KITCHENETTE RECIPES

Research Manual

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Abstract

The purpose of this project is to create an Android application where the user can mark foods that they have in the house and based on these foods the app should suggest recipes they can cook. The application should present the user the option to add their own custom ingredients and recipes. If a user selects they have cooked a certain recipe, the app should automatically update the contents list to remove the ingredients they used. If a user wants to make a recipe, but does not have all the necessary ingredients, the app should present the user with a “shopping list” of ingredients to buy.

Table of Contents

Table of Figures

Section 1 - Introduction

When designing an application there are two main platforms to consider: Google's Android operating system and Apple's iPhone operating system.

The Android Operating System (OS) is a mobile operating system developed by Google (Investopedia, 2018). Android OS was originally developed by Android, Inc. before being acquired by Google in 2005. It is designed to be used across a wide range of mobile and tablet touchscreen devices. Google also deploys the Android OS software across smart watches, televisions and cars, all with a customised version of the Android interface. Android OS allows for the devices to be used intuitively "with phone interactions that mirror common motions, such as pinching, swiping, and tapping" (Investopedia, 2018). The Android operating system allows different companies to add their own custom features to their devices while still using the underlying Android OS. Each version of Android OS has been named after a "sweet treat" and the most current version of Android that has been released is version 9.0 or "Pie" (Android, 2018).

Apple's iPhone Operating System (iOS) is Apple's mobile operating system for their range of iPhone and iPad devices (Investopedia, 2018). It is based on Apple's Mac OS for desktops and laptop computers. All of Apple's devices and operating systems are designed to interact with each other seamlessly. It was first developed and released onto the market in 2007 with the introduction of the first iPhone. In its initial release the iOS had a huge impact on the market, culturing the traditional "smartphone" operating system which is now predominant and distancing itself from flip-phones and Blackberry styled devices of the time. The iOS was the first mobile operating system to combine "many functions within a single device, including a camera, internet browser and media player alongside the phone and messaging" (Investopedia, 2018). Apple's iOS is only available for their own devices and is currently on version 12 of its software.

The following research manual will determine the advantages of both operating systems to consider when developing a new application. This research report will also attempt to discover applications with similar functionality to the "Kitchenette" application to be built. Through this research it should be determined what features in existing applications have proved successful for users, and what areas of application with similar functionalities can be improved upon in designing the "Kitchenette" application.

Section 2 - Overview

Section 2.1 - Android vs IOS

The question of whether to develop an application first for Android or iOS has long been debated. Both platforms contain many advantages over the other so neither is a clear preferred. In 2017, Android's market share was over 64%, compared to a lower 32% for iOS (SAG IPL, 2018). *Figure 1* shows the number of devices containing different operating systems on the market. Android is currently ranked higher than the Windows operating system for personal computers. And has been continuing to climb in recent years.

Operating System	2012	2013	2014	2017
Android	497,082	860,937	1,069,503	1,069,503
Windows	346,457	354,410	397,533	570,937
iOS/MacOS	212,899	293,428	359,483	504,147
RIM	34,722	31,253	27,150	24,121
Others	1,122,213	871,718	702,786	396,959
Total	**2,213,373**	**2,411,796**	**2,556,455**	**2,964,783**

Figure 1 – Market Share of Devices per Operating System (SAG IPL, 2018)

In 2017, global app revenue climbed 35% to reach nearly $60bn (Perez, 2018). Despite Androids prominent claim on the market, the App Store for iOS brought in $38.5 billion in 2017, compared to Android's Google Play stores estimated $20.1 billion. *Figure 2* shows the revenue growth for 2017 over 2016. Despite Android having the most devices on the market, iOS is still pulling in a lot more revenue.

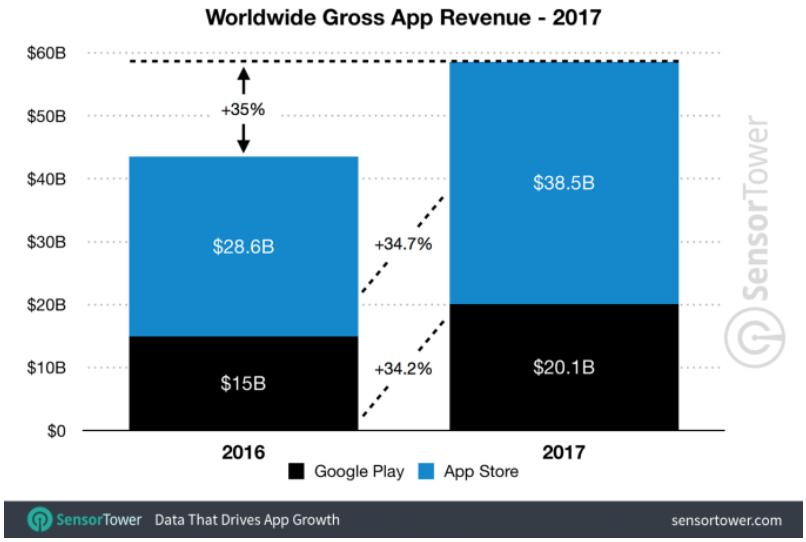

Figure 2: Worldwide Gross App Revenue 2017 (Perez, 2018)

The Google Play store currently boasts more first-time downloads of apps per year to that of the iOS App Store. In 2017, the Google Play Store's new app installs grew "91.5 billion in 2017, up around 13.5

percent from the estimated 80.7 billion in 2016" (Perez, 2018). *Figure 3* shows the growth of first-time app installs for Android and iOS.

