Research Document

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At the heart of South Leinster

Project: Smart Shopping Application

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1.Introduction

1.1 Smart Shopping Application

The Smart Shopping Application is a cross-platform, mobile shopping list application. Its key features are:

- Allow a user to create a shopping list in a quick and easy manner.
- Allow a user to save this list to a cloud database.
- Allow the user to add information regarding the location of a product in a given shop to a cloud database.
- Allow a user to sort a shopping list based on the location of products in a given shop.

The functionality that separates this application from the many other basic shopping list applications available is the list-sorting functionality. This uses crowd-sourced data to maintain a database describing the location of products across a selection of different shops and supplies users with the ability to integrate this information directly into their personal shopping list.

The intention is to develop this application in a cross-platform manner with a particular focus on mobile platforms. This application will be developed across three iterations from October 2015 until April 2016 by a single developer.

1.2 Purpose of This Document

The purpose of this document is to give an overview of the research that went into this project, the findings and conclusions of the research, a description of the chosen technologies and justification for their choice.

The details of project implementation can be found in the Functional Specification and Design Documents of this project and the results of the project are discussed in the Final Project Report.

2. Current Shopping Applications

It was necessary to perform research on current shopping list applications for the following reasons:

- To get a perspective on the current shopping list application market.
- To identify things that current applications do right.
- To identify things that current applications do wrong.
- To identify if there are already any applications that implement list sorting in the same way as the Smart Shopping Application.

2.1 Anylist

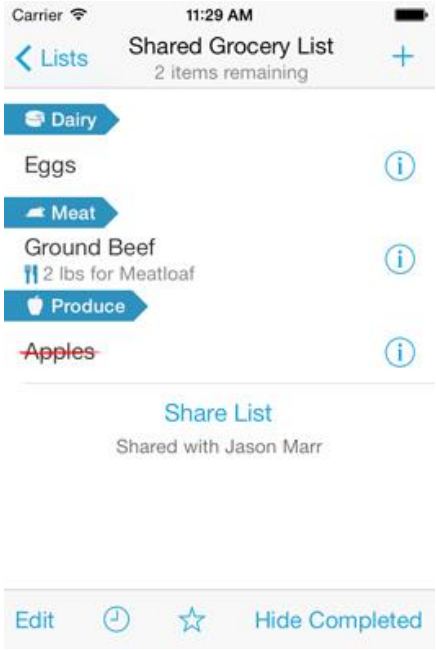
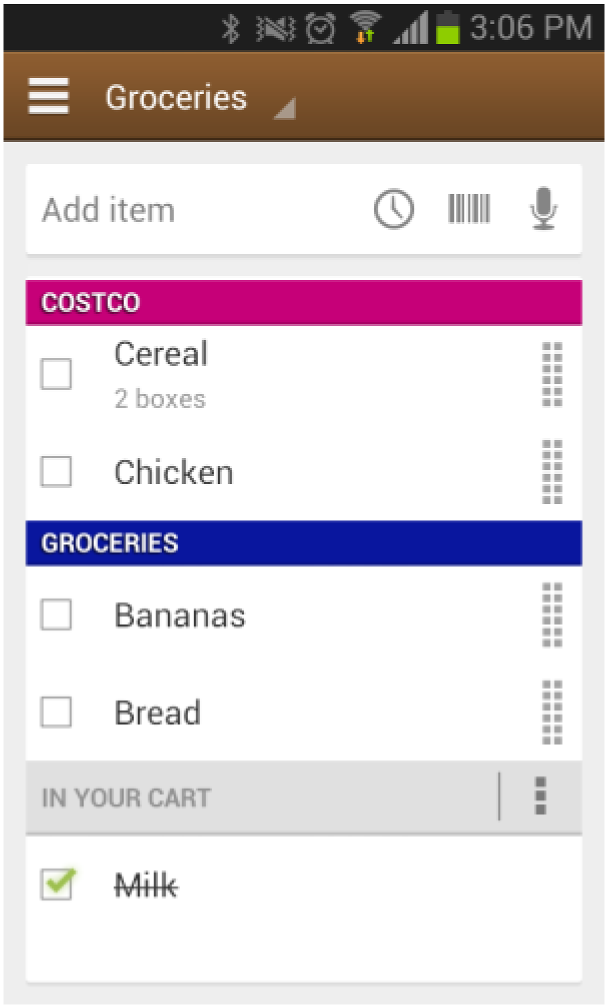


