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Software Project

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Food Rescue

Technical Report



Food
Rescue

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Executive Summary

Food rescue is an application that can help to save on costs for a business by letting them be able to sell food that is destined to be waste. This gives the benefit of saving the business money by not throwing as much food away, save user's money as food will be available for cheaper and the environmental impact it has on the environment is crucial.

This report goes over the inspiration of why I chose to undertake this application, how it was built, the architectural design and the technology I used. It also provides pictures of the GUI of the application along with some code snippets to further help with showcasing my application.

It will also discuss how I tested to application to further build on my requirements and to prove that the requirements have been achieved over the course of my application.

1.0 Introduction

1.1. Background

Food waste is a huge concern in not only Ireland, but the entire world. When doing research for my Business intelligence and Data Warehousing II module, I came across a dataset talking about food waste. While I could not use this dataset as it was not granular enough, I did do more research into food waste in Ireland and discovered worrying consumer level waste figures. This gave me an idea to do an application around food waste and how to tackle how we waste food.

Another reason why food waste was always a concern for me is my time working in the retail sector. While I worked as a sales assistant in a local Tesco, I noticed thousands of euro's worth of food going to waste. This has still stuck with me to this day, and I have made it my goal to assist in any way possible. The environment is something that we take for granted and it must be essential that we as humans contribute in any way possible.

Technology Idea

For my application technology, I was listing the various technologies that I could use and ended on the conclusion that I wanted to do an android app. I had done 2 different projects with android studios so my thought was that this would be too simple. I wanted to try a new technology such as JavaScript or Python. I came across a framework called Ionic which was used to write JavaScript and create mobile applications using this. After further research, I was not too impressed with it for my application. I then came across React and that is where I found out about React Native. I spoke to my supervisor as I had never worked with React or React Native and was again given good things about react native. I bought a course for react native on Udemy to try it out and immediately knew that I wanted to use it.

Being a Business Information System's student, I felt that incorporating a new technology with React Native and using JavaScript for a full project would be difficult as my main experience with coding has been basic, older versions of JavaScript and using Java. To prepare for this I will have to go into detail with how React works and how React native fits into working with React.

For my backend technology, I wanted to use something different from a SQL database as I have a lot of experience with SQL through my BIS modules such as Data Warehousing and Advanced Databases. I had used Google's Firebase in 2nd year for a project and never got the hang of it so I decided that I would retry using Firebase as it had features that interested me such as Firestore, Firebase Storage for images and Robo testing.

1.2. Aims

The aim of my project is to develop an application that will be used for Android and IOS. There will be 2 users, an actual consumer of products and a business that can list their products. The consumer will have a view of a map that they can scroll through and view the various restaurants available. On the other hand the business will have a list of their products in a list, and they can put up a product, delete the product and update the product. I also want to add a feature that allows for 2 different products, one normal product that would be like something on websites such as Just Eat which has a set price, and another product with a diminishing price which will be called "Food Countdown".

Food Countdown -

Food Countdown will work is that based on the time of day, food lowers in price based on how close to the ending time of the project. The product will have a set time – Let's say 10 hours. During the 10 hours, the price goes down as the time gets closer to 10 hours. So if the price starts at €10 and ends at €0, every hour the price will go down by €1.

After doing research on competitors such as Karma, an application which is a mixture between a standard food app such as Just Eat and Deliveroo and a food waste app, I knew I had to try to add a new feature that was not present in any app developed before. Food Countdown is a new feature that looks to get rid of the usual static price and brings in something that better suits a time orientated product. This allows a business to set a decreasing price for the products for the only thing that effects the products, time.

It is possible that in the future, I could commercialise this application through either a joining fee when a business joins or allowing for the payment of products online which would let me take a cut of each order. The project has a real-world capability with benefits for the business, the consumer, and the environment.

1.3. Technology

Software used -

- Balsamiq – For Wireframes, I used Balsamiq mock-ups to create and plan my UI.
- Visual Studio Code – VS Code was used as my text editor as I have experience using it and it is the best for assisting with debugging applications and its integration with GIT.
- GitHub – I used GitHub for version control and to have a location where my application is safe from issues such as data wipes.
- Firebase – I used Firebase as my backend functionality. This was used to store images, store, and query data and to get API keys for areas like Google Maps and Geocoding.
- React Native – React native was used as the framework React was easy to create screens and link my firebase backend to my UI. This translates JSX into native code for an Android or an iPhone so they can read and display this as an app. Various packages can be installed through react native that I can use too such as Haversine, Dialog picker and more.
- Expo – Expo is used to develop, build, and deploy my application as a web application, IOS app and Android app.

Languages used -

- JSX – JSX was used as this is standard with React Native. This is essentially JavaScript with HTML and CSS elements built in.

1.4. Structure

Introduction –

The introduction consists of the background, the aims and the technology used. It gives a brief overview of the reasoning for my application, the real-world benefits and how the application is built.

System –

The system section of this report describes the requirements of this application, use cases, wireframes, and the testing that I performed on the application.

Conclusions –

This conclusion covers the advantages, disadvantages, strengths, and limitations of my project.

Further Development or Research –

This section talks over how I would develop and expand on this project given more time and resources.

References –

The references covers sources of information that assisted me with this project with permission.

Appendices –

The appendices section is where my project plan, reflective journals and any other technology used are stated.

2.0 System

2.1. Requirements

Performance: The performance of the application needs to be quick to load, above 60 FPS on each page and no lag on high demand pages. There are various tools to test each of the following with an application called Robo Testing from Firebase used to check quickness of the application and performance monitor on Expo used to check the FPS on pages.

Availability: The application must be up 24/7 meaning that it should be always available. Firebase and Expo will always be running meaning that there should be no problem with the availability of this application.

Security: The API Key and Firebase data should not be accessible to anybody whether it is through GitHub or hard coded into the application. Ensuring that my API keys are stored separately from my GitHub account lets me ensure that the API key will not be stolen so that any Firestore documents are not gathered by a dangerous individual. There will be no SQL attacks due to firebase query not working like a traditional SQL query. For emails and passwords, I will be using Firebase authentication which leverages standards like OAuth 2.0 and OpenID Connect so that the transfer of sensitive data is secure.

Scalability: The app should be scalable to keep up with the demand of the market. For now, this is an Irish only application but with Firebase, the app is easily scalable as a pay as you go project to ensure that other countries could eventually take part.

2.1.1 Functional Requirements

FR1: The business can put up both Food Countdown and Normal Products

FR2: Gathering the user and Business Location

FR3: User can purchase an item from the business

FR4: The user and business can manage their profile

FR5: The user can sort their products by category

2.1.2 Use Case Diagram

1 Requirement 1: The business puts up a product

1.1 Description and Priority

This use case details how a business will put up a product onto the Food Rescue application. This consists of 2 kinds of products, the Food Countdown product, and the normal products. It is essential that a business can upload a product as this is how the business will be displayed on the Map, this is how a user will see each different business and the items and the app becomes useless if there are no items. Therefore, business putting a product onto the market is the first and most important requirement.

1.2 Use Case

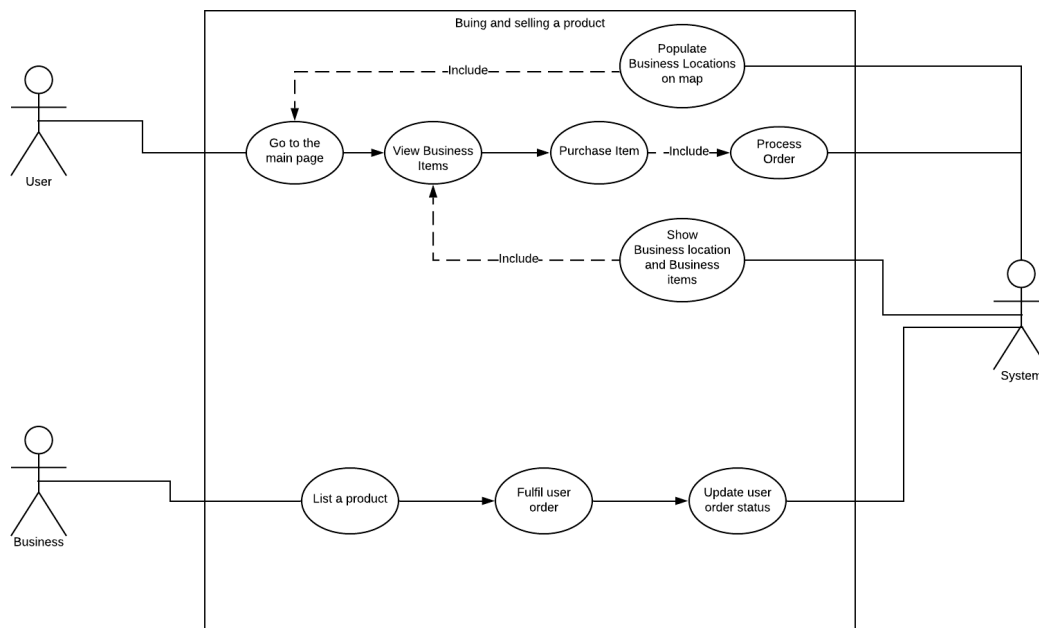
Scope

The scope of this use case is to allow a business to create a product and the interaction between that product and a user

Description

This use case describes the interaction between a business's order and the user. The user will be able to purchase a product that the business puts on the website.

Use Case Diagram



Flow Description

Precondition

The user is logged in and there is items available in the area

Activation

This use case starts when a user logs into the Main page or when a business lists a product.

Main flow

1. The user logs onto the main page and the system finds the location of the user and uses a marker to pinpoint the user on the map. (See E1 & E2, A1)
2. The user clicks on a business to view their products.
3. The user purchases that product (See E3)
4. The system processes the order and informs the business

Alternate flow

A1: Business logs in

1. The business logs into their account and clicks on "Add a product"
2. The business picks between Food Countdown or a normal product
3. The business lists the product
4. Any orders on that product are fulfilled
5. The business updates the status of the order

Exceptional flow

E1: Location Services not enabled

1. The user does not have their location enabled
2. The system displays a message that location must be enabled to use this application.

E2: No Businesses Available

1. The system finds the users location.
2. The system cannot find any businesses near the user.
3. The system displays a message that there is no businesses in the area.

Termination

The users order has been fulfilled by the business.

Post condition

The system goes into a wait state

2 Requirement 2: Gathering the user and Business Location

1.1 Description and Priority

This use case details how a map will display for the user with both all the business's locations near that user and the user's location in itself. The importance of this use case will be used by a user to see how far away a business is from their current location. It is also the backbone of the map functionality for my app.

1.2 Use Case

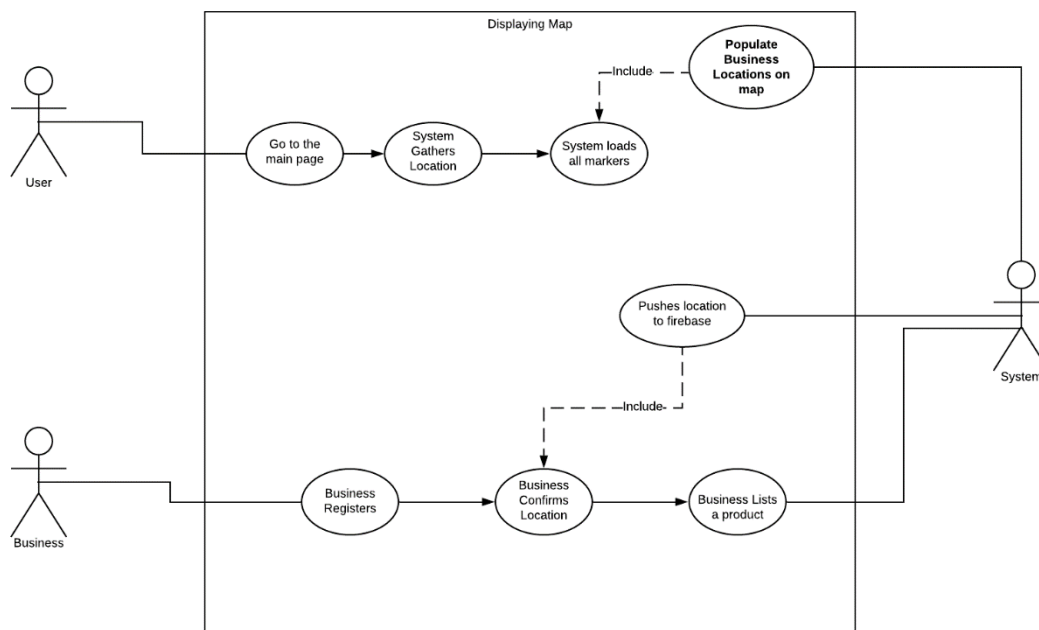
Scope

The scope of this use case is for the system to gather the user and business's location

Description

This use case describes how a system takes the location from the user, how the system takes the location from the business and how it will display these.

Use Case Diagram



Flow Description

Precondition

The user has their location enabled and is logged in.

Activation

This use case starts when a user logs into the Main page or a business is creating an account.

Main flow

1. The business registers and they get a prompt to confirm their location (See A1, E1)
2. The system stores this location in Firebase

3. The user goes to the main page
4. Their location is gathered (See E1)
5. The system loads every marker from the business.
6. The system loads the marker from the user

Alternate flow

A1: Business corrects location

1. The location of the business is wrong
2. The business goes onto the correct location page
3. The business puts in their location into a text input
4. The system Geocodes this location
5. The business submits this as their new location
6. The main flow continues at step 2

Exceptional flow

E1: Location Services not enabled

1. The user does not have their location enabled
2. The system displays a message that location must be enabled to use this application.

Termination

The locations have been displayed as markers and the user picks a business to view their items.

Post condition

The system goes into a wait state

3 Requirement 3: User can buy a product

1.1 Description and Priority

This use case details how a user will buy a product. The user must be able to purchase a product as this is the basis of the app. Once a business puts up a product, the user must have the option to buy that product. This is important and a huge priority as this is the main functionality for the user.

1.2 Use Case

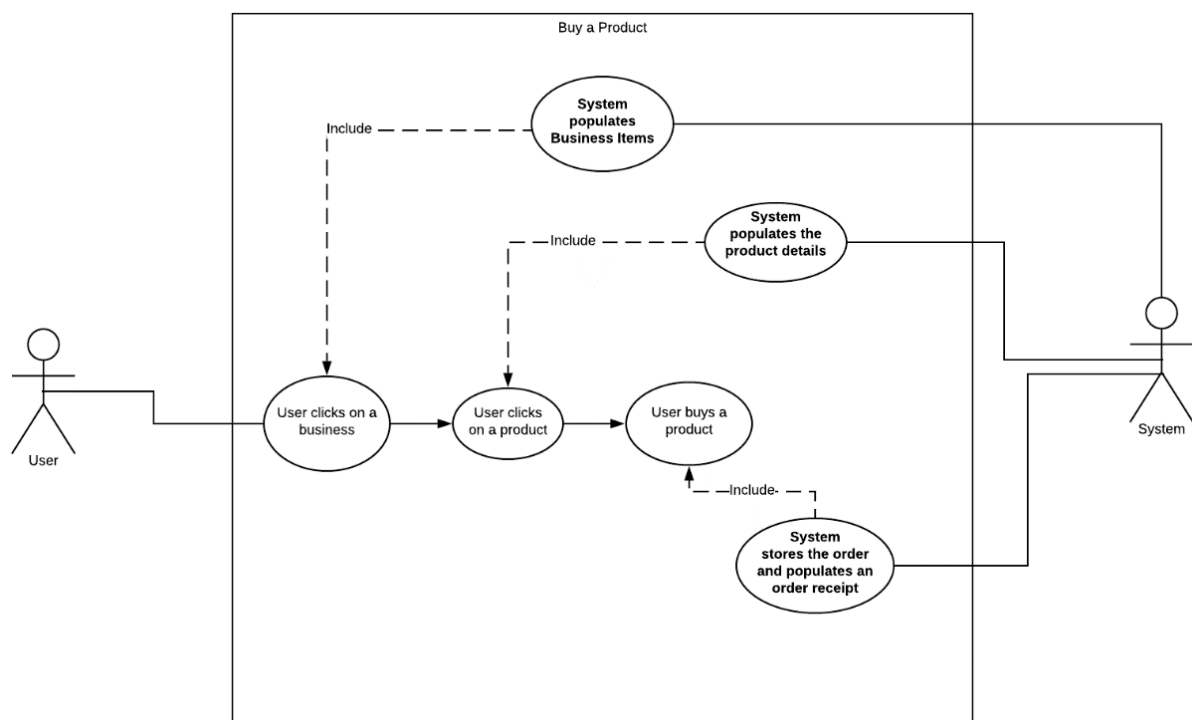
Scope

The scope of this use case is for the user to purchase a product.

Description

This use case describes how a user will view a business's product, pick a product, and buy that product. The user will then get a receipt with their order details.

Use Case Diagram



Flow Description

Precondition

User is logged in and there are products available on the market.

Activation

The use case starts when a business clicks on a business on the main screen

Main flow

1. The user clicks on a business
2. The system populates the businesses products (See E1)
3. The user clicks on an item
4. The system populates the information about the product
5. The user buys the product (See E2)
6. The system loads into the data into the database and displays a receipt page
7. The user views the receipt page

Exceptional flow

E1: No products available

1. The system displays an error message that there is no products available
2. The user goes back to the main screen
3. The flow continues at 1.

E2: Product goes out of stock

1. The system displays an error message that the product is no longer available
2. The user goes back to the main screen
3. The flow continues at 1.

Termination

A product has been ordered

Post condition

The system goes into a wait state

4 Requirement 4: The user and business can manage their profile

1.1 Description and Priority

This use case details how a user or business can manage their profile. Managing your profile is important for deleting accounts, changing user information, changing a business's details etc.

This is 3rd on the priority list for my application.

1.2 Use Case

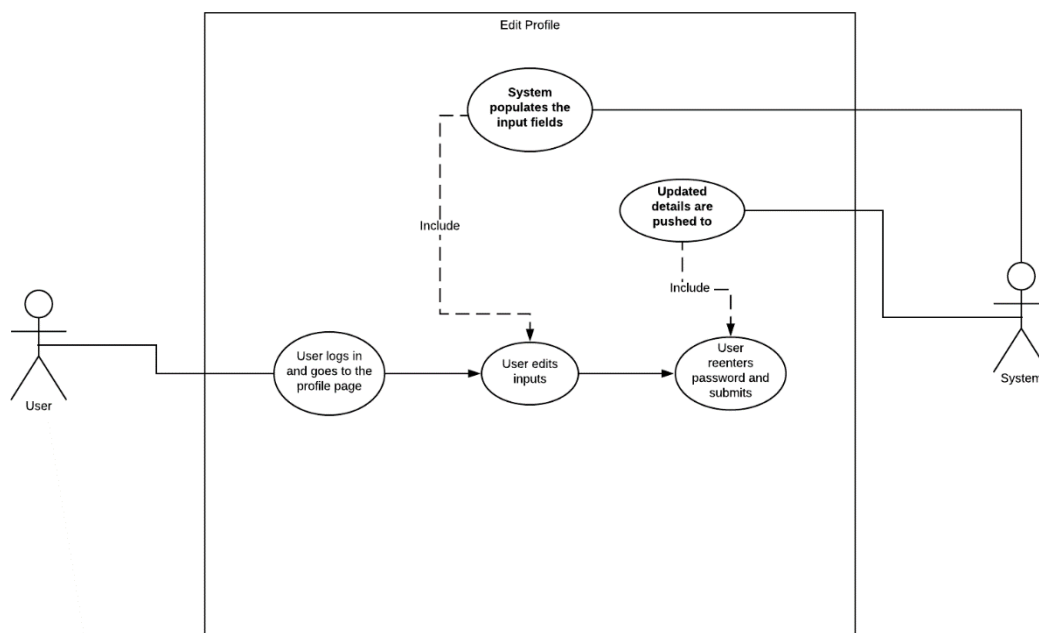
Scope

The scope of this use case is for the user to edit their profile. – The user can be the business user or the consumer in this scenario.

