# System and Software Architecture Description (SSAD)

**GEOCODE Data Reader**

**Team 10**

<table>
<thead>
<tr>
<th>Name</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anamarie Ha</td>
<td>Software Architect / UML Modeler</td>
</tr>
<tr>
<td>Ashi Ranka</td>
<td>Feasibility Analyst / Prototyper</td>
</tr>
<tr>
<td>Damini Cousik</td>
<td>Implementer / Quality Focal Point</td>
</tr>
<tr>
<td>Karthik Kenkere</td>
<td>Software Architect / Implementer</td>
</tr>
<tr>
<td>Pawandeep Gill</td>
<td>Requirements Engineer / Prototyper</td>
</tr>
<tr>
<td>Sriramkumar Thamizharasan</td>
<td>Implementer / Project Manager</td>
</tr>
<tr>
<td>Suchetha I Bhat</td>
<td>Project Manager / Operational Concept</td>
</tr>
<tr>
<td>Vidhubala Selvaraj</td>
<td>Operations Engineer / Feasibility Analyst</td>
</tr>
</tbody>
</table>

11/20/20
# Version History

<table>
<thead>
<tr>
<th>Date</th>
<th>Author</th>
<th>Version</th>
<th>Changes made</th>
<th>Rationale</th>
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<tr>
<td>10/11/20</td>
<td>Anamarie Ha</td>
<td>1.0</td>
<td>First draft of SSAD</td>
<td>Initial draft of SSAD, before peer-review by team.</td>
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<tr>
<td>10/13/20</td>
<td>A.H.</td>
<td>1.1</td>
<td>Changed wording surround export features</td>
<td>Changes made after peer reviewed by Operations Engineer / Feasibility Analyst - Vidhubala Selvaraj</td>
</tr>
<tr>
<td>10/15/20</td>
<td>A.H.</td>
<td>1.2</td>
<td>Added Robust Diagram</td>
<td>Changes made after peer reviewed by Implementer - Sriramkumar Thamizharasan</td>
</tr>
<tr>
<td>10/21/20</td>
<td>A.H.</td>
<td>2.0</td>
<td>Added UC and ARTF numbers and related to other portions of documents</td>
<td>Feedback by professor and T.A. during ARB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Added Sign Up into Use Case diagram</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Added rationale to why certain portions are left out.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Updated table of contents.</td>
<td></td>
</tr>
<tr>
<td>10/22/20</td>
<td>A.H.</td>
<td>2.1</td>
<td>Changed Search by Map to Map visualization to more accurately reflect functionality</td>
<td>Changes after feedback by Program Manager - Suchetha I Bhat and Feasibility Analyst – Ashi Ranka</td>
</tr>
<tr>
<td>11/20/20</td>
<td>A.H.</td>
<td>3.0</td>
<td>Modify use case diagram to show guest user/registered user have different access</td>
<td>Modification after feedback from ARB package comments</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Removed “Register, Login, Search” from Artifacts</td>
<td>Added Phase 2 features</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Specify action required in tables 4 &amp; 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Removed Modes of Operation</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Modified Deployment Diagram to show what gets deployed where</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Removed Robustness diagrams</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Added Bulk Upload, Contact Us</td>
<td></td>
</tr>
<tr>
<td>11/24/20</td>
<td>A.H.</td>
<td>3.1</td>
<td>Modified deployment diagram</td>
<td>After consulting with Sriramkumar Thamizharasan</td>
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1. Introduction

1.1 Purpose of the SSAD

Objective of the document is to outline and explain the rationale behind our project’s system and software architecture. We will explore the intended users and how we designed our product to suit each of their specific needs, as well as an in-depth architectural design and proposed implementation strategy for our technology.

1.2 Status of the SSAD

This is the final iteration of the SSAD, it reflects all use case, artifacts, and components we are using within the scope of our project. It contains both Phase 1 and 2 of our project.
2. **System Analysis**

2.1 **System Analysis Overview**

The GEOCODE’s purpose was to unite all academic institutions across the globe under one unified index to simplify the data exchange process for institutions around the world. However, the current web interface lacked complexity and data visualization capabilities. Therefore, our team aims to build another system to house GEOCODE database with added user profile functionalities, data management capabilities through the web interface, better data visualization for all users, and a more accurate search result.

2.1.1 **System Context**

![System Context Diagram]

*Figure 1: System Context Diagram*
### Table 1: Actors Summary

<table>
<thead>
<tr>
<th>Actor</th>
<th>Description</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admin</td>
<td>Manages GEOCODE database through the web interface.</td>
<td>• Manage database records: add, remove records</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Approve suggestions by the user</td>
</tr>
<tr>
<td>User</td>
<td>Any user of the web interface.</td>
<td>• Search for GEOCODE of institutions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Can sign up to suggest new or suggest an edit to existing institutions</td>
</tr>
<tr>
<td>Maintainer</td>
<td>Fix problems that arise after deployment</td>
<td>• Maintain the web interface and database back-end</td>
</tr>
</tbody>
</table>
2.1.2 Artifacts & Information

![Diagram of Artifacts and Information]

**Figure 2: Artifacts and Information Diagram**

**Table 2: Artifacts and Information Summary**

<table>
<thead>
<tr>
<th>Artifact</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTF-01 Map</td>
<td>This artifact visualizes institutions on a map.</td>
</tr>
<tr>
<td>ARTF-02 Export</td>
<td>Create a downloadable JSON/CSV file of search results.</td>
</tr>
<tr>
<td>ARTF-03 Suggestion Form</td>
<td>Allows registered users to submit a suggestion to add another institution into the database or changes to an existing institution.</td>
</tr>
<tr>
<td>ARTF-04 Suggestion</td>
<td>Stores all information of a suggestion.</td>
</tr>
<tr>
<td>ARTF-05 Institution</td>
<td>Stores all information of one institution.</td>
</tr>
<tr>
<td>ARTF-06 Add Institution Form</td>
<td>Mechanism for an admin account to add institution(s).</td>
</tr>
<tr>
<td>ARTF-07 Activity</td>
<td>Stores activity information: activity, name of user/admin, time, and date.</td>
</tr>
<tr>
<td>ARTF-08 Activity Log</td>
<td>Log of all activities within the last 30 days.</td>
</tr>
<tr>
<td>ARTF-09 Recovery Bin</td>
<td>Log of all deletes in the last 30 days.</td>
</tr>
<tr>
<td>ARTF-10 Transaction Statistics</td>
<td>Contains statistics of usage.</td>
</tr>
<tr>
<td>ARTF-11 Pending Tasks</td>
<td>Log of all suggestions pending approval from user.</td>
</tr>
<tr>
<td>ARTF-12 User Profile</td>
<td>Contains information about user.</td>
</tr>
<tr>
<td>ARTF-13 Admin Profile</td>
<td>Contains information about admin.</td>
</tr>
<tr>
<td>ARTF-14 Support Email</td>
<td>This artifact contains all information a user fills out in Contact Us capability.</td>
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</table>
2.1.3 Behavior

