

Imperial College London

DEPARTMENT OF COMPUTING
INDIVIDUAL PROJECT INTERIM REPORT

AMBLE

A Social Walking App

Author:
Jonathan MULLER

Supervisor:
Professor Michael HUTH

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Chapter 1

Introduction

1.1 Motivation

In this day and age, it is extremely important to keep fit. With the rapid development in technology in the recent years, people are more inclined to stay inside looking at a screen rather than to go outside and exercise. The main demographic seeing an increase in the use of smartphones and computers are teenagers and young men. The increased day-to-day use of technology is shown to have an impact on the number of obese adolescents in the UK [1], which can increase the chances of people developing serious illnesses including diabetes [2]. It is therefore of great significance to provide a means of exercising that helps people, especially adolescents, keep healthy.

The difficulty in trying to encourage people to exercise lies in the ability to engage the user and find something that they enjoy to do. If exercising is seen as something that you enjoy, it then becomes a pleasure to do rather than a burden. Gamification plays an important part in helping people exercise, and has been used in lots of fitness apps available on the iOS App Store already [3]. The range in which companies have implemented gamification into their fitness applications ranges from a score-based system where users can compete against their friends to a complete game that allows the user to explore the world around them. An example of the latter is the popular mobile game Pokémon Go, where you have to walk around and capture virtual ‘creatures’ that are scattered around in the real world.

Another problem in trying to keep fit is the difficulty of motivating yourself to exercise regularly. A study conducted in 2001 found that exercising with another person helped to reduce stress and increase calmness compared with exercising alone, however it also resulted in people being more tired [4]. As well as this, exercising with another person also allows you to motivate and set goals for each other to achieve, which can be a challenge when exercising by yourself.

The idea behind this project is to encourage people to walk more often via helping them to find out more about the area around them. Exploring your surroundings can be very interesting

and walking is one of the best ways to discover new areas. Let's say, for example, that there was a monument along your commuting route. When travelling via another means of transport, such as a car or train, you might not have the chance to notice this monument. When walking, along with a tool which displays points of interest as you were walking, you would be able to see something that you may never have noticed before.

The idea also extends to helping people walk together to promote regular exercise. A way to do this is to allow the user to schedule walks for a point in the future, and invite their friends along to join them. This means that users will have a fixed event in their calendar which will help keep a more structured fitness routine.

1.2 Objectives

The aim of this project is to produce a working application that encourages people to walk more and helps discover new places in the world. The main objectives for the project to measure success on are as follows:

Obj 1 Encourage walking: users should be encouraged to keep fit and exercise more. One way to do this is to make it easy for users to exercise with another person as it has been shown to increase motivation and reduce stress. Gamification is another method that could be used to encourage walking more. Users should be able to compete with their friends as a means of motivating one another.

Obj 2 Help discover the world: while walking users should be able to discover new places or points of interest in the area around them, which will hopefully motivate them to explore new areas of the world as well as increasing their fitness at the same time.

Obj 3 Test and evaluate with real users: evaluation should be conducted with real users to see if the project has an impact on how often they exercise. The full plan on how the project is going to be evaluated can be seen in Section 4.

Chapter 2

Background

2.1 Existing Applications

There are a number of existing applications available that attempt to solve the problem posed by this project. These range from fitness applications to various navigation applications, which although may not be completely relevant to this project, do provide some similar features such as place recognition that will be useful to research.

Table 2.1 shows how well each of the existing applications related to this project have implemented certain features. The maximum score for the feature category is displayed in brackets. The full matrix detailing what aspects each feature category is split into and why the score was given to each app can be seen in Appendix A.

Features	MapMyWalk	Strava	Let's Walk	Google Maps	Citymapper	Pokémon Go
Design (2)	1	2	0	2	2	2
Ease of use (3)	3	3	1	3	3	3
Tracking location (2)	2	2	2	1	1	1
Navigation (4)	3	1	1	3	1	2
Social interaction (5)	2	2	2	0	0	0
Total (16)	11	10	6	8	7	9

Table 2.1: Matrix showing how well existing walking apps perform at given features. Each app is given a score for a category, with the maximum score shown in brackets next to the feature category.

The rest of this section discusses each application in detail, explaining their benefits and

limitations. All of the applications researched are free to use unless stated otherwise.

2.1.1 MapMyWalk

MapMyWalk [5] is a popular fitness application for iOS and Android that allows you to track your walks and complete challenges to help you keep fit. You are able to track a walk as you go on one, or log a previous workout that you have done without the app. The app also provides a premium subscription for £4.49 per month, which gives you the ability to monitor your heart rate and set training goals designed to help you walk more.

The area in which MapMyWalk lacks is social interaction. A user can publish a walk that they have previously tracked to their profile, but there is no real aspect of communication with other users other than adding each other as friends. There is also a limited level of gamification in the app, with challenges being the only option available to encourage a higher rate of fitness. Challenges can either be added by the user or chosen from a precompiled list, with the latter being fairly limited in the range of options to choose from.

2.1.2 Strava

Strava [6] is another fitness application that primarily focuses on running and cycling. It features a sleek user interface with similar functionalities as MapMyWalk. The journey view within the application can switch between either showing the map of your workout or a statistics screen as shown in Figure 2.1, visibly showing the time elapsed in the workout, the distance travelled and your average pace per kilometre. Strava also provides a premium subscription for £5.99 per month, which features personalised coaching and advanced analysis of your workouts.

