

**Interactive Statistic Mapping Application**

**Software Requirements Specification (SRS)**

CMSC447\_Team3\_CodePods\_SRS

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| --- | --- |
| **Course** | CMSC 447 |
| **Team** | Team 3 - Code Pods |
| **Members** | Benjamin Hazlett  Darrell Laffoon  Desiree Mercuree  Kevin Miller  Ian Moskunas  David Pan |
| **Sponsor (Customer)** | Shawn Squire |

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# Introduction

## Purpose

The purpose of this Software Requirements Specification (SRS) is to describe the requirements for the Interactive Statistic Mapping Application,aka the Application. It outlines the Application's purpose, what features and behaviors it must support, and what requirements it must meet. It is intended to convey the developers understanding of these requirements to the customer and other key stakeholders.

## Scope

This SRS describes the requirements for the Interactive Statistic Mapping Application,aka the Application. It will provide an overview of the Application, identify some expected system components and services , and will describe both functional and non-functional requirement, represented using User Stories, Use Cases, Use Case Specifications, and other diagrams, tables, and artifacts. Table 1, in Section 2 - References and Definitions, describes these artifacts.

# References and Definitions

The following table describes the artifacts used to convey requirement details:

### *Table 1 - Document Artifacts*

|  |  |
| --- | --- |
| **Artifact** | **Description** |
| **User Stories** | Describes the expected features and requirements from the customer’s perspective. These are presented in a common User Story format:  “As a **<type of user>**, I want to **<do something>**, so that I **<receive some benefit>**”  User Stories also include acceptance criteria for the particular story. |
| **Use Case**  **& Use Case Diagrams** | **Use Case Diagrams** graphically describe the interactions between the user(s) and the described system/application. These interactions are called **Use Cases** and describe actions that the user(s) and other systems can perform on the system/application. |
| **Use Case Specifications** | Specifies the functional requirements for each **Use Case** (identified in the **Use Case Diagram**) in detail. |
| **Other Diagrams/Tables** | Will be used as needed to provide additional clarity and to define any non-functional requirements. |

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### *Table 2 - Glossary of Terms*

|  |  |
| --- | --- |
| **Term** | **Meaning** |
| **The Application** | The targeted software solution - the Interactive Statistic Mapping Application |
| **The System** | The System that encompasses the application. The System and The Application could be used interchangeably in most cases |
| **The Customer** | The Customer that sponsored the project/software Application - Shawn Squire |
| **The User** | The individual who will use the Application |
| **Actor** | A person, external system, or other ‘actor’ who interacts with The Application or System |
| **Component** | A sub-system or part of the Application or System |
| **Map** | The selected, displayed Map, including boundaries. For example, it could be the State of Maryland, or Baltimore, or a neighborhood |
| **Map Data** | Detailed data about the selected Map |
| **Statistics Option** | One of the statistic choices such as crime, school ranking, etc. |
| **Statistical Data** | Detailed data about the Statistics Option for a particular Map |

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# System Overview

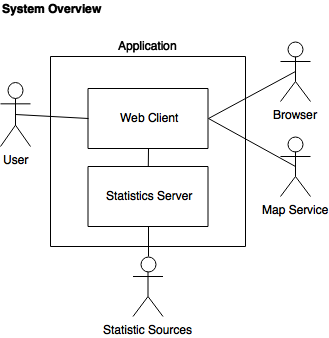
This section provides a high level System Overview for the Application. The Application’s purpose is to help a user answer a universal question:

"Where do I want to live, work, or retire?”

The Application will allow a user to select a Map and visually overlay important Statistics such as crime, income, school ranking, average commute, etc. The overlay will help the user identify areas on the Map that are more or less desirable. An expected, common use case would be a parent, who is looking to move to a safe and desirable place to raise her child, would use the Application to see and compare the crime rate and school rankings in the areas of interest.

*Diagram 1* depicts the key actors and components of the Application.