Figure 3: Process Diagram

2.1.3.1 Search

2.1.3.1.1 Search by Country

Table 3: Process Description – Search by Country

<table>
<thead>
<tr>
<th>Identifier</th>
<th>SR-01 Search by Country</th>
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<tr>
<td>Purpose</td>
<td>User can search for institution(s) by name of the country</td>
</tr>
<tr>
<td>Requirements</td>
<td>• OC-3 Search System</td>
</tr>
<tr>
<td>Development Risks</td>
<td>None</td>
</tr>
<tr>
<td>Pre-conditions</td>
<td>• System database properly initiated</td>
</tr>
</tbody>
</table>
| Post-conditions | • No change to database.  
                   • Search results can be exported. |

Table 4: Typical Course of Action – Search by Keywords

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>User select “Search by Country” in the drop-down menu. Type in Country Name field matches what user entered.</td>
<td>System displays all records where Country Name field matches what user entered.</td>
</tr>
</tbody>
</table>
Table 5: Alternate Course of Action – Search by Keywords: No result

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>User select “Search by Country Name” in the drop-down menu. Type in search bar and click “View”.</td>
<td>System found no fields matching the keywords, pop-up a “Invalid Country” message.</td>
</tr>
</tbody>
</table>

Table 6: Exceptional Course of Action – Search by Keywords: Empty Search

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>User select “Search by Country” and type nothing in a search box, then click “View”.</td>
<td>System pop-up “Empty search field. Please enter a value to search.”</td>
</tr>
</tbody>
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2.1.3.1.2 Search by Institution Name

Table 7: Process Description – Search by Institution Name

<table>
<thead>
<tr>
<th>Identifier</th>
<th>SR-02 Search by Institution Name</th>
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<tr>
<td>Purpose</td>
<td>User can search for institution(s) by name of the institution</td>
</tr>
<tr>
<td>Requirements</td>
<td>• OC-3 Search System</td>
</tr>
<tr>
<td>Development Risks</td>
<td>None</td>
</tr>
<tr>
<td>Pre-conditions</td>
<td>• System database properly initiated</td>
</tr>
</tbody>
</table>
| Post-conditions    | • No change to database.  
|                    | • Search results can be exported. |

Table 8: Typical Course of Action – Search by Keywords

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>User select “Search by Institution Name” in the drop-down menu. Type in search bar and click “View”.</td>
<td>System displays all records where Institution Name field matches what user typed.</td>
</tr>
</tbody>
</table>
Table 9: Alternate Course of Action – Search by Keywords: No result

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>User select “Search by Institution Name” in the drop-down menu. Type in search bar and click “View”.</td>
<td>System found no fields matching the keywords, pop-up a “No institution found with name:” message.</td>
</tr>
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</table>

Table 10: Exceptional Course of Action – Search by Keywords: Empty Search

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>User select “Search by Institution Name” and type nothing in a search box, then click “View”.</td>
<td>System pop-up “Empty search field. Please enter a value to search.”</td>
</tr>
</tbody>
</table>

2.1.3.1.3 Search Results Filtering

Table 11: Process Description – Search Results Filtering

<table>
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<th>Identifier</th>
<th>Purpose</th>
<th>Requirements</th>
<th>Development Risks</th>
<th>Pre-conditions</th>
<th>Post-conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR-03 Filtering</td>
<td>User can filter search results by typing in the smaller search bar</td>
<td>• OC-3 Search System</td>
<td>None</td>
<td>• System database properly initiated</td>
<td>• No change to database. ● Search results can be exported.</td>
</tr>
</tbody>
</table>

Table 12: Typical Course of Action – Search Results Filtering

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>User search using by Country (SR-01) or Institution Name (SR-02)</td>
<td>System displays all records with associated keywords for user.</td>
</tr>
<tr>
<td>2</td>
<td>User types into a smaller search bar what the user wants to the narrow the results down by.</td>
<td>System displays a smaller list of results corresponding to the filter the user chose.</td>
</tr>
</tbody>
</table>
Alternate Course of Action for Make Suggestion is not applicable.

Table 13: Exceptional Course of Action – Search Results Filtering: No record

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>User search using by Country (SR-01) or Institution Name (SR-02)</td>
<td>System displays all records with associated keywords for user.</td>
</tr>
<tr>
<td>2</td>
<td>User types into a smaller search bar what the user wants to narrow the results down by.</td>
<td>System finds no results after filtering. Result page becomes empty and with the message “No matching records found”</td>
</tr>
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</table>

2.1.3.1.4 Export

Table 14: Process Description – Export

<table>
<thead>
<tr>
<th>Identifier</th>
<th>SR-04 Export</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>User can export search results to JSON/CSV file</td>
</tr>
</tbody>
</table>
| Requirements | • OC-3 Search System  
|            | • OC-4 Interaction with Local File System |
| Development Risks | None |
| Pre-conditions | • System database properly initiated |
| Post-conditions | • A downloadable instance of the user’s current search result |

Table 15: Typical Course of Action - Export

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>User search using by Country (SR-01) or Institution Name (SR-02).</td>
<td>System displays all records with associated search for user.</td>
</tr>
<tr>
<td>2</td>
<td>User clicks “Export”.</td>
<td>System prompts a download of a JSON/CSV file of the search results in the current search.</td>
</tr>
</tbody>
</table>

Table 16: Alternate Course of Action – Export: After Filtering

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>User search using by Country</td>
<td>System displays all records with</td>
</tr>
</tbody>
</table>
### Exceptional Course of Action for Export

is not applicable.