The setback of Strava is that you cannot track walks in the app as you are constrained to either running or cycling. With regards to this project, it performs well in allowing the user to record and share their workouts but it does not provide any features for the user to explore areas around them. This is expected given that it is a fitness application and does not cater for walking whatsoever.

2.1.3 Let's Walk

A lesser-known iOS fitness application is Let's Walk [7]. Users can record new walks and view a list of either their friends' walks or public walks nearby. The app is also focused on helping you maintain a balanced diet – the amount of calories you consume can be added for particular meals during the day. A calorie goal per day can then be added, with the app recording how many calories were burned during a walk and updating the goal accordingly.

Let's Walk tries to emulate many of the features implemented by the more well-known apps as mentioned above, but a lot of these features seem unpolished. There is a global ranking section

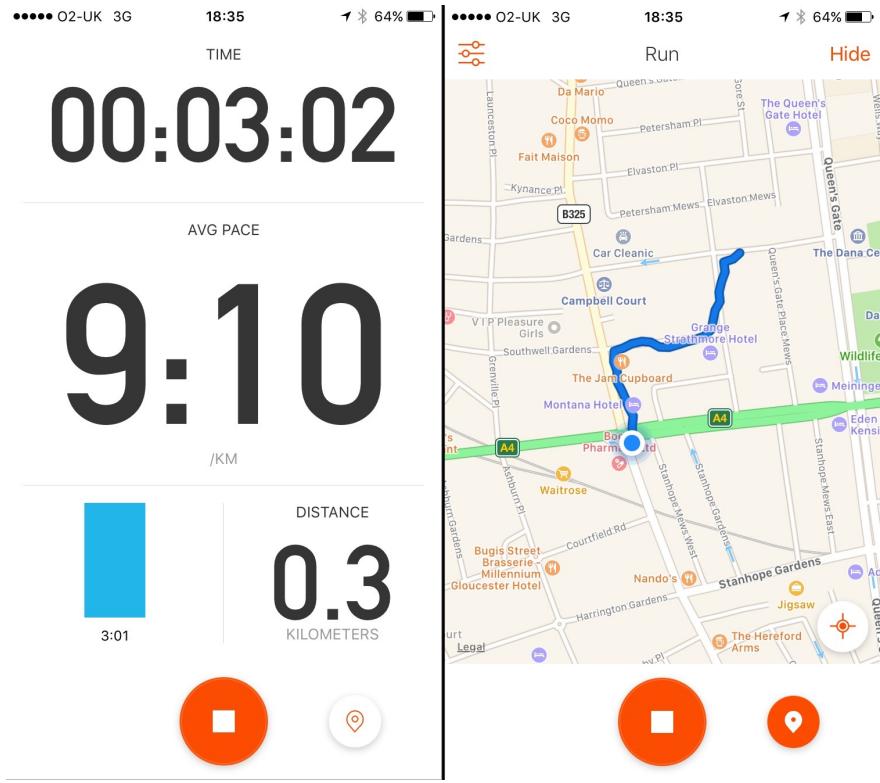


Figure 2.1: Journey view in Strava, allowing you to switch between statistics (left) or a map of your progress (right)

of the application showing which users have walked the most over the last week, month or year, however there seems to be little to do with this information other than view a leaderboard.

2.1.4 Google Maps

Although not a fitness application per say, Google Maps [8] is one of the oldest services that provides route planning via different transport modes. The mobile app contains current information about public transport, traffic and displays well-known cycling routes on a map, however there is little in the way of customisation for walking. When entering a destination, the app generates a route but users can also choose from a few different routes on the map, with the app showing the difference in time each one would take. However, no information is given as to whether a certain route is quieter than another, for example.

One feature of the Google Maps iOS application that is interesting to note is the ability to search for places along a route during a journey. Once a user has started a walking journey, they are able to search for places that are along the route. Google provides some categories of places to choose from, such as cashpoints and restaurants, but users can search for a specific place if they wish. The app will then display the results of the places search on the map, showing how much additional time