Fig 2.1 A Screenshot of Anylist

Anylist is a free shopping list application that is currently only available on IOS, there is also a premium edition. The user interface allows the user to manually type in products and the application makes suggestions as they do. The application also allows the sharing of lists between multiple users.

Products may be automatically categorized on the main list screen, since most shops group products by category on the shop floor this could be seen as a primitive version of the Smart Shopping Application's list sorting functionality. The user can also change the order of these categories, however this data is only set for one user and there is no concept of different shops. [1]

2.2 Out of Milk Shopping List



3:06 PM

Groceries

Add item

COSTCO

□ Cereal
2 boxes

□ Chicken

GROCERIES

□ Bananas

□ Bread

IN YOUR CART

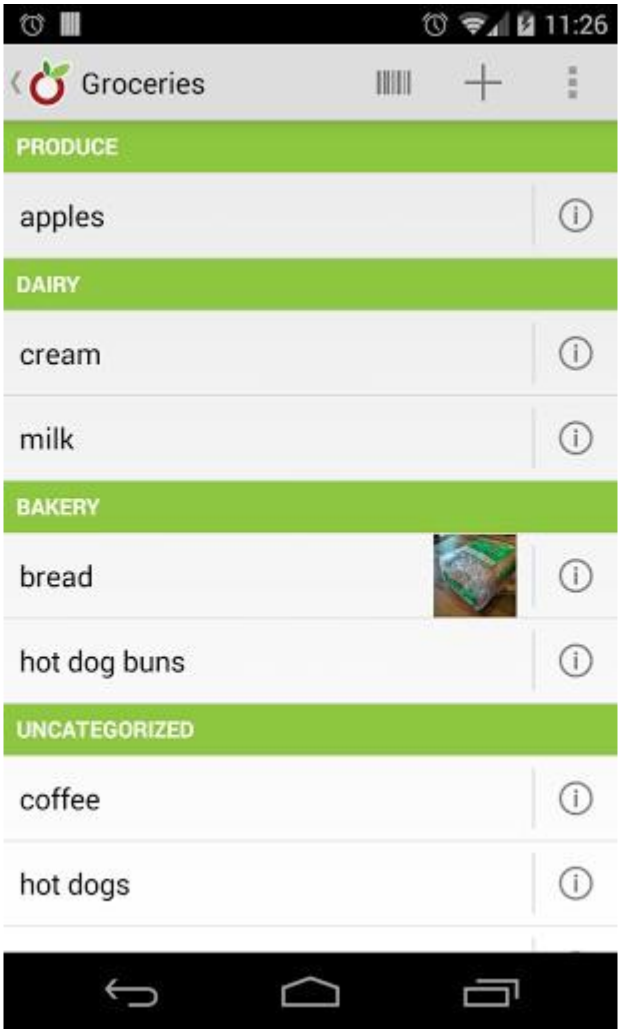
☑ ~~Milk~~

Fig 2.2 A Screenshot of Out of Milk Shopping List

Out of Milk Shopping List is a free shopping list application that is currently only available on Android. It is possibly the most popular Android shopping list application with over 170,000 downloads, although there are other general list applications that are more popular. This application allows users to maintain several lists such as a shopping list, a pantry list, a to-do list and a grocery list. It may be used both to maintain a record of what products you have at your house already and what products you want to get when shopping.