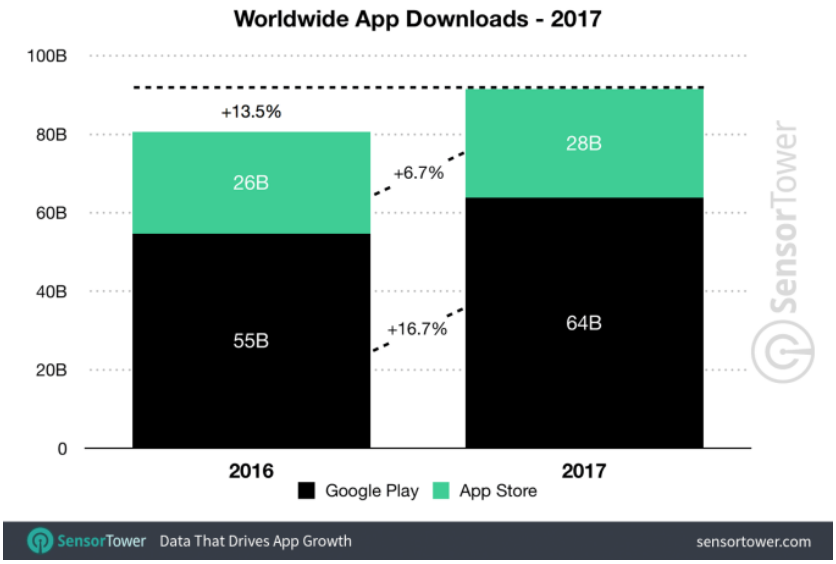

Figure 3: Worldwide App Downloads (Perez, 2018)

Android is also seen to have a wider variation of apps available for its users on the Google Play Store compared to iOS App Store, as seen in *Figure 4.*

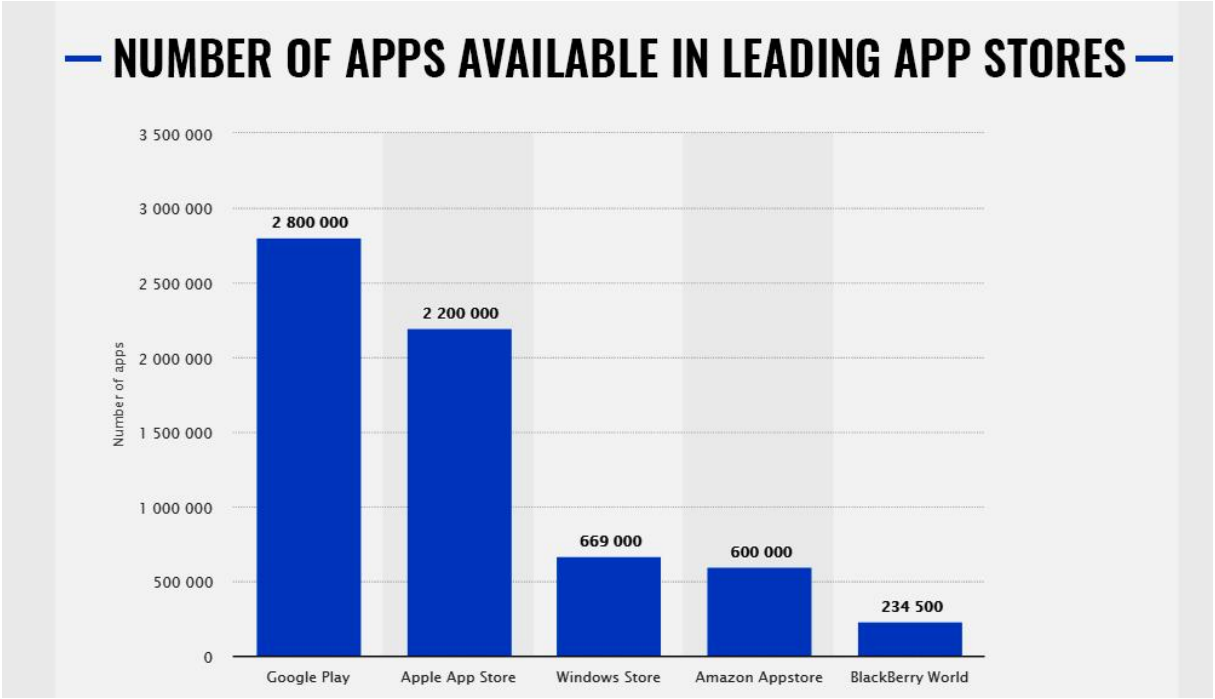

Figure 4: Market Saturation, Android v. iOS

Android applications are written in Java and iOS are written in Swift, Apple's own Objective-C language, like C and C++. This gives Android the advantage of using open-source development tools which support any third-party applications, features and tools. Development for iOS in comparison is done using a limited set of tools and requires the use of an Apple Mac. There are no external development tools for iOS development. iOS development, however, is a lot less complex than Android development due to the limited number of iOS devices on the market and the consistency of their operating system updates. Android's development is far more complex as not all Android devices

need to be on the same version of Android, on top of the variation of devices and screen sizes using the Android operating system. To develop a successful application for Android the finished application must be compatible with most of all target platforms. *Figure 5* and *Figure 6* show the comparisons of development complexity for Android and iOS development. Because of this complexity, Android takes, on average, 30-40% more time to develop than iOS application.

