



MACRO MEALS RESEARCH DOCUMENT 2022



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Abstract

The purpose of this document is to highlight the research is taking place for the Macro Meals App project. This app will allow users to maintain a healthy balanced lifestyle by suggesting personalised recipes. In this document, I will discuss similar applications, the target platform, and the best technical solutions.

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Introduction

This document will highlight all the research that was conducted for the Macro Meals project. The goal of this project is to provide an app that will suggest recipes based on users' concerns while cooking.

Firstly, the research document will outline the description of the application, it will also review similar applications currently on the market and finally will discuss the best target platform to be used.

Finally, the document will highlight the various technologies that will be used throughout the development of this project, these include Python, Flask Framework, HTML, CSS, MySQL databases vs NoSQL databases and APIs that will be used to retrieve recipe and nutritional information.

Description of Application

In today's world cooking meals can be a difficult task for some. With the cost of living and global warming increasing people are more conscious about their costs and carbon footprint when making meals. As more and more people are trying to maintain a healthy lifestyle and the increase of vegetarian and vegan lifestyles, trying to find recipes that will work for them is a challenge.

Macro Meals will allow users to conveniently find personalised recipes based on their concerns. People have many concerns while cooking meals these concerns include

- Weight management
- Lowering food costs
- Saving time
- Reducing carbon footprint
- Cooking meals for small or large numbers
- Dietary requirements
- New to cooking

Having an application that allows users to enter multiple concerns will make cooking meals easier and more enjoyable. The users would not need to use multiple applications and recipe books to find a recipe that caters to their needs.

The proposed functionality for this application includes:

- User Registration
- Save recipes
- Suggesting carbon footprint-friendly alternatives
- Personalised Recipes

- Providing nutritional information about recipes
- Recipe Search

Similar Applications

Throughout the research document, multiple similar applications will be reviewed. These were located using the Google browser, and the Google Play Store.

My Fridge Food

This application [1] allows its users to enter available ingredients in their fridges and suggests possible recipes. It is available on multiple platforms including a web application (web app), an IOS app and an Android app. This allows its users to use it anywhere and at any time. It also has the option for users to submit their recipes but they must have an account and be logged in for this functionality. My Fridge Food provides its users with helpful kitchen tips including removing burnt food from pans [1].

Although My Fridge Food provides all these services though it lacks in the UI/UX design area, the lack of design and misaligned components may cause users to stop using the application.

In Figures 1 and 2 below, the suggested recipes from the available ingredients are shown.

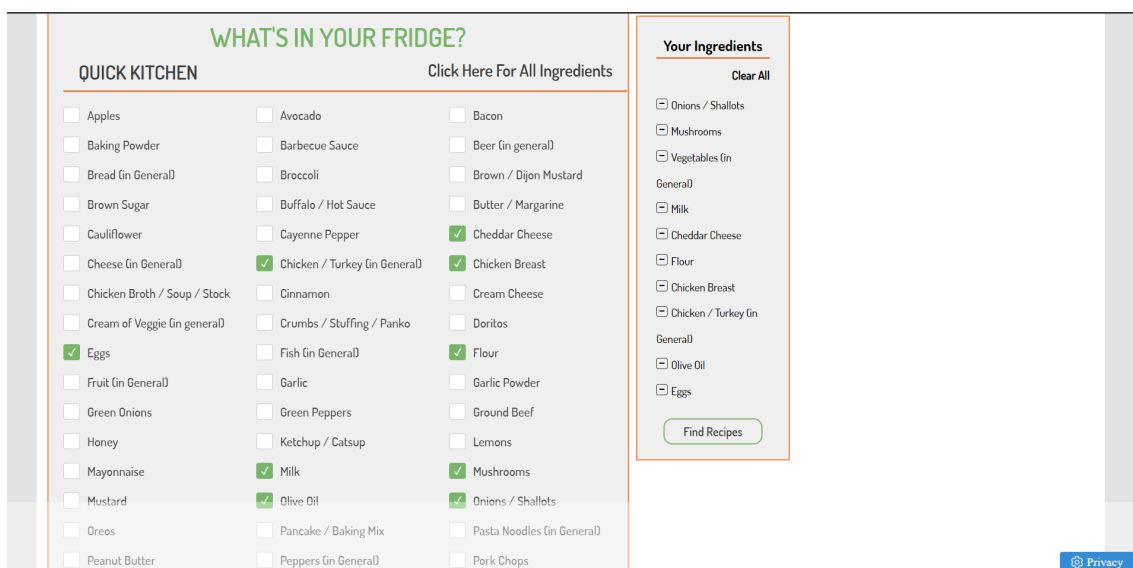


Figure 1. My Fridge Food Ingredients Screenshot, Source [1]