This application features a basic list item categorization function that could be used to manually sort items by aisle, however this is only saved locally and probably wouldn’t be practical in most situations.[2]

2.3 Our Groceries Shopping List



PRODUCE

apples

DAIRY

cream

milk

BAKERY

bread

hot dog buns

UNCATEGORIZED

coffee

hot dogs

Fig 2.3 A Screenshot of Our Groceries Shopping List

Our Groceries Shopping List is a free shopping list application that is currently only available on Android, users may pay for the removal of on-screen adverts. This is a simple application that allows users to maintain a collection of different shopping lists and recipes.

Shopping lists may be shared between multiple devices, barcode scans and pictures can be attached to particular list items. [3]

2.4 Grocery iQ

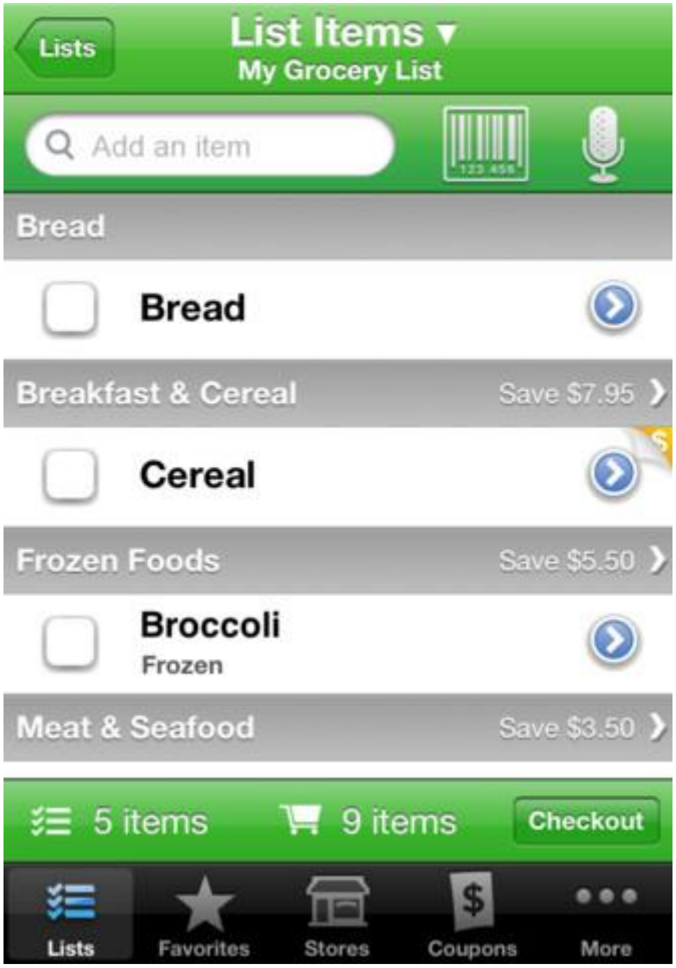
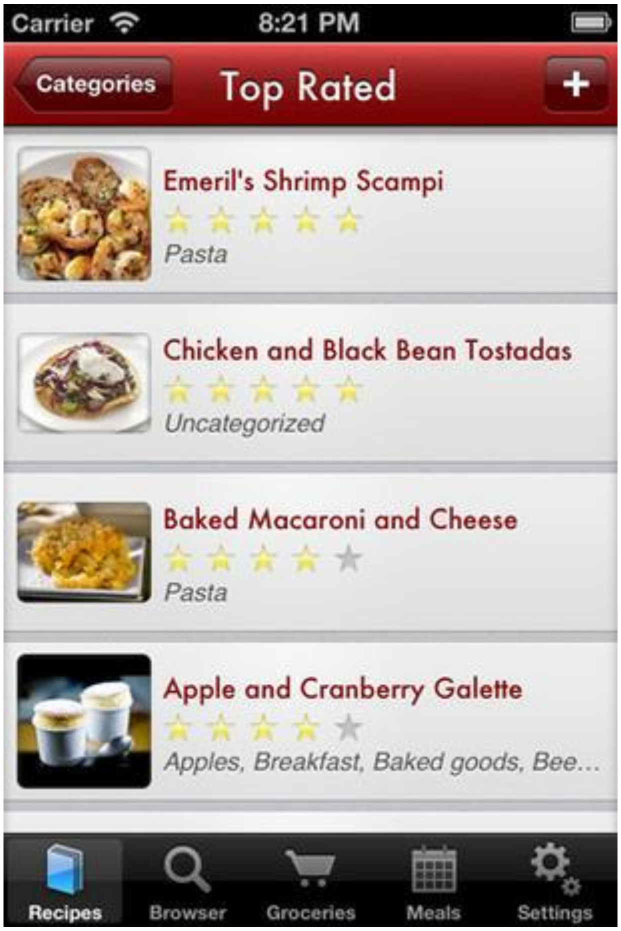


