University of Brighton

School of Computing, Engineering and Mathematics

CI360 Mobile Application Development

Project Report

Pantree

Mobile Cooking Assistant Application

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ABSTRACT

This report documents the *research*, *design* and d*evelopment* that went into the Android application Pantree. A cooking assistant app with the aim of providing a recipe sharing platform, with pantry tracking and ingredient-based recipe searching.

Using these features, I hope to tackle two problems, food waste by using up the left-over ingredients that would otherwise go to waste, and the decrease of home cooking over the last 30 years. Home cooking is a vital component to a healthy balanced diet, in a world where fast food and processed foods are an easily accessible commodity, Pantree attempts to simplify the process of cooking and its organisational aspect to therefore motivate people to start cooking at home.

The Application is built within Android Studio and uses Firebase technologies, this allows users to sign in on any phone and instantly be able to use the application seamlessly thank to Firebase's Realtime Database, as well as maintain a secure application thanks to Firebase Authentication.

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1 INTRODUCTION

1.1 AIMS

The aim of this project is to create a platform on which users can share and explore interesting Recipes. And equip the user with a with cooking organizational tools that will make it easy and approachable to the inexperienced cook. One such tool is the Grocery tracker that allows the user to track what ingredients they have, this can then be used to search for recipes. Reducing food waste by providing recipes to finish left over food and instead of having to go out to buy new groceries.

1.2   MOTIVATION

Cooking can be quite a daunting task to some, this is reflected in the decrease of home cooking over the past 30 years, a study in the **Nutrition Journal** [9] found that Home cooking had dropped 16-30 % over that time, and in 2007 only 54-57% of participants reported cooking activity. The decrease indicates that people don't take the time to get comfortable with cooking, since easy solutions like processed premade meals and fast food have become more easily available and cheaper.

A study published in 2017 [8], highlights the possible implications of this decrease. They found that *"home cooked meals was associated with a greater likelihood of having a normal range BMI..."* [8], in fact people who cooked 5 times a week, had 62g more fruit and 97.8g more vegetables on average than those who cooked only 3 times a week.

Home cooking is important for a healthy balanced diet, and as it's on the decline, solutions need to arise that make cooking, enjoyable, easy, and organised. A difficulty I have found when searching for recipes is the hassle of having to jump between web pages as well as hand written lists to organise what you want to make. And then having to keep track of what ingredients need to be bought, and finally what you currently have in the pantry/fridge.

The app aims to eliminate this deterrent by providing a simple all in one solution for planning and finding recipes from a user-created and curated collection, keeping users healthier, and exploring new foods.

1.3   REPORT STRUCTURE

Throughout the Report I go in-depth into the technologies and methodology used in planning, designing, implementing and evaluating the development of **Pantree**, in the rest of this Chapter I Elaborate on the Market Research I have done looking into applications similar to my own.

In Chapter 2 I go into detail on the Process of Manging and planning the project, as well as an analysis of the requirements of the system.

In Chapter 3 I elaborate on the structure of the application, as it relates to the Activites and Fragments that make up the application, I also go in depth into the Api's that were used during development their purpose, as well as the feature implementations of the application and their challenges.

Then in Chapter 4 I reflect on the process of developing Pantree, and touch on the possible future implementation possible for the app.

And Finally, the conclusion summarises the final project, and what was achieved in the designated time.

1.4 MARKET RESEARCH

Existing solutions for Recipe searching applications vary widely, but the ones relevant to my project can be broken down into two groups:

1.4.1 Recipe Search Applications

There are a variety of good cooking applications available in the app store and play store. ***Kitchen Stories*** and the ***BBC Good Food*** are two good examples of very solid implementations. With a very intuitive interface, providing a very user-friendly experience, and as such provided inspiration while developing my application for intuitive UI Design.

On the other hand, very few of these applications provided features such as ingredient tracking, and solutions for recipe search based on ingredients, other than rudimentary single ingredient searches. This being a main feature of Pantree, makes it stand out as a concept through increased organisation, while also decreasing food waste.