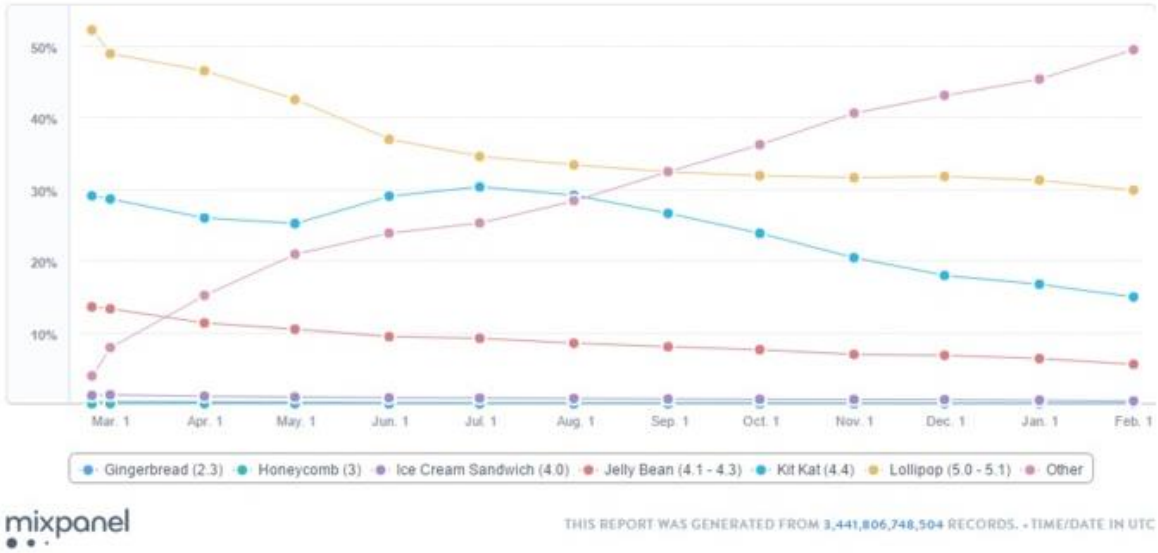

Figure 5: Android versions Still in use (SAG IPL, 2018)

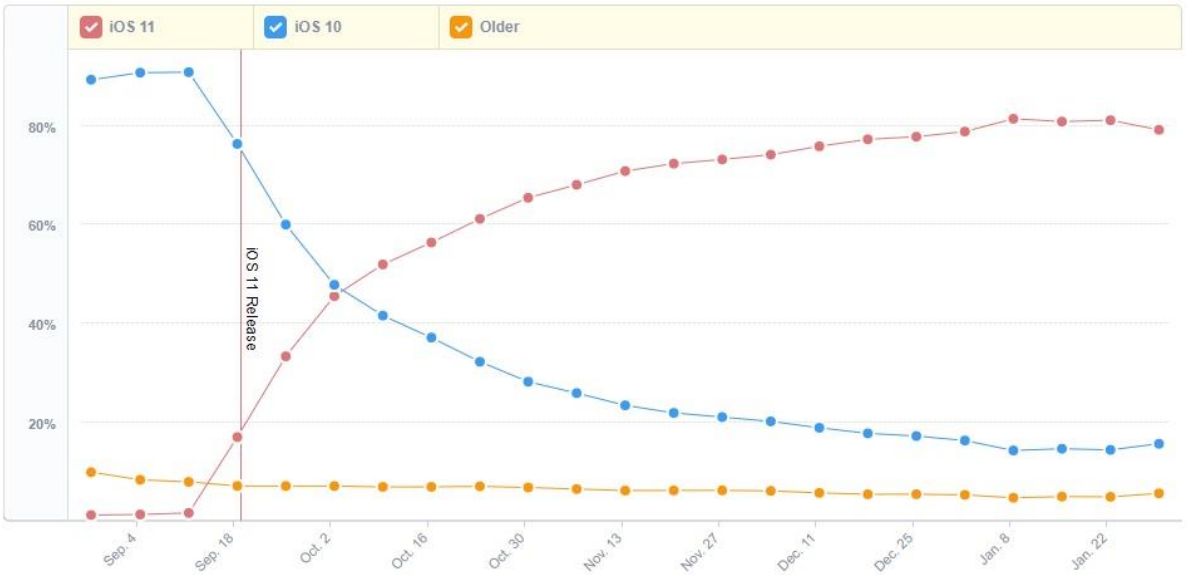

Figure 6: iOS versions still in use (SAG IPL, 2018)

To publish an app to the Google Play Store is relatively more straightforward than to publish to the Apple App Store. An application uploaded to the Google Play Store requires no validation and may be approved in a few hours. Android's testing platform makes testing your app before publishing it be more thorough than Apples XCode platform. To publish an application for iOS, however, requires extensive validation and has a long wait for approval. Publishing an iOS app is quite expensive. Apple charges $99 per year to publish an application to their App Store compared to the one-time fee of $25 the Google Play Store charges (Author, 2018).

Section 2.2 - Cross Platform

An alternative option to choosing to develop for either Android or iOS development is to pursue cross-platform development. Kivy is an open source python library which can run the same pure-Python code on multiple different platforms, including Android and iOS. Kivy is licensed by MIT from versions 1.7.2 and comes with a custom-built UI toolkit (kivy.org, 2018). Kivy's toolkit provides the developer with its own buttons, labels and forms. Kivy does not render widgets using native platform UI controls. This has the advantage of allowing consistency and portability across platforms, however can also cause the app to "look and feel" different to natively developed applications (Bader, 2017).

