Analytics of Environmental Data

(Environmental Complaints)

CSP 586 – Software Modelling and Development with UML

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1. Overview

The project aims at providing details about environmental complaints received by the Department of Environment (DOE) from January 1993 to December 31, 2011 and by the Department of Public Health (CDPH) since January 1, 2012. The users can perform various analysis to explore and use statistical information derived from the dataset.

Complaints are regarding Air, water, and noise pollution or anything concerning the environment of particular region. In specific, the complaint types are categorized as: “Abandoned Site”, “Air Pollution Work Order”, “Asbestos Work Order”, “Construction and Demolition”, “Toxics Hazardous Materials Work Order”, ”Illegal Dumping Work Order”, “Noise Complaint”, “Permits Issued by DOE Work Order”, “Recycling Work Order”, “Service Stations/Storage Tanks Work Order”, “Vehicle Idling Work Order”, and “Water Pollution.”

In addition, the dataset also provides information regarding the complaint date, status, personnel handling the case, and location of the site as determined through the Chicago open data portal’s geocoding engine.

This serves as a great data source to generate insightful visualizations of the data determined over various factors and analyze them as per needs.

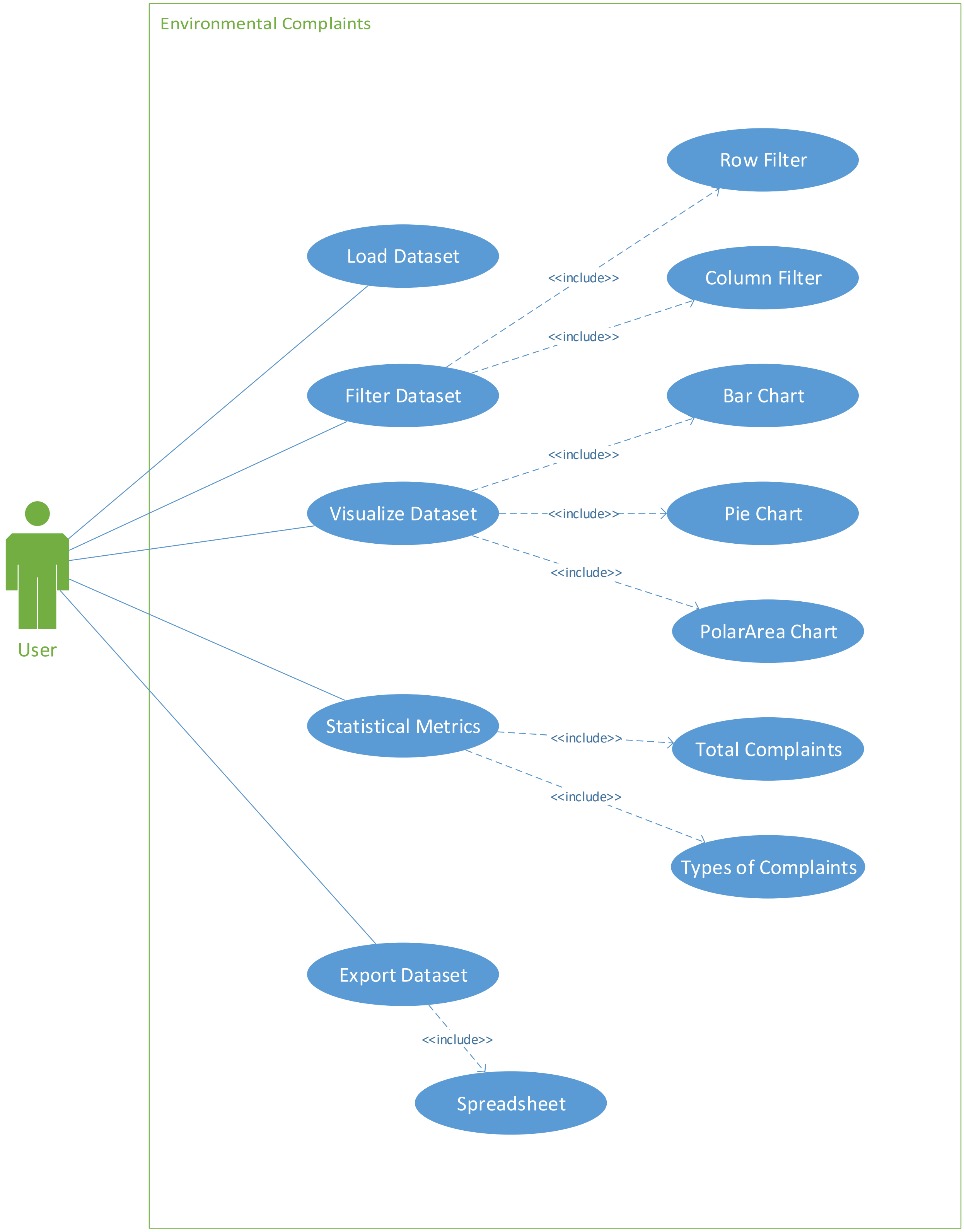
2. Feature List

1. Load data from dataset file
2. Display the selected data in tabular format
3. Visualize data as different types of charts – Bar chart, Pie chart, Polar area etc.
4. Filter datasets based on column (what needs to be included for data display)
5. Statistical metrics – total complaints, different types of complaints
6. Export data as csv spreadsheet.
7. Explore data by complaint type, over time

3. List of Actors

1. User
2. System

4. Use Cases


Environmental Complaints
User
Load Dataset
Filter Dataset
Visualize Dataset
Statistical Metrics
Export Dataset
Row Filter
Column Filter
Bar Chart
Pie Chart
PolarArea Chart
Total Complaints
Types of Complaints
Spreadsheet
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The use cases are defined as tasks executed by the actors to satisfy the requirements supported by the application. They can be defined as a list of actions of event steps typically defining the interactions between a user and a system to achieve a goal.

Use case diagrams are usually referred to as behavior diagrams used to describe a set of actions – use cases that some system of systems can perform in collaboration with one or more external users of the system – actors. Each use case should provide some observable and valuable result to the actors or other stake holders of the system.

The complete list of use cases is listed below.

1. User can select and loads the dataset
2. User can select the columns to be displayed – column filtering
3. User can apply filtering criteria on rows
4. User can sort rows based on column names and value
5. User can apply filtering criteria – “equal to” row value from drop down
6. User can get numerical metrics – Total number of complaints statistical data, Count of Different types of complaints statistical data
7. Users can select the chart type to be displayed
8. Users can export the data to csv.

5. Use Cases – Fully Dressed Format

Use Case Name:	Selection and loading the dataset	
Triggering Event:	User confirming to select the dataset	
Brief Description:	The user selects the dataset to be loaded. Once the dataset gets loaded, the data is displayed in the tabular format.	
Primary Actors:	User	
Related Use Cases:	Column Filtering after data selection and loading	
Stakeholders:	User	
Preconditions:	User must have access to the Complaints dataset Dataset should be in the correct format - csv	
Post conditions:	Dataset visible in tabular format	
Flow of events:	Actor	System
	• The user selects the dataset	• Verify the dataset format • Loads the dataset • Displays the dataset in the tabular format • Shows column filtering option with checkbox for each available column
Exception Conditions	User loads a dataset which is not in the expected format.	

Use Case Name:	Selecting the columns to be displayed – column filtering	
Triggering Event:	User confirming to selection of columns to be displayed	
Brief Description:	The user selects the dataset to be loaded. Once the dataset gets loaded, the data is displayed in the tabular format along with option for column filtering. User selects the columns to be displayed and applies the column filtering to display column specific data	
Primary Actors:	User	
Related Use Cases:	Selection and loading of dataset	
Stakeholders:	User	
Preconditions:	User must have access to the Complaints dataset Dataset should be in the correct format – csv Dataset should be displayed in the tabular format Checkboxes with column names should be available for the dataset loaded	
Post conditions:	Data set visible with only selected columns	
Flow of events:	Actor	System
	• The user selects the dataset	• Verify the dataset format • Loads the dataset • Displays the dataset in the tabular format • Shows column filtering option with checkbox for each available column
	• The user selects the columns to be displayed • Applies column filtering	
		• Only selected columns displayed in the data table
Exception Conditions	User loads a dataset which is not in the expected format.	

