FIND MY PET – CROSS PLATFORM MOBILE APPLICATION

Research Manual

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Contents

Table of Figures 2

Abstract 3

1 - Introduction 3

2 - Flutter Technology 3

2.1 – Overview 3

2.2 - Flutter Architecture 3

2.3 – Dart 4

3 - Similar Technologies 4

3.1 - React Native 5

3.2 - Ionic 5

4 - Push Notification Technologies 6

4.1 - Amazon SNS 7

4.2 - Urban Airship 7

4.3 - Firebase Cloud Messaging 8

4.4 - Apple Push Notification Service 9

5 - Potential Databases 9

5.1 – SQLite 9

5.2 - Firebase 10

6 - Animal Detection 10

7 - Similar Applications 11

7.1 - ISPCA 11

7.2 - Large Facebook pages 12

7.3 - Websites 12

7.4 - Finding Rover - Facial recognition 13

7.5 - Runaway Pets 14

Conclusion 15

Plagiarism Declaration 16

Declaration 16

Bibliography 17

Table of Figures

Figure 1: Dart Code Sample (Dart language samples) 4
Figure 2: React Native Code Sample (React Native Documentation) 5
Figure 3: Ionic Code Sample (Ionic Work) 6
Figure 4: Amazon SNS Diagram (Amazon SNS) 7
Figure 5: Airship Notification Sample Code (Airship) 8
Figure 6: FCM Technical Diagram (Firebase Documentation) 8
Figure 7: Apple Push Notification Layout (Apple) 9
Figure 8: SQLite Database Example (SQLite tutorial) 10
Figure 9: Firebase Database Layout (Firebase Documentation) 10
Figure 10/11: Test Image and Result (TensorFlow Animals) 11
Figure 11: ISPCA Website (ISPCA) 11
Figure 12: Lost and Found Pets Page (Lost and Found Pets) 12
Figure 13: Lost Pets Website (Lost & Found Pets Ireland) 13
Figure 14: FindingRover Application Screens (Finding Rover) 14
Figure 15: RunawayPets Application Screens (Runaway Pets) 15

Abstract

The purpose of this project is to create a cross platform mobile application (iOS & Android) in which the user can post details of lost or found animals in their area. This mobile application will be written using Flutter Technology, an open-source UI software development kit created by Google. The application will present the user with the option to post or view lost and found animals in a selected area. There will be a range of features, such as push notifications if an animal is reported lost in a user's area, searching for posts based on location and communicating with other users via comments.

1. - Introduction

The main aim of this project is to create an application using Flutter technology to give users the ability to share information about lost and found animals in their area. The following research manual will delve into what Flutter technology is, how it works and the benefits and potential issues of using it. This manual will also involve researching other similar applications currently in place for lost and found pets. It will analyse the benefits and perceived negative functions of each.

An integral feature of this project is that a user is notified when an animal goes missing in their area. The notification will show an image, description and the area the pet was last spotted. As this feature is crucial, there will be an area of research dedicated to the current notification technologies and types.

2. - Flutter Technology

2.1 – Overview

Flutter is an open source UI software development kit created by Google. It is most commonly used to create cross platform mobile applications for Android and iOS. All of which is done using one programming language called Dart and one codebase. Simply put, it allows you to write one application that will inherently work on both devices.

When you download Flutter, it comes with its own software development kit. This includes tools that allow a created mobile application to compile code into native machine code, which will make it run on both platforms.

An important selling point for Flutter is that it has an extensive framework that contains a widget library. This library consists of commonly used widgets to aid in faster development for users.

The language that you use to write Flutter application in is called Dart, which was also developed by Google. The main purpose of Dart is for developing frontend mobile applications but it an object-oriented language. This means that experience in other object-oriented languages, such as Java, will make the learning experience easier.

2.2 - Flutter Architecture

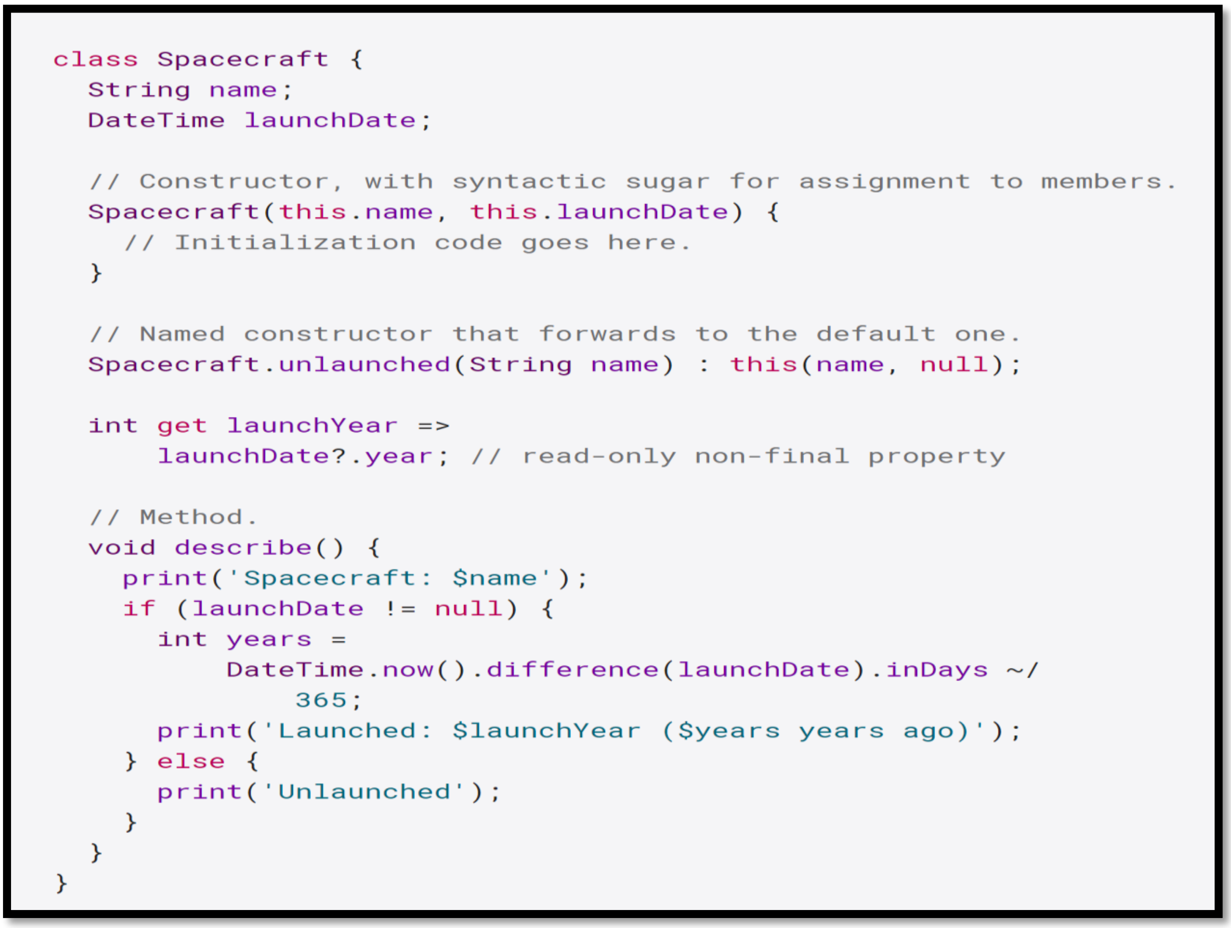
According to Flutters own documentation, the framework takes a 'UI as code' approach, which means that everything within the application is written in code. Unlike developing for

Android or iOS native, where there are options to drag and drop buttons which auto-generate the code for the dropped item.