Fig 2.4 A Screenshot of Grocery iQ

Grocery iQ is a free shopping list application for Android and IOS. Grocery iQ sacrifices some simplicity for a larger number of features. It allows shopping lists to be created and shared, you may have different lists for different shops. The properties of different shopping list items can be customised in some detail, including the use of barcodes. The companion website allows for much of the same functionality within a web browser. There seems to be a particular focus on the use of coupons, including in-list prompts.

A sort-by-aisle function is advertised but there is no crowd-sourced data involved. Shops and aisles are created manually by a user and are only visible to that user. [4]

2.5 Paprika Recipe Manager



Emeril's Shrimp Scampi
★★★★★
Pasta

Chicken and Black Bean Tostadas
★★★★★
Uncategorized

Baked Macaroni and Cheese
★★★★☆
Pasta

Apple and Cranberry Galette
★★★★☆
Apples, Breakfast, Baked goods, Bee…

Fig 2.5 A Screenshot of Paprika Recipe Manager

Paprika Recipe Manager is a €4 application available on Android, IOS and Windows. It features a shopping list but the application focuses more on recipes and meal planning. It is one of the most cross-platform applications of this type. Shopping lists are designed for groceries exclusively, no other household products are explicitly catered for. There is some element of crowd-sourced data in the form of users rating different recipes.

As with many other applications the sort-by-aisle function advertised is just a sort-by-category function by a different name. [5]

2.6 Conclusions on Current Shopping Applications

There are several conclusions that can be drawn from the research into current shopping list applications:

- Android and IOS are clearly the most popular platforms for this kind of application.
- Most shopping list applications are free or less than €5.
- Many applications choose to include recipe list functionality to complement the shopping list functionality.
- Many applications choose to include a barcode scanner.
- There appears to be no application that implements list sorting functionality as is proposed for this project. Current implications of this idea are just categorised lists or require users to manually assign values that aren't shared.
- There are several further applications in addition to the ones above that are primarily health and nutrition apps with a shopping list as a secondary feature.
- Reading much of the documentation that comes with these applications it is clear that they are marketed towards a demographic that may have limited technology skills.

During this research many features or design decisions were observed as being useful and/or intuitive, it is worth considering incorporating some of these into the Smart Shopping Application:

- Having a recipe or pantry list you can browse and quickly add items from.
- A search box that suggests common items or previously added items.
- A simple user interface that requires as few swipes/taps as possible to perform a task.
- The shopping list being presented immediately upon opening the application.
- Almost all applications add something that specifically caters to shopping. This justifies their use over a generic list application like Evernote.
- Out of Milk Shopping List has an excellent interface and some very intuitive and usable features, it may be good to use as a guide in some respects.

There were also some features encountered that seemed unhelpful, unnecessary and generally to be avoided:

- Busy, cramped or cheap looking user interfaces A shopping list should be simple and elegant looking, presenting the user only with the information they need to see. Grocery iQ is a particularly notable instance of a unappealing user interface.
- Barcode scanners. It is difficult to imagine many day-to-day shopping situations where individually scanning each product you buy is practical. It seems like many applications choose to add this feature simply because they can.
- Paid applications that don't offer any unique selling points. It's hard to justify this cost when an application like Out of Milk Shopping List is free and is just as full-featured as many paid applications.

