CMSC 447

Software Design Description (SDD)

# Scope

This section shall be divided into the following paragraphs.

## Identification

The following document applies to the Code Fury website version 1.0 This paragraph shall contain a full identification of the system and the software to which this document applies, including, as applicable, identification number(s), title(s), abbreviation(s), version number(s), and release number(s). [COMPLETE]

## System overview

This paragraph shall briefly state the purpose of the system and the software to which this document applies. It shall describe the general nature of the system and software; summarize the history of system development, operation, and maintenance; identify the project sponsor, acquirer, user, developer, and support agencies; identify current and planned operating sites; and list other relevant documents. [COMPLETE]

This webpage aims to provide information about areas to move to within the United States consistent with specified criteria. Each specified criteria will appear as a search option on a webpage and will be used by a user to narrow down results for a new location to move to. Locations fitting the criteria of the search will be displayed on a map as points.

## Document overview

The purpose of this document is to outline and describe system-wide design decisions, including architectural design, behavioral constraints, and the components necessary for implementation. Additionally, supplemental information about interface design and database configuration will be provided.

# Referenced documents

This section shall list the number, title, revision, and date of all documents referenced in this document. This section shall also identify the source for all documents not available through normal Government stocking activities. [COMPLETE]

* Software Requirements Specification (SRS)

# CSCI-wide design decisions

The following is an itemization of legal inputs and their respective outputs. Handling of illegal input combinations are also described. Each input is associated with a unique interface component id. These components are described in detail in the interface design section of this document.

* Input: Public school slider switched to on position. Output: Results of search query filtered on all schooling levels selected and any other selected criteria displayed as pins on the map display. In the case that the slider is switched to the on position and no schooling level is selected, an error message will displayed asking the user to select a schooling level. Additionally, the slider’s position will be displayed in the active options bar above the map display.
* Input: Schooling level boxes checked. Note: There are three schooling level options, namely elementary, middle, and high. Output: Results of the search query filtered on all schooling levels selected and any other selected criteria displayed as pins on the map display. In the case that any of the schooling level boxes are checked and the public schools slider is switched to the off position, an error message will be displayed asking the user to switch the public school slider to the “on” position. Additionally, the status of the schooling level boxes will be displayed in the active options bar above the map display.
* Input: Public transportation slider switched to the on position. Output: Results of the search query filtered on public transportation accessibility threshold and any other selected criteria displayed as pins on the map display. In the case that the slider is switched to the on position and the public transportation accessibility threshold is set to 0, an error message will be displayed asking the user to set the threshold to a nonzero value. Additionally, the slider’s position will be displayed in the active options bar above the map display.
* Input: Transportation accessibility threshold set to a nonzero value. Note: The threshold can be set to any value between 0 and 100. Output: Results of the search query filtered on threshold value selected and any other selected criteria displayed as pins on the maps display. In the case that the threshold is set to a nonzero value and the public transportation slider is in the off position, an error message will be displayed asking the user to switch the public transportation slider to the on position. Additionally, the threshold value will be displayed in the active options bar above the map display.
* Input: Crime slider switched to on position. Output: Results of search query filtered on crime threshold and any other selected criteria displayed as pins on the map display. In the case that the slider is switched to the on position and the crime threshold is set to 0, an error message will displayed asking the user to set the threshold value to a nonzero value. Additionally, the slider’s position will be displayed in the active options bar above the map display.
* Input: Crime threshold set to a nonzero value. Note: The threshold can be set to any value between 0 and 100. Output: Results of the search query filtered on threshold value selected and any other selected criteria displayed as pins on the maps display. In the case that the threshold is set to a nonzero value and the crime slider is in the off position, an error message will be displayed asking the user to switch the crime slider to the on position. Additionally, the threshold value will be displayed in the active options bar above the map display.
