*Process MeNtOR 3.0*

# Country Statistics Data Analysis & Visualization System

# **Requirements Model**

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# 1 Introduction

## 1.1 Purpose

This document details the requirements of a prototyping model that allows for users to retrieve, process and render data for visualization and analysis of one selected country from the *World Bank's data repository*. It examines details and scenaria pertaining to the existing system as well those relevant to the functional extension, and presents models at the business scenario, domain, and interaction levels. It also addresses the non-functional requirements of the system, and the distribution of activities towards system development.

## 1.2 Overview

The aim of the project is to implement a prototype system which allows users to:

1. Retrieving demographics and other data of a country by selecting its name and year of data interested related to Environment and to Health from the *World Bank's data repository*.
2. Once the data is collected, they may choose to process the data with different types of analyses needed on the data collected. Such as the ratio of different variables, and then display the date on a User Interface system.
3. By computing and rendering the retrieved data or the processed data using selected parameters, the users can choose visualization methods such as bar charts, line graphs, scattered plots, and pie charts to demonstrate the data. Initially there are multiple plotting methods available. However, it should allow adding/removing one/multiple types of graphs/viewers to diverse the illustration of the analysis.

The interface performs the selected parameters and the rendering data, with different parts of tuning parameters.

Non-functional requirements such as security and performance are also considerations within the context of platform deployment.

## 1.3 References

**World Bank's API:**
*https://datahelpdesk.worldbank.org/knowledgebase/articles/898581*

**JavaAPI:**
*http://api.worldbank.org/v2/country/can/indicator/SP.POP.TOTL?date=2000:2001&format=json*

**Draw.io:** *https://app.diagrams.net/*

**UMLet:***https://www.umlet.com/*

# 2 Business Scenario Model

## 2.1 Actors

### 2.1.1 Overview

The actors in our system include client end users, managers, services and databases. As providing the correct combination of username and password, end users exist in an environment that allows interaction with the country statistics system to retrieve, process and render data. Managers have access to manage the resources (retrieved data, parameters etc). Database stores all user data, country data, views data. User service interacts with the World Bank's database every time when there's a request from the end client user.

### 2.1.2 Actor Diagram

The figure below represents the actors in our system. Based on their interaction with the system , the actors are characterized into four general groups: a) Users, b) Managers, c) Services and d) Databases.

As illustrated in the actor diagram, UI Managers and Data Managers inherit from Managers, manage the resources based on the request created by Client User from User Service. System databases and World Bank's databases inherit from databases where they store all the data required about login information, retrieved data, processed data and selected parameters for visualization and analysis of country data.

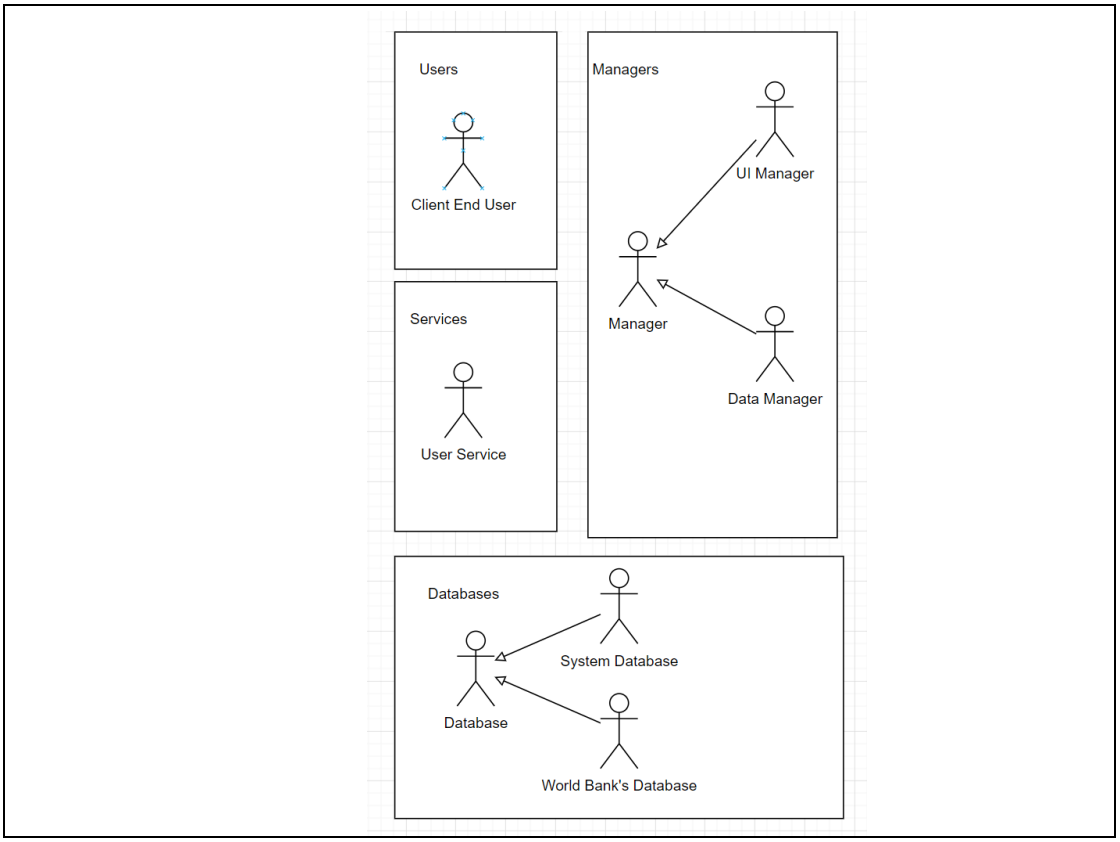


Fig. 2.1.2 Actor Diagram

### 2.1.3 Actor Definitions

#### Client End User

| | |
|---|---|
| **Description** | The Country Statistics Client User is a human actor that interacts with the system through the “Country Statistics” software. Anyone who uses this software is considered a “Country Statistics Client User”. The roles of this actor in the context of the system include creating and login to a user |
| **Aliases** | Client User, End User, User |
| **Inherits** | None |
| **Actor Type** | Active - Person |
| **Contact Person** | None |
| **Contact Details** | None |

