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Research Document

Diet Track

Diet Tracker Application

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Abstract

In today's lifestyle, society is changing, and people are more dedicated towards achieving a fit and healthy body. This drastic shift has changed the way of living in almost every household, most people now crave healthy and nutritious meals. This why healthy eating, nutritious meals and diet tracking have become an essential element in everyone's lifestyle in order to accomplish a healthy life and balanced diet in such a busy and strenuous environment. The purpose of this project is to develop an application that is used to monitor and track the user's diet. The application will track nutritional intake and manage diets for healthy eating, weight loss, weight maintenance, weight gain, and fitness.

This document will provide a detailed description of the research conducted prior to the development of the diet tracking application which will help users track and monitor their diets. The following topics will be researched, similar applications, potential development environments, potential target platforms, front-end technologies, mobile application development, cloud and database infrastructure. After each topic is researched a conclusion will be formulated on which technologies are best for this application.

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1. Introduction

The following research document is intended to document any research undertaken to achieve an understanding of the entire project and its requirements. The main aim of the project is to create an application will track nutritional intake and manage diets for healthy eating, weight loss, weight maintenance, weight gain, and fitness.

This document introduces, details, analyses and discusses the extensive amount of research needed in order to develop a new diet tracking application. Several topics will be researched in order to aid and inspire the development of this application. This document will explore similar applications along with their features and functionalities in order to identify the applications essential features. Tools and technologies available to develop this application are reviewed to find out the most suitable option. A range of material has been researched but might not be incorporated into the projects final stage.

2. Application Description

Diet tracking applications have become an integral part of a lot of people's lives, mainly because in today's lifestyle many people are now focusing on tracking their diets in order to have a fit and healthy body. The conventional methods for studying food intake or tracking diets were extremely inaccurate but since the introduction of smartphones and mobile devices these apps have made diet tracking significantly easier, convenient and much cheaper. The purpose of using these applications is for tracking nutritional intake and to manage diets for weight loss, weight maintenance, weight gain, healthy eating, fitness and so much more.

They are also used to monitor calories, the intake of carbohydrates, proteins, fats and many other nutrients, based on your diet these apps can also suggest healthy meals and recipes for users to prepare. Many diet apps are free, but some of them can be purchased and users can be charged subscription fees for full functionality.

There are many features included in a diet tracker, I plan to implement some existing features in my application and to also add some of my own features in order to make my application more advanced.

Proposed features for the application include:
- User registration in the application
- Meal Planner
- Barcode Scanner in order to scan food items

- Calorie Tracker to track the user's calorie intake

- Recipe Recommendations for the user

- Weekly/Monthly reports on the user's progress

- Goal Setting

- Nutritional Advice/Plans

- Weight Log

- Recipe Importer

3. Similar Applications

There are a few similar applications that help people track their diet which is used globally by people of different ages. Nowadays people are leaning towards achieving a fit and healthy body, which is why the use of diet tracker applications have become more popular. These applications help people maintain a healthy and balanced diet by allowing users to monitor what they eat, providing users with nutrition advice, weight loss plans and so much more.

In the following section, similar applications available in the market will be explored in order to gain insights on the popular features and functionalities that are actively being used in diet tracking applications. The applications will be introduced, and all the common features and functionalities will be discussed.

MyFitnessPal

The first application that will be explored is MyFitnessPal, MyFitnessPal was founded in 2005 and is one of the most popular web-based exercise and fitness social media applications available. This application helps you keep track of your daily food and beverage intake, it calculates all your nutrients, calories and vitamins for you. This enables you to gather information in order to analyse patterns and find out what your diet is missing, what you need to add to your diet and what you need to cut out of your diet. The nutrition database includes many restaurants foods that aren't easy to track, and the app can generate various reports, including a pie chart which gives you an overview of your total protein, fat and carbohydrate consumption. This application consists of the following features: barcode scanner, body measurements, calorie counter, exercise log, food diary, goal setting, in-app challenges, in-app community, nutrient tracker, progress charts, recipes, reminders, water tracker and weight log (Woodward, 2021).
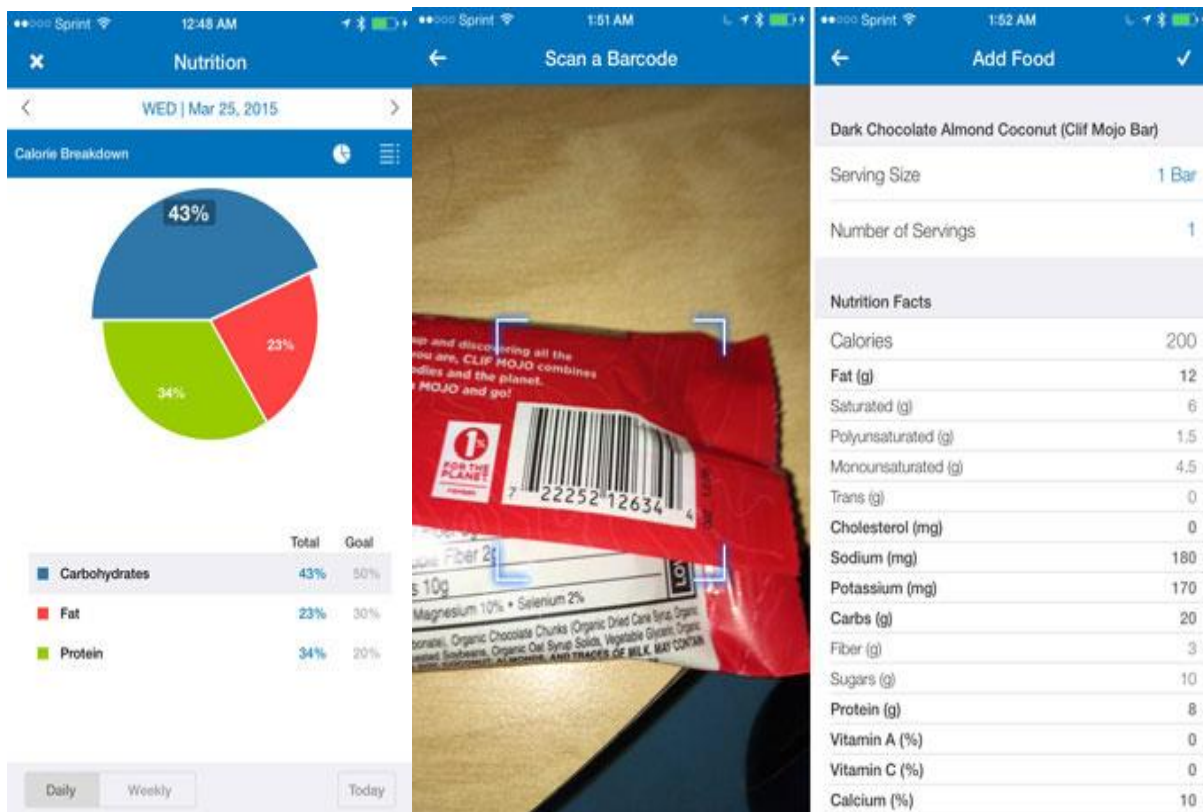
Figure 1 - Dummies – MyFitnessPal Interface

