README_Everyware

Introduction

The brief for the Everyware project was to create a physical intelligent object for the home – a smart home device. Also known as an "internet of things" object, these can include everyday objects such as fridges, speakers and cars. Google defines the internet of things as "the interconnection via the Internet of computing devices embedded in everyday objects, enabling them to send and receive data."[1] The Smart Fridge project works in exactly this manner. The basic features of the smart fridge include scanning items via the barcode through the use of a front facing camera, storing an inventory of food products, a database of the foods nutritional values, having recipes suggested to the user dependant on what products are in the inventory, a weekly meal planner and being able to view UK statistics on the average nutritional values across each region of the country.

The background context behind this fridge is that it aims to gather the eating habits of the population in aid to tackle poor health issues such as the obesity crisis. This would theoretically work by gathering the average nutritional values of the contents of the population's fridges. This can then be compared alongside correlating data such as the average annual income of certain areas within the country to support hypothesis such as that the lower the income in an area, the more likely it is that the area's residents are eating lower quality food with poor nutritional value. This is then more likely to lead to health issues in the areas thus costing underdeveloped areas more money in terms of healthcare.

Background research / Literature review

A study conducted by the Department of Health Visiting, Worcester Health and Care NHS Trust, Bromsgrove and the Centre for Health and Social Care, Birmingham on Food choices made by low income households for their children states that "All parents were aware that children should eat fruit and vegetables and avoid salt but were not necessarily aware of what foods were high in salt"[2]. Additionally to this, in 2016/17 there were 617,000 admissions into UK hospitals where obesity was a factor – an 18% increase from 2015/16.[3] Statistics like these indicate that the UK has an increasing issue in poor eating habits that are undoubtedly costing the NHS a large amount of money and potentially a key factor to the general impression that the NHS is rapidly declining due to lack of funds. Furthermore, the claim that parents weren't aware which foods were high in salt in the Food Choices study suggests that a leading factor of this could be that people simply aren't aware of which foods possess poor nutritional values.

The conceptual inspiration of the fridge came from the book "Consuming Technologies". The book states that "The household is a moral economy because the economic activities of its members within the household and in the wider world of work, leisure and shopping are defined and informed by a set of cognitions, evaluations and aesthetics, which are themselves defined and informed by the histories, biographies and politics of the household and its members".[4] Baring this in mind, it inspired the project to become a means of collecting data from each of these "moral economies" of individual households to then be shared to a wider online "cloud" that could compare data across

[1] Google definition. (2018). Google Search "Define Internet of things".
[2] Sally Lovelace and Fatemah Rabiee-Khan. (2013). "Food choices made by low-income households when feeding their pre-school children: a qualitative study". Department of Health Visiting, Worcester Health and Care NHS Trust, Bromsgrove, UK, and † Centre for Health and Social Care, Faculty of Health, Birmingham City University, Birmingham, UK.
[3] NHS. (2018). "Statistics on Obesity, Physical Activity and Diet – England, 2018".
[4] Roger Silverstone and Eric Hirsch. (1994). "Consuming Technologies". Routledge, London.

the nation. This is in comparison to how it was originally heading towards being a closed off, individual technology designed purely to benefit the users of the house rather than sharing data to benefit larger bodies such as the NHS.

Following this research, inspiration for the smart fridge was also taken from looking into other products currently on the market. In particular, the Smart Fridge project has a likeness to the Samsung Family hub in terms of basic primary features.. However it differs greatly in terms of its intentions. The Family Hub is designed purely for the benefit of the inhabitants of the individual home and it ends there. The Smart Fridges intentions of collecting data of dietary habits are where the two products hugely vary.

Methodology

For idea generation the idea for the smart fridge came from a session where people were asked to consider everyday household objects that better peoples life's. People were then asked to think about how these could be combined with technology. Some of the first idea's included objects such as a coat hanger that tells you the weather or a door mat that scans your shoes to indicate how dirty they are and whether you should take them off or not. However, the Smart Fridge came from the intention to design a smart object that could better the lives of many in a more serious manner at a larger scale.