#### World Bank’s Database

| | |
|---|---|
| **Description** | The World Bank’s Database is an external agent that is invoked through the system. The data of this system will be retrieved from one or more data pools from the World Bank’s database remote issuing http GET requests. |
| **Aliases** | None |
| **Inherits** | Database |
| **Actor Type** | Passive actor |
| **Contact Person** | None |
| **Contact Details** | None |

#### User Service

| | |
|---|---|
| **Description** | User Service is where the request from the user is being processed. It interacts Client end user and database to execute the actions defined by that service and returns the invocation result status back to the system. |
| **Aliases** | None |
| **Inherits** | None |
| **Actor Type** | Active |
| **Contact Person** | None |
| **Contact Details** | None |

#### Data Manager

| | |
|---|---|
| **Description** | Data manager is an inherited type of manager who manages with retrieved data from the World Bank’s database or processed data from the System database, and then delivers data for further use. |
| **Aliases** | None |
| **Inherits** | Manager |
| **Actor Type** | Active |
| **Contact Person** | None |
| **Contact Details** | None |

### UI Manager

| | |
|---|---|
| **Description** | The UI manager is an actor who manages, displays and removes all the error message windows, viewers and any UI elements. It demonstrates and tunes UI based on the parameter selected. |
| **Aliases** | None |
| **Inherits** | Manager |
| **Actor Type** | Active |
| **Contact Person** | None |
| **Contact Details** | None |

### System Database

| | |
|---|---|
| **Description** | The system database stores all the retrieved and/or processed data, users' information. Every time when users try to login, demonstrate data on the UI, the system database is called. |
| **Aliases** | Noner |
| **Inherits** | Database |
| **Actor Type** | Passive |
| **Contact Person** | None |
| **Contact Details** | None |

## 2.2 Use Case Descriptions

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

### 2.2.1 XXXX-0001 User Login Scenario

In this scenario, the client user inputs a username-password combination to log in to the system. The main UI of the system will be shown once the combination is verified.

**Goal in Context:**

To let the client user login to the system and start the main UI.

**Actors:**

1. Country Statistics Client User
2. UI Manager
3. System Database

**Preconditions:**

1. The database that stores the user information must be connected to the system.

**Trigger:**

The client user of the application starts the software.

**Scenario Text:**

1. UI Manager opens the login window.
2. Client user login to the system.
    2.1. Client user supplies a username-password combination.
    2.2. System database verifies the client user.
    2.3. Use alternative 2 to notify that there is an error with the provided credentials and the application will be terminated.
3. UI Manager opens the main UI.

**Alternative Scenario Courses:**

1. The username-password combination does not exist in the system database, UI Manager opens a pop-up window containing the error message will be shown and the application will be terminated.

**Constraints:**

None.

**Questions:**

None.

### 2.2.2 XXXX-0002 Analysis Type Selection Scenario

In this scenario, the client user changes the type of analysis they would like to perform to the retrieved data.

**Goal in Context:**

To initialize the analysis type to be performed on the retrieved data.

**Actors:**

1. Country Statistics Client User

2. UI Manager

**Preconditions:**

1. The user must have logged in to the system.

2. The user must have selected the country for which they would like to perform data analysis on.

**Scenario Text:**

1. Client user selects the analysis type to be performed.

2. UI Manager empties the viewer for this specific analysis type.

2.1. Use alternative 1 if the user selects the same analysis type.

**Alternative Scenario Courses:**

1. The user selects the same analysis type, UI Manager will remain all viewers intact.

**Constraints:**

None.

**Questions:**

None.

### 2.2.3 XXXX-0003 Country Selection Scenario

In this scenario, the client user selects the country for which they would like to perform data analysis on.

**Goal in Context:**

To initialize the analysis the country to be performed data analysis on.

**Actors:**

1. Country Statistics Client User
2. UI Manager
3. System Database

**Preconditions:**

1. The user must have logged in to the system.

**Scenario Text:**

1. Client user selects the country to be performed data analysis on.
2. System database verifies whether this country's data can be fetched.
    2.1. Use alternative 1 if the user selects an invalid country.

**Alternative Scenario Courses:**

1. The user selects a country which data cannot be fetched, the UI Manager will open an error message window.

**Constraints:**

None.

**Questions:**

None.

### 2.2.4 XXXX-0004 Year Selection Scenario

In this scenario, the client user selects the start and end year of the data to be fetched.

**Goal in Context:**

To initialize the start and end year of the data to be fetched.

**Actors:**

1. Country Statistics Client User
2. UI Manager
3. System Database

**Preconditions:**

1. The user must have logged in to the system.
2. The user must have selected the type of analysis.

**Scenario Text:**

1. Client user selects the start and end year of the data to be fetched.
2. System database verifies whether data within this period can be fetched.
    2.1. Use alternative 1 if the user selects an invalid starting or ending year.

**Alternative Scenario Courses:**

1. The user selects an invalid starting or ending year, the UI Manager will open an error message window.

**Constraints:**

None.

**Questions:**

None.

### 2.2.5 XXXX-0005 Visualization Graph Manipulation Scenario

In this scenario, the client user adds and removes the visualization graphs that display the data analysis.

**Goal in Context:**

To add and remove the visualization graphs that display the data analysis.