Section 2.3 - Database Structures

A relational database is the traditionally structured database format of tables with pre-designed columns. Rows in a relational database are identified using an index, which is then used to access specific data in the tables. It generally uses a form of the SQL language to add, update or delete records from the table as well querying the database. This allows the user to "access and manipulate their data in sophisticated ways to support both operational and analytical applications" (MongoDB, 2018). A relational database presents a strong consistency across the system it is incorporated into. Applications which connect to the relational database should be able to immediately interpret the data the data returned from a relational database.

Non-Relational, or NoSQL, databases offer a much more flexible model than traditional relational databases. Tables in a non-relational database do not need to be as statically structured as their counterparts and are more flexible to "allow dynamic modification of the schema without downtime or performance impact" (MongoDB, 2018). NoSQL databases were built with scalability in mind and are optimised to allow for unlimited growth of the database structure. Columns are not pre-determined for every row in the dataset, more can be added as some may not be used for each row. Like a relational database, indexing is still used to search through the rows of data. NoSQL databases such as MongoDB attempt to meet the traditional needs of a relational database such as strong consistency and standard query language, while maintaining all the features and flexibility of a non-relational database.

Despite the flexibility of non-relational databases, many large tech giants are still using relational databases, such as MySQL to manage the back-end of their applications. Some apps which still use relational databases include, Twitter, YouTube, Facebook and Google. MySQL can be designed to meet scalability requirements of the application while still providing the system with structured data which is quick to analyse and process (Space-O Technologies, 2016).

SQLite is a fully featured single-file relational SQL database (SQLite, 2018). The database itself is stored on a single disk file instead of on the server, and it is cross compatible on 32 bit and 64-bit architectures. SQLite is one of the top five most deployed software modules, with billions of deployments across Android, iOS, Mac and Windows operating systems. It is also used within browsers such as Firefox, chrome and safari, and is used in automotive vehicles and in television sets. All of SQLite's source code is contained within one file, meaning it contains a small footprint within systems and is faster than direct file input and output (I/O). Despite its small size, SQLite has a maximum database size of up to 140 terabytes. SQLite is easy to implement as it requires zero configuration and contains extensive detailed documentation and long-term support, with the intent to support SQLite until the year 2050 by developers (SQLite, 2018).

Section 2.4 - Servers and Infrastructure

Section 2.4.1 – Amazon Web Services

Amazon Web Services (AWS) is a software as a service (SaaS) global computing, data storage, analytics, application and deployment services platform. AWS is outsourced to many companies to increase their digital flexibility and catalyse digital transformation efforts (Attunix, 2018). Some AWS customers include companies such as Netflix, Workday, Samsung and Nokia. AWS is the second largest cloud service provider globally after Microsoft azure. Aws can eliminate capacity restraints in comparison to in house data servers. This mitigates cost in companies as it prevents the need to add extra servers and therefore have an excess of idle storage. AWS has global reach and scalability, with data storage centres internationally including North America, Ireland, Japan and Australia.

Amazon Simple Storage Service (S3) is an AWS web interface (AWS, 2018). S3 allows simple access to store and retrieve data across servers. It will also store data across multiple redundant servers so that there is always a backup of the users' data, even if servers go down (Attunix, 2018). S3 is a cost-effective form of AWS which can implemented quickly. However, S3 does charge users extra for individual transactions on top of data storage and can get quite expensive in this regard. Amazon Relational Database Services (Amazon RDS) is an easy to set up, scalable and operable relational database in the cloud (AWS, 2018). Amazon RDS is considered a cost-effective cloud service and is compatible with many forms of SQL including MariaDB, MYSQL and Oracle (Ksiazek, 2017).

Section 2.4.2 – Google Cloud Platform

Google has developed its own Google Cloud SQL which is compatible with MYSQL and PostgreSQL (Google Cloud, 2018). Google Cloud SQL is a part of the Google Cloud Platform, Google's own cloud computing service. Google Cloud Platform is run entirely internally on the google service and is a platform as a service (PaaS). It runs on the same infrastructure as YouTube and Google Search. It is written in, and compatible with, Java, C++, Python, Go and Ruby (Google Cloud, 2018).

Google App Engine is a web framework on the Google Cloud Platform. It allows a user to run web-based applications in Google managed data centres (Google Cloud, 2018). Applications run on Google App Engine are sandboxed and run across multiple servers, rather than just the one. Google App Engine offers 99.99% durability with servers across every continent (Vidal, 2018). Google App Engine offers different storage classes for data depending on usage and has a flexible pricing plan. Users are given $300 free credit to get started. However, the pricing plan can sometimes be complex, with unexpected costs. The support service for Google App Engine is highly commended, but expensive starting at $150 per month for the basic service (Vidal, 2018). Google App Engine does allow simple integration with existing Google Cloud Storage Services. It offers a free layer for developers to build prototypes on (Vidal, 2018).

