Requirements Document

Cetacean Observation System

Group 3: The Squad

April 7th 2021

Contents

Revision History

Name	Date	Reason for Changes	Version
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Group 3	**Feb 2nd 2021**	**Continue Creation**	**1.1**
Group 3	**Feb 3rd 2021**	**Editing**	**1.2**
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Alexander Aldridge and Braiden Kirkland	**March 3rd 2021**	**Began Review of Inspection Report**	**3.0**
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Group 3	**March 24th 2021**	**Creation of Traceability Matrix**	**5.0**
Group 3	**March 31st 2021**	**Final Report Editing**	**6.0**
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1 Introduction

1.1 Purpose

This document describes the software requirements for a cetacean observation reporting system. It is intended for the project manager, designer, developer and maintainer of the cetacean reporting system.

1.2 Project Scope

The current system [1] is a website and mobile app used to document cetacean sightings near Vancouver Island for use in research, education and public safety. It is intended to be used by both scientists and regular citizens. The reporting system is an expansion on an existing system. The software benefits the general public as an education tool, as well as researchers, providing important data regarding the state of the marine ecosystem. Cetaceans also benefit as it enables other systems to report information relevant for large commercial vessels to reduce their risk of disturbing or striking cetaceans. The software expansion must improve the usability of the reporting system in order to increase the number of and quality of cetacean reports.

1.3 Glossary of Terms

BC Cetacean Sightings Network (CSN). The BC Cetacean Sightings Network is a research and conservation program that aims to increase public awareness of British Columbia's cetaceans.

Cetaceans. Comprehensive term for whales, dolphins, and porpoises.

Department of Fisheries and Oceans (DFO)**.** Works with CSN to collect information about aquatic wildlife.

WhaleReport Alert System. CSN's service for reporting cetaceans to mariners to decrease the impact on marine life.

Reporting System. The hypothetical system in the project proposal which replaces or modifies the current system [1].

1.4 References

[1] "Report a Sighting," WildWhales. [Online]. Available: https://wildwhales.org/sightings/. [Accessed: 28-Jan-2021].

1.5 Overview

This document describes the requirements for a reporting system. Section 1 provides a brief overview of the reporting system and its purpose. Section 2 further elaborates on the purpose and describes the domain of the reporting system. Additionally, Section 3 describes the various aspects of the functional requirements. Section 4 documents the external application and software requirements. Section 5 outlines performance, safety, and security requirements. Finally, Section 6 includes any remaining requirements and appendices.

2 Overall Description

2.1 Product Perspective

This reporting system is a follow up to a joint venture between the BC Cetacean Sightings Network, the federal Department of Fisheries and Oceans and Coastal Oceans Research Institute. Previously, the joint venture implemented a cetacean reporting system available online and on mobile. This reporting system requires improvements in order to generate more reports during non-peak times and in remote locales, increase accuracy of reports, and attract more users to the reporting system. The reporting system may replace portions or the entirety of the CSN's current system [1].

2.2 Product Features

Major features that the reporting system must implement include the ability to accept and store all of the relevant information required for a CSN report and work offline in remote regions. It should assist users in making correct species identifications and gathering details about citizen sightings of cetacean creatures. The current system [1] asks for:

- Photos
- Date and Time
- Location
- Species
- Group Size
- Distance from Observer
- Direction of Animal Travel
- Sighting Vessel Details
- Interesting Physical Markings
- Contact Information for the Observer

The reporting system should allow users to upload reports during or after the event, as internet over open water can be tenuous or inaccessible. It should visualize user data, provide users with feedback regarding the quality of their reports and maintain privacy of the user.

The reporting system also needs to output data to CSN employees. Employees should be able to filter and retrieve sighting data from the user base, but civilian users should not. Employees also need to access metadata related to user retention, engagement, and usage.

2.3 User Classes and Characteristics

There are three main user classes that will use this reporting system: scientists, regular sailors, and other citizens. Scientists offer the most accurate observations and have the highest level of expertise. Regular sailors contain all those who spend much of their time on the water such as amateur boaters, coast guards, and ferry crew. These users offer less accurate information, however, they comprise the majority of our sightings. Other citizens include cetacean sighting reporters with irregular or rare visits to coastal and ocean areas. For example, hobby whale watchers and beach goers are in the “other citizens” category. One of the goals of the reporting system should be to increase the quality and quantity of reports from this group and as such this is the favoured user class of this document.