Use Case Name:	Selecting the rows to be displayed – row filtering based on column values	
Triggering Event:	User selecting the row filtering criteria	
Brief Description:	To be able to filter rows based on each column values.	
Primary Actors:	User	
Related Use Cases:	Column Filtering	
Stakeholders:	User	
Preconditions:	Dataset loaded and displayed in tabular format	
Post conditions:	Data set visible with only selected rows satisfying the row filter criteria	
Flow of events:	Actor	System
	• The user selects the dataset • The user selects the column value for each column to be filtered • Applies row filtering	• Verify the dataset format • Loads the dataset • Displays the dataset in the tabular format • Shows row filtering option with dropdown for each available row value • Only rows satisfying the filter criteria are displayed.
Exception Conditions		

Use Case Name:	Selecting the rows to be displayed – sort rows based on column value	
Triggering Event:	User selecting the row filtering criteria	
Brief Description:	To be able to sort rows based on values for each column value.	
Primary Actors:	User	
Related Use Cases:	Column Filtering	
Stakeholders:	User	
Preconditions:	Dataset loaded and displayed in tabular format	
Post conditions:	Data set visible with only selected rows satisfying the row filter criteria	
Flow of events:	Actor	System
	• The user selects the dataset • The user selects the column to sort the table on • Applies row sorting	• Verify the dataset format • Loads the dataset • Displays the dataset in the tabular format • Shows row filtering option with dropdown for each available row value • All rows are displayed in sorted order for the selected column.
Exception Conditions		

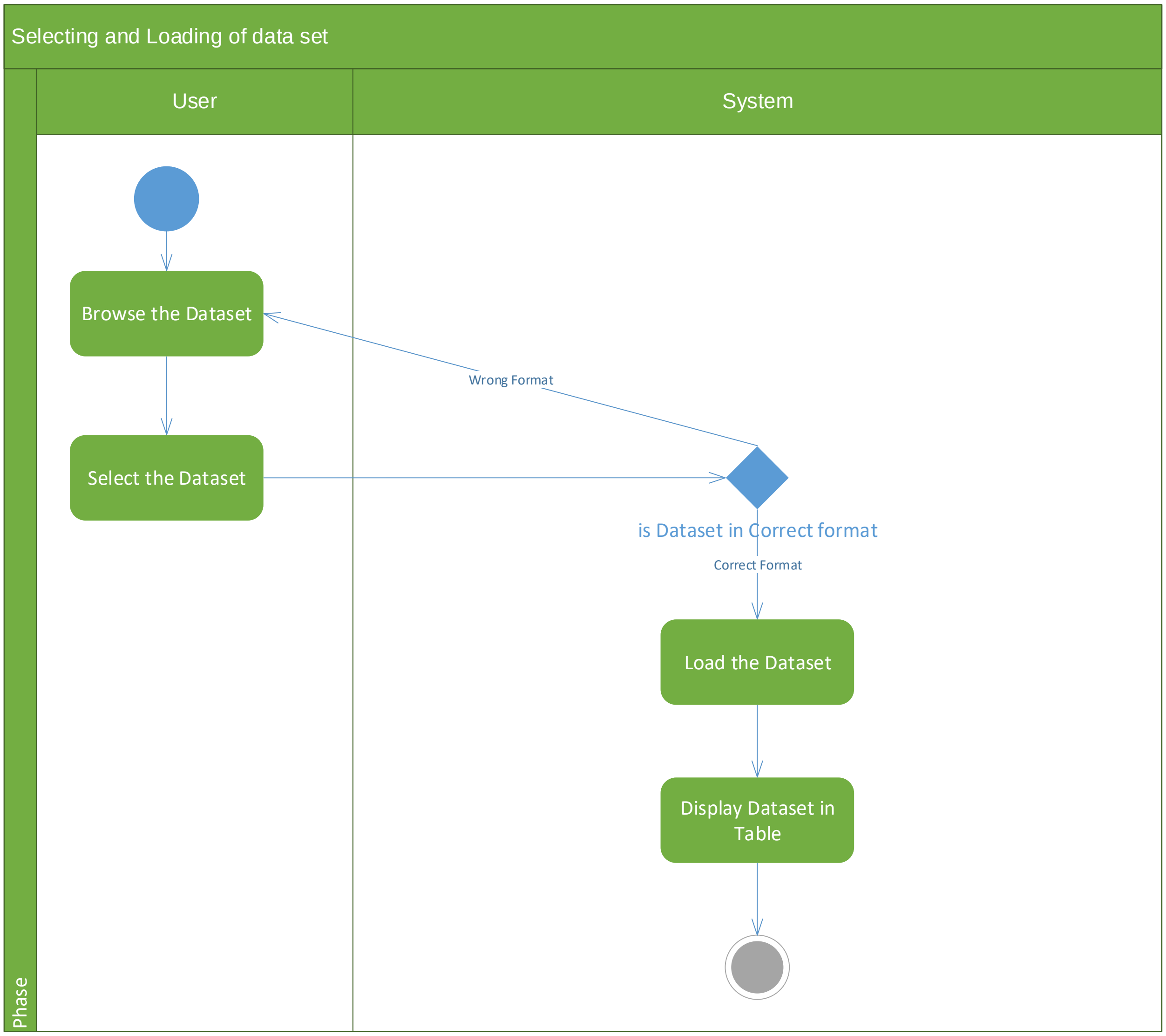
Use Case Name:	Selecting the rows to be displayed – search rows based on column value	
Triggering Event:	User selecting the row filtering criteria	
Brief Description:	To be able to search rows based on particular column value.	
Primary Actors:	User	
Related Use Cases:	Column Filtering	
Stakeholders:	User	
Preconditions:	Dataset loaded and displayed in tabular format	
Post conditions:	Data set visible with only selected rows satisfying the row filter criteria	
Flow of events:	Actor	System
	• The user selects the dataset • The user searches for the rows with the particular column value. • Applies row filtering	• Verify the dataset format • Loads the dataset • Displays the dataset in the tabular format • Shows row filtering option with dropdown for each available row value • Only rows satisfying the filter criteria are displayed.
Exception Conditions		