#### 2.1.3.2 Authentication

##### 2.1.3.2.1 Sign Up

| Table 17: Process Description – Sign Up |
| Identifier | AUTH-01 Sign Up |
| Purpose | Allow a guest user to sign up for credentials—to make suggestions. |
| Requirements | • OC-1 User Profile Functions. |
| Development & Risks | • Credential storage encryption. |
| | • Credential in-transit encryption. |
| Pre-conditions | None |
| Post-conditions | • Add user profile and credentials to system |

| Table 18: Typical Course of Action – Sign Up |
| Seq# | Actor’s Action | System’s Response |
| 1 | User clicks “Login” button. | System popups a prompt that asks user for username and password. |
| 2 | User clicks “Sign Up” button. | System redirects to a signup form where user is asked for Name, password, and email address. |
| 3 | User fills out fields. | System checks whether the email address already linked to another profile. |
| 4 | | Sign up success: System sign the user into the profile he/she just created. |
Alternative Course of Action for Sign Up not applicable.

Table 19: Exceptional Course of Action – Sign Up: Email address already used

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>User clicks “Login” button.</td>
<td>System popups a prompt that asks user for username and password.</td>
</tr>
<tr>
<td>2</td>
<td>User clicks “Sign Up” button.</td>
<td>System redirects to a signup form where user is asked for Name, password, and email address.</td>
</tr>
<tr>
<td>3</td>
<td>User fills out fields.</td>
<td>System checks whether the email address already linked to another profile.</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>System founds email address associated to another profile.</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>System returns pop-up message “An account with the given email already exists”</td>
</tr>
</tbody>
</table>

2.1.3.2.2 Login

Table 20: Process Description – Login

<table>
<thead>
<tr>
<th>Identifier</th>
<th>AUTH-02 Login</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>Determine if the person logging into the system is already exists in the system, and their level of authorization.</td>
</tr>
<tr>
<td>Requirements</td>
<td>• OC-1 User Profile Functions.</td>
</tr>
<tr>
<td></td>
<td>• OC-2 Admin Profile Functions.</td>
</tr>
<tr>
<td>Development</td>
<td>• Credential storage encryption.</td>
</tr>
<tr>
<td>Risks</td>
<td>• Credential in-transit encryption.</td>
</tr>
<tr>
<td>Pre-conditions</td>
<td>• User not logged in.</td>
</tr>
<tr>
<td></td>
<td>• User has an existing account, i.e. Signed up (AUTH-01)</td>
</tr>
<tr>
<td>Post-conditions</td>
<td>• User is logged in.</td>
</tr>
</tbody>
</table>

Table 21: Typical Course of Action - Login

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>User clicks “login.”</td>
<td>System popups a prompt that asks user</td>
</tr>
</tbody>
</table>
for username and password.

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>User fills out login information and clocks “Log in”</td>
<td>System sends username and password to authentication module</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Sign in success: System redirects back to where the user left off but now with a suggestion button visible.</td>
</tr>
</tbody>
</table>

**Alternative Course of Action for Login not applicable.**

**Table 22: Exceptional Course of Action – Login: Invalid username/password**

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>User clicks “login.”</td>
<td>System popups a prompt that asks user for username and password.</td>
</tr>
<tr>
<td>2</td>
<td>User fills out login information and clocks “Log in”</td>
<td>System sends username and password to authentication module</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Sign in failed: System popups login prompt again with the message “Invalid username/password, please try again.”</td>
</tr>
</tbody>
</table>

**Table 23: Exceptional Course of Action – Login: Empty username/password**

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>User clicks “login.”</td>
<td>System popups a prompt that asks user for username and password.</td>
</tr>
<tr>
<td>2</td>
<td>User does not fill out login prompt but clicks “Log In”</td>
<td>System popups error message “Please enter username and password.”</td>
</tr>
</tbody>
</table>

**2.1.3.3 Modification of data**

**2.1.3.3.1 Make Suggestion**

**Table 24: Process Description – Make Suggestion**

<table>
<thead>
<tr>
<th>Identifier</th>
<th>DATA-01 Suggest New</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>Allow a registered user to suggest for a change in the database.</td>
</tr>
<tr>
<td>Requirements</td>
<td>• OC-1 User Profile Functions.</td>
</tr>
<tr>
<td>Development Risks</td>
<td>None</td>
</tr>
<tr>
<td>Pre-conditions</td>
<td>• User must be logged in</td>
</tr>
<tr>
<td>Post-conditions</td>
<td>• Suggestion can be viewed on Suggestions portal for</td>
</tr>
</tbody>
</table>
admins to approve/reject
  • Action recorded in Activity Log

Table 25: Typical Course of Action – Make Suggestion

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>User logs in with their credentials (AUTH-02).</td>
<td>System redirects user to user home page.</td>
</tr>
<tr>
<td>2</td>
<td>User clicks “Suggest Addition” button.</td>
<td>System redirects user to the suggestion form, where user must fill out mandatory fields: institution name, country, and state/province.</td>
</tr>
<tr>
<td>3</td>
<td>User fills out the form and click “Submit Details.”</td>
<td>System sends suggestion to Suggestion Portal where admins can approve or reject suggestions.</td>
</tr>
</tbody>
</table>

Table 26: Alternate Course of Action – Make Suggestion: Edit

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>User logs in with their credentials (AUTH-02).</td>
<td>System redirects user to user home page.</td>
</tr>
<tr>
<td>2</td>
<td>User clicks “View Institution”</td>
<td>System directs to search portal.</td>
</tr>
<tr>
<td>3</td>
<td>User search using by Country (SR-01) or Institution Name (SR-02)</td>
<td>System displays all records with associated keywords for user.</td>
</tr>
<tr>
<td>4</td>
<td>User clicks the “Edit” button.</td>
<td>System redirects user to the institution’s information where user can change one (or more) of the fields (except PESC Code).</td>
</tr>
<tr>
<td>5</td>
<td>User fills out the form and click “Submit Details.”</td>
<td>System sends suggestion to Suggestion Portal where admins can approve or reject suggestions.</td>
</tr>
</tbody>
</table>

Exceptional Course of Action for Make Suggestion is not applicable.

2.1.3.3.2 Approve Suggestion

Table 27: Process Description – Approve Suggestion

<table>
<thead>
<tr>
<th>Identifier</th>
<th>DATA-02 Approve Suggestion</th>
</tr>
</thead>
</table>
### Purpose

Admin can approve a suggestion for change in the database suggested by the user.