## *Diagram 1 - System Overview*

[](https://www.draw.io/#G1nqSkvUCma-uFmSX96F2KdXn3Pjgeq0vn)

The Application will consist of two components:

## *Table 3 - Application Components*

|  |  |
| --- | --- |
| **Component** | **Description** |
| **Web Client** | Frontend web application that allow a user to interactively identify a Map, and desired Statistics. It will dynamically update the Map with a visualization of the selected Map and selected Statistics Options |
| **Statistics Sources** | Backend server application that provides aggregated Statistical Data (to the Web Client), such as crime, income, commute, etc., from various trusted Statistic sources. This server encapsulates all data sources and converts them into a common, normalized format |

The Application will have of four primary actors :

## *Table 4 - Application Actors*

|  |  |
| --- | --- |
| **Actor** | **Description** |
| **User** | Will interact with the Web Client to select the Map and Statistics Option she wishes to see visualized |
| **Browser** | Will host the Application and provide input and output. Specifically, the browser will display the Map and a representation of the Statistical Data, etc. |
| **Map Service** | An external map service (Google Maps) that will provide the mapping capabilities and Map Data to the Web Client |
| **Statistic Services** | Publicly accessible Statistical Data sources that will return data for the user selected Map. *See Appendix for list of sources under consideration* |

The User will interact with the Web Client, which will present a Map and Statistics Options. As the User makes changes to the Map and/or chooses a Statistics Option, the Web Client will communicate with the Statistics Server to get updated Statistical Data for the selected Map. The Web Client will then redraw the Map to include Statistical Data based on the User’s selections. The Map Service will provide Map Data. The Statistics Sources will provide Statistics Data.

# Functional Requirements

## User Stories

This section will presents the User Stories that were gathered from interview with the Customer. These stories represent the functional and behavioral features and requirements from the Customer’s perspective.

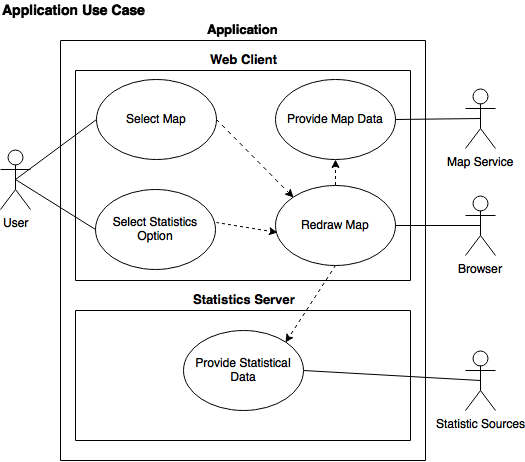
### *Table 5 - User Stories (Customer Requirements)*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **ID** | **As a** | **I want to** | **So that I can** | **Acceptance Criteria** |
| US-1 | User | Compare statistics (such as crime, schools, etc) on a map | Determine the place I would like to live, retire, or work | * Must run in Chrome, * Must run in Firefox * Must run in Edge * Must contain no more than 5 inputs to fetch data * Must include commute and crime as statistics options * Should include other statistics options (such as income, affordability, etc) |
| US-2 | User | Select area on an interactive map | Limit the Map (to the area I am interested in) | * Must be able to drag map via mouse or touch screen to view new areas * Must be able to click on markers to display details of the metric * Should also support entering a zip code, city, or state to select a map area * Must render the map to match the selected area * Must apply any selected statistics option to the new Map and update the statistic visualization (see US-3) |
| US-3 | User | Select a statistic | See a gradient style, heat-map, data visualization of the statistic overlaid on the current map that represents a ranking of the statistic as it applies to areas of the map | * Must be able to select one statistics option at a time from a list of options * Must support the ability to clear/remove the selected option * Must displays a heatmap style gradient from green (Best) to red (worst) over the selected Map for the selected statistics option * Selected Map must persist and can only be changed by the User * Must provide a key to indicate best-worst values for the area (and should provide other important details about the area and or statistic) * Statistics must be fetched in real time from publicly available data sources via API calls * Must use more than 1 data source * Must support Maryland (which will be the default map view) |
| US-4 | User | Switch from one statistic to another | So I can see how the statistic(s) compare for the current map | * Must replace the existing heatmap overlay (for previous statistics option) with a heatmap representing the newly selected option * Must apply the updated visualization over the currently selected Map |