Source: myfitnesspal.com [Online]

https://www.dummies.com/article/body-mind-spirit/physical-health-well-being/exercise-movement/general-exercise-movement/what-is-myfitnesspal-144590/

Lose It

The second similar application that will be explored is Lose it, lose it first launched in 2008 and is a fitness tracker and calorie counter app that sets personalized goals for you, tracks your diet, food and exercises to reach your fitness goals. This application guides you during your weight loss journey by providing accurate calorie counting, weight loss forecasting and personalized daily insights. This application consists of the following features: barcode scanner, calorie counter, exercise log, food diary, goal setting, progress charts, reminders and weight log (Singh, 2021).
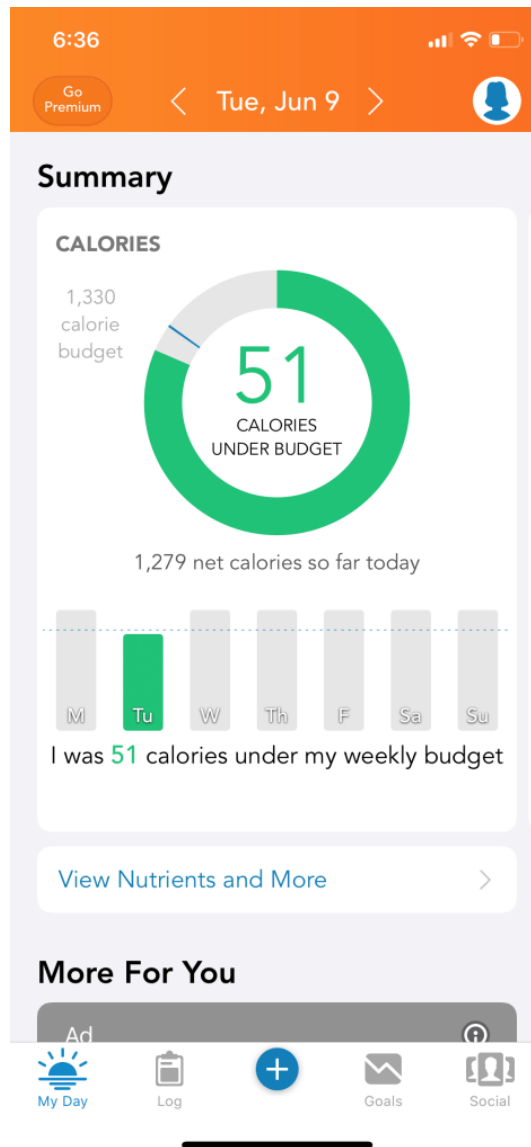
Figure 2 - Clark – Lose It Interface

Source: Clark.com [Online]

https://clark.com/health-health-care/free-weight-loss-apps/

MyNetDiary

MyNetDiary which launched in 2005 is a mobile application that allows you to track what you eat and how much you exercise your body. It offers a calorie counter, a food log and an effective diet plan which is centred around your activity level and age. A meal planning service is also available in the application which provides users with a 21-day menu of meals and snacks to help them meal prep according to their chosen diet plan. This application consists of the following features: barcode scanner, calorie counter, exercise log, food diary, goal setting, GPS access, in-app community, nutrient tracker, progress charts, reminders, water tracker, weight log and recipes (Sande, 2021).
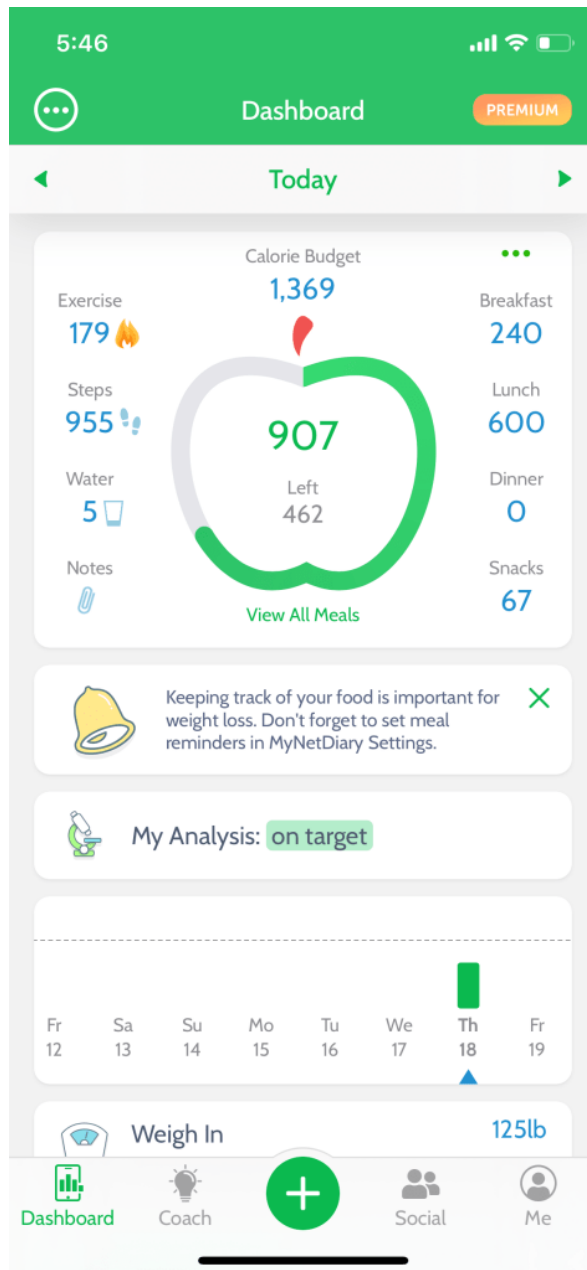
Figure 3 - Clark – MyNetDiary Interface