Description

This use case describes how a system displays a user's information and allows the user to edit that information.

Use Case Diagram



Flow Description

Precondition

The user has an account already created

Activation

The use case starts when a user goes onto the profile page.

Main flow

1. The system fills in the fields with the existing user information.

2. The user edits a field or all fields
3. The user clicks the submit button.
4. The user enters their password (See E1)
5. The system pushes the changes to Firebase

Exceptional flow

E1: Wrong password entered

1. The user doesn't enter the right password
2. An alert alerts the user of this issue
3. The user gets brought back to step 3

Termination

The new changes have been pushed to the firebase or the user exits the page

Post condition

The system goes into a wait state

5 Requirement 5: The user can sort their products by category

1.1 Description and Priority

This use case details at how a user can sort through the different businesses by the products they sell. Users can sort by what food each business sells which allows them to query the results. This is not an essential feature but it is one that adds a better experience for the user.

1.2 Use Case

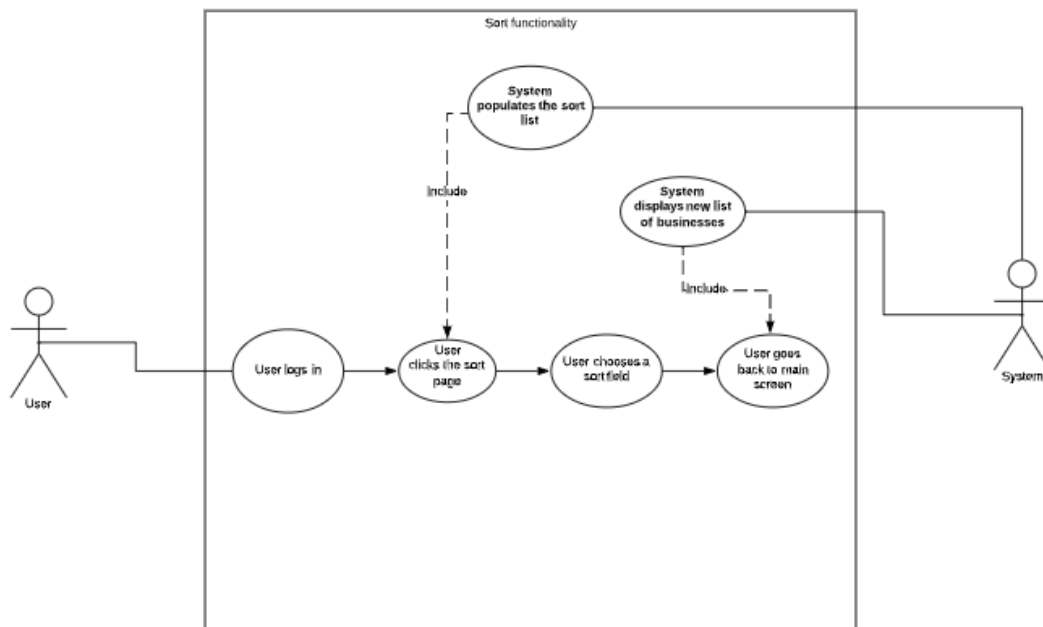
Scope

The scope of this use case is for the user to sort the businesses by category.

Description

This use case describes how a system provides the businesses and allows for the user to pick which category of business he wants to see.

Use Case Diagram



Flow Description

Precondition

The user has an account already created

Activation

The use case starts when a user goes onto the sort page.

Main flow

1. The user logs into the application and goes to the sort page.
2. The system populates the categories for sorting
3. The user clicks on one of the available categories.

4. The system navigates the user back to the main page
5. The system displays the available businesses that fall in that category (See E1)

Exceptional flow

E1: No Businesses available

1. There are no available businesses with that category
2. An alert alerts the user of this issue

Termination

The user chooses a category

Post condition

The system goes into a wait state

2.1.3 Data Requirements

The application needs to access the user's current location for them to be able to view the locations close to them. On Android and IOS, users can opt for their location to be used as a one-time instance each time they open the application. The data (Longitude and Latitude) is then sent to the map view and they can view this location on their screen. For businesses, this will be the same with their location gathered once, sent to the firebase and then read constantly by users.

The full list of data requirements are below:

- Users' name / Business Name
- Location
- Phone Number
- Email
- Password

2.1.4 User Requirements

To have access to this application, an account will have to be made. This can be done on the first page the user sees. They will be able to register as a user or a business. This will be done on one page and the email used for this, will be how they are differentiated.

- User can scroll through the map
- User can manage their profile
- User can view businesses that are available
- User can sort every business by a category
- User can see each businesses items
- User purchase a product
- User gets a receipt and can sort their receipts by status

- Business can put a product on the market
- Business can edit their profile
- Business get a receipt and can sort their receipts by status

2.1.5 Environmental Requirements

The application will be available on both android and IOS due to the expo application being available on each app store. The user must have a valid internet connection and have their location enabled on their device. Android will have more flexibility with the application due to the fact Androids can run APK's.

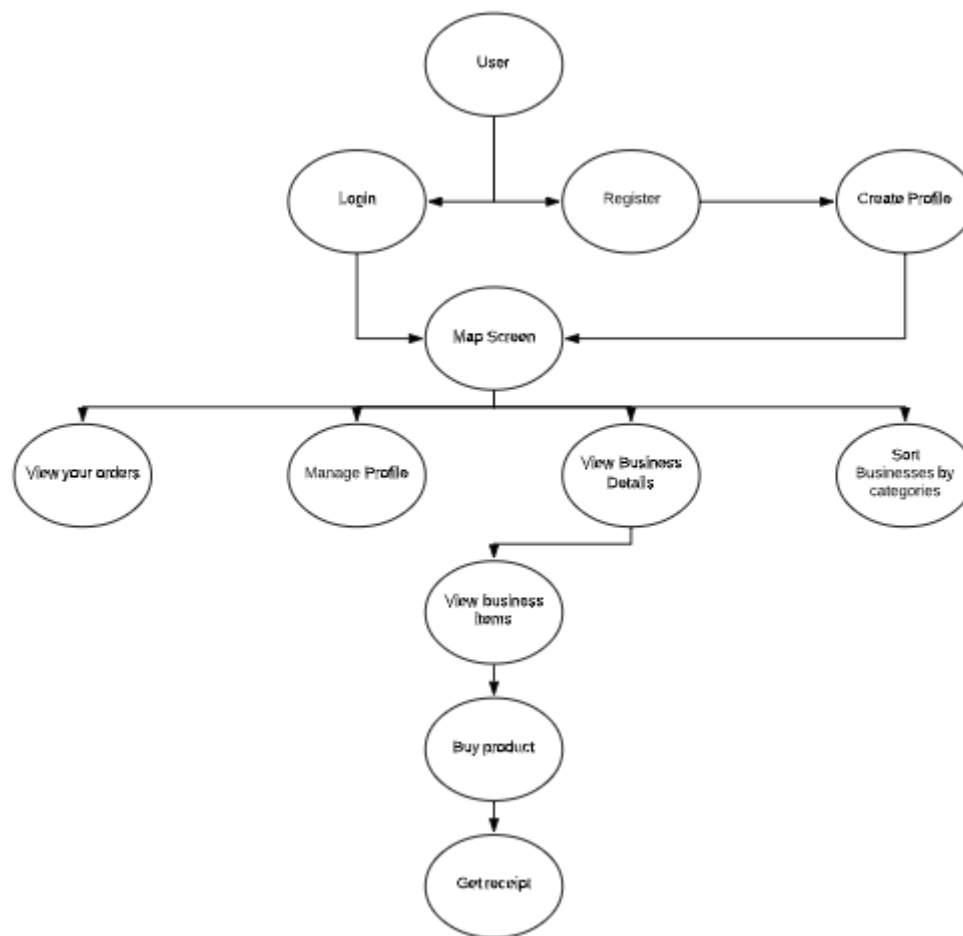
2.1.6 Usability Requirements

This application will be hosted using Expo which is an application download. This will make the app available to both Android and IOS. On Android, it is possible to get users to download the application as an APK. Expo will be needed for IOS users. Once the app is downloaded, the app is easy to use and requires basic knowledge of using mobile devices.

Once inside the application, the app should be easy to use by anyone. The app will allow for an easy experience. Once the user logs into the application, there will be a section they can go to get information on the app with instructions.

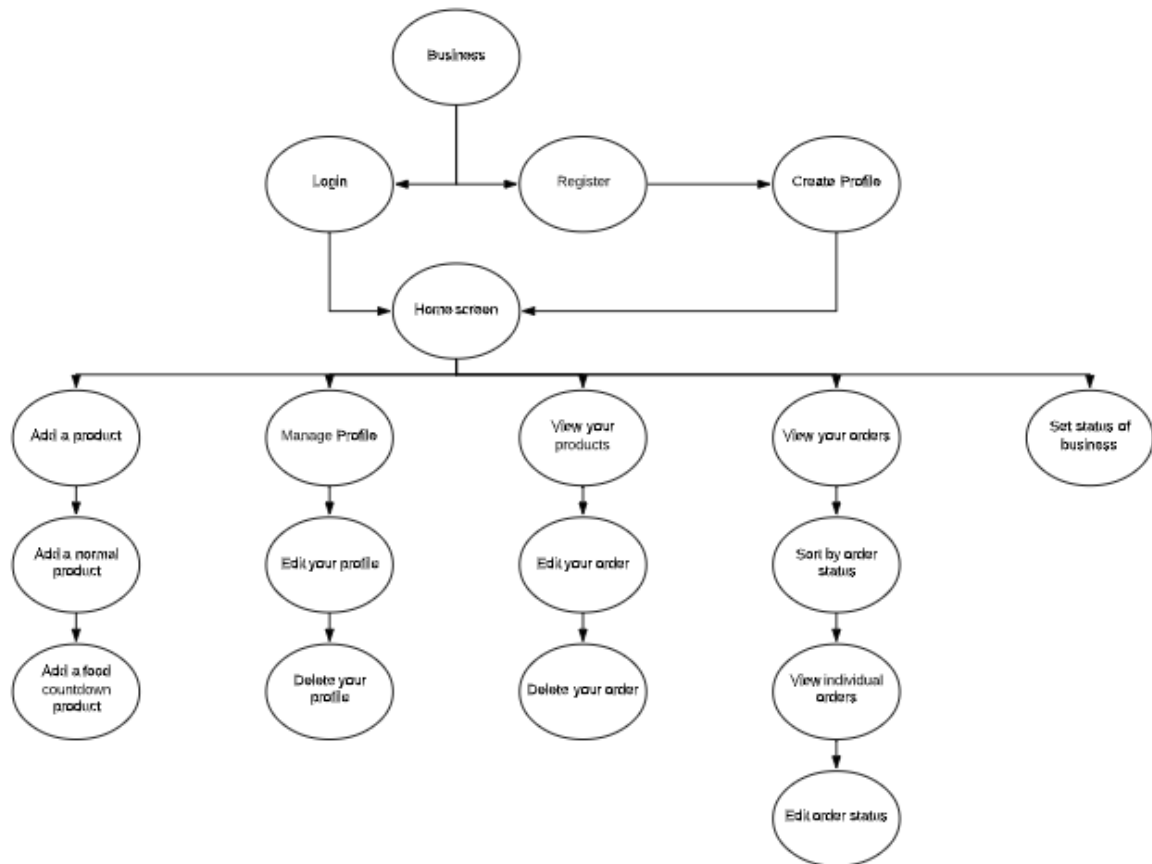
2.2 Design & Architecture

User design Flow



The flow of how a user interacts with the app is important as it is vital to make it as quick and easy for the user. The first step for the user is to login or create a profile. After that they are directed to the map screen in which all the functionality is. There is the option to view all the current orders, manage the user's profile, view business details, and sort the businesses by category. When they view a business, there will be a very clear flow for them to follow with only one option per page. They will be able to view all the items that the business has to offer, they will then be able to purchase that product and will get a receipt with the information regarding their order.

Business Design Flow



The flow of how a business interacts with the app is important as it is vital to make it as quick and easy for the business to sell on the platform. The first step for business user is to login or create a profile. After that they are directed to the Home screen in which all the functionality is. There is the option to add a product, manage their profile, view the products they have on the market right, view their current orders and set the status of their business i.e. open or closed.

Add a product:

A business adding a product consists of two options, adding a normal product and adding a food countdown product. Each of these have different functionality in the app but the inputs for each are similar.

Manage profile:

Managing the profile allows the business to edit their information such as the name, phone number, category etc. They can also delete their profile.

View your products:

The business can view all the products they have on the market currently. This will be split into both food countdown and normal items. The business can edit and delete the products that are available.

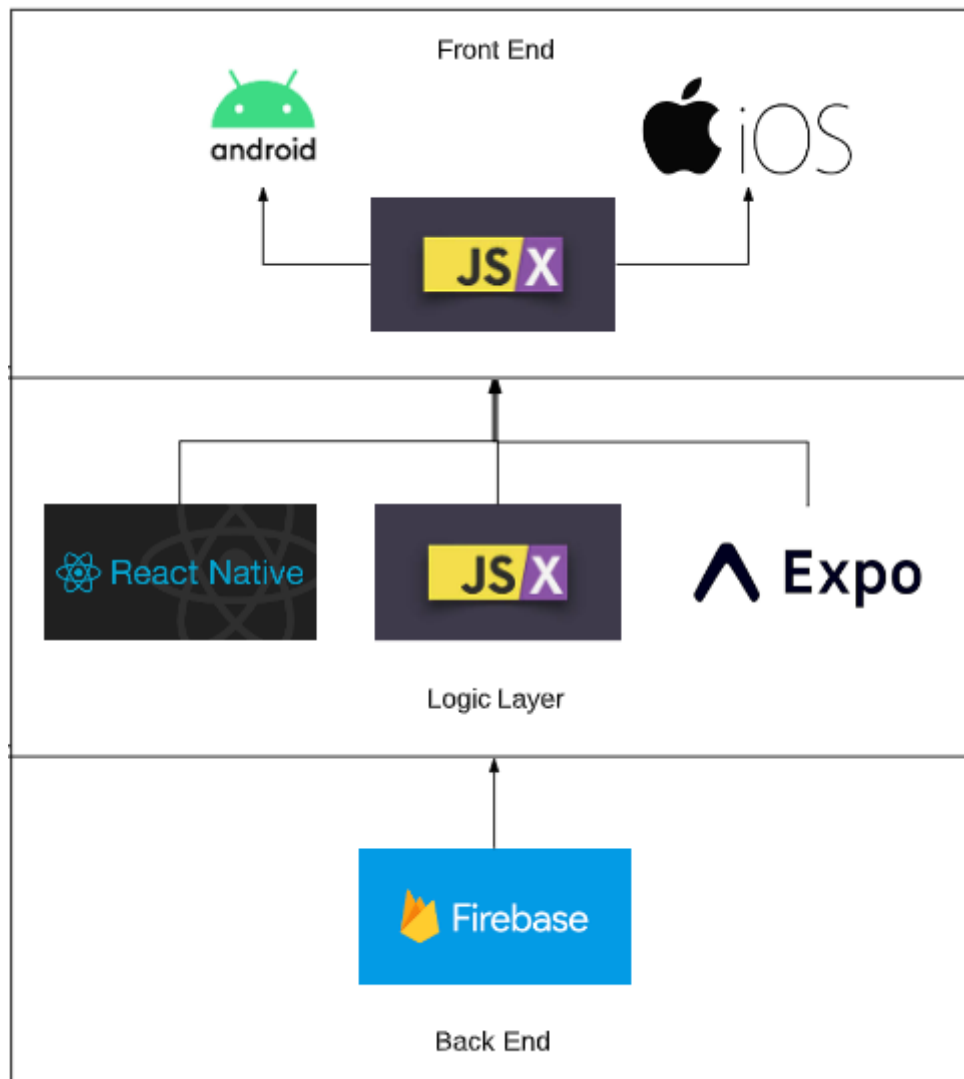
View your orders:

The orders should be available to view. The orders can be sorted by the status (Complete, in progress and cancelled) and status can be set in this section.

Set status of business:

This is a piece of functionality used to set whether the business is visible or not to users on the marketplace.

Architecture Design



The design of how my application will run is shown above. The front end showcases how JSX is used to write applications for screens and style these screens. This is because JSX is essentially JavaScript with both HTML and CSS elements.

In the logic layer, JSX will again be used to pick what information they need to allow the app to function. This will also be done using React Native code such as hooks which essentially allow us to gather information from the database in a quicker and easier way.

Firebase is used as our backend service to store the data. The logic layer will be able to pull data from the firebase and this data will be queried in the logic layer.

2.3 Implementation

2.4.1 Food Countdown Algorithm –

The below algorithm will discuss how the Food Countdown aspect of my application will work. Essentially food countdown is a feature that a business can utilise which allows for them to put a product on the app but with a price that goes down based on the time of the product. Essentially there will be 3 factors present that the business will have to specify –

Hours:

This is the amount of time that the product will be available on the market for. So if a business puts a product up at 4pm and has the hours set to 2, the product will be off the market by 6pm.

Starting Price:

This is the price that the product must start at.

Ending price:

This is the price that the product must finish at.

For example, we put up a product for €6 at 2pm and have a 2-hour timer on the product. The ending price for the product is €2. At the halfway point, so at 3pm or 1 hour into the product being on the market, the price of the product will be €4.

Below, I will go through each line of the algorithm.

Line 64: This gets the date that the product was created. This will be used to get our finished date.

Line 66: Another instance of getting the date from the firebase, this will be used as the start date so no modifications will be done to this date.

Line 68: This is getting the final time that the product will go off the market, this is done by getting the hour the product ends its time on the market and replacing the current date with this.

Line 72, 74 and 76: Converting each of the dates into minutes as to perform calculations. This will give us the current progress of how far through the time limit we are.

Line 79, 80, 81 and 84: Using the formula for progress of 2 targets, we will compute how far through the time we are. Line 81 is needed due to an issue with the last hour of food countdown. On line 84 we get our result for how far we are into the time.

$$\frac{\text{current progress}}{\text{total interval}} = \frac{\text{current} - \text{start}}{\text{total} - \text{start}}$$

Line 87 and 89: Getting the hours and minutes remaining as a human readable format

Line 92 and 96: Used for solving issues with the hours and minutes being minus figures.

Line 100, 101 and 102: Getting the price of the product. The first step is to calculate the discount rate which is the starting price minus the ending price. Then you get the new rate which is the discount rate multiplied by the hourly price (Which we calculated on line 85). The final step is to get the updated price of the product which is the starting price minus the newer discount rate.

```

63 //Getting the date from the firebase timestamp
64 var myDate = new Date(itemData.item.created * 1000);
65 //Getting the date from the firebase timestamp
66 var start = new Date(itemData.item.created * 1000);
67 //Getting the date hours and adding on the amount of hours specified
68 var finishDate = new Date(
69 | myDate.setHours(myDate.getHours() + parseInt(itemData.item.hours))
70 | );
71 //Get todays hours and minutes
72 var todayAsMin = today.getHours() * 60 + today.getMinutes();
73 //Get the end of food countdown hours and minutes
74 var endAsMin = finishDate.getHours() * 60 + finishDate.getMinutes();
75 //Get the start of food countdown hours and minutes
76 var startAsMin = start.getHours() * 60 + start.getMinutes();
77
78 //Getting current progress and total interval |
79 var Current_Start = todayAsMin - startAsMin;
80 var total_start = endAsMin - startAsMin;
81 if (total_start === 0) {
82 | total_start = total_start + 60;
83 | }
84 //Final percentage of time
85 var hourlyPrice = Current_Start / total_start;
86 //Hours remaining on food rescue
87 var hoursRemaining = finishDate.getHours() - today.getHours();
88 //Minutes remaining on food rescue
89 var minutesRemaining = finishDate.getMinutes() - today.getMinutes();
90 //Get minutes remaining - Went negative if lower than 45 so changed it to always be positive
91
92 if (minutesRemaining < 0) {
93 | minutesRemaining = 60 + minutesRemaining;
94 | hoursRemaining -= 1;
95 | }
96 if (hoursRemaining < 0) {
97 | hoursRemaining += 1;
98 | }
99 //Getting the final price of the product
100 var discount = itemData.item.usualPrice - itemData.item.newPrice;
101 var newDiscount = discount * hourlyPrice;
102 var finalPrice = itemData.item.usualPrice - newDiscount;
103

```

2.4.2 Displaying the businesses markers on the MapView

This function is used to display every marker relating to every business with the user. The purpose of this is to provide a view of a map on the main screen and have users interact with the map through every business location on the map. These will be stored as markers.