* Input: Outdoor recreation slider switched to on position. Output: Results of search query filtered on all activities selected and any other selected criteria displayed as pins on the map display. In the case that the slider is switched to the on position and no activities are selected, an error message will displayed asking the user to select an activity. Additionally, the slider’s position will be displayed in the active options bar above the map display.
* Input: Outdoor activity boxes checked. Note: There are five activity options, namely hiking, climbing, camping, fishing, and wilderness. Output: Results of the search query filtered on all activities selected and any other selected criteria displayed as pins on the map display. In the case that any of the activity boxes are checked and the outdoor recreation slider is switched to the off position, an error message will be displayed asking the user to switch the outdoor recreation slider to the on position. Additionally, the status of the activity boxes will be displayed in the active options bar above the map display.
* Climate slider switched to on position. Output: Results of search query filtered on minimum/maximum temperature values, average precipitation value, and any other selected criteria displayed as pins on the map display. In the case that the slider is switched to the on position and no minimum/maximum temperature value or average precipitation value is set, an error message will displayed asking the user to set these values. Additionally, the slider’s position will be displayed in the active options bar above the map display.
* Minimum/maximum temperature value set. Note: Possible temperature values are in the range [20, 90] for minimum temperatures and [5, 70] for maximum temperatures. In the case that the set values fall outside of this range or the set values are contradictory, an error message will be displayed asking the user to give legal values. Output: Results of the search query filtered minimum/maximum temperature values, average precipitation value, and any other selected criteria displayed as pins on the map display. In the case that the minimum/maximum temperature values are set and the climate slider is switched to the off position or the average precipitation value is not set, an error message will be displayed asking the user to switch the climate slider to the on position or set the average precipitation value. Additionally, the set temperature values will be displayed in the active options bar above the map display.
* Average precipitation value set. Note: Possible precipitation values are in the range 5” to 200”. In the case that the set value falls outside of this range, an error message will be displayed asking the user to give a legal value. Output: Results of the search query filtered average precipitation value, minimum/maximum temperature values, and any other selected criteria displayed as pins on the map display. In the case that the average precipitation value is set and the climate slider is switched to the off position or the minimum/maximum temperature values are not set, an error message will be displayed asking the user to switch the climate slider to the on position or set the minimum/maximum temperature values. Additionally, the set precipitation value will be displayed in the active options bar above the map display.
* Input: Health care slider switched to on position. Output: Results of search query filtered on quality health care availability and any other selected criteria displayed as pins on the map display. Additionally, the slider’s position will be displayed in the active options bar above the map display.
* Input: Employment distance slider switched to on position. Output: Results of search query filtered on commute time threshold value and any other selected criteria displayed as pins on the map display. In the case that the slider is switched to the on position and no commute time threshold value is set, an error message will displayed asking the user to select a threshold value. Additionally, the slider’s position will be displayed in the active options bar above the map display.
* Input: Commute time threshold set to a nonzero value. Note: The threshold can be set to any value between [0 minutes, 60 minutes] Output: Results of the search query filtered on threshold value selected and any other selected criteria displayed as pins on the maps display. In the case that the threshold is set to a nonzero value and the employment distance slider is in the off position, an error message will be displayed asking the user to switch the public employment distance slider to the on position. Additionally, the threshold value will be displayed in the active options bar above the map display.
* Input: Zoom between country, state, and county level. Output: Map display will switch to state level if zooming in from country level or county level if zooming in from state level. Conversely, map display will switch to state level if zooming out from county level or country level if zooming out from state level. If the user attempts to zoom out from country level or zoom in from county level, nothing will happen.