Source: Clark.com [Online]

https://clark.com/health-health-care/free-weight-loss-apps/

LifeSum

LifeSum is a health application with a spotless, user-friendly interface that helps you track food and exercise routines. It allows users to incorporate healthy practices into their lifestyle and offers and immerse range of resources for both eating and exercising. It helps users lose weight, east nutritious meals and reach their desired weight goal. Users can also measure their health status and receive

advice on how they can become healthier. This application consists of the following features: barcode scanner, body measurements, calorie counter, exercise log, food diary, goal setting, progress charts, water tracker and weight log (Banks, 2021).
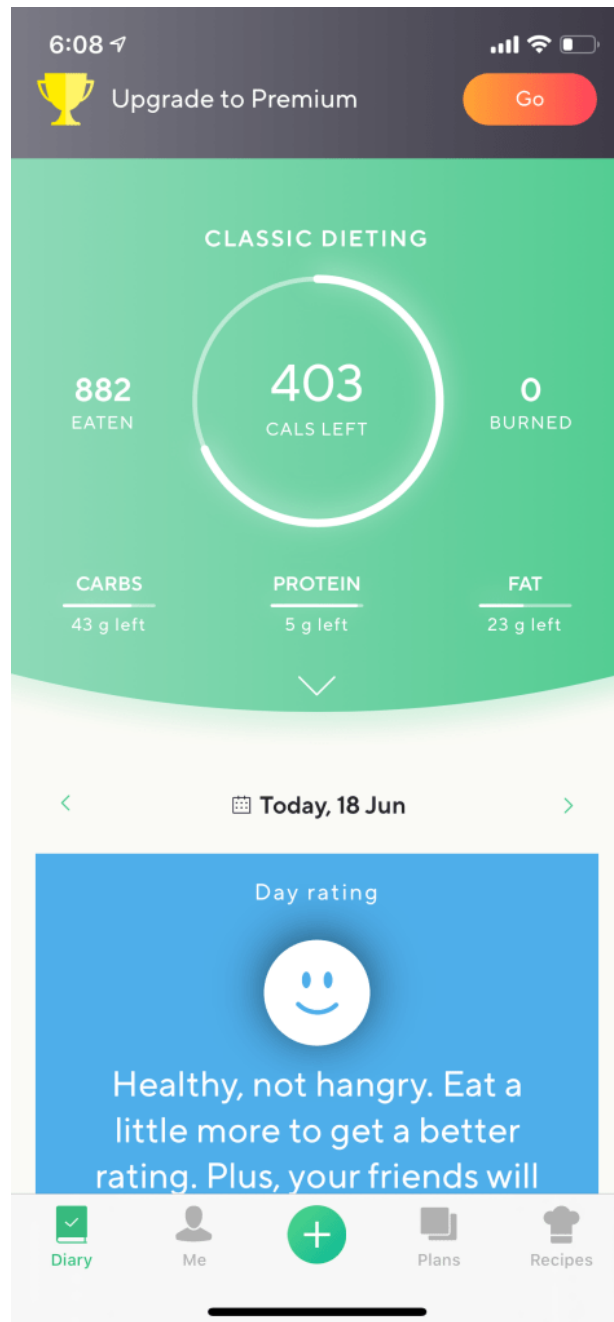
Figure 4 - Clark – LifeSum Interface

Source: Clark.com [Online]

https://clark.com/health-health-care/free-weight-loss-apps/

Fooducate

Fooducate is an application that allows you to track your food intake and provides you with information about the calories and macros you have consumed. It determines your caloric needs by allowing you to input basic biometrics, like your age, height, sex, current weight and goal weight, and calculates your daily calorie target aim by using these values. This application consists of the following features: barcode scanner, calorie counter, exercise log, food diary, goal setting, in-app community, in-app rewards, progress charts, recipes, reminders, water tracker and weight log (Hurda, 2021).
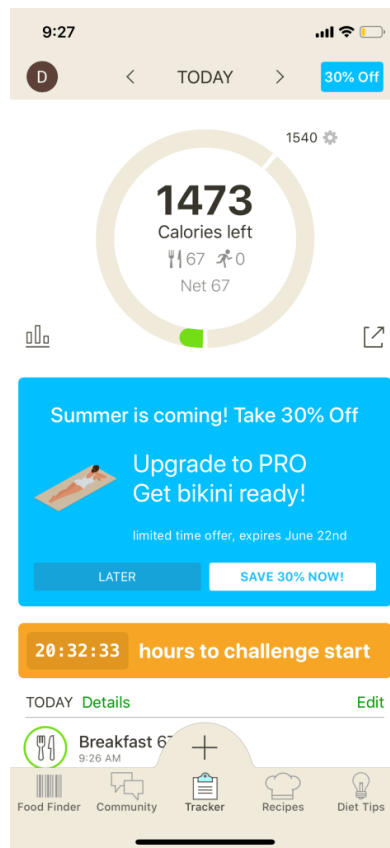
Figure 5 - Clark – Lose It Interface

Source: Clark.com [Online]

https://clark.com/health-health-care/free-weight-loss-apps/

Common Features in Existing Applications

- **Food Diary:** The food diary feature is used to log meals and any food item consumed daily, the application will store the number of calories, carbs, protein and fats that has been consumed. The information obtained can be viewed by the user in order to track their diet. It

also has a nutrition database which is searchable and includes a wide variety of food. This feature also has an integrated barcode scanner which makes it easier for you to view and log the nutritional facts in packaged foods.

- **Calorie Counter:** The calorie counter feature is vital as it keeps track of the number of calories you have consumed daily so that you don't eat too many calories as a high calorie count will have a negative impact on your diet.

- **Recipe Recommendations:** Users can search for recipes to inspire a healthy meal option. The recipe and all its nutritional facts will be saved onto the database, which is helpful as if the user needs to prepare the same meal again all the facts will be available to the user without them having to search the recipe again. Based on the chosen diet plan the user will also be able to view recipe recommendations and prepare a meal which will help add to their healthy eating journey.