Step 1: Get the users location

```
//Getting users location
useEffect(() => {
  (async () => {
    let { status } = await Location.requestPermissionsAsync();
    if (status !== "granted") {
      setErrorMsg("Permission to access location was denied");
      return;
    }

    let location = await Location.getCurrentPositionAsync({});
    setLocation(location);
  })();
}, []);

if (location) {
  long = location.coords.longitude;
  lat = location.coords.latitude;
  [(global.longitude = long)];
  [(global.latitude = lat)];
}
```

The code above shows how the user's location was gathered. The location is read through an asynchronous call for the current location which returns an object with the users longitude and latitude. The user must give permission for this to be read. The location is then stored in a global variable to be used throughout the application. After running testing of the application, no performance issues occur because of this for users since it is only 2 variables.

Step 2: Get every businesses longitude and latitude

```
//Setting business Location state
const [businessLoc, setBusinessLoc] = useState([]);
//Connection to firebase
const dbconnection = firebase.firestore();
useEffect(() => {
  //Getting business locations
  //prettier-ignore
  dbconnection.collection('businessDetails').onSnapshot((querySnapshot) => {
    //creating array
    const businessLoc = [];
  //pushing each business location to the array
  querySnapshot.forEach((doc) => {
    businessLoc.push({
      ...doc.data(),
      key: doc.data().email,
    });
  });
  //pushing this array to an object
  setBusinessLoc(businessLoc);
});
}, []);
```

Above shows how each longitude and latitude is pulled from the firebase. First, we create an array that we will eventually store our locations inside. Then we read all of our business's locations from the firebase, these will be pushed to a new array. The key for each object will be the email used by the business. Finally this is pushed into our original array where we can use it for populating the map.

Step 3: Populating the map

```
<MapView
  style={styles.Map}
  region={{
    latitude: lat,
    longitude: long,
    latitudeDelta: 0.02,
    longitudeDelta: 0.0,
  }}
>
  <Marker
    coordinate={{ latitude: lat, longitude: long }}
    title={"You"}
    description={"Your Location"}
  >
    <MaterialCommunityIcons
      name="home-map-marker"
      size={50}
      color={Colour.primaryColour}
    />
  </Marker>

  {businessLoc.map((marker) => (
    //Mapping each location to a marker in the mapview
    <Marker
      key={marker.email}
      coordinate={{
        latitude: parseFloat(marker.latitude),
        longitude: parseFloat(marker.longitude),
      }}
      title={marker.name}
    >
      <Feather name="map-pin" size={40} color="green" />
    </Marker>
  ))}
</MapView>
```

The first step when populating the map is to set our map to be focused on our user. The variables `lat` and `long` on the 4th and 5th lines refer to our user's location. The marker is also focused on our user's location and is an icon of a "Home-map-marker" as specified in the `Icon` tag. We then populate every marker in our business using the `map` function for arrays. This allows us to map each of the business longitude, latitude, and the name of their business to a separate marker. The longitude and latitude are parsed to allow for them to showcase on the map instead of showing as a string.

2.4.3 User can buy a product –

This function describes how the system handles a user buying a product. The user can buy 2 types of products, any standard product or a food countdown product. For this showcase we will be focusing on a user buying a food countdown product only as the functions are quite similar.

Step 1: Checking if there is any products available

This is done by gathering the quantity of the product. If the quantity of the product in firebase is 0, we don't let the transaction go through.

```
if (newQuantity <= 0) {  
  props.navigation.navigate({ routeName: "Businesses" });  
  alert("This Product is sold out");  
} else if (newQuantity > 0) {
```

If the quantity is less than 0, we navigate the user back to the businesses page and alert them that the product is sold out.

Step 2: Updating quantity and adding a new entry for the receipt

This step involves getting multiple fields and adding them to the firebase.

Since there are a lot of variables, I will go over the ones that are not self-explanatory

X = A random string used for the Document ID

newQuantity = The new quantity of the product. This is updated first as this is needed asap for other users to check if a product is out of stock

Created = This is a timestamp that is used by firebase – It gives the seconds since 1/1/1970 and to use it we just use the toDate function on this variable

BusName = The name of the business the user ordered from

BusNumber = Their phone number

Status = This is used to sort and give a different colour code to both users and businesses in the receipt page.

Finally, the user can navigate to the receipt page. The only thing needed here is the document ID which is our x Variable.

```

} else if (newQuantity > 0) {
  x = randomString({ length: 30 });
  docRef.get().then(function (doc) {
    console.log(doc.id);
    if (doc.exists) {
      newQuantity = newQuantity - specifiedQuantity;
      var long;
      var lat;
      [(long = global.longitude)];
      [(lat = global.latitude)];

      console.log(long, lat);
      return docRef

      .update({
        quantity: newQuantity,
      })
      .then(function () {
        console.log("Document successfully updated!");
        dbconnection.collection("OrderDetails").doc(x).set({
          productID: productID,
          businessID: businessID,
          quantityOrdered: specifiedQuantity,
          pricePerItem: newPrice,
          userLongitude: long,
          userLatitude: lat,
          created: firebase.firestore.FieldValue.serverTimestamp(),
          busName: busName,
          busLong: busLong,
          busLat: busLat,
          busNumber: busNumber,
          productName: productName,
          productUsualPrice: productUsualPrice,
          userID: user.uid,
          Status: "In Progress",
        });
        //then navigate to receipt page
        props.navigation.navigate({
          routeName: "Receipt",
          params: {
            orderID: x,
          },
        });
      });
    }
  });
}

```

Step 3: Showcasing the receipt to the user

This step simply involves creating multiple hooks to store the firebase data into. As below we can see that to store the data inside a useState hook, we just need to write "setState(Variable name)". Once this is done, the next step is to convert our timestamp to a human readable one. This means converting it to a date and a time using built in JavaScript functions such as getDate, getMonth and get year. Once this is done we can showcase this on a page using the variables pulled from firebase and that is how a user buys a product.

```
54  dbconnection
55  .collection("OrderDetails")
56  .doc(orderID)
57  .get()
58  .then((doc) => {
59    if (doc.exists) {
60      setBusinessID(doc.data().businessID);
61      setID(doc.id);
62      setCreated(doc.data().created.toDate());
63      setPrice(parseInt(doc.data().pricePerItem));
64      setProductId(doc.data().productID);
65      setQuantity(doc.data().quantityOrdered);
66      setLong(doc.data().userLongitude);
67      setLat(doc.data().userLatitude);
68      setBusName(doc.data().busName);
69      setBusLong(doc.data().busLong);
70      setBusLat(doc.data().busLat);
71      setBusNumber(doc.data().busNumber);
72      setProductName(doc.data().productName);
73      setProductUsualPrice(parseInt(doc.data().productUsualPrice));
74      setStatus(doc.data().Status);
75    } else {
76      console.log("Nothing There");
77    }
78  })
79  .then(function () {
80    //Changing timestamp to readable time
81    var mins = created.getMinutes();
82    if (created.getMinutes() < 10) {
83      mins = "0" + created.getMinutes();
84    }
85    setFinalDate(
86      created.getDate() +
87      "/" +
88      (created.getMonth() + 1) +
89      "/" +
90      created.getFullYear()
91    );
92
93    setTime(created.getHours() + ":" + mins);
94    console.log(time);
95  });
96  }, []);
```

2.4.4 Business can add a product

Step 1: Getting user inputs

To get our user inputs, we use hooks with text input fields. As seen below for the usual price hook, we initialise the hook using the below line. This sets the original state as null and we use the `setUsualPrice` state to update our usual price. Since this is a const, we cannot directly update the variable `usualPrice` but must update `setUsualPrice` which updates `usualPrice` itself.

```
const [usualPrice, setUsualPrice] = useState(null);
```

Below shows an example of how the state is read, in a text input we use `onChangeText` as an event listener and then allow the input of that text input to be our new `usualPrice` variable.

```
<Text style={styles.text}/>Initial Price before food countdown />  
  <TextInput  
    style={styles.input}  
    keyboardType={"numeric"}  
    onChangeText={(usualPrice) => setUsualPrice(usualPrice)}  
    placeholder="4.00"  
  />
```

Step 2: Adding all the user inputs to firebase

Due to the multiple fields we have, we must add logic to these before adding these all to firebase. We do this as below, we only run the function if each input passes the input logic such as not a null field. Then we can get a random string to be used as a doc ID.

Below that, we get our image link. The response waits to fetch the URI of the local image. Once it has that, the blob is created which is the blob from the response. This is an array of bytes that the image is stored under. We then get a link to the firebase storage where we will eventually put our image and we put it there using the `productRef.put(blob)` function. After that we simply add everything to the firebase using the fields the user has filled in such as the one above.

```

onSubmit = async () => {
  //Text input logic
  if (!itemName || itemName.length < 3) {
    alert("Please Enter a valid Item Name");
    return;
  } else if (!quantity) {
    alert("Please Enter a valid Quantity");
  } else if (!usualPrice) {
    alert("Please Enter a valid original price");
  } else if (!newPrice || newPrice >= usualPrice) {
    alert("Please Enter a valid New price");
  } else if (!image) {
    alert("Please Pick an image");
  } else {
    //Setting x as a random string
    x = randomString({ length: 30 });
    console.log(x);
    //Getting the image uri
    const response = await fetch(image);
    //getting the blob from firebase
    const blob = await response.blob();
    //storage connection
    var storageRef = firebase.storage().ref();
    //pushing the link to the firebase storage
    var productRef = storageRef.child("products/" + x);
    productRef
      .put(blob)
      .then(async function () {
        //creating a new product with the details
        dbconnection
          .collection("Products")
          .doc(x)
          .set({
            itemName: itemName,
            quantity: parseInt(quantity),
            usualPrice: usualPrice,
            newPrice: newPrice,
            hours: time.itemValue,
            foodCountdown: "Yes",
            businessID: uid,
            docId: x,
            image: x,
            created: firebase.firestore.FieldValue.serverTimestamp(),
          });
      });
  }
}

```

Step 3: Update Image url in firebase

Due to the fact the image URL has not been created by the time we put the blob on firebase storage, we need to perform it after the blob has been stored. This is done by getting the google storage link from firebase. This is done by getting the google storage link to our application and appending our folder name with the name of the document the image is named as. We then update this URL in our firestore using the update function.

```
.then(() => {
  //Getting links to firebase storage
  var storage = firebase.storage();
  //getting the google cloud storage URI
  var docRef = dbconnection.collection("Products").doc(x);
  //getting the URL from that URI
  var gsReference = storage.refFromURL(
    "gs://food-rescue-34ffd.appspot.com/products/" + x
  );
  //updating the URL in the firebase
  gsReference.getDownloadURL().then((url) => {
    docRef.get().then(function (doc) {
      if (doc.exists) {
        return docRef.update({
          image: url,
        });
      }
    });
  });
})
```


2.4.5 Managing the profile

Step 1: Reading and storing the current data into the text inputs

We need to read our data from the firestore and push it into our profile screen so that the user does not have to fill in every field again. The user will be able to simply edit the field instead of rewriting it. This is done by getting the data from firebase and storing it into a hook such as the one from the previous example. The data that will be gathered is the email, name and number of the user.

```
if (user) {
  // User is signed in.

  console.log(user.uid);
  docRef
    .get()
    .then(function (doc) {
      if (doc.exists) {
        setEmail(doc.data().email);
        setFirstName(doc.data().firstName);
        setLastName(doc.data().lastName);
        setNumber(doc.data().number);
      } else {
        // doc.data() will be undefined in this case
        console.log("No such document!");
      }
    })
    .catch(function (error) {
      console.log("Error getting document:", error);
    });
} else {
  // No user is signed in.
  console.log("No User Logged In");
}
```

Step 2: Taking user input and getting password, then updating data

This step involves gathering the user password and logging in the user so that they can change their data. The reason for this is that to update the authentication section I felt that a password should be used so that any hacker that gets access to the account through something such as session fixation attack cannot change the email without the password.

```

const handleSubmit = () => {
  setConfirm(false);
  // The user has pressed the "Submit" button
  docRef.get().then(function (doc) {
    if (doc.exists) {
      Alert.alert("Worked", "Your details have been updated.");
      console.log(email, firstName, lastName, number, password);
      return docRef
        .update({
          firstName: firstName,
          lastName: lastName,
          email: email,
          number: number,
        })
        .then(function () {
          console.log("Document successfully updated!");

          firebase
            .auth()
            .signInWithEmailAndPassword(doc.data().email, password)
            .then(function (userCredential) {
              userCredential.user.updateEmail(email);
            });
        })
        .catch(function (error) {
          // The document probably doesn't exist.
          console.error("Error updating document: ", error);
        });
    }
  });
};

```

Step 3 (Optional): Delete account

Deleting an account is something that should be allowed to allow the user to get rid of personal information. This can be done at any time through the course of the application. We use an alert that has two buttons, one simply cancels the delete function and one deletes the users account. When they click the delete button, the system deletes the authentication details from firebase and then proceeds to delete the document ID linked to that user.

```
deleteProfile = () => {
  //Deleting profile
  Alert.alert(
    "Second Chance!",
    "Are you sure you would like to delete your profile? This cannot be undone!",
    [
      {
        text: "I Wont Go",
        onPress: () => {
          console.log("Not Pressed");
        },
      },
      {
        text: "GoodBye Forever",
        onPress: () => {
          user
            .delete()
            .then(function () {
              // User deleted.
              console.log("User Deleted");
              dbconnection
                .collection("userDetails")
                .doc(user.uid)
                .delete()
                .then(function () {
                  console.log("Document successfully deleted!");
                })
                .catch(function (error) {
                  console.error("Error removing document: ", error);
                });
              props.navigation.navigate({ routeName: "Login" });
            })
            .catch(function (error) {
              // An error happened.
              console.log("Error Happened", error);
            });
        },
      },
    ],
    { cancelable: false }
  );
};
```

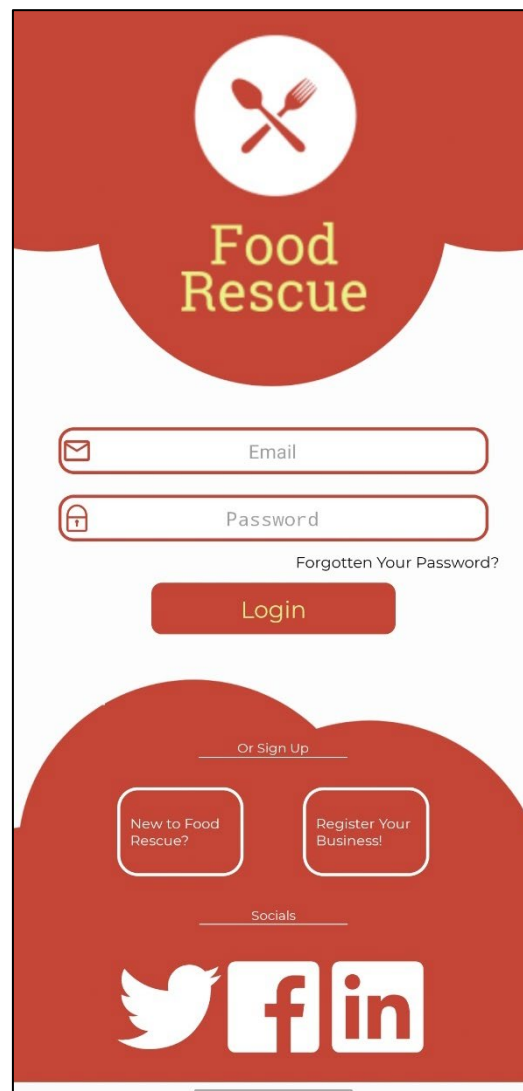
2.4 Graphical User Interface (GUI)

2.4.1 Login Screen

The login screen is the opening screen that appears when a user enters the app. The two user inputs for email and password are shown. The forgotten password link is shown below these and is used to change the password. Once the two inputs are filled in the user can login through the login button.

If the user needs to register, they can choose to register as a user or a business using one of the two buttons.

Links to all socials are below this.



2.4.2 Register Screen

The register screen appears when the register button is clicked. The register page takes in user inputs such as –

First Name

Last Name

Email

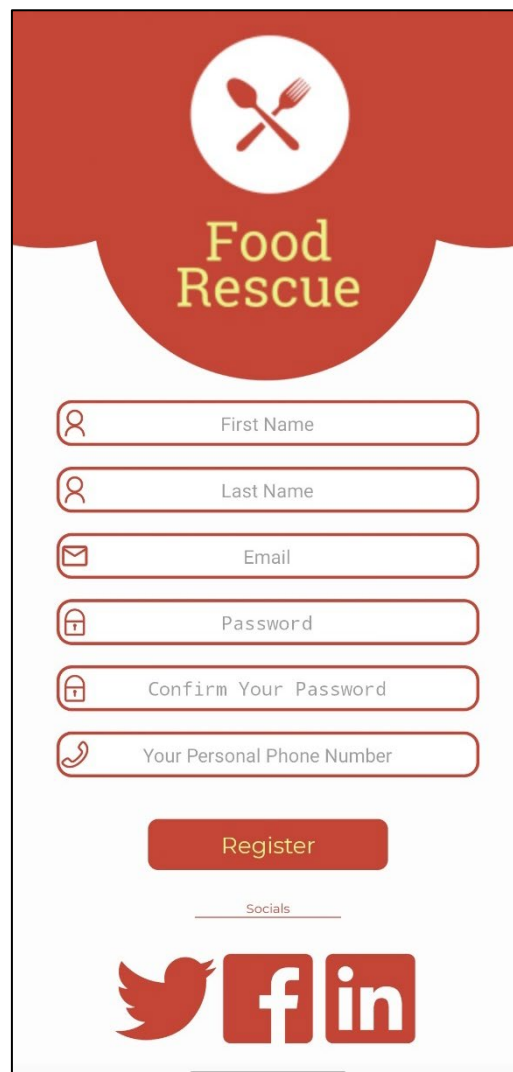
Password

Phone Number

Once the fields are filled, the register button is used to register.

The socials are linked below the register button.

The business register is fairly similar to this so there is no need to showcase this.