**Actors:**

1. Country Statistics Client User
2. UI Manager
3. System Database

**Preconditions:**

1. The user must have logged in to the system.

**Scenario Text:**

1. Client user adds a new viewer.

    1.2. System database verifies whether the viewer is compatible with the chosen analysis.

    1.3. Use alternative 1 if the viewer is incompatible.

2. Client user removes a viewer.

    2.1. System database verifies whether the viewer is already in the list of viewers.

    2.2 Use alternative 2 if the viewer is not in the list of viewers.

**Alternative Scenario Courses:**

1. The user adds a viewer that is incompatible with the chosen analysis, the UI Manager will open an error message window.
2. The user removes a viewer that is not in the list of viewers, the UI Manager will open an error message window.

**Constraints:**

None.

**Questions:**

None.

### 2.2.6 XXXX-0006 Analysis Conduction Scenario

In this scenario, the user-specified data analyses are generated and rendered on the main UI.

**Goal in Context:**

To generate and render the user-specified data analyses on the main UI.

**Actors:**

1. World Bank's Database

2. User Service

2. Data Manager

3. UI Manager

**Preconditions:**

1. The user must have logged in to the system.

2. The user must have finished selecting different parameters and pressed Recalculate Button.

**Scenario Text:**

1. Data Manager gets and processes the specified data.

    1.1. User Service sends a request to retrieve data.

    1.2. The World Bank's Database responds with the requested data.

    1.3. User Service passes the data to the Data Manager.

    1.4. Data Manager processes and performs analysis on the retrieved data corresponding to user specification.

**Alternative Scenario Courses:**

None.

**Constraints:**

None.

**Questions:**

None.

### 2.2.7 XXXX-0007 Result Display Scenario

In this scenario, the system displays the data analysis on the main UI.

**Goal in Context:**

To display the data analysis on the main UI.