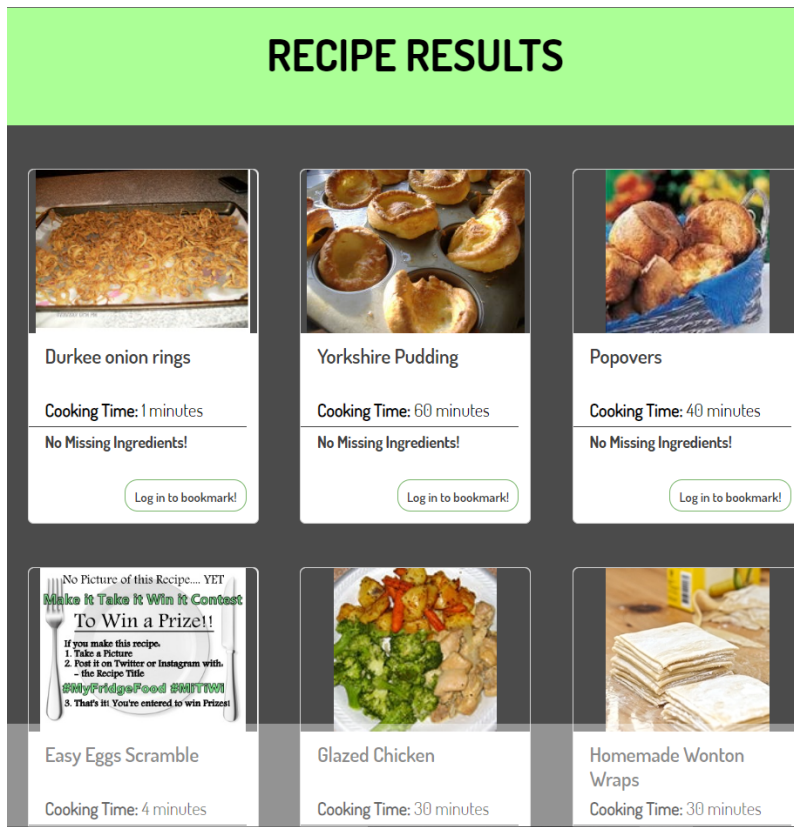


Figure 2. My Fridge Food Recipe Results Screenshot, Source [1]

Empty my Fridge

This application [2] allows its users to find recipes based on ingredients in their fridges. The application has a vegan and vegetarian diet filter as well. The recommended recipes as shown in Figure 2 are either in text form or youtube video links. Having youtube videos available allows visual learning cooks to easily follow.

Empty my Fridge has multiple functionalities alongside recommending recipes. Users can choose to generate recipes from ingredients in their fridge, pantry or freezer. Empty My Fridge also has a shopping list feature that users can use to manage their shopping.

Empty My Fridge is free and available on Google Play Store, App Store and as a web app as well. Being free and available on a wide variety of devices is a plus as it allows users to access it no matter what device they are on. Empty my Fridge also uses small icons to display the food and separates ingredients into different categories for example dairy, meat and spices. These small details enhance the user experience.

In Figures 3 and 4 below personalised recipes are shown based on the available ingredients in the fridge.