- **Personalised Meal Planning:** The personalised meal planning feature makes a custom weight loss plan that will help you accomplish your health targets. It uses the data obtained from your macro, carb, protein and overall calorie intake to provide you with personalised meal suggestions for breakfast, lunch and dinner. It also customises diet plans based on your food intake and preference which will assist you while you track your diet.

- **Track Nutrients:** This feature tracks your macro, protein, water, carb, sugar, body measurements and sleep cycle. It also measures your daily water intake to guarantee you are drinking the recommended amount of water daily. Regardless of whatever diet you might be partaking in this feature helps you understand what nutrients your body requires and how much you need in your daily weight loss plan.

- **Integrated Barcode Scanner:** This feature will enable users to scan a food item in order to show them all the nutritional facts, which makes it easier to view and log food items consumed daily.

- **Goal Setting:** The user can set goals and try and beat the goals by the selected timeframe.

- **Weight Log:** The weight log feature will enable users to input their weight every week for them to view their progress. They will be able compare their weight across several weeks to see if they are gaining, losing or maintaining their weight.

Common Features Available in Similar Applications Visual:
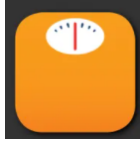
Apps → Features ↓	Lose It!	MyFitnessPal	MyNetDiary	Life Sum	Fooducate
Food Diary	✔	✔	✔	✔	✔
Calorie Counter	✔	✔	✔	✔	✔
Recipe Recomm.		✔			
Meal Planning			✔		
Nutrition Tracker		✔	✔		
Barcode Scanner	✔	✔	✔	✔	✔
Goal Setting	✔	✔	✔	✔	✔
Weight Log	✔	✔	✔	✔	

Figure 6 – Common Features Available in Similar Applications Visual

Source: Emmanuel Ayelabola

Conclusion

While exploring similar apps I have noticed in all the common features that should be included in a diet tracking application there are some features missing in various applications. The main selling point of my app is that all the common features will be incorporated into the application, which from the table above is not done yet in any existing application. Which means the user will have access to everything they are looking for while using my application. My application will also give users the option to import recipes from online in order to add it to their own food diary and meal planner which has not been done in any existing application.

4. Potential Development Environments
Android Studio

Android Studio is the official integrated development environment (IDE) for android application development, using Java and Kotlin. It provides fast tools for building applications for Android devices (smartphones, tablets and smart watches). This IDE offers an immerse range of features which

includes a flexible gradle based build system, a unified environment for all android devices, code templates, testing tools and frameworks. Android studio projects contain modules with source code files and resource files, modules included are the android app module, library modules and google app engine modules (Ghanchi, 2022). Android studio is available on Windows and Linux operating systems and supports a variety of version control systems such as CVS, Subversion, GitHub and Google Cloud Source Repositories.

Version control is important in application development as it enables the ability to track changes in the application source code, regularly backs up the source code, allows version updates and the ability to roll back to previous versions. Android Studio was initially unveiled in May 2013 at Google I/O, and the first stable build was published in December 2014. Android Studio is available for the desktop platforms Mac, Windows, and Linux. It took over as the primary IDE for Android application development from Eclipse Android Development Tools (ADT). Google offers direct downloads of Android Studio and the Software Development Kit (Developers, 2022).

Xamarin

Xamarin is an open-source application platform which is used to develop cross platform mobile apps using C#. It also extends the .NET framework developed by Microsoft and uses a shared C# code base which provides tools and libraries specifically for developing apps on iOS. Android, MacOS and many more operating systems (Soft, 2022). Xamarin is very popular because of its cross-platform capabilities which means that once the application is fully built it can be used by iOS, Android and Windows users.

Xamarin also allows you to include Objective-C, Java and C++ libraries directly, developed apps are native and have access to all the features of a native software development kit. In order to be utilized the Xamarin package can be installed on the Visual Studios IDE which means it also works for MacOS and apps can be debugged using the desktop or on devices and emulators. Time and cost of developing a mobile app are reduced and Xamarin features robust compile-time checking which leads to fewer runtime errors and high-quality applications (Soft, 2022).

The advantages of Xamarin are:

- Fast Application Development .
- Native Applications.
- Shared App Logic.
- API Integration (Points, 2022).

The disadvantages of Xamarin are:

- The Time-Consuming Nature of UI development.

- Issues with the size of the application.

- Unavoidable Software Overheads (Points, 2022).

XCode

XCode is an integrated development environment (IDE) developed by Apple that can be used to build applications for MacOS, IOS, watchOS and tvOS platforms. XCode offers tools in order to help you manage your development plan from app creation, to optimising and launching it on the App Store. With XCode you can write, compile, test and debug code for your application, it also supports an enormous variety of programming languages which include C, C++, Objective-C, Java, Python, Ruby and Swift. XCode also includes developer documentation from Apple and interface builder which will help throughout the entire application development process.

Listed are a few features included in XCode:

- SwiftUI

- Minimap

- Rich Documentation

- Swift Package Manager

- Inline Diff

- Transform iPad Apps to Mac

- Debugging and Simulators

Visual Studios

Visual Studio is an IDE developed Microsoft that can be used to develop Graphical User Interface (GUI), mobile applications, web applications, cloud and so much more. The code created in Visual Studios can be managed code as well as native code, code can be written in several languages such as C#, C++, Phyton, JavaScript and many more. Visual Studio is available for Windows and MacOS devices.

Conclusion

In conclusion after extensive research and gathering all IDE options available, the development environment I have chosen to utilise is Android Studio. I have chosen this IDE as it provides very simple navigation built on top of a minimal user interface which allows greater proficiency while developing

this application. It also provides the necessary software development kit's (SDK) in its software which is essential while developing mobile applications, so that developers will not have to obtain it from third parties. It is also very stable when compared to other IDE's such as Eclipse as the hardware requirements to run Android Studio are significantly low so it will not always crash or become unresponsive. Finally, the features and functions included in Android Studio are extensive which is exactly what is needed to develop this application.