3. Current Crowd-sourcing Projects

Since crowd-sourcing is an important component of the proposed application it's a good idea to have a look at services that have implemented it successfully. The focus here is on applications that require users to actively enter data rather than passively. The focus is also on applications where objective boolean values are crowd-sourced, i.e. an item is either in Isle A or it's not, there's no subjective rating involved.

3.1 Waze Social GPS Maps & Traffic

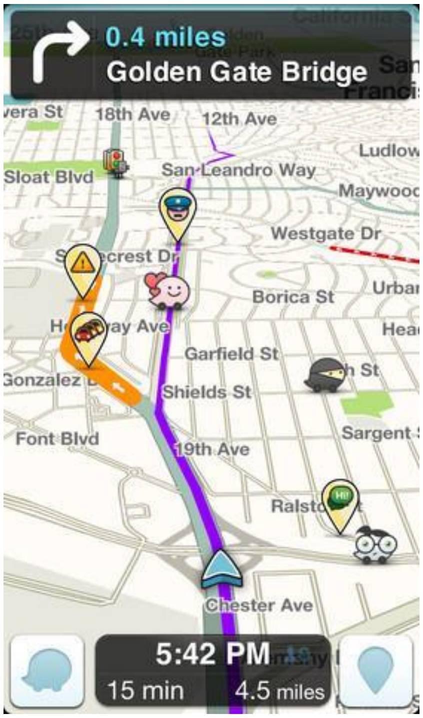


Fig 3.1 A Screenshot of Waze Social GPS Maps & Traffic

Waze Social GPS Maps & Traffic is a free traffic and navigation application that uses crowd-sourced data. It is currently available on Android, IOS and Windows. The crowd sourced data is related to route changes and traffic conditions. The route changing is a particularly good analogy for this project as it is entirely objective true or false information. For all intents and purposes a road is either there or it's not, there's no middle ground. This is similar to how a product is either in an aisle or not, this also has no middle ground.

This is a highly successful application with over 4.5 million downloads on Android alone, the success of this application clearly demonstrates the huge potential for mobile applications relying on crowd-sourcing. [7]