2.4 Operating Environment

The software may operate in the following domains:

- Web application supported by all major browsers
- Android Application
- iOS application
- Desktop application

The software must provide sanitized and uniform data for use in the WhaleReport Alert System. It must work with Microsoft Azure to maintain consistency with the current system [1].

2.5 Design and Implementation Constraints

Many administrative and budgetary constraints impact the reporting system. The budget for the solution is limited to $500,000 for software development, and recurring cost should not exceed $50,000 per fiscal year. The data gathered may eventually be publicized. Personal privacy of sighting reporters must be considered when publicizing data. Finally, data should be available for usage by our researchers within twenty-four hours of a user submitting a sighting.

Software development of the reporting system must also maintain key standards. The reporting system must maintain an uptime of 99.9% with unexpected outages lasting less than 60 seconds. To enable future maintenance, the reporting system must follow IEEE standards.

The reporting system must meet several design constraints as well. Users may report sightings during or after a sighting event. Internet connections might be stable, unstable, or unavailable during these sightings, but users will eventually have stable internet access for reporting (for example by returning to shore after a boating trip). Users may also identify different cetacean species inaccurately. The reporting system should account for these errors.

2.6 Assumptions and Dependencies

The new system should merge data with the current system [1] (unless replaced). The current system [1] is described in section 2.1. The implemented mobile applications need to interface with the current system [1] in order to send the data from reports collected. They will implement a database local to the user's device to store report data in the event of a loss of internet connection. CSN currently uses Microsoft Azure as the central data repository; therefore, the reporting system must use Azure for their servers.

3 System Features

3.1 Collect Data

3.1.1 Description and Priority

Collecting report data is a major purpose of the reporting system providing CSN with valuable data for research, education and public safety. It is a high priority.

3.1.2 Functional Requirements

Input: Accept user input from computing devices into a cetacean report.

Processing: Handle and validate report data.

Output Message: Produce output message in response to user input.

3.1.3 Rationale

The main purpose of this reporting system is to capture cetacean data.

3.1.4 Test Scenarios

1. User enters data into the data collection form.
2. Data is sent by the user.
3. System administrator checks if data has been delivered to the reporting system.

3.2 Output Sightings Data

3.2.1 Description and Priority

After users have reported sightings, the data needs to be accessible by CSN and its partner organizations. This feature is a high priority. Without accessible data outputting features, the application will not meet its purpose.

3.2.2 Functional Requirements

Input: Employee user selects and filters the data they wish to collect from the database.

Processing: The reporting system retrieves the data and converts it to a comma separated value sheet.

Output: Return the comma separated value sheet to the user.

3.2.3 Rationale

CSN and its partner organizations require access to the submitted sightings data. Comma separated value sheets will ensure compatibility with all our partner's systems.

3.2.4 Test Scenarios

1. User selects output data.
2. User adds a filter to the request.
3. User sends the request.
4. Confirm data is received and is correct.

3.3 Output Sightings Metadata

3.3.1 Description and Priority

CSN needs to be able to analyse information about our sightings data. This includes mean sightings per user, user count, time per sighting submission, and user retention. This is a high priority.

3.3.2 Functional Requirements

Input: Employee user selects the metadata they wish to download.

Process: The reporting system retrieves the metadata and converts it into a comma separated value sheet.

Output: Return the comma separated value sheet to the user.

3.3.3 Rationale

Exporting sighting metadata will enable CSN to analyse the effectiveness of the current system [1] and procedures. Comma separated value sheets enable cross compatibility with other data analysis software.

3.3.4 Test Scenarios

1. Select the desired data for downloading.
2. Download the data.
3. Verify that the content and format of the data is correct.

3.4 Offline Reporting

3.4.1 Description and Priority

Collecting offline data is important for reporting in remote areas. This is high priority. The data should be transmitted when an internet connection is reestablished.

3.4.2 Functional Requirements

Report Offline: Accept user input when out of service.

Local Storage: Store reports data on local devices.

Save Coordinates: Save GPS coordinates.

Send Data: Send report data once reconnected to the network.

3.4.3 Rationale

External users may submit sightings while they do not have access to the internet. This enables sightings to be reported while in remote regions or on the ocean (see section 2.2).