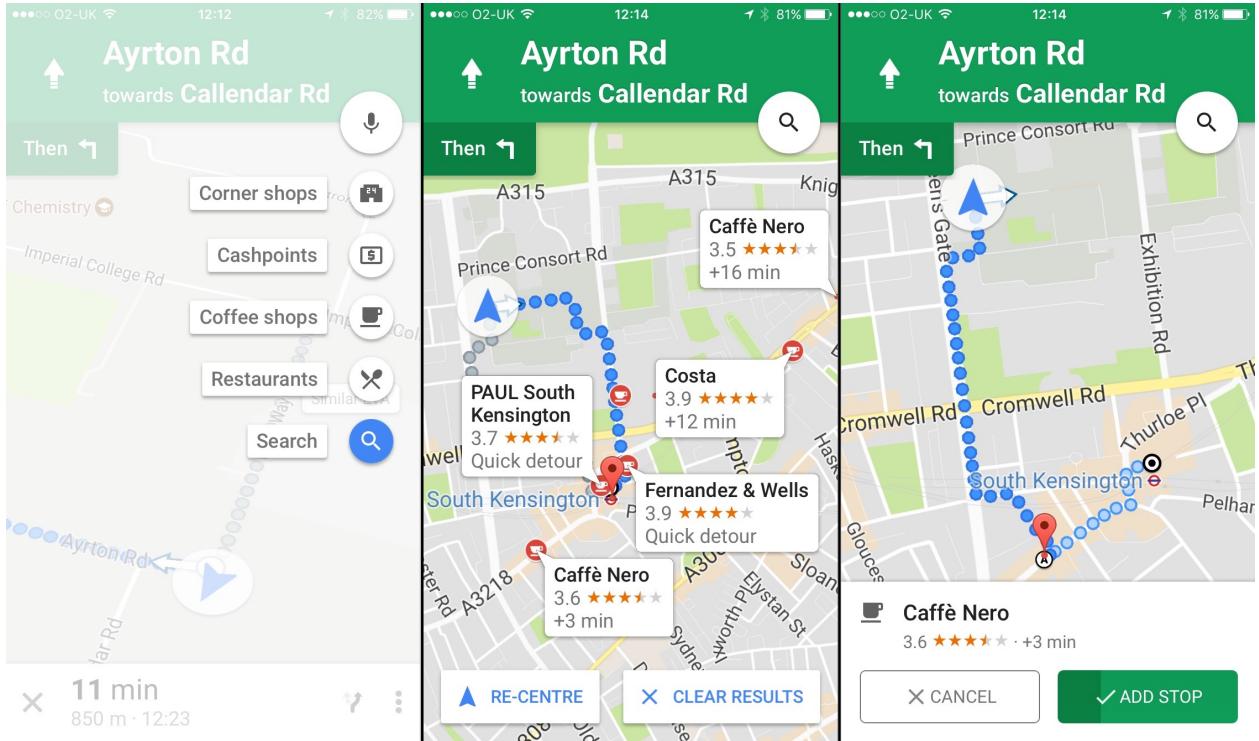


Figure 2.2: Adding places along your walking route in Google Maps for iOS. A list of categories to choose from (left), then shows all the places from within a search on a map (middle). A stop can then be added and the journey will be updated (right).

would be added on to your journey if you were to stop at a place, if any. One or more places can then be added to your journey and the walking directions will subsequently update to include these new stops. Figure 2.2 shows an example journey from Imperial College to South Kensington station. It details the full process of choosing *coffee shops* as the place category, selecting a particular coffee shop on the map and the stop being added to the journey.

The places search feature is important as it is unique within any of the existing journey planner apps I have researched and it relates to one of my objectives regarding displaying points of interest when a user is on a walk (**Obj 2**). More research is conducted in Section 2.3.3 to discover what tools these applications use to implement this feature.

2.1.5 Citymapper

Originating in London, Citymapper [9] has become one of the leading journey planners for major cities around the world including Paris, Barcelona, New York, Tokyo and Sydney. One of the key features of Citymapper is that different modes of transport can be combined to create a faster journey time. For example, a journey from Imperial College to Oxford Circus (as shown in Figure 2.3) could just use the Tube, but it could be faster to hire a bike and cycle to a different station

and then take the Tube.

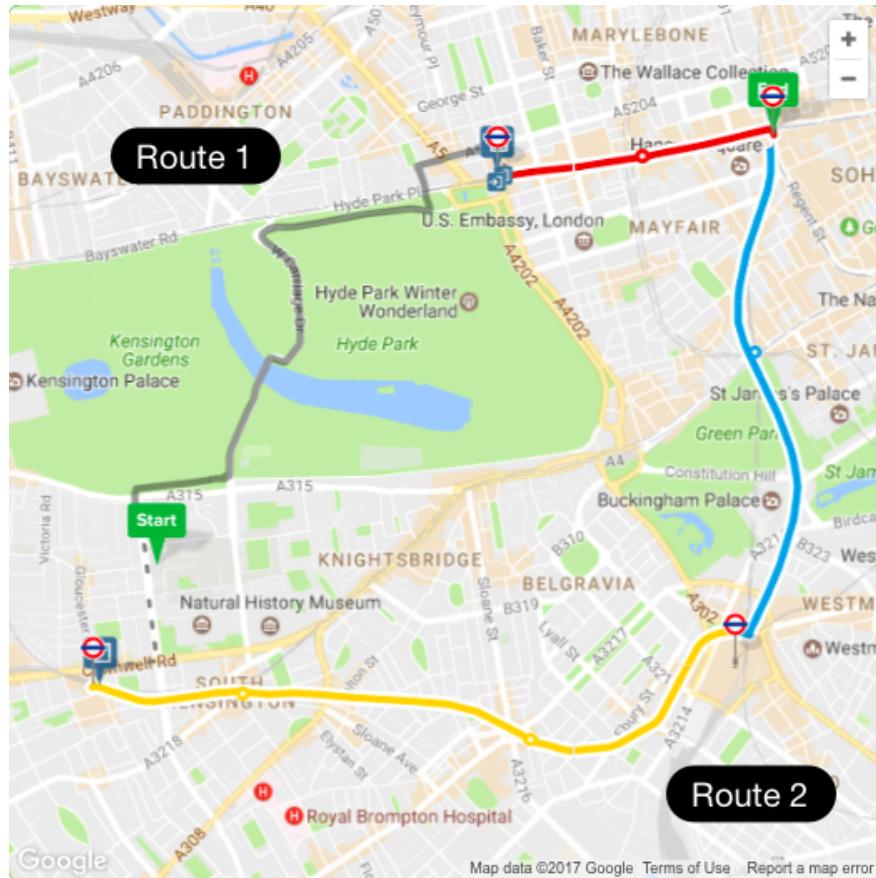


Figure 2.3: Two routes generated on the Citymapper website superimposed – cycle and Tube route (Route 1) and Tube only route (Route 2)