5. Potential Target Platforms
iOS

iOS is the mobile operating system that was developed for Apple mobile devices, such as the iPhone, iPad, and the iPod Touch. It is designed for easy and flawless networking between Apple products and features a user centred design. The source model for iOS is closed but it also includes some open-source components, to develop iOS applications iOS utilises its own language which is Swift. In order to upload an application to the App store the process is extended as the application needs to be reviewed by Apple and conform to apple terms and conditions (Path, 2022).
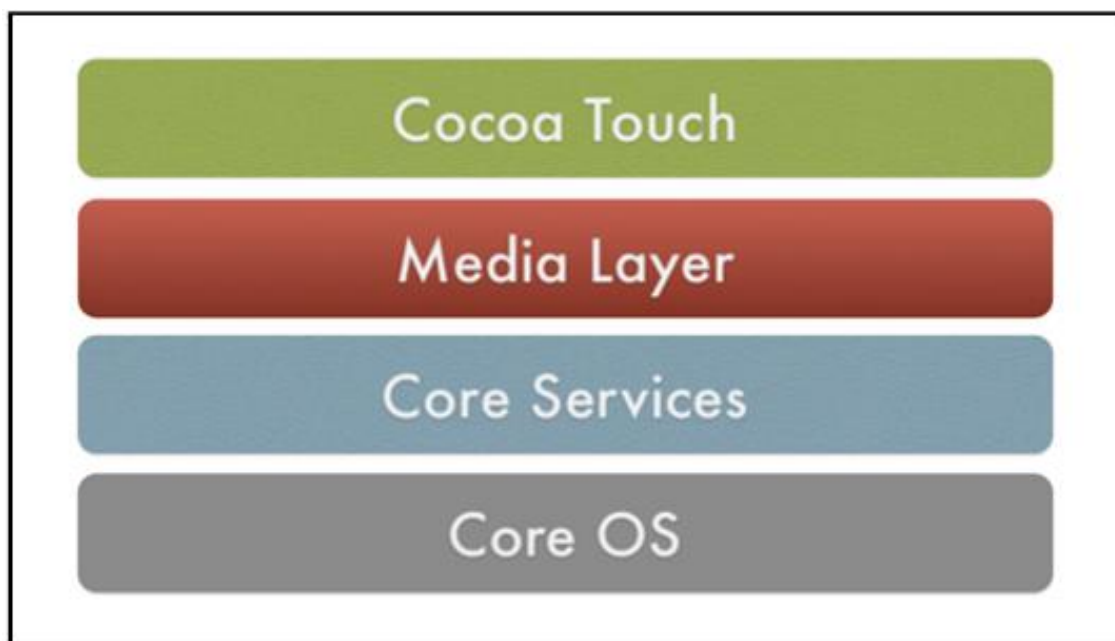
Figure 7 - Intellipaat – iOS Architecture

Source: Intellipat.com [Online]

https://intellipaat.com/blog/tutorial/ios-tutorial/ios-architecture/

The advantages of iOS (Davis, 2022):

- **Intuitive UI:** The iOS interface was developed by professionals and delivers a clean and user-friendly UI.

- **Performance:** The iOS operating system is a very durable operating system which is updated frequently by Apple in order to continue improving performance.

The disadvantages of iOS (Davis, 2022):

- **Non-Open Source:** The non-open-source nature of iOS means that you cannot customise or use iOS on any other devices other than Apple devices. Android is open sourced which means it can be customised by any mobile company.

- **App Approval:** When attempting to release an application to the Apple App store the application must go through a rigorous screening process by Apple which could take weeks before it is released into the App store.

Android

Android is an open source and Linux based mobile operating system that was developed by Google to be predominantly used for smartphones and tablets. The open-source nature of Android means that it is free, and anyone can utilize it. Android features a unified approach to mobile application development, which means that developers simply must code for Android, and their apps should run on a variety of Android-powered devices. The main language used to develop android applications is Java. The android engine uses two main runtime compilers which are Dalvik and Android Run Time (ART).
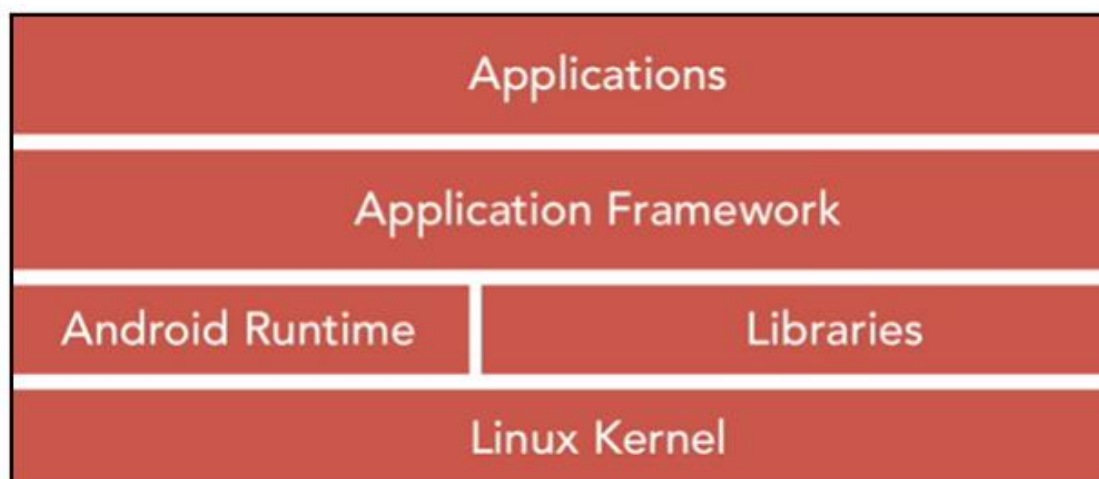
Figure 8 – The Android News – Android Architecture

Source: The Android News.com [Online]

https://www.theandroidnews.com/tutorial-2-android-architecture/

Android Run Time: This is the main runtime process used by Android which uses an Ahead of Time (AOT) process that requires code to be compiled before it is utilized. Initially, ART is a slower process compared to Dalvik but as it is used it saves the instructions of code compiling and eventually becomes a faster process. This process functions by allowing code to be saved in the cache. The perfect example for this in application usage, the first time a user opens an application it will take longer than expected, but after that initial attempt of opening the application, the application will open much faster every time subsequently. Additionally, Dalvik does not save instructions on code compiling and the application speed is the same every time.

**Dalvik:** This is no longer used by android but was officially the main runtime process in the past. Dalvik uses a Just in Time (JIT) process which means that code needed to run certain applications are only compiled when required.

The advantages of Android are:

- **Open Source:** Android is open source which means that no licensing is required in order to develop android applications.
- **Simple Integration:** Android applications are also easy to integrate and customise which gives you full control in android development.