Most applications available also provided curated lists of recipes produced by professional chefs, which results in a collection of high-quality recipes but limits the potential of growth. This again varies from Pantree, as the community aspect and the ability to share recipes allows users, to not only search recipes but add their own to the collection.
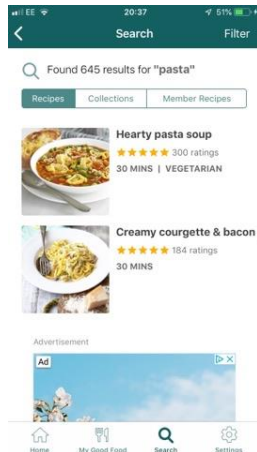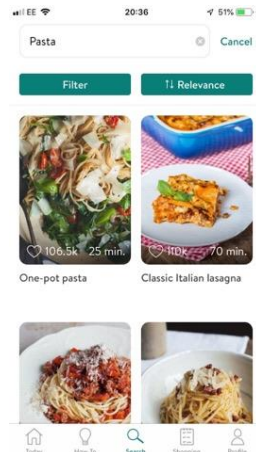
Figure 1 Good Food Recipe Search

Figure 2 Kitchen Stories Recipe Search

1.4.2   Ingredient based search solutions

There is a selection of Ingredient based search solutions available, an example being Super Cook [1], which provides an intuitive web-based application, for searching a comprehensive Database of recipes. It does provide an ingredient-based recipe search solution, but does not have a system for tracking ingredients, and therefore requires you to input the ingredients manually for every new search. This results in an experience with little organisation and tedious searches.

Another popular solution I found was Bigoven [2], which is much more comprehensive than Super Cook. Providing a wide host of functionality, such as recipe sharing, where you can add recipes manually by text input, or by scanning them in with the camera, a shopping list, a meal planner, and is available as a mobile app. An impressive application and is reminiscent of a social network, it does have an ingredient-based search but is limited to only 3 items at a time.
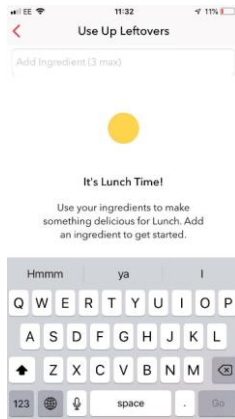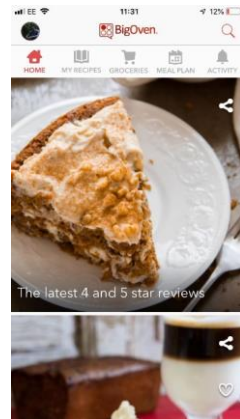
Figure 3 Bigoven Use Up Leftovers Search

Figure 4 Bigoven Home

2 PROJECT MANAGEMENT

2.1 AGILE METHODOLOGY

The planning methodology used in the development of the project was a Scrum Agile approach, modified to accommodate the one-person team. The Sprints were kept short at 3-4 days, which allows for many iterations of development to occur in a short period of time. This means I can evaluate progress at a faster pace, and make changes where required. A *sprint* as defined in the scope of this project is defined by the following process:

- Envision
    - o Here we determine requirements for this *sprint,* implementing any modifications from the previous *sprint*.
- Research
    - o Then Research is done into the best practices and technical implementations of the requirements for this *sprint*.
- Development
    - o The features are then designed and implemented.
- Test
    - o The features are then tested and evaluated, and any bugs are recorded.
- Adapt
    - o Any bugs or changes to be made are now implemented after testing.
    - o Adapt future *sprint* plans.

With the methodology decided, I kept a log of development as I iterated through the *sprints,* all organisation was done through Notion [8], a versatile web app, which allowed me to store research, Development logs, as well as image files throughout development all in one place.
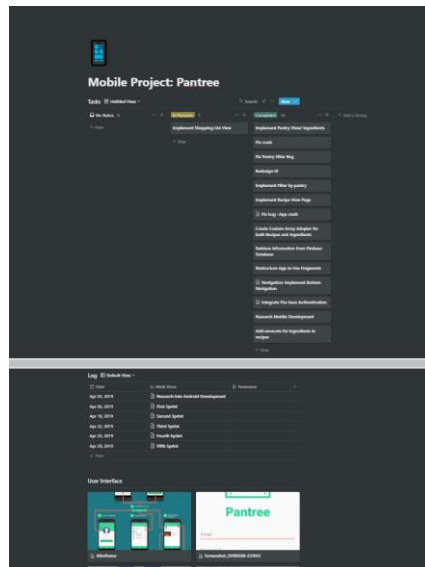
Figure 5 Notion Planning and log

2.2 REQUIREMENTS ANALYSIS

These are the functional requirement as organised by priority, the requirements in green have the highest priority, those in orange were the second most important requirements, and ones in red did not make it into the final version of the application due to time restrictions.

