
Software Requirements Specification

for

BirdGo

Version 1.1 approved

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BirdGO

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Revision History

Name	Date	Reason For Changes	Version
Chua Yong Xuan	01/09/21	First release	1.0
Bryan Ong	03/11/21	Updating use cases, formating	1.1

1. Introduction

1.1 Purpose

Sharing rare bird sightings on Facebook and Telegram is a common practice amongst the growing birding community in Singapore. Existing platforms only allow users to record a sighting in a general location. For example, “Crimson Sunbird spotted at Pasir Ris Park” with a photo of the bird accompanying the post, users are then left to their own devices to search this expansive park in hopes of finding the 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, being able to see the locations of recent bird sightings in a map format can help birdwatchers plan which park they want to visit for the best chance to see their favourite birds.

Furthermore, using an algorithm and historical data on the birds spotted in Singapore from eBird API 2.0 and NParks BIOME database, BirdGo can provide predictions as to where certain rare birds will likely appear, along with its probability, 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 that 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 whenever possible. Sentences are written in the active voice. Terms are defined clearly and used consistently throughout this document. All requirements are denoted using the words “must” or “shall”. Requirements are verifiable and atomized by stating each requirement in a numbered simple declarative sentence or in a numbered equation, tree, label or diagram. Requirements statements state a single application 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 font in this document.

1.3 Intended Audience and Reading Suggestions

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

1. Developers: See 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 Section 1 and Sections 2.1 and 2.2

1.4 Product Scope

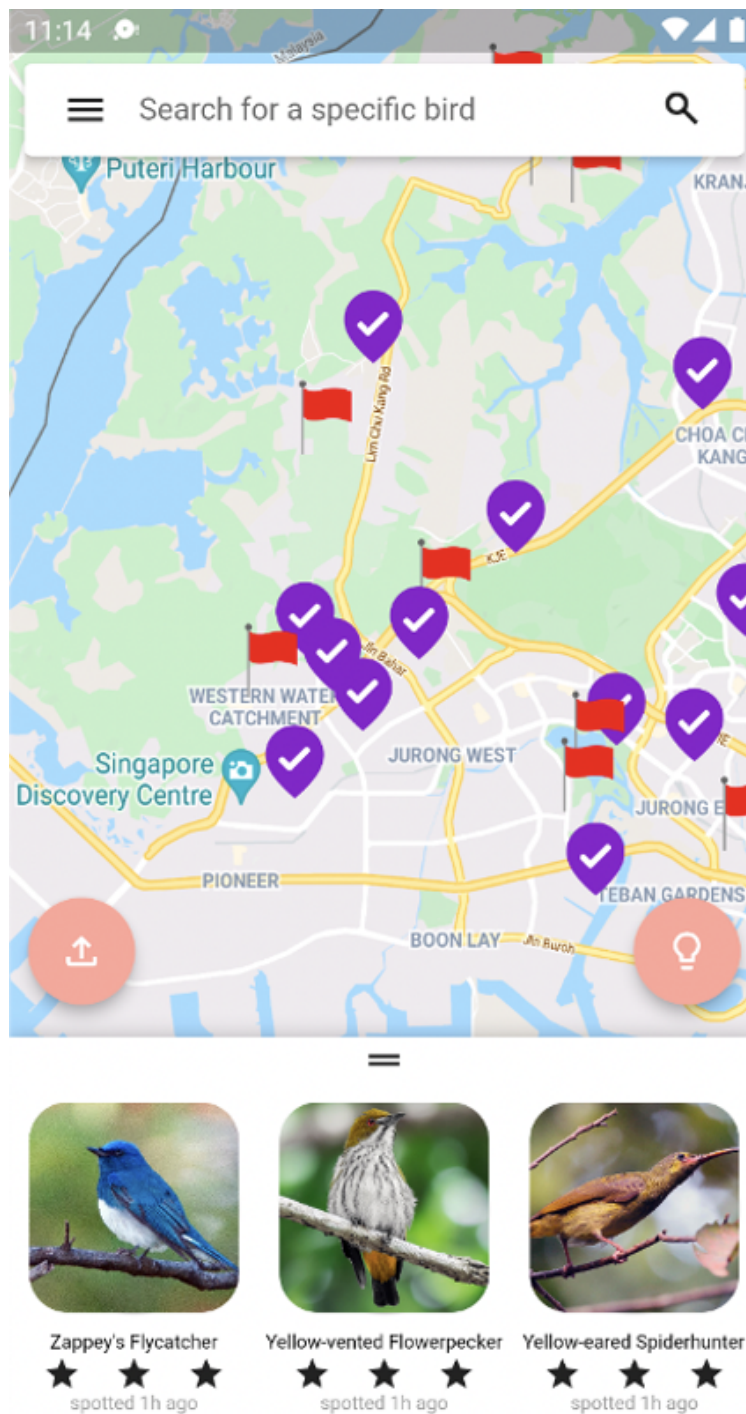


Fig 1. Home Page

The application landing screen is a map of Singapore, zoomed in to the user's current location, that displays the locations of the sightings of rare birds nearby (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 chance of encountering said rare birds. They can also upload new sightings on the application and share their observations with other users of this application. The application also presents an encyclopedia feature that 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, 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 cultivate an appreciation for the local biodiversity 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 application inspired by wildlife sightings systems.