Food Rescue

First Name

Last Name

Email

Password

Confirm Your Password

Your Personal Phone Number

Register

Socials

Twitter Facebook LinkedIn

2.4.3 Main Screen

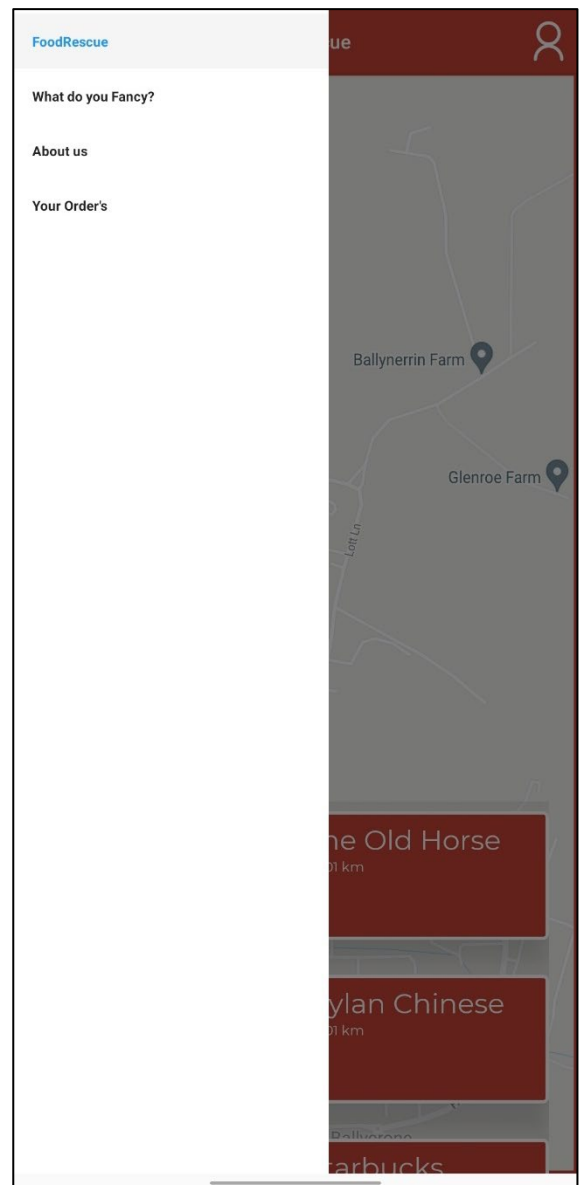
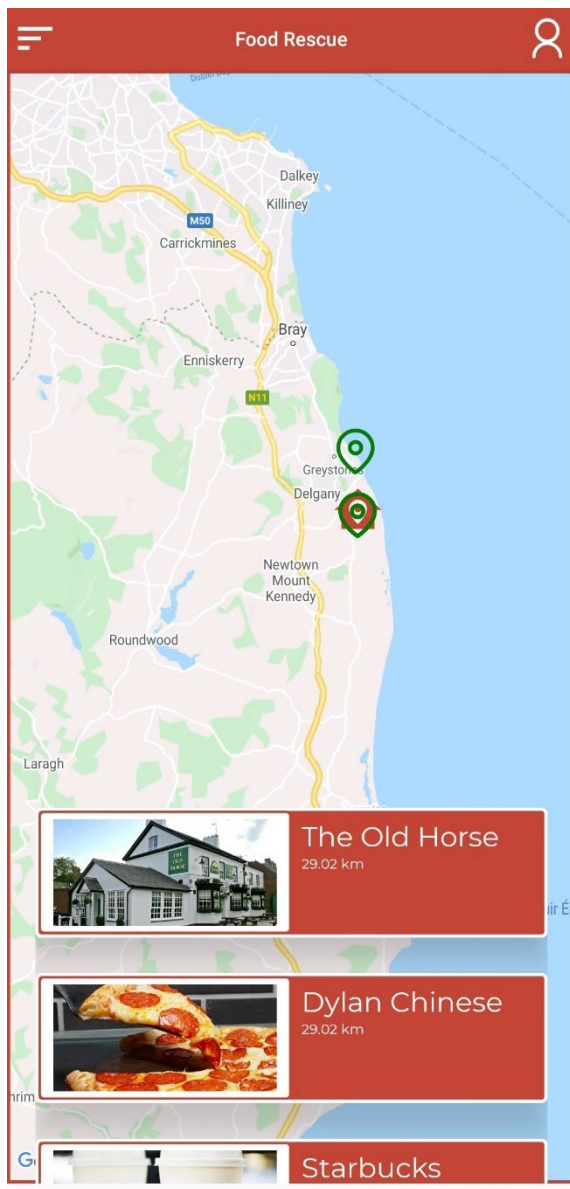
This is the main screen that appears once a user logs into the application. As we can see, there is a mapview with the various businesses that are available to the user. The only businesses that appear here are the ones that have their business status set to TRUE. The distance from each of these areas is here aswell. The user can scroll the map and when they click on one of the markers which will give the name of the business. In the top left screen, we have a button which brings up a stack navigator. This gives us the option to:

Sort our products

View an about us screen for help with the project

View your orders

In the top right, there is a link to the manage profile page.



2.4.4 Manage Profile page

The manage profile page consists of multiple inputs that the user can edit. The inputs are populated from the database (As discussed in 2.3.5) and the user can edit them as they please. Once the edited fields are to be submitted, the user will click the submit button. Once the submit button is clicked, an alert box will appear with an option to enter the user's password. If this is correct, the users' details will be updated both on the firestore and the authentication section of firebase.

Below the submit button, there are buttons for both logging out of the users account and deleting the users' account.

The screenshot shows the 'Edit Your Profile' page with a red header bar containing a back arrow and the title 'Edit Your Profile'. The page has a light gray background. It features four text input fields with red borders, each with a label above it: 'First Name:' (Dylan), 'Last Name:' (Murphy), 'Your Phone Number:' (0830373003), and 'Email:' (Hhhh@gmail.com). Below the fields is a red 'Submit' button, a white 'Log Out' button with a circular arrow icon, and a red 'Delete Account' link at the bottom.

This screenshot shows the same 'Edit Your Profile' page as the previous one, but with a white modal dialog box overlaid. The dialog is titled 'Enter Password' and contains the text 'To update information, Please enter your password.' followed by a red input field. At the bottom right of the dialog are two buttons: 'CANCEL' and 'SUBMIT'. The background of the page is dimmed to gray.

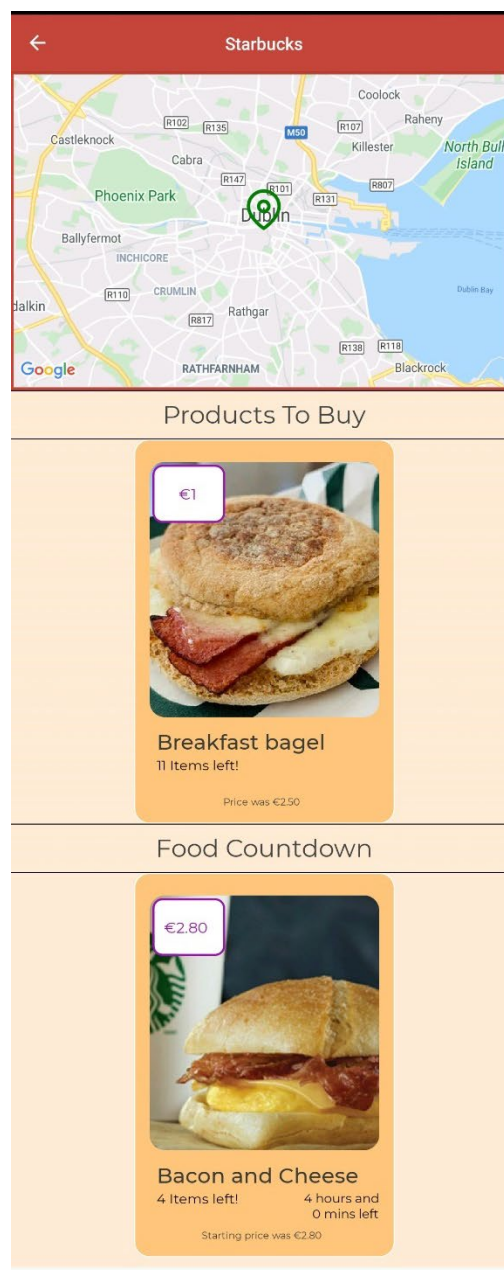
2.4.5 Business Items Screen

This screen showcases the items that the business selected has. There are 3 sections to this page:

Map: The map shows markers for both the business and the user. This allows the user to see how far away the business they are ordering from is.

Products to buy: This section showcases the normal products that the business has available. This means products that have a static price and no time limit.

Food Countdown: This section showcases the food countdown products. This shows the amount of hours and minutes left on the item, the current price of the product and the starting price of the product.



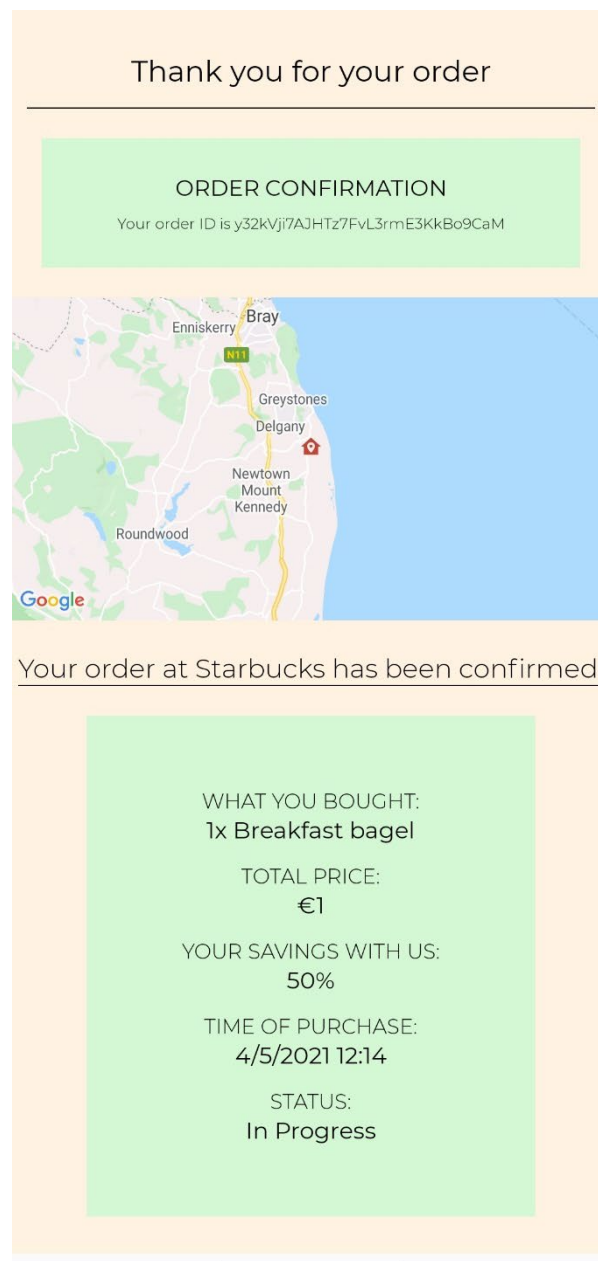
2.4.6 Item Detail Screen

The item detail screen is where the user would buy a product. Below is a food countdown product which shows the name of the product, the current price of the product and how much the user will save relative to the starting price. The user can then view a picture of the product and adjust the quantity.



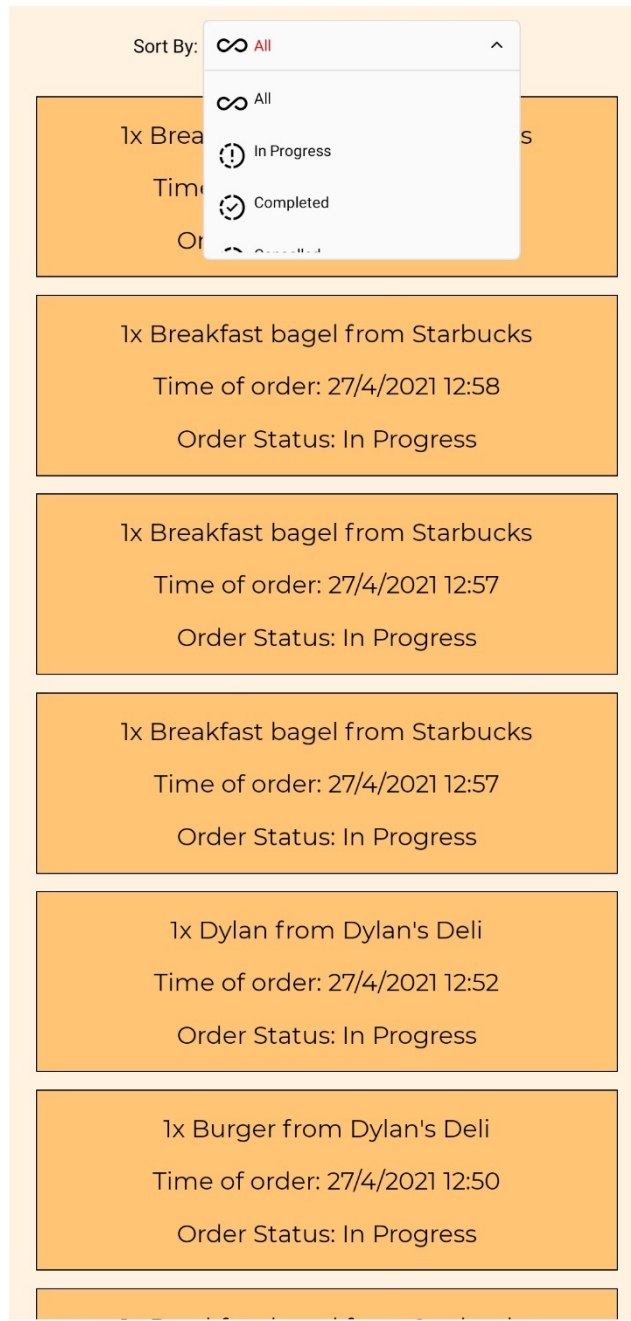
2.4.7 Receipt page

The receipt page showcases information about the order. There is an order ID that the user can use if they have to get in contact with the business. Details surrounding the order are showcased below with the quantity of the product, the product name, the total price, how much you saved relative to the original price and the time of purchase. It also showcases the status of the order which can be changed on the business receipt page.



1.4.8 Order Page

The order page for the business and the user is used to view the orders that the user has made. The user can sort through their orders to see the status of these orders whether they are in progress, complete and cancelled.



2.4.9 Business Home page

The business home page is the page given to the business once they login. It consists of 5 different sections:

Activate Site button: This button will activate or deactivate the businesses status as to whether or not they are accepting orders

Add a product: This section allows the business to add Normal products or Food Countdown products

View your current products: This gives an overview of the businesses current products

View your orders: This is similar to the user orders page and gives a list of the orders for the business. I will not be showcasing this due to its similarity with the user orders.

Manage your profile: This is similar to the user manage profile. I will not be showcasing this due to its similarity with the user manage profile page.



2.4.10 Add a product

The add a product page allows a business to add a product to the market. There are 2 options for the business:

Normal Product: This is any normal product that you would see on a food app such as just eat or Karma. The reason I included a normal product section is that it may suit a business more than something with a price that lowers such as food countdown.

Food Countdown: A food countdown product is one that lowers with time. The more time that goes by, the lower it goes. I feel that an app that focuses on Food waste should have a feature such as food countdown as this fully allows the product to sell. The closer the food gets to being food waste, the lower the price should go. This lets products go down in price if they aren't selling immediately for the higher price the business may set.

← Add your product

Normal Product Food Countdown

Product Name
Chocolate Chip Cookie

Quantity Available
5

Initial Price before Food Countdown
4.00

Ending Price
2.00

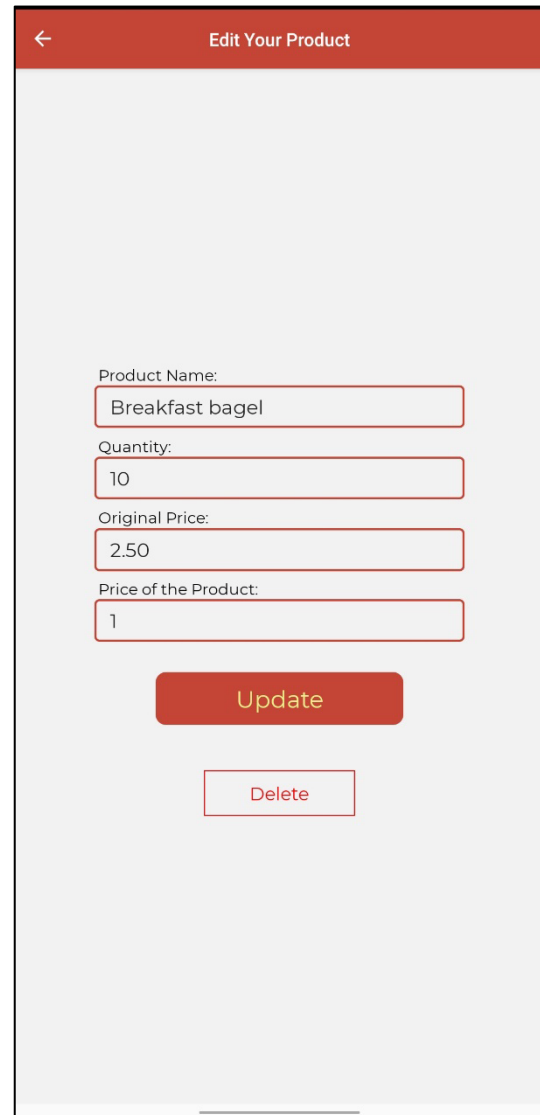
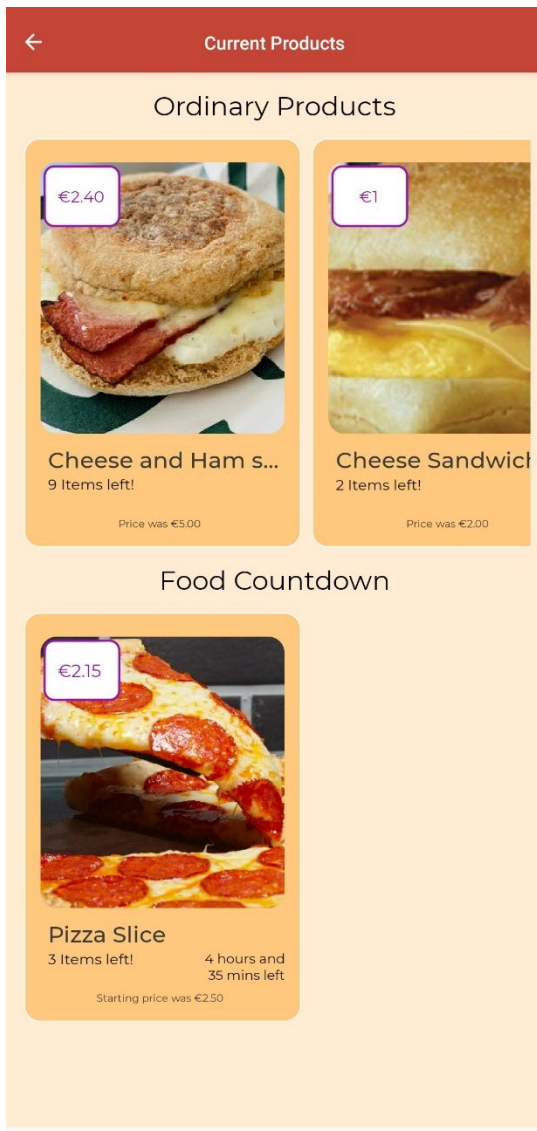
Time Available
1 Hour

Pick an image

Submit

2.4.11 Businesses Current products

This page showcases businesses products that they have for sale. As below, it is split into ordinary products and food countdown products. These products can be edited and deleted so that the business has full control over every product.



2.5 Testing

Describe any testing tools, test plans and test specifications used in the project. Provide evidence for and results of all Unit, Integration and End User testing that is carried out.

2.5.1 Unit testing

For my application, I used Jest to unit test each of my screens to ensure that they can render without depending on the native environment. Jest testing is used for ensuring that sudden changes do not happen in my UI. This is done by taking a snapshot of the page and converting this to JSON. This then compares it to the original page to find any issues relating to the UI changing.

Example of a Jest Test:

```
1  /*
2  *
3  * className: // __tests__/UserOrders.test.js
4  *
5  *
6  * Date: 28/04/2021
7  *
8  *
9  * @author: Dylan Murphy, X17506166
10 *
11 * @reference : https://docs.expo.io/guides/testing-with-jest/
12 * @reference : https://medium.com/react-native-training/learning-to-test-react-native-with-jest-part-1-f782c4e30101
13 *
14 */
15 import React from "react";
16 import UserOrders from "../Screens/UserOrders";
17 import renderer from "react-test-renderer";
18 import { firebaseConfig } from "../config";
19 import * as firebase from "firebase";
20
21 jest.mock("react-navigation", () => ({
22   NavigationEvents: "mockNavigationEvents",
23 }));
24
25 firebase.initializeApp(firebaseConfig);
26 test("renders correctly", () => {
27   const tree = renderer.create(<UserOrders />).toJSON();
28   expect(tree).toMatchSnapshot();
29 });
30
```

An example of a jest test is seen above. Line 15:19 imports all the essential modules that I need for testing. These consist of React, The screen I will use, the React test renderer and Firebase with the config to initialize firebase.