Although, as previously mentioned, Flutter allows you to create an app for both platforms using only one codebase. They still state that they embrace platform differences and do not restrict what is possible on either platform. They provide you the tools within the code to detect which operating system the application is running on. With that information you can choose to run “different code snippets based on which device the application is running” (Flutter Documentation).

2.3 – Dart

Dart is a typically front-end facing object-oriented language, developed by Google. It allows Flutter to avoid the need for a separate declarative layout language like JSX or XML, which many other cross platform development kits do. “Dart also removes the need for separate visual interface builders, as it is a declarative language, the programmatic layout is easy to read and visualize” (Dart language samples). The main advantage of Dart is that it is the only language Flutter uses and therefore is easy for Flutter to provide advanced tooling for it. The language and layout are in one place.



```
class Spacecraft {
  String name;
  DateTime launchDate;

  // Constructor, with syntactic sugar for assignment to members.
  Spacecraft(this.name, this.launchDate) {
    // Initialization code goes here.
  }

  // Named constructor that forwards to the default one.
  Spacecraft.unlaunched(String name) : this(name, null);

  int get launchYear =>
      launchDate?.year; // read-only non-final property

  // Method.
  void describe() {
    print('Spacecraft: $name');
    if (launchDate != null) {
      int years =
          DateTime.now().difference(launchDate).inDays ~/
              365;
      print('Launched: $launchYear ($years years ago)');
    } else {
      print('Unlaunched');
    }
  }
}
```

Figure 1: Dart Code Sample (Dart language samples)

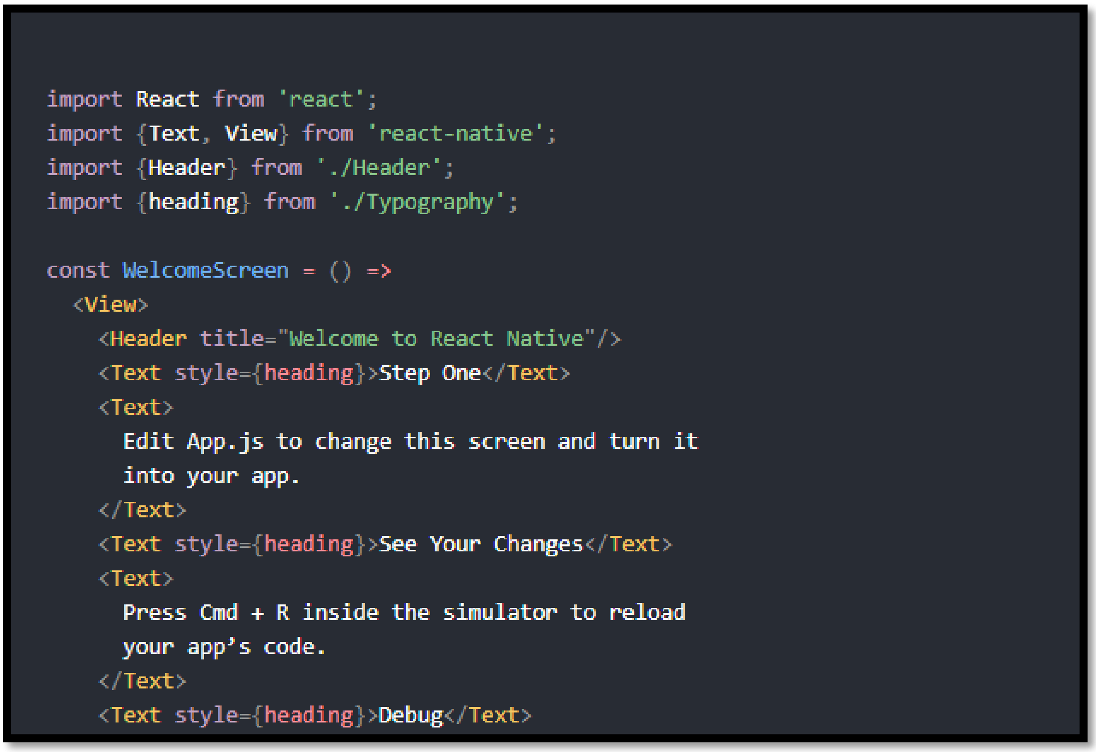
3. - Similar Technologies

While researching similar technologies to Flutter, there appears to be two preferred by developers. They are as follows;

3.1 - React Native

React Native is an another open-source mobile application framework, that was created by Facebook. Unlike Flutter it is used for more than just mobile development. “It is used to develop applications for Android, iOS, Web and UWP by enabling developers to use React along with native platform capabilities” (React Native Documentation). React achieves this by getting its components to wrap existing native code and interact with native APIs using Reacts declarative UI paradigm and JavaScript.

One of its main selling points for developers, alongside the features it offers, is that it is written with JavaScript. Arguably, this is a language that a lot of experienced developers would have familiarity with. It is also a language people involved in web development will need to learn in most cases. It can be suggested that as a result React Native is an easy choice for a lot of developers.



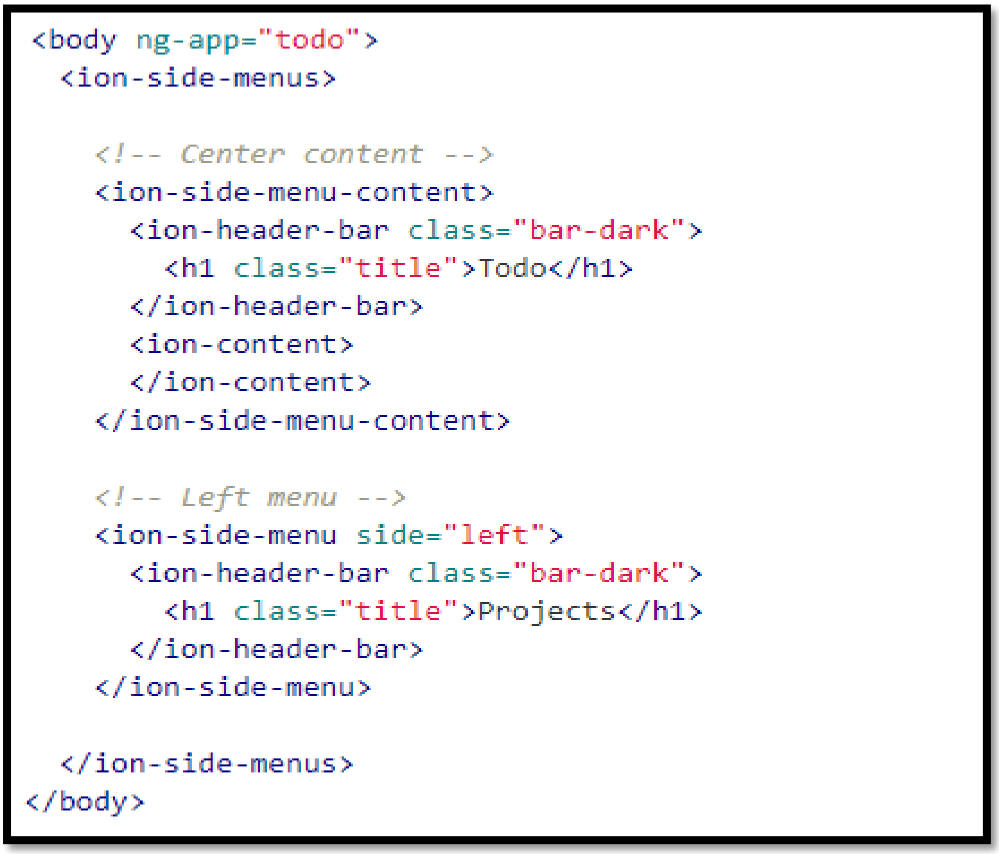
```
import React from 'react';
import {Text, View} from 'react-native';
import {Header} from './Header';
import {heading} from './Typography';

const WelcomeScreen = () =>
  <View>
    <Header title="Welcome to React Native"/>
    <Text style={heading}>Step One</Text>
    <Text>
      Edit App.js to change this screen and turn it
      into your app.
    </Text>
    <Text style={heading}>See Your Changes</Text>
    <Text>
      Press Cmd + R inside the simulator to reload
      your app’s code.
    </Text>
    <Text style={heading}>Debug</Text>
```