# CSCI architectural design

## CSCI components

The following is an itemization of all software components. A short description of each component is given along with a unique component id. If a component is assigned an id elsewhere, that id will be used in this section as well. Ids for interface components begin with an I, while ids for database and API components begin with D and A respectively. Additionally, ids for routine and language components will begin with R.

* (I1) The map display. This is where the search results are displayed. More specifically, locations that match the search criteria are overlaid with pins. Hovering over these pins will give specific values for search criteria.
* (I2) The active options bar. This component is located above the map display. It lists the filters that are currently selected. If the space required to display the filters exceeds the space available in the activity options bar, the filters will scroll from right to left when the user hovers their mouse over the bar.
* (I3) The state bar. This component is located above the map display to the right of the activity options bar. If the user is zoomed in to the state or county level, the name of the state (or state that contains the county) will be displayed here. Otherwise, the bar will be empty.
* (I4) The side menu button. This component is located above the map display to the left of the activity options bar. When pressed the options menu will slide out to the left of the map display. If the options menu is open and the button is pressed, the menu will disappear.
* (I5) The options menu. This component is a container for the search filters described in the interface design section of this document.
* (I6) The public schools slider. This component controls filtering by public school availability.
* (I7) The school level boxes. These components allow the user to narrow the search by school level. There are three possible school levels, namely elementary, middle, and high.
* (I8) The public transportation slider. This component controls filtering by public transportation availability.
* (I9) The transportation accessibility value slider. This component allows the user to narrow the search by setting a transportation accessibility threshold value. Legal values range from 0 to 100. More information about these values can be found in the detailed design section of this document.
* (I10) The crime slider. This component controls filtering by crime rate.
* (I11) The crime rate value slider. This component is used to set the crime rate threshold value. Legal values range from 0 to 100. More information about these values can be found in the detailed design section of this document.
* (I12) The outdoor recreation slider. This component controls filtering by outdoor recreation availability.
* (I13) The activity boxes. These components allow the user to narrow the search by the availability of activities. There are five possible activities to filter by, namely hiking, climbing, camping, fishing, and wilderness.
* (I14) The climate slider. This component controls filtering by climate conditions.
* (I15) The minimum/maximum temperature value boxes. This component allows the user to narrow the search by setting minimum and maximum temperature values. The range of legal maximum temperature values is 20°F to 90°F. The range of legal minimum temperature values is 5°F to 70°F. More information about these values can be found in the detailed design section of this document.
* (I16) The average precipitation value slider. This component allows the user to narrow the search by setting an average precipitation value. The range of legal precipitation values is 5” to 200”. More information about these values can be found in the detailed design section of this document.
* (I17) The health care slider. This component controls filtering by the availability of quality health care.
* (I18) The employment distance slider. This component controls filtering by employment distance.
* (I19) The commute time value slider. This component allows the user to narrow the search by setting a commute time threshold value. The range of legal commute time values is zero minutes to 60 minutes. More information about these values can be found in the detailed design section of this document.
* (D1) The RIDB recreation database. The RIDB recreation database contains information about recreation centers and their respective zip codes. This database is used for filtering on availability of outdoor recreation activities.
* (D2) The NOAA weather database. The NOAA weather database contains information about climate conditions in various areas of the country. This database is used for filtering on climate conditions.
* (A1) The datausa.io API. The datausa.io API will be used to retrieve information for filtering on public school availability, public transportation accessibility, employment distance, crime rate, and health care availability.
* (A2) The Google Maps API. The Google Maps API will be used to construct the map display.
* (R1) Interface will submit a JSON request, with scope (either state or county, as well as a latitude and longitude for the center of the map, plus a bounds tuple (discussed further in (R3)) and search criteria (associative array of active items to search with specific criteria of each search, as appropriate)
* (R2) Controller file will receive request, parse, and call scope model to retrieve array of desired ids to query against. After scope is defined relevant models to execute desired searches will be called.
* (R3) Scope model will retrieve a single string parameter, either “state” or “county” as well as a latitude and longitude (representing the center of a search), and a bounds tuple which will be the +x, +y from that center to reach the maximum latitude and longitude currently displayed.
* (R4) Datausa model will handle all requests for items from (A1). The scope will be sent to the model, after a search is executed for all items in scope, any entries that are not matches will be unset from the scope array. This pruned array will be returned for any further processing.
* (R5) Climate and Recreation Model will handle requests for climate and outdoor recreation data. This will be called after the datausa model is given a chance to be called and reduce the scope of the search. A final scope array will be returned to the controller for final parsing.
* (R6) The controller will call the scope model again, to convert the final pruned scope array into latitude and longitude points. These points are then returned to the interface.
* (R7) The interface will receive a response in the form of a JSON array of latitude and longitude points, which will be used to drop google map API pins onto the map, representing matches.

## Concept of execution

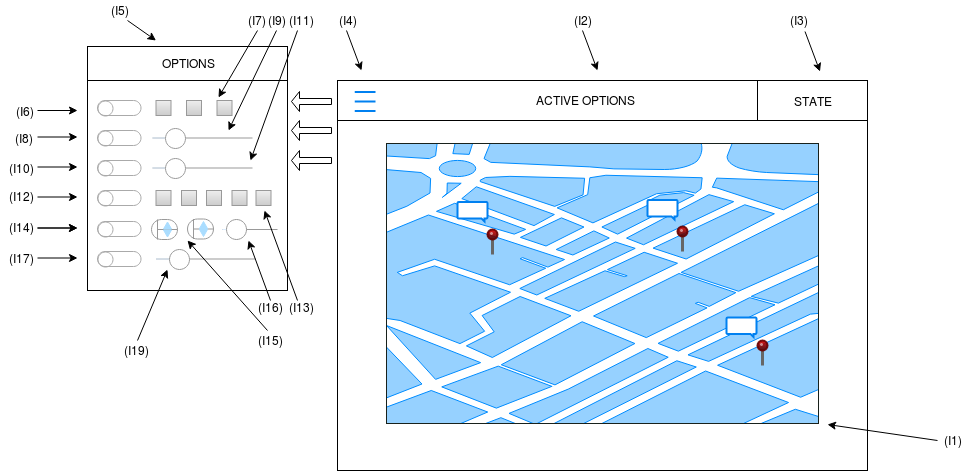
The following is a description of how the software components detailed in the section above will interact with each other. First, the user will activate search filters according to their needs. The states of these search filters will be used to construct a query to the relevant databases and/or generate a list of necessary API calls. Once the data has been retrieved, matching locations on the map display will be overlaid with pins.