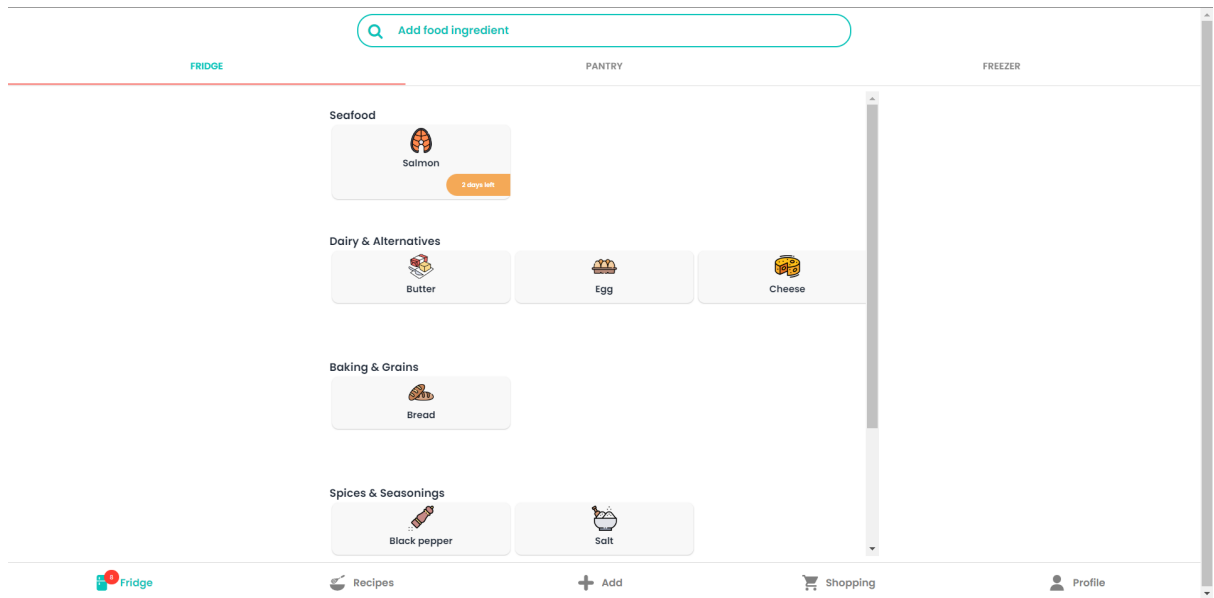


Figure 3. Empty My Fridge Ingredients List Screenshot, Source [2]

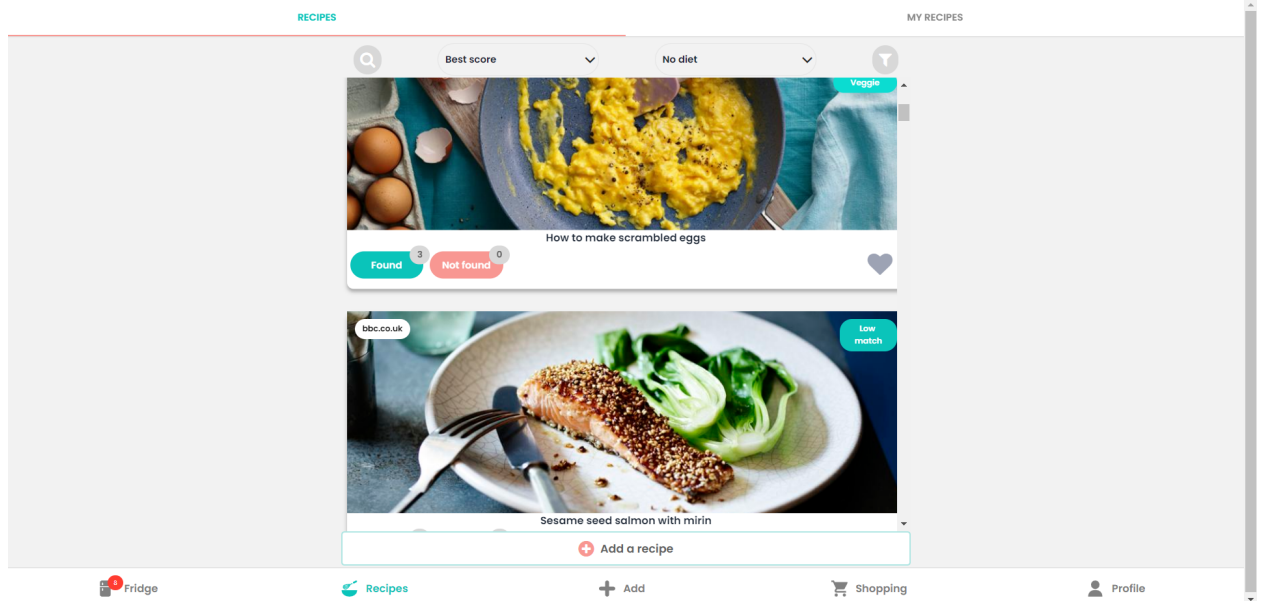


Figure 4. Empty My Fridge Recipe Results Screenshot, Source [2]

RecipME App

RecipME App [3] is a sustainable recipe recommendation application. Their vision statement is “*Making responsible eating easy and fun for everyone*” [3]. It provides its users with recipes based on their filters including preparation time, ingredients, level of sustainability and their diets such as vegan, vegetarian and gluten-free. This application is available on Android and IOS devices.

Users can swipe left if they dislike the suggested recipe and swipe right if they like it. After swiping right it displays the nutritional information, ingredients required and cooking instructions. Users can also choose to save recipes for future use and upload their own recipes.

RecipME App tracks the user's carbon footprint level. Once the user selects a recipe to cook they can upload a picture of the dish and the carbon footprint for that recipe gets recorded. It also has a shopping list functionality where users can add any ingredients they do not have for a certain recipe.