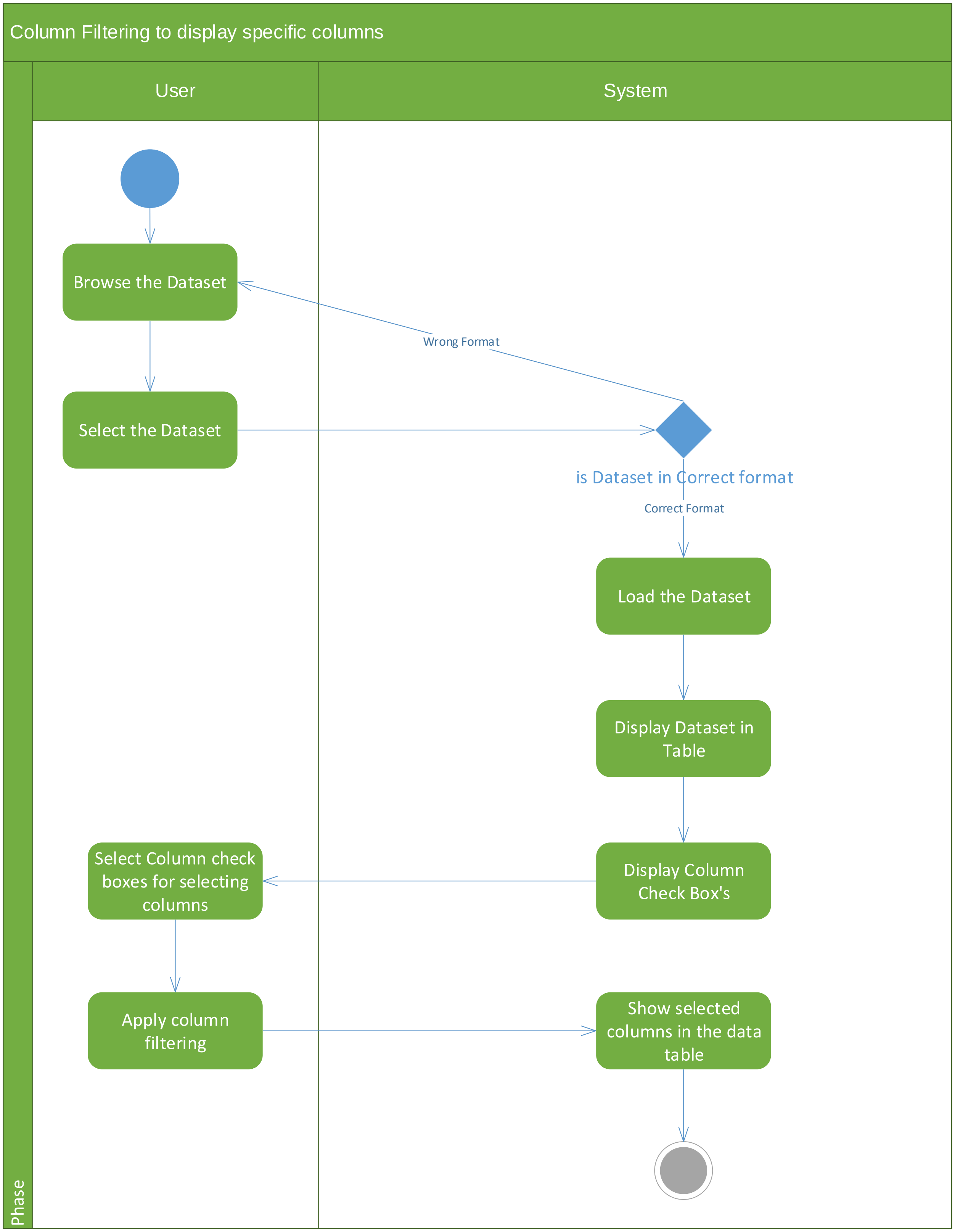
Use Case Name:	Export view as csv	
Triggering Event:	User clicks export data option	
Brief Description:	To be able to export data in view as csv	
Primary Actors:	User	
Related Use Cases:		
Stakeholders:	User	
Preconditions:	Dataset loaded and displayed in tabular format	
Post conditions:	Data set visible with only selected rows satisfying the row filter criteria	
Flow of events:	Actor	System
	• The user selects the dataset • The user applies the required filters on rows and columns and clicks on export data button to save the view as csv. • Pop up appears to user to download the data in view as csv file • Clicks on save button to save file to local system.	• Verify the dataset format • Loads the dataset • Displays the dataset in the tabular format • Shows row filtering option with dropdown for each available row value • Creates CSV file with all data in the current view.
Exception Conditions		

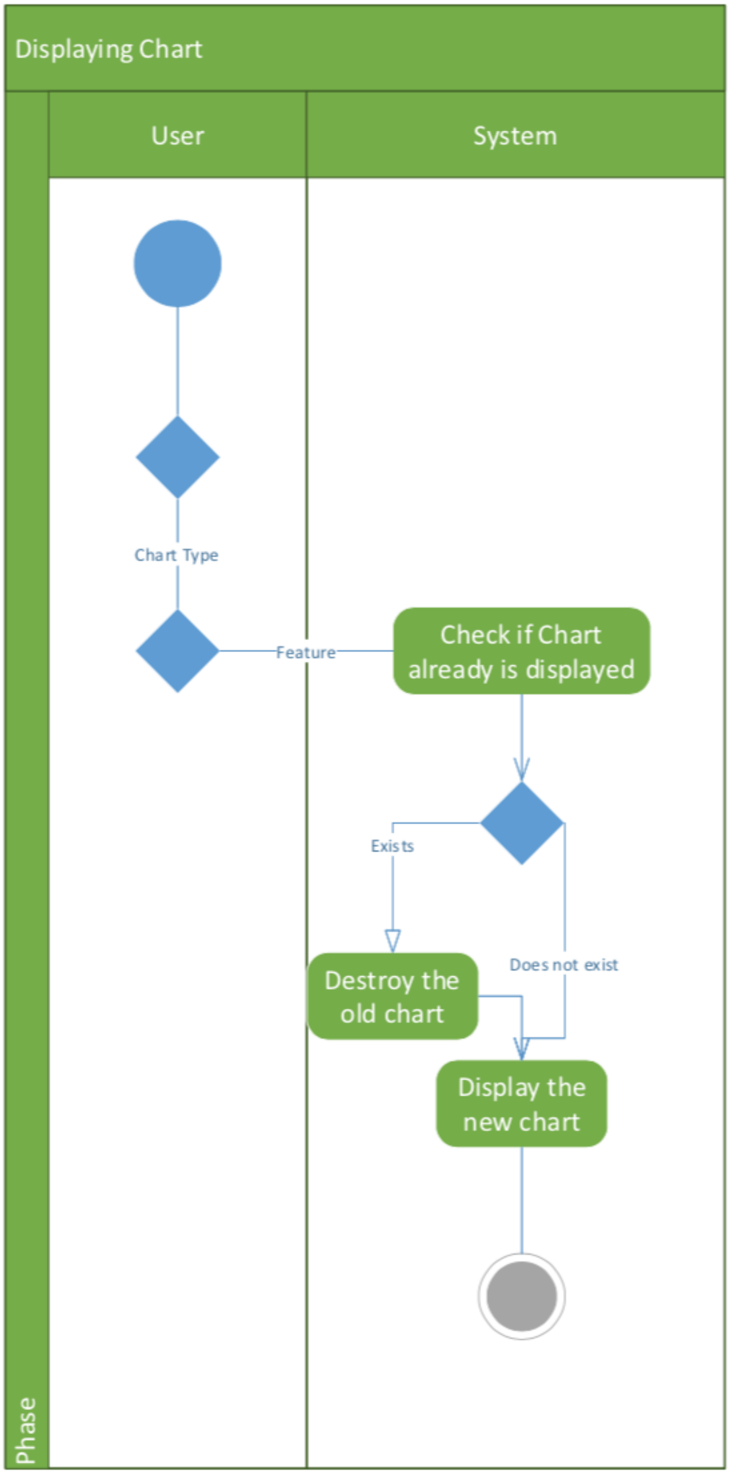
Use Case Name:	Selecting the chart to be displayed	
Triggering Event:	User selecting the chart type for visual representation of the data	
Brief Description:	The user selects the type of chart to be displayed. The user then chooses a feature or column to be used as the data for the chart. When the user click the ‘Display Chart’ button, their graph will appear below.	
Primary Actors:	User	
Related Use Cases:		
Stakeholders:	User	
Preconditions:	• The data set must be loaded • At least one feature should be populated in the table • There should exist at least 1 row in the table	
Post conditions:	Data set visualized using the selected chart type	
Flow of events:	Actor	System
	• User selects chart type from the dropdown menu • User selects the specific feature from the dropdown menu • User clicks on the Display Chart button	• Checks and removes any previous charts • New chart is displayed
Exception Conditions	• The dataset is corrupt or in the wrong format thus failing to populate the feature list in the dropdown menu	