Line 21:23 is for mocking react navigation. This means that any function that has anything to do with react navigation will have the implementation of that function erased and the links between the code can be tested.

Line 25 Initializing Firebase to ensure that we can run any functions related to firebase.

Line 26:29 To ensure that the test renders correctly, we create a tree of the screen and parse it to JSON. We then compare it to the Snapshot and if this passes, the component passes our unit test.

Running every page through testing:

The next step of course is to run each of my pages through testing. Initially I was running into some problems as seen below. 5 of my modules had failed testing.

```
Test Suites: 5 failed, 17 passed, 22 total
Tests:      5 failed, 17 passed, 22 total
Snapshots:  4 failed, 17 passed, 21 total
Time:       11.668s
Ran all test suites.
npm ERR! Test failed.  See above for more details.
```

The common issue that I was having was that my params were being set as undefined as Jest didn't know how to deal with them. To fix this, I made changes to my code to ensure that if the Params were undefined, we would catch an error.

```
FAIL  __test__/Receipt.test.js (5.928s)
  ● renders correctly

  TypeError: Cannot read property 'getParam' of undefined

   27 |   const Receipt = (props) => {
   28 |     //Getting order param
>  29 |     var orderID = props.navigation.getParam("orderID");
      |                                     ^
   30 |     //User and firebase details
   31 |     var user = firebase.auth().currentUser;
   32 |     const dbconnection = firebase.firestore();
```

An example is seen below, with a try catch statement in place the error resolves and the tests now pass.

```
try {
  title = props.navigation.getParam("Title");
  quantity = props.navigation.getParam("quantity");
  initialPrice = props.navigation.getParam("initialPrice");
  price = props.navigation.getParam("price");
} catch (error) {
  console.log(error);
}
```

As seen below, every test writes a new snapshot, and every screen passes this testing. This ensures that there is no sporadic changes in the UI when running the application.

```
Snapshot Summary
> 22 snapshots written from 22 test suites.

Test Suites: 22 passed, 22 total
Tests:      22 passed, 22 total
Snapshots:  22 written, 22 total
Time:       8.278s
Ran all test suites.
```


2.5.2 User Testing

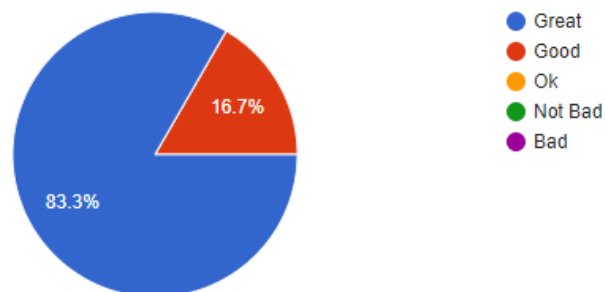
User testing lets users test the usability of the application while also spotting UI bugs or giving recommendations on how the app can perform better. The reason I performed user testing was to give me a better oversight into any usability issues, any performance issues or any bugs that a user may encounter when using my application. The user would use my application from both a business and user perspective. This took the user an estimated 5 – 10 minutes.

2.5.2.1 Overall Experience

The overall experience that a user has with my application is something that I wanted to keep on a high level for my application. I asked various questions about how they felt the app performed, bugs, styling etc. which will link to how the user who performed the testing felt about the application.

What was your overall experience with the "Food Rescue" App

6 responses



As seen above, the application performed quite well in relation to the overall experience that users experienced.

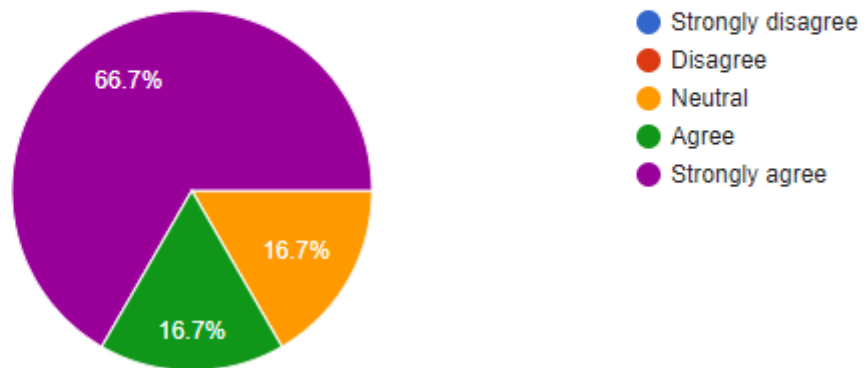
2.5.2.2 Performance Issues

The performance of the application is something that needs to be addressed when we consider deploying an application out to multiple devices that have different specifications. I asked the users questions based on whether the application performed well and if the users had any issues when it came to the performance of the application.

As seen below, there were mostly good reviews but one neutral review that ran into an issue with the receipt page. The issue they encountered was that when they loaded the receipt page, they encountered an issue with the price not loading. This may be related to the performance of the reads from Firebase. After trying to recreate this issue, I noticed that if you ordered a product too quickly when heading into the item detail screen that an error occurred on the receipt page that caused the price to appear as NaN. The reason for this is that the firebase order was getting read before it had been created. To fix this, I changed the variable to not read the firebase as soon as the page had ran but before the read for the firebase had run.

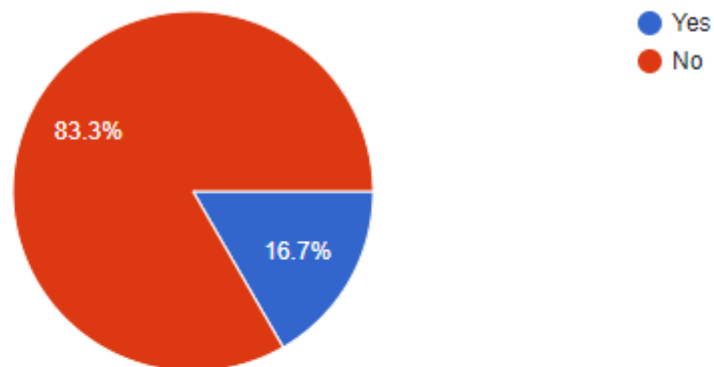
The app provided a fluid experience and there was no performance hiccups

6 responses



Did you have any performance issues with the application?

6 responses



If yes, what happened?

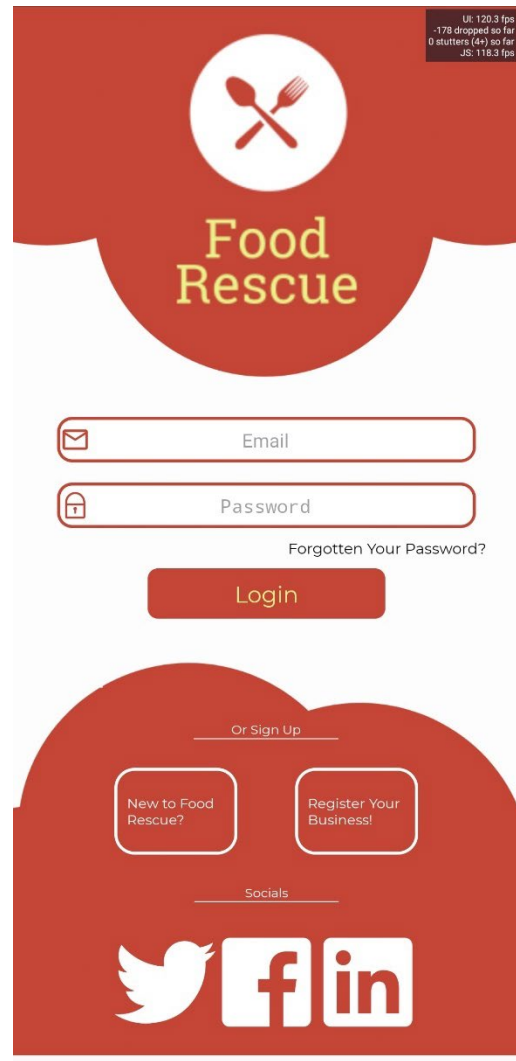
2 responses

N/A

Receipt page and price not loading

As per my requirements, I also need to find the FPS of standard pages and pages that have a lot of content. The device I will be using is a 2020 OnePlus 8 Pro with 120hz, therefore I expect standard pages to get 120 FPS and pages with content such as maps to get 60 FPS+ as map view may not be subject to 120 FPS. At least

30 - 60 FPS is needed throughout the application to have a good experience. To test for the FPS, I will be using Expo's performance monitor.



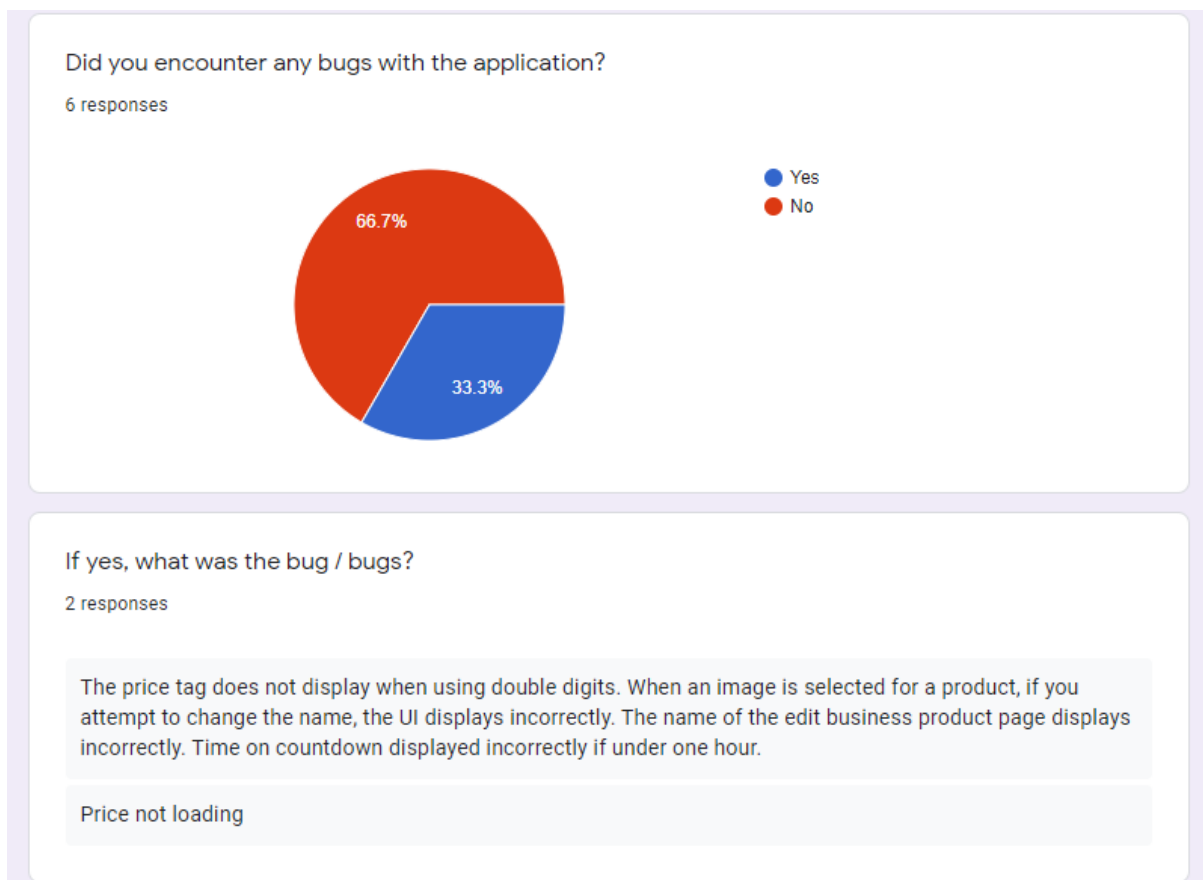
UI: 60.1 fps
 -563 dropped so far
 0 stutters (4+) so far
 JS: 56.0 fps

UI: 120.3 fps
 -178 dropped so far
 0 stutters (4+) so far
 JS: 118.3 fps

As we can see from the images below, basic UI for the login page has an FPS of around 120 whereas any page with a map has an FPS of around 56 to 60. This is due to the map page not supporting 120 FPS so the page sticks to at most 60 FPS. This is about where we want our FPS to maintain to provide a great user experience. Even if the FPS dropper by ½ the application would still be usable with an OK user experience.

2.5.2.3 Bug Fixes

The next issues that I wanted to resolve were any issues with the application itself. I asked the users if they had encountered any bugs and what these bugs were so that I could replicate them for myself.



Above we can see the bugs that were found when users tested the application. The first user found quite a few bugs so I will go through each of these and if I managed to fix them:

Price tag does not display when using double digits – This was a matter of the font being too big for a circular view. To fix this, I made the view larger to accept a larger price.

When an image is selected, if you attempt to change the name, the UI displays incorrectly – This issue was easily solved by not allowing the keyboard to change the height of the view. To do this, I got the height of the phones screen and set that to the definite height instead of 100% of the phone screen as the keyboard had caused issues.

The name of the edit business product page displays incorrectly: When a business would try and edit a product, the parameter was non existent, and the name of the page kept appearing as “EditProduct”. Unfortunately, I was unable to fix this to make it the name of the product and had to settle with naming it “Edit your product”.

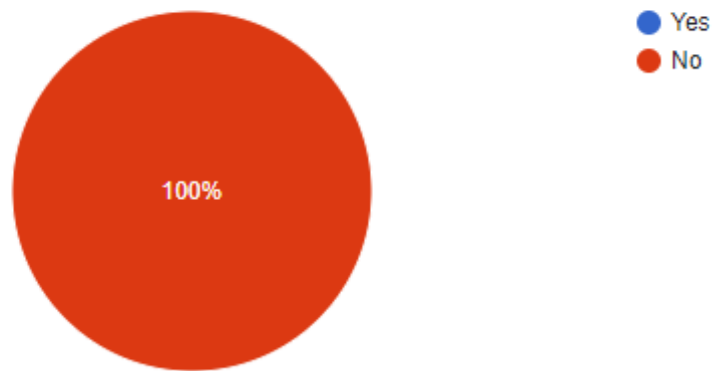
Time on countdown displayed incorrectly if under one hour: After testing this, I found that if you put up a product for 1 hour, it appeared as – 1hour: 59 minutes. To tackle this, I added when the hour is below 0, change the hour count to 0.

2.5.2.4 Styling

I also wanted to see if any pages looked weird or any issues occurred with different devices. I asked the users who tested the app if they had seen any issues relating to the application's styling.

Did you notice any pages that could have looked better?

6 responses



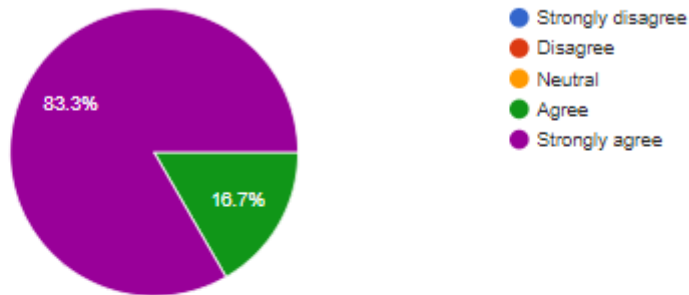
As we can see above, no users had any issues with any of the styling of the application. There was nothing to report based on the users within the issues of the apps styling.

2.5.2.5 Specific Functionality

The final thing I wanted to ask users about is the specific functionality relating to navigating the application and ordering items. Ordering items is the main functionality of the app so any issues relating to ordering items would be a huge flaw with the application. Navigating through the different pages is a crucial functionality in any app and any issue with this would cause the app to be useless to the user.

You could easily order an item using the application

6 responses



You could easily navigate the application and the pages

6 responses



As seen above, ordering an item was quite easy for most users with most of the results being strongly agree and a single result being an agree. For the navigation, every user strongly agreed that the navigation through pages was easy. Overall, this was one of the most important set of results as any issues with these functions would cause my app to be extremely flawed.

2.6 Evaluation

2.6.1 Performance

To test for performance, I will be using 5 machines that are of different specs to run performance analysis on. The application that I will be using for this is Robo Testing by Firebase. Robo testing allows for your application to run on multiple devices and will give you a pass or a fail if the app can run on that application.

The reason that I wanted to perform additional performance testing (Original was through user testing) was that I wanted to check older android devices as most of the testing may have been done on iPhones. To do this, I used a range of phones and tablets ranging from 2012 and 2017.

The 5 devices I will be using are –

Nexus 10 – 2012 (Tablet)

HTC 10 – 2016

Pixel 2 – 2017

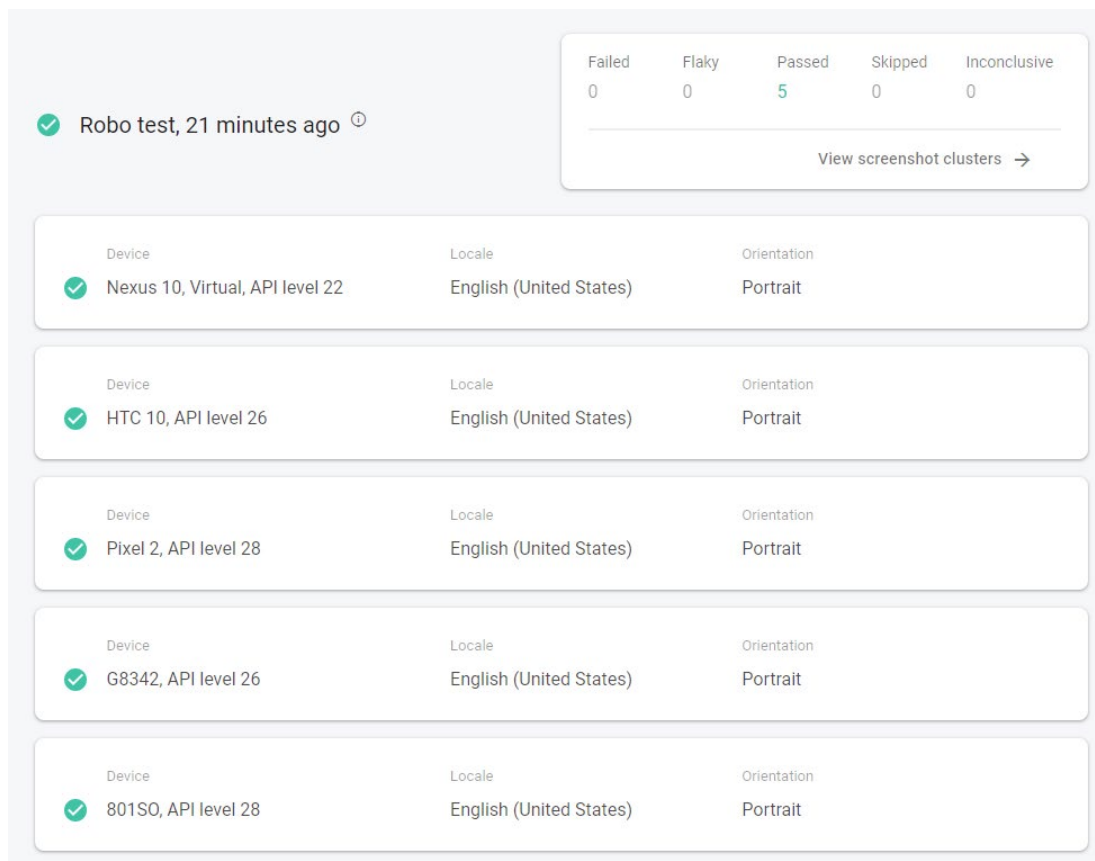
Xperia XZ1 – 2017 (G8342 Model)

Sony Xperia XZ3 – 2018 (801SO Model)

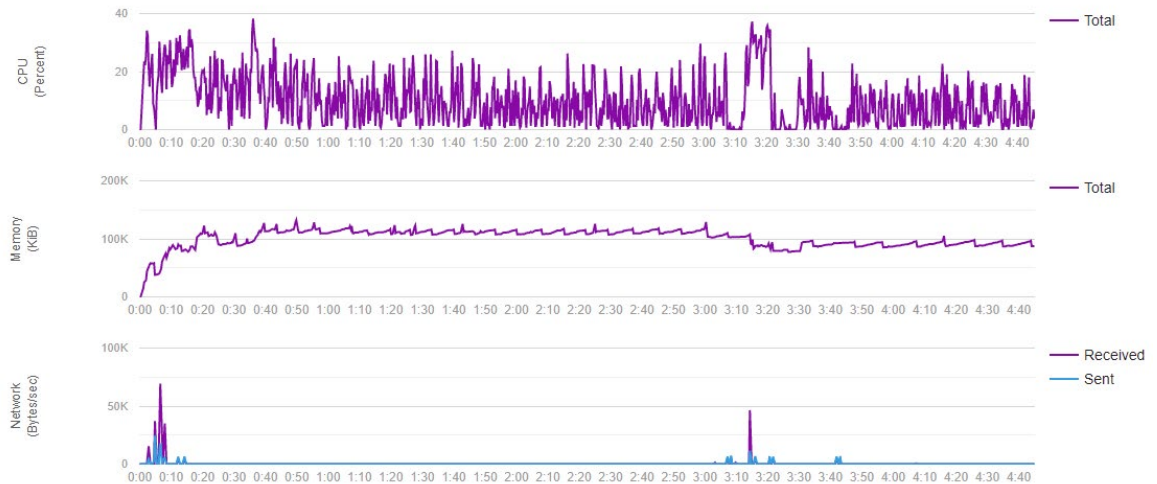
I tried to use a large range of devices ranging from an older device to newer devices. I also used a tablet to showcase that my application can run without an issue on Tablets.

