
Software Requirements Specification

for

BirdGo

Version 1.0 approved

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BirdGO

25/8/2021

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Revision History

Name	Date	Reason For Changes	Version
Chua Yong Xuan	01/09/21	First release	1.0

1. Introduction

1.1 Purpose

A major problem encountered by Singaporean birdwatchers occurs when trying to spot a rare bird. Such a bird may have been recently spotted by another birdwatcher, yet there is no efficient way for them to share useful information pertaining to this sighting. Existing platforms simply allow one to record a sighting in a general location such as 'NTU', and users are left to their own devices to search this expansive campus in hopes of finding the particular bird. Thus, the purpose of BirdGo is to bridge this gap by allowing users to share the precise location (down to longitudinal and latitudinal coordinates) of the bird in real-time so other birdwatchers nearby can identify that location quickly and increase their likelihood of spotting such rare birds.

Furthermore, using machine learning and historical data on the birds spotted in Singapore from eBird API 2.0 and biome database, BirdGo can provide predictions as to where certain rare birds will likely appear so birders can also plan the location they want to travel to beforehand.

The target audience of this application includes both experienced birdwatchers as well as new newcomers who are interested in cultivating this hobby. There will hence be an encyclopedia feature which fetches more in-depth information on each bird species from Wikipedia, allowing the latter group of users to learn more about the birds and encourage a greater appreciation of the biodiversity amongst the Singapore public.

1.2 Document Conventions

Requirements are stated using formal or semi-formal notations when possible. Sentences are written in the active voice. Terms are defined clearly and used consistently throughout this document. All requirements should be expressed using the words "must" or "shall". Requirements should be verifiable and atomized by stating each requirement in a numbered simple declarative sentence or in a numbered equation, tree, label or diagram. Requirements statements should state a single product function, feature, characteristic, or property and have a unique identifier. Main requirements are enumerated with whole numbers and related sub-requirements are enumerated with a dotted extension (1.1, 1.2, etc). We use 1.15 line spacing and Arial to represent paragraphs.

1.3 Intended Audience and Reading Suggestions

The target audience of the application would be bird watchers of all levels in Singapore. This documentation is intended for the following groups.

1. Developers: The sections most pertinent to this group are Sections 1 to 4.
2. Technical application managers: See Sections 1 to 4.
3. Testers: See Sections 2 and Sections 4 to 5.