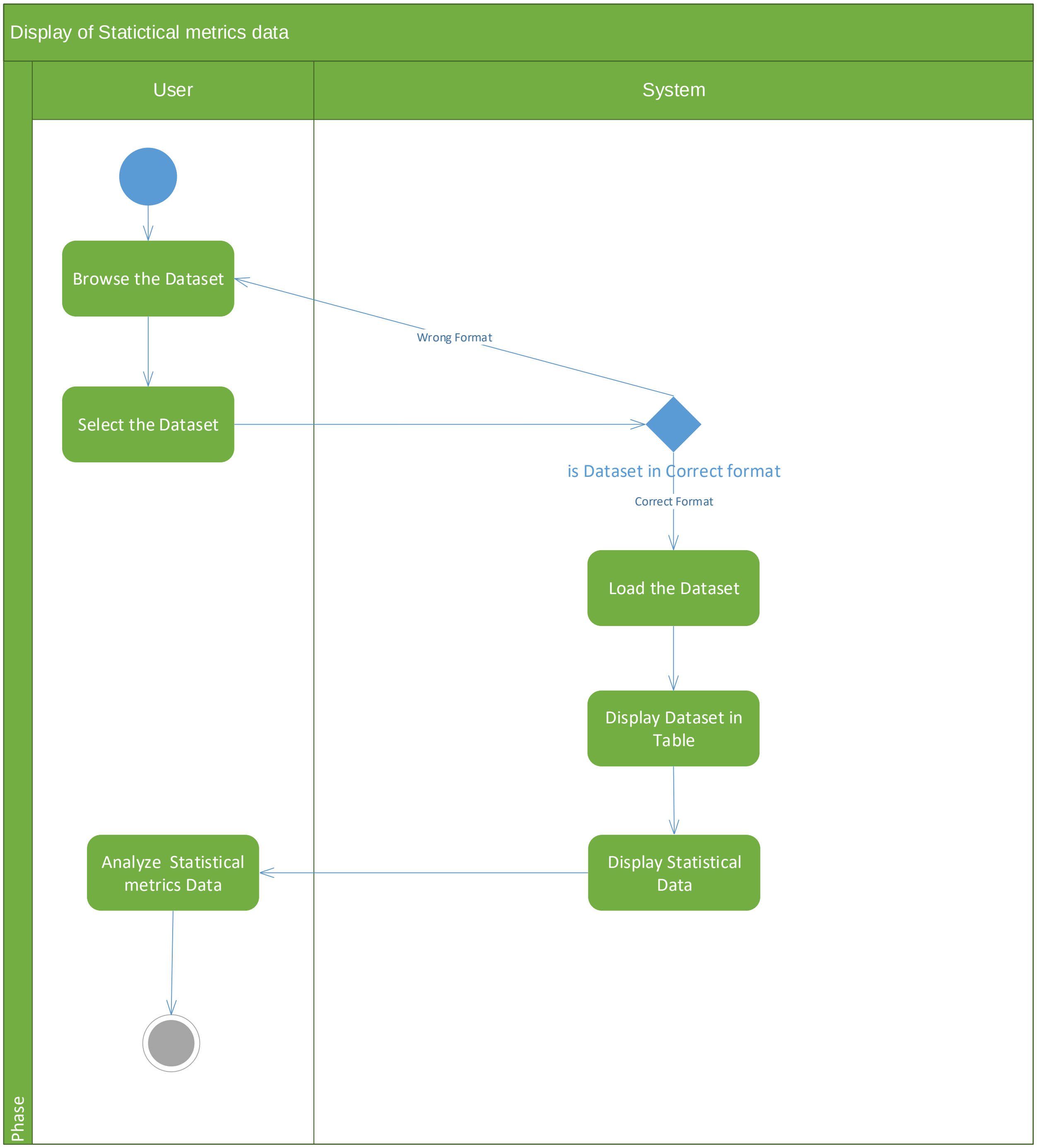
Use Case Name:	Calculate Statistics of the data	
Triggering Event:	User selecting the dataset for load	
Brief Description:	The user selects the dataset to be loaded. Once the dataset gets loaded, the data is displayed in the tabular format along with statistics of number of complaints, and count of different types of complaints.	
Primary Actors:	User	
Related Use Cases:	Row Filtering	
Stakeholders:	User	
Preconditions:	User must have access to the Complaints dataset Dataset should be in the correct format - csv	
Post conditions:	Statistics visible in a section of the dashboard	
Flow of events:	Actor	System
	• The user selects the dataset	• Verify the dataset format • Loads the dataset • Displays the dataset in the tabular format Shows statistics with number of complaints
Exception Conditions		

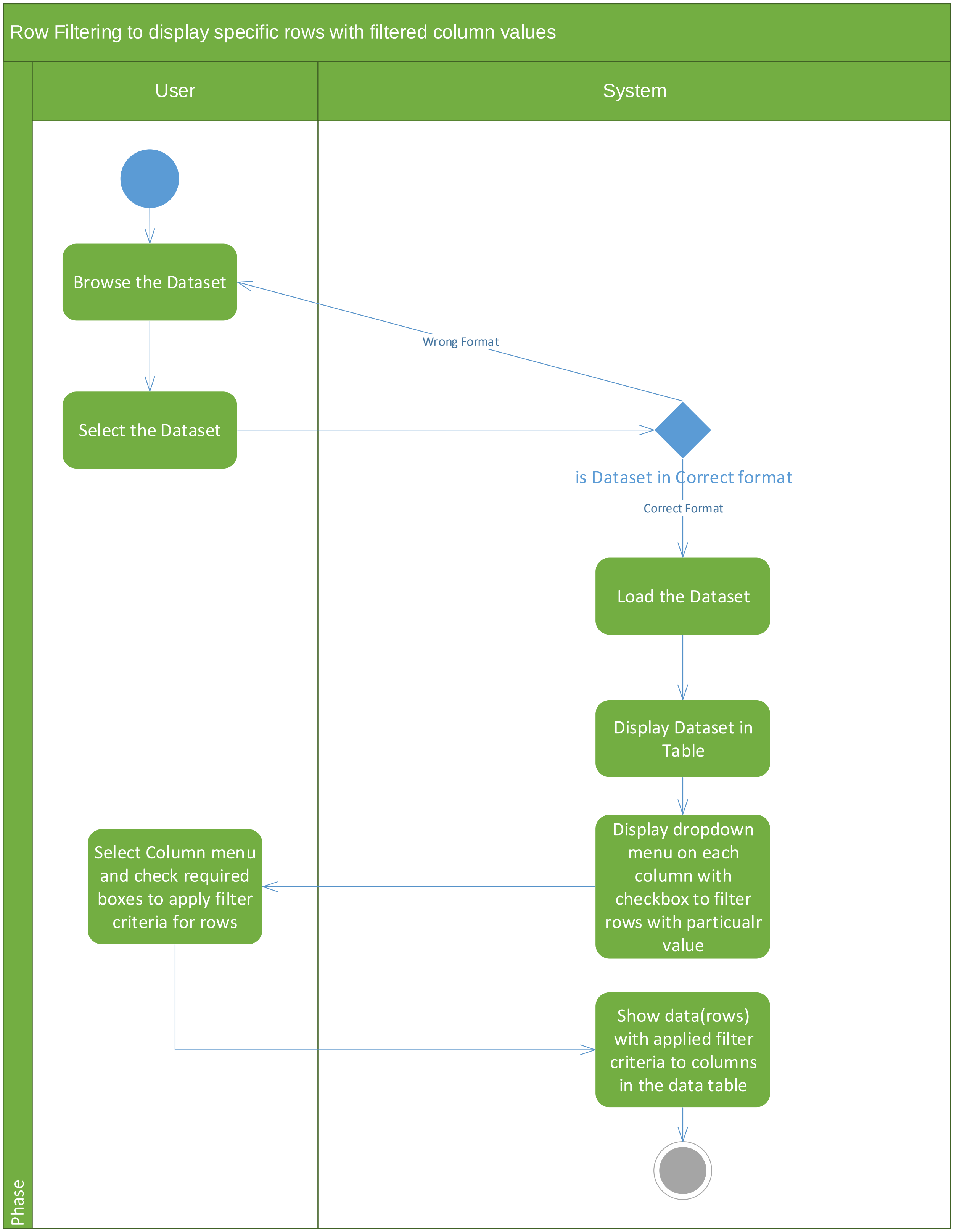
6. Activity Diagrams



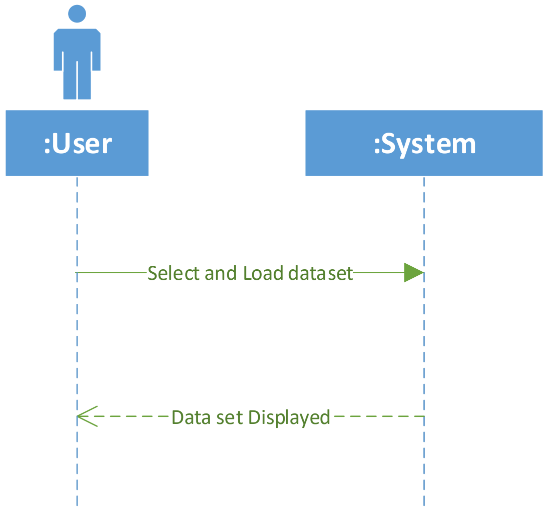

Column Filtering to display specific columns
User
System
Phase
Browse the Dataset
Select the Dataset
Wrong Format
is Dataset in Correct format
Correct Format
Load the Dataset
Display Dataset in Table
Display Column Check Box's
Select Column check boxes for selecting columns
Apply column filtering
Show selected columns in the data table