Results:

As we can see below, each 5 of the tests has passed the Robo test. This means that on each of the applications the app has opened, run and googles AI has simulated user activities, all while looking for any performance related issues and documenting performance of the application while running.



Robo test also gives CPU and Memory metrics that can help with understanding how much usage the application takes up. Below are the metrics which tell us more about the performance of the application.



CPU Usage: The CPU usage is how much of a percentage the application uses of the device’s CPU. The app uses at most 40% of the device’s CPU. This is quite normal for an application such as mine using React Native to have CPU usage around the 40% mark. React Native mostly uses the GPU over the CPU to increase the performance of the application, so this should be no problem for most older devices and every newer device.

Memory: The memory usage of the application is on average 100KB. This is quite low in relation to newer devices where the average RAM is 4-6GB. On older devices such as the Nexus 10 tablet from 2012, the RAM is 2GB meaning that our App should run fine on a device such as the Nexus 10.

Finally, Robo Test also gives us some metrics regarding aggregate frame stats from the run of the project. As seen below, we have figures for time to display, Missed VSync, input latency, slow draw commands and bitmap uploads.

App start time	Graphics stats				
Time to initial display	Missed VSync	High input latency	Slow UI thread	Slow draw commands	Slow bitmap uploads
631ms	0%	27%	1%	0%	0%

Time to initial display: This is the time it takes to start the application and then get to the login screen. This is around .6 seconds. This is quite a good speed for the application and will allow the user to log into the app quite quick.

Missed VSync: This is the percentage of missed frames that occur in the UI thread. With this being 0%, there are no missed frames in the UI thread meaning a stable performance for the user.

High Input Latency: The delay between the transfer of data following its instruction to transfer. 27% is average for an application and there should be no big issues with users with this delay.

Slow UI Thread: 1% for the UI thread is good to receive and falls hand in hand with her result about the time to display causing it to be quite quick.

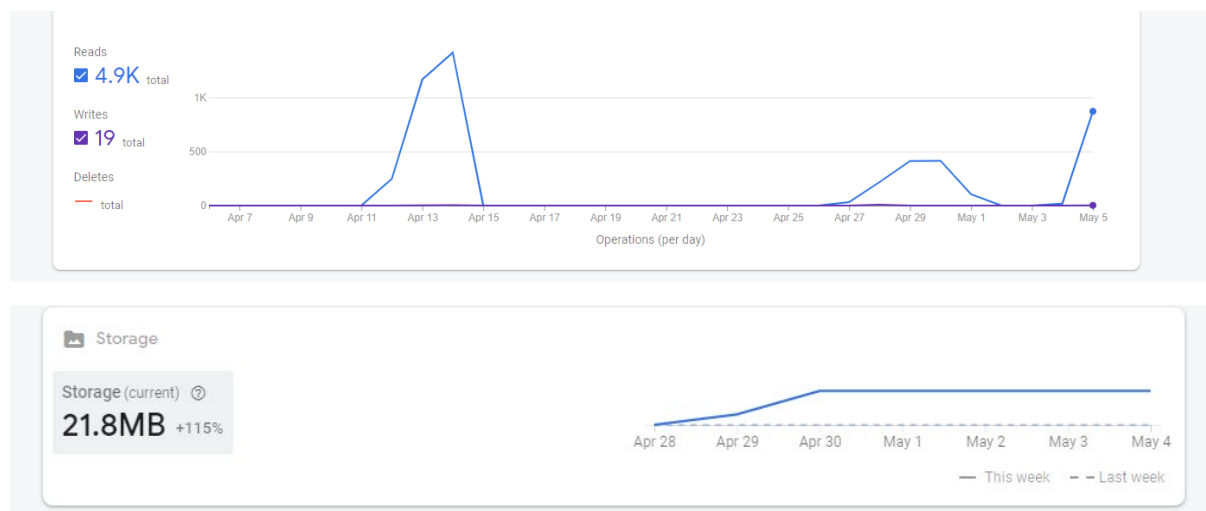
Slow draw commands and slow bitmap uploads are 0% meaning that they do not affect the applications performance in any way.

2.6.2 Scalability

Scalability of the application is something to be considered when starting your application. Part of the reason I chose Firebase for the backend of my application is how scalable it is. Firebase allows you to upgrade the amount of storage, read, writes, authentication accounts etc. based on the needs of the business as a pay as you go option. This allows the application to be fully scalable and to grow as the users grow.

2.6.3 App usage

Firebase gives an overview of the app's user usage data, the reads and writes to the Firestore and the amount of MB used in Firebase Storage. The usage data was collected after the usability testing of my application.



The usage data of my application is quite high with the reads from Firestore being almost 5000. This is due to the amount of data being stored, some bugs I encountered where reads would go through the roof and the user testing that occurred. The writes seem very low so Firebase must not be calculating every write. Each user test would consist of between 5 – 10 writes so Firebase is not fully gathering every write.

Firebase storage consists of all images that exist in the application, each product and each business must have their own image so this means as the app grows, this figure will grow.

3.0 Conclusions

3.1 Advantages

The big advantage that Food Rescue has is its ability to help with food waste. Food waste is a big issue in the world and if food waste was a country, it would be the 3rd largest emitter of greenhouse gases (Frightening Facts on Food Waste, 2021). Food Rescue aims to help with this by providing a clear solution to waste in restaurants, cafés etc. Caring for the environment should be the first thought when it comes to deciding where you buy your products from.

Another advantage is the money saving aspect that Food Rescue has not only for the consumer, but also the business who decides to sell on the app. Businesses can list up products that will go to waste and sell these instead of throwing them away. This saves money that would be spent on dealing with food waste while making money with food that was destined to be waste. For a consumer, they get a good deal on food that is from the restaurant while also knowing they are contributing to saving the environment.

A big advantage of food rescue is the Food Countdown function. The reason that this is an advantage is that this allows a product to go down in price over the day, as it gets closer to going to waste. Competitors in the industry such as Karma have a static selling mechanism such as one you would find at Just Eat. Why I feel this is a let-down is that businesses can take advantage of this, setting the usual price to higher than usual and setting the discounted price at close to the usual price. Food countdown will give businesses a clear indication at whether their price is too high because no one will buy it and will wait for the price to go down. This makes much more sense when we think about how food turns into waste, with the amount of time it sits around for.

3.2 Disadvantages

A disadvantage of my application is that its lack of support for a web application. While react native supports web applications, most of the functionality does not support web applications. This means that navigation, map views, markers etc. do not work on the web. This is an issue as the app cannot be run on laptops or PCs without an emulator. This may be a problem for the older generation as some of these may not have access to smart phones and instead use a PC, meaning they cannot use my app.

Expo being a fairly new technology can lead to some issues with the application. An example is that when testing out the app, the app can sometimes refresh randomly. This is a known issue with the expo refresh feature and can cause issues with the application. Another problem with expo is that there is a lack of testing materials out there. For a managed app such as my one, there is no end-to-end testing available. To do these tests, I would have to eject my app which can cause many time-consuming issues. Therefore, I had to not perform these testing techniques because of this issue with expo.

Due to the food countdown feature being innovative and not really normalised (I.e a changing price based off time is not normalised), users may find it difficult to understand how it works. I have a page in the application that describes how this works but unfortunately, this may not be enough for older generations of people.

3.3 Strengths

The application has the ability to be commercially viable through multiple ways such as:

- Charging Businesses who sign up and place a product
- Adding a service fee on top of the sale to a user
- Advertising different businesses on the app

This is important when making an application to think about as if there is no money-making aspect to the application, the app will not survive an influx of users, server costs, hiring employees etc.

Another strength of my application is its ability to be used on almost every mobile device whether it is Android or IOS. This is due to React Native utilising the GPU of a device instead of the CPU to allow for better performance. As per the Robo Testing and user testing, we can safely say that the application runs great on all devices ranging from 2012 – 2017 phones and can run on tablets.

3.4 Limitations

A limitation of my app is its ability to accept payments. Currently this is not a feature that is possible right now and users must pay inside the restaurant

Another limitation of my application is that it is a collection only service right now. There is no options for delivery of food. This may discourage users from using the apps in times like these due to social distancing and moving to a WFH environment becoming more apparent.

There are a lot of competitors in the food market with huge companies such as Just Eat, Deliveroo and Uber eats. The advantages my app has must be sure to win over big companies like this as it is quite hard to pull people away from these staples in the food industry.

4.0 Further Development or Research

4.1 Paying with card

A feature that I would like to implement in the future would be a way to pay for products through a debit or credit card. This would allow for a much more seamless experience for the user where they could pay and collect their food instead of going into the shop and paying.

4.2 Delivery

A delivery system is something that is extremely essential for a food application. With lockdown and social distancing, most of the food sold would be sold through deliveries so this is a disadvantage that my application does not support this.

4.3 Web Application

When developing with expo, a limitation it has is that it is not supported as a web application. This is due to certain features being unavailable on the web that are available on mobile devices. Creating a web application for this project is something that could be done to further develop my application.

5.0 References

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6.0 Appendices

6.1 Project Proposal



National College of Ireland

Project Proposal

Food Rescue

05/10/2020

Business Information Systems

2020/2021

Dylan Murphy

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1.0 OBJECTIVES

Food Rescue is an application that is made around food waste. The goal of this application is to reduce the amount of food waste a café, restaurant, a coffee shop etc. would go on to produce. The other benefits are that it helps the business to make more money that they would've made for throwing it out, reducing the price of the food for the consumer and overall helping the environment.

There are some applications abroad which are similar to my idea. Why I feel my app is different is that the applications abroad such as Karma, have poor policies in place that allows the company's selling food to sell their "food waste" at any time of the day even when they open. They use the app to sell more and not to sell food that could become waste at the end of the day. I plan to differentiate that to my application by only allowing food to be sold in the latter hours.

The objectives for this project are to create an react native application using expo CLI to create and android/IOS application with the following features-

- Login/Registration
- Navigation
- Filter System
- Map View
- Sort By - Location
- Different UI's for Shops and customers.

As I delve into making the app, I may add or change aspects of the app that can affect the above list. If at the end of this project, I had achieved the list above, I would be satisfied with my application.

I would also like to add a feature that differentiates my app from other apps.

A feature I am looking to implement is an idea called "Countdown" Once an item of food is placed onto the "Market", the price of the food starts higher than usual, but towards the end of the day/ a cafes closing time, this item slowly goes down in price. Overtime, this price would go into a very low price and is likely to be snatched up by competitive customers. This could be good for products such as scones, pizza slices etc that could go off towards the end of the day.

2.0 BACKGROUND

I thought of Food Rescue when I was doing research for my Business Intelligence and Data Warehousing II module. I was researching datasets to implement into my project and came across a waste dataset. While it was not a good dataset, it did make me look more into food waste and to think about creating an application around it.

INITIAL IDEA -

My first idea was implementing the HSE Covid Tracker in a nice UI to allow a business to incorporate that into their system and using the Covid Trackers built in COVID 19 Symptoms checker, the business could use that as a way to allow people in instead of creating their own system. While I liked this idea, it would have been difficult to implement and hard to make a good business out of it since businesses have already created systems to allow employees into their premises.

WASTE EXPERIENCE —

In 2018/2019 I was a customer assistant in a local Tesco. When it came to the end of the day, foods were thrown away on their best before date. This led to piles of food waste building up every day and being thrown to waste. Every day, roughly 1 full black bag of food was wasted. This was a smaller Tesco too, so I could only imagine the amount of waste being thrown away.

The reason I am bringing up my background in Tesco, is that this heavily motivates me when it comes to limiting food waste. While I won't be targeting retail shops, but instead cafés, my experience in dealing with how much waste was produced in Tesco, pushes me to try solving a big problem with the current structure of restaurants.

TECHNOLOGY —

When I was looking for technologies to create the app, I was originally planning on creating a java application in Android Studios. When doing research for the related to android studios, I quickly backtracked on this as I know more about making web-based applications. I was studying different tutorials for making web-based applications, but I was still disappointed as I wanted to create an application for an Android. I was torn between android studios and a web-based application. When I was researching react for a web-based application, I came across Ionic Framework. This led me to looking into hybrid web-apps and led me to react native and expo cli. This is currently what I want to use for creating my application.

3.0 TECHNICAL APPROACH

My approach to starting this project is to firstly draw out basic wireframes of each individual page. I will have different pages via the different roles - Customer and Café/Restaurant. The reason for this is that I plan on making different pages available for different users to help with access control and security.

I will be using balsamiq wireframes to create the wireframes,

I also plan on creating some use cases to show how a user's goal would be achieved within the system.

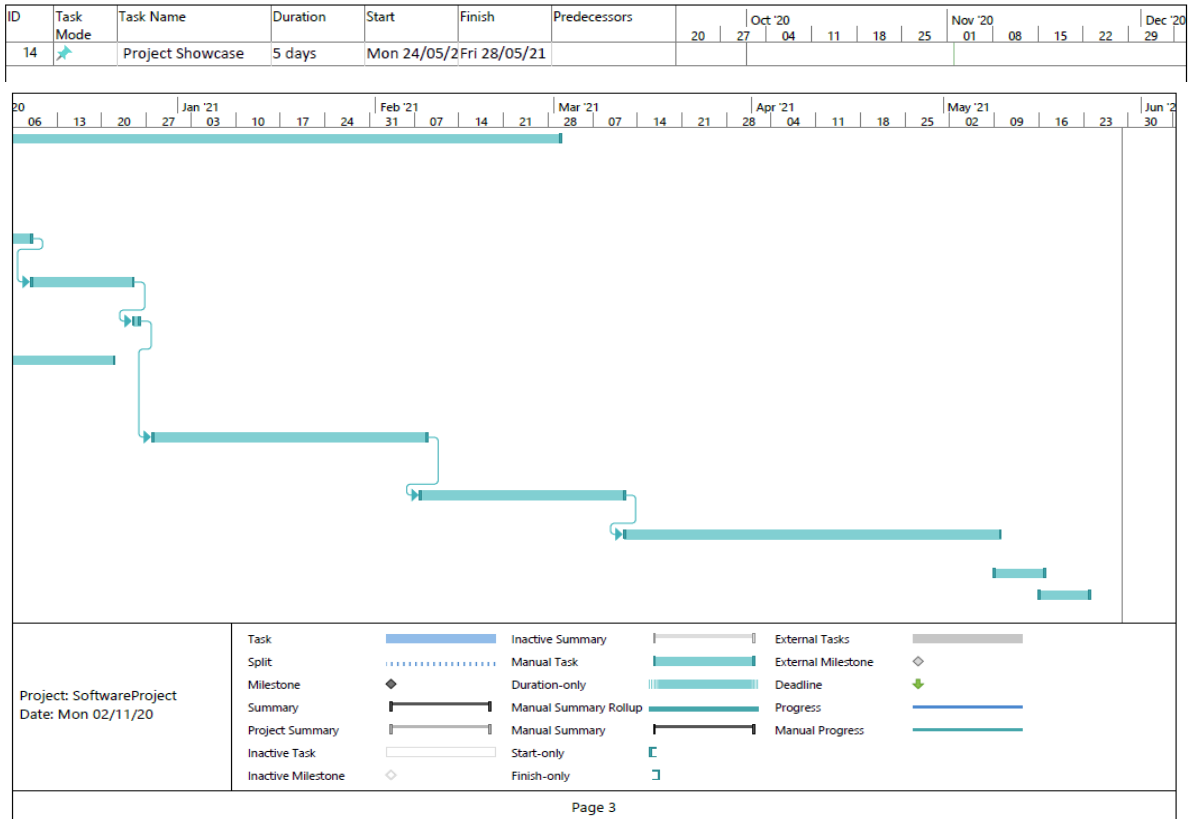
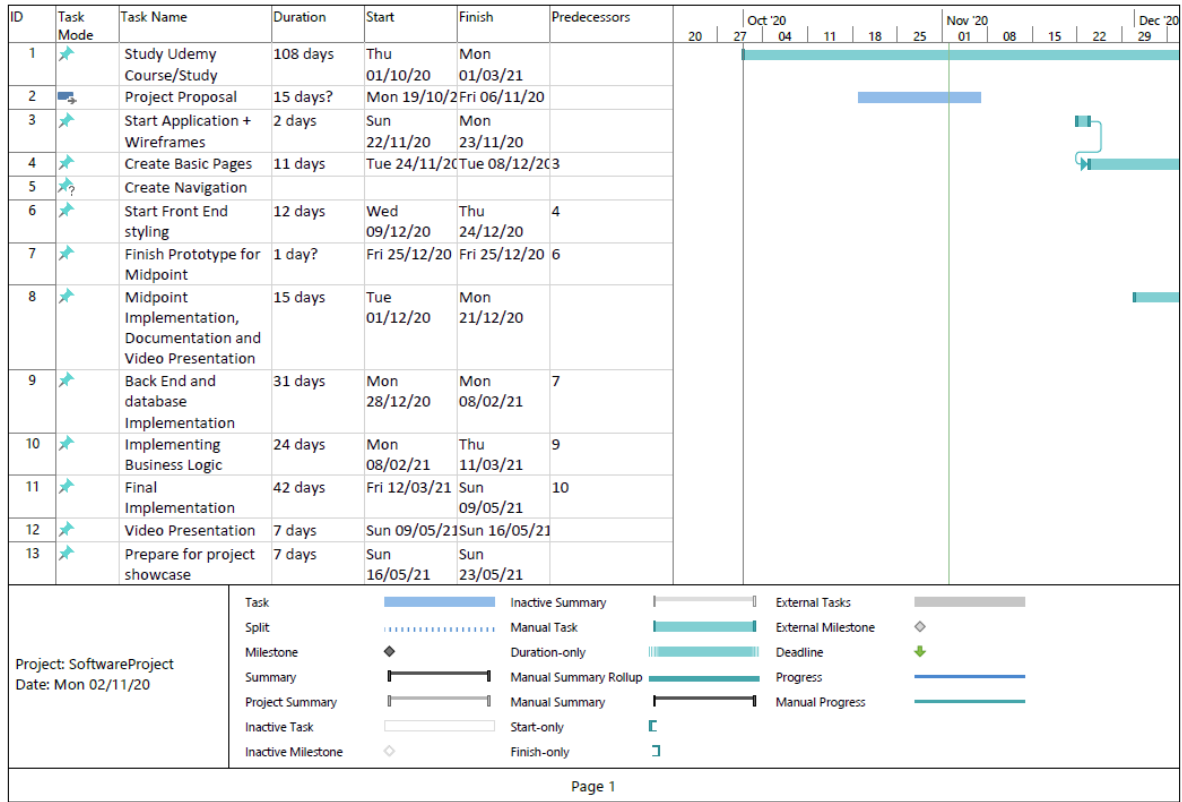
With the amount of food apps targeting the broad market, I feel as if I can take some of the applications in the food market and what makes them so successful. Examples of this could be Just Eat or Deliveroo. They are not my competitors but instead, could complement my application by helping me understand the food market.