- User Authentication
  - o Sign in
  - o Sign up
- Cloud Data Storage
- Intuitive Navigation System throughout Application
- User Account
- Pantry
  - o Allows user to add/remove ingredients with ease
- Recipe search
  - o Through both text search and by pantry ingredient
- Add User Created Recipes to Collection

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- Readable Recipe view
- Favouriting System
- Shopping List
- Barcode scanning
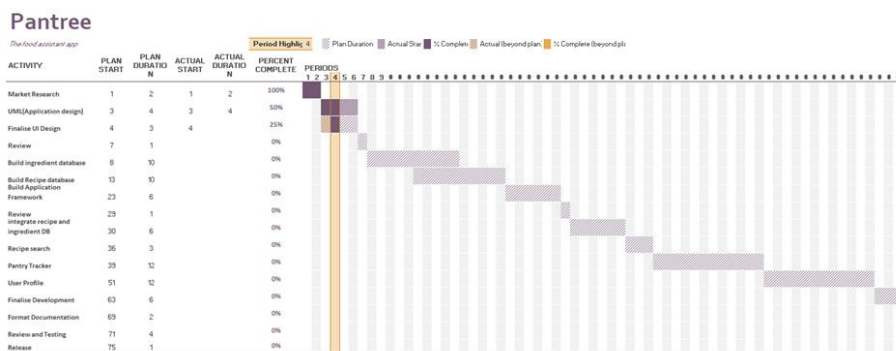
3 DESIGN AND IMPLEMENTATION

Within this chapter I will explore in depth the design and development process of developing Pantree. I will first go over the structure of the application and then explore implementations of a variety of features.

3.1 LIBRARIES USED

3.1.1 Glide [5]

Glide is an open source media management framework for Android created by Sam Judd. In Pantree this is used to fetch the images from the URLs stored in the Firebase Database, to display them within an ImageView. This is used for the profile picture as well as for all the *Recipes*.

3.1.2 Circular ImageView [6]

Is a simple UI Library that allows you to make circular ImageView's, made by Lopez Mikhael. This is used for the display of the user profile.
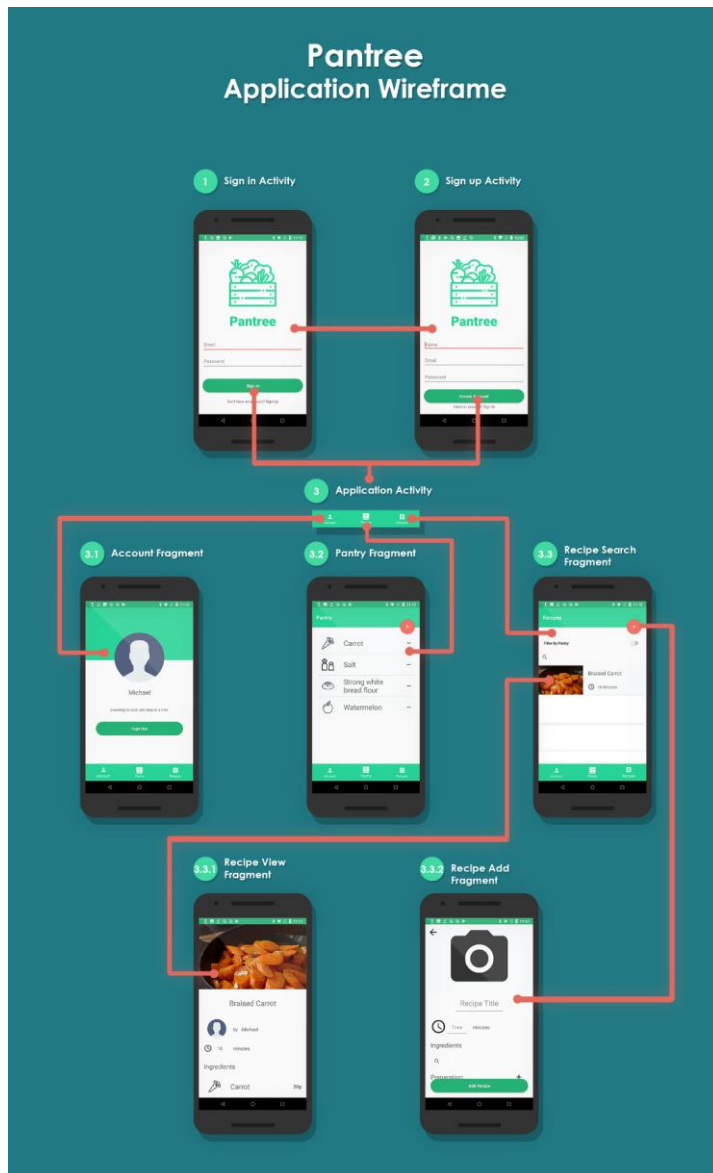
3.2 APPLICATION WIREFRAME