Figure 2: React Native Code Sample (React Native Documentation)

3.2 - Ionic

Ionic is also open-source and is used for both mobile and web app development. Ionic website states that its framework is used for “some of the world’s best-known brands - from highly successful consumer apps like Sworkit, Untappd and Dow Jones MarketWatch, to mission-critical apps supporting Nationwide, Amtrak, and NASA.” (Ionic Work). It is similar to Flutter in that it offers predefined UI components to help speed up the development process. It can be suggested it is attractive to developers for reasons similar to React, in that it writes much like other web languages.



```
<body ng-app="todo">
  <ion-side-menus>

    <!-- Center content -->
    <ion-side-menu-content>
      <ion-header-bar class="bar-dark">
        <h1 class="title">Todo</h1>
      </ion-header-bar>
      <ion-content>
      </ion-content>
    </ion-side-menu-content>

    <!-- Left menu -->
    <ion-side-menu side="left">
      <ion-header-bar class="bar-dark">
        <h1 class="title">Projects</h1>
      </ion-header-bar>
    </ion-side-menu>

  </ion-side-menus>
</body>
```

Figure 3: Ionic Code Sample (Ionic Work)

4. - Push Notification Technologies

“Push notifications are when information is delivered to an individual’s mobile device from an application on that device, without a request being sent” (Blair). The mobile application installed on the individual’s mobile does not need to be launched to receive the push notification, it originates directly from the server.

There are typically three main types of push notification carried out on mobile device.

1. The user has the application opened, which typically causes the notification to appear in the app as a pop up or marker.
2. The user has the application running in the background. This notification typically appears in the device’s notification bar.
3. The user has the application closed. This notification also typically appears in the device’s notification bar.

Push notifications are an integral feature of this project. They are needed to ensure users are made aware of missing animals within their radius and provided with an image of same. This stems from the idea that users do not even need to open the application to be made aware of a lost pet near them. Arguably, this makes the app more appealing as it does not need to be closely monitored by the user to be functional. The following research was carried out on potential push notification services that could be implemented in the application.

4.1 - Amazon SNS

"Amazon SNS (Simple Notification Service) is push notification service provided by Amazon, which was launched in 2010" (Amazon SNS). The main selling point of this service it that the company provides an API that allows for push notifications to be sent to multiple platforms.

This service is a premium product that has starting prices at $0.50 per million notifications. This appears reasonable when compared against other prices and they offer a flexible trial period in which the first million notifications are free.

The main benefit of this service appears to be the cross-platform support. As the *FindMyPet* application will be built across two platform this support is a necessity. Also, the service provides in-depth documentation which will help answer questions that arise during development.