3.2 StereoPublic

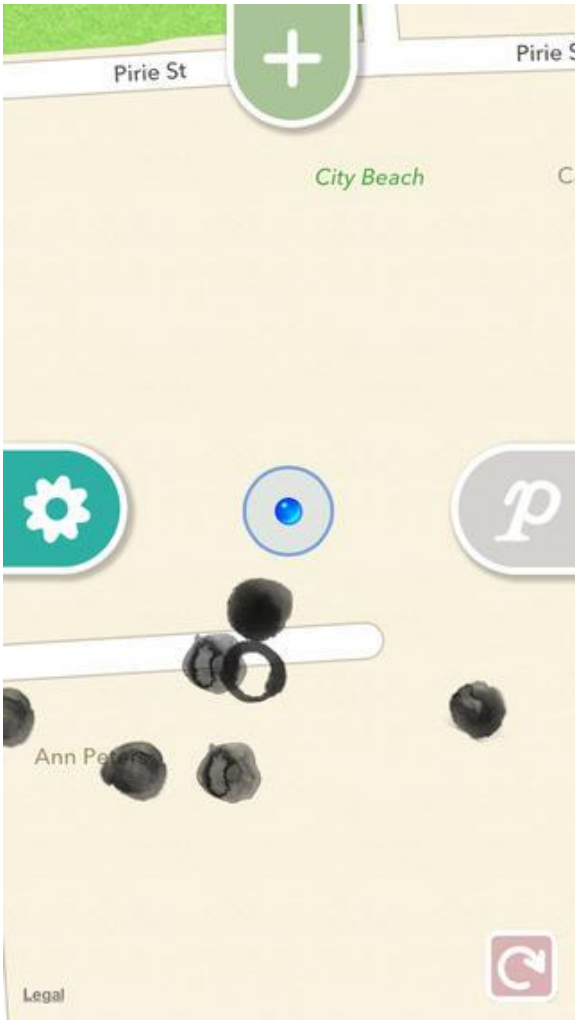


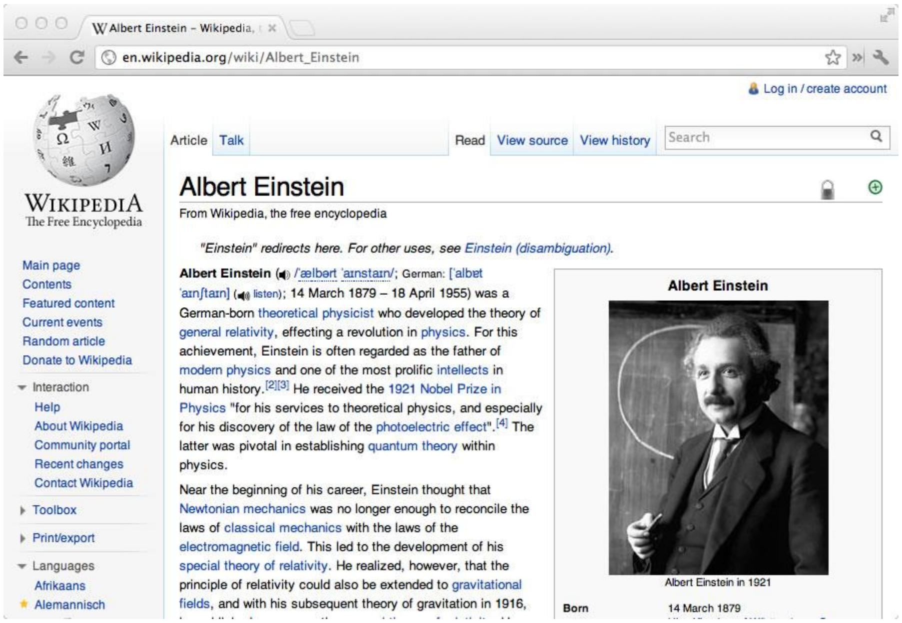
Fig 3.2 A Screenshot of StereoPublic

StereoPublic is a free application that is currently exclusive to IOS. The purpose of the application is to used crowd-sourced information in order make a map of quiet locations within urban areas.

This application is noteworthy because despite being quite a niche idea, many people continue to support it and contribute to the crowd-sourced data. It seems unintuitive that many people would be willing to take the time to record and share the fact that a location within a city is quiet, however the application continues to receive data from its users.

These findings are encouraging for the Smart Shopping Application, as this application also relies on users taking some time to keep it updated.

3.3 Wikipedia



Albert Einstein

From Wikipedia, the free encyclopedia

"Einstein" redirects here. For other uses, see Einstein (disambiguation).

Albert Einstein (/ˈælbərt ˈaɪnstaɪn/; German: [ˈalbɛɐ̯t ˈaɪnʃtaɪn] (listen); 14 March 1879 – 18 April 1955) was a German-born theoretical physicist who developed the theory of general relativity, effecting a revolution in physics. For this achievement, Einstein is often regarded as the father of modern physics and one of the most prolific intellects in human history.[2][3] He received the 1921 Nobel Prize in Physics "for his services to theoretical physics, and especially for his discovery of the law of the photoelectric effect".[4] The latter was pivotal in establishing quantum theory within physics.