## Use Cases

The Use Case Diagram (***Diagram 2***) was derived from the Customer supplied User Stories and the subsequent requirements analysis. It Is a more detailed view of the Application depicted in ***Diagram 1*** and highlights the specific Use Cases that the User and other Actors will perform on the Application.

### *Diagram 2 - Application Use Case Diagram*

[](https://www.draw.io/#G1CbxdfRkKvO7GuHhGZwr6bRa5-ox5EAZN)

The Application contains five key Use Cases (***Table 6***) and will be presented as Use Case Specification format that identifies the Actors, Components, expected inputs & outputs, and other attributes that detail the expected behavior from the System and Application to support the features/requirements.

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### *Table 6 - Five Use Cases*

|  |  |  |  |
| --- | --- | --- | --- |
| **ID** | **Use Case** | **Actor** | **Component** |
| UC-1 | Select Map | User | Web Client |
| UC-2 | Select Statistics Option | User | Web Client |
| UC-3 | Provide Map Data | Map Service | Web Client |
| UC-4 | Provide Statistical Data | Statistic Sources | Statistics Server |
| UC-5 | Redraw Map | Browser | Web Client |

## Use Case Specifications

### Use Case 1 - Select Map

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|  |  |
| --- | --- |
| **Use Case Name** | Select Map |
| **Use Case ID** | UC-1 |
| **Trigger** | The user selects an area of the Map |
| **Precondition** | A Map is presented to the user in a web browser that allows input via interactive mechanisms (mouse or touchscreen) and/or keyboard. |
| **Basic Path** | 1. The User selects an area of the Map 2. The Map Service provides Map Data for the selected Map 3. The Statistics Server provides Statistical Data for the selected Statistics Option and selected Map 4. The Web Client will refresh the displayed Map, if needed 5. The Web Client will overlay a heatmap visualization of the Statistic over the displayed Map 6. The Web Client will display a Legend/Info area of the display to define the meaning of min/max values, and other pertinent details about the area and the Statistic |
| **Alternative Paths** | In step 1, the User can select the Map one of two ways:  1a. The User uses interactive mechanisms supported by the browser such as a mouse or touch screen.  or  1b. The User enters a zip code or city/state into a text box to define the Map area of interest |
| **Postcondition** | The displayed Map is updated to reflect the selected Map and a visualization of the selected Statistics Option and an updated Key/Legend |
| **Other** | * The selected Statistics Option will persist as the user selects different Map * Maryland will be the default Map and the Statistics Options must work for Maryland. Other states are a bonus |

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### Use Case 2 - Select Statistics Option

|  |  |
| --- | --- |
| **Use Case Name** | Select Statistics Option |
| **Use Case ID** | UC-2 |
| **Trigger** | The User selects a Statistic from the Statistics Options list |
| **Precondition** | A Map is presented to the user in a web browser that allow input via interactive mechanisms (mouse or touchscreen) and/or keyboard. Additionally, a list of Statistics Options will be presented to the user |
| **Basic Path** | 1. The user selects a Statistics Option from the list 2. The Statistics Server will provide Statistical Data for the selected Statistics Option and selected Map 3. The Web Client will refresh the displayed Map, if needed 4. The Web Client will overlay a heatmap visualization of the Statistical Data over the displayed Map 5. The Web Client will display a Legend/Info area of the display to define the meaning of min/max values, and other pertinent details about the area and the Statistic |
| **Alternative Paths** | 1. The user clears or de-selects the Statistics Option 2. The Web Client will clear the Statistical Data 3. The Web Client will update the displayed Map to remove any existing heatmap visualization 4. The System will clear the Legend/Info and indicate no Statistical Data is selected |
| **Postcondition** | The displayed Map reflects the selected Map and a visualization of the selected Statistics Option (or cleared if none) and an updated Key/Legend |
| **Other** | The selected Map will persist as the user selects different Statistics Options |