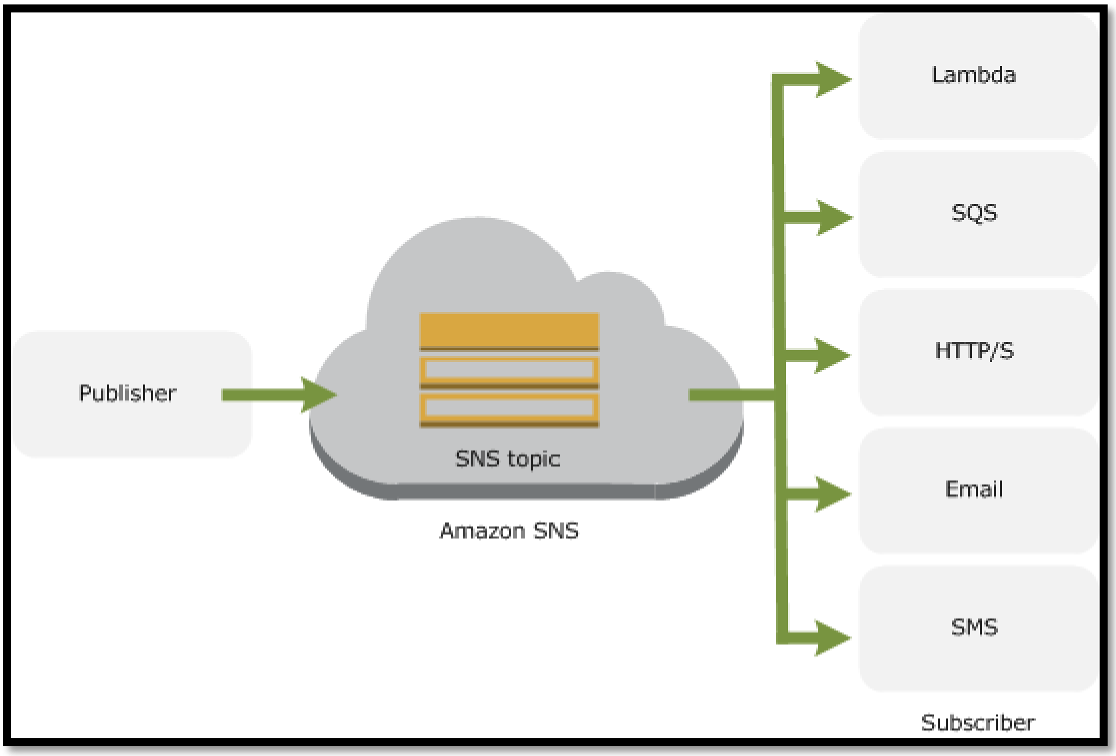


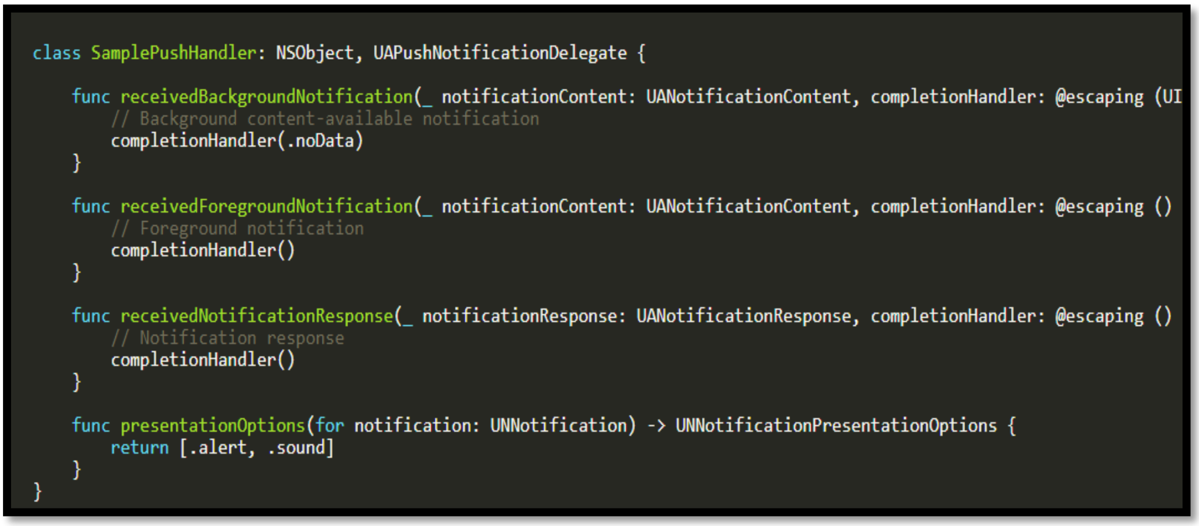
Figure 4: Amazon SNS Diagram (Amazon SNS)

4.2 - Urban Airship

Urban Airship is a mobile engagement platform company, that offers other functions alongside push notifications. Such as targeting features, in-app messaging, and analytics.

This service offers a free one-month trial of its services but when that expires it costs $99 a month. This would make development difficult as all backend work would have to be carried out over one month to not incur a fee.

The main benefits of this service are that it supports both Android and iOS. It also has "personalisation options to help modify the push notifications" (Airship) to be more appealing from a UI perspective. Finally, it also offers comprehensive documentation. However, the cost issue makes it clear that it is not a feasible option for the present moment.



```
class SamplePushHandler: NSObject, UAPushNotificationDelegate {

    func receivedBackgroundNotification(_ notificationContent: UANotificationContent, completionHandler: @escaping (UI
        // Background content-available notification
        completionHandler(.noData)
    }

    func receivedForegroundNotification(_ notificationContent: UANotificationContent, completionHandler: @escaping ()
        // Foreground notification
        completionHandler()
    }

    func receivedNotificationResponse(_ notificationResponse: UANotificationResponse, completionHandler: @escaping ()
        // Notification response
        completionHandler()
    }

    func presentationOptions(for notification: UNNotification) -> UNNotificationPresentationOptions {
        return [.alert, .sound]
    }
}
```

Figure 5: Airship Notification Sample Code (Airship)

4.3 - Firebase Cloud Messaging

Firebase Cloud Messaging (FCM) is also cross platform and offers more than just a push notification service. It offers a variety of tooling for mobile development. Its products include cloud storage and a real-time database as well as push notification services.

Like the previously mentioned service, Firebase allows you to send targeted and automated push notifications that allow you the ability to customize the notification.

The main benefit of this service would be it can be used in conjunction with the other tooling Firebase has on offer, such as the database. Having the application backend based on the one service would likely allow for a more efficient system and less time learning multiple systems.

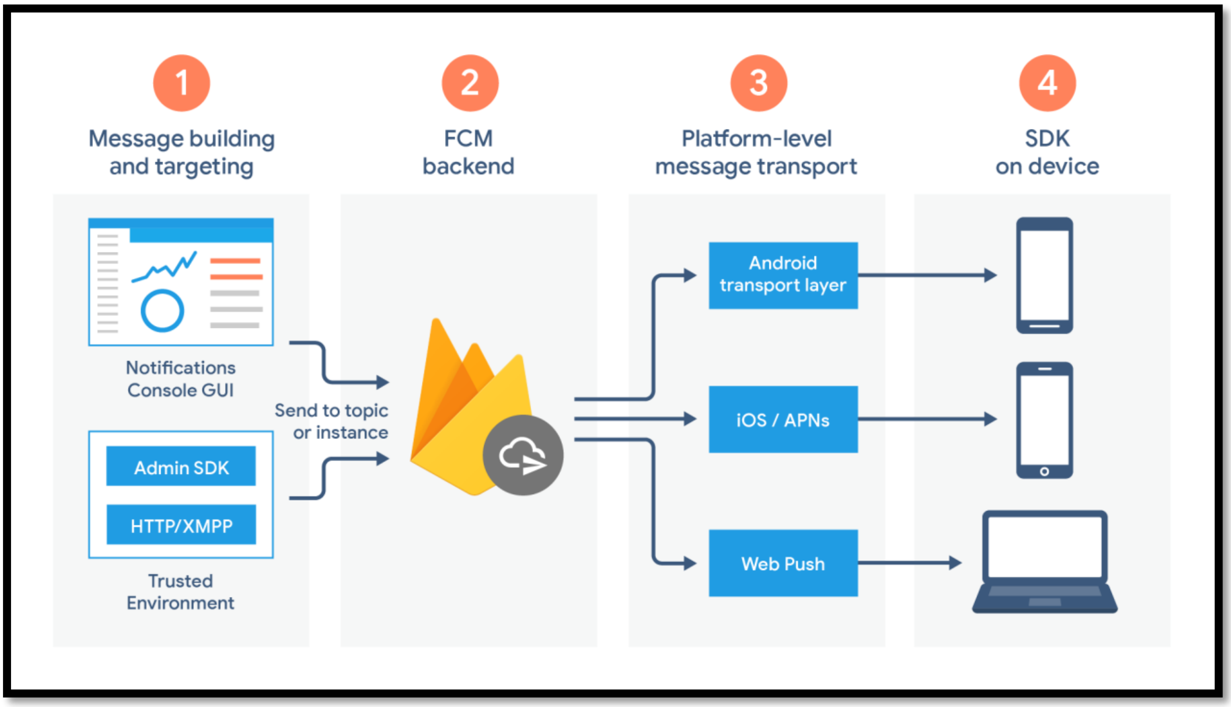

1
Message building and targeting
2
FCM backend
3
Platform-level message transport
4
SDK on device
Notifications Console GUI
Admin SDK
HTTP/XMPP
Trusted Environment
Send to topic or instance
Android transport layer
iOS / APNs
Web Push

Figure 6: FCM Technical Diagram (Firebase Documentation)

4.4 - Apple Push Notification Service

Apple Push Notification service offers similar functionality as the previous services, but it has been designed for and created by Apple. “It allows for third party application developers to send notification data to applications installed on Apple devices” (Apple).

This appears to be the only way to send push notifications to Apple devices. Therefore, it will have to be implemented as part of the project. However, it should not cause too much difficulty as the previously mentioned services are able to push to Apples Push Notification Service and from there Apple takes over.