The disadvantages of Android are:

- **Expensive Cost:** The testing of android applications is expensive as an immense amount of time is spent performing quality and reliable tests.
- **Version Testing:** There are a wide variety of android versions, which makes it very challenging to test all the versions available.

Conclusion

For this project, I will develop my application on Android, which will allow more users to access the application and make it available to a larger group of people. According to stats counter, as of March 2021, Android accounted for 71 percent of the mobile operating system share market. This demonstrates that Android has a monopoly on the market in continents such as Asia and Europe. This demonstrates that by developing my app for Android, I will be able to cover most of the market. By using Android, this application will cover 71% of the global mobile market, which is a very important statistic because it means that this application will be available to 71% of people who own a smartphone. Developing on Android will also be a much easier process as Android offers a large amount of support and communication due to its open-source nature.

6. Front-End Technologies

Front-End developers utilize server-side languages like Java, Python, and C# to construct an application, and technologies like MySQL, MongoDB, and SQL Server to discover, store, or alter data and send it back to the user in front-end code to make the server, application, and database communicate with each other. Server-side scripting has several advantages, including, but not limited to, ease of addition, content update through content management systems, increased security, and quicker loading time (Thor, 2022).

The capacity of server-side scripting to significantly modify replies by taking user-specific requirements and queries into consideration and making device-specific performance through responsive web development is its primary advantage. A variety of variables influence the choice of server-side programming languages, including the developer's overall preference, specific site specs, responsive web development requirements, and database and operating system settings. Before selecting, it is important to properly study and compare each language's various features, benefits, restrictions, diversity, and functionality (Thor, 2022).

WORLDWIDE POPULARITY OF PROGRAMMING LANGUAGES

RANK	LANGUAGE	SHARE	TREND
1	Python	29.49 %	+4.5 %
2	Java	19.57 %	-2.4 %
3	Javascript	8.4 %	+0.1 %
4	C#	7.35 %	-0.4 %
5	PHP	6.34 %	-1.2 %
6	C/C++	5.87 %	-0.4 %
7	R	3.82 %	-0.2 %
8	Objective-C	2.6 %	-0.7 %
9	Swift	2.57 %	-0.1 %
10	Matlab	1.87 %	-0.2 %

According to the PYPL index.
October, 2019.

Figure 9 – Light IT – Worldwide Popularity of Programming Languages

Source: Light IT.com [Online]

https://light-it.net/blog/why-use-php-main-advantages-and-disadvantages/

Java

Java is a high-level object-oriented programming language and is one of the most widely used programming language in the world. The Java language was modelled after C++ but is easier to use, portable and is an interpreted language. Java has a rich Application Programming Interface (API) which helps programmers when developing applications. Java is deemed the official language for mobile application development, it used by the android app development IDE Android Studios which makes it easier to develop android applications if you are already familiar with Java. Java syntax is also like C and C++ but has less low-level facilities than C and C++ (Jones, 2022).

According to Oracle, Java is the most widely used runtime environment in companies, and it is utilized by more than three billion devices. Its popularity stems from its simplicity, since developers find it simple to learn. It is also familiar, as many developers began with C/C++ languages, and Java is comparable, so it can be learnt fast. It is preferred by developers because it eliminates C/C++ complexity such as pointers, and the language supports automated garbage collection, transforming it into a robust programming language. Java is overkill for a few tiny applications where something simpler can achieve the same goal. As a result, many major corporate applications, such as those in banking and insurance, utilize it to link to other systems, such as mainframes (Point, 2022).

Swift

Swift is an open-source programming language which was developed by Apple, it builds on Objective-C techniques and maintains its object orientated features to provide a more simplified programming experience. This language was specifically developed to write apps for Apple platforms such as macOS, iOS and watchOS, it is based around other modern programming languages like JavaScript, Ruby and Kotlin. Swift is simple to learn and read which is why it is becoming the popular programming language to use when developing applications for Apple Platforms (Schaffer, 2022).

C++

C++ is a cross platform object-oriented programming language which was created by computer scientist Bjarne Stroustrup in . It is a middle level language as it consists of a combination of both high- and low-level features. C++ is based on the C language; it supports almost all the features of the C language and can be used to develop a wide range of applications such as video games and GUI apps. C++ is very portable and allows developers create programs that can run on different platforms and operating systems (Goel, 2022).

C#

C# is a popular programming language developed by Microsoft that runs on the.NET Framework and is used to create a variety of products such as mobile apps, games, and online applications. C# is a straightforward, contemporary, general-purpose, object-oriented programming language that is largely used on Microsoft Windows. When compared to more difficult languages like Java, the learning curve for C# is rather low; yet it is not as simple to learn as Python, the ultimate programming language for individuals who are totally new to the field (Chand, 2022).

This programming language is statistically typed, which ensures that problems are discovered before the application goes online. This greatly simplifies the detection of tiny faults in the application stack that would otherwise be practically unnoticeable. C# is an incredibly scalable and simple-to-maintain programming language. Because of the rigorous structure of static codes that must be created, C# applications are significantly easier to adapt and maintain than programs built in other languages (Chand, 2022).

PHP

"PHP: Hypertext Pre-processor," which originally stood for "Personal Home Page," is another open-source server-side scripting language. It is quite popular on numerous huge platforms, such as WordPress and Facebook. PHP is a programming language that can only be interpreted by a PHP-enabled server, and its files terminate with the.php suffix. In comparison to other languages, PHP is considered a stable language. It is simple to interact with databases such as Oracle, MySQL, and PostgreSQL. PHP is a simple language to learn. Because it is open source, it has extensive documentation with precise language details, making it straightforward even for beginners (Chris, 2022).

A large support group makes growth and troubleshooting simpler. PHP is more adaptable than other programming languages. Core functionality may be extended by libraries built by developers all around the world to meet the needs of specific developers. Custom extensions and components may also be readily embedded into the source code. PHP is used to create websites that are robust, secure, dynamic, and interactive, ranging from basic blogs and data forums to large e-commerce and chatting sites (Roznovsky, 2022).

Python

Python is a versatile and widely used interpreted programming language for general-purpose applications. It is concise and simple to learn, and it is a fantastic language to have in every

programmer's toolbox because it can be used for everything from web development to software and scientific applications. Python is open-source and provides developers with assistance from a large development community (Van Gumster, 2022).