### Requirements

- OC-2 Admin Profile Functions

### Development Risks

- Duplications in suggestions

### Pre-conditions

- User signed in and possess admin-level authorization
- Suggestion portal set up and managed correctly

### Post-conditions

- An addition to database and suggestion removed from suggestion portal.
- Action recorded in Activity Log

---

#### Table 28: Typical Course of Action – Approve Suggestion

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Admin logins AUTH-02.</td>
<td>System displays profile homepage.</td>
</tr>
<tr>
<td>2</td>
<td>Admin clicks on “Pending Tasks” from sidebar menu to see existing Suggestions made by users</td>
<td>System displays all existing Suggestions along any pre-existing data that matches what the suggestion entails.</td>
</tr>
<tr>
<td>3</td>
<td>Admin clicks “Approve” on one of the Suggestions.</td>
<td>System verifies for duplicates in name and address.</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>System adds institution to database with a new, unique GEOCODE.</td>
</tr>
</tbody>
</table>

---

**Alternative Course of Action for Approve Suggestion** is not applicable.

**Exceptional Course of Action for Approve Suggestion** is not applicable.

---

#### 2.1.3.3.3 Reject Suggestion

**Table 29: Process Description – Reject Suggestion**

<table>
<thead>
<tr>
<th>Identifier</th>
<th>DATA-03 Reject Suggestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>Admin can reject a suggestion for change in database</td>
</tr>
<tr>
<td>Requirements</td>
<td>• OC-2 Admin Profile Functions.</td>
</tr>
<tr>
<td>Development Risks</td>
<td>None</td>
</tr>
<tr>
<td>Pre-conditions</td>
<td>• User signed in and possess admin-level authorization</td>
</tr>
</tbody>
</table>
• Suggestion portal set up and managed correctly

**Post-conditions**

• No change to database.
• Suggestion deleted from Suggestion Portal.
• Action recorded in Activity Log.

### Table 30: Typical Course of Action – Reject Suggestion

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Admin logs in AUTH-02.</td>
<td>System displays profile homepage.</td>
</tr>
<tr>
<td>1</td>
<td>Admin clicks on “Pending Tasks” from sidebar menu to see existing Suggestions made by users.</td>
<td>System displays all existing Suggestions along any pre-existing data that matches what the suggestion entails.</td>
</tr>
<tr>
<td>2</td>
<td>Admin clicks “Reject” on one of the Suggestions.</td>
<td>System displays a confirmation message.</td>
</tr>
<tr>
<td>3</td>
<td>Admin clicks “Confirm Rejection”</td>
<td>System deletes Suggestion from portal.</td>
</tr>
</tbody>
</table>

**Alternative Course of Action for Reject Suggestion is not applicable.**

**Exceptional Course of Action for Reject Suggestion is not applicable.**

### 2.1.3.3.4 Add Institution(s)

**Table 31: Process Description – Add Institution(s)**

<table>
<thead>
<tr>
<th>Identifier</th>
<th>DATA-04 Add Institution(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td>Admin can add institution(s) to database without making suggestions</td>
</tr>
</tbody>
</table>
| **Requirements** | • OC-2 Admin Profile Functions  
• OC-4 Interaction with Local File System |
| **Development Risks** | None |
| **Pre-conditions** | • User signed in and possess admin-level authorization |
| **Post-conditions** | • An addition to database and suggestion removed from suggestion portal.  
• Action recorded in Activity Log |
### Table 32: Typical Course of Action – Add Institution: One Institution

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Admin logins AUTH-02</td>
<td>System displays profile homepage.</td>
</tr>
<tr>
<td>2</td>
<td>Admin clicks on “Add Institution” in the sidebar menu.</td>
<td>System displays a form for user to fill out with compulsory fields: Name, Country, and state/province.</td>
</tr>
<tr>
<td>3</td>
<td>Admin fills out appropriate details then clicks “Add.”</td>
<td>System adds record to the database.</td>
</tr>
</tbody>
</table>

### Table 33: Alternate Course of Action – Add Institution: Bulk Upload

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Admin logins AUTH-02</td>
<td>System displays profile homepage.</td>
</tr>
<tr>
<td>2</td>
<td>Admin clicks on “Bulk Upload” in the sidebar menu.</td>
<td>System directs to Bulk Upload page where an admin can download a format CSV file and upload a CSV file of institutions.</td>
</tr>
<tr>
<td>3</td>
<td>Admin downloads format CSV.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Admin uploads a CSV file with institutions to be added to the database.</td>
<td>System displays success message.</td>
</tr>
</tbody>
</table>

### Table 34: Exceptional Course of Action – Add Institution: Empty Form for One Institution

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Admin logins AUTH-02</td>
<td>System displays profile homepage.</td>
</tr>
<tr>
<td>2</td>
<td>Admin clicks on “Add Institution” in the sidebar menu.</td>
<td>System displays a form for user to fill out with compulsory fields: Name, Country, and state/province.</td>
</tr>
<tr>
<td>3</td>
<td>Admin leave some mandatory field empty then clicks “Add.”</td>
<td>System display error message.</td>
</tr>
</tbody>
</table>

### Table 35: Exceptional Course of Action – Add Institution: Bad Upload

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Admin logins AUTH-02</td>
<td>System displays profile homepage.</td>
</tr>
<tr>
<td>2</td>
<td>Admin clicks on “Bulk Upload” in the sidebar menu.</td>
<td>System directs to Bulk Upload page where an admin can download a format CSV file and upload a CSV file of institutions.</td>
</tr>
</tbody>
</table>
Admin downloads format CSV.

Admin uploads a CSV file with institutions to be added to the database, but some mandatory fields are missing. System displays error message.

## 2.1.3.3.5 Remove an Institution

### Table 36: Process Description – Remove an Institution

<table>
<thead>
<tr>
<th>Identifier</th>
<th>DATA-05 Remove an Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>Admin can remove an institution</td>
</tr>
<tr>
<td>Requirements</td>
<td>• OC-2 Admin Profile Functions.</td>
</tr>
<tr>
<td>Development Risks</td>
<td>None</td>
</tr>
<tr>
<td>Pre-conditions</td>
<td>• User signed in and possess admin-level authorization</td>
</tr>
</tbody>
</table>
| Post-conditions | • Institution would not show up on any search.  
                  • Institution moves to Recovery Bin.  
                  • Deleted Institution’s GEOCODE does not get reused.  
                  • Action recorded in Activity Log. |

### Table 37: Typical Course of Action – Remove an Institution

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Admin logs in with their credentials (AUTH-02).</td>
<td>System redirects admin to admin home page.</td>
</tr>
<tr>
<td>2</td>
<td>Admin clicks “View Institution” from sidebar menu</td>
<td>System directs to search portal.</td>
</tr>
<tr>
<td>3</td>
<td>Admin search using by Country (SR-01) or Institution Name (SR-02)</td>
<td>System displays all records with associated keywords for user.</td>
</tr>
<tr>
<td>4</td>
<td>Admin clicks on the trash icon next an institution.</td>
<td>System displays all of the institution’s details with a password field at the bottom.</td>
</tr>
<tr>
<td>5</td>
<td>Admin enters current password for the corresponding admin profile and clicks “Delete”</td>
<td>System invoke AUTH-02 Login to verify admin authorization.</td>
</tr>
<tr>
<td>6</td>
<td>System moves the institution to Recovery Bin (ARTF-06) and displays a success message.</td>
<td></td>
</tr>
</tbody>
</table>
Alternative Course of Action for Remove an Institution is not applicable.