Figure 6 Application Wireframe

3.3 ACTIVITES

An Android application is comprised of Activities, which are used to initiate code, and are can be described as a page. Generally, an Activity takes up the entire screen and is normally interacted with by the user one at a time. Here I describe the function of the Activites in this project. The activities need to be declared within the Android Manifest.

3.3.1 Sign in Activity

This activities purpose is simply to allow the user to sign in, it is the first activity the user interacts with when first opening the application or once signed out. Access to the ***Sign-Up Activity*** (Figure 8) is provided via the clickable *TextView* at the bottom of the screen. If the user is signed in, they will automatically skip this page when opening the app, and land in the ***Main Application Activity*** (Figure 9). Error signs are displayed if the email is invalid and if the password is too short, as adhering to the Firebase authentication requirements.
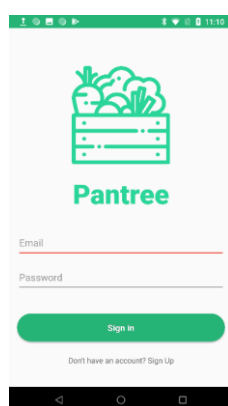
Figure 7 Sign in Activity

3.3.1.1 Sign up Activity

This Activity is Equally simple and after being accessed through the sign in Activity allows the user to create an account. Both the email and the Password are checked if they adhere to the Firebase Authentication requirements, and then the user is signed in and are then send to the ***Main Application Activity*** (see figure 9). They can also return to the **Sign in Activity** (Figure 7) via the clickable TextView at the bottom of the screen.

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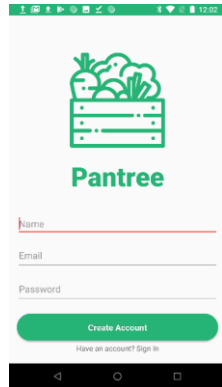
Figure 8 Sign up Activity

3.3.1.2   Application Activity

This is where all the application functionality is presented to the user, the Activity is deceptively simple, and is composed of only a *FrameLayout*, and a *BottomNavigationBar*. The navigation bar can be used to access all *Fragments* that make up the application, the *FrameLayout* is then replaced with the corresponding *Fragment*. If the user is not authenticated, they are sent back to the sign in screen, where they will be required to sign in.

Figure 9 Main Application Activity

3.4 FRAGMENTS

Fragments have similarities with Activites, and can be considered a type of sub activity, it is described 'as a modular section of an activity, which has its own lifecycle, receives its own input events, and which you can add or remove while the activity is running' [4] in the official Android Documentation. In Pantree 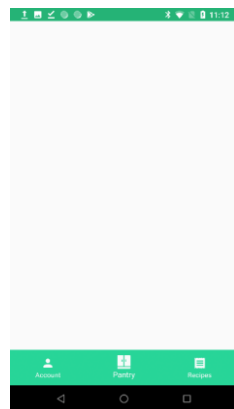I take advantage of fragments as a tool, most of the functionality is handled in Fragments within the **Main Application Activity** (see Figure 9).