4. Users: See Sections 2.1 and 2.2

5. Marketing Staff: See Sections 1 and Sections 2.1 and 2.2

1.4 Product Scope

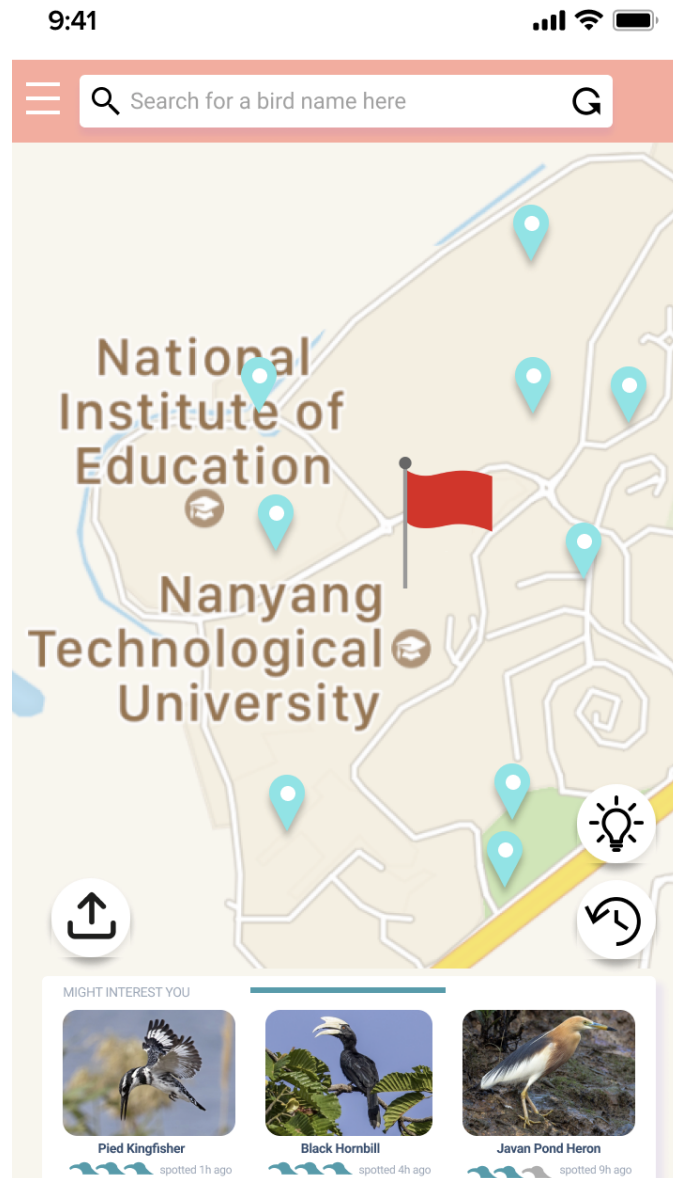


Fig 1. Home Page

The product landing screen is a map of Singapore that displays the pinpoint locations of the sightings of rare birds nearby to the user's current location (see Fig 1). Bird watchers can, through the application interface, locate the rare birds which have been sighted near them so that they can have a greater probability of encountering said rare birds. They can also upload new sightings on the application and share their observations with other users of this product. The application also

presents an encyclopedia feature which allows bird enthusiasts to learn more about the different species of birds that they spot while on the go.

With a large enough user base and community using the application, the offer of advertising services on the application could be explored as a means to monetise the application. Alternatively, government partnerships and sponsorships with NParks and/or ActiveSG could be sought to promote healthy living and an interest in wildlife among Singaporeans.

1.5 References

- [1] US Fish & Wildlife Service. 2011. [online] Available at: <<https://www.fws.gov/southeast/pdf/report/birding-in-the-united-states-a-demographic-and-economic-analysis.pdf>> [Accessed 25 August 2021].
- [2] List of bird species present in Singapore. February 2021. [online] Available at: <<https://www.nparks.gov.sg/biodiversity/wildlife-in-singapore/species-list/bird>> [Accessed 29 August 2021].

2. Overall Description

2.1 Product Perspective

This product is a self-contained product inspired by wildlife sightings systems.

Apart from creating new functions, this product improves on and integrates certain existing features into one software application, to allow for more intuitive and user-friendly features and to suit a larger target audience.

The product database shall include all recent bird sightings in Singapore, collated from the eBird database and biome database. This shall be displayed as a scatter of flags that indicate a general location. For example, around Nanyang Technological University where rare birds have been sighted recently, the map is marked with a flag as displayed on the landing screen as shown in Fig 1. The map shall also include a scatter of pins which indicate the exact coordinate location of the latest sightings recorded by other users of this product. Together with the marker that indicates the user's current location, the user would be able to zoom in and out of the map, and select a specific flag or pin to learn more about the species of bird sighted, specific time and location of the sighting. On the same map, the user could also opt to view the locations of predicted sightings, instead of recent sightings.

There is also a search function that allows the user to search for recent sightings of a particular bird species. If there is only one sighting of the particular species, the map will zoom in to that

location. If there are multiple recent sightings, the relevant pins on the map will blink for the user's perusal.

Apart from extracting data from existing databases, the product allows users to upload their new sightings, which adds a pin on the map as mentioned in the paragraph above. This feature works as a sharing platform to inform other users of the latest sightings while serving as a personal bird watching diary for the user who is uploading the new sighting onto the application. The details of the upload shall consist of a picture of the bird sighted, the exact time and location, such that it is convenient for other users to learn more about the sighting.

The product also offers an encyclopedia of bird species sighted in Singapore, educating the users on various bird species in Singapore. Within the encyclopedia, there is also a search function for users to search for a particular bird species.