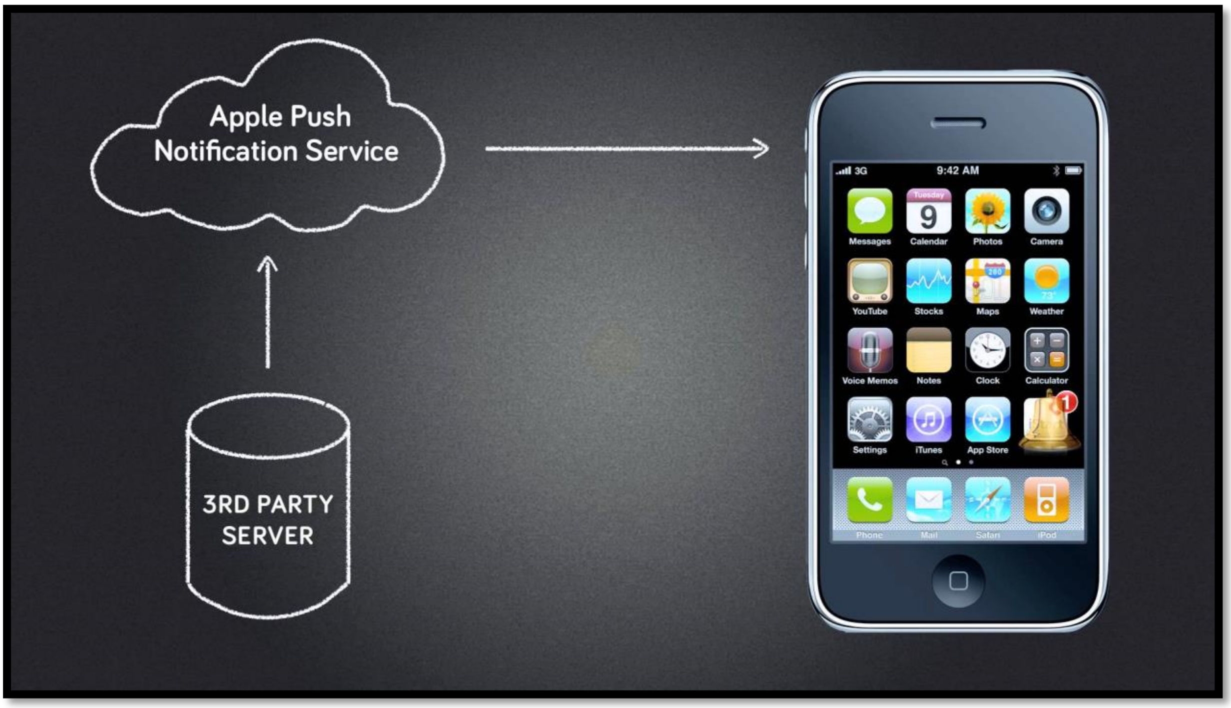


Figure 7: Apple Push Notification Layout (Apple)

5. - Potential Databases

5.1 – SQLite

Throughout researching potential databases, SQLite seems to be the foremost recommended for mobile applications. This appears to be because of its range of convenient features, such as it being serverless. SQLite database is integrated with the application that is accessing its data. The applications interact with the SQLite database read and write directly from the database files stored on disk (Figure 8).

“SQLite is also self-contained meaning it only requires minimal support from the operating system or external library, making it ideal for mobile devices” (SQLite tutorial).

The main benefit for SQLite combined with Flutter is that Flutter has a plugin available, which makes interacting with the database much easier.

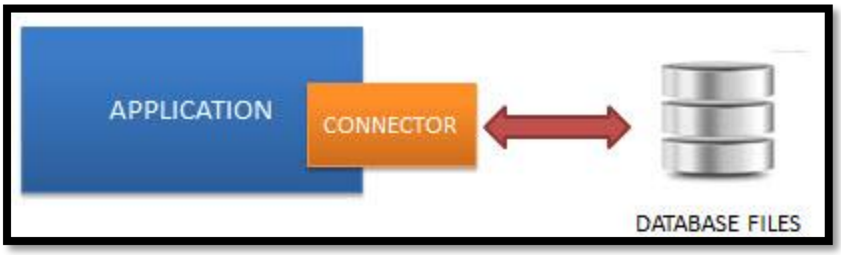
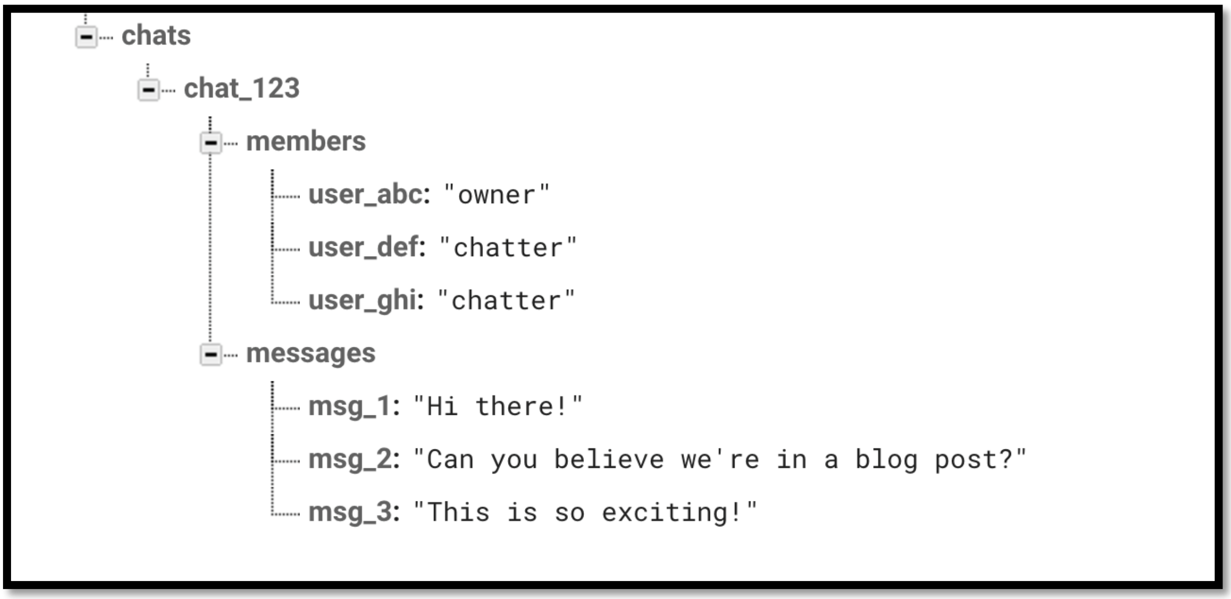


Figure 8: SQLite Database Example (SQLite tutorial)

5.2 - Firebase

The Firebase Realtime Database is a cloud-hosted database. The data gets synchronised across all connected devices in real time. “Cross-platform apps all share one Realtime Database instance and automatically receive updates with the newest data” (Firebase Documentation).