Section 2.4.3 – Python Anywhere

Python Anywhere is a PaaS that supports web applications written in python only (Stackshare, 2014). Python Anywhere can support scheduled jobs with shell access in addition to its web applications. It gives users free hosting for one small web application. Python Anywhere has a fixed pricing plan rather than a scalable one (Python Anywhere, 2018) and get be quite expensive in this way. Python anywhere can be quite fast for small, simple applications but slows down considerable for larger applications. In 2014, Python Anywhere began to support applications for Android and iOS development written in python (Giles, 2014).

Section 2.5 - Similar Apps

Section 2.5.1 - Fitbit

There are many food tracking apps on the market that allow the user to enter the food they have eaten and view a breakdown of the nutritional content, macros and calorie count of the food they have eaten throughout the day. Some examples of such applications include, Fitbit, My Fitness Pal and Weight Watchers. *Figure 7* and *Figure 8* show an example of logging food in the Fitbit app.

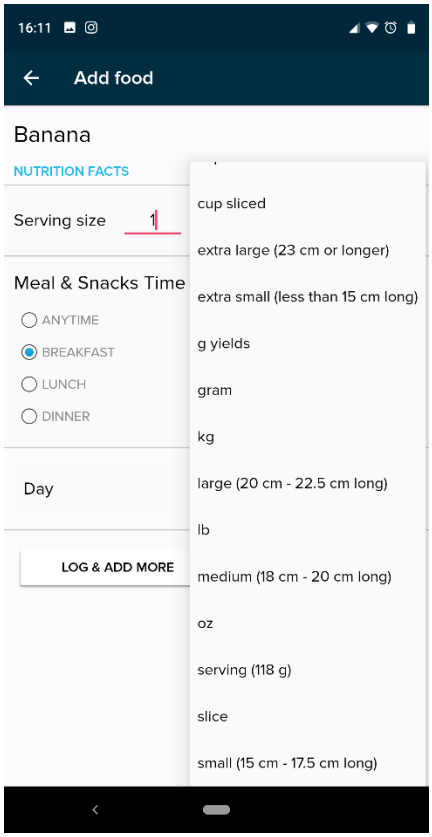

Figure 7: Logging food in the Fitbit app part 1

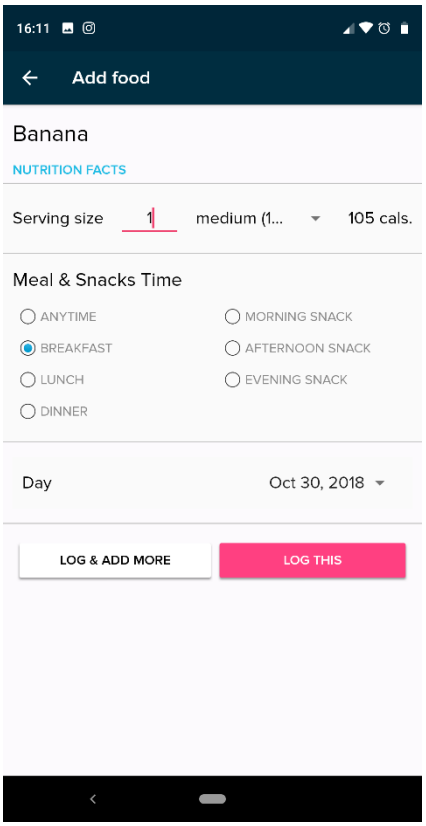

Figure 8: Logging food in the Fitbit app part 2

The Fitbit app especially has the added functionality of letting you add your own custom food if the food you have eaten is not in their database. The Fitbit app also allows the user to scan the barcode of the food eaten, and if this barcode is already attached to a food in the database, the food will automatically add to what you have eaten today. However, the Fitbit app does not allow you to attach a new barcode to an existing or custom food. *Figure 9* shows the UI for adding a custom food to the Fitbit app.