Near the beginning of his career, Einstein thought that Newtonian mechanics was no longer enough to reconcile the laws of classical mechanics with the laws of the electromagnetic field. This led to the development of his special theory of relativity. He realized, however, that the principle of relativity could also be extended to gravitational fields, and with his subsequent theory of gravitation in 1916,

Albert Einstein

Albert Einstein in 1921

Born	14 March 1879

Fig 3.3 A Screenshot of Wikipedia

Wikipedia is the world’s largest online encyclopaedia. It’s free, cross-platform and relies entirely on crowd-sourced contributions. Wikipedia is relevant to this project as a case study of how to handle the intentional vandalism of crowd-sourced data.

Vandalism of Wikipedia has been well documented and several conclusions may be drawn from it:

- The most extensive vandalism is usually centred around controversial topics such as sensitive or divisive political situations.
- Pages referring to objective and uncontroversial information are less likely to be vandalised.
- All vandalism tends to be repaired very quickly by another volunteer.
- Obvious vandalism of objective information is identified and repaired quicker than more subtle vandalism of more subjective information.

These conclusions encourage a less restrictive model of crowd-sourcing for the Smart Shopping Application. Since the information being crowd-sourced is objective and unlikely to be controversial it seems that the application would have a low risk of extensive vandalism. Restricting every user’s power may make it harder for volunteers to correct incorrect information, taking away the self-correcting nature of the system. The barrier to entry for this application is already much higher than that of Wikipedia. That said, it would be best to take a cautious and observant approach to this potential issue upon release.

4. Technologies Chosen

This section will discuss the technologies chosen for this project, the reasons for their choice and any relevant alternatives.

4.1 Python and Kivy

4.1.1 Overview of Technology

Python is a widely used general-purpose programming language. It differentiates itself from other general-purpose languages such as Java and C++ with its emphasis on code readability and simplicity, often at the expense of some speed and efficiency. Typing is dynamic and the language allows for a significant amount of flexibility in its use, allowing programming to be done in an object-oriented, imperative or functional manner. [10]

Python is not a popular language for developing mobile applications, most mobile applications are written in Java in the case of Android or Objective-C/Swift in the case of IOS. Kivy is a cross-platform Python framework for natural user interface development with support for all major desktop and mobile operating systems. Kivy is an emerging tool that is bringing Python to mobile platforms. [11]

Once an interface to the Python code has been created using Kivy there are methods of packaging and deploying the program to all major mobile platforms. In regards to Android, Python for Android is a project that allows developers to create their own Python distribution and then create an APK using it. Buildozer is a tool that automates the entire process of creating an APK with Python for Android. Similar processes exist for IOS. [12][13]

4.1.2 Reasons for use in this Project

- In order to create a cross-platform mobile application using more traditional methods it would be necessary to create the application in several different languages. Given the schedule and resources of this project, such an approach would not be practical.
- Writing a mobile application in Python is an unconventional approach that would likely lead to a more interesting project with greater learning outcomes.
- The project’s sole developer had some experience in the use of Python.

4.1.3 Alternatives

Java
Java is a widely used object-oriented programming language and the main programming language used on the Android mobile operating system. Java development for mobile is often done via the Android Studio environment and there are extensive online tutorials detailing how to get started along this development route. Java was not chosen as it would effectively limit application deployment solely to Android devices. [14]

Swift
Swift is the programming language intended for use on all IOS devices, it is currently being pushed by Apple as the successor to Objective-C on the platform. The programming language is relatively new and incorporates many elements of Objective-C. Swift was not chosen as it would effectively limit application deployment solely to Apple products. In addition, many of Apple's restrictive development regulations make developing for the platform quite difficult on a student project such as this. [15]

Phonegap/Apache Cordova
Phonegap is a technology that allows developers to create cross-platform applications using just HTML, CSS and JavaScript. Phonegap was not used for this project because initial work with it lead to applications that did not look or feel native. This is a common issue with the emerging platform, with applications often rejected from the Apple store for this reason. The platform seems more suited to simpler applications at this point in time. [16] [17]

4.2 Flask

4.2.1 Overview of Technology

Flask is a lightweight framework for the development of Python web applications. It has been called a micro-framework because it does not force a developer to use any particular tool or library. It is somewhat based on the older Django library but it generally considered more "pythonic" because of the explicit nature of the web application code. It works on the basic premise that you may specify URLs on a server to be associated with methods and when any of these URLs are called the associated method is run. [18]

4.2.2 Reasons for use in this Project

- The minimalist approach suited this project. All that was required was a basic web server that could send and receive information based on GET and POST requests. Flask was a simple way of achieving this.
- The minimal nature of Flask also allows a great range of flexibility and extensibility.

