can always be made again.

5.6.3 Maintainability

This system should be easy to analyse and change. The selections should be easy to change to fit other analysis options. And, by using different analysis options, this program is adaptable for other purposes. Also, this allows for better testing of the program. In order to measure the stability of the system, the speed, responsiveness, and number of crashes should be used. By using these criterias, we can see if the code can be more optimized and if there are still underlying bugs within them.

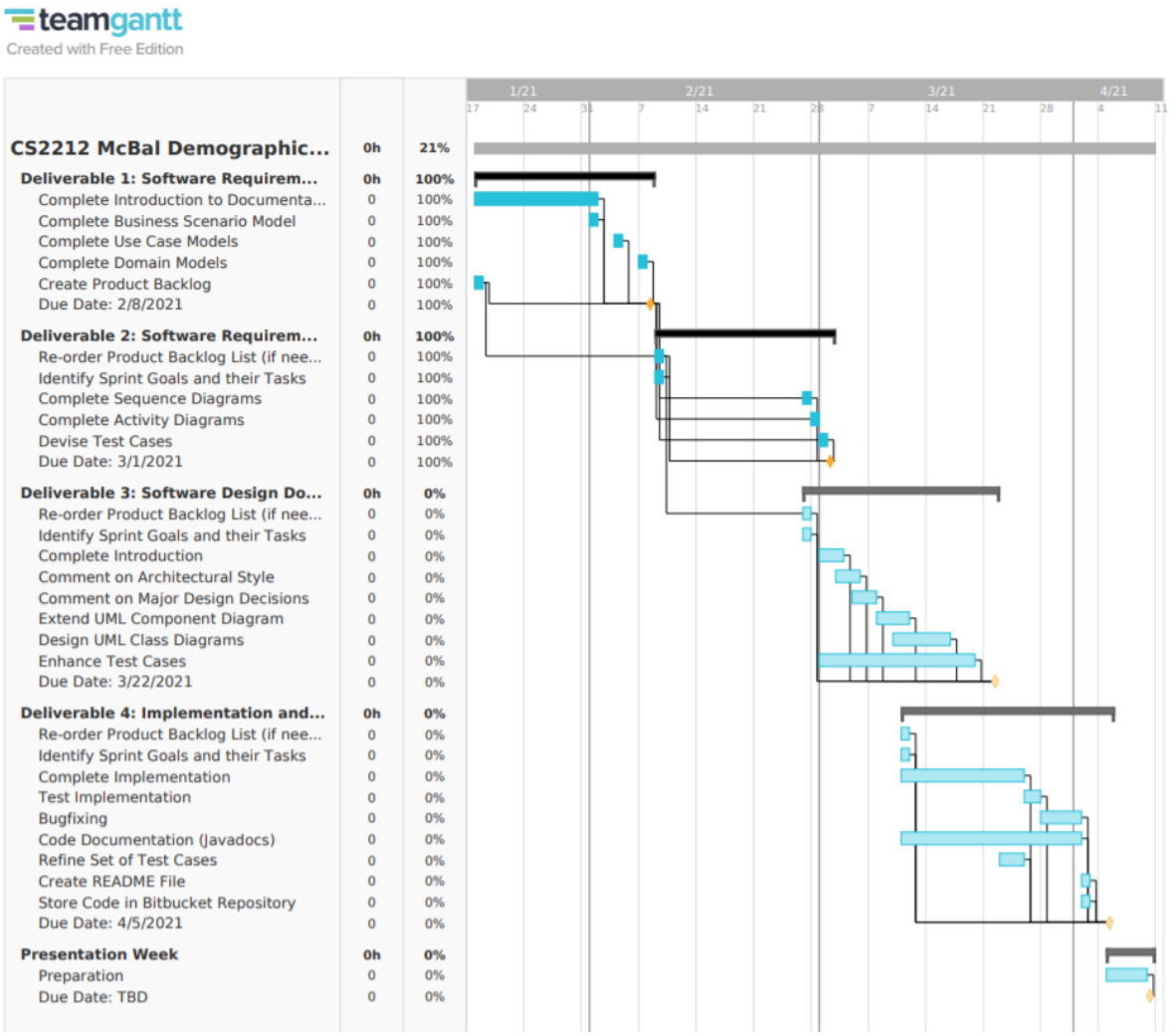
5.6.4 Portability

As specified in Section 5.2.2, the system will be developed in a modern Windows environment using Java, in Eclipse 3.1 as the Integrated Development Environment. The consistency of a singular operating system will allow a consistent integration, development, execution and testing of the system implementation. The Java Virtual Machine will handle compiling of the system into machine readable byte code.

6 Activities Plan

6.1 Gantt Chart

This Gantt Chart (designed using TeamGantt) designates a tentative plan for the McBal Demographic Analysis Application. It is updated daily to ensure quality project management.