In Figures 5 and 6 below a suggested recipe is shown alongside the additional information once swiped right.

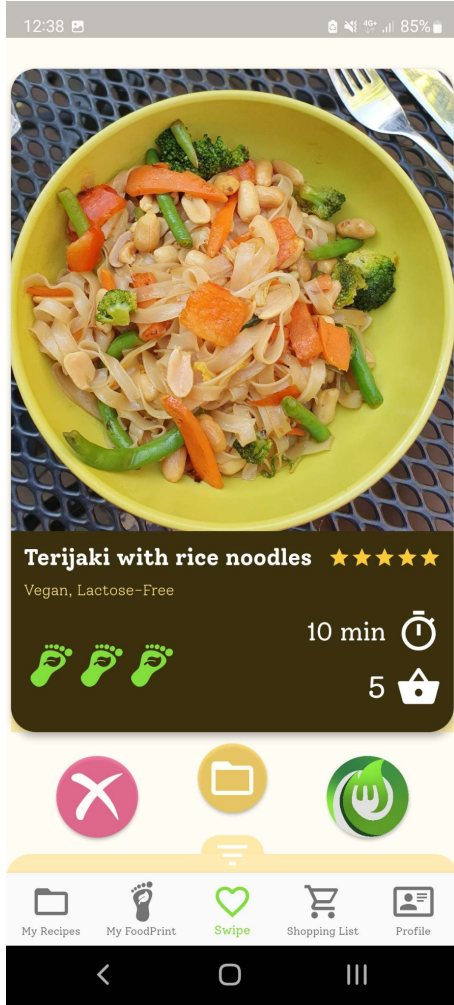


Figure 5. RecipeME Suggested Recipes, Source [3] Figure 6. Recipe Information, Source [3]

Food Cost Calculator

This application [7] allows its users to calculate the cost of their meals. It is available on the Google Play Store. Users have to manually create a new recipe and enter in the details such as a recipe name, servings and list of ingredients. Users also have to manually enter each ingredient and the quantity used. This can be inconvenient for users as each time they wish to know the value of their meal they need to enter all the information about it each time and this can be very time-consuming with large recipes. This application also has some useful tips and guides. It allows users to convert whatever currency they wish to use. It has a list of unit conversions that users can use as a reference when entering the weight for the ingredients used.

Although Food Cost Calculator has a very useful functionality for calculating costs or recipes. It lacks at being accurate with the prices, as shown in Figure 8 below 50g of bread for \$50. It also has advertisements on the application which may also reduce the user experience.

In Figures 7 and 8 a recipe is added alongside the ingredients used with their costs.

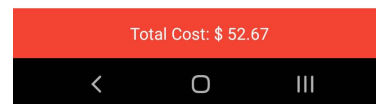
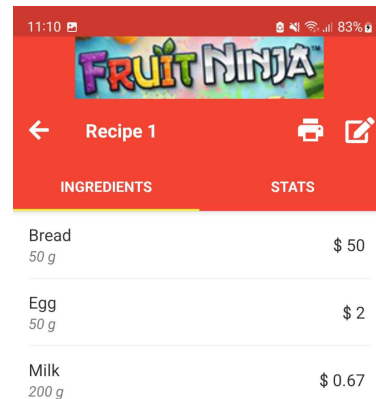
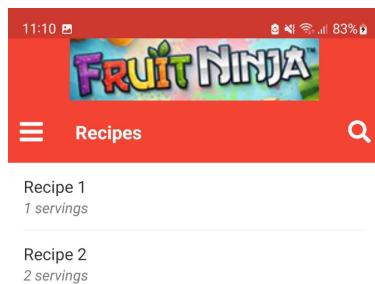


Figure 7. Recipe List, Source [7]

Figure 8. Recipe Cost Breakdown, Source [7]

Recipe Cost Calculator

This application [8] is a recipe cost calculator for restaurants. It is available for restaurant owners who wish to manage their food costs and assist them in the pricing of their recipes. User needs to purchase a subscription which ranges from \$24.17, \$40.83, and \$107.50 a month. Each subscription plan has its perks including, exporting to Excel files and uploading images and backups.

Recipe Cost Calculator provides a detailed breakdown of recipe cost with the use of graphs and spreadsheets. This is incredibly useful for business to visualise their costs. It also allows its users to generate nutritional information labels for its products. It tracks the

prices of ingredients and shows whether the price for certain ingredients has gone up or down and by what percentage.

In Figures 9 and 10 cost breakdown is shown with spreadsheets and price changes for ingredients.