2.2 Product Functions

1. Prediction for likely sightings
2. Search for recent sightings of specific bird species
3. Display of location of sightings on map
4. Display of detailed information of sighting(s) at particular location
5. Bird species encyclopedia
6. Search for specific bird species in encyclopaedia
7. Upload of new sightings
8. Import data from existing databases
9. Update of database
10. Update of prediction model for likely sightings

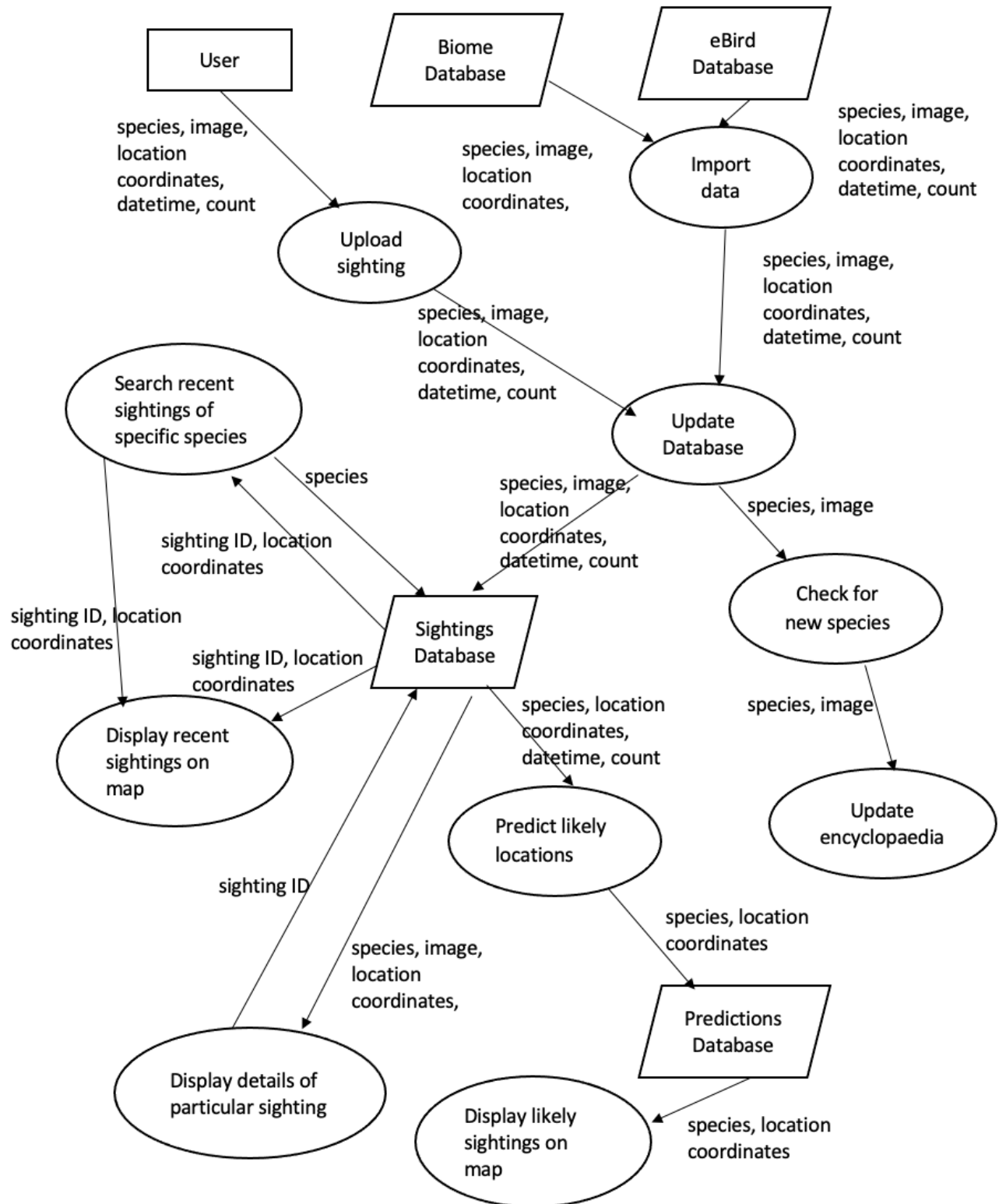


Fig 2. Data Flow Diagram

2.3 User Classes and Characteristics

There are several expected users for the application. The first, and likely the largest user are avid birdwatchers. The user classes are introduced as follows:

1. Avid bird watchers. This user group has prior knowledge and experience in bird watching, and embarks on bird watching trips regularly. They are likely to be the most active users of the application, mainly utilising the map display to locate predicted sightings and recent sightings. They will also use the upload function to record new sightings.
2. Amateur bird watchers. This user group is newly introduced to bird watching and interested in cultivating this hobby. This user group would mainly utilise the map display to locate predicted sightings and recent sightings. The encyclopedia function would also be attractive to this user group who are passionate about learning more about the bird diversity in Singapore.
3. General members of the public. This user group would mainly use the function that displays the nearby sightings to check if there are any recent encounters near where they are.
4. Developers who maintain the system. Developers update model functions to update the prediction models and the encyclopedia when new bird species have been sighted in Singapore.

2.4 Operating Environment

The application shall be available on Android 11 and above, and is meant to be used on handheld smartphones. The justification behind the selected type of device is because smartphones are the most common and convenient electronic devices that many people carry along when bird watching, or in general, when outdoors.

The application shall require access to certain built-in applications on the smartphones and must be compatible with other built-in functions on smartphones. These built-in applications and functions are:

1. Camera function
2. Location tracking service
3. Date-time service
4. Gallery application

2.5 Design and Implementation Constraints

Memory constraints limit the number of historical sightings the product would be able to store and display to the user on the application. Google Maps charges for the use of its APIs, limiting the number of map-related functions that could be obtained from the Google Maps Platform and implemented into the product. However this shall be overcome by cross referencing from other

free-of-charge maps services such as MapQuest. The app requires the use of internet and GPS, which may only be limitedly available on some devices.

2.6 User Documentation

1. Follow-along step-by-step tutorial for first-time users and users who have not used the product for 3 months or longer
2. User manual available on the app. This user manual would document all functions available on the product and how to navigate between them to optimise the use of the app. It would also include FAQs.

2.7 Assumptions and Dependencies

1. Assume that users are willing to allow the product to access the other built-in applications and functions on the smartphones, as listed in section 2.3
2. Assume eBird and NParks' biome databases and APIs, as well as the APIs of Global Positioning System (GPS) softwares such as Google Maps, are all readily accessible.

3. External Interface Requirements

3.1 User Interfaces



Fig 3. Predictions Page

In the application (see Fig 3), there will be several buttons which allow users to access different features as well as a dynamic map which users can use to navigate and locate birds. The functionality of these application components are further elaborated in Section 4: System Features.

The data, controls and buttons in BirdGo are designed in a similar way to other Android applications such as Google Maps, with additional visual indicators to assist users to utilise the data. For example, the red flag denotes the general location while the blue pins denote the precise location of where the birds were spotted recently.

3.2 Hardware Interfaces

BirdGO is an Android mobile application that will be supported on android mobile devices. BirdGo also requires the Android device to be connected to the internet to retrieve data from the database. The Android device must also have a GPS unit and location services turned on to fetch location data as well as a camera and camera permissions to take photos.

3.3 Software Interfaces

Because this app will primarily be on the Android OS, there will not be a need to account for a variety of operating systems, except for non-depreciated versions of Android. We will primarily be hosting our database using MySQL. App communication will be done through web services, and will contain occurrences of a bird, as well as information about that particular occurrence (Datetime, Name, Image). At the same time, when the user uploads information about a particular occurrence, this will update our database as well. The predictions will be held in a separate database. Additionally, the Google Maps API will be used to provide a user interface for a map.