Table 38: Exceptional Course of Action – Remove an Institution: Wrong Password

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Admin logs in with their credentials (AUTH-02).</td>
<td>System redirects admin to admin home page.</td>
</tr>
<tr>
<td>2</td>
<td>Admin clicks “View Institution” from sidebar menu</td>
<td>System directs to search portal.</td>
</tr>
<tr>
<td>3</td>
<td>Admin search using by Country (SR-01) or Institution Name (SR-02)</td>
<td>System displays all records with associated keywords for user.</td>
</tr>
<tr>
<td>4</td>
<td>Admin clicks on the trash icon next an institution.</td>
<td>System displays all of the institution’s details with a password field at the bottom.</td>
</tr>
<tr>
<td>5</td>
<td>Admin enters the wrong password for the corresponding admin profile.</td>
<td>System invoke AUTH-02 Login to verify admin authorization. System displays error message and the Institution would not get deleted.</td>
</tr>
</tbody>
</table>

2.1.3.3.6 Set Inactive

Table 39: Process Description – Set Inactive

<table>
<thead>
<tr>
<th>Identifier</th>
<th>DATA-06 Set Inactive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>Admin can remove an institution</td>
</tr>
<tr>
<td>Requirements</td>
<td>• OC-2 Admin Profile Functions.</td>
</tr>
<tr>
<td>Development Risks</td>
<td>None</td>
</tr>
<tr>
<td>Pre-conditions</td>
<td>• User signed in and possess admin-level authorization</td>
</tr>
</tbody>
</table>
| Post-conditions | • Institution still shows up in search but marked as inactive.  
|              | • Action recorded in Activity Log. |

Table 40: Typical Course of Action – Set Inactive

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Admin logs in with their credentials (AUTH-02).</td>
<td>System redirects admin to admin home page.</td>
</tr>
<tr>
<td>2</td>
<td>Admin clicks “View Institution”</td>
<td>System directs to search portal.</td>
</tr>
<tr>
<td>3</td>
<td>Admin search using by Country</td>
<td>System displays all records with</td>
</tr>
</tbody>
</table>
(SR-01) or Institution Name (SR-02) associated keywords for user.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Admin clicks on the trash icon next an institution. System displays all of the institution’s details with a password field at the bottom.</td>
</tr>
<tr>
<td>5</td>
<td>Admin enters current password for the corresponding admin profile and clicks “Set Inactive.” System invoke AUTH-02 Login to verify admin authorization.</td>
</tr>
<tr>
<td>6</td>
<td>System set “Status of Institution” as “Inactive”</td>
</tr>
</tbody>
</table>

Alternative Course of Action for Set Inactive is not applicable.

Table 41: Exceptional Course of Action – Set Inactive: Wrong Password

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Admin logs in with their credentials (AUTH-02).</td>
<td>System redirects admin to admin home page.</td>
</tr>
<tr>
<td>2</td>
<td>Admin clicks “View Institution” from sidebar menu</td>
<td>System directs to search portal.</td>
</tr>
<tr>
<td>3</td>
<td>Admin search using by Country (SR-01) or Institution Name (SR-02)</td>
<td>System displays all records with associated keywords for user.</td>
</tr>
<tr>
<td>4</td>
<td>Admin clicks on the trash icon next an institution.</td>
<td>System displays all of the institution’s details with a password field at the bottom.</td>
</tr>
<tr>
<td>5</td>
<td>Admin enters the wrong password for the corresponding admin profile and clicks “Set Inactive”.</td>
<td>System invoke AUTH-02 Login to verify admin authorization. System displays error message and no change to the Institution’s information.</td>
</tr>
</tbody>
</table>

2.1.3.3.7 Edit an Institution

Table 42: Process Description – Edit an Institution

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Purpose</th>
<th>Requirements</th>
<th>Development Risks</th>
<th>Pre-conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATA-07 Edit an Institution</td>
<td>Admin can make edit an institution’s information</td>
<td>• OC-2 Admin Profile Functions. • Duplicates after edit</td>
<td>• User signed in and possess admin-level authorization</td>
<td></td>
</tr>
</tbody>
</table>
### Post-conditions
- Information updated for institution
- Action recorded in Activity Log

**Table 43: Typical Course of Action – Edit an Institution**

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Admin logs in with their credentials (AUTH-02).</td>
<td>System redirects admin to admin home page.</td>
</tr>
<tr>
<td>2</td>
<td>Admin clicks “View Institution” from sidebar menu</td>
<td>System directs to search portal.</td>
</tr>
<tr>
<td>3</td>
<td>Admin search using by Country (SR-01) or Institution Name (SR-02)</td>
<td>System displays all records with associated keywords for user.</td>
</tr>
<tr>
<td>4</td>
<td>Admin clicks on the edit icon next an institution.</td>
<td>System redirect user to a suggestion form that’s prefilled with the institution’s information but GEOCODE and institution name are immutable.</td>
</tr>
<tr>
<td>5</td>
<td>Admin make changes and clicks “Submit”</td>
<td>System displays a success message.</td>
</tr>
</tbody>
</table>

**Alternative Course of Action for Edit an Institution is not applicable.**

**Table 44: Exceptional Course of Action – Edit an Institution: Empty Field**

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Admin logs in with their credentials (AUTH-02).</td>
<td>System redirects admin to admin home page.</td>
</tr>
<tr>
<td>2</td>
<td>Admin clicks “View Institution”</td>
<td>System directs to search portal.</td>
</tr>
<tr>
<td>3</td>
<td>Admin search using by Country (SR-01) or Institution Name (SR-02)</td>
<td>System displays all records with associated keywords for user.</td>
</tr>
<tr>
<td>4</td>
<td>Admin clicks on the edit icon next an institution.</td>
<td>System details institution’s information on a form but GEOCODE and institution name are immutable.</td>
</tr>
<tr>
<td>5</td>
<td>Admin deletes a required field and clicks “Submit”</td>
<td>System displays an error message.</td>
</tr>
</tbody>
</table>
2.1.3.4 Recent Activity Log