The walking directions in Citymapper are relatively limited. If you choose to walk on any route that you input, you are greeted with the screen shown in Figure 2.4. Details such as estimated time of arrival, calorie burn and time of journey are displayed on this screen. Once you press *Go*, you are transferred to the journey view, which simply tracks your location on a map and allows you to share your estimated time of arrival with others.

2.1.6 Pokémon Go

Pokémon Go, released last July, quickly grew to become one of the most popular games of the year. Although not necessarily a walking application in the normal sense, the aim of the game is to capture virtual ‘creatures’ called Pokémons that appear in real world places. Thus, the game motivates you to walk more to collect more and more Pokémons.

One of the more interesting parts of the application that is relevant to this project are the

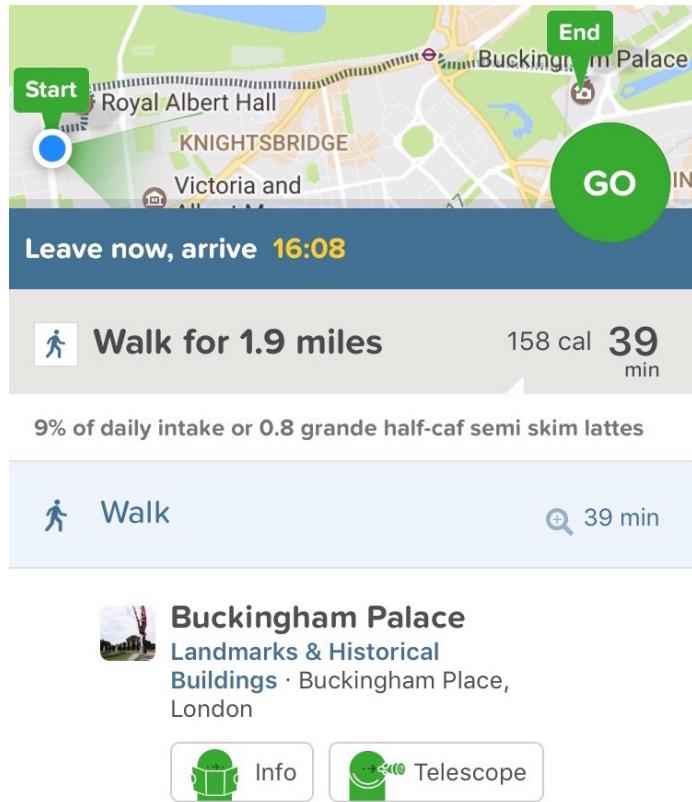


Figure 2.4: Walking view in Citymapper

Pokéstops within the game. A Pokéstop is a location in the game where various in-game items can be collected. They are displayed on a map using blue beacons as shown in Figure 2.5. These locations were crowdsourced by users of the game and are normally points of interest in the area such as a statue, a building or a famous plaque. Although not completely, this feature of the application does somewhat tie into my objective for helping people discover the world (**Obj 2**).

2.1.7 Summary

From the subset of fitness applications that I researched in this section, it can be seen that some of the objectives I proposed in Section 1.2 have been achieved but no single application encompasses all of my proposed objectives. I have found that it is important for this project to have a sleek design and easy-to-use interface as this is something that stood out straight away when looking at existing applications.