3.4.4 Test Scenarios

1. Use a device that does not have access to the internet.
2. Enter and submit a report.
3. Reconnect device to internet.
4. Confirm reports are sent to the server.

3.5 Species Identification

3.5.1 Description and Priority

The reporting system should guide users while identifying cetaceans to increase the quality of reports. This is a medium priority.

3.5.2 Functional Requirements

Identification Questions: Provide users with prompts to help identify cetaceans.

3.5.3 Rationale

The external user may not have in-depth knowledge of the cetaceans they want to report. This feature is important to increase the accuracy of the submitted reports.

3.5.4 Test Scenarios

1. Attempt to submit a sightings report.
2. Check if there is information on identifying certain cetaceans.

3.6 User Data Feedback

3.6.1 Description and Priority

The product should provide users with an idea of the quality of their reports. Quality metrics can be based on the presence and accuracy of categories in section 2.2: Project Features. This is a medium priority.

3.6.2 Functional Requirements

User Profile Rating: Provide users with a report rating.

Data Feedback: Provide users with assessments on a given report.

Report Suggestions: Provide users with suggestions on improving reports.

3.6.3 Rationale

User data feedback provides an opportunity for users to learn and improve as observers. Gamification elements may be implemented as future encouragement for external users to submit sightings.

3.6.4 Test Scenarios

1. User submits an observation.
2. Confirm feedback is output and corresponds to user data.

3.7 Visualize Data

3.7.1 Description and Priority

Data visualization enables users to see what they are inputting. This visual feedback should be available to users and encourage further sighting registration. This is a low priority.

3.7.2 Functional Requirements

Multiple Data Visualizations: Implement a wide variety of data visualizations. Include sighting frequency, location frequency, date and time frequency, and compare this user data to other users.

3.7.3 Rationale

Data modeling provides important information regarding trends in data for researchers. Encouraging users to regularly and frequently report sightings is core to this reporting system.

3.7.4 Test Scenarios

1. User selects a dataset for modeling.
2. User selects the type of model.
3. User sends the request.
4. Confirm data is demonstrated by the reporting system using the correct dataset and model.

3.8 Traceability Matrix

Feature Name	Requirements		Priority	Test Cases
	Number	Name		
Retrieve Sighting Data from Users	3.1	Collect Data	High	Ensure user data is successfully captured and submitted.
Output Meaningful Data	3.2	Output Sightings Data	High	Ensure requested report data is received.
Output Meaningful Data	3.3	Output Sightings Metadata	High	Ensure requested metadata is received.
Retrieve Sighting Data from Users	3.4	Offline Reporting	High	Ensure sightings data is downloaded correctly.
Improve Sighting Reports	3.5	Species Identification	Medium	Ensure species is capable of identification through the reporting system feature.
Improve Sighting Reports	3.6	User Data Feedback	Medium	Ensure users can receive feedback from their observation submissions.
Improve Sighting Reports	3.7	Visualize Data	Low	Ensure users can visualize observation data.

4 External Interface Requirements

4.1 User Interfaces

The reporting system must have large interactive elements such as buttons and navigation bars to support users who wear hand protection during the winter. Additionally, the solution must be accessible for new users with less knowledge in cetacean identification as well as experienced users who require less assistance.

4.2 Software Interfaces

The solution must connect to an existing Redis database to store data as well as an existing legacy dataset in SQLserver. The legacy tables should not be modified by the reporting system.

4.3 Communications Interfaces

Based on user preference, the user should receive email and/or push notifications related to their sightings. The reporting system must use secure communication protocols to transfer any user data.

5 Other Non-Functional Requirements

5.1 Performance Requirements

The reporting system should not require internet bandwidth over 50Mbps download or 10Mbps upload. Many reporters are in remote regions of BC with limited bandwidth, or on the ocean without stable internet connections.

Software interfaces should load within 500ms under ideal conditions, and should upload their required data within 5 seconds of user submission. Therefore, no upload data should exceed 50Mb. If additional space is required, the user should be notified of this.

5.2 Safety Requirements

If users are driving motorized vehicles such as cars and boats, the reporting system must not present excessive distractions. Users should be encouraged to have passengers record their sightings, or bring their vehicles to a stop before recording sightings. If nearby large cetacean creatures (such as whales), users must remain aware of their surroundings for safety.

Methods to achieve these safety requirements may vary depending on the reporting system. For example, some mobile applications monitor movement speeds and produce warnings when above a speed threshold. Desktop or laptop computers are less likely to distract drivers, so the requirement may be vacuously satisfied.