**Actors:**

1. UI Manager
2. Data Manager

**Preconditions:**

1. The user must have logged in to the system.
2. The required data must have been retrieved and processed.

**Scenario Text:**

1. Data Manager sends the processed data to the UI Manager.
2. UI Manager renders the result on the main UI.

**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.

**User Login System**

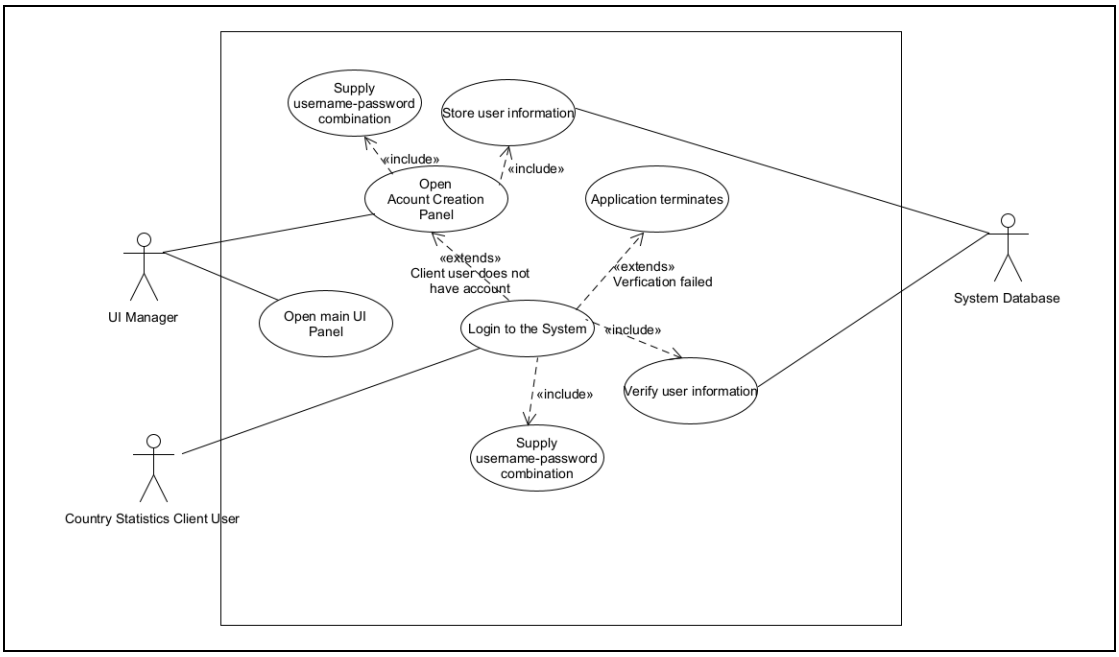


Fig. 2.3.1 Use Case Diagram for Scenario 2.2.1

**Analysis Type Selection System**

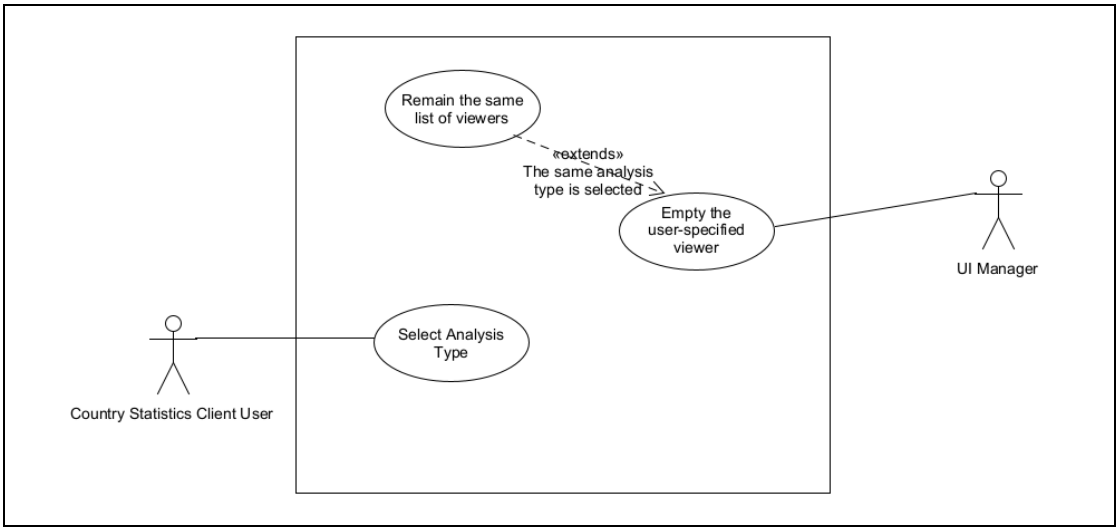


Fig. 2.3.2 Use Case Diagram for Scenario 2.2.2

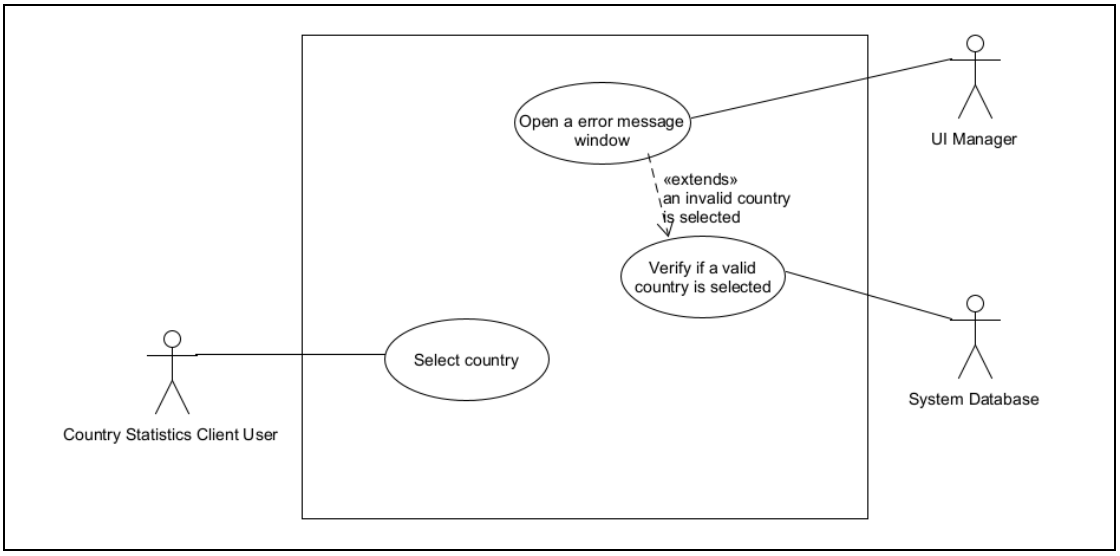