3.4.1   User profile Fragment

This is the first *Fragment* a user sees displayed in the FrameLayout within the Main Application Activity. Here the user can add/change their profile picture, view their name, and sign out of the application. This Fragment has substantial potential for future implementations.

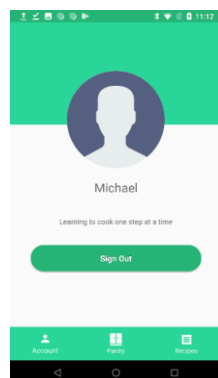*Figure 10 User Profile Fragment*

3.4.2   Pantry Fragment

Within this fragment all the ingredient tracking functionality can be accessed, a user can view all the ingredients currently in their pantry, as well as add ingredients via search when the button on the top right is pressed. The Ingredients can be removed by clicking on the minus symbol on the right of the ingredient list item.

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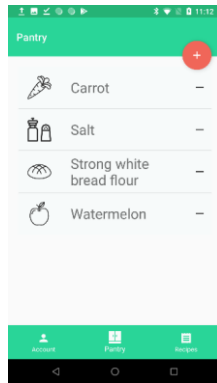
Figure 11 Pantry Fragment

3.4.3 Recipe Search Fragment

This Fragment has similarities in design to the **Pantry Fragment** (Figure 11), but differs in functionality, the list view is populated by the Recipes Stored in the Firebase Realtime Database. The user may now search via *Title* of the *Recipe*, as well as searching by the ingredients available in their Pantry by clicking the switch. *Recipes* can be accessed by clicking them in the ListView, which opens the **Recipe View Fragment** (Figure 13), which is populated with the corresponding information. By pressing the add button on the top right the user can access the **Add Recipe Fragment** (Figure 14).

Figure 12 Recipe Search Fragment

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3.4.4   Recipe View Fragment

A simple *Fragment* with little intractability and is only used to view the recipes and the information associated with it, this can be accessed only via the ***Recipe Search Fragment*** (see figure 12). This displays information such as a recipe image, the recipe contributor, the time for completi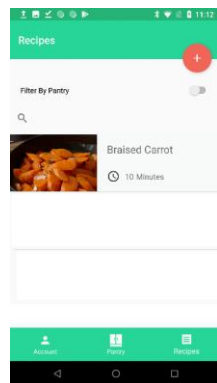on, ingredients required and amounts, and the preparation steps. This Fragment is instantiated on clicking a recipe item within the ListView and destroyed when the back button on the top left is clicked.
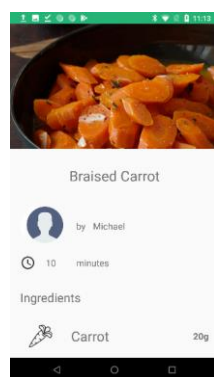
Figure 13 Recipe View Fragment

3.4.5   Recipe Add Fragment

This *Fragment* can also only be accessed through the ***Recipe Search Fragment*** (see Figure 12). Here a user can fill in the information to add their own recipe to database, all the fields are required when uploading a recipe. An image can be added by clicking on the camera icon, the title and time can be add through the EditText's, ingredients can be searched and are then added on click, Steps are added by pressed the plus button which will create an EditText which can then be filled with the necessary information.
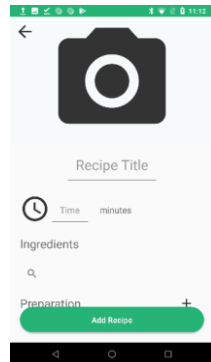
Figure 14 Recipe Add Fragment

3.5 FIREBASE

Firebase is a toolkit which provides a fully featured platform for a variety of application functionality. In Pantree it was used throughout the development process, implementing the Firebase Authentication, Realtime Database and Storage.

3.5.1 Firebase Authentication

Provides the backend services, for authenticating users, with integration with other federated identity providers that can be used as sign in options, such as Google, Facebook etc. The user data is securely stored and allows me to keep the application secure by checking the user's identity and only allowing the correct user access to their information.