5.3 Security Requirements

Some users may wish to receive email responses after entering a whale sighting. This means their email address will be sent to the server along with the sighting information, and possibly stored for future use. This is why all communications will need to be encrypted. Scientists will require advanced privileges in order to perform system maintenance and research tasks. These users must be authenticated using a username and password.

5.4 Software Quality Attributes

The reporting system should be intuitive such that the average smartphone owner should be able to learn how to use it in 10 minutes. These users should then be able to produce reports in less than five minutes time after they have learned how to use the reporting system.

The reporting system must have a 99.9% availability and be in a common programming language for maintainability.

5.5 User Privacy

User privacy must be maintained. Provincial and federal legislation should be considered when collecting and distributing user data. Users' identities are anonymized meaning no personally identifiable information is exposed to the external world.

6 Other Requirements

The reporting system must adhere to any privacy laws in Canada. A legal team should be consulted to ensure no privacy laws are violated.

7 Use Cases

7.1 Report a Sighting

7.1.1 Description

This use case describes how the reporting system collects sighting data from user input.

7.1.2 Actors

External User

7.1.3 Pre-Conditions

The user has a computing device with access to the reporting system for data input.

7.1.4 Main flow

1. The use case begins when the user opens the reporting system on their device.
2. The collect data screen is displayed.
3. <Data Entry> The user enters their observation data into the required and non-required fields.
4. The information is saved and a message saying “Data collection successful” is displayed.
5. <More Data> The reporting system prompts the user for another sighting to report.
6. <Notification> The reporting system asks the user if they want to receive information on their reports through email.
7. The user closes the reporting system on their device.
8. The use case ends.

7.1.5 Post-Conditions

The validated data has been stored in the sightings database of the reporting system.

7.1.6 Alternative Flows

A. At <Data Entry>, if the user fails to enter the required fields, then
    1. The reporting system displays a message saying “Required fields missing, please enter again”.
    2. The reporting system displays the fields for data collection with any entered fields retaining their entry.
    3. Return to <Data Entry>
B. At <More Data>, if the user wants to input another sighting, then
    1. The reporting system displays a yes/no option to input more data.
    2. If yes, return to <Data Entry>
    3. If no, return to <Notification>
C. At <Notification>, if the user enters their email, then
    1. The reporting system sends an email containing the user’s sighting information.
    2. Return to <Notification>

7.2 Download Sighting Data

7.2.1 Description

After users have reported sightings, the data needs to be accessible by CSN and its partner organizations. Without accessible data outputting features, the application will not meet its purpose.

7.2.2 Actors

Internal Users (including CSN partners and CSN employees)

7.2.3 Pre-Conditions

The internal user must have a stable internet connection and an account with proper authorization for the reporting system (including a username and password).

The internal user must have sufficient space on their device to download the data.

7.2.4 Main Flow

1. The internal user opens the reporting system.
2. The reporting system requests the internal user’s username and password.
3. <User Authentication> The internal user enters in their username and password.
4. The reporting system displays the user interface for selecting and filtering sighting data for retrieval.
5. <Query Database> The internal user selects their preferred data and filters, and then submits their query.
6. <Query Validation> The reporting system validates the query and returns an HTTP 200 OK response.
7. The reporting system downloads the data to the internal user’s device as a .csv file.
8. The internal user may now leave the reporting system or submit another query.

7.2.5 Post-Conditions

The internal user now has a copy of the some or all the sightings data on their device.

7.2.6 Alternative Flows

A. At <User Authentication> if the user does not have authorization to access the data
    1. The reporting system generates an error.
    2. The reporting system displays an error that the user is not authorized.

B. At <User Authentication> if the information does not correspond correctly to an existing user then
    1. The reporting system generates an error.
    2. Error displaying that one or more of the username or password is incorrect.
    3. The reporting system prompts the user to input their information again.

C. At <Query Validation> if the internal user's query is invalid,
    1. The reporting system returns an HTTP 404 error response.
    2. The reporting system website displays an error message describing the error in the query.
    3. Then the internal user returns to <Query Database>.