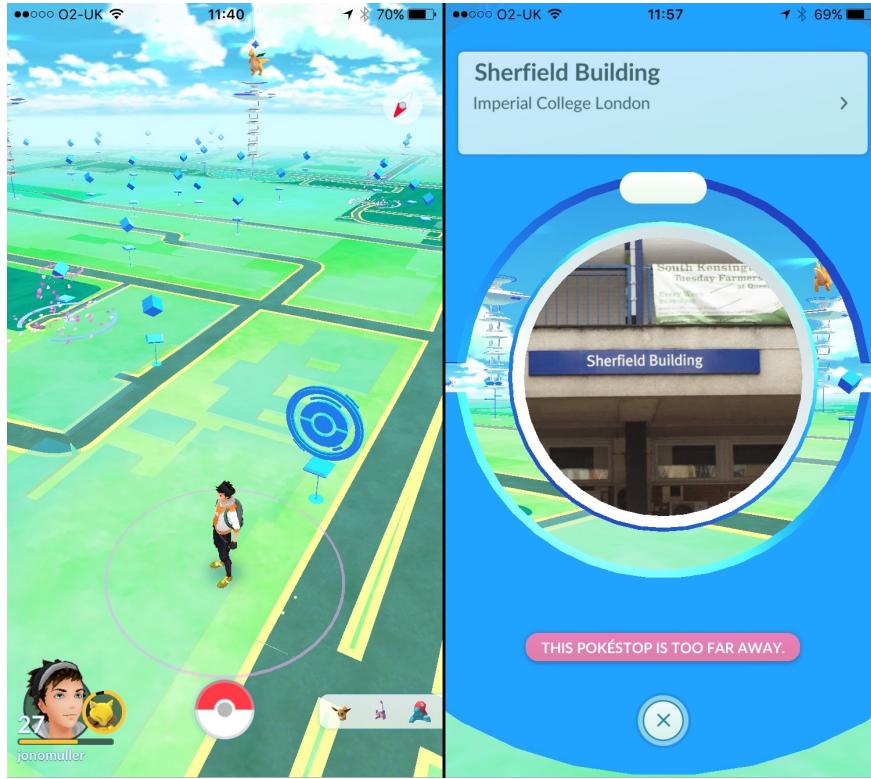


Figure 2.5: Screenshots of Pokéémon Go showing Pokéstops in an area (left) and a detailed view of a Pokéstop (right)

2.2 Gamification

Gamification is used in mobile applications not only for fitness but also in a wide range of areas including productivity, finance and mental health. We have seen how gamification can be used in existing fitness applications, with some apps setting challenges for users to complete within a given timeframe – such as running a half marathon in February.

An application and website called Habitica [10], labelled as a “gamified task manager”, helps motivate you to complete household tasks by unlocking features and levelling up an in-game avatar. Completing real-life tasks earns you gold for your character, which can then be redeemed for either virtual rewards such as equipment or real-life treats like watching an episode of a TV show, for example. The home page of Habitica, shown in Figure 2.6, is split into columns containing your bad habits, daily tasks, to-do list and rewards. It also shows the progress of your avatar, along with what is needed to progress to the next level. This type of app helps you become more productive at home in a fun and creative way that users enjoy.

Gamification is also used in some finance applications. Mint [12] is an application available in America that links to your bank accounts to help you manage your bills and track how much money

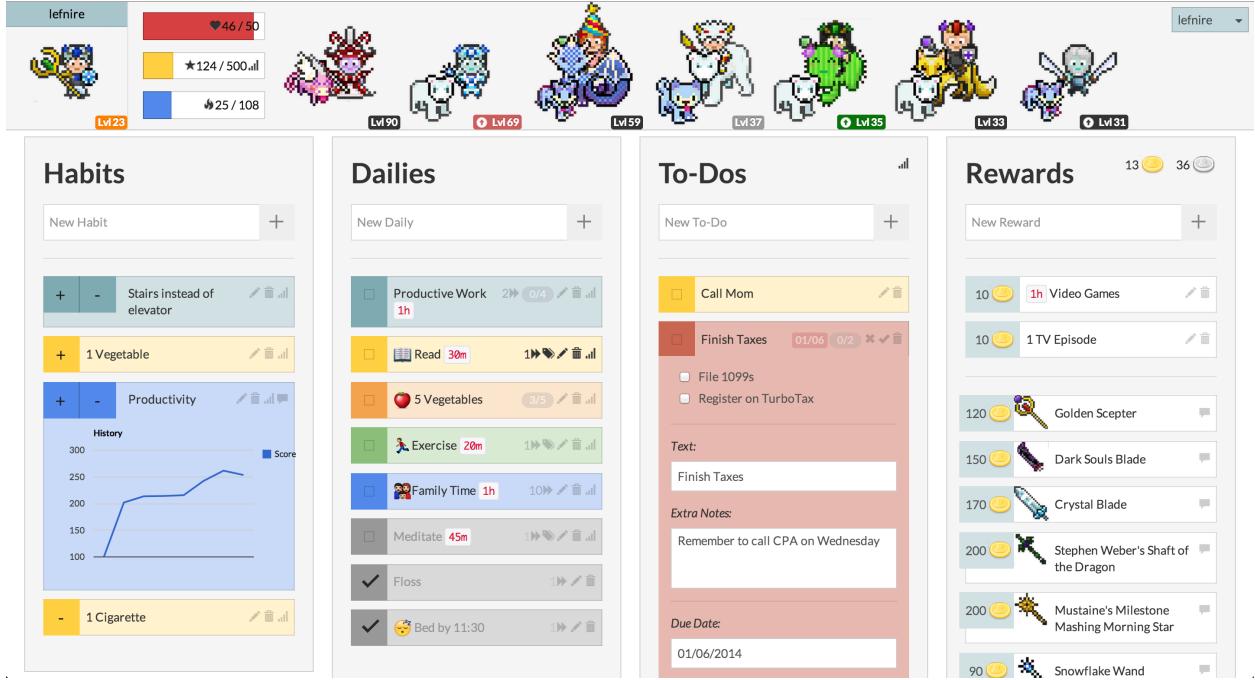


Figure 2.6: Home page of Habitica showing your habits, tasks and rewards as well as your avatar at the top [11]

you spend. It shows a breakdown of what you are spending your money on and creates a budget with the option of using any left over money on goals designed to help you save money, as shown in Figure 2.7. You can create goals to be either a long-term one-off payment – buying a house, for example – or a short-term monthly payment such as a subscription service. This game mechanic of working towards a goal to help you buy something you want is extremely effective and is why gamification is so widespread.