Cost Breakdown

As Created By Ingredient By Category

Item	Quantity (Gross)	Item Cost	Cost %	Ingredient Weight %	Sort	Swap
🍏 Salted Butter	8 oz (0.5 lb)	\$2.14	40.15%	18.5%	↓	↔
🍏 Flour	12 oz (0.34 Kg)	\$0.29	5.41%	27.8%	↓	↔
🍏 Vanilla Extract	1.5 tsp (6.25 g)	\$0.52	9.65%	0.5%	↓	↔
🍏 Eggs	2 each (2 each)	\$0.58	10.91%	8.2%	↓	↔
🍏 Whole Milk	2 floz (59.15 g)	\$0.07	1.24%	4.8%	↓	↔
🍏 Brown Sugar	10 oz (0.28 Kg)	\$0.43	7.96%	23.1%	↓	↔

Figure 9. Recipe Cost Calculator Ingredients Cost Breakdown, Source [8]

Lemon Zest	1/10 g	\$0.00	\$0.00/g	-	👁️ ✎️ 🗑️
Ribbon, Raffia	1/9100 g	\$9.00	\$0.00/g	-	👁️ ✎️ 🗑️
Salt	1/1000 g	\$1.25	\$0.00/g	-	👁️ ✎️ 🗑️
Sea Salt	1/850 g	\$3.89	\$0.00/g	↓ -2.51%	👁️ ✎️ 🗑️
Whole Milk	1/4000 g	\$5.05	\$0.00/g	↑ 6.32%	👁️ ✎️ 🗑️
Avalon Cream	1/1000 ml	\$7.99	\$0.01/ml	↑ 6.68%	👁️ ✎️ 🗑️
Black Currant Jam (Crofter's)	6/235 ml	\$19.98	\$0.01/ml	↑ 5.71%	👁️ ✎️ 🗑️
Blueberry Jam	1/290 g	\$3.33	\$0.01/g	↑ 5.71%	👁️ ✎️ 🗑️
Champagne	1/1500 ml	\$13.31	\$0.01/ml	↓ -90.49%	👁️ ✎️ 🗑️

Figure 10. Recipe Cost Calculator Ingredients Price Change, Source [8]

Similar Application Findings

After analysing various other applications currently on the market, there are many.

applications that suggest recipes based on diets and available ingredients. There is a growth of new applications that make users more aware of their carbon footprint. Finally, there is a lack of applications that help users with managing their costs with ease.

OpenAI - ChatGPT

OpenAI [31] is an artificial intelligence company that developed a chat model called ChatGPT. ChatGPT [32] communicates in a conversational pattern and can answer any question and remembers the chat history to provide accurate results. It is trained using reinforcement learning from human feedback [32], this means the model uses previous human questions and answers and learns from that. If it performs a correct action it is given a reward if it returns the wrong answer it is given a punishment. This allows it to return answers accurately. ChatGPT can generate large pieces of text or code in any language based on the correct prompts.

ChatGPT will be utilised in this application to generate healthy carbon-friendly alternatives for recipes that have high carbon footprints and for recipes which users would like to find greener alternatives for. This is done via the OpenAI API to access the ChatGPT model and provide it with a prompt and receive an answer.

Carbon Footprint

Food's carbon footprint is the number of greenhouse gases produced during the growth, processing and delivery of a food item. Over the past few years, there's been an increase in people eating healthier and greener. This is done to help prevent the spread of greenhouse gases and increase the longevity of the planet and its resources. This application will have a carbon footprint calculation element to it. It will analyse the list of ingredients, the measurements and the serving size to determine if it's a high or low level of carbon emissions. The food items that have the highest carbon emissions are shown below in Figure 11. These will be used by the Macro Meals application to calculate the emissions for each recipe.