Apart from creating new functions, this application 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 application database shall include all recent bird sightings in Singapore, collated from the eBird database and NParks biodiversity 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 scattering of pins that indicate the exact coordinate location of the latest sightings recorded by other users of this application. 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 obtain information about a particular bird species. The information, which will be displayed on a slide up panel, includes a picture of the specific bird, the name of the bird, images of the birds as well as an embedded Wikipedia link of the bird.

Apart from extracting data from existing databases, the application allows users to upload their new sightings, as mentioned in the paragraph above. This feature works as a sharing platform to inform other users of the latest sightings on 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 application also offers an encyclopedia of bird species sighted in Singapore, educating the users on various bird species in Singapore. The users can select a specific entry in the encyclopedia of bird species, to obtain the information of each specific bird. This information includes an image of the bird, its common name, its scientific name which is embedded with a Wikipedia URL, the number of occurrences and, a list of occurrences.

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 the 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. Updating of database

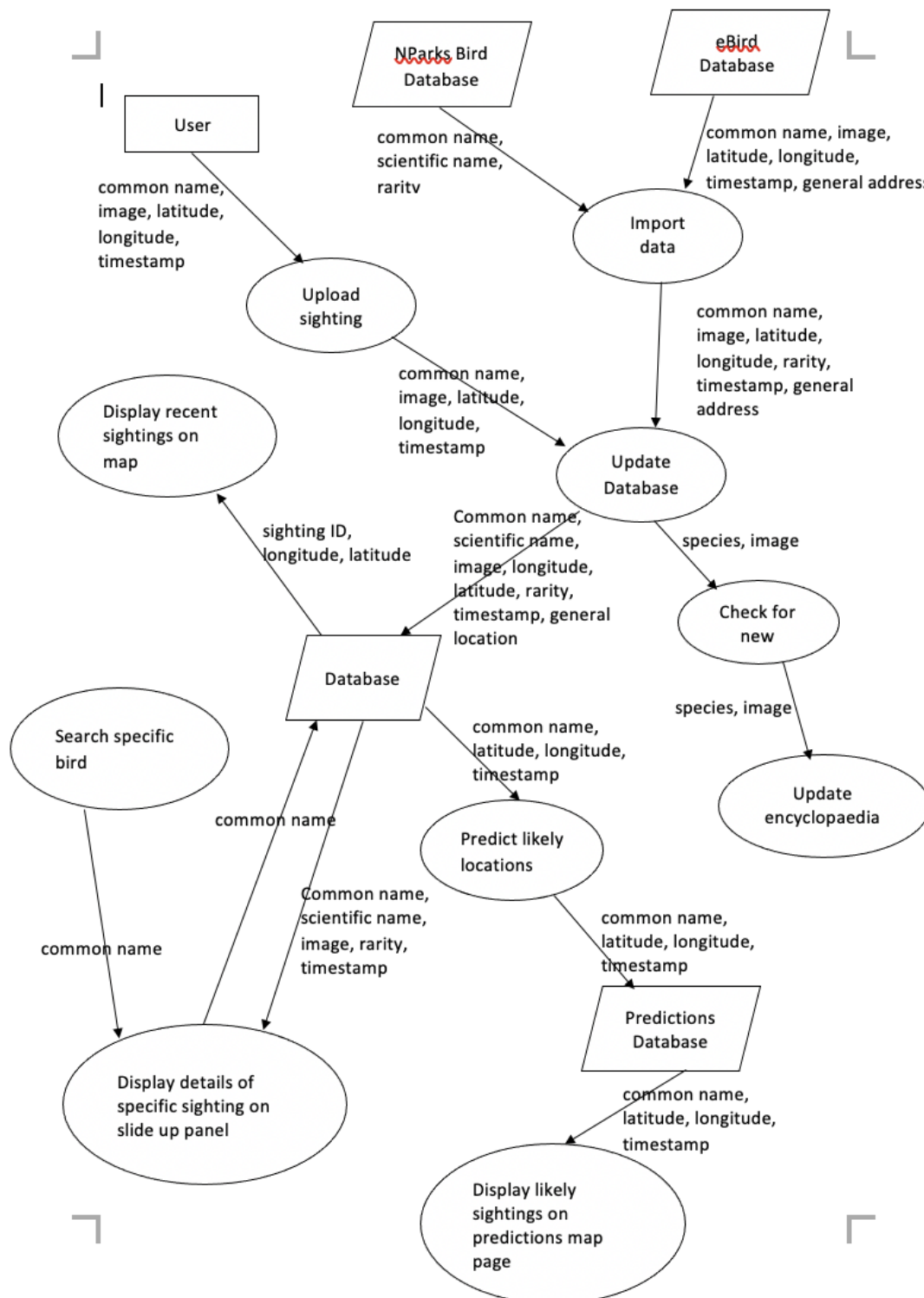


Fig 2. Data Flow Diagram

2.3 User Classes and Characteristics

There are several expected users for the application. The first, and likely the largest user group is the 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 are 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 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. They would likely use the encyclopedia function to read up on a bird when they chance upon one.