This contains similar features, such as serverless apps and a Flutter plugin. An extra benefit is that, as previously mentioned, Firebase also provides a push notification service. This would allow for the database and notifications to work under the one area and stay synced. The push notifications could be listening to the database for changes in real time.



```
chats
    chat_123
        members
            user_abc: "owner"
            user_def: "chatter"
            user_ghi: "chatter"
        messages
            msg_1: "Hi there!"
            msg_2: "Can you believe we're in a blog post?"
            msg_3: "This is so exciting!"
```

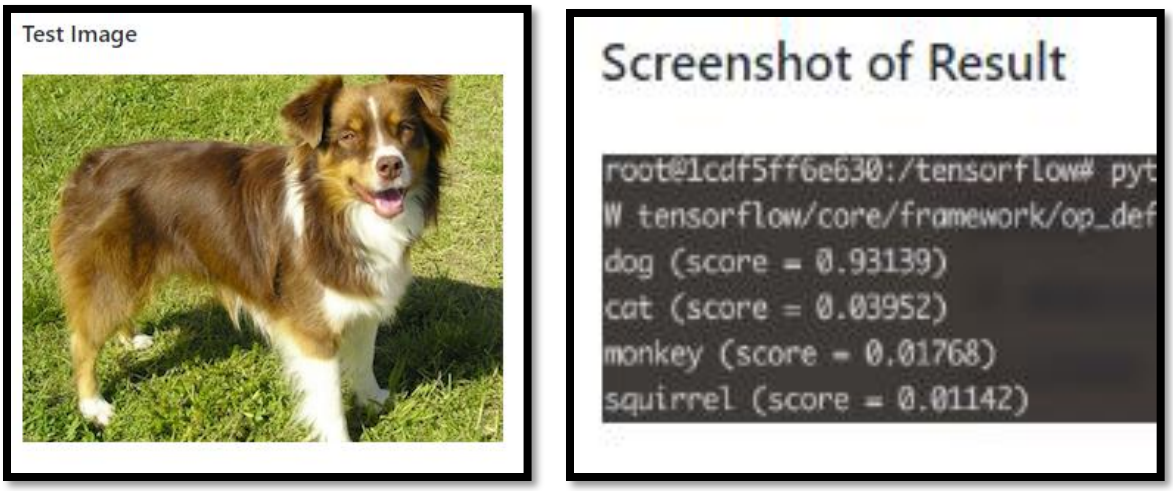
Figure 9: Firebase Database Layout (Firebase Documentation)

6. - Animal Detection

A possible issue that may arise when this application is developed and released, is that users may abuse the ability to upload images independently. It can be suggested that users may upload non animal related images.

Due to this issue, it is important to research into existing open-source machine learning software that has the ability to detect whether the images contain a particular animal.

There is a repository on GitHub called TensorFlow-Animals which gives the needed functionality (TensorFlow Animals). There is no documentation on how to integrate this into a mobile application so it will be an ongoing process during development.



Test Image

Screenshot of Result

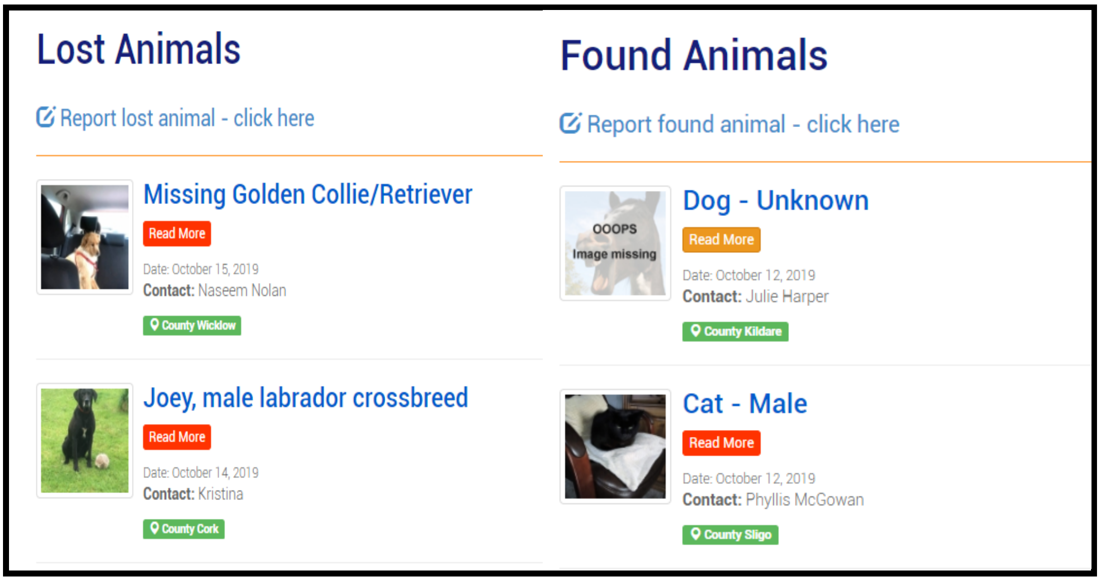
```
root@1cdf5ff6e630:/tensorflow# pyt
W tensorflow/core/framework/op_def
dog (score = 0.93139)
cat (score = 0.03952)
monkey (score = 0.01768)
squirrel (score = 0.01142)
```

Figure 10/11: Test Image and Result (TensorFlow Animals)

7. - Similar Applications

7.1 - ISPCA

The Irish Society for the Prevention of Cruelty to Animals is recognised as Ireland's leading animal welfare charity. Their role is to is to "prevent cruelty to animals, to promote animal welfare and to proactively relieve animal suffering in Ireland" (ISPCA). The main area of interest for me is the 'lost & found' section in which you can report or view lost and found pets.



Lost Animals

Report lost animal - click here

Missing Golden Collie/Retriever

Read More

Date: October 15, 2019
Contact: Naseem Nolan

County Wicklow

Joey, male labrador crossbreed

Read More

Date: October 14, 2019
Contact: Kristina

County Cork

Found Animals

Report found animal - click here

Dog - Unknown

OOOPS
Image missing

Read More

Date: October 12, 2019
Contact: Julie Harper

County Kildare

Cat - Male

Read More

Date: October 12, 2019
Contact: Phyllis McGowan

County Sligo

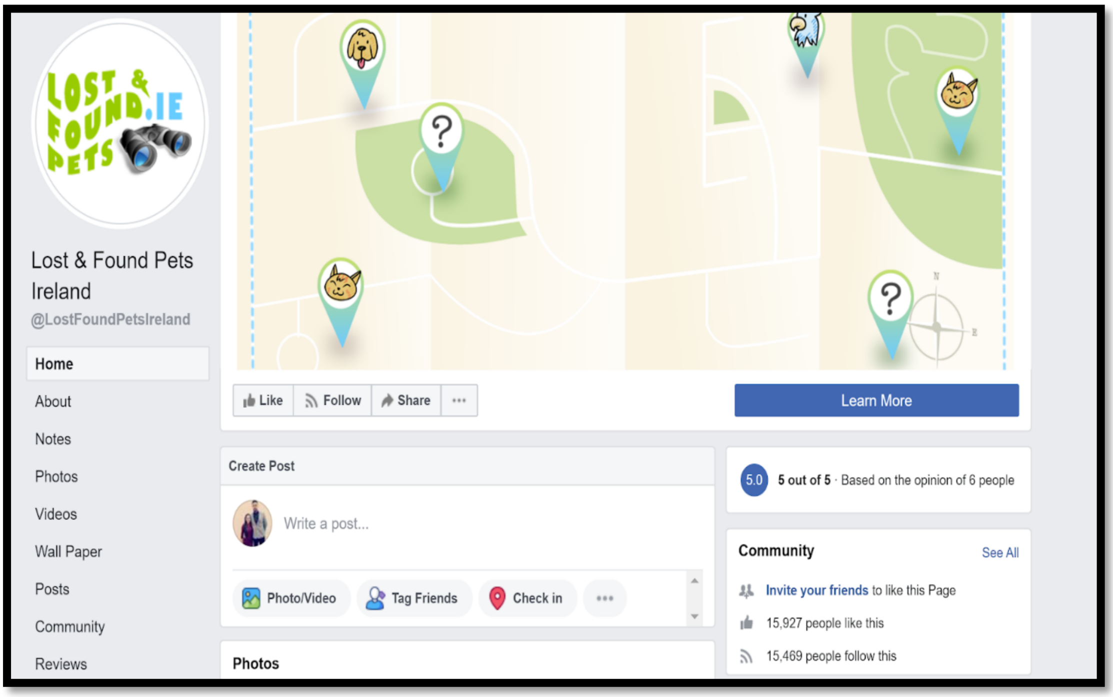
Figure 11: ISPCA Website (ISPCA)

There are both positive and negative aspects of this site. In terms of positives it presents the user with an image of the animal, a description, location and contact. These are all important from a user's perspective and is similar to the content of the project.