Food: greenhouse gas emissions across the supply chain

Our World in Data

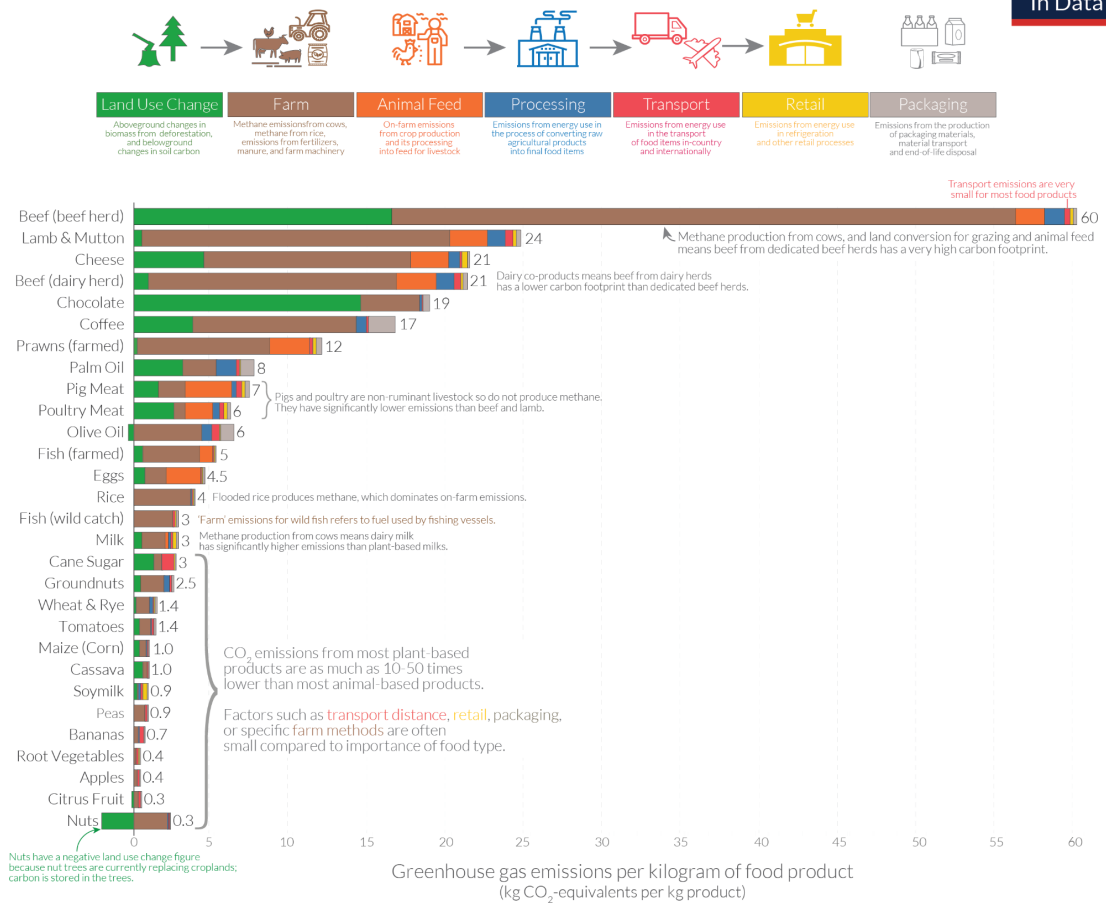


Figure 11. Carbon emissions of food items, Source [33]

Recipe Cost Data

The cost of food has been a big difficulty for many people. As there are not many food cost calculators on the market it can be difficult for individuals to budget their food expenses. Macro Meals will calculate the rough cost of the recipe based on the ingredients, the amount of each ingredient and the serving sizes. The most expensive food items found by BBC [34] will be used to develop a cost calculator.

Target Platform

The target platform for this application is a Web App. A Web App is an application that is stored on a server and delivered to the user through the web browser [9].

Advantages

There are many advantages to using Web Apps over Mobile Apps. The advantages of using a Web App are as follows:

No Install

As Web Apps are delivered through the web browser, there is no download needed to access them. Web Apps can be accessed using any browser of choice such as Chrome, Firefox etc. Unlike Mobile Apps where apps need to be installed via the play store [9].

Responsive

Web Apps are highly responsive. This means that they can be designed to be viewed on various screen sizes. Users can access it on any device they have and get the full experience of the Web App [9].

Easy Update

Web Apps are easier to update than mobile apps. Code changes only need to be deployed to the web server for them to take place and everyone is viewing one version of your website. With mobile apps, changes need to be coded and then pushed to the application, where users must update the application manually in the Play Store.

Quick Deployment

Web Apps are very quick and easy to launch, they only require a domain name to access them and a web server to host them. With mobile apps, they must be approved by the app stores first before they are available to the public.

Security

Web Apps can be developed in a way to promote security such as having an HTTPS protocol that encrypts all the information sent between the client side and the server [10].

Disadvantages

As Web Apps do have many advantages they also have some disadvantages these include:

Internet

Web Apps need an internet connection to be accessed. Many places across the globe have limited internet connection which prevents them from accessing any Web Apps [11].

Availability

Since Web Apps are not available in app stores, this makes them difficult to be found by the general public. Only people aware of the website can access the link.

Performance

Web Apps are slower than mobile apps as they are stored on a server. Whereas mobile apps are stored locally on the mobile phone. This gives them access to all the phone's resources including Central Processing Unit (CPU) and Random Access Memory (RAM).