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### Use Case 3 - Provide Map Data

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|  |  |
| --- | --- |
| **Use Case Name** | Provide Map Data |
| **Use Case ID** | UC-3 |
| **Trigger** | The Map is changed or at startup |
| **Precondition** | A Map is selected (by user or by default) |
| **Basic Path** | 1. The Web Client passes the selected Map to the Map Service 2. The Map Service returns Map Data for the selected Map |
| **Alternative Paths** | None |
| **Postcondition** | The returned Map Data corresponds to the selected Map |
| **Other** |  |

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### Use Case 4 - Provide Statistical Data

|  |  |
| --- | --- |
| **Use Case Name** | Provide Statistical Data |
| **Use Case ID** | UC4 |
| **Trigger** | The selected Statistics Option changes or at startup |
| **Precondition** | A Map is selected (by user or by default) |
| **Basic Path** | 1. The Web Client will pass the selected Statistics Option and the Map Data to the Statistics Service 2. The Statistics Server will provide Statistical Data for the selected Statistics Option and selected Map |
| **Alternative Paths** | If there is no selected Statistics Option, the Statistical Data will be cleared |
| **Postcondition** | The returned Statistical Data will represent the selected Statistics Option for the selected Map |
| **Other** |  |

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### Use Case 5 - Redraw Map

|  |  |
| --- | --- |
| **Use Case Name** | Redraw Map |
| **Use Case ID** | UC-5 |
| **Trigger** | AT startup (with default settings), or the selected Map changes, or the selected Statistics Option changes |
| **Precondition** | A Map is selected (by user or by default) |
| **Basic Path** | 1. The Map Service provides Map Data for the selected Map 2. The Statistics Server will provide Statistical Data for the selected Statistics Option and selected Map 3. The Web Client will refresh the Map, if needed 4. The Web Client will overlay a heatmap visualization of the Statistical Data over the displayed Map 5. The Web Client will display a Legend/Info area of the display to define the meaning of min/max values, and other pertinent details about the area and the Statistical Data |
| **Alternative Paths** | None |
| **Postcondition** | The displayed Map is updated to reflect the selected Map and a visualization of the selected Statistics Option, and an updated Key/Legend |
| **Other** |  |

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# Non-Functional Requirements

## External Interface requirements

The Application will access two sets of external services:

1. Google Map Service
2. External Statistical Data Sources

Google Map Service provides a robust set of APIs and will be used to get Map Data for a selected Map and will also be used to update the Map visually with the statistical heatmap.

There are a number of External Statistical Data Sources that provide API integration. The exact set of sources used will be selected as part of the design and implementation phases as the team evaluates the source for their ability to provide the necessary Statistical Data. See Appendix for list of Statistical Sources.

## Internal interface requirements

The Application will follow a Client Server architecture with a Web Client component allowing the User to interact with the Application to make Map and Statistic selections. There will be a separate Statistics Server that the Web Client will interface with. The Server will encapsulate all the external Statistical Data sources (See 4.1) and provide access to this data in a normalized and consistent fashion. It is expected that the various Statistical Data sources will all behave and handle data differently. The main purpose of the Server is to hide this complexity from the Web Client. The actual specifications for the Server API will be made during the design phase, but here is a high level view of a possible interface:

### *Table 7 - Server Interface*

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Input or Output** | **Description** |
| **Map Data** | Input | Defines the Map to get Statistical Data for |
| **Statistics Option** | Input | Defines the Statistic to return Statistical Data for |
| **Statistical Data** | Output | Returns Statistical Data for the supplies Map Data and Statistics Option. This data that will be used to create the visual heatmap and provide other data points that can be shared on the Map and Key/Legend |

Parameters will most likely be XML based so that the interface can stay consistent while additional features are added the the server.