6.2 Project Backlog and Sprint Backlog

1. Create login system
   - 1.1. Create database
   - 1.2. Create initial registration system
2. Create main application GUI
   - 2.1. Create list of countries selectable
   - 2.2. Create year drop-down menus
   - 2.3. Create viewer drop-down menu
   - 2.4. Implement buttons
3. Create debug method/mode
4. Create country data retrieval API call methods

4.1. Enable application to make HTTP requests
4.2. Implement GSON JSON parsing abilities
5. Implement data analysis methods
5.1. Calculate required statistics for visualizations and viewers
6. Implement visualization types
6.1. Create GUI for each viewer type
7. Implement 'Recalculation' method
7.1. Check for desired viewers to be displayed
7.2. Push all viewers and refresh main GUI
8. Test application with test cases
9. Debug potential errors/bugs
10. Upload code to BitBucket
11. Create README file

6.3 Group Meeting Logs

Present Group Members	Meeting Date	Issues Discussed / Resolved

Henry So, Jacob Chun, Yan Qing Niu, Samuel Su	February 1 / 2021 7:50PM - 10:30PM (EST)	- Read over project outline
		- Assigned project roles/work (everyone will do two use cases and use case models as well as contribute to the domain model collectively)
		- Broke down workload into three meeting days
		  - day 1: intro and 2.1 completed
		  - day 2: complete business scenario model
		  - day 3: complete domain model/ product backlog and gantt chart
		- completed introduction (Jacob, Henry) and overview (Henry) and actor descriptions (Samuel). Yan Qing looked over all the current work done and made appropriate revision

Henry So, Jacob Chun, Yan Qing Niu, Samuel Su	February 4 / 2021 9:00 PM - 12:45 AM	- Completed Use Case Descriptions (U1,U2 Jacob, U3,U4 Henry, U5,U6 Yan, U7,U8 Samuel) - Completed Use Case Diagrams - Proposed to finish Domain Models next meeting, product backlog and Gantt Chart and revise Table of Contents
Henry So, Jacob Chun, Yan Qing Niu, Samuel Su	February 7 / 2021 10:30PM - 1:10 AM	- Completed Domain Model - Completed Product Backlog - Revised Table of Contents - Essentially finished Part 1 Deliverable

Henry So, Jacob Chun, Yan Qing Niu, Samuel Su	February 27/2021 9:45 PM - 1:00 AM	- Completed Sequence Diagrams - Small Changes to product backlog and sprint backlog
Henry So, Jacob Chun, Yan Qing Niu, Samuel Su	February 28/2021 9:45 PM - 12:30AM	- Completed Activity Diagrams - Small Changes
Henry So, Jacob Chun, Yan Qing Niu, Samuel Su	March 1/2021 2:30 PM - 5:00 PM	- Completed Non-Functional Requirements - Completed and devised test cases - Updated Gantt Chart - Updated table of contents - Document formatting - Essentially finished Part 2 Deliverable

7 Test Driven Development

Initial test cases will be provided in the form of a table as follows:

Test ID	1.1
Category	Login System
Requirements Coverage	UC1-Successful-User-Login
Initial Condition	System initiates and runs.
Procedure	1. The user opens the system 2. The user provides a user name 3. The user provides a password 4. The user credentials are correct 5. The user is presented with the main UI window
Expected Outcome	Login form closes, and the user is presented with the main UI window
Notes	N/A

Test ID	1.2
Category	Login System
Requirements Coverage	UC1-Unsuccessful-User-Login
Initial Condition	The application initiates and runs.
Procedure	1. The user opens the application 2. The user provides a user name 3. The user provides a password 4. The user credentials are verified by the system 5. The user credentials are incorrect 6. Incorrect credentials message appears on the screen 7. The application terminates
Expected Outcome	Credentials cannot be verified and application terminates.
Notes	N/A

Test ID	2.1
Category	Analysis Selection
Requirements Coverage	UC2-Successful-Analysis-Select

Initial Condition	System runs and the user successfully logs in.
Procedure	1. User logged in 2. User selects analysis type
Expected Outcome	The system confirms the user's selection and stores the chosen analysis type.
Notes	Country selection and year selection is dependent on analysis selection

Test ID	3.1
Category	Country Selection
Requirements Coverage	UC3-Successful-Country-Select
Initial Condition	System runs and the user successfully logs in. The user has already selected the analysis type.
Procedure	3. User logged in 4. User selected analysis type 5. User selects allowed country 6. System stores country selection
Expected Outcome	The system confirms the user's selection and stores their country. The drop down menu reflects the user's selection.
Notes	Available countries are determined by the engineers.