It can be argued that the main negative is that it is only available through a website. This will decrease the likelihood of users interacting with it daily. In turn, awareness of missing animals is lessened which potentially affects how many are found.

7.2 - Large Facebook pages

There is a sizeable amount of Facebook pages for lost and found pets with their overall purpose being to use the reach of social networking to reunite Irish pets with their owners in the quickest and easiest way possible.



5.0 5 out of 5 · Based on the opinion of 6 people

Invite your friends to like this Page

15,927 people like this

15,469 people follow this

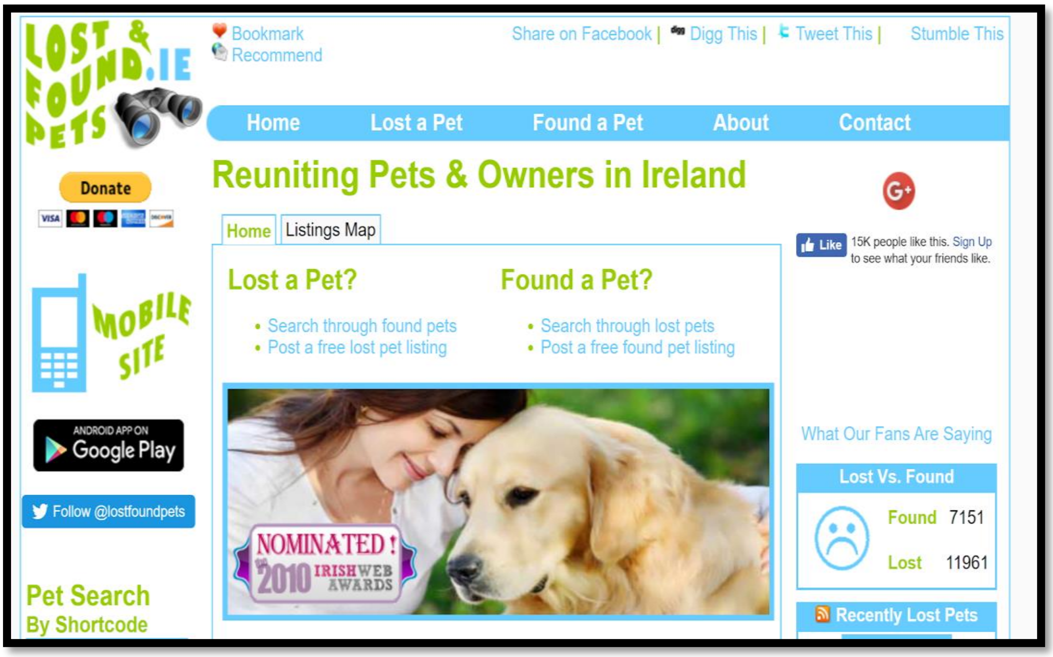
Figure 12: Lost and Found Pets Page (Lost and Found Pets)

The main benefit of implementing the idea this way is it makes the information accessible to a large user-base. For anyone using Facebook it is simply a matter of following a page.

On a negative note, the integration with Facebook may mean that animal posts are missed or scrolled past amongst all the other information on offer. Also, users may start to ignore these posts as there is no divide between locations. Consistent posts that are not relevant to the user due to location issues may prove to be overwhelming.

7.3 - Websites

There are several websites available online regarding lost dogs, cats and other animals. They are quite similar in that they allow you to post if you have lost or found an animal along with an image, description, location and contact information. Some also introduce the idea of a section for animals looking to be adopted, an idea already planned to be implemented into this project.



Reuniting Pets & Owners in Ireland

Lost a Pet?

- Search through found pets
- Post a free lost pet listing

Found a Pet?

- Search through lost pets
- Post a free found pet listing

15K people like this. Sign Up to see what your friends like.

What Our Fans Are Saying

Lost Vs. Found

Found	7151
Lost	11961

Recently Lost Pets

Figure 13: Lost Pets Website (Lost & Found Pets Ireland)

A positive element of websites such as these is that their sole purpose is reuniting pets and owners. This means users do not have to wade through irrelevant information.

However, it can be argued that the websites are not as accessible as an application that uses push notifications. This is because users must go out of their way to check websites regularly, whereas an application can alert users when an animal is lost.

7.4 - Finding Rover - Facial recognition

Finding Rover is a website and cross platform mobile application with the unique selling point of facial recognition for dogs and cats. The idea is that the user uploads an image of their pets to the platform, if the pet is lost and later found by someone, they can take a photo of the pet using the application and it is matched to the owner.