Fig. 2.3.3 Use Case Diagram for Scenario 2.2.3

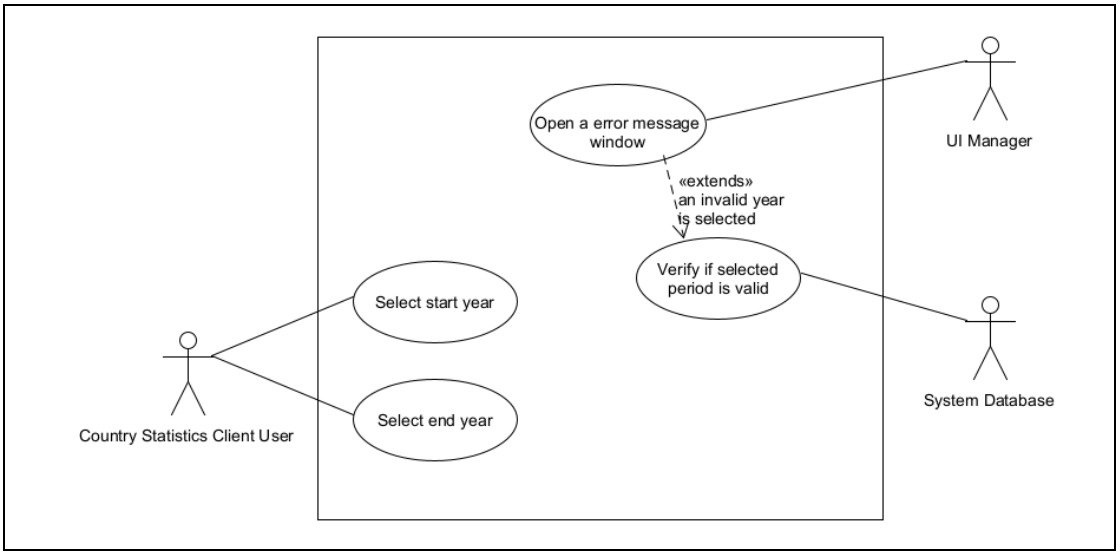


Fig. 2.3.4 Use Case Diagram for Scenario 2.2.4

**Graph Manipulation System**

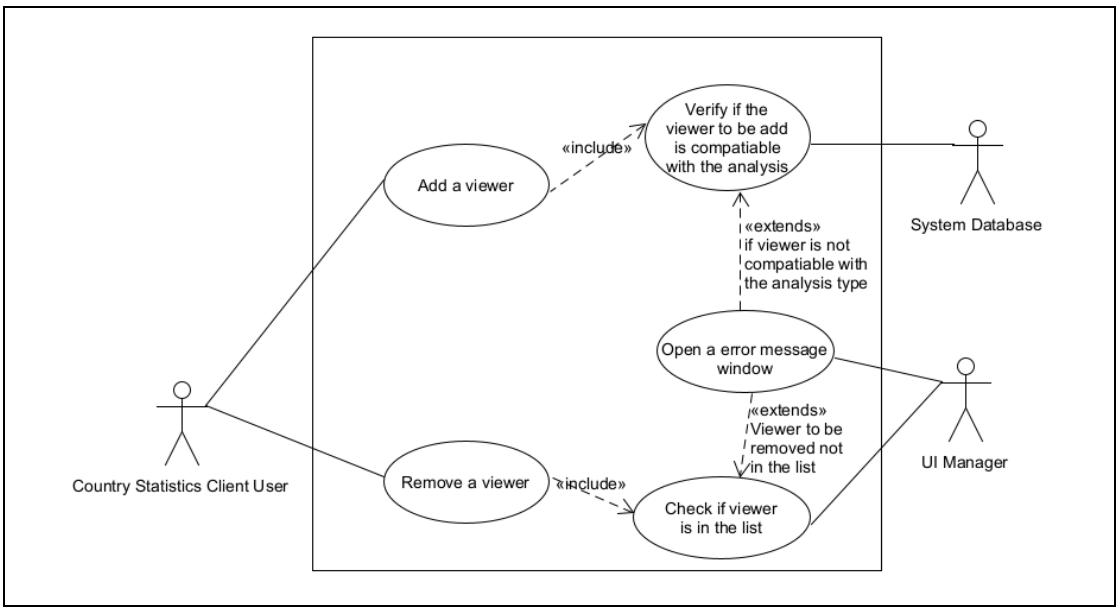


Fig. 2.3.5 Use Case Diagram for Scenario 2.2.5

**Analysis Conduction System**

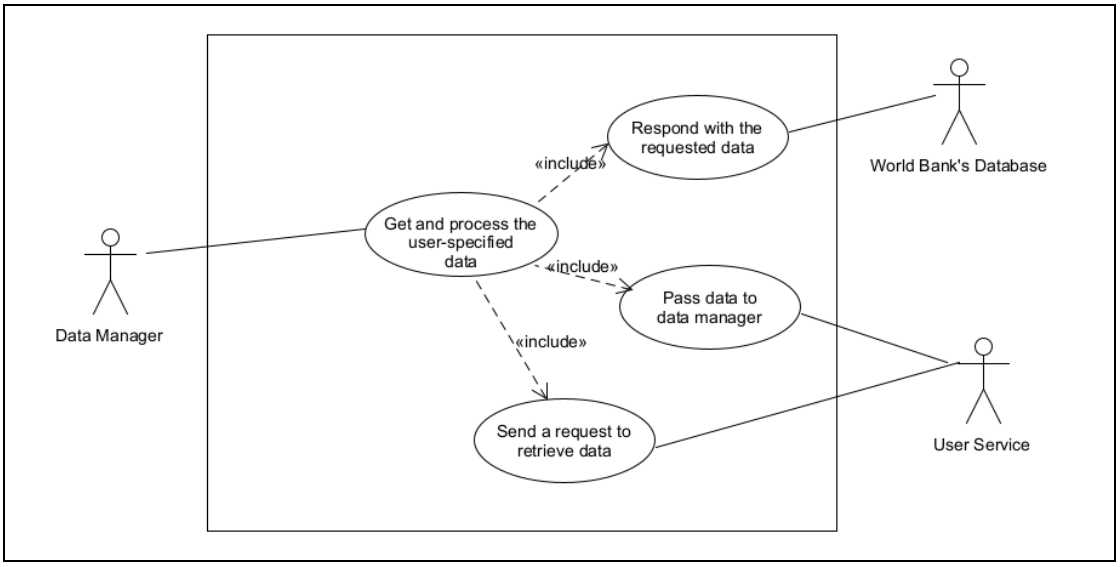


Fig. 2.3.6 Use Case Diagram for Scenario 2.2.6

**Result Rendering System**

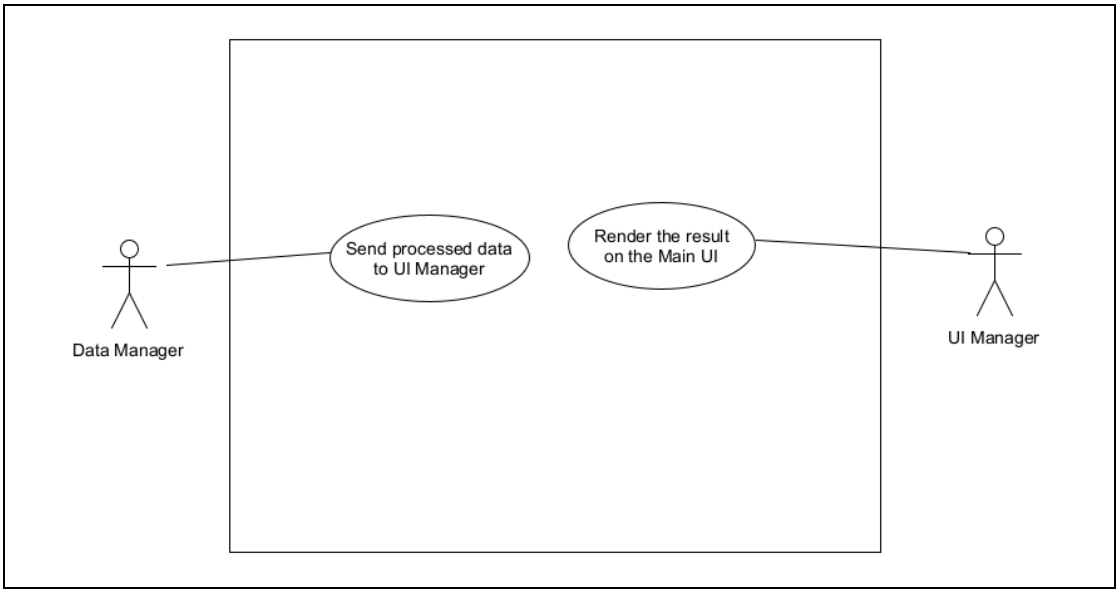


Fig. 2.3.7 Use Case Diagram for Scenario 2.2.7

# 3 Domain Model

## 3.1 Domain Model Class Diagram

The domain model class diagram for the Country Statistics System appears below:

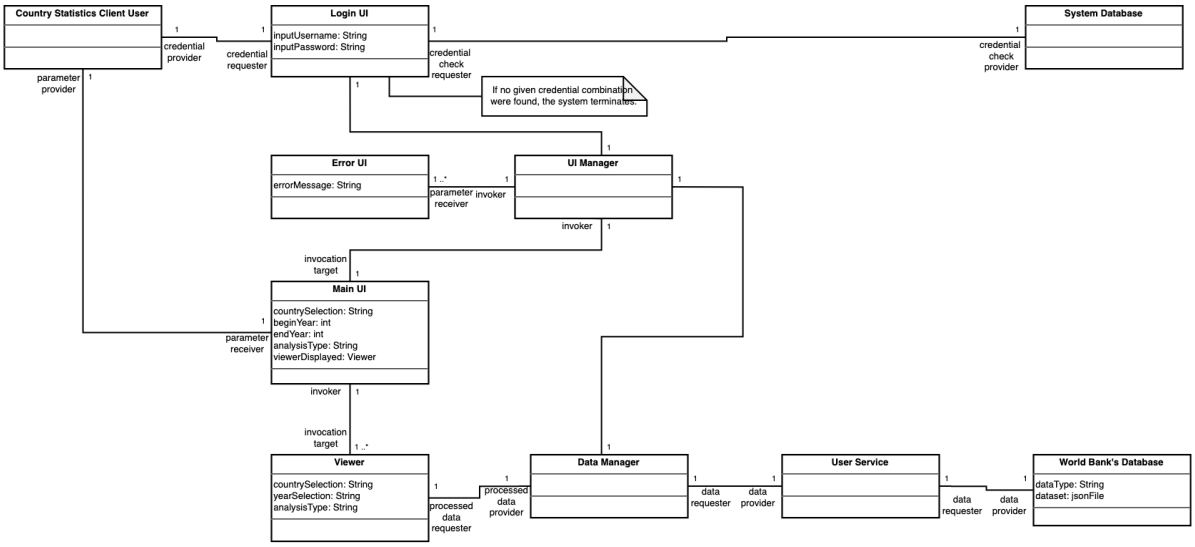


Fig. 3.1 Domain Model Class Diagram

## 3.2 Domain Model Class Definitions

### 3.2.1 Country Statistics Client User

| | |
|---|---|
| **Description** | This object represents the user of Country Statistics software in the context of the domain. This is a human user that can provide the credentials to log into the system and select the analysis type, country and duration of the analysis to be performed. |
| **Attributes** | username: String |
| **Responsibilities** | This user is responsible for providing credentials to the Login UI, and selecting the analysis type, country and duration of the analysis to be performed for the Main UI. |
| **Business Rules** | |

### 3.2.2 System Database

| | |
|---|---|
| **Description** | This object represents the System Database that stores username-password combinations and checks whether a combination exists in the database. |
| **Attributes** | credentialExists: Boolean |
| **Responsibilities** | The System Database is responsible for receiving username-password combinations from the Login UI and returns whether the credential exists or not to back to the Login UI. It is |
| **Business Rules** | |

### 3.2.3 World Bank’s Database

| | |
|---|---|
| **Description** | This object represents the World Bank’s Database which stores the datasets needed to create the Viewers. |
| **Attributes** | dataType: String<br>dataset: jsonFile |
| **Responsibilities** | The World Bank’s Database is responsible for providing the requested dataset to the User Service. |
| **Business Rules** | |

### 3.2.4 Login UI

| | |
|---|---|
| **Description** | This object represents a user interface which allows users to log into the system. Users have direct access to it. It is connected to the System Database in order to check the given username-password combination. |
| **Attributes** | inputUsername: String<br>inputPassword: String |
| **Responsibilities** | A login UI object is responsible for forwarding the username and password information obtained from the user to the System Database. If the combination exists in the System Database, it calls the UI Manager to invoke the Main UI. If it does not exist, it calls the UI Manager to invoke the Error UI and terminates the whole program. |
| **Business Rules** | |

### 3.2.5 Main UI

| | |
|---|---|
| **Description** | This object represents the Main UI which receives the country, duration, analysis type and selected viewers from the user. Inquiry of specific dataset required to plot the viewers are sent to the World Bank's Database so that the Main UI receives the data, analyses it if needed and invokes the viewers. |
| **Attributes** | countrySelection: String<br>beginYear: int<br>endYear: int<br>analysisType: String<br>viewerDisplayed: Viewer |
| **Responsibilities** | This Main UI is responsible for receiving the parameters for visualization from the User. Once an analysis type that is different from the previous selection is chosen, the Main UI closes all the presenting Viewer windows. Once the User hits the button "recalculate", the Main UI is then responsible for sending requests and receiving the processed dataset needed for creating the viewers to and from the UI Manager, and invoking the Viewer. When the parameter combination entered by the User is prohibited or if the User tries to remove a Viewer that is not presenting, the Main UI calls the UI Manager to invoke the Error UI. |
| **Business Rules** | |

### 3.2.6 Error UI

| | |
|---|---|
| **Description** | This object represents the pop-up window used to display error messages. |
| **Attributes** | errorMessage: String |
| **Responsibilities** | Serves as a pop-up window displaying the appropriate error message when called by the UI Manager. |
| **Business Rules** | |