The system design will be the 3 layers of presentation, business logic layer and the data layer. Presentation will be the front-end development of the application and be used to display UI such as the navigation, the map etc. The logic layer will have functions and processing commands such as a search function or receiving data from the data layer. The data layer will hold all of the SQL script and data stored by the website.

4.0 SPECIAL RESOURCES REQUIRED

For study, I have purchased and currently following a Udemy course based on react native and Expo CLI.

5.0 PROJECT PLAN



6.0 TECHNICAL DETAILS

I have planned out the basic languages and software that I will use to create my project:

SOFTWARE —

- Balsamiq - I will use Balsamiq mock-ups to create wireframes for each page
- Visual Studio Code - I will use visual studio code as my code editor to write the code for the application.
- GitHub - I will use GitHub for my source control as I am experienced with it and it is easy to use with VS code.
- Firebase* - I have used Firebase before so would prefer to use it for my project. However, I am open to using a different tool for the app development but since I have not used much expo CLI or react Native yet, I am yet to learn what is the best way to host an application using these. Firebase would be used for data storage, user authentication and hosting the website.
- React Native - React Native will be the used to make this application. React native translates base code into native code for Android/iPhone to understand.

LANGUAGES —

- JSX - React Native applications are written in JSX which is a mixture of HTML and JavaScript.

7.0 EVALUATION

System tests are very important for this application and in any development life cycle. I will be using integration testing to test groups of individual modules. Something like cypress may be good for this. I also want to unit test with a tool such as Jest or WebDriver.

National College of Ireland

DECLARATION OF ETHICS CONSIDERATION

School of Computing

Student Name: Dylan Murphy

Student ID: X17506166

Programme: Business Information Systems **Year:** 2020/2021

Module: Software Project

Project Title: Food Rescue

Please circle (or highlight) as appropriate

This project involves human participants	Yes / No
--	----------

3 Introduction

Secondary data refers to data that is collected by someone other than the current researcher. Common sources of secondary data for social science include censuses, information collected by government departments, organizational records and data originally collected for other research purposes. Primary data, by contrast, is collected by the investigator conducting the research.

A project that does not involve human participants requires ONLY completion of Declaration of Ethics Consideration Form and submission of the form on module's Moodle page

A project that involves human participants requires ethical clearance and an Ethics Application Form must be submitted through the module's Moodle page. Please refer to and ensure compliance with the ethical principles stated in NCI Ethics Form available on the Moodle page.

The following decision table will assist you in deciding if you have to complete the Declaration of Ethics Consideration Form or/and the Ethics Application Form.

Public Data	Y	Y	Y	Y	N	N	N	N
Private Data	Y	Y	N	N	Y	Y	N	N
Human Participants	Y	N	Y	N	Y	N	Y	N
Declaration of Ethics Consideration Form	x	X	x	X	X	X	x	
Ethics Application Form	X		X		X		X	

Please circle (or highlight) as appropriate

The project makes use of secondary dataset(s) created by the researcher	Yes / No
The project makes use of public secondary dataset(s)	Yes / No
The project makes use of non-public secondary dataset(s)	Yes / No
Approval letter from non-public secondary dataset(s) owner received	Yes / No

4 Sources of Data:

It is students' responsibility to ensure that they have the correct permissions/authorizations to use any data in a study. Projects that make use of data that does not have authorization to be used, will not be graded for that portion of the study that makes use of such data.

Public Data

A project that makes use of public secondary dataset(s) **does not need ethics permission**, but **needs a letter/email from the copyright holder** regarding potential use.

Some websites and data sources allow their data sets to be used under certain conditions. In these cases, a letter/email from the copyright holder is NOT necessary, but the researcher should cite the source of this permission and indicate under what conditions the data are allowed to be used. See Appendix I for examples of permissions granted by Fingal Open Data, and Eurostat website.

Where websites or data sources indicate that they do not grant permission for data to be used, you will still need a letter/email from the copyright holder. For example, see Appendix II for an example from the Journal of Statistics Education.

Private Data

A project that makes use of non-public (private) secondary dataset(s) must receive data usage permission from School of Computing.

An approval letter/email from the owner (e.g. institution, company, etc.) **of the non-public secondary dataset must be attached to the Declaration of Ethics Consideration**. The letter/email must confirm that the dataset is anonymised and permission for data processing, analysis and public dissemination is granted.

Evidence for use of secondary dataset(s)

Include dataset(s) owner letter/email or cite the source for usage permission

5 CHECKLIST

Non-public/private secondary dataset(s) -Owner letter/email is attached to this form	Yes / No
OR	
Citation and link to the web site where permission is granted – provided in this form	
	Yes / No

6 ETHICS CLEARANCE GUIDELINES WHEN HUMAN PARTICIPANTS ARE INVOLVED

The Ethics Application Form must be submitted on Moodle for approval prior to conducting the work.

Considerations in data collection

- Participants will not be identified, directly or through identifiers linked to the subjects in any reports produced by the study
- Responses will not place the participants at risk of professional liability or be damaging to the participants' financial standing, employability or reputation
- No confidential data will be used for personal advantage or that of a third party

Informed consent

- Consent to participate in the study has been given freely by the participants
- participants have the capacity to understand the project goals.
- Participants have been given information sheets that are understandable
- Likely benefits of the project itself have been explained to potential participants
- Risks and benefits of the project have been explained to potential participants
- Participants have been assured they will not suffer physical stress or discomfort or psychological or mental stress
- The participant has been assured s/he may withdraw at any time from the study without loss of benefit or penalty
- Special care has been taken where participants are unable to consent for themselves (e.g children under the age of 18, elders with age 85+, people with intellectual or learning disability, individuals or groups receiving help through the voluntary sector, those in a subordinate position to the researcher, groups who do not understand the consent and research process)
- Participants have been informed of potential conflict of interest issues
- The onus is on the researcher to inform participants if deception methods have to be used in a line of research

I have read, understood, and will adhere to the ethical principles described above in the conduct of the project work.

Signature:



Date: 09/04/2021

7 Appendix I

1) Fingal Open Data: <http://data.fingal.ie/About>

Licence

Citizens are free to access and use this data as they wish, free of charge, in accordance with the Creative Commons Attribution 4.0 International License (CC-BY).

Note: From November 2010 to July 2015, data on Fingal Open Data was published in accordance with the PSI general licence.

Use of any published data is subject to Data Protection legislation.

Licence Statement

Under the CC-BY Licence, users must acknowledge the source of the Information in their product or application by including or linking to this attribution statement: "Contains Fingal County Council Data licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) licence".

Multiple Attributions

If using data from several Information Providers and listing multiple attributions is not practical in a product or application, users may include a URI or hyperlink to a resource that contains the required attribution statements.

2) Eurostat: <https://ec.europa.eu/eurostat/about/policies/copyright>

COPYRIGHT NOTICE AND FREE RE-USE OF DATA

Eurostat has a policy of encouraging free re-use of its data, both for non-commercial and commercial purposes. All statistical data, metadata, content of web pages or other dissemination tools, official publications and other documents published on its website, with the exceptions listed below, can be reused without any payment or written licence provided that:

- the source is indicated as Eurostat

- when re-use involves modifications to the data or text, this must be stated clearly to the end user of the information

8 Appendix II

Journal of Statistics Education: http://jse.amstat.org/jse_users.htm

JSE Copyright and Usage Policy

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9 Appendix III

Consent Form – Debriefing sheet and Information sheet included as seen below

Name

First Name

Last Name

Email

example@example.com

About the app:

The project is a phone application that lets users order foods close to them for collection. These foods will be foods that will be subject to food waste at the end of the day and will be put up for a cheap price.

What you will do:

The users of the app will perform a run through of the starting from the register page. They will create an account and they will be told to try make an order and check their order. They will then open the Google Form's survey and fill it out to the best of their ability.

Steps:

Step 1: The user agrees to join my app testing.

Step 2: They get the app through email and a link to download an APK of the application.

Step 3: The user uses the application for however long they need.

Step 4: The user opens the Survey and fills it out

Step 5: The user submits the survey.

Total Time: 15 Minutes

Survey: 5 Minutes

App Testing: 10 Minutes

There will be no penalty for leaving the study after you sign the consent form.

You must be over 18 to participate in this application.

The only data that will be recorded after you have completed the testing is the survey, which is completely anonymous.

Your personal data will be deleted as soon as testing is done, or you opt out of testing.

Your survey answers will be used in my documentation for my final year project Food Rescue.

Any queries can be emailed to x17506166@student.ncirl.ie

Sign here if you give your consent to partake in Food Rescue user testing

Sign Here 

Clear

Survey

13:03 [notifications] [signal] [wifi] [battery 33%]

docs.google.com/forms/d/e/1FAIpQLSFSW9okyjBVc

Food Rescue User Testing

This form should be accompanied with the Food Rescue app and should be completed AFTER you have used the Food Rescue app.

* Required

What was your overall experience with the "Food Rescue" App *

- Great
- Good
- Ok
- Not Bad
- Bad

Did you encounter any bugs with the application? *

- Yes
- No

If yes, what was the bug / bugs?

Your answer

Did you notice any pages that could have looked better? *

- Yes
- No

If Yes, what pages and what could look better?

Your answer

If Yes, what pages and what could look better?

Your answer

Did you have any performance issues with the application? *

- Yes
- No

If yes, what happened?

Your answer

Page 1 of 3

Next

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Google Forms

13:04 [status icons] docs.google.com/forms/d/e/1FAIpQLSfSW9okyjBVc

Food Rescue User Testing

* Required

Multi Choice Questions

A question will pop up on the screen and you have to pick one of the answers associated with the question

You had an overall good experience with the application *

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

You could easily order an item using the application *

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

You could easily navigate the application and the pages *

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

The app provided a fluid experience and there was no performance hiccups *

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

You could easily find your orders and could easily make changes to these orders *

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Page 2 of 3

Back Next

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Google Forms

6.3 Ethics Approval Application

National College of Ireland

**Ethical Guidelines and Procedures for Research involving
Human Participants**



SEPTEMBER 2017

1. Introduction

All research involving human participants that is conducted by students or staff at the National College of Ireland should be done so in an ethical manner. The college has therefore developed an Ethics Committee, which acts as a sub-committee of the Research Committee, to ensure that ethical principles pertaining to research involving human participants are upheld and adhered to. All researchers intending to use human participants as part of their projects are thus required to reflect upon any potential ethical issues and submit their research proposals for ethical review before commencing data collection.

This document gives an overview of the core ethical principles guiding research in NCI, while also documenting the procedures required for seeking ethical approval of research involving human participants.

Am I conducting research?

Research is defined as “the attempt to derive generalisable new knowledge by addressing clearly-defined questions with systematic and rigorous methods” (NHS Health Research Authority). Sometimes, we collect data in order to evaluate a service or practice we are engaged in (“service evaluation”). The main difference between research and service evaluation is in the aim: research is trying to create new generalisable knowledge, and service evaluation is trying to evaluate whether a delivered service/practice is working well. One project may have both aims included in it. It can be confusing if a service or intervention is involved, whether or not research is being conducted. If new or competing interventions are being evaluated, then it is likely to be research, whereas if an existing service is being conducted anyway, with an evaluative component, then it is likely to be a service evaluation. Research requires consideration of the below guiding principles, whereas service evaluation does not require approval from an ethics committee.

2. Guiding Principles

In line with other research institutions, there are three core guiding principles governing the ethical conductance of research involving human participants at NCI. These principles stem from the *Belmont Report* (1979) published by the National Commission for the Protection of Human Subjects of Biomedical and Behavioural Research. While it is recognised that these principles may be operationalised differently depending on the specific research discipline, it is recommended that these are consulted as a starting point for any research involving human participants.

2.1 Principle 1: Respect for Persons

This principle entails recognition that participants should be treated as autonomous individuals and hence should never be coerced or swayed into participating in a research project against their will. The participant’s right to withdraw from a research study at any time should be respected, as well as their right to dignity and protection from harm.

Respect for individuals can often be implemented in practice via the process of informed consent, whereby potential participants are made fully aware of the requirements involved in participation. While it is recognised that in certain cases deception (i.e. the withholding of certain information from participants) may take place, this should only occur when it is robustly justified for the validity of the research. In cases where deception is justified, researchers should ensure that any potential risk

resulting from this measure is minimised. Participants should also be fully debriefed on the nature of the research after it has taken place.

The principle of respect also requires researchers to protect individuals from vulnerable groups who may have diminished autonomy (see section 4.2 for more detail as to what constitutes vulnerable groups). Where full informed consent is not possible for such population groups, consent may instead be sought from their guardians. In all cases however clear assent, or willingness to participate, should be demonstrated from participants.

2.2 Principle 2: Beneficence and non-maleficence

This principle specifically focuses on the need to protect the well-being of participants. Any potential risk to participants should be minimised, whether that be risk of physical discomfort or of any psychological, emotional or social distress, while possible benefits should be maximised. Researchers adhering to this principle should thus ensure that any potential benefits derived from carrying out the study (e.g. in terms of knowledge gained) should outweigh potential risks. Even in cases where there is only a slight potential risk of harm, participants should be provided with appropriate support to alleviate this.

2.3 Principle 3: Justice

This principle emphasises the need to employ fairness in the distribution of benefits and risks to participants. The way in which participants are selected to take part in research should relate to the purpose of the study, as opposed to other factors such as availability or manipulability of participants. The exploitation of vulnerable populations should be avoided.

Where applicable, researchers are encouraged to consult guidelines stemming from their own professional bodies (e.g. The Psychological Society of Ireland) in addition to the general guiding principles above when planning their research. Researchers should also be sensitive to those issues which are specific to the population under investigation and the methodology that is employed in the project (e.g. qualitative methodologies involving the recording of data may raise issues relating to participants' right to anonymity, as well as the ethical management and use of data). Detailed consideration should be given to all these issues when planning research and when completing the Ethical Review Application form.

3. Ethics Committee

The NCI Ethics Committee was established by the Academic Council in 2012. Acting as a sub-committee to the Research Committee, its role is to oversee ethical issues arising from all research involving human participants that is conducted by students and staff of the college. The key purpose of this committee is to safeguard against any potential harm to participants, and to ensure that their rights are recognised in line with the guiding principles outlined above.

The Ethics Committee reviews all research proposals posing ethical risk to the participants involved, however the decision as to whether projects pose ethical risk is firstly made via the appropriate Filter Committee which operates at School level (see organisational structure in Figure 1 below). The Filter

Committees may review and approve research proposals which are of low ethical risk, while referring those of high ethical risk to be considered by the Ethics Committee (see categories of ethical risk in section 4.1).

While the Filter Committees are made up of staff members with subject-specific knowledge, membership of the Ethics Committee should comprise of no less than five representatives from both the School of Computing and the School of Business, including representatives from the Research Committee.

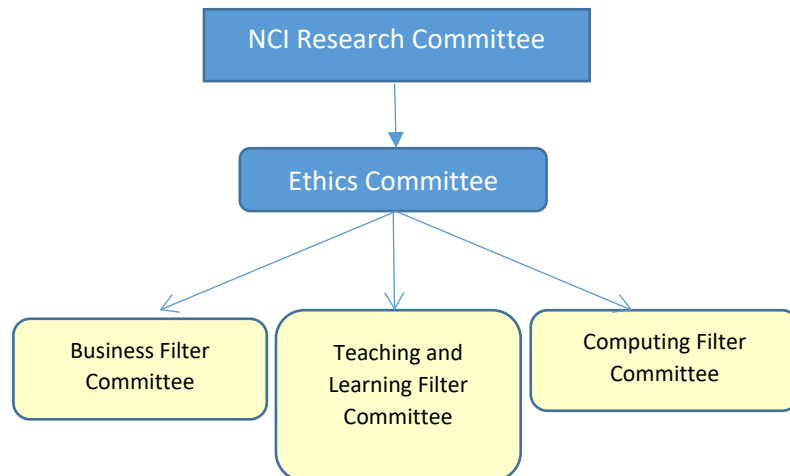


Figure 1: Committee Structures.

4. Review Process

Any staff or student of NCI wishing to conduct a study involving human participants should first submit the Ethical Review Application Form (included at the end of this document), to the relevant School Filter Committee at proposal stage. This initial review will result in a graded categorisation of ethical risk, as outlined below.

4.1 Categorisation of Ethical Risk

Research category A

Research in this category poses little ethical risk to the participants involved. Specifically, it refers to research involving human volunteers, but **excluding** studies involving:

- therapeutic interventions
- new research methodologies
- vulnerable populations (see section 4.2)
- deception of the participants
- any other significant physical, social or psychological risk to participants

Research category B

Research in this category involves human volunteers **including** studies involving:

- therapeutic interventions
- new research methodologies

- vulnerable populations (see section 4.2)
- deception of the participants
- any potentially significant risk to participants

Research Category C

This specifically refers to research involving human volunteers who are service users, patients, staff, records, etc., within the sphere of the HSE or similar setting (but not including clinical trials of investigative medicinal products).

4.2 Vulnerable groups

There are a number of participant populations that may fall under the heading of 'vulnerable groups'. These groups require consideration of unique ethical challenges regardless of the nature of the project. Research involving such populations should therefore always be reviewed by the Ethics Committee.

Groups that may be classed as vulnerable include, but are not limited to:

- Children (under 18 years of age)
- The older old (aged 85+)
- People with an intellectual or learning disability
- Individuals or groups receiving help through the voluntary sector
- Those in a subordinate position to the researcher (e.g. employees)
- Any other groups who might not understand the research and consent process

Note: in addition to the Ethical Review process, any researchers intending to work directly with children will be required to undergo Garda Vetting in advance of the proposed research.

4.3 Exemption from Full Ethical Review

In certain limited cases, researchers can apply for an exemption from full ethical review. In such cases, the Ethical Review Exemption form should be completed, explicitly detailing why the exemption is sought.

In completing this form, researchers must declare that the research does not involve any of the following:

- Vulnerable groups
- Sensitive topics
- Risk of psychological or mental distress
- Risk of physical stress or discomfort
- Any other risk to participants
- Use of drugs or invasive procedures (e.g. blood sampling)
- Deception or withholding of information from participants
- Conflict of interest issues
- Access to data by individuals or organisations other than the researchers

- Any other ethical dilemmas

4.4 Outcomes of Review Process

Following consideration of research projects submitted for Ethical Review, each Filter Committee will submit a report to the Ethics Committee summarising the applications considered and the decisions made.

For research that is deemed to fall under Research Category A (low ethical risk), a favourable outcome at the relevant Filter Committee will be sufficient to secure ethical approval. Research falling under the other two categories must however be considered by the Ethics Committee before approval may be granted.

On the basis of this review, four key outcomes may arise:

1. Research proposal approved (no recommendations)
2. Research proposal approved pending minor revisions (to be accepted by the Chair and Research Supervisor)
3. Research proposal approved pending major revisions (to be resubmitted and approved by the Ethics Committee)
4. Research proposal rejected (resubmission necessary)

A summary of the processes involved in applying for ethical approval can be seen in Figure 2.

Appeals

Appeals against the Committee's decision may be made within ten working days. In this case, at least three members of the Ethics Committee, none of whom will have reviewed the initial application, may review this along with any additional information submitted by the applicant.