Technologies

In this section, multiple technologies required for the development of a Web App will be discussed including the programming languages, databases and APIs.

Languages

A programming language must be used to develop a Web App. This section of the research document will outline a few programming languages.

Python

Python is a free open-source high-level programming language. *“It is often described as a “batteries included” language due to its comprehensive standard library”* [4]. Python is an easy-to-learn language due to its large range of libraries and very little structure. Python has gained popularity in the web development world due to its many benefits. The large range of libraries and functions built-in, allows websites to be built using less code [5]. Due to Python being written much like the English language it has been a popular choice among web developers [6].

Javascript

Javascript is a programming language very popular in web development. 98% of the websites in the world use javascript in one way or another [12]. Originally it executes in the client-side browser but today there are many libraries that have server and backend support such as Node.js. It was heavily influenced by Java hence the name javascript and follows a structure similar to Java also.

HTML

HyperText Markup Language (HTML) is a markup language used to display content on the web browser. HTML is the bare minimum that a website needs to be able to show content. All websites use HTML in one way or another, it can be embedded using Javascript or

Python. HTML on its own can be very difficult to design nicely though CSS can be used to add styling to the website.

CSS

Cascading style sheets (CSS) is a styling language. It allows websites to be made more appealing. CSS adds to the “look and feel” of the website [14]. CSS can be used to style multiple components using one block of code. CSS allows the addition of videos, images and other sources of media. The main benefit of using CSS is that it makes responsive design possible.

Frameworks

Bootstrap

Bootstrap is a framework for CSS HTML and Javascript [15]. It allows for developing responsive applications and styling without manually writing CSS code for each element. Bootstrap 5 is the latest version and it works on all major browsers. Bootstrap styles HTML content with the use of div class names. It also comes with many templates for developers to use. Bootstrap has increased in popularity as it allows quick and easy development of websites. As of 11 November 2022, Bootstrap is used by 21.7% of all websites compared to React which is only used by 3.0% [18].

Benefits

- Saves Time - With templates, developers can have websites fully designed much quicker than manually writing the CSS for each element and component.
- Cleaner Code - By using div names for styling purposes it saves the developer from writing extra code. With less code, there will be fewer chances of bugs occurring.

Challenges

- Basic Look - Since Bootstrap uses basic components developers need to manually change the CSS of the components if they want the website to look different to others.

Flask

Flask is a Python web app framework [22]. It uses Jinja which is a templating engine, which allows for the quick and simple building of web applications. Flask has a very simple installation procedure with the use of the “pip install Flask” command, developers have all the necessary libraries needed to get started straight away. Flask makes use of HTML files and allows for the creation of templates. These templates can be called from various HTML

files and save developers time and resources rewriting repeated components including headers and footers.

Databases

In this application, a database will be used to store the name, email, password, favourite recipe and user settings.

MySQL

MySQL is a relational database management system (RDMS) [16]. It is free open-source software. It stores data in tables and uses the structured query language (SQL) to create, read, update and delete (CRUD) records. The key benefit of using MySQL is that is known for being secure and reliable. It is used in web apps like Facebook [17] and Twitter [19]. MySQL can be hosted on many cloud platforms including Amazon Web Service (AWS) and Google Cloud. It can also be hosted locally for local development with the use of XAMPP and PHPMyAdmin.

API

An API is an Application Programming Interface which is a software interface that allows two applications to exchange information with each other [20]. Macro Meals will use a wide variety of APIs to access information about food cost, carbon footprint and recipe information.

Edamam

Edamam [21] is an API that has multiple functionalities. It has Nutrition Analysis API which provides nutritional information about single items of food, Food database API which is an extensive database of food items and finally, Edamam has a recipe search API, this API reads a list of ingredients and returns possible recipes that can be cooked using the inputted ingredients. The Recipe API allows users to filter based on allergies such as gluten-free and peanut-free, users can filter diets including vegan and vegetarian. Edamam provides comprehensive documentation for each API [25] and a free API Demo [26], this demo shows the key functionality of each API and does not require an API key or any signup.

Edamam provides 3 tiers of pricing, Developer, Enterprise Core and Enterprise Unlimited. The developer tier is free to use but has a 10,000 API call limit a month and limits the results return for a call to 100. The Enterprise Core tier is \$49 a month and provides all functionality of the developer tier and extras including a 50,000 API call limit a month and returns up to 1,000 results per call. Finally, the Enterprise Unlimited tier provides all functionality of Enterprise Core and allows unlimited API calls a month at \$999 per month.