The idea of using gamification in applications is to motivate you to complete some form of task that you otherwise might not have attempted. It can make an app seem more engaging to the user, providing them with something to achieve every time they use the app. It is especially useful in fitness applications as keeping fit and staying healthy is very important, and should therefore be carefully considered for this project.

2.3 Technologies

The features of existing applications are not the only important part to research – the technologies that they use to implement these features are just as useful. This section discusses how existing applications implement certain features and which technologies integrate well with each other.

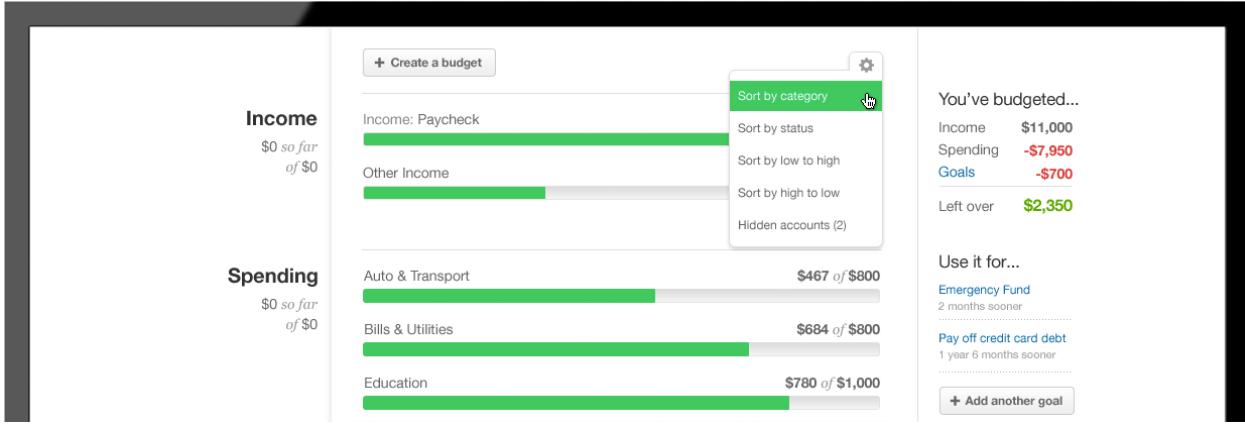


Figure 2.7: The breakdown of spending in Mint, giving you the option to use any left over money from your budget for one or more goals [13]

2.3.1 Operating System

Many of the applications that I have researched have been developed for iOS, the operating system running on iPhones and iPads. I have chosen to develop my application on iOS due to my previous experience with iOS app development. Another factor in this choice is that I have gained a lot of experience programming in Swift, one of the programming languages used to develop iOS apps, over the last few years. Swift is extremely readable and easy to use, which is the reason why I am choosing to use it over the other programming language available, Objective-C.

2.3.2 Location Tracking

To track the user's location within iOS, an application can use the classes from the Core Location framework [14] inbuilt into the iOS SDK (software development kit). This framework allows a developer to obtain the user's current location in the form of latitude and longitude. To keep a history of where the user has been, these coordinates could be stored in an array and updated every few seconds. This will be useful for my application to show on a map where a user has previously walked.

2.3.3 APIs

One of the most important application programming interfaces (APIs) to consider is which source of map to use. The majority of existing applications use Apple's maps apart from, of course, Google Maps. This is because Apple's MapKit framework [15] is much better integrated with the Core Location framework mentioned above, making it much easier to display the user's location on MapKit than on the Google Maps SDK.

However, there are some advantages of Google Maps over Apple Maps – one being that Google Maps tends to be more detailed than Apple Maps. An example of this is shown in Figure 2.8, where in my opinion roads are easier to see and buildings are clearly visible on Google Maps than on Apple Maps.

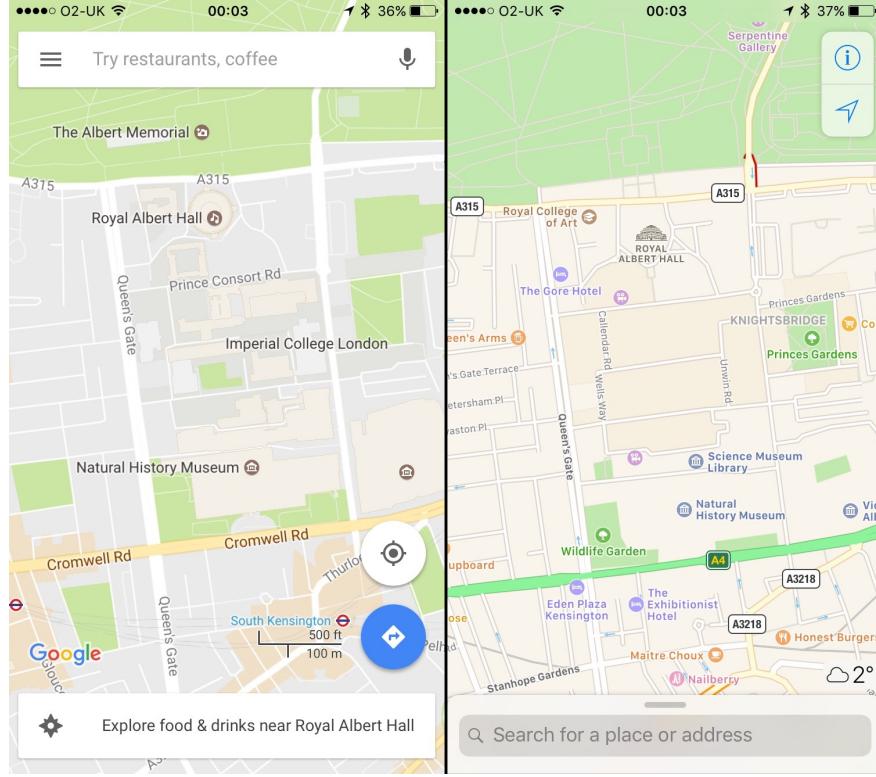


Figure 2.8: An example of the difference between Google Maps (left) and Apple Maps (right), showing Imperial College London