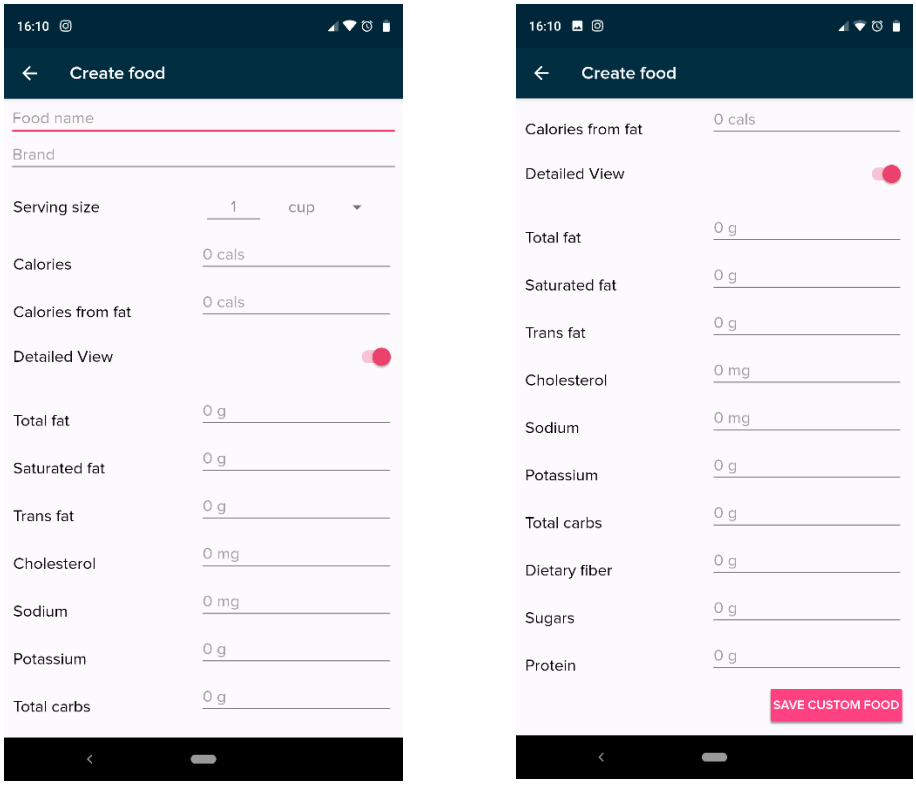

Figure 9: Adding a custom food to the Fitbit app part 1

Section 2.5.2 – Supercook

'Supercook' is an online web application which allows the user to select from a list food that they have in their home and then provides them with suggested recipes based on what they have (Supercook, 2014). Supercook also suggests to the user additional recipes with missing ingredients and gives a breakdown of how many recipes match the ingredients list in total versus how many of them the user has all necessary ingredients for. Supercook also allows the user to filter the recipe results by several categories: Diet, Key Ingredients, Meal Type and Cuisine.

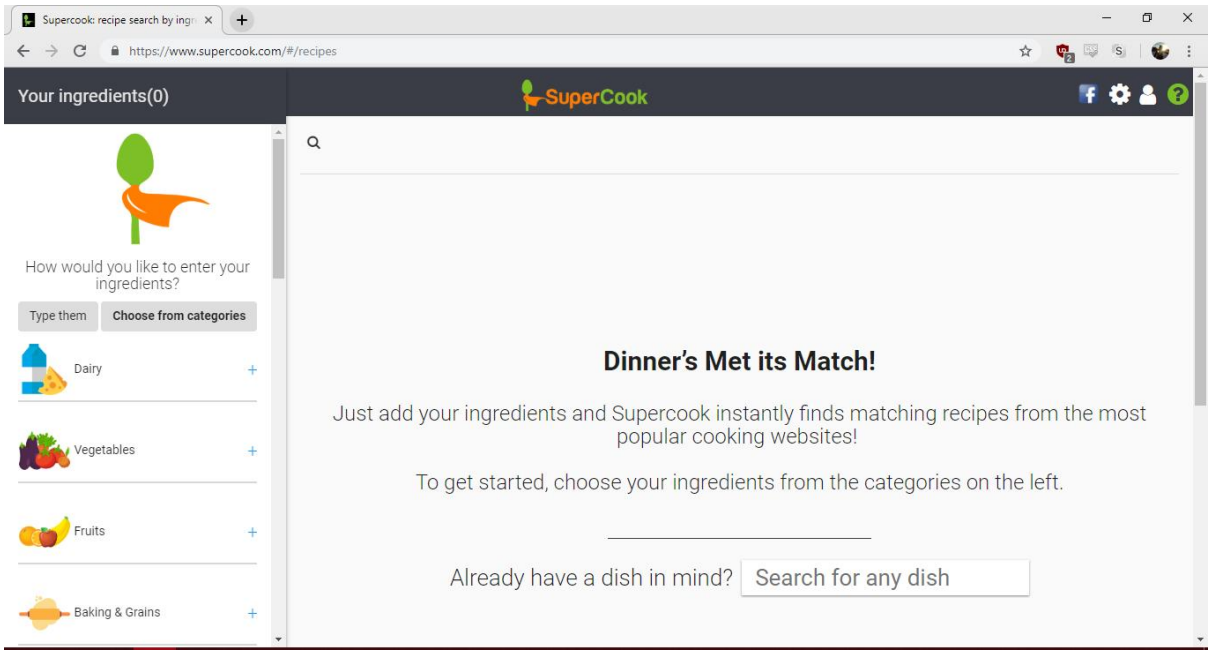

Figure 10: The Supercook home page

The ingredient or food lists on Supercook, however, though they are extensive are not complete. The lists are missing a lot of ingredients and offer no customisation for the user to add a food themselves. The food lists on Supercook are also very long, and for the user to add food they must scroll through these lists to find the list they are looking for. The website does not list the quantity of the food the user has either, so it is harder to evaluate which recipes the user has enough of the key ingredients to make.