## Interface design

The following is an itemization of interface components and detailed descriptions of their respective behavior. The expected outputs of each component are given in the system-design section. Hence, they have been omitted from this section.

* The on/off sliders. When pressed an on/off slider will move to whatever position it is not currently in. That is, if it is in the off position, pressing it will move it to the on position and vice versa. Search results will then be filtered by whatever sliders are in the on position at the time of searching.
* The scale sliders. Scale sliders are used to narrow the search to within a threshold value. The user will drag the slider to the desired value.
* The check boxes. Check boxes are used to narrow the search to locations with selected criteria. Pressing a check box will turn on filtering by the respective criterion. Pressing it again will turn it off.
* The value boxes. Value boxes allow the user to enter a threshold value. Subsequently, the search will be filtered by the value. The user may enter the value themselves or use the increment and decrement arrows.
* The side menu button. When the side menu button is pressed, the options menu will be revealed. If it is pressed again the side options menu will be hidden.
* Zooming. Zooming between country, state, and county level will be controlled by the mouse wheel.

The following is a diagram of interface components and their layout.



# CSCI detailed design

## Value range descriptions and database sources

## The following is a itemization of interface requirements that allow for input within a specific range and those ranges.

* (I8) Public transportation accessibility. The range of acceptable values for this component is [0, 100]. These values correspond to WalkScore’s rating.
* (I11) Crime rate threshold value. The range of acceptable values for this component is [0, 100]. This value is taken to be violent crime as defined by the FBI normalized on a scale of 0 to 100, with 0 being the safest and 100 being the most dangerous.
* (I15) Minimum/maximum temperature values. The range of acceptable values for this component is [20,90] and [5, 70]. The values are taken to be in degrees Fahrenheit.
* (I16) Average precipitation value. The range of acceptable values for this component is [5, 200]. This value is taken to be inches of precipitation in one year.
* (I19) Commute time threshold value. The range of acceptable values for this component is [0,60]. This value is taken to be minutes per commute.

The following is a list of sources for the databases used.

* RIDB Recreation Data: <https://ridb.recreation.gov/>
* NOAA Climate Data: <https://catalog.data.gov/dataset/u-s-daily-climate-normals-1981-2010>
* DataUSA <https://datausa.io/>

# Requirements traceability

# The following is a record of the CSCI requirements and their associated software units as identified above; in addition, some traceability is included retroactively in 4.1.

1. Traceability from each software unit identified in this SDD to the CSCI requirements allocated to it. (Alternatively, this traceability may be provided in [4.1.)](#_26in1rg)
2. Traceability from each CSCI requirement to the software units to which it is allocated. [COMPLETE]
3. The following CSCI requirements are expanded on in Section 4.1 above, and refer to their corresponding requirements within the Software Requirements Specification (SRS).

* (I1) Map display; SRS 2.1.3
* (I2) Active Options Bar; SRS 2.1.1.4 - 2.1.1.10
* (I3) State Bar; 4.1
* (I4) Side Menu Button; 4.1
* (I5) Options Menu; 4.1
* (I6) Public Schools Slider; SRS 2.1.1.4
* (I8) Public Transportation Slider; SRS 2.1.1.5
* (I9) Transportation Accessibility Value; 4.1
* (I10) Crime Slider; SRS 2.1.1.6
* (I11) Crime Rate Value Slider; 4.1
* (I12) Outdoor Recreation Slider; SRS 2.1.1.7
* (I13) Activity Boxes; 4.1
* (I14) Climate Slider; SRS 2.1.1.8
* (I15) Minimum/Maximum Temperature Value Boxes; 4.1
* (I16) Average Precipitation Value Slider; 4.1
* (I17) Health Care Slider; SRS 2.1.1.9
* (I18) Employment Distance Slider; 4.1
* (I19) Commute Time Value Slider; SRS 2.1.1.10
* (D1) RIDB Recreation Database; 4.1, 5.1
* (D2) The NOAA Weather Database; 4.1, 5.1
* (A1) datausa.io API; 4.1
* (A2) Google Maps API; 4.1
* (R1) MySQL; 4.1
* (R2) Controller File; 4.1
* (R3) JSON data structures; 4.1

# Notes

I am leaving this section for later use.