### 3.2.7 UI Manager

| | |
|---|---|
| **Description** | This object represents the UI Manager that manages, calls and removes all the Error UI windows, Viewers and other UI elements. |
| **Attributes** | credentialExists: Boolean |
| **Responsibilities** | The UI Manager invokes and closes all UI in this program. When called by the Login UI, the UI Manager invokes the Main UI when the login process is successful, or invokes the Error UI and terminates the whole program when the login process is unsuccessful. When called by the Main UI, the UI Manager invokes the Error UI or receives data requests from the Main UI and forward |

| | |
|---|---|
| | the requests to the Data Manager. When called by the Data Manager, the UI Manager calls the Main UI to display the Viewers. |
| **Business Rules** | |

### 3.2.8 Data Manager

| | |
|---|---|
| **Description** | This object represents the Data Manager that handles the data requests and processes the raw data received. |
| **Attributes** | |
| **Responsibilities** | When called by the UI Manager, the Data Manager is responsible for forwarding the data request to the User Service and processing the raw data received from the User Service so it can be used to generate the Viewers. It then sends the processed data to the Viewers and calls the UI Manager to display the Viewer windows. |
| **Business Rules** | |

### 3.2.9 User Service

| | |
|---|---|
| **Description** | This object represents the User Service that receives requests from the Main UI, interacts with the World Bank's Database and sends the raw data to the Data Manager. |
| **Attributes** | |
| **Responsibilities** | When called by the Data Manager, the User Service is responsible for obtaining the datasets requested from the World Bank's Database and sending the raw data to the Data Manager. |
| **Business Rules** | |

### 3.2.10 Viewer

| | |
|---|---|
| **Description** | This object represents the Viewer that visualises the obtained or computed data based on the User's requests. |
| **Attributes** | countrySelection: String<br>beginYear: int<br>endYear: int<br>analysisType: String |
| **Responsibilities** | When invoked by the Main UI, the Viewers are responsible to plot the graphs with the processed data obtained from the Data Manager. |
| **Business Rules** | |

# 4 Sequence and Activity Diagrams

## 4.1 Sequencing Diagrams

*For each use case diagram introduce the corresponding sequence diagram. Make sure you identify and associate each sequence diagram with the proper use case by maintaining unique Identifiers for use cases. Refer to the project description for which of the scenario you need to write collaboration diagrams.*

## 4.2 Activity Diagrams

*For each use case introduce the corresponding activity diagram. Make sure you identify and associate each activity diagram with the proper use case by maintaining unique Identifiers for use cases. Refer to the project description for which of the scenario you need to write collaboration diagrams.*

# 5 Non-Functional Requirements Specification

*Often when the full requirements of a system are explored, it is difficult to represent all of the requirements on a Business Scenario Model. The Business Scenario Model is best at representing truly "functional" requirements that map to the process of the business. Those that are non-functional in nature (ie. statements on useability, reliability etc) can only be embedded within the context of a functional requirement, and as such, risk getting lost in the paper work.*

*This document exists to document the "non-functional" requirements of the system.*

*They should be clearly and concisely stated.*

## 5.1 Overview

*Provide a brief overview of the non-functional requirements.*

## 5.2 Enabling Technologies

### 5.2.1 Target Hardware & Hardware Interfaces

*Where a requirement exists for a specific hardware environment to be used to deliver the system, detail the requirements.*

*This should specify the logical characteristics of each interface between software product and the hardware components of the system. It also covers such matters as what devices are to be supported, how they are to be supported, and protocols. For example, terminal support may specify full screen support as opposed to line by line.*

### 5.2.2 Target Development Environment

*Where a requirement exists for the system to be developed using specific platforms, software and tools, state the requirement.*

### 5.2.3 System Interfaces

*Due to deployment requirements, specific system interfaces may be required (eg. "the business cannot deliver service X if the new system does not talk to System B"). If these are known, state them. Focus on the enabling technology aspect of these connections.*

*Where specific technology must be used, document the requirements.*

*The account should list each system interface and identify the functionality of the software to accomplish the system requirement and the interface description to match the system.*

## 5.3 Capacity Planning

### 5.3.1 Permanent Storage

*What are the expected requirements with respect to permanent storage? What volume of data is to be held?*

## 5.4 Network

*What are the networking requirements? Explore these requirements in as much detail as possible.*


 

## 5.5 Workstations

*Explore the requirements for a workstation by covering the following subjects:*

- *Diskspace*
- *Performance*
- *Memory*
- *Screen attributes*
- *Processor requirements*
- *Interfaces.*

## 5.6 Operational Parameters

### 5.6.1 Useability

*Discuss the useability requirements for the new system. How understandable, learnable and operable is the new system to be?*

### 5.6.2 Reliability

*Discuss the requirements which respect to the level of reliability that is expected with the new system.*

*In particular, consider the following section on the recoverability requirements for the new system.*

***Recoverability & Backup***

*Describe the backup and recovery requirements for the system.*

***Restart***

*Describe the requirements for restarting the system after a temporary problem in the system hardware or software.*

### 5.6.3 Maintainability

*Explore the maintainability requirements for the new system. How easy should it be to analyse it, change it and test it?*

*What criteria will be used to measure the stability of the system?*

### 5.6.4 Portability

Review the requirements of the system in terms of portability. Consider how *adaptable, installable, and replaceable the system is to be.*

*Should the system conform to any portability standards?*

*The section should specify the attributes of software that relate to the ease of porting the software to other host machines and/or operating systems. This may include:*

- *Use of proven portable languages*
- *Use of a particular compiler or language subset*
- *Use of a particular operating system.*


 