## Internal data requirements

The Application will not persist any data after a user session ends. However, during the user session there will be some key data elements that will be stored in memory and should persist there until the session ends. The actual data entities will be determined during the design and implementation phases, but here is a high level view of possible entities:

### *Table 8 - Data Entities*

|  |  |  |
| --- | --- | --- |
| **Data Entity** | **Input or Output** | **Description** |
| **Map** | Input | Represents the selected Map. It will be updated by the user when they select a Map, or it be defined by default at Application startup |
| **Map Data** |  | Represents detailed data for the selected Map and will be provided by the Map Service. This data will be used as input into the Statistics Server |
| **Statistics Option** | Input | Represents the selected Statistics Option which will be selected by the User from a list of Options that correspond to the available external data Statistical Data sources. No Statistics Option selected is a valid state, as it would represent that no Statistic overlay is desired. |
| **Statistical Data** | Output | Represents detailed, normalized, aggregated, Statistical Data that is returned from the Statistics Server. This data will be used to create the heatmap visualization of the selected Statistics Option and will also contain other data contextual data for the selected Map and Statistics Option, such as min/max, and actual data values for the Statistic. |

## Security and privacy requirements

The Application will not ask for, nor store, any personal identifying information (PII) nor any non-public information (NPI) for the user. However, as the application evolves, such data could be introduced. So, good security coding practices will be used and proper security measures will be put in place to reduce the likelihood of a security breach or data privacy issue.

## Design and implementation constraints

The team will have to research and find usable, external Statistical Data sources that will provide the data in a usable form. If such free and publicly available sources are not found, or are not useful, the team can, and will as a last resort, create their own data sources to demonstrate the applications capabilities. These data sources would be encapsulated in the Statistics Server and would be replaced when real, useful sources are found.

## Other requirements

Here are a list of other requirements that should guide design and implementation:

* The Application should provide a simple, minimalistic and intuitive interface for the user
* The Web Client should allow the user to select and manipulate the Map via interactive methods (mouse and touchscreen) and direct input of a zip code, or city, or state.
* The heatmap visualization of the Statistical Data should be a gradient that ranges from Green (best value) to Red (worst value)
* Multiple external data sources should be used and the use of a team supplied data source should only be used as a last resort
* The Statistics Options must include Crime and School Ranking. The options should include others such as Commute, affordability, if there is time and these statistics are available. The Team will use their discretion to select additional statistics presented.
* During a User’s session, their selections must persist at all times. Only they can change the Map or the selected Statistic Option

# 

# Appendix

### *Table 9 - Potential Statistical Data Sources*

|  |  |
| --- | --- |
| **Data.gov** | <http://docs.ckan.org/en/latest/api/index.html>  <https://catalog.data.gov/dataset?q=-aapi+api+OR++res_format%3Aapi#topic=developers_navigation> |
| **Data.gov for Maryland** | <https://catalog.data.gov/dataset?sort=views_recent+desc&q=-aapi+api+OR++res_format%3Aapi&publisher=data.maryland.gov&_publisher_limit=0> |
| **Maryland Transportation** | <https://data.maryland.gov/api/views/ief7-i74z/rows.json?accessType=DOWNLOAD> |
| **Census.gov** | <https://www.census.gov/data/developers/data-sets.html>  <https://www.census.gov/data/developers/guidance/api-user-guide.html> |
| **USA.gov** | https://www.usa.gov/developer?source=busa#item-211492 |

### *Table 10 - Google Maps API*

|  |  |
| --- | --- |
| **Google Maps API** | <https://developers.google.com/maps/get-started/> |
| **Visualizing data example** | <https://developers.google.com/maps/documentation/javascript/earthquakes> |
| **Heatmaps example** | <https://developers.google.com/maps/documentation/javascript/earthquakes#heatmaps> |