3.5.2 Firebase Realtime Database

The Fire base Realtime Database is a cloud-hosted database, which keeps the data synchronised between all the connected clients. This was vital, as the user data as well as the recipe data is all stored within the database regular consistent updates should be instant and synchronised for other users, e.g. adding recipes, adding/removing ingredients, changing the user profile image.

In Figure 14 we can see the structure of the database and the data it contains, represented in an Entity Relationship Diagram.
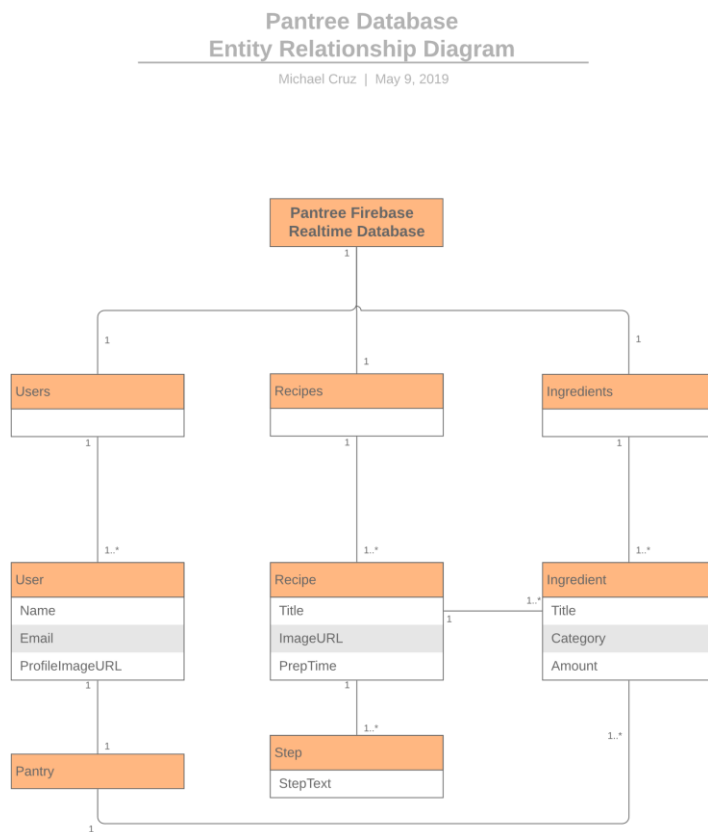
Figure 15 Pantree Realtime Database Structure

3.5.3   Storage

Allows me to store the images for both the user profiles as well as the recipes, I then retrieve the URL's and store them in the ***Realtime Database*** (see Figure 14). I can later retrieve these using ***Glide*** [5].

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3.6 TECHNICAL CHALLENGES

Pantree has been my first large Android based project that I have undertaken, it provided many hurdles along the way. Throughout the development process the applications Architecture has changed substantially, initially comprised of only Activites. I later decided against that and implemented the main 'pages' of the application as fragments, so I could swap them out easily while reusing the bottom Navigation bar throughout the application.

Once again, after some further development, I decide that the system I was using, where the Fragments would be created on clicking of the navigation bar and then replace the currently active Fragment resulted in an inconsistent slow experience. I decided the best way to solve the problem was to load the three main *Fragments* on sign in and hide the inactive ones. This also meant that if a user was scrolling through recipes and wanted to quickly check their pantry, the recipe search would maintain its position, and the user could then continue scrolling seamlessly.

Changing the architecture in both cases came with its own deluge of problems, which prevented me from progressing further until they were fixed. This resulted in even more careful research into best practices while implementing features in the hopes to pre-emptively stop a similar situation occurring again.

User interface posed challenges as well, even with a large amount of experience in graphic design, providing a consistent and intuitive experience required many iterations. Even now there are areas in which the UI could be improved.

Surprisingly another big hurdle I faced during the design and testing process was having little experience with the android OS standards, not having used an Android phone in a long time, it took a while for me to become fully acquainted with the User interface standards for Android.