- Android Smartphone
 - Flutter SDK 2.2 for creating the application
 - Google Maps API
 - Minimum SDK: Android 11 (API Level 30)
 - Platform: Android SDK Framework
 - Android Emulator: BlueStacks
 - Codebase: Flutter (Dart), Java
- Server API
 - Codebase: PHP, HTML, Python
 - MySQL DB Engine

3.4 Communications Interfaces

Communication to the database will be done through PHP, and messages will be in the SQL format.

1. HTTPS Communication
2. Bidirectional Communication
3. HTTP Post to retrieve data

4. System Features

4.1 BirdGo Almanac

4.1.1 Description and Priority

The BirdGo almanac refers to a feature within the app which allows users to search for a bird of their choice from a list of rare birds. Once a user taps onto the bird of their choice, they will be redirected to a Wikipedia page which explains the bird species in depth. The priority for this feature is medium as it is not the key feature of the app.

4.1.2 Stimulus/Response Sequences

In order for the user to access the encyclopedia, the user can tap the “three bar” icon on the top left of the screen. There will be a search function for the user to find the bird species of interest. The species names will be arranged alphabetically.

4.1.3 Functional Requirements

- REQ-1: The user must be redirected to the desired Wikipedia page within three seconds.
- REQ-2: The user must be redirected to the correct Wikipedia page.
- REQ-3: The user should be able to search for a particular bird.

4.2 User Input Form

4.2.1 Description and Priority

The user input form is to allow the user to upload an image of the bird into the app. The image will be stored in the backend database. The user will be allowed to upload the image together with the name of the species, and the location coordinates of where the picture was taken. This is to allow future birdwatchers to appreciate more pictures of the particular bird as well as to apprise them on where the bird could be spotted. It should also be noted that birds are habitual creatures, and gravitate towards the same spot. Thus, location information would be useful for the user. The priority of this feature is medium.

4.2.2 Stimulus/Response Sequences

There will be an upload button at the bottom left side of the app which will redirect the user to a form where the user can input the species of the bird and the location coordinates of where the photo was taken, together with an upload of an image of the bird. After the user taps on upload, the form will close and the user will be redirected back to the home page which is the map interface.

4.2.3 Functional Requirements

- REQ-1: Image and form details must be uploaded within three seconds.

REQ-2: The app must have access to the user's smartphone's gallery.

REQ-3: The user should be able to input a location of their choice.

4.3 Interactive Map User Interface

4.3.1 Description and Priority

The interactive map user interface will occupy the bulk of the user interaction in the app. The user will have two views to choose from: one view which displays the map based on recent sightings, and another view displays predictions of birds in an area. The user can scroll around the map to look around at markers, and either plan their next outing or find birds closeby. The priority on this function is high as it is quintessential to how this app will function.

4.3.2 Stimulus/Response Sequences

The first thing the user will see is the map. It will be built similar to other map apps, thus the user should have an intuitive understanding of how to use the app. There will be markers and landmark names located around the map for the user to get their bearings.

4.3.3 Functional Requirements

REQ-1: Map user interface must have access to the user's location in real-time to track its path.

REQ-2: Map interface must be able to switch between "recent sightings" view and "predictions" view almost instantaneously.

REQ-3: Map should be scrollable to view other portions not near the user.

4.4 Recent Sightings

4.4.1 Description and Priority

The map will have various markers to denote the location of where the rare birds have been recently spotted. Users can tap on these markers to learn more about the specific birds that have been spotted there. The priority of this feature is high as it is one of the main features of the app.

4.4.2 Stimulus/Response Sequences

Under the recent sightings view, the map will show past sightings of birds based on the past week. Red flags will be scattered about the map to denote regions of interest in Singapore. For example, NTU would be considered as one region, and Gardens by the Bay would be considered as another. In addition, once the user zooms into one of the general regions of interest, blue pins will denote the specific locations where a specific rare bird was spotted. Tapping on the flag will change the interface of the bottom half of the screen to display all the past sightings of birds at this general region. Tapping on the blue pin on the other hand will change the interface of the bottom half of the screen to display the specific rare bird species that was spotted at that specific location. The user will also be greeted with a gallery of past images of that bird species, allowing the user to

appreciate the photographs that past users have taken. Moreover, there will be a refresh button to update recent sightings to the latest data.