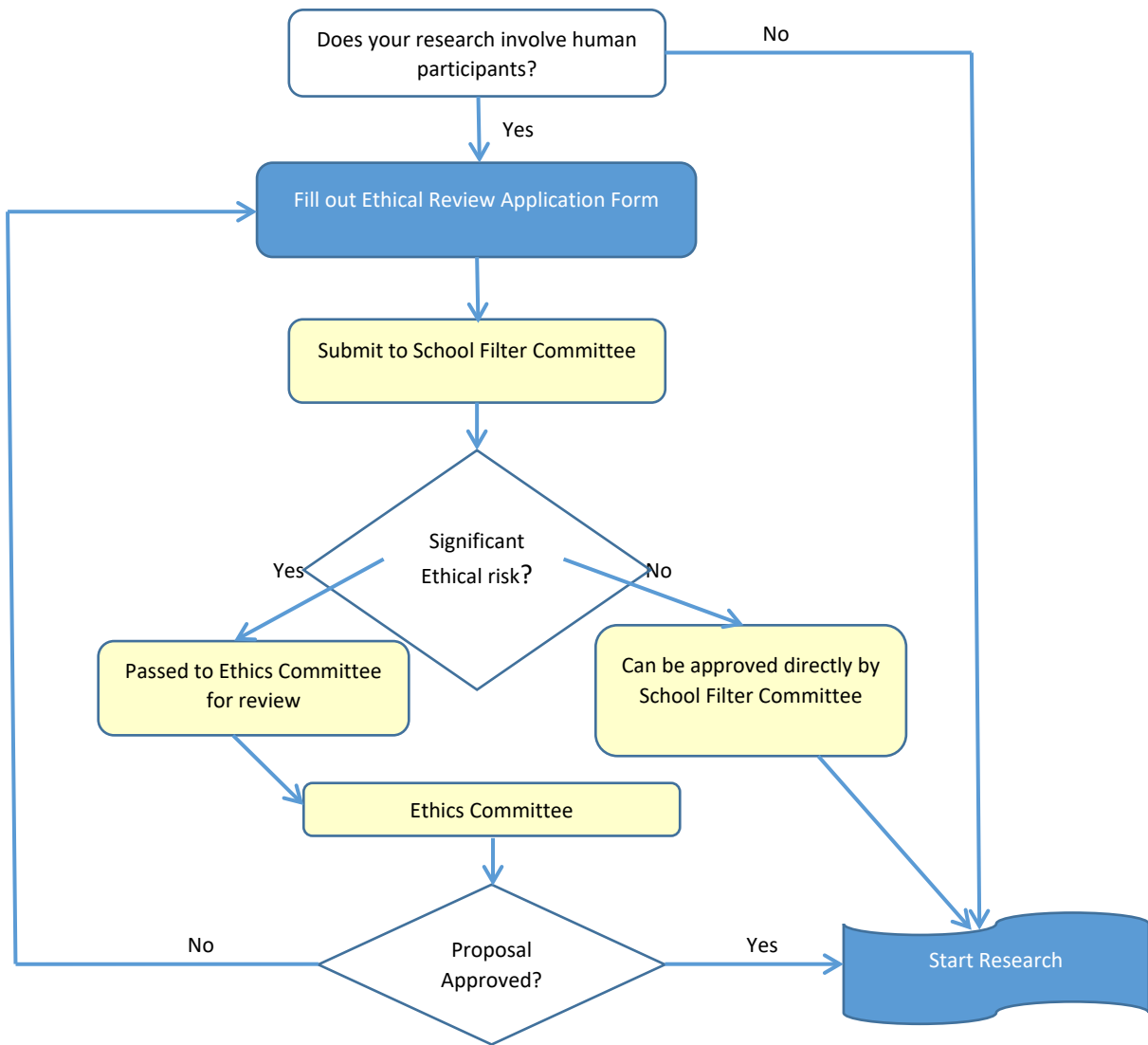


Figure 2: Process chart for seeking Ethical Approval

Ethics Application Checklist

To be submitted alongside the ethics application.

Please complete the below checklist, ticking each item to confirm that it has been addressed.

1. I agree to obtain informed written consent from all human participants aged over 18 who are involved in this research (or if circulating digitally, I will ensure that informed consent is completed, and will have the participants indicate their informed consent by continuing with their study engagement).	<input checked="" type="checkbox"/>
2. I agree to obtain informed written consent from the parents of anyone aged under 18 in this research (or from the schools if appropriate), and informed written assent from those under 18 in this research.	<input checked="" type="checkbox"/>
3. I include a letter of agreement from a clinically responsible individual agreeing to (where appropriate) help me recruit/provide clinical support in the event that participants become distressed/host the study data collection.	<input type="checkbox"/>
4. I append a letter of agreement from an external institution or organisation agreeing to host the study.	<input type="checkbox"/>
5. I agree to comply with NCI's Data Retention Policy.	
6. I have appended a) information sheet, b) consent form/assent form, c) debriefing sheet.	<input checked="" type="checkbox"/>
7. I have provided details of how non-anonymised data will be stored, in a safe and encrypted manner.	<input checked="" type="checkbox"/>
8. I have included my contact details and those of my supervisor (where appropriate). I have only included my NCI email address and not included any personal contact information.	<input checked="" type="checkbox"/>
9. I have given sufficient details on the proposed study design, methodology, and data collection procedures, to allow a full ethical review, and I understand that my failure to give sufficient detail may result in a resubmission being required.	<input checked="" type="checkbox"/>
10. I understand that if I make changes to my study following ethical approval, it is my responsibility to seek an ethics amendment if the change merits ethical consideration.	<input checked="" type="checkbox"/>

National College of Ireland

Human Participants Ethical Review Application Form

All parts of the below form must be completed. However in certain cases where sections are not relevant to the proposed study, clearly mark NA in the box provided.

Part A: Title of Project and Contact Information

Name

Dylan Murphy

Student Number (if applicable)

X17506166

Email

X17506166@student.ncirl.ie

Status:

Undergraduate

Postgraduate

Staff

Supervisor (if applicable)

Dr Anu Sahni

Title of Research Project

Food Rescue

Category into which the proposed research falls (see guidelines)

Research Category A

Research Category B

Research Category C

Have you read the NCI Ethical Guidelines for Research with Human Participants?

Yes

No

Please indicate any other ethical guidelines or codes of conduct you have consulted

Not Applicable

Has this research been submitted to any other research ethics committee?

Yes

No

If yes please provide details, and the outcomes of this process, if applicable:

Not Applicable

Is this research supported by any form of research funding?

Yes
No

If yes please provide details, and indicate whether any restrictions exist on the freedom of the researcher to publish the results:

Not Applicable

Part B: Research Proposal

Briefly outline the following information (not more than 200 words in any section).

Proposed starting date and duration of project

12/04/2021

The rationale for the project

The project is a phone application that lets users order foods close to them for collection. These foods will be foods that will be subject to food waste at the end of the day and will be put up for a cheap price.

The research aims and objectives

I intend to perform testing of my application using human participants. This testing will involve a run through of the application and then an anonymous survey to give an overview of any bugs, styling or changes that can be recommended by the tester.

The research design

The users of the app will perform a run through of the starting from the register page. They will create an account and they will be told to try make an order and check their order. They will then open the Google Form's survey and fill it out to the best of their ability.

The research sample and sample size

Please indicate the sample size and your justification of this sample size. Describe the age range of participants, and whether they belong to medical groups (those currently receiving medical treatment, those not in remission from previous medical treatment, those recruited because of a previous medical condition, healthy controls recruited for a medical study) or clinical groups (those undergoing non-medical treatment such as counselling, psychoanalysis, in treatment centres, rehabilitation centres, or similar, or those with a DSM disorder diagnosis).

Sample Size: 5+

Age Range: 18 – 50

No medical Groups

If the study involves a MEDICAL or CLINICAL group, the following details are required:

- a) Do you have approval from a hospital/medical/specialist ethics committee?
If YES, please append the letter of approval. Also required is a letter from a clinically responsible authority at the host institution, supporting the study, detailing the support mechanisms in place for individuals who may become distressed as a result of participating in the study, and the potential risk to participants.
If NO, please detail why this approval cannot or has not been sought.
- b) Does the study impact on participant's medical condition, wellbeing, or health?
If YES, please append a letter of approval from a specialist ethics committee.
If NO, please give a detailed explanation about why you do not expect there to be an impact on medical condition, wellbeing, or health.

The nature of any proposed pilot study. Pilot studies are usually required if a) a new intervention is being used, b) a new questionnaire, scale or item is being used, or c) established interventions or questionnaires, scales or items are being used on a new population. If no such study is planned, explain why it is not necessary.

Not Applicable

The methods of data analysis. Give details here of the analytic process (e.g. the statistical procedures planned if quantitative, and the approach taken if qualitative. It is not sufficient to name the software to be used).

Not Applicable

Study Procedure

Please give as detailed an account as possible of a participant's likely experience in engaging with the study, from point of first learning about the study, to study completion. State how long project participation is likely to take, and whether participants will be offered breaks. Please attach all questionnaires, interview schedules, scales, surveys, and demographic questions, etc. in the **Append**

Step 1: The user agrees to join my app testing and fills out a consent form.

Step 2: They get the app through email and a link to download an APK of the application.

Step 3: The user uses the application for however long they need.

Step 4: The user opens the Survey and fills it out

Step 5: The user submits the survey.

Total Time: 15 Minutes

Survey: 5 Minutes

App Testing: 10 Minutes

Part C: Ethical Risk

Please identify any ethical issues or risks of harm or distress which may arise during the proposed research, and how you will address this risk. Here you need to consider the potential for physical risk, social risk (i.e. loss of social status, privacy, or reputation), outside of that expected in everyday life, and whether the participant is likely to feel distress as a result of taking part in the study. Debriefing sheets must be included in the appendix if required. These should detail the participant's right to withdraw from the study, the statutory limits upon confidentiality, and the obligations of the researcher in relation to Freedom of Information legislation. Debriefing sheets should also include details of helplines and avenues for receiving support in the event that participants become distressed as a result of their involvement in this study.

User can leave the survey whenever they want.

No ethical issues that may cause harm or distress.

Do the participants belong to any of the following vulnerable groups?

(Please tick all those involved).

- Children;
- The older old (85+)
- People with an intellectual or learning disability
- Individuals or groups receiving help through the voluntary sector
- Those in a subordinate position to the researchers such as employees
- Other groups who might not understand the research and consent process
- Other vulnerable groups

How will the research participants in this study be selected, approached and recruited? From where will participants be recruited? If recruiting via an institution or organisation other than NCI please attach a letter of agreement from the host institution agreeing to host the study and circulate recruitment advertisements/email etc.

Participants will be colleagues and family.

What inclusion or exclusion criteria will be used?

Must be over 18

How will participants be informed of the nature of the study and participation?

They will be asked by email or through mediums such as WhatsApp

Does the study involve deception or the withholding of information? If so, provide justification for this decision.

Only survey answers will be used in report.

What procedures will be used to document the participants' consent to participate?

Consent Form must be filled out before using the app

Can study participants withdraw at any time without penalty? If so, how will this be communicated to participants?

Yes, it will be stated in the email/message

If vulnerable groups are participating, what special arrangements will be made to deal with issues of informed consent/assent?

Email me to discuss consent form, can opt out at any time even if they sign consent form.

Please include copies of any information letters, debriefing sheets, and consent forms with the application.

Part D: Confidentiality and Data Protection

Please indicate the form in which the data will be collected.

Identified Potentially Identifiable **De-Identified**

What arrangements are in place to ensure that the identity of participants is protected?

User details will only be gathered during the signing of the consent form and details about the user details will be deleted after their testing is done.

Will any information about illegal behaviours be collected as part of the research process? If so, detail your consideration of how this information will be treated.

No

Please indicate any recording devices being used to collect data (e.g. audio/video).

None

Please describe the procedures for securing specific permission for the use of these recording devices in advance.

Not Applicable

Please indicate the form in which the data will be stored.

Identified Potentially Identifiable **De-Identified**

Who will have responsibility for the data generated by the research?

Dylan Murphy – National College of Ireland student – x17506166

Is there a possibility that the data will be archived for secondary data analysis? If so, has this been included in the informed consent process? Also include information on how and where the data will be stored for secondary analytic purposes.

This testing will be used for testing off my application and the survey results will feature in my Final Year Report for my Food Rescue Application

If not to be stored for secondary data analysis, will the data be stored for 5 years and then destroyed, in accordance with NCI policy?

Yes

No

Dissemination and Reporting

Please describe how the participants will be informed of dissemination and reporting (e.g. submission for examination, reporting, publications, presentations)?

Consent Form

If any dissemination entails the use of audio, video and/or photographic records (including direct quotes), please describe how participants will be informed of this in advance.

Not Applicable

Part E: Signed Declaration

I confirm that I have read the NCI Ethical Guidelines for Research with Human Participants, and agree to abide by them in conducting this research. I also confirm that the information provided on this form is correct (Electronic signature is acceptable).

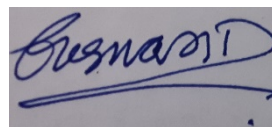
Signature of Applicant

Date 09/04/2021



Signature of Supervisor (where appropriate): Dr

Date 12/04/2021



Anu Sahni

Any other information the committee should be aware of?

Links to both the consent form and the survey:

<https://eu.jotform.com/210993038970058>

<https://forms.gle/bMpSNY1ynN53qwtD8>

Reflective Journal

X17506166

Dylan Murphy

This is my first reflective journal where I will discuss what I have done, where what I have done will fit into my project and what I plan to do.

What I have done:

So far, most of what I have done has been studying and taking in new information about react native. Currently, I have been following a Udemy course which covers basic React Native to an intermediate level. I have also worked with expo CLI and have made a basic app which uses react states and hooks to create a to-do list. While basic, this has taught me the foundations of what features React Native is filled with and has helped me a lot through study.

Where what I have done will fit into my project:

I am currently studying React Native as I want to use it for my final year project. The reason I chose React Native was that I was really interested in making an app, but I was not the most interested in android studio or java. I was researching for applications and found IONIC framework for react and angular. Doing more research on this, it led me onto react native and when I was watching videos on the basics, I knew I wanted to do this for my final year project. All my study so far on my Udemy course has drastically improved my skills when it comes to JSX and learning the basics of react native which in turn will prepare me for my project.

What I plan to do:

I plan on filling out my project proposal soon. I want to hopefully receive feedback on my app idea (Which is an anti-Food waste kind of app) and then get a start filling in the various sections. I also plan to delve more into react native and follow my Udemy course further.

Reflective Journal

X17506166

Dylan Murphy

This is my second reflective journal where I will discuss what I have done, where what I have done will fit into my project and what I plan to do.

What I have done:

I have been catching up mostly on react native and going through a Udemy course to delve more into detail on how to create a react native application. I have also completed my project proposal and got my app idea accepted, with some minor tweaks from advice via my supervisor.

Where what I have done will fit into my project:

Studying react native is helping me setup for the start of my project. I want to make sure I don't rush into the creation of an app only to make a mistake. Learning more react native is going to greatly help me in the long run for my project. Planning my application in my project proposal keeps giving me a better image of how I want to go about my application and what the app should do and what it should contain.

What I plan to do:

I plan on writing the first two sections of my technical report for December and to get a start on my application. I still need to do my Udemy course to get up to date on how to create a react native application effectively. I also plan to draw mock-ups of my app using Balsamiq Mock-ups. This will give me a template for how I want my application to work. Midpoint presentation is due on the 22nd of December so I will need to get a prototype ready for that date.

Reflective Journal

X17506166

Dylan Murphy

This is my third reflective journal where I will discuss what I have done, where what I have done will fit into my project and what I plan to do.

What I have done:

This month has been crucial to code a lot of my project. I have created a UI that I feel looks good for a prototype, but it will be upgraded and changed for my final submission. I have also added in some base functionality such as passing params over to the next page to render the items the user has clicked on.

Where what I have done will fit into my project:

All my work done so far has been to create my UI for my final year project and to satisfy my midpoint presentation. I have added in some base functionality like the params mentioned above and a mapview that locates the user's location. Functionality implemented this early will allow me to focus more on other areas instead of worrying about this functionality closer to the final submission.

What I plan to do:

For the time being, I plan on studying for other lectures until after all my TABA's are due. After that, I would like to implement firebase into my app and make sure that business and items are read and can be updated effectively.

Reflective Journal

X17506166

Dylan Murphy

This is my fourth reflective journal where I will discuss what I have done, where what I have done will fit into my project and what I plan to do.

What I have done:

During January, I spent half the month primarily focusing on my TABA's. Once I had completed my TABA's on the 13th, I started to work on integrating firebase into my project. I started by integrating email and password authentication using firebase's built in authentication section. Once I completed that, I set upon creating business and user registration which create records in Firebase Firestore.

Where what I have done will fit into my project:

Integrating firebase into my project is a crucial step in my project. It allows me to create, read, update and delete data that the user needs. It also allows me to display different data for the users such as businesses close to them, items in that business etc.

What I plan to do:

My plan for the next month is to add more firebase connections so that I can allow for a user to view various items/businesses based on their location. I would like to get my firebase as soon as possible to allow for more time adding in extra features such as my food countdown feature.

Reflective Journal

X17506166

Dylan Murphy

This is my fifth reflective journal where I will discuss what I have done, where what I have done will fit into my project and what I plan to do.

What I have done:

During this month I completed bug fixes in a few screens in my app. There were many small bugs such as keyboard obstruction and fields not displaying properly. I also added in 2 new parts - allowing the business to view their current projects and edit them products.

Where what I have done will fit into my project:

This functionality is crucial in allowing the business to manage, update and delete their products that they have put onto the website. This is needed when things need to be changed due to lack of error or change of plans. The bug fixes will help the overall UX of the app and allow the users to have a seamless experience.

What I plan to do:

I plan on further updating the UI of the current and edit pages and implement some more functionality on the business side. I also plan to discuss with my supervisor on where I should be in the coming month.

Reflective Journal

X17506166

Dylan Murphy

This is my sixth reflective journal where I will discuss what I have done, where what I have done will fit into my project and what I plan to do.

What I have done:

During this month, I have finished a lot of functionality regarding displaying user's orders, business orders, creating receipt pages for the users and businesses and then fixing some UI on the main page. I have also fixed some bugs relating to the Mapview which were causing some issues rendering some longitude and latitudes and rendering some markers.

Where what I have done will fit into my project:

This functionality is crucial in ensuring that both a user and a business can essentially communicate with one another through the buying and selling of products. A business can now put up a product for sale, the user can purchase that product and then the business will be able to see where the user placed the order and how far away, they placed the order. The business can also assign a status of "In Progress", "Completed" or "Cancelled" and then sort by these to allow for easier sortation of orders.

What I plan to do:

I plan on finishing my main functionality this month and fixing a lot of UI. I also plan to start some testing which may come in the form of unit testing from software such as Jest. This will allow me to test units of my application to see if they are performing correctly to how I need them to perform.

Reflective Journal

X17506166

Dylan Murphy

This is my seventh reflective journal where I will discuss what I have done, where what I have done will fit into my project and what I plan to do.

What I have done:

During this month, I have started to fix some bugs in my code such as getting rid of warnings, variable issues and problems with component's mounting. I have started my testing of the application which lets me get an idea on how well the application runs. The two types of testing I will be doing are -

Jest testing: This is done to see if my application renders correctly.

User testing: Testing my application with real people so they give anonymous feedback on how the app performs, usability of the app, how well it looks etc.

Another thing that I completed this month was the referencing of my code.

Where what I have done will fit into my project:

User testing of my application allows me to check any issues that users may find such as hard to read text, colours that could look better, bugs etc for users. Render testing allows me to generate a JSON snapshot of the page and then compare that to my running screen. This allows me to find any issues with the code and lets me fix them to pass the test.

What I plan to do:

The last 2 weeks are approaching, and this will be used for cleaning my application, working on documentation of my project, deployment and creating a presentation and poster.