The methodology for designing this project once the context behind it was settled was followed by thinking about the features the fridge would hold. From the start the project always intended to keep an inventory of food products as a main feature and show "best before" dates. However, following this the project developed into being made from a healthcare perspective. This meant that the fridge would need to show nutritional values of foods and be able to collect averages so that this data could then be shared publicly in an online cloud. This is in comparison to how it originally would be designed with just the primary user in mind. Further features that followed later on included a set of electronic scales underneath the fridge. This is so that when food is entered into the inventory the weight is recorded into the system. The result of this is that when a specific weight is removed, the fridge automatically knows which item has been taken away and can edit the inventory. The intention of this was for the ease of use for the user.

In terms of creating an appropriate interface, multiple stages of design were carried out. As there are only a small amount of features, and for ease of use, it was always intended to follow a basic tile design. A design that would show every option in one page to save the user having to navigate through multiple pages to get to what they want. As you could liken the user scanning products in to their fridge to scanning products on a self-service till, this is where the original inspiration was taken from. Further down the line, the design needed to be more aesthetically appealing as it was designed to be a product within the home. For this reason the windows phone/windows 10 user interfaces also played a huge part in inspiring the interface design for the smart fridge. Tiles were also made as large as possible with the use of icons for ease of use to the target market – home owners who would more likely be middle aged to elderly and possibly suffer from poor eyesight. The fridge was always intended to be easy and accessible to use for anybody from children to the elderly.

Critical Analysis

Overall the smart fridge project works to a fairly professional standard and is capable of carrying out what it is aimed to achieve. It also provides a visually appealing and easy to use interface. However there are a number of flaws.

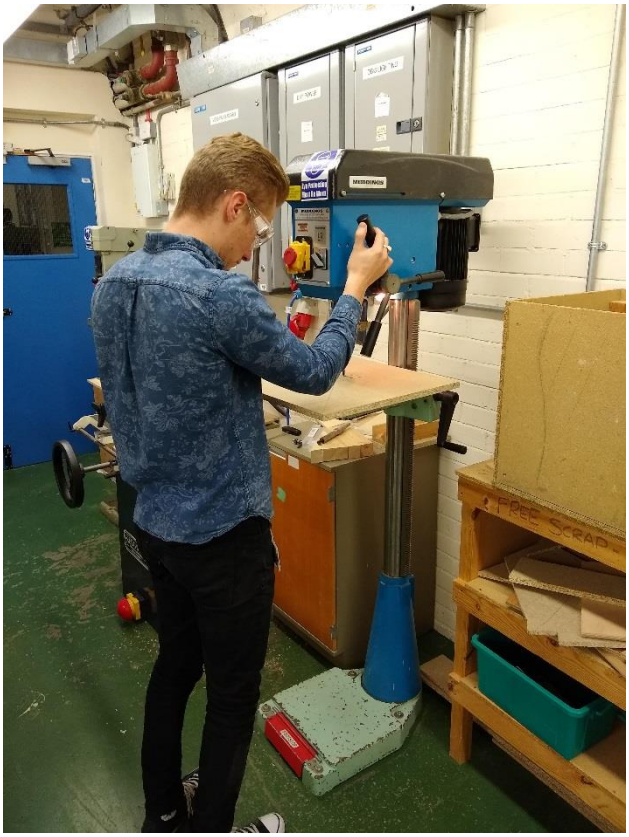
As an experimental project everything looks very positive, however to really come to life the fridge would have to be mass produced and spread across the nation to really take effect. Prior to this it would at least have to be rolled out to a smaller number of homes for testing. However, baring this in mind there is nothing to say that this isn't possible as the fridge is still in its first iteration of design and is currently a prototype. When thinking of different ways in which the fridge could be delivered as a product, it is already clear that it would be relatively cheap to purchase. This is because from early on it was decided that it would not come as the entire fridge, but as a kit consisting of scales, sensors, a micro-computer (raspberry pi at the moment but potentially a specialised micro-computer for production) that can be cheaply purchased and easily installed to any fridge. The idea of having it cheap is that this makes it more possible to roll out to a larger number of consumers to gather more accurate data.