2.1.3.4.1 View Recent Activities

Table 45: Process Description – View Recent Activities

<table>
<thead>
<tr>
<th>Identifier</th>
<th>LOG-01 View Recent Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>Admin can see activities by all users type within the last 30 days.</td>
</tr>
<tr>
<td>Requirements</td>
<td>• OC-2 Admin Profile Functions</td>
</tr>
<tr>
<td>Development</td>
<td>None</td>
</tr>
<tr>
<td>Risk</td>
<td>None</td>
</tr>
</tbody>
</table>
| Pre-conditions | • User is logged in and possess admin-level authorization.  
                  • All activities are recorded into the log. |
| Post-conditions | None |

Table 46: Typical Course of Action – View Recent Activities

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Admin logs in with their credentials (AUTH-02).</td>
<td>System redirects admin to admin home page.</td>
</tr>
<tr>
<td>2</td>
<td>Admin clicks “Recent Activities Log” from sidebar menu.</td>
<td>System displays activities in the last 30 days, time, and who made the change.</td>
</tr>
</tbody>
</table>

Alternative Course of Action for View Recent Activities not applicable.

Exceptional Course of Action for View Recent Activities not applicable.

2.1.3.4.2 Recover Record

Table 47: Process Description – Recover Record

<table>
<thead>
<tr>
<th>Identifier</th>
<th>LOG-02 Recover Record</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>Admin can view any record that has been removed within the last 30 days</td>
</tr>
<tr>
<td>Requirements</td>
<td>• OC-2 Admin Profile Functions</td>
</tr>
<tr>
<td>Development</td>
<td>None</td>
</tr>
<tr>
<td>Risk</td>
<td>None</td>
</tr>
</tbody>
</table>
| Pre-conditions | • User is logged in and possess admin-level authorization.  
                  • All deletes are recorded into the recovery bin. |
| Post-conditions | • Recovered record now appears in search results. |
• Record deleted from Recovery Bin, if recovered.

Table 48: Typical Course of Action – Recover Record

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Admin logs in with their credentials (AUTH-02).</td>
<td>System redirects admin to admin home page.</td>
</tr>
<tr>
<td>2</td>
<td>Admin clicks “Recovery Bin” from sidebar menu.</td>
<td>System displays delete records in the last 30 days.</td>
</tr>
<tr>
<td>3</td>
<td>Admin clicks “Recover” next to a deleted institution.</td>
<td>System verify there are no duplicates with existing database at current time.</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Recovery successful: institution now appears in search results. Record deleted from Recovery Bin.</td>
</tr>
</tbody>
</table>

Alternative Course of Action for View Recent Activities not applicable.

Exceptional Course of Action for View Recent Activities not applicable.

2.1.3.4.3 View Pending Tasks

Table 49: Process Description – View Pending Tasks

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Purpose</th>
<th>Requirements</th>
<th>Development Risks</th>
<th>Pre-conditions</th>
<th>Post-conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOG-03</td>
<td>Admin can see pending suggestions.</td>
<td>• OC-2 Admin Profile Functions</td>
<td>None</td>
<td>• User is logged in and possess admin-level authorization.</td>
<td>None</td>
</tr>
</tbody>
</table>

Table 50: Typical Course of Action – View Pending Tasks

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Admin logs in with their credentials (AUTH-02).</td>
<td>System redirects admin to admin home page.</td>
</tr>
<tr>
<td>2</td>
<td>Admin clicks “Pending Tasks” from the sidebar menu.</td>
<td>System displays all tasks admin has yet to do, such as: pending suggestions.</td>
</tr>
</tbody>
</table>
Alternative Course of Action for View Pending Tasks not applicable.

Exceptional Course of Action for View Pending Tasks not applicable.

2.1.3.5 Data Visualization
2.1.3.5.1 Map Visualization

Table 51: Process Description – Search by Interactive Map

<table>
<thead>
<tr>
<th>Identifier</th>
<th>VIZ-01 Data Visualization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>User can use interactive map to see number of institutions across the world</td>
</tr>
<tr>
<td>Requirements</td>
<td>• OC-5 Data Visualization</td>
</tr>
<tr>
<td>Development Risks</td>
<td>• How to display institutions on the map</td>
</tr>
<tr>
<td>Pre-conditions</td>
<td>• System database properly initiated</td>
</tr>
<tr>
<td>Post-conditions</td>
<td>None</td>
</tr>
</tbody>
</table>

Table 52: Typical Course of Action – Search by Interactive Map

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>User clicks on a geographic region on the interactive map.</td>
<td>System display a zoomed in version of the region with further breakdown of GEOCODE regions.</td>
</tr>
<tr>
<td>2</td>
<td>User clicks on another region.</td>
<td>System zooms again</td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>User clicks on country/city and chooses “Display results”</td>
<td>System returns a table view of all institutions in the country/city.</td>
</tr>
</tbody>
</table>

Alternate Course of Action for Search by Interactive Map is not applicable.

Table 53: Exceptional Course of Action – Search by Interactive Map: No result

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>User clicks on a region on the map where GEOCODE has no record of institutions for.</td>
<td>System displays “GEOCODE has no record for institutions in this region.”</td>
</tr>
</tbody>
</table>
2.1.3.5.2 View Transaction Statistics

Table 54: Process Description – View Transaction Statistics

<table>
<thead>
<tr>
<th>Identifier</th>
<th>VIZ-02 View Transaction Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>An admin can see how many Adds, Edits, Deletes… etc. has occurred to the data.</td>
</tr>
</tbody>
</table>
| Requirements | • OC-2 Admin Profile Functions  
• OC-5 Data Visualization |
| Development Risks | None |
| Pre-conditions | • All transactions are recorded in Activity Log |
| Post-conditions | None |

Table 55: Typical Course of Action – View Transaction Statistics

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Admin logs in with their credentials (AUTH-02).</td>
<td>System redirects admin to admin home page. The admin’s home page features the “Transaction Statistics.”</td>
</tr>
</tbody>
</table>