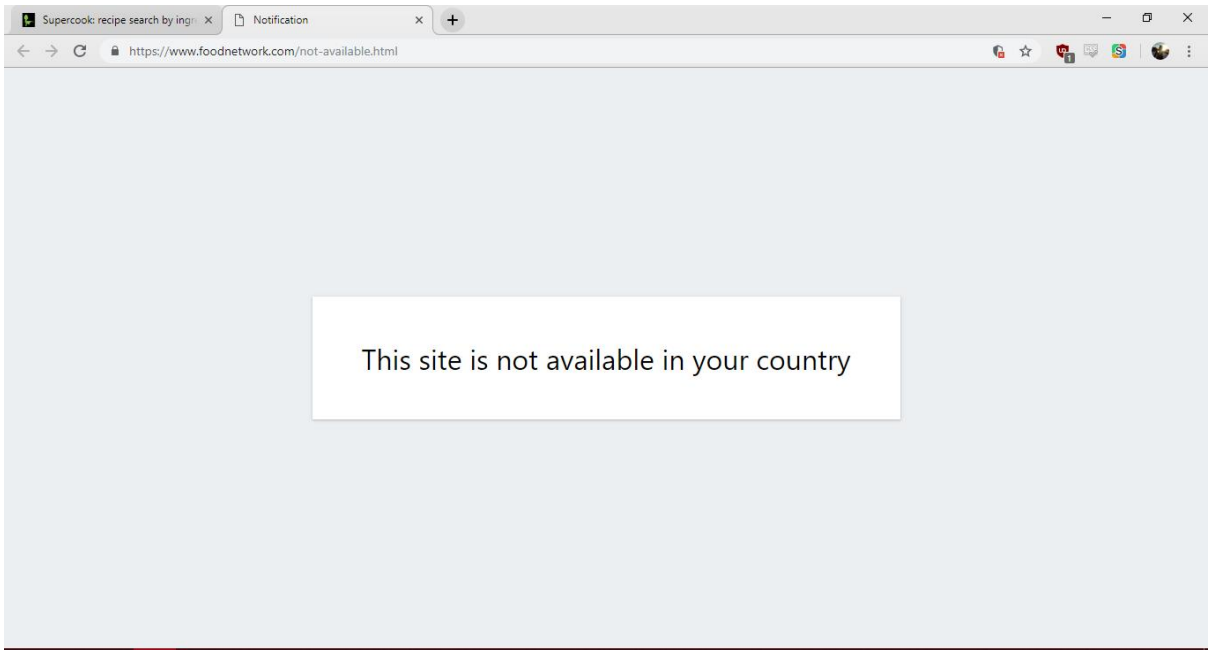

Figure 11: Not all recipes on Supercook can be opened outside of America

Supercook is an American based website and does not have an app available for mobile devices. A lot of the recipes Supercook suggests are blocked from being opened outside of America with the caption "This site is not available in your country" *(Figure 11)*. There is a large amount of repetition on Supercook, the web site will suggest multiple recipes of the same thing, for example scrambled eggs, instead of giving the user variation in the choices (*Figure 12*). If the user chooses to make a recipe, there is no way for the Supercook application to automatically detract the ingredients used in that recipe from the users list. All ingredients must be added and removed manually by the user.

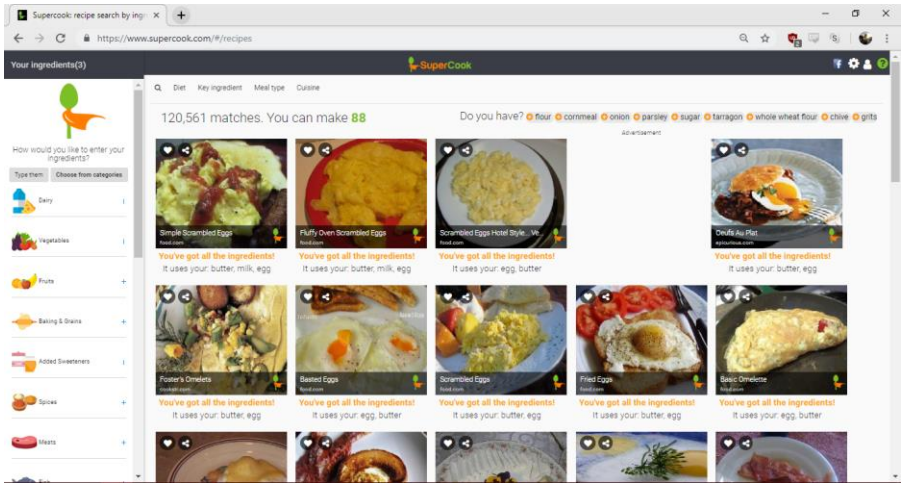

Figure 12: Supercook presents the user with multiple options for the same recipe, in this case: Scrambled Eggs

Section 2.5.3 – My Bar

The "My Bar" application, available on the Google Play store offers similar functionality to Supercook, only with cocktails and drinks instead of food (My Bar, 2016). Nonetheless, "My Bar" provides the user with a simple interface which allow them to enter ingredients which they have in their home and shows them suggested recipes they can make and recipes they are missing several ingredients for. Like Supercook, "My Bar" does not allow the user to add any custom ingredients or recipes or add the quantities of the ingredients they have. *Figure 13* and *Figure 14* show descriptions of the functionality of "My Bar," as taken from its website.