The standard library provides scripts that considerably decrease code duration and execution time for various regularly used programming operations. Python is an object-oriented programming language that enables for reusable data structures to reduce repetitive labour. It is mostly used to create powerful, adaptable, scalable, and responsive online applications. Python may be slower than other scripting languages in terms of speed since it uses an interpreter rather than a compiler, which might have an impact on performance (Van Gumster, 2022).

Conclusion

I have concluded that I will be using Java to develop my project because it is a simple programming language to grasp and is user-friendly, it is easier to create, compile, debug, and learn than other programming languages. Object-oriented programming is the basis of Java which enables you to write modular applications and code that is reusable. Java runs on any platform and one of Java's most significant advantages is its ability to seamlessly migrate from one computer system to another. The ability to run the same program on several computers is critical for my application and Java does this by being platform-independent at both the source and binary levels.

7. Cloud and Database Infrastructure

Databases have developed tremendously since their inception in the early 1960s. Navigational databases, such as the hierarchical database, which depended on a tree-like model and allowed only one-to-many interactions, and the network database, a more adaptable model that allowed numerous relationships, were the first structures used to store and manage data. Relational databases were popular in the 1980s, followed by object-oriented databases in the 1990s. NoSQL databases have recently emerged as a response to internet development and the demand for faster and unstructured data processing. Cloud databases and self-driving databases are breaking new ground in terms of how data is processed, stored, managed, and used today (Stonebaker, 2022).
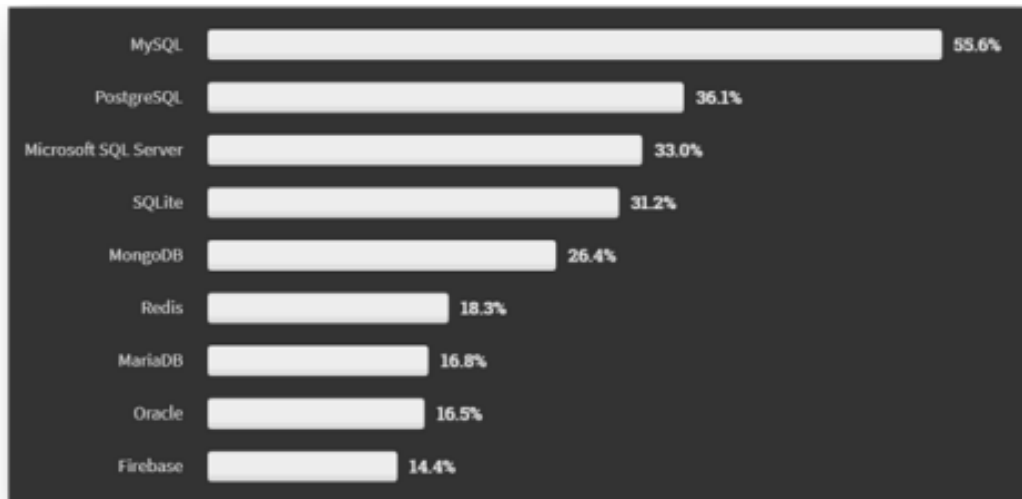
Figure 10 - Popular databases 2020

Source - insights.stackoverflow.com [Online]

https://insights.stackoverflow.com/survey/2020#overview

MySQL

My SQL which is developed by Oracle is an open-source relational database system (RDBMS) that is based on Structured Query Language (SQL). It can run on various operating systems including Windows, Linux and Unix. It is based on a client-server model and uses its own MySQL server which manages all the database commands. My SQL stores and permits data therefore it can be accessed across multiple storage engines. My SQL enables developers create, modify and extract data from tables and controls the users access to the database (Talend, 2022).

NoSQL

NoSQL is a database that provides a method for storing and retrieving data. It is a non-relational database which means that data is stored in a format other than the tabular relations utilised in relational databases. The data structures incorporated by NoSQL databases differ from those used in relational databases which makes certain operations in NoSQL faster. It is also used for unstructured, semi structured and polymorphic data such as YAML and JSON. NoSQL is built to be flexible, scalable and capable of swiftly responding to the data management demands of the developer (Base, 2022).

Firebase

Firebase is Backend-as-a-Service tool which is built on Google's infrastructure. It provides developers with an immerse range of tools and services to help them develop iOS, Android, and Web applications. The Firebase Realtime Database is a NoSQL database which stores data in JSON documents and allows users store and sync data in real-time (Esplin, 2022). Firebase provide their personal Authentication

API which manages user registrations, password rest functions, active user sessions and many more. The advanced notification system allows developers select when and what notifications can be pushed to their users. It is also a cloud hosted database which means data is synced across all clients which makes data available when devices are offline (Team, 2022). Some of the reasons why Firebases Realtime Database would be ideal for this application are listed below:

- The database integrates with Firebases Authentication to deliver easy and intuitive authentication for application developers. This will be useful for the user registration process and will also provide the application with a very secure authentication service.
- The database also works using SDK's which eliminates the need for servers.
- The database is optimized which means if a user loses connection the local cache is utilised until a stable connection is re-established, once stable connection is re-established the local data is synchronised (Sykutera, 2022).

MongoDB

MongoDB, which debuted in 2000, is a document-oriented NoSQL database intended for high-volume data storage. MongoDB employs sets and records rather than tables and rows as in traditional relational databases. In MongoDB, documents are made up of key-value pairs, which are the fundamental data unit. The collections include documents and feature sets that are identical to relational database tables. The fields in these JSON-like documents might differ from one another, and the data structure can be readily altered over time. MongoDB is free to use, and its unique queries, indexing, and real-time aggregation make it a database that offers sophisticated methods to access and analyse data (Botelho, 2022).

SQLite

SQLite is a database engine that provides users with a relational database management system. It is compatible with SQL, does not use a client-server architecture and is contained in a C library which gets embedded into applications. SQLite is integrated with the application that accesses the database which means it is serverless and self-contained. It stores data in a single cross-platform file which allows the database to be used across multiple platforms if transferred from one device to another. It also has zero configuration due to the serverless architecture and does not need to be installed before usage which gives it an effortless set up process. The user just needs to define SQLite statements to Create, Read, Update and Destroy (CRUD) and the platform OS will manage the remainder (Adams, 2022).