Test ID	3.2
Category	Country Selection
Requirements Coverage	UC3-Unsuccessful-Country-Select
Initial Condition	System runs and the user successfully logs in. The user has already selected the analysis type.
Procedure	1. User logged in 2. User selects analysis type 3. User selects unavailable country 4. System prints error message for user
Expected Outcome	System does not allow country to be selected and prints an error message for the user
Notes	Unavailable countries are determined by the engineers.

Test ID	4.1
Category	Year Selection

Requirements Coverage	UC4-Successful-Year-Select
Initial Condition	System runs and the user successfully logs in. The user has already selected the analysis type and a country.
Procedure	1. User logged in 2. User selects analysis type 3. User selects country successfully 4. User selects start year 5. User selects end year 6. System stores start and end year selection and checks the time period in between to see if it is valid for the analysis type chosen
Expected Outcome	The system confirms the user's selection and stores their start and end year. The drop down menu reflects the user's selection.
Notes	N/A

Test ID	4.2
Category	Year Selection
Requirements Coverage	UC4-Unsuccessful-Year-Select
Initial Condition	System runs and the user successfully logs in. The user has already selected the analysis type and country.
Procedure	1. User logged in 2. User selects analysis type 3. User selects country successfully 4. User selects start year 5. User selects end year 6. System stores start and end year selection and checks the time period in between to see if it is valid for the analysis type chosen 7. The time period is invalid for the analysis type chosen 8. Error message is displayed 9. User is prompted to reselect a new start year and end year
Expected Outcome	The user is prompted by the system to reselect a new start year and end year that is valid for the analysis type chosen.
Notes	N/A

Test ID	5.1
Category	Addition/Removal of Viewers
Requirements Coverage	UC5/6-Successful-Viewers

Initial Condition	System runs and the user has successfully logged in. The user successfully selected analysis, country, start and end years.
Procedure	1. User logged in 2. User selects analysis type 3. User selects country successfully 4. User selects start and end year 5. User selects viewer from drop-down menu 6. User selects to add viewer a. Addition of viewer successful b. Removal of viewer successful
Expected Outcome	If the user added the viewer successfully, the system should store the type of viewer to be displayed. If the user removes the viewer successfully, the system should remove the type of the viewer from storage.
Notes	N/A

Test ID	5.2
Category	Addition/Subtraction of Viewers
Requirements Coverage	UC5/6-Unsuccessful-Viewers
Initial Condition	System runs and the user has successfully logged in. The user successfully selected analysis, country, start and end years.
Procedure	1. User logged in 2. User selects analysis type 3. User selects country successfully 4. User selects start and end year 5. User selects viewer from drop-down menu 6. User selects to add or remove viewer a. Addition of viewer unsuccessful b. Removal of viewer unsuccessful 7. Error message is displayed
Expected Outcome	If the user added the viewer unsuccessfully, then the system already has the viewer stored. If the user removes the viewer unsuccessfully, the system does not have the viewer stored yet. In both cases, an error message is displayed
Notes	N/A

Test ID	7.1
Category	Data Procurement
Requirements Coverage	UC7-Successful-Data-Retrieval

Initial Condition	System runs and the user has successfully logged in. The user successfully selected analysis, country, start and end years.
Procedure	1. User logged in 2. User selects analysis type 3. User selects country successfully 4. User selects start and end year 5. User presses “Recalculate” button 6. System takes selection and requests from Web Service 7. Web Service sends necessary data to System 8. Data is usable 9. Data is processed to be used 10. Data is stored
Expected Outcome	Based on the selection the user made, the system requests and receives data from the web service to be processed and stored.
Notes	N/A

Test ID	7.2
Category	Data Procurement
Requirements Coverage	UC7-Unsuccessful-Data-Retrieval
Initial Condition	System runs and the user has successfully logged in. The user successfully selected analysis, country, start and end years.
Procedure	1. User logged in 2. User selects analysis type 3. User selects country successfully 4. User selects start and end year 5. User presses “Recalculate” button 6. System takes selection and requests from Web Service 7. Web Service sends necessary data to System 8. Data is unusable 9. Display error message, prompt user to reselect choices
Expected Outcome	An error message is displayed to prompt the user to reselect new choices as the analysis cannot be done/ data is unusable.
Notes	N/A

Test ID	8.1
Category	Rendering results and System UI update
Requirements Coverage	UC8-Successful-Displaying-Graphs
Initial Condition	System runs and the user has logged in successfully. The user has selected an analysis type, country, start and end years, added viewers, and analysis has been performed on the computed data.

Procedure	1. User logged in 2. User selects analysis type 3. User selects country successfully 4. User selects start and end year 5. User selects viewer from drop-down menu 6. User selects to add/remove viewer 7. User presses the “Recalculate” button. 8. Data from Web Service is received based on selected analysis type, country, start and end years. 9. Data is processed and usable 10. User interface updates, data is rendered onto chosen viewers
Expected Outcome	The analysis is shown in graphical summaries based on viewers selected.
Notes	N/A