Displaying Chart
User
System
Chart Type
Feature
Check if Chart already is displayed
Exists
Does not exist
Destroy the old chart
Display the new chart
Phase

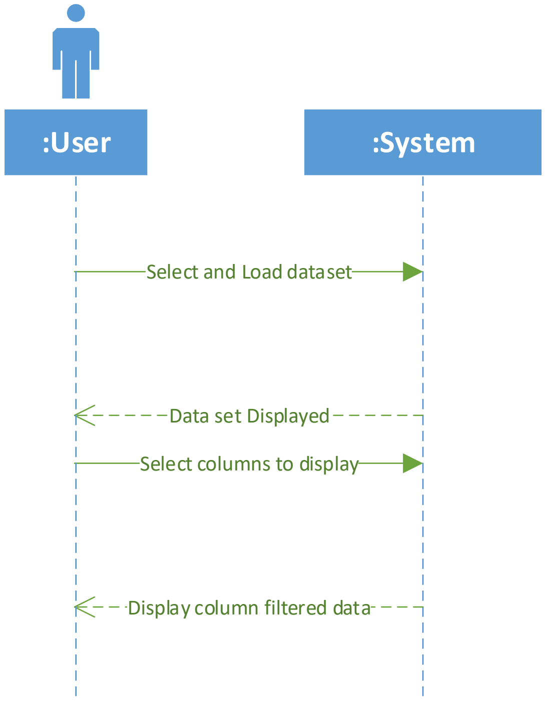

Display of Statictical metrics data
User
System
Phase
Browse the Dataset
Wrong Format
Select the Dataset
is Dataset in Correct format
Correct Format
Load the Dataset
Display Dataset in Table
Display Statistical Data
Analyze Statistical metrics Data


Row Filtering to display specific rows with filtered column values
User
System
Browse the Dataset
Wrong Format
Select the Dataset
is Dataset in Correct format
Correct Format
Load the Dataset
Display Dataset in Table
Display dropdown menu on each column with checkbox to filter rows with particualr value
Select Column menu and check required boxes to apply filter criteria for rows
Show data(rows) with applied filter criteria to columns in the data table
Phase

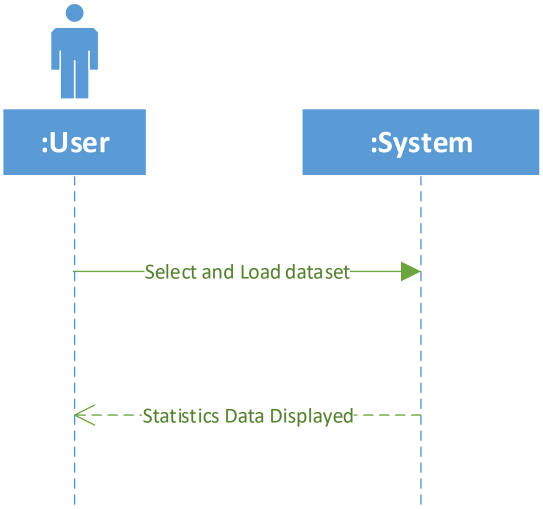
7. System Sequence Diagrams



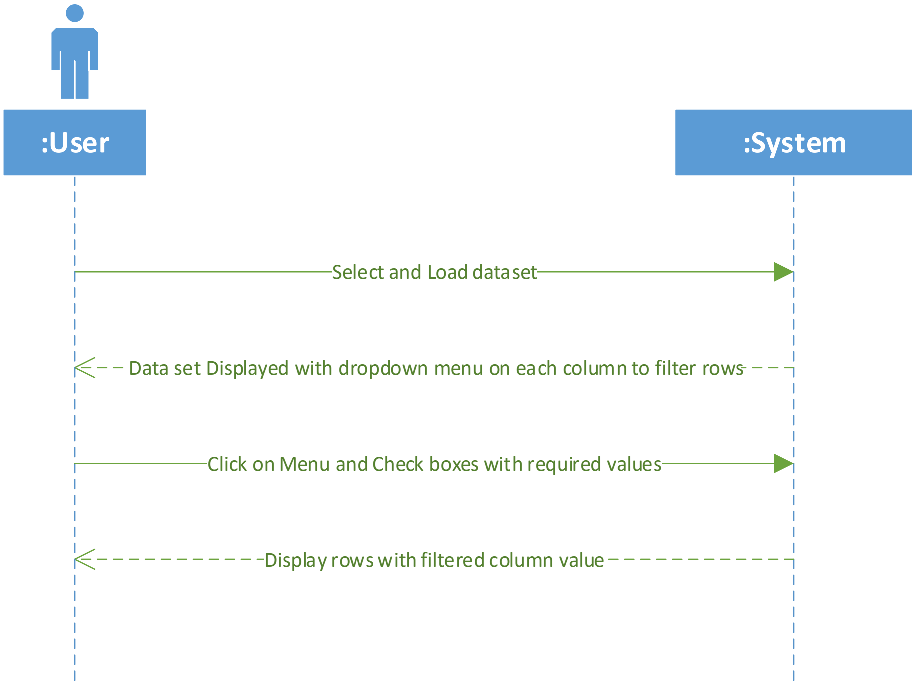
System Sequence Interaction Diagram for Selecting and loading a dataset



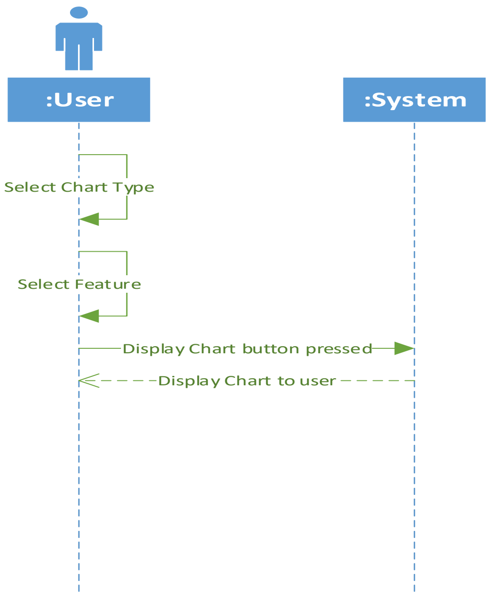
System Sequence Interaction Diagram for column filtering



System Sequence Interaction Diagram for Statistics Display

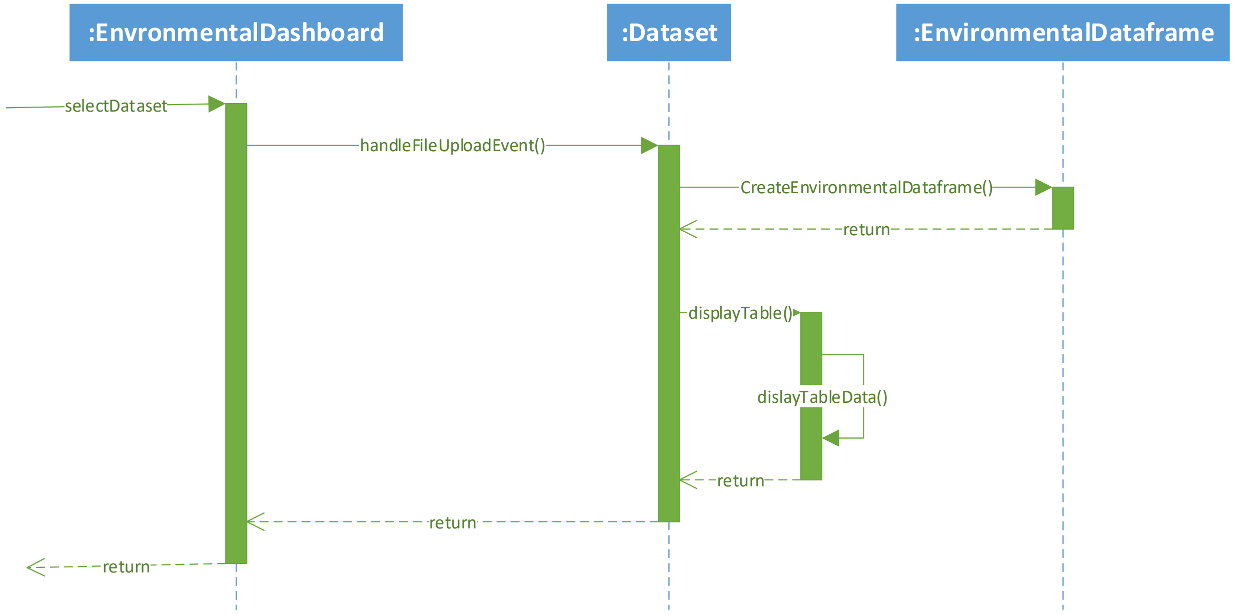

:User
:System
Select and Load dataset
Data set Displayed with dropdown menu on each column to filter rows
Click on Menu and Check boxes with required values
Display rows with filtered column value