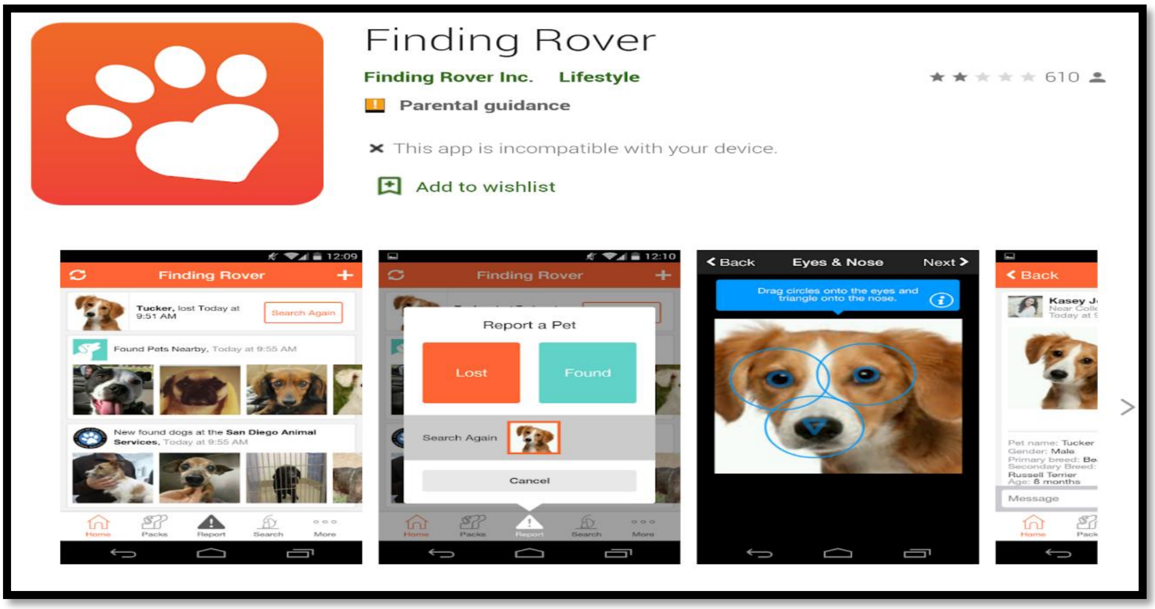

Finding Rover
Finding Rover Inc.
Lifestyle
610
Parental guidance
This app is incompatible with your device.
Add to wishlist
Finding Rover
Tucker, lost Today at 9:51 AM
Search Again
Found Pets Nearby, Today at 9:55 AM
New found dogs at the San Diego Animal Services, Today at 9:55 AM
Home
Packs
Report
Search
More
Report a Pet
Lost
Found
Search Again
Cancel
Back
Eyes & Nose
Next
Drag circles onto the eyes and triangle onto the nose.
Pet name: Tucker
Gender: Male
Message

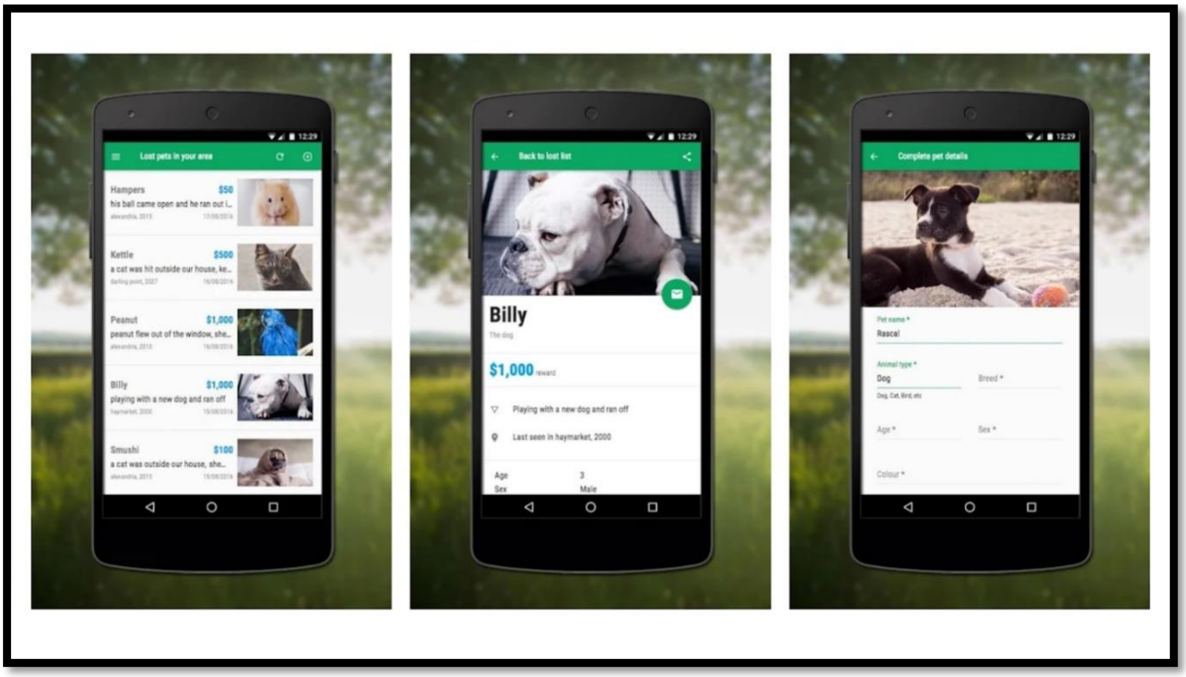
Figure 14: FindingRover Application Screens (Finding Rover)

On further research into the application, it appears the facial recognition may not be very effective. These results are gathered from the review section on the Google Play store, which contains a lot of complaints that the app does not work as described. After personally testing, it seems that the software matches the image to a breed of the pet, as opposed to the individual pet itself.

7.5 - Runaway Pets

Runaway Pets is the closest application to *FindMyPets*. It allows the user to mark the last seen location of a lost pet, upload the pet's details along with picture and notify all the users in the area. The main features *Runaway Pets* offers are:

1. Three easy steps to notify all users in the area.
2. Simple Sort & Filter results in user's area.
3. Simple Sign Up/ Login process.
4. Easy to use upload / take a photo and crop image.



Hampers $50
his ball came open and he ran out i...
alexandria, 2015 17/08/2016

Kettle $500
a cat was hit outside our house, ke...
darling point, 2027 16/08/2016

Peanut $1,000
peanut flew out of the window, she...
alexandria, 2015 16/08/2016

Billy $1,000
playing with a new dog and ran off
haymarket, 2000 15/08/2016

Smushi $100
a cat was outside our house, she...
alexandria, 2015 15/08/2016

Billy
The dog

$1,000 reward

Playing with a new dog and ran off

Last seen in haymarket, 2000

Age 3
Sex Male

Pet name *
Rascal

Animal type *
Dog
Dog, Cat, Bird, etc

Breed *

Age *

Sex *

Colour *

Figure 15: RunawayPets Application Screens (Runaway Pets)

Conclusion

From my research I have concluded that I will be using Firebase for my push notification service and for my real-time database. Both functions being implemented through the same mobile development platform will help promote a more seamless interaction. For example, notifications are a huge requirement of the application. Firebase offers a push notification service that can directly listen to the database for when new data is added. This will allow for a quicker and easier process. Firebase cloud messaging works to directly trigger the Apple push notifications, which that are a requirement of iOS. Furthermore, all Firebase products are very well documented which will help promote faster learning.

Flutter suits the requirements of this application more than other similar technologies. This is because Flutter applications run just as fast as native applications. This paired with the large store of pre-defined UI widgets and that it is written in an object-oriented language make it a more suitable choice.

It can be argued that the research also demonstrates that existing methods of helping owners find their lost pets are not as effective as they can be. Real time notifications are not common and oftentimes the location is not relevant to the user as the service encompasses a wide area. This project hopes to address these downfalls. It will do so by providing functions that allow users to be updated in real time about lost animals in their direct vicinity. It is hoped that it can make a genuine and positive impact on the lives of the users and the lost pets.

Plagiarism Declaration

Declaration

- I declare that all material in this submission e.g. thesis/essay/project/assignment is entirely my/our own work except where duly acknowledged.
- I have cited the sources of all quotations, paraphrases, summaries of information, tables, diagrams or other material; including software and other electronic media in which intellectual property rights may reside.
- I have provided a complete bibliography of all works and sources used in the preparation of this submission.
- I understand that failure to comply with the Institute's regulations governing plagiarism constitutes a serious offense.

Student Name: Martin Walsh

Student Number: C00170339

Signature: M.Walsh

Date: 20/04/2020

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"Apple." 2019. *apple.* 8 November 2019. <https://developer.apple.com/library/archive/documentation/NetworkingInternet/Conceptual/RemoteNotificationsPG/APNSOverview.html>.

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Finding Rover. 2019. 26 October 2019. <https://findingrover.com>.

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