The other API that I need to consider is one that gathers points of interest near a user’s location. Google’s Places API [16] would be a very good resource to use, allowing you to search for places by over a hundred types including *point of interest*, *place of worship* and *museum*. The only issue with using Google Places is that you must use Google Maps to display the places on. From the Google Places Policies, “*If your application displays data from the Google Places API for iOS on a map, that map must be a Google map*” [17]. This would mean that if I were to choose Apple Maps for the maps within the app, I would be unable to use Google Places as well.

Apple also provides an API for obtaining places called `MKLocalSearch` [18]. To generate a list of places, you pass the `init()` method a `MKLocalSearchRequest`, which contains a string describing what type of place you would like to search for on a map. There seems to be little documentation online explaining what range of places that this API returns, which is something to consider when comparing it to other similar services.

A different option that could be used to generate points of interest around a geographical location

originates from Pokémon Go. As mentioned in Section 2.1.6, Pokémon Go contains thousands of Pokéstops – crowdsourced points of interest from all over the world. There exists an API [19] that returns a list of Pokéstops in JSON format given a location. Each item that the API returns contains the name and location of a point of interest as shown in Listing 2.1, and so could therefore be used in this project.

```
{
    "distance": 44,
    "name": "Sherfield Building",
    "bearing": 200,
    "latitude": 51.498359,
    "image": "http://lh3.googleusercontent.com/07q4ms3tgDKsQMy04xye
              _i-UiraP03j0S18TXwKpTMecgIXm2jXBy01CAUWVW9vNgqfx12ZtjqLdZr0lfsPu",
    "guid": "2cc0f9d9c7ba49348299c15749c49ea1.16",
    "compass": "S",
    "longitude": -0.178544
},
```

Listing 2.1: Example of one item returned from the Pokéstop API, with attributes including its name, latitude, longitude and distance from your location

Chapter 3

Project Plan

3.1 Requirements

Based on the broad objectives from Section 1.2 and the background research conducted in Chapter 2, a detailed list of technical requirements was created. The objective that each requirement supports is shown in brackets.

- Req 1** Build a fully functioning iOS application with a simple design and an easy-to-use user interface (**Obj 3**).
- Req 2** Allow the user to track the routes of the walks they go on, as well as provide statistics about the walk such as distance travelled and calories burned (**Obj 1**).
- Req 3** During a walk, the application should display certain points of interest on a map near the user's current location (**Obj 2**).
- Req 4** Each user should be able to register an account within the application and publish their tracked walks to their profile if they wish (**Obj 1**).
- Req 5** The application should display a list of the most popular walks in the area around you, with each walk containing statistics about how many times it has been walked and which user has walked it the most (**Obj 2**).
- Req 6** Users should be able to invite other users to go on a walk together and schedule this walk for a point in the future (**Obj 1**).
- Req 7** The application should contain some level of gamification - each user will have a score on their profile based on how far they have walked in total, how many walks they have been on and how often they go for a walk (**Obj 1**).

3.2 Project Timeline

With the requirements of the project established, a project timeline could be created showing how much time each task had been allocated. This timeline can be seen in Table 3.1. At the time of writing this interim report, I have concluded my background research and just started designing the application for the project, with the implementation planned to start next week. I have labelled the week of 20th March as exam week, with the thought that not much work will be done on the project due to revision.

Activity	January				February				March				April				May				June			
	9	16	23	30	6	13	20	27	6	13	20	27	3	10	17	24	1	8	15	22	29	5	12	19
Research																								
Design																								
Implementation																								
Evaluation																								
Report																								
Presentation																								

Table 3.1: Project timetable split into main tasks, with each column showing a week starting at the given date. The red line at the end of a coloured block represents the deadline for that row's task.

In addition to the project timeline, I have constructed a more detailed version which shows when each subtask of the implementation needs to be completed. By the end of the week of 6th March I plan to have created a functioning skeleton application with some features implemented, so that evaluation can start as soon as possible.

The week of 13th March has been labelled as revision week – some project work might be done this week but I have allocated enough time in my timeline that this week can be solely for revision if needed.

Activity	February				March				April				May			
	13	20	27	6	13	20	27	3	10	17	24	1	8	15	22	29
Skeleton app																
Set up web server																
Set up database																
Login system																
Track walks																
User Profile																
Popular walks																
Invite users for walk																
Gamification																
Extensions																

Table 3.2: Detailed implementation timeline

3.3 Extensions

Should the requirements listed in Section 3.1 be completed before the end of the project and there is enough time remaining, I have created a list of extensions that I would like to implement to extend the app's functionality.