System Sequence Interaction Diagram for row filtering

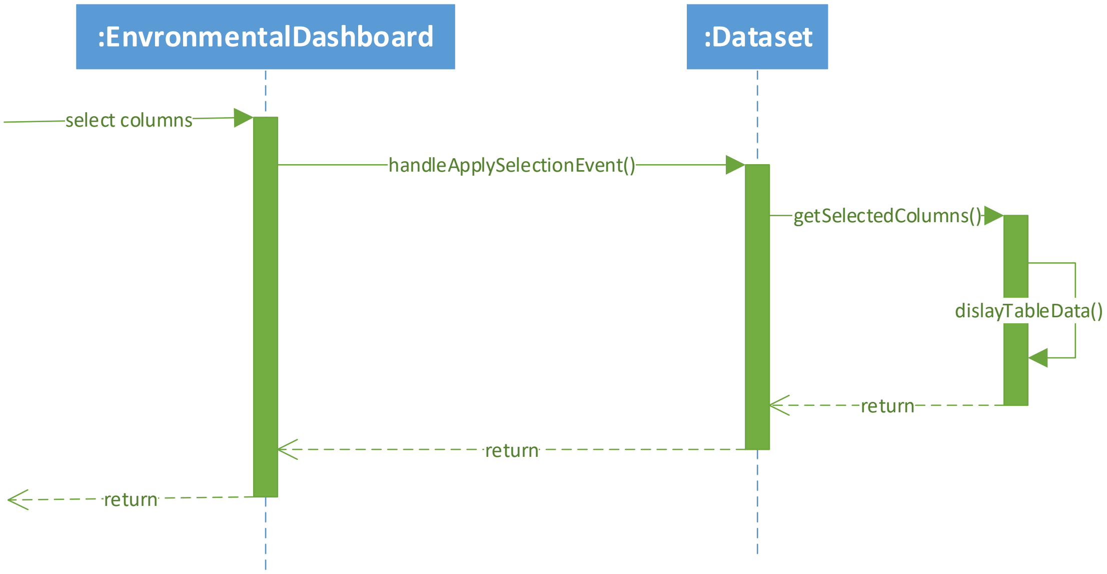


System Sequence Interaction Diagram for charting

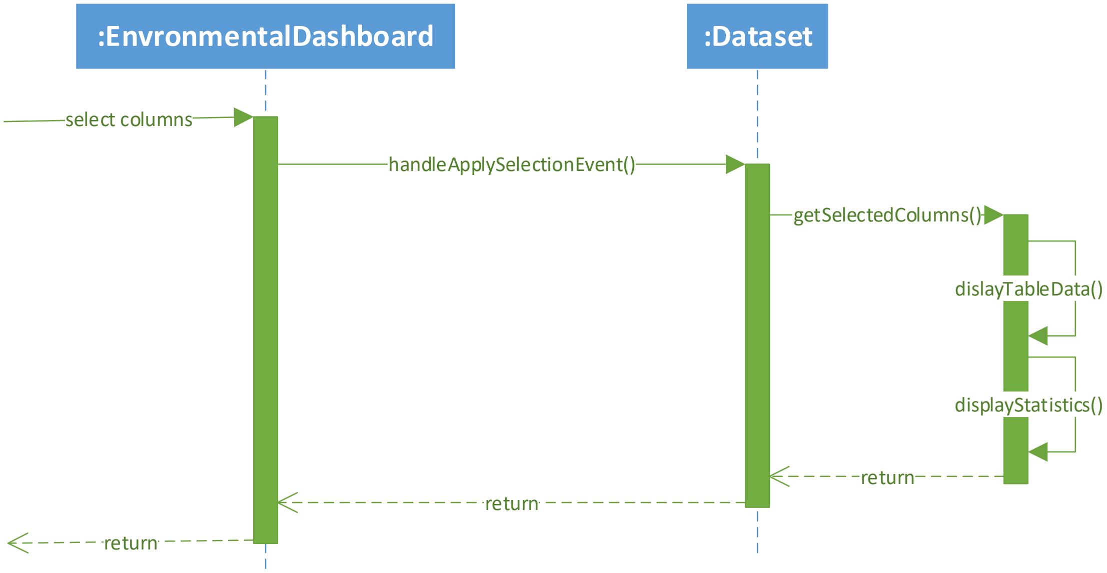
8. Sequence Diagrams



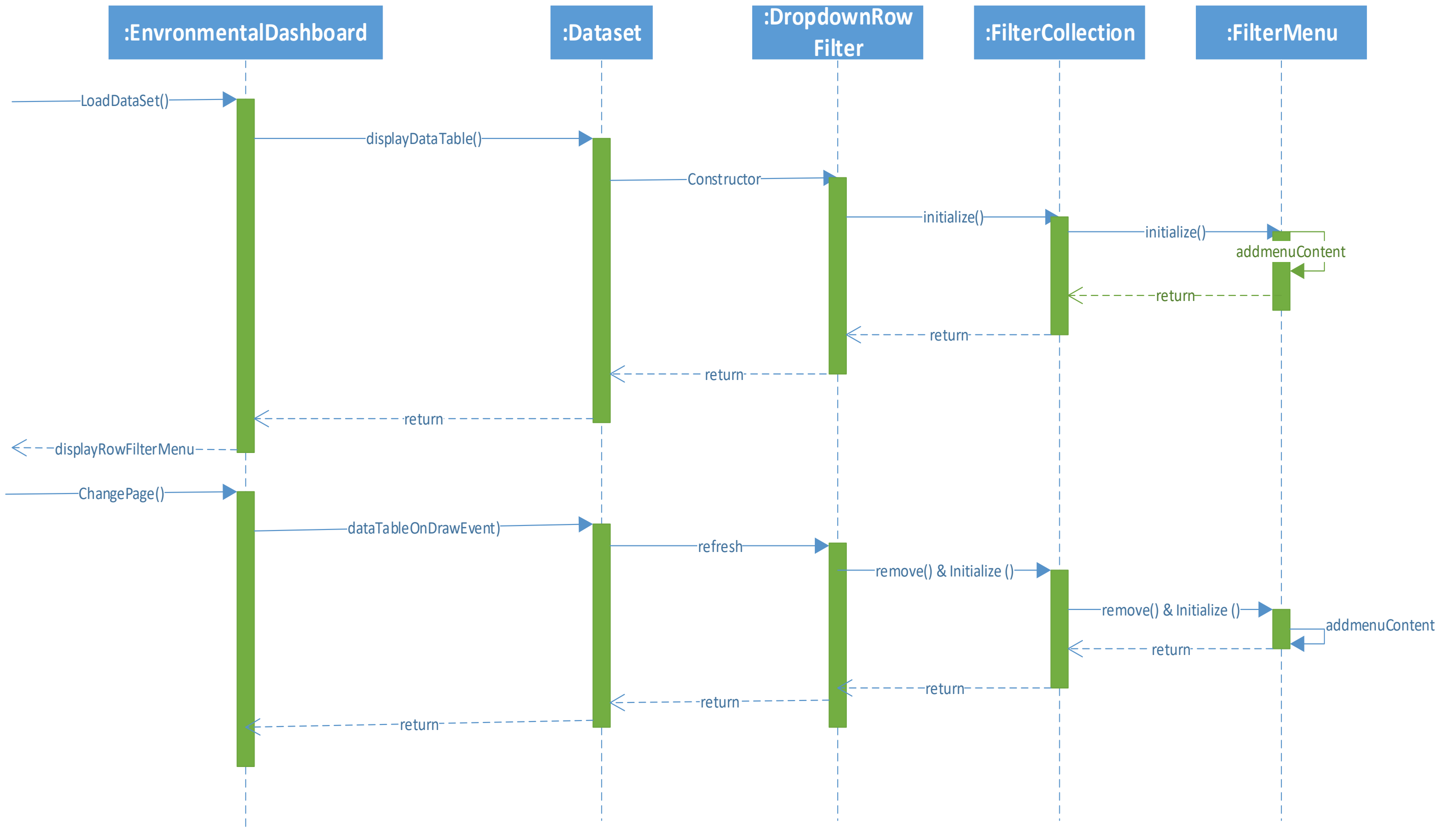
Sequence Interaction Diagram for creating order and making payment