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. Internet connection
2. Location tracking service
3. Date-time service
4. Gallery application
5. Web browser

2.5 Design and Implementation Constraints

Memory constraints limit the number of historical sightings the application 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 application. The application requires the use of internet and GPS, which may only be limitedly available on some devices.

2.6 User Documentation

The users of the application are the target audience for user documentation generated about the software system. A follow-along step-by-step tutorial will be made available for first-time users and users who have not used the application for 3 months or longer in Portable Document Format (PDF) format.

2.7 Assumptions and Dependencies

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

3. External Interface Requirements

3.1 User Interfaces

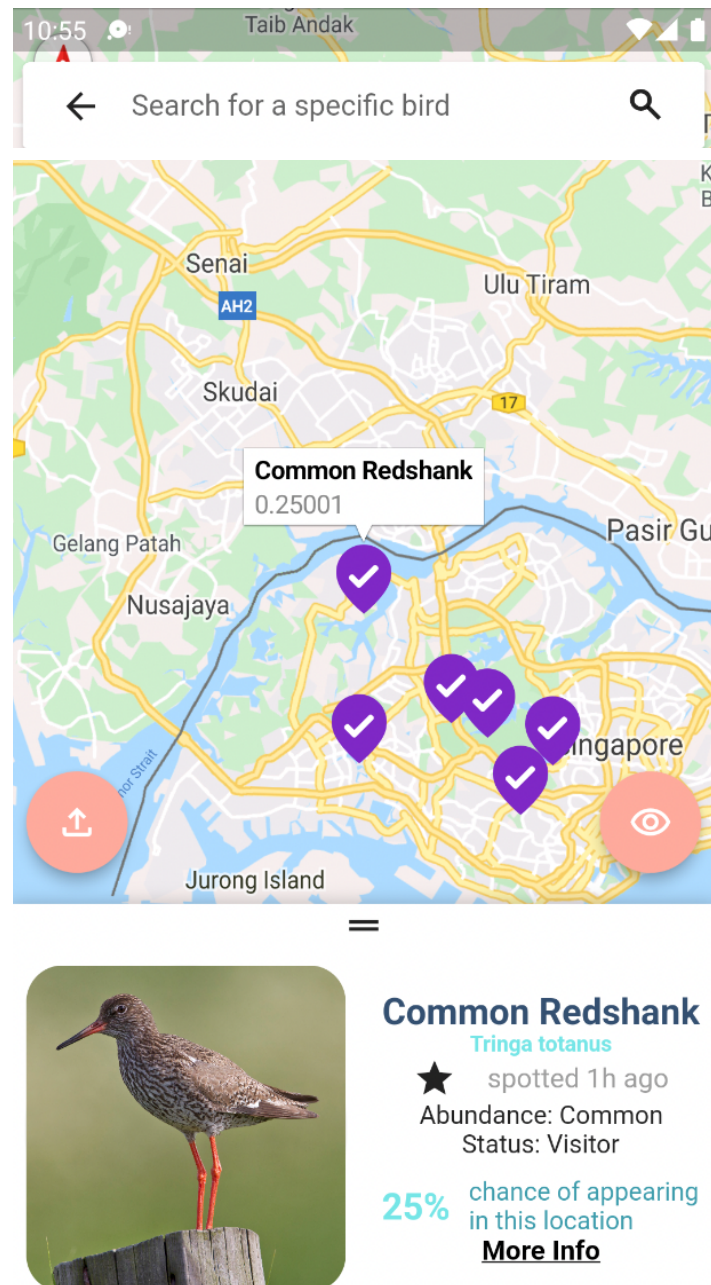


Fig 3. Predictions Page

In the application (see Fig 3), there will be several buttons that allows 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 purple 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 Cloud Firestore and Cloud Storage for Firebase. App communication will be done through web services, and will contain occurrences of a bird, as well as information about that particular occurrence (Datetime, Common 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 collection. 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 5.0 (API level 21)
 - Platform: Android SDK Framework
 - Android Emulator: Android SDK version 30.0.3
 - Codebase: Flutter (Dart)
- Server API
 - Codebase: Dart, Python
 - Cloud Firestore
 - Cloud Storage for Firebase