# 6 Activities Plan

## 6.1 Gantt Chart

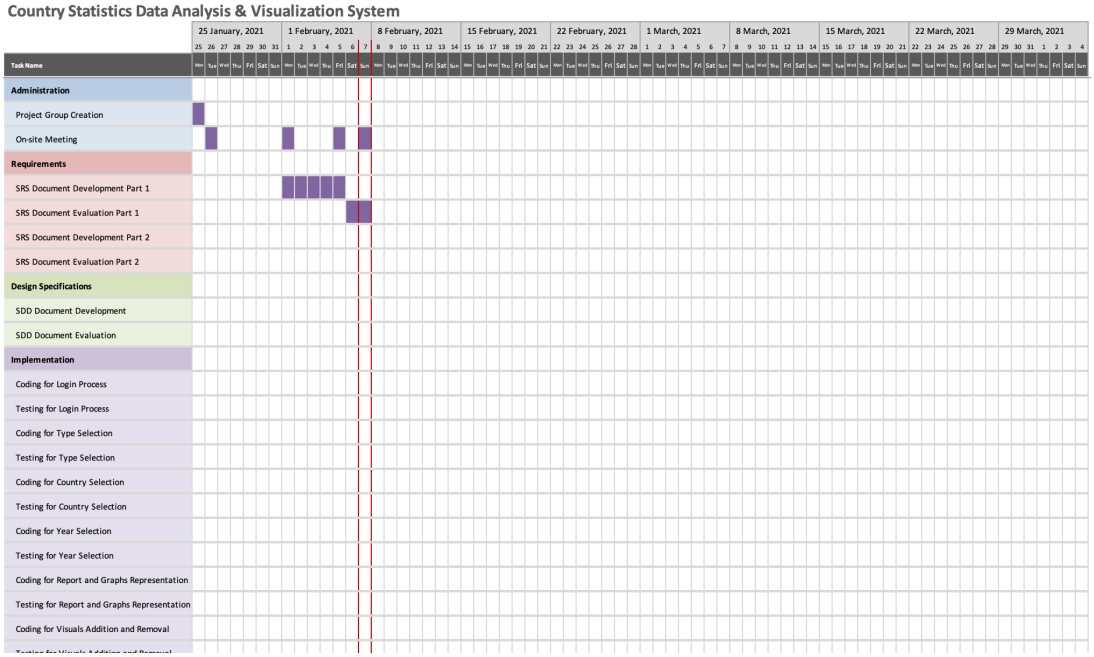


Fig. 6.1 Gantt Chart

## 6.2 Project Backlog and Sprint Backlog

| Story | Estimation | Priority | Status |
|---|---|---|---|
| As a user I want to be able to login to the system. | 2 | 1 | To be started |
| As a user I want to select a particular type to analyze data. | 3 | 2 | To be started |
| As a user I want to select a particular country to analyze data. | 1 | 3 | To be started |
| As a user I want to select a particular year to analyze data. | 2 | 4 | To be started |
| As a user I want to see the reports and graphs representing the selected data. | 4 | 5 | To be started |

| | | | |
|---|---|---|---|
| As a user I want to add or remove visualization graphs | 2 | 6 | To be started |
| As a user I want to see the error message when I enter incorrect credentials or perform an invalid operation. | 1 | 7 | To be started. |
| **Total** | 15 | | |

## 6.3 Group Meeting Logs

| **Present Group Members** | **Meeting Date** | **Issues Discussed / Resolved** |
|---|---|---|
| Yiran Shao;<br>Junyi Yang;<br>Zheng Yang;<br>Rui Zhu | 26 January, 2021 | 1. Meeting was held through online-phone call.<br>2. General discussion about the project.<br>3. Created a timetable for future meetings.<br>4. Brainstormed the product backlog list for this project.<br>5. Decided to meet again on 1st February. |
| Yiran Shao;<br>Junyi Yang;<br>Zheng Yang;<br>Rui Zhu | 1 Feb, 2021 | 1. Meeting was held through online-phone call. We,<br>2. assigned parts for each group member; which parts may often connect between assigned members;<br>3. Discussed what actors or functionalities we may need in our project -- relevant diagrams should come out before the next meeting;<br>which parts may require extra collaborations between members;<br>4. Decided to meet again on 5th February. |
| Yiran Shao; | 5 Feb, 2021 | 1. Meeting was held through online-phone call. |

| | | |
|---|---|---|
| Junyi Yang;<br>Zheng Yang;<br>Rui Zhu | | A generalized version of the actor diagram and user case come out.<br>2. We added some extra actor type of managers for some invocation of functionality.<br>3. Administrator actors were removed from our actor diagrams.<br>4. Some analysis of user cases used in each scenario came out. |
| Yiran Shao;<br>Junyi Yang;<br>Zheng Yang;<br>Rui Zhu | 7 Feb, 2021 | 1. Meeting was held through online-phone call. During this meeting,<br>2. Went through all the details that were mentioned in the assignment description.<br>3. Finalized the deliverable for the first assignment. |

# 7 Test Driven Development

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

| | |
|---|---|
| **Test ID** | The unique Id of the test case |
| **Category** | Which part of the system is tested (*e.g. evaluation of user credentials stored on file or DB*) |
| **Requirements Coverage** | The unique ID of the requirement tested (*e.g. UC1-Successful-User-Login*) |
| **Initial Condition** | Initial conditions required for the test case to run (*e.g. the system has been initiated and runs*) |
| **Procedure** | The list of steps required for this test case (*e.g.*<br>*1. The user selects login*<br>*2. The user provides a user name*<br>*3. The user provides a password*<br>*4. The user logs-in into the system and is presented with the main UI window*) |
| **Expected Outcome** | The expected outcome of the test case (*e.g. the login form closes, and the user is presented with the main UI window*) |
| **Notes** | Any other notes you may want to add for this test case, which are also reflected in the requirements specification (*e.g. the user should provide only alphanumeric user names and passwords without any special characters*) |

# 8 Domain Dictionary (optional and as required)

## 8.1 Terms and Abbreviations

| Term | Definition |
|---|---|
| *Place term here* | *Place a definition of the term here. Make the definition short and concise and consistent with other terms. Only used terms defined elsewhere in the domain dictionary.* |
| *Place synonym here* | *This is a synonym of <another term>* |