The advantages of SQLite are:

- There is no installation required.
- SQLite is reliable and rarely inaccessible due to maintenance.
- It is very lightweight as data storage is performed on the device (Point, 2022).

The disadvantages of SQLite are:

- The database size is restricted to 2GB.
- The data stored in the database file cannot be queried (Point, 2022).

Open Food Facts API

Open Food Facts is a free eating product database that can help you make better food decisions. At the time of writing, the database had about 1.3 million goods, including food information such as ingredients, allergies, nutrition statistics, and other miscellaneous information found on product labels. The barcode scanner will get all the food/product data from this API and show it to the user for the food diary option of the application.

Edamam API

The Edamam Food and Grocery Database API is a REST-based API service that allows you to seek up nutrition and diet data for food goods. The API provides nutrition and diet data for generic foods, packaged foods, and restaurant meals to its customers. It allows you to look for a food item by keyword, name, or UPC/Barcode. The API gives the end user nutritional information for the input food item, such as macro and micronutrients, as well as labels such as allergy, lifestyle, and health. It also allows you to search for food goods under a certain brand name. This API is used by the recipe recommendations feature in order to search and display recipe ingredients and calories to the user.

Conclusion

In conclusion after extensive research and gathering all backend options available to me, I have decided to use Firebase by Google. I have come to this conclusion because of the following factors:

- **Resources:** Firebase is the easier tool to use for the development of this project as it offers various resources in terms of forums and community tutorials. Although Amazon services are more powerful, they sometimes require time consuming courses to learn and master their functionality in full.
- **Data:** The data included in Firebase is not queryable but is in a simple format. The data included in SQLite is not usable as it comes with many complications.

- **Cost:** The major factor which influenced my choice is cost. Firebase offers users a free account with no subscriptions or hidden add-ons and a pay as you go option is also available unlike amazon which requires credit/debit card information and can charge you if you reach the limits they have put in place.

8. Mobile Applications

A mobile application, which is generally referred to as an app is a type of software application designed to run a mobile device such as a smartphone or tablet. Mobile applications are frequently used to provide users with similar services as those available on PCs or Laptops. Apps, despite being tiny software units with limited functionality, manage to provide consumers with high-quality services and experiences. Mobile application development is the process of designing software applications that operate on a mobile device, there are two dominant platforms in the smartphone market which are iOS from Apple and Android from Google (Mroczkowska, 2022). Two development approaches for building mobile apps which are, native and cross platform application development will now be discussed.

Native Mobile Application Development

Native App development is when a mobile application is designed entirely for use on a specific platform or device. The app is built with tools and programming languages that are particular to a single platform, for example, you may create a native Android app using Java and an iOS app using Swift. Native apps are well-known for providing an amazing user experience due to their high performance, they also interact with the devices operating system in ways that allow them to function quicker and more flexibly than other application kinds (Gillies, 2022).

The advantages of Native App Development are:

- **High Performance:** You will have access to all the APIs and tools provided by the platform you are working on, which leads to better application performance and user experience. This also leads to fast and responsive software performance on that platform (Duggal, 2022).
- **High Performance:** Native applications are highly responsive, faster and present an amazing user experience (Duggal, 2022).

The disadvantages of Native App Development are:

- **Costly:** When building native apps that need to be launched for both iOS and Android, it can be expensive. It also means you'll need to utilize two development teams that work on different platforms (Gillies, 2022).

- **Time Consuming:** Native app development is time consuming as work completed for one platform cannot be reproduced for another. Once again, another team will be required to develop the app on the other platform (Gillies, 2022).

Cross-Platform Mobile Application Development

Cross platform development is when a mobile application is created to operate on multiple mobile platforms or devices. The apps developed will be compatible with more than one operating system, this can be accomplished by using tools like Xamarin, React Native and Flutter where the apps can be deployed on Android and iOS. The application will also be able to reach a wider audience because it is compatible with a variety of mobile operating systems. It will also take less time and money to develop but it might be difficult to create an app that will run flawlessly on various platforms (APPSCHOPPER, 2022).

The advantages of Cross Platform App Development are:

- **Cost Effective:** To design a cross-platform app, you will only require one team of developers, rather than two, hence you'll save money on development (Uptech, 2022).
- **Faster Development:** A single development cycle is required to produce an app that operates on various platforms which leads to the app being developed at a rapid rate.
- **Single Code Base:** The program is built with a single cross-platform development tool, therefore only one code base is generated (Luetic, 2022).

The disadvantages of Cross Platform App Development are:

- **Lower Performance**: Cross Platform applications face performance issues due to integration problems with some operating systems. This occurs due to the lack of compatibility between the native and non-native components of the device that's running the application. These applications when developed are slower and underperforming in comparison to native development (Luetic, 2022).
- **Limited UX:** Cross platform development uses a single codebase for both iOS and Android platforms. All built-in features provided by mobile devices cannot be used during development which makes the user experience on cross platform applications poor and limited (Uptech, 2022).

Figure 11 - Native vs. Cross Platform

Source – Sphinx Solutions.com [Online]

https://sphinxsolutionblogs.wordpress.com/2018/07/17/native-vs-cross-platform-what-you-should-know-before-app-development/

Native Vs Cross Platform Development:

Native applications make use of the device's native features, mainly with iOS which only runs on Apple devices, they also allow offline features which is not possible with cross platform applications. Developing native applications consume more time than developing a cross platform application. Cross platform apps cannot exploit the native features of the device as they have limited access to the API. They are developed for several devices with a variety of features which makes developing applications harder (Uptech, 2022).

Conclusion

I have decided to choose native application development for my project for the following reasons:

- **Native Apps Have the Best Performance:** When utilizing native mobile app development, the app is produced and optimized for a certain platform which in my case is Android. As a result, the app will have impressive performance. Native apps are fast and responsive since they are built for a single platform and include its core programming language and APIs. As a result, my application will become significantly more efficient. Once installed on the device, the software will take full advantage of the device's processing capabilities. The material and aesthetic

features of a native mobile application are already saved on the phones of users, resulting in quicker load times of my application.

- **The full feature set on an android device can be accessed:** The app developed will be particularly for Android Devices and make use of the device's capabilities. It will have instant access to the device's hardware, such as the GPS, camera, and microphone, allowing them to execute more quickly. This is a major aspect that is needed as I will need to utilise the phones camera for barcode scanning. I will also have access to every API and tool available on the Android platform.

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