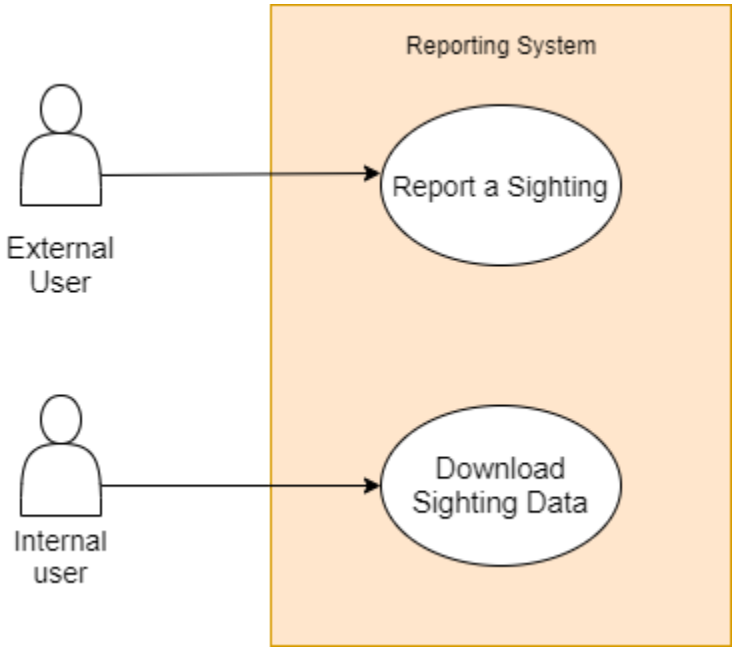


Figure 7.3 *Use Case Diagram*

8 Data Flow Diagrams

8.1 Level 0 Context Diagram: Reporting System

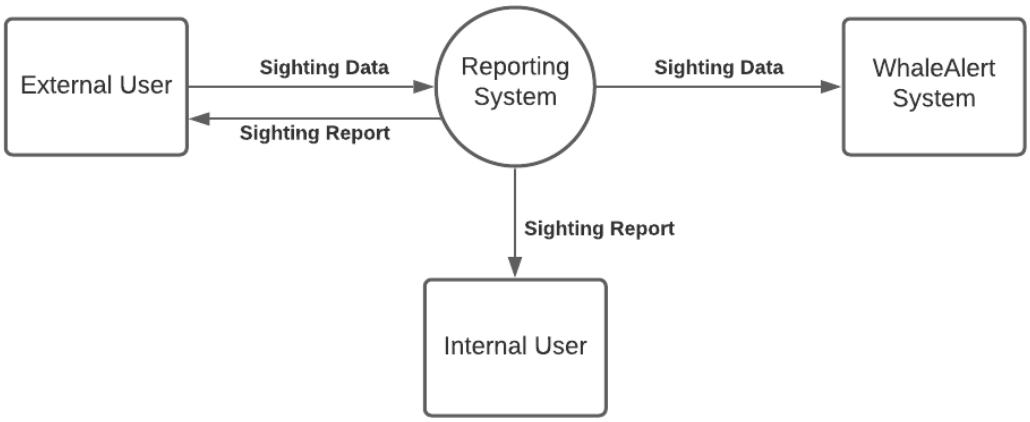


Figure 8.1 *Overview of data flow in the reporting system.*

8.2 Level 1 Context Diagram: Collect Data

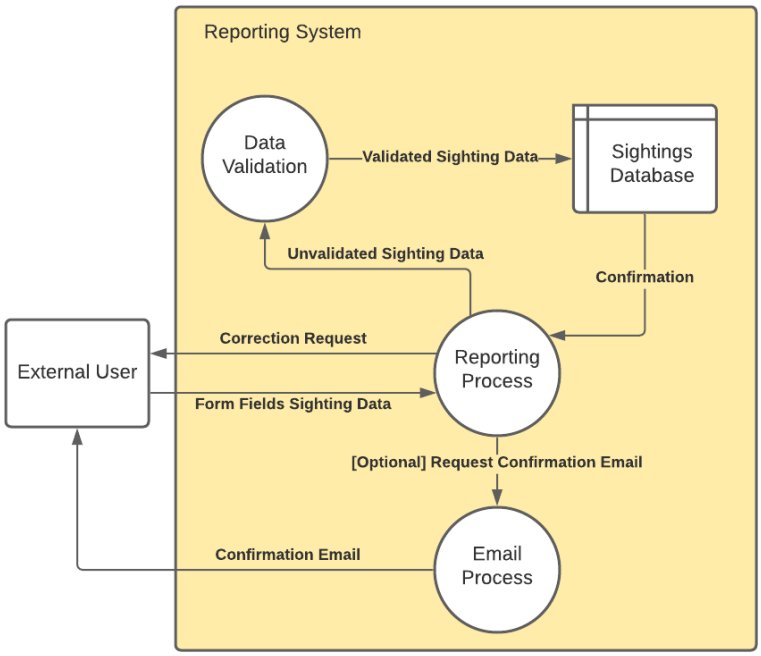


Figure 8.2 *Overview of data flow in Collect Data system function.*

8.3 Level 1 Context Diagram: Output Sightings Data

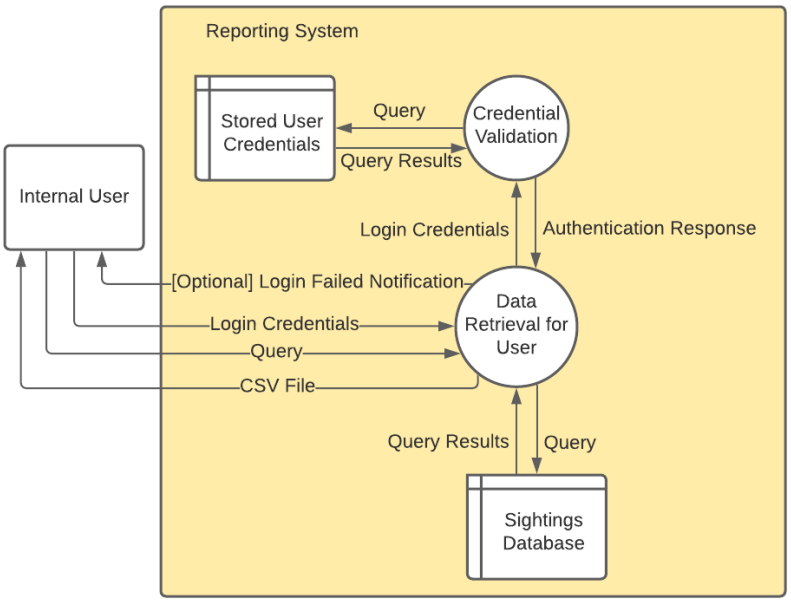


Figure 8.3 *Overview of data flow in Output Sightings Data system function.*

8.4 Level 1 Context Diagram: Offline Reporting

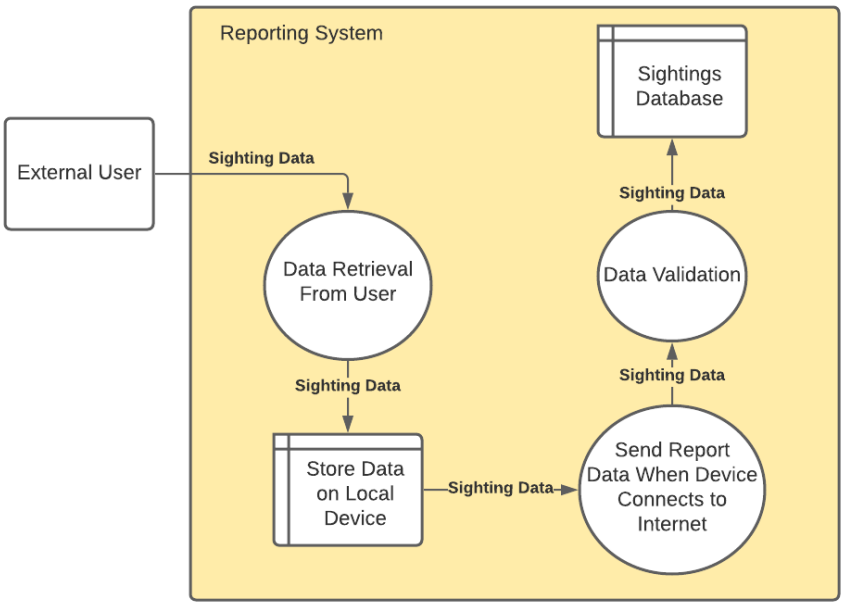


Figure 8.4 *Overview of data flow in Offline Reporting system function.*

9 User Interface

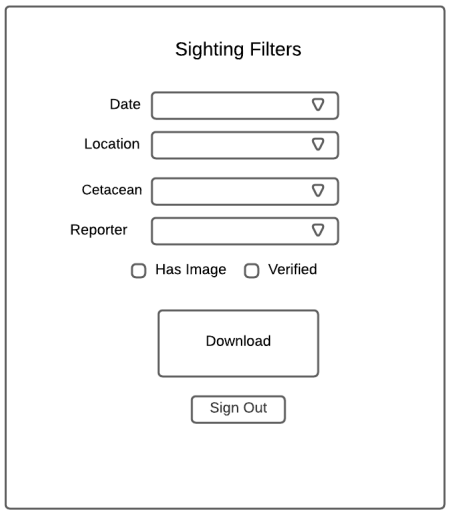
9.1 Download a Sighting

9.1.1 Login

This screen is a prototype of the login page that an internal user will see when they first open the application. This refers to Steps 2 and 3 in the Download a Sighting use case described in section 7.2. Entering your login information and clicking sign in will send you to the “Filter Sighting Data” page described in 9.1.2.