The main flaws of the Edamam API are that it does not provide a cost breakdown of each ingredient and does not provide cooking instructions for the recipes. It instead provides a URL to another site where it has detailed cooking instructions listed.

Spoonacular

Spoonacular [27] is a food API with multiple functionalities. It has multiple categories including recipes, ingredients, and meal planning. The recipe section has an extensive list of features which include recipes by nutrient, recipes by ingredients, random recipe generator, similar recipe generator and receive recipe information based on recipe ID. The API has support for dietary needs including gluten-free and vegan/vegetarian. The API also allows users to prioritise the list of ingredients available in the suggestion of recipes and whether to ignore basic ingredients like water, salt and pepper. Spoonacular provides various API endpoints which include an ingredients amount conversion and a price breakdown for each recipe. This makes Spoonacular a well-rounded API to use as it has everything you need for developing a full recipe application. Spoonacular also provides very detailed documentation about all the features it offers [28].

Spoonacular provides 4 tiers of pricing, the free tier allows for 150 calls a day and then there are no more allowed until the next day, and the “Cook” tier costs \$29 a month and allows for 1,500 calls a day and then a \$0.005 cost for each call after that. The “Culinarian” tier costs \$79 a month, allowing for 4,500 calls a day and then a \$0.004 cost for each call after that. Finally, the “Chef” tier costs \$79 a month, allowing for 10,000 calls a day and then a \$0.002 cost for each call after that. It also has phone support for any queries.

The main drawback with this API is that a subscription is needed to avail the functionality fully. On the free tier, you only get 150 calls per day. Spoonacular API has multiple endpoints to retrieve data from, to retrieve recipes you use one URL and to get a detailed breakdown of the recipe another URL is used. Due to having various endpoints, to retrieve cooking instructions for a recipe a separate API call must be made each time. Each separate call contributes to the 150 calls-a-day limits. When testing multiple combinations of ingredients the API call limit is quickly reached and I must wait 24 hours until more calls can be made. This makes the Spoonacular slow and difficult to use for this project.

Hosting

PythonAnywhere

PythonAnywhere is a development environment that hosts Python applications [23]. It allows for the deployment of web apps with database support. PythonAnywhere allows users to use Python and bash terminals to configure their web app settings and supports the HTTPS protocol [24]. PythonAnywhere comes with multiple subscription tiers. The first one is a “Beginner” tier which is free and only allows one web app to be deployed and

does not allow you to add a custom domain name. Secondly, the “Hacker” tier is \$5 a month and allows you to add a custom domain to your web app and allows users to SSH into their account. Thirdly the “Web Developer” tier for \$12 a month has all the features of the “Hacker” tier with the only major bonus of having 2 web apps deployed at one time. The “Startup” tier provides all features of the previous tiers and allows up to 3 web apps per account. Finally, there is a “Custom” tier which starts from \$5 to \$500 a month and the user can customise the number of features they would need including the number of web apps, storage level and the number of Python and custom domain names.

The few drawbacks to using PythonAnywhere are that it only supports Python projects. Only Flask and Django projects are supported. PythonAnywhere is not a suitable hosting site for other projects in other languages. PythonAnywhere is slightly slower compared to its competitors such as AWS or Heroku. This makes deploying large-scale projects difficult.

Chosen Technologies

Macro Meals will use all the programming languages listed above.

It will utilise the following

- Python Web app using the Flask framework
- Bootstrap, HTML, CSS and JavaScript Frontend
- MySQL database backend
- Edamam API for the recipe and nutritional information
- OpenAI API for ChatGPT model for carbon-friendly alternatives
- PythonAnywhere hosting

Login Methods

There are multiple ways to implement a login/register feature, these include social media login or direct login to applications. Social media login [29] is a process where the user chooses which social media account they would like to use and the authentication is done by the social media network provider. Some of these include Facebook, Google, LinkedIn, Microsoft and Apple. This method does have its pros and cons.

Pros

- Less password reliance -> Users don't need to remember the different passwords they have for different applications.
- Faster Register/Login process -> Users don't need to spend time filling in multiple input fields when registering or signing up. Just a few clicks and the process is done.

Cons

- Stolen data -> There is a possibility of these social networks having data leaks and all data being compromised. Facebook and LinkedIn have previously had data breaches [29].
- Too many options [30] -> In today's world there are so many social media networks that can be used to log in. Users may be overwhelmed in deciding which one to use sometimes. Users also forget which one they used to initially register with. This can lead to multiple accounts registered for the same user.

This feature will not be developed due to time constraints and the fact that it is not the main core functionality of the application. The main functionality of the application is to provide personalised recipes. Social media login only serves as a convenience tool.

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