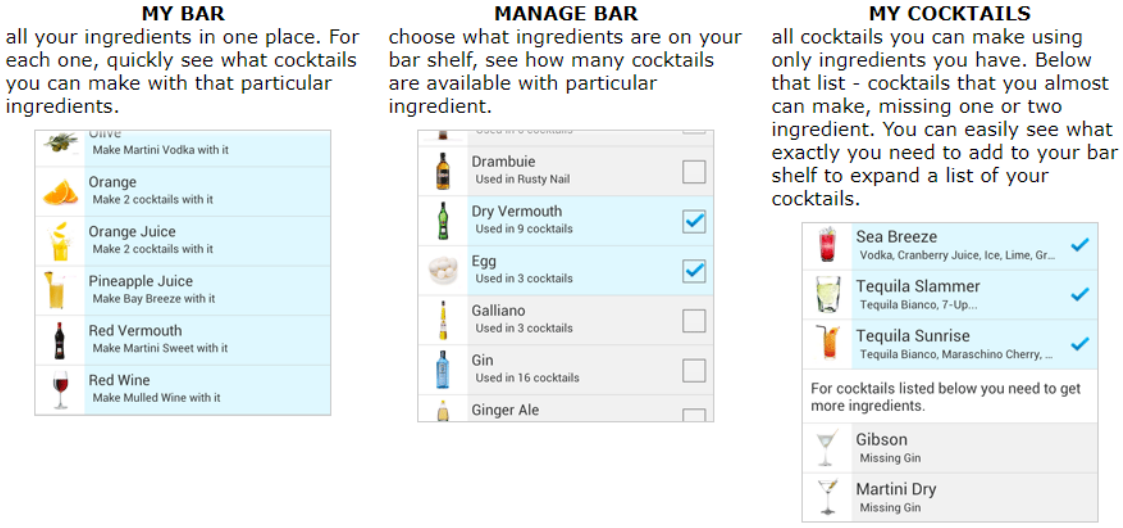

Figure 13 - mybarapp.com functionality

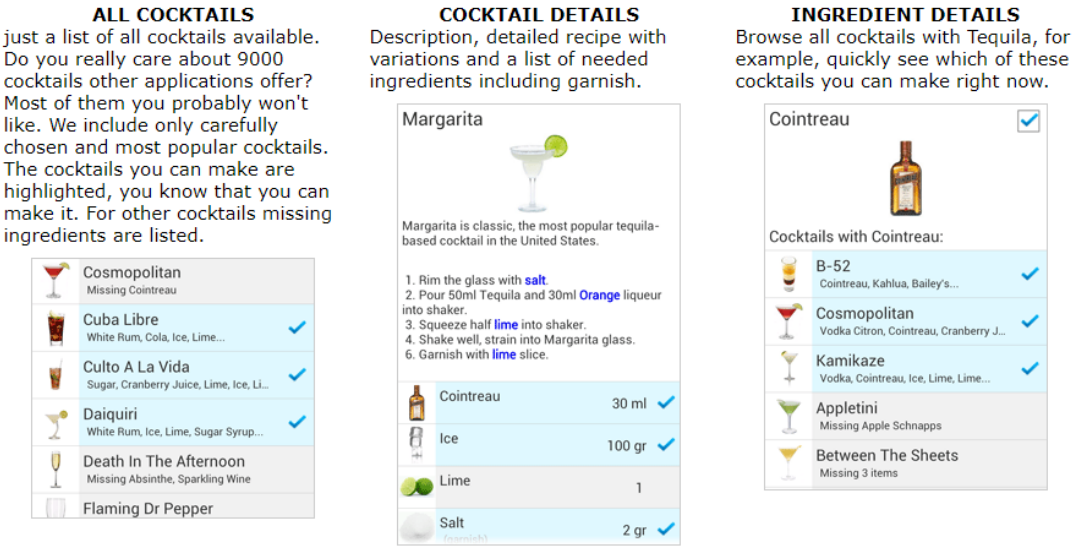

Figure 14 - mybarapp.com functionality

Section 2.6 - Barcode Scanners

A Global Trade Item Number, GIN or barcode for short, is a machine-readable number for identifying registered products (GS1 Ireland, 2018). They are printed with vertical black lines of varying width on a white label. A barcode can be found on any product available on the market and is its unique identifier. “Using a barcode can greatly reduce human error in data entry and processing, eliminate doubt caused by inconsistent approaches to product labelling and mistakes in reading handwriting” (GS1 Ireland, 2018). A product must register for a license GS1, a non-profit organisation that develops and maintains global standards of business. Within Ireland, the most common type of barcode is the EAN (European Article Number) 13 type, but there are various others.

There are multiple barcode scanning API’s which can be added into an Android or iOS application. Some of these are free applications, which will scan and read the barcode but not identify the product. Some barcode scanner API’s can be costly but will automatically tell the user what the product is after they have scanned its barcode.

Section 2.6.1 – Barcode Lookup

Barcode Lookup is a website that allows a user to enter any barcode number, and receive product information, photos and store pricing worldwide for that product (Barcode Lookup, 2018). Barcode lookup currently has a database identifying the barcodes of 108,469,544 products (Barcode Lookup, 2018). The website itself is free to use and the have their own Android and iOS applications which are also free to use for an unlimited amount of barcode lookups. Barcode Lookup have an API which can be licensed and added into a developer’s Android or iOS applications. The first 30 API calls for this are free but afterwards can become costly, starting at $99 per month for 5,000 API calls (Barcode Lookup, 2018).

Section 2.6.2 - Scandit

Scandit is an API for Android applications which allows a user to scan barcodes into their Android, iOS and Windows applications (Scandit, 2018). It is free to implement for the “community” version, or pre-commercial applications, and offers flexible pricing plans afterwards (Scandit, 2018). Scandit can scan in and read many different forms of barcodes. It does not, however, identify the product for the users. Implementing the Scandit API into an application, the developer may then add the barcode to their own database but will not have the product pre-identified for them. Despite this inconvenience, Scandit benefits from having its free to implement version of the API to be added into applications.

Section 2.6.3 – Zebra Crossing

Zebra Crossing (ZXing) is an open-source barcode image processing library for Android applications (Google Open Source, 2018). ZXing is licensed under the Apache License v2.0 (Owen, 2014) and can be added into any application free of charge if full credits are given and any changes made to the source code are noted. ZXing does not identify the product scanned but allows the user to register a new barcode into their own database so it may be identified in the future. As a member of the Google Open Source Projects, ZXing has extensive support in the online community and has been implemented into many existing Android applications (Smith, 2013).

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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.

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