Ext 1 Add the ability for users to add each other as friends within the app.

Ext 2 A recent activity feed could be added to show users what walks their friends have been on recently.

Ext 3 The user should be able to take photos during a walk and then publish these photos to their profile along with the walk.

Ext 4 Extend the gamification aspect of the app – users could set each other challenges to encourage a higher level of fitness.

Ext 5 Allow users to post a public invitation to a walk for any other user to join them.

Ext 6 Implement a list of set walks nearby that the user could go on – the London Loop for example.

Chapter 4

Evaluation Plan

4.1 Software Validation

To evaluate the technical aspects of the software created, the following areas will need to be tested during implementation phase:

- **Database stress testing:** one of the more technical aspects to test is the database. I will need to stress test the database to prevent any performance issues when providing data for the user. I will also test whether the user's login details are stored securely in the database.
- **Unit testing:** unit testing will be conducted on the iOS application to make sure there are no errors in areas such as storing data to the phone's internal database and displaying map data on screen.

4.2 Additional Evaluation

As well as the software validation, qualitative aspects of the project also need to be evaluated. This part of the evaluation should not only be done at the end of project to reflect back on what I have achieved, but also during the implementation phase. This is to ensure that problems with the application can be fixed and re-implemented as quickly as possible and hence maintain a fast feedback loop between me and the user.

- **Design of application:** to test the design of the application, a design survey will be conducted during the design phase of the project asking users what they think of initial mockups of the application. Another survey will then be conducted near the end of the project to assess whether the design of the application I have made is appealing to the user, along with anything I need to change.

- **Ease-of-use of application:** the ease-of-use of the application will be evaluated through user testing. Family and friends can test the application and give me feedback on how easy the application is to use, as well as what features are implemented well. Once I have implemented more features into the application, I will be able to beta test the app with other users. At this stage I could also conduct hallway testing where I give the app to a stranger and they give me their initial feedback.
- **Reflect on objectives:** once the project is nearing completion, I will look back and assess if have accomplished my original objectives listed in Section 1.2 and the requirements in Section 3.1, or explain why I have not.

4.3 Evaluation Timeline

Following on from the project timeline in Section 3.2, I have created a detailed timeline listing each of the testing and evaluation tasks that should be completed during the project. The timeline can be seen in Table 4.1.

Activity	February			March			April				May						
	13	20	27	6	13	20	27	3	10	17	24	1	8	15	22	29	5
Design survey																	
Database testing																	
Login security																	
Unit testing																	
User testing																	
Hallway testing																	
Final survey																	

Table 4.1: Detailed evaluation timeline

A lot of the technical testing will be done throughout the implementation, including the database stress testing and the login security tasks. The surveys conducted at the start and end of the implementation section, along with the reflection on the initial objectives, will allow me to assess whether what I have made can be constituted as a success.

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Appendix A

Existing applications matrices

The full matrices for the existing applications are shown below. Table A.1 contains all the existing fitness and walking applications, while Table A.2 contains existing journey planners.

Features		MapMyWalk	Strava	Let's Walk	Pokémon Go
Design (2)	Clean, uncluttered design	✗	✓	✗	✓
	Nice colour scheme	✓	✓	✗	✓
Ease of use (3)	All functions of app work correctly	✓	✓	✓	✓
	App is not slow/clunky	✓	✓	✗	✓
	Features accessible within 3 clicks	✓	✓	✗	✓
Tracking location (2)	Accurately tracks location while walking	✓	✓	✓	✓
	Records information about number of steps, distance travelled, etc.	✓	✓	✓	✗
Navigation (4)	Journey view while walking	✓	✓	✓	✓
	Provides accurate navigation directions	✓	✗	✗	✗
	Gives information about points of interest near user	✗	✗	✗	✓
	Able to take photos during walk	✓	✗	✗	✗
Social interaction (5)	Able to publish walks completed to profile	✓	✓	✓	✗
	Leaderboard of most popular walks	✗	✗	✗	✗
	Able to invite other users to join walks	✗	✗	✗	✗
	Each user has a score based on km walked, day streaks, etc.	✗	✗	✗	✗
	Users can add other users as friends	✓	✓	✓	✗
Total		11	10	6	8

Table A.1: Matrix for existing fitness/walking applications

APPENDIX A. EXISTING APPLICATIONS MATRICES

Features		Google Maps	Citymapper
Design (2)	Clean, uncluttered design	✓	✓
	Nice colour scheme	✓	✓
Ease of use (3)	All functions of app work correctly	✓	✓
	App is not slow/clunky	✓	✓
	Features accessible within 3 clicks	✓	✓
Tracking location (2)	Accurately tracks location while walking	✓	✓
	Records information about number of steps, distance travelled, etc.	✗	✗
Navigation (4)	Journey view while walking	✓	✓
	Provides accurate navigation directions	✗	✓
	Gives information about points of interest near user	✗	✓
	Able to take photos during walk	✗	✗
Social interaction (5)	Able to publish walks completed to profile	✗	✗
	Leaderboard of most popular walks	✗	✗
	Able to invite other users to join walks	✗	✗
	Each user has a score based on km walked, day streaks, etc.	✗	✗
	Users can add other users as friends	✗	✗
Total		7	9

Table A.2: Matrix for existing journey planners