Sequence Interaction Diagram for filtering columns

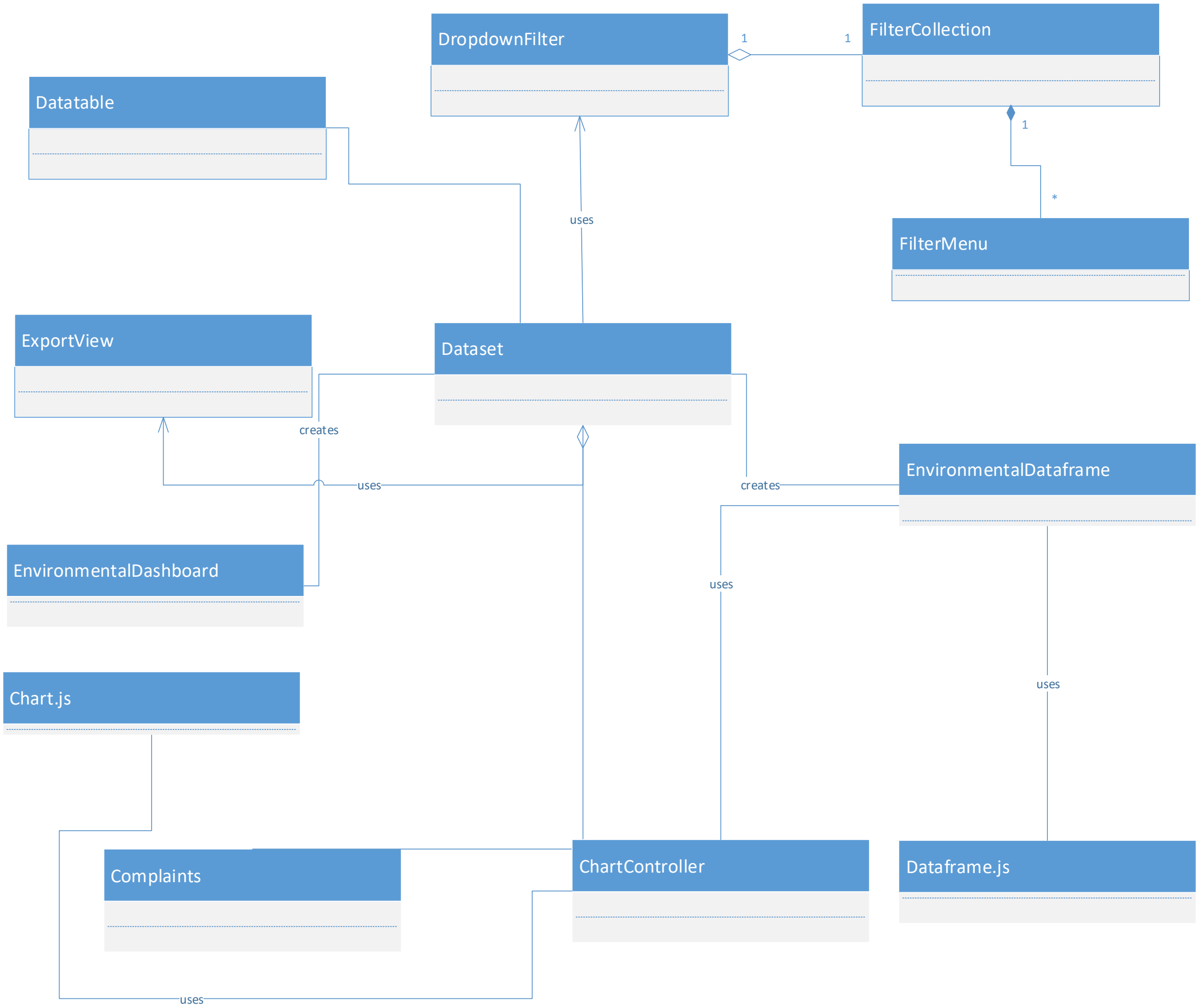


Sequence Interaction Diagram for Display Statistics

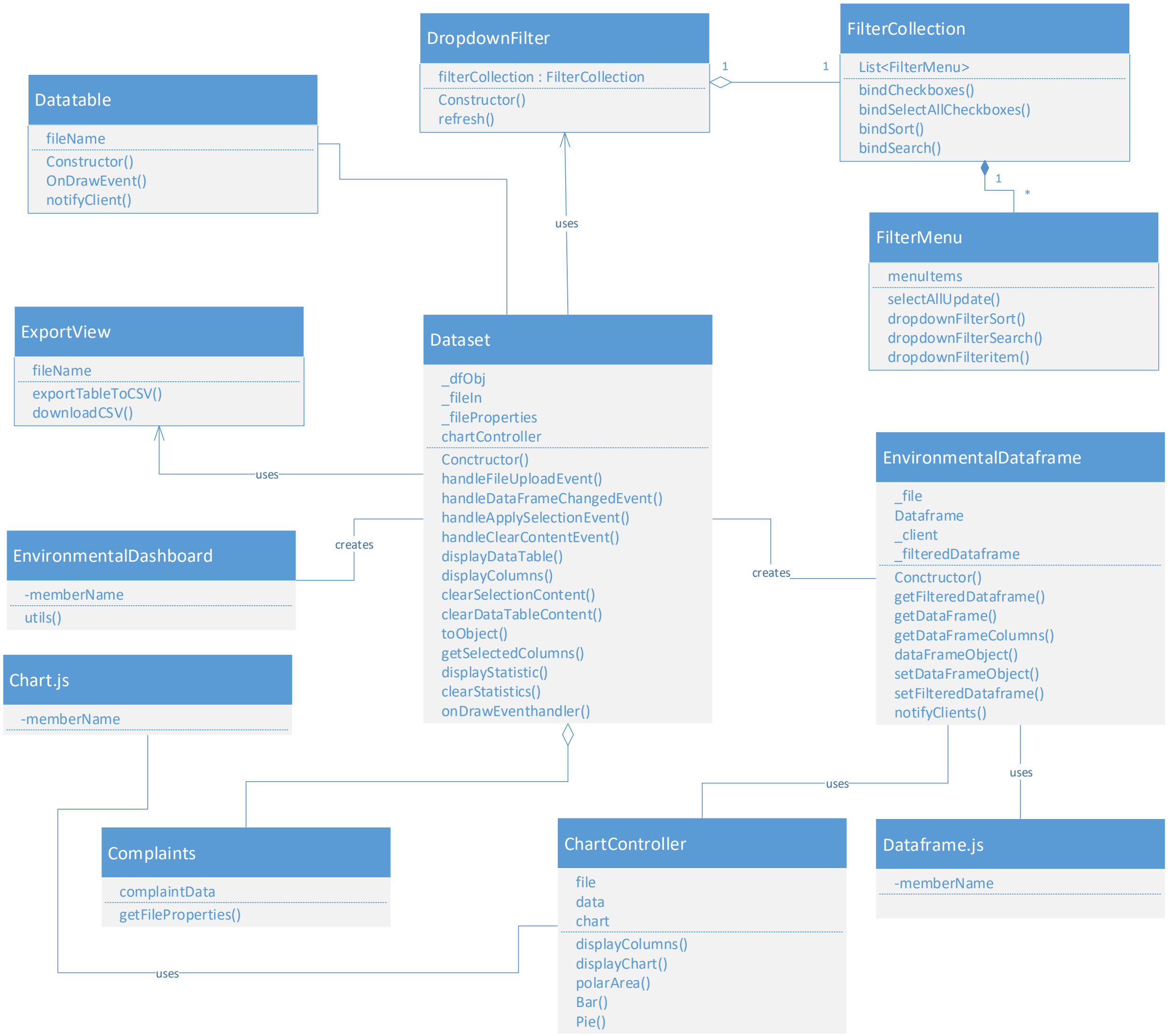


Sequence Interaction Diagram for row filtering

9. Analysis Model Class Diagram



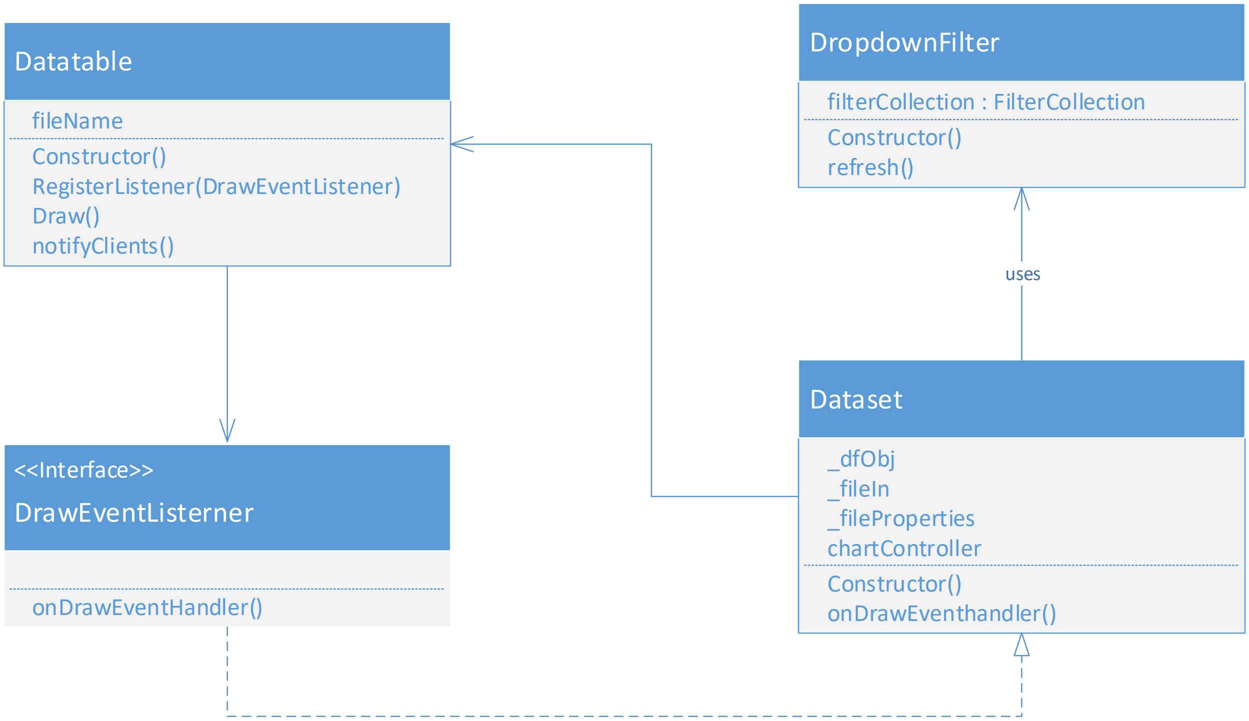
10. Design Model Class Diagram



11. Design Patterns

Observer Pattern:

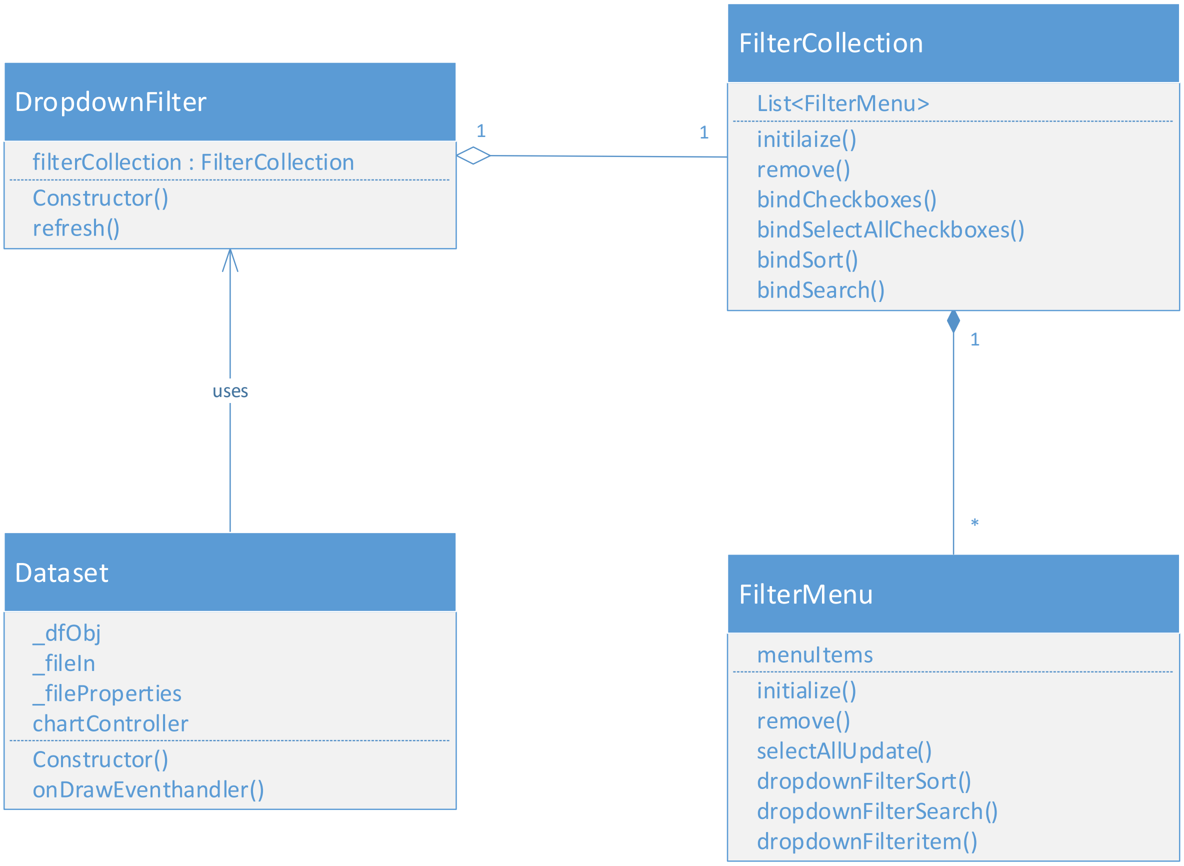
- Dropdown Menu for row filtering contains each values of the column it belongs to.
- This data should be dynamically updated based on the data displayed in data table.
- We use the DrawEventListener Interface of DataTable to receive the draw event update to update the menu content of the drop-down filter.
- This works according to the observer pattern (publisher subscriber) where DataTable would publish the changes to its table data, and dataset being the subscriber of the event, receives notification and refresh the menu content of the dropdown filter dynamically.



Observer Pattern for Row Filter Content Update on Table Draw Event of DataTable

Façade Pattern:

- When the dataset class receives the table draw notification, it has to perform, activities on the drop-down Filter menu to remove the old items and create new menu with updated data items and associate handlers for each of the item click event.
- Clearly this means that it performs multiple operations on filter selection and filter menu.
- This interface is simplified using the façade pattern by implementing the intermediate class – DropDownFilter which handles all the background actions required.



Facade Pattern for Row Filter Content Update activities on Table Draw Event of DataTable