3.7 TESTING AND EVALUATION

Testing of Pantree was a continuous process, and as mentioned previously was done at the end of every *Sprint*. While mostly performed by me, I had potential Users also testing the application while I was developing the App. Doing this, yielded a list of bugs, but getting the feedback and testing done early in the process meant I had a significant amount of time to fix any problems, as well as bugs found in the system.

4 REFLECTION

The process of developing Pantree raised many questions as to what makes a good application architecture and an intuitive UI. Thanks to both the Module and the Development Process, I have developed an in depth understanding of the nuances of Android Development, Human Computer Interaction, as well as refining my skills in project management. Interacting with a variety of tools and libraries during the development process has allowed to expand my knowledge further in areas and therefore allowed me to develop an Application which although simple, has great potential for future development.

4.1 STRENGTHS AND WEAKNESSES

The UI for Pantree was designed iterated on many times, as I knew creating an intuitive UI was not an easy task. I compiled different UI elements from other applications in my research that I thought fit well in the concept. The result was cohesive but simple UI, that results in a pretty positive experience, although there are still inconsistencies and things I would like to improve, particularly issues such as misaligned text.

By maintaining all the data on the cloud this meant that users could access their accounts from any device, by signing in they instantly have access to their Pantry. This does mean on the other hand that an internet connection is required for the app to function.

I also believe that because of this I could have taken more steps in the optimization of data in the Firebase Realtime Database, sometimes having unnecessarily long node names and variable names.

4.2 FUTURE DEVELOPMENT

Pantree as a concept has a lot of potential for further development, as it provides a solution to a problem which is rarely addressed within other applications of its kind. With a variety of future implementations possible, the following is a selection, of possible future features, some suggested by potential users of the application:

- Ingredient amounts within the Pantry.
- Shopping list:
  - The ability to add all the ingredients from a recipe into the Shopping list with a press of a button.
  - Organised by Shopping isle: this could be achieved by using the ingredient Categories.
  - With check boxes allowing for easy visual tracking of which ingredients have been bought and which are left.
- Adding Ingredient Use by dates and suggesting recipes with those that are going to go off soon.
- Set Food requirements such as *Vegetarian*, *Vegan*, *Gluten-free* etc. which would affect recipe searches.
- Finish implementation of the contributor system.
- Adding Recipe Ratings and favourites.
- Adding follow functionality, that allows you to follow a user's recipes.

5 CONCLUSION

The aim of Pantree was to Get people back into cooking in an intuitive way, with the goals of reducing waste and creating a community for recipe sharing.

The result of this Project is an application that implements this concept, while it may be missing components like the shopping list, the main system for recipe searching and adding, as well as that for pantry tracking are present, resulting a robust simple application. That I believe with some further iterations would be a very viable solution to the problem raised in this report.

Thanks to this project I have developed a deeper understanding of the workings of Android Development, and I can now say that I have add invaluable tools such as Firebase to my arsenal for future mobile development projects.

REFRENCES

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[8] Mills S, Brown H, Wrieden W, White M, Adams J. Frequency of eating home cooked meals and potential benefits for diet and health: cross-sectional analysis of a population-based cohort study. *Int J Behav Nutr Phys Act*. 2017;14(1):109. Published 2017 Aug 17. doi:10.1186/s12966-017-0567-y

[9] JOUR Smith, Lindsey P, Ng, Shu Wen, Popkin, Barry M. Trends in US home food preparation and consumption: analysis of national nutrition surveys and time use studies from 1965–1966 to 2007–2008 Nutrition Journal. Published 2013/04/11. doi:10.1186/1475-2891-12-45

APPENDIX

CREDITS

Vegetables free icon made by Freepik from www.flaticon.com

Fish free icon made by Freepik from www.flaticon.com

Oil bottle free icon made by Freepik from www.flaticon.com

Meat free icon made by Freepik from www.flaticon.com

Salt free icon made by Freepik from www.flaticon.com

Round bread free icon made by Freepik from www.flaticon.com

Wardrobe free icon made by Freepik from www.flaticon.com

Apple free icon made by Smashicons from www.flaticon.com

Carrot free icon made by Smashicons from www.flaticon.com

Milk free icon made by Smashicons from www.flaticon.com

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