Figure 9.1.1 *Login Screen for CSN Employees.*

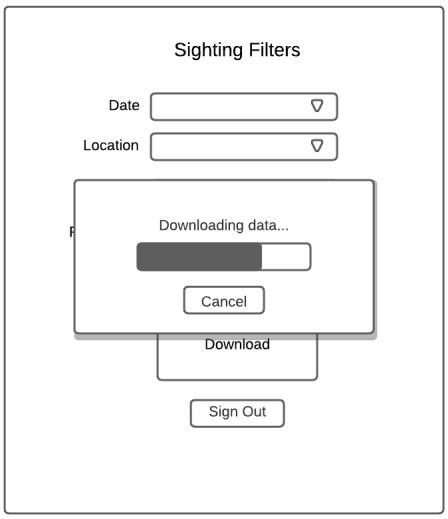
9.1.2 Filter Sighting Data



This screen is a prototype of the user interface for the “Filter Sighting Data” screen mentioned in Step 5 of the Download a Sighting use case described in section 7.2. The internal user is expected to enter information into at least one data field and that data is then used to query the sightings database. If all the data is entered in the correct format when the user presses download then they are sent to the “Downloading Sighting Data” screen described in 9.1.3, otherwise, they are sent to the “Misformed Sighting Request Error” screen described in 9.1.4.

Figure 9.1.2 *Sighting Filters for CSN Employees.*

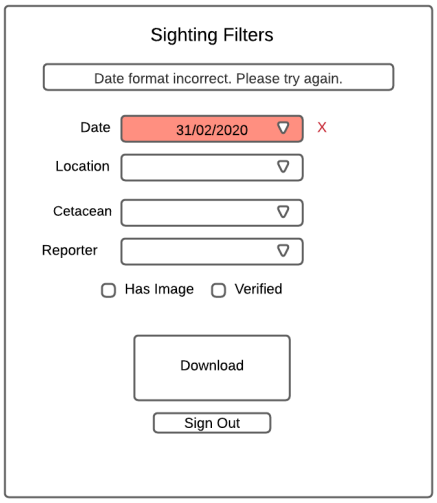
9.1.3 Downloading Sighting Data



This screen is a prototype of the user interface for the "Filter Sighting Data" screen mentioned in Step 7 of the Download a Sighting use case described in section 7.2. Once the user has entered the required information and pressed the download button, the user will see a pop-up window indicating that the download is in progress. The pop-up window gives the user the option to cancel the download while it is in progress. After the download is complete the user will be prompted to save the file to their machine. The reporting system will then return them to the "Filter Sighting Data" page described in 9.1.2.

Figure 9.1.3 *Download in Progress.*

9.1.4 Misformed Sighting Data Request Error



This screen is a prototype of the user interface for the "Filter Sighting Data" screen mentioned in alternative flow C of the Download a Sighting use case described in section 7.2. Following from Step 5, this screen results after the user selects an incorrect field when requesting sighting data. An error message is displayed, and the incorrect fields are marked in red and have an X beside them. If the user clicks the download button again, they will be returned to this page if the data is incorrect, or go to the "Download Sighting Data" page described in 9.1.2 if their information is correct.

Figure 9.4 *Misformed sighting request screen with incorrect fields highlighted in red.*

Appendix: Issues List

No appendices were necessary for this document.