4.2.3 Alternatives

Django

Django is a framework bearing some similarity to Flask that focuses on the rapid development of scalable Python web applications. It is more established than Flask and so is more widely used and documented. Django could be a potential alternative to Flask in this project. There was no particular reason why one was chosen over the other, as both were deemed equally suitable.[19]

4.3 PythonAnywhere

4.3.1 Overview of Technology

PythonAnywhere is a service for hosting and running Python code in the cloud. It will be used to host the Flask web application that serves as this project's backend. This service focuses on allowing developers to host Python code in a quick and simple manner. It provides a Flask quick-start installer and a domain name as part of the free plan. There is also a SQL database built into the service. [20]

4.3.2 Reasons for use in this Project

- Simplicity. This is a simple service that allows for rapid deployment, which exactly what this project requires.
- Support for Python.
- Support for Flask web applications.
- Integrated SQL database.
- Alternatives were overly complex.

4.3.3 Alternatives

Google Cloud Platform/Google Cloud SQL

Google Cloud Platform is a fully featured framework that provides set of modular cloud-based services for application development.[21] It was developed by Google. Google Cloud SQL is one of these services, it allows developers to maintain and administrate an SQL database in the cloud. The service is largely intended for use with projects that also use Google Cloud Platform services such as Google App Engine. This service was not chosen for this project due to it being more complex than was necessary.[22]

Microsoft Azure/SQL Database

Microsoft Azure is a cloud computing infrastructure developed by Microsoft. It supplies a wide variety of platform-as-a-service and infrastructure-as-a-service tools for cloud application development.[23] One of the services provided is simply called SQL Database and it allows developers to host an SQL database in the cloud and connect to it from a wide variety of different programming languages. This service was not chosen for this project due to it being more complex than was necessary.[24]

Parse
Parse is a mobile backend-as-a-service provider. It provides tools for mobile developers to store data in the cloud, manage logins, handle push notifications and run custom code in the cloud. It is owned by Facebook and currently services over 500,000 mobile applications. Parse will be closing down on January 28th 2017, news of the closure was announced during the course of this project. This service was not chosen for this project due to it being more complex than was necessary.[25]

4.4 MySQL

4.4.1 Overview of Technology

MySQL is a widely used and supported relational database management system. It allows developers to store databases comprising of a set of two-dimensional relational tables. Once these tables are created the data within may be modified or queried using the SQL query language. PythonAnywhere comes with a MySQL database built into the service, this was the MySQL database used in this project. [26]

4.4.2 Reasons for use in this Project

- The relational and strongly-typed nature of the system was suitable for the data being used by this project.
- It is a widely supported standard.
- Since the PythonAnywhere service was being used anyway it was a natural choice.

4.4.3 Alternatives

MongoDB
MongoDB is a document-oriented (“NoSQL”) database and is one of the most popular databases technologies of this nature. MongoDB supports unstructured data. This means that data being added into each collection (table) is not necessarily uniform in nature. Collections and databases are also created dynamically as they are needed. This more flexible approach can be helpful but in the case of this project the more rigid nature of MySQL was suitable.[27]

5. References

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[3] https://play.google.com/store/apps/details?id=com.headcode.ourgroceries&hl=en
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[5] http://paprikaapp.com/
[6] https://itunes.apple.com/us/app/groceries-smart-shopping-list/id669031956?mt=8
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[10] https://www.python.org/
[11] https://kivy.org/#home
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[13] https://github.com/kivy/python-for-android
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