3.4 Communications Interfaces

Communication to the database will be done through Flutter.

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

4. System Features

4.1 BirdGo Encyclopedia

4.1.1 Description and Priority

The BirdGo encyclopedia refers to a feature within the app which allows users to search for a bird of their choice from a list of rare birds. When the user clicks on the name of the bird, he shall be redirected to a Wikipedia page corresponding to that bird species. 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 “hamburger” icon on the top left of the screen. A drawer on the left shall display a list of common names of all rare birds, arranged alphabetically.

4.1.3 Functional Requirements

- REQ-1: The list of common names of rare birds shall be displayed within three seconds.
- REQ-2: The user must be redirected to the desired profile page of the bird within three seconds.
- REQ-3: The user must be redirected to the desired Wikipedia page within three seconds.

4.2 User Input Form

4.2.1 Description and Priority

The user input form allows the user to upload information on recent bird sightings to the database. This information includes:

- the name of the species
- an image of the bird

- the date and time of sighting
- the latitude and longitude
- description of the location

The image will be uploaded to the Firebase storage and the URL of the image will be saved in a field under the same document as the rest of the information. This allows fellow birdwatchers to collaborate and apprise each other of rare bird sightings as well as where the bird could be spotted. It should also be noted that birds are habitual creatures, and tend to gravitate towards the same spot. Thus, a description in addition to the location information would be highly useful for the user. The priority of this feature is high as it will provide real-time sightings of rare birds for the user based on the inputs of the community.

4.2.2 Stimulus/Response Sequences

There will be an upload button at the bottom left side of the map which will redirect the user to a form where the user can choose the name of the species, type in a description of where the bird is in the area, upload the location, as well as an image of the bird. After the user taps on the submit button, the information will be uploaded to the database, along with the date and time of submission.

4.2.3 Functional Requirements

- REQ-1: Image and form details must be uploaded within three seconds after the submit button is pressed.
- REQ-2: The app must have access to the user's Google photos gallery.
- REQ-3: The app must have access to the location of the user's device.

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 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. The priority on this function is high as it is quintessential to how this app will function.

4.3.2 Stimulus/Response Sequences

A pinch in motion will cause the map to zoom out, while pinching out will cause the map to zoom in. Double tapping a particular location will cause the map to zoom in at that location.

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, including its

- common name
- scientific name
- rarity
- when it was last spotted
- images of that bird species

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 scattering 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, down to the accurate longitude and longitude where a specific rare bird was spotted. Tapping on the flag will change the slide up panel at the bottom half of the screen to display all the past sightings of birds at this general region. Tapping on the purple instead 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.

4.4.3 Functional Requirements

- REQ-1: Loading time of images and descriptions must take 3 seconds or less 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 the birding hotspots in Singapore, with a species of bird tagged to the marker. This represents the bird that is likely going to be in the hotspot. The probability of the particular species being in a region is calculated by an algorithm that takes into account the date and location of all past occurrences of the bird. 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. The priority of this feature is medium.

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 slide-up display which will show the top three bird species of interest as one of its panels. These top three birds will be determined by the ranking feature, based on the rarity of the bird species which corresponds to its abundance in NParks' species list. 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 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) must be completed within 3 seconds. This is to facilitate a smooth and speedy application usage experience.

5.2 Safety Requirements

Users must not use the application 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 application may be near locations consisting of hazards, such as rivers, tall buildings or structures, cordoned off areas, thick vegetation, dangerous wildlife et cetera. Users must exhibit caution and be mindful of the physical risks present while using the application. The application will not be responsible for any possible physical or financial injury sustained while using the application.

5.3 Security Requirements

The application 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 application will not store nor use personal data which can be used to identify users, such as their names, mobile phone number, and the users' location history for any purposes.

5.4 Software Quality Attributes

The software is required to have a consistently high performance 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 application must have a clutter-free UI coupled with good UX.

5.5 Business Rules

The application is only designed for personal use. Users must not monetise the services of the application for their own personal or business gain.