Table 56: Alternate Course of Action – View Transaction Statistics: Dashboard

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Admin logs in with their credentials (AUTH-02).</td>
<td>System redirects admin to admin home page.</td>
</tr>
<tr>
<td>2</td>
<td>Admin chooses another functionality from sidebar menu.</td>
<td>…</td>
</tr>
<tr>
<td>3</td>
<td>Admin clicks “Dashboard” from sidebar menu.</td>
<td>System displays the “Transaction Statistics.”</td>
</tr>
</tbody>
</table>

Exceptional Course of Action for Search by Interactive Map is not applicable.
2.1.3.6 Support

2.1.3.6.1 Contact Us

Table 57: Process Description – Contact Us

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Purpose</th>
<th>Requirements</th>
<th>Development Risks</th>
<th>Pre-conditions</th>
<th>Post-conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>SU01-01</td>
<td>Allow any user to send email to maintainer/admin</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

Table 58: Typical Course of Action – Contact Us: Guest User

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>User clicks “Contact Us” button at the top left corner of search page.</td>
<td>System directs to Contact Us page where user can fill out name, phone number, email address, and message.</td>
</tr>
<tr>
<td>2</td>
<td>User fills out information and clicks “Submit Details” button.</td>
<td>System send an email form of the message with all the above fields (ARTF-11).</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>System pop-ups successful message.</td>
</tr>
</tbody>
</table>

Table 59: Alternate Course of Action – Contact Us: Registered User

<table>
<thead>
<tr>
<th>Seq#</th>
<th>Actor’s Action</th>
<th>System’s Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>User logs in with their credentials (AUTH-02).</td>
<td>System redirects user to user home page.</td>
</tr>
<tr>
<td>2</td>
<td>User clicks “Contact Us” from sidebar menu.</td>
<td>System directs to Contact Us page where user can fill out name, phone number, email address, and message.</td>
</tr>
<tr>
<td>3</td>
<td>User fills out information and clicks “Submit Details” button.</td>
<td>System send an email form of the message with all the above fields (ARTF-11).</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>System pop-ups successful message.</td>
</tr>
</tbody>
</table>

Exceptional Course of Action for Make Suggestion is not applicable.
2.1.4 Modes of Operation

There is only one mode of operation for our system.

2.2 System Analysis Rationale

Based on our client’s envisioned aspirations for the features on the system and our analysis of the current GEOCODE website, we believe these were critical capabilities required to be delivered for the project to be considered successful.

We focused on designing a system that is free, open, and easy to use for all but allows admins to have more sophisticated functionalities for our client.

One of the most critical capability is for users to make suggestions because GEOCODE is an index of thousands of schools around the world and will most likely expand further in the future, therefore gaps in the database is bound to happen.

On the admin side, we designed the system with all the functionalities an admin might need day-to-day so admins do not have to interact directly with the database. The password verification for deletes, recovery bin, and activity logs are designed to ensure mistakes are not made on the database, and even in the case that there are then it would still be easily fixable. Using our system, a new admin could be introduced to data management with ease, rather than having to be trained to use NoSQL or other technologies.

Data visualization modules are for ease-of-us, and they promote global adoption of GEOCODE, as visuals are easier to understand performing queries in English.
3. Technology-Independent Model

3.1 Design Overview

3.1.1 System Structure

Figure 4: Technology-Independent - Conceptual Domain Model

Figure 5: Technology-Independent - Hardware Component Class Diagram
Figure 6: Technology-Independent - Software Component Class Diagram

Figure 7: Technology-Independent - Deployment Diagram

Table 60: Technology-Independent - Hardware Component Description

<table>
<thead>
<tr>
<th>Hardware Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database Host</td>
<td>Host that store our GEOCODE database.</td>
</tr>
<tr>
<td>Web Host</td>
<td>Host that store our webpage.</td>
</tr>
</tbody>
</table>
User Management | Provides user management and authentication.

**Table 61: Technology-Independent - Software Component Description**

<table>
<thead>
<tr>
<th>Software Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Interface Component</td>
<td>User-facing web interface.</td>
</tr>
<tr>
<td>Personnel Management Component</td>
<td>This component performs functions involved with managing user profiles for the system.</td>
</tr>
<tr>
<td>Data Management Component</td>
<td>This component includes all functionalities that accesses or modifies the data.</td>
</tr>
<tr>
<td>Activity Management</td>
<td>This component manages activities across the system.</td>
</tr>
</tbody>
</table>

### 3.1.2 Design Classes

#### 3.1.2.1 Interface Classes

![Design Class Diagram – Interface Classes](image)

**Figure 8: Design Class Diagram – Interface Classes**

**Table 62: Design Class Description – Interface Classes**

<table>
<thead>
<tr>
<th>Class</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MainPage</td>
<td>Boundary</td>
<td>The web interface home page with display of VIZ-01 Interactive Map</td>
</tr>
<tr>
<td>UserHomePage</td>
<td>Boundary</td>
<td>User home page with the menu of functionalities.</td>
</tr>
</tbody>
</table>
### AdminHomePage
- **Boundary**: Admin home page with the menu of functionalities.

### LoginPage
- **Boundary**: AUTH-02 Log in page.

### SearchPage
- **Boundary**: SR-01 Search by Keywords main page.

### ResultsPage
- **Boundary**: Search results page with SR-04 Export functionality.

### SuggestionFormPage
- **Boundary**: DATA-01 Suggestions portal for the user page.

### PendingTaskPage
- **Boundary**: Pending tasks for admin page, includes pending DATA-01 Suggestions.

### EditPage
- **Boundary**: Data modification main page for admin with DATA-04 Add functionality.

### RecoveryBinPage
- **Boundary**: Recovery bin for deleted indices for admin page.

### RecentActivityLogPage
- **Boundary**: Recent activities log for admin page.

### 3.1.2.2 Data Management Classes

#### Table 63: Design Class Description – Data Management Classes

<table>
<thead>
<tr>
<th>Class</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institution</td>
<td>Entity</td>
<td>Contains name, address, region, country, and unique GEOCODE for each institution.</td>
</tr>
<tr>
<td>SuggestionForm</td>
<td>Controller</td>
<td>Collects information from SuggestionFormPage to create an Institution</td>
</tr>
</tbody>
</table>

**Figure 9: Design Class Diagram – Data Management Classes**
### 3.1.2.3 Personnel Management Classes

<table>
<thead>
<tr>
<th>Class</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>User</td>
<td>Entity</td>
<td>Contains name, contact information, suggestion record, and key ID.</td>
</tr>
<tr>
<td>Admin</td>
<td>Entity</td>
<td>Contains all specification of an admin profile, such as which data set can they modify.</td>
</tr>
</tbody>
</table>
### 3.1.2.4 Activity Management Classes