4.4.3 Functional Requirements

- REQ-1: Loading time of images and descriptions must not take longer than three seconds upon selection.
- REQ-2: Markers should refresh to the latest entry every time a user opens their app.

4.5 Predictions

4.5.1 Description and Priority

In the prediction view under the map, users will see markers at certain regions, with a species of bird tagged to the marker. This represents a bird that is likely going to be in the region. The probability of the particular species being in a region is calculated by an AI model that will take in the region's location as an input, as well as the current datetime. It will be trained on past data provided by the API, that is normalised to the number of inputs. This allows the user to plan for future outings by the chance that a sought after bird will appear.

4.5.2 Stimulus/Response Sequences

Under the "predictions" view, pins will again be used as markers, but this time it would denote the most likely bird to be sighted at a pin location. Upon clicking, similar to recent sightings, the user can see the type of bird, as well as the likelihood that it will appear based on past appearance.

4.5.3 Functional Requirements

- REQ-1: Upon changing views, the relevant pins should load within 3 seconds.
- REQ-2: Loading time of images and descriptions must not take longer than three seconds upon selection.

4.6 Bird Rankings

4.6.1 Description and Priority

The bottom half of the app user interface will be a scroll-up display which will show the top three bird species of interest. How the ranking will be decided will be based on a combination of how recent the bird was spotted and how rare the bird species is. This feature will serve as a recommendation tool for beginner or amateur bird watchers who are unsure of which birds to look out for. The priority for this feature is medium as it is a supporting feature of the app and not a key feature.

4.6.2 Stimulus/Response Sequences

The top three birds will have an image of the bird accompanied with its rating. The rating will be out of 3 stars, or in this case "wings", representing the rarity of the birds. The display can be scrolled

up to occupy the whole screen or chosen to be kept at the bottom of the screen so as to not obstruct the view of the map.

4.6.3 Functional Requirements

REQ-1: The top three birds must appear within three seconds from the user choosing the general location.

REQ-2: This feature must have access to a library of bird photographs to display the image of the bird together with the species of the bird.

5. Other Nonfunctional Requirements

5.1 Performance Requirements

95% of the information piping (refreshing/updating of the main map, uploading a bird sighting, searching for a specific bird, fetching the specific information of a bird) will be completed within 1 second. This is to facilitate a smooth and speedy application usage experience.

5.2 Safety Requirements

Users must not use the product while doing work that requires full attention and involves the safety of oneself and others, such as operating heavy machinery or driving a vehicle. It is possible that sightings as provided by the product may be near locations consisting of hazards, such as rivers, tall buildings or structures, cordoned off areas, thick vegetation et cetera. Users must exhibit caution and be mindful of the physical risks present while using the application. The product will not be responsible for any possible physical or financial injury sustained while using the application.

5.3 Security Requirements

The product will store the location of the users' bird sightings in its database when users upload a new sighting of a bird that they come across. This includes information about the latitude and longitude of the location where the bird is spotted, as well as the location name and bird species of the sighting. The product will not store nor use personal data which can be used to identify users, such as their names, mobile phone number, and location history for any purposes.

5.4 Software Quality Attributes

Users of the product will require the application's correctness level to be maintained at a high level, while having a high ease of use. A high level of accuracy in the information provided by the application will lead to users trusting and relying on the application as their main source of information while bird watching, allowing for high rates of user retention. Hence, the information provided by the application such as the prediction function and the location of sightings must be of

a high level of correctness. Since the average birdwatcher in the US is 53 years old [1], the application must have high ease of use so that potential enthusiasts will not be put off by a steep learning curve of using the application. Hence, the product must have a clutter-free UI coupled with good UX.

5.5 Business Rules

The application is only designed for personal usage among users. Users must not monetise the services of the application for their own personal or business gain. If a user is found to have done so, the user may be suspended from the application.