![Design Class Diagram](image)

**Figure 11: Design Class Diagram – Activity Management Classes**

<table>
<thead>
<tr>
<th>Class</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity</td>
<td>Entity</td>
<td>Contains activity type (search, export, add, edit, remove, suggestion, suggestion approval/rejection), activity information, activity date, and user profile who is responsible.</td>
</tr>
<tr>
<td>ActivityLog</td>
<td>Controller</td>
<td>Contains all activities within a certain time frame.</td>
</tr>
<tr>
<td>RecoveryBin</td>
<td>Controller</td>
<td>Contains delete activities within the last 30 days.</td>
</tr>
</tbody>
</table>
3.1.3 Process Realization

![Sequence Diagram – SR-02 Search by Institution Name]

In the above sequence diagram, we can also see SR-01/SR-02 Search by Country & Institution Name, and SR-03 Filtering.

![Sequence Diagram – SR-04 Export]
In the above sequence diagram, we can also see AUTH-02 Log In capability.

Figure 14: Sequence Diagram – LOG-01 View Recent Activities

Figure 15: Sequence Diagram – DATA-01 Make Suggestion
In the above sequence diagram, we can also see AUTH-01 Sign Up capability.
In the above sequence diagram, we can also see AUTH-02 Log In, and SR-03 Filtering.
In the above sequence diagram, we can also see a demonstration of the DATA-02 Approve Suggestion Exceptional case.
Figure 22: Sequence Diagram – VIZ-01 Map Visualization

- User
- Login to Geocode portal
- Visualize map
- Verify credentials
- Hover on the country on map
- Return the Count of the colleges registered under GEOCODE for that country
3.2 Design Rationale

From the developer’s perspective, we have designed our architecture based on the 3-tier architecture style because considering our tight timeline the 3-tier architecture allows us to be able to develop in parallel. This style of architecture also allows high flexibility for future development changes depending on the growth of our client’s project.

Specific components of each tier:

- User Interface Layer
  - User Interface Component
- Application Layer
  - Personnel Management Component
  - Activity Log Component
- Database Management Layer
  - Data Management Component

Since the core functionalities of our project also does not require large computational power, nor did we have an existing application to build on, we decided to go with a serverless architecture because we believe that it is in our success critical stakeholders’ interest that, as developers, we can focus on our core product rather than worrying about managing and operating servers or runtimes.

We decided to use a COTS DBMS because it is the least time-consuming with ensured security protection for our clients’ information.
4. **Technology-Specific System Design**

4.1 **Design Overview**

4.1.1 **System Structure**

![Diagram of Technology-Specific System Design](image)

**Figure 23: Technology-Specific - Hardware Component Class Diagram**

![Diagram of Technology-Specific Deployment Diagram](image)

**Figure 24: Technology-Specific - Deployment Diagram**
Table 66: Technology-Specific - Hardware Component Description

<table>
<thead>
<tr>
<th>Hardware Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWS Amplify</td>
<td>Hosts static web resources that are loaded into user’s browser.</td>
</tr>
<tr>
<td>Amazon Cognito</td>
<td>User management and authentication functions to secure backend API.</td>
</tr>
<tr>
<td>Amazon API Gateway</td>
<td>Enable real-time two-way communication applications.</td>
</tr>
<tr>
<td>AWS Lambda</td>
<td>Serverless computing platform.</td>
</tr>
<tr>
<td>Amazon DynamoDB</td>
<td>NoSQL database service that houses our GEOCODE database.</td>
</tr>
<tr>
<td>User’s Web Browser</td>
<td>User’s machine where our web interface displays.</td>
</tr>
</tbody>
</table>

Table 67: Technology-Specific - Software Component Description

<table>
<thead>
<tr>
<th>Software Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Interface Component</td>
<td>User-facing web interface using HTML and CSS.</td>
</tr>
<tr>
<td>Personnel Management Component</td>
<td>This component performs functions involved with managing user profiles for the system. We are using Amazon Cognito to reduce development time, meanwhile ensuring security and good integration with other AWS tools.</td>
</tr>
<tr>
<td>Data Management Component</td>
<td>This component includes all functionalities that accesses or modifies the data using Amazon API Gateway, AWS Lambda, and Amazon DynamoDB.</td>
</tr>
</tbody>
</table>

4.1.2 Process Realization

There are only minor variations from the general, technology-independent design in section 3, and the complexity of process realization for each recourse, it is better to rely on the general abstraction to explain our process.
4.2 Design Rationale

We chose to use a NoSQL database over a relational database in favor of fast query times and cost for our client. We specifically chose to store our GEOCODE database in Amazon DynamoDB over other NoSQL technologies because it is free up to 250 million requests per month, and since GEOCODE is most likely only used within the educational organizations, we believe that this is enough for our client’s needs. Our use of Amazon DynamoDB combined with our desire to implement a serverless architecture, previous explained in Section 3.2, we decided to use AWS Lambda and Amazon API Gateway.

We decided to use Amazon Cognito for authentications rather than building our own because for our application’s needs, we only need two kinds of user profile types and Amazon Cognito is free for our case, comes with built in security, and it can integrate seamlessly with the other AWS services we are already using.

Further analysis of COTS technologies can be found in our Feasibility Evidence Document.
5. Architectural Styles, Patterns and Frameworks

Table 68: Architectural Styles, Patterns, and Frameworks

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Benefits, Costs, and Limitations</th>
</tr>
</thead>
</table>
| MVC (Model View Controller) | MVC is a client-side paradigm which separates the model from the view and allows modifications to the model via a controller. | • Benefits: MVC allow parallel development and ease of modification for each artifact thanks to decoupling of data, view, and controller.  
• Cost: Free-to-use  
• Limitations: Requires more knowledge in multiple technologies between artifacts and requires more coordination to keep a feature in sync. |
| NodeJS                      | Framework                                                                   | • Benefits: allows us to write in the same language for both front-end and back-end  
• Costs: Free-to-Use  
• Limitations: Doesn’t support high computationally intensive tasks but our system does not require that. |
| 3-Tier                      | This architecture style separates application into 3 different layers: presentation, application tier, and data tier. | • Benefits: 3-tiers can be upgraded independently and developed in parallel.  
• Cost: Free-to-use  
• Limitations: Require coordination to ensure seamless integration of the layers. |