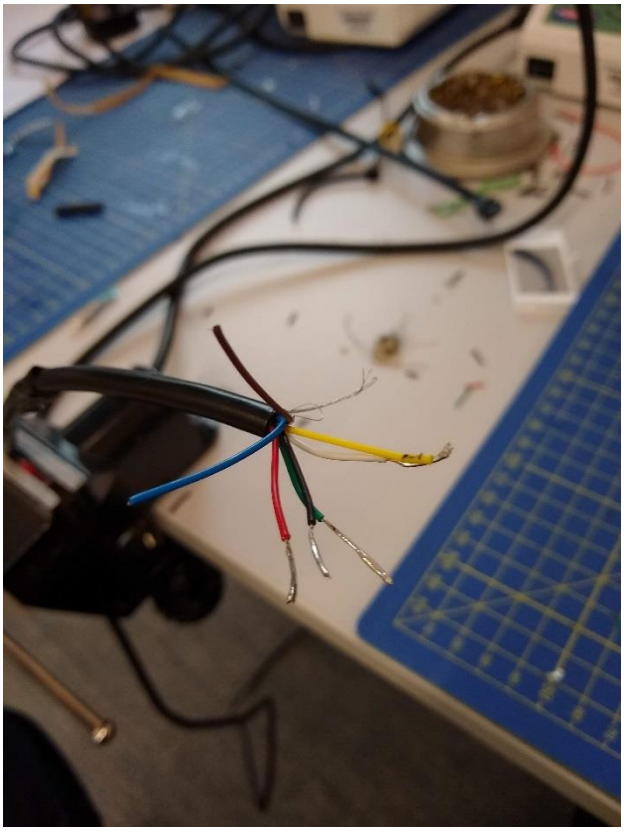
In terms of functionality, the scales are sometimes inaccurate and sometimes need calibration. We have also received multiple queries of how the fridge might behave if a user is to use half of a product, for example eat half a quiche, and place it back in the fridge. However, the way to solve this may be that users will be expected to manually remove items from the inventory once they are finished. Once the item has been noticed to have been removed, the fridge will be expected to show pop up reminders through the form of a push notification to ask whether that product is still in the inventory or whether it needs to be removed. This however, would be a feature for a later iteration of the fridge.

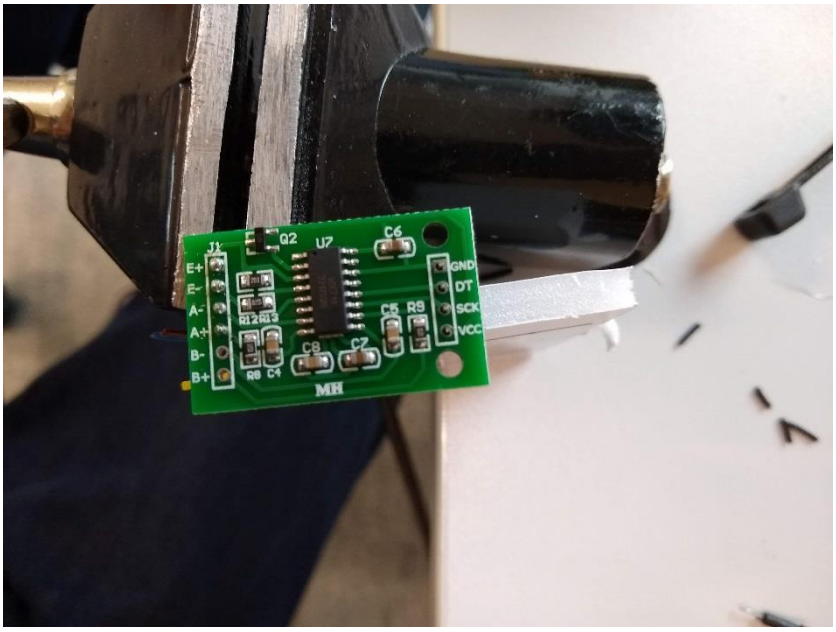
Conclusion / Closing Remarks

In conclusion the Smart fridge has been an overall successful prototype project. The fridge meets the brief of being a smart or intelligent object for the home. It has been completed to a high standard in terms of technical development, design, usability and contextual depth. It appears to be fairly unique in terms of its aims as a product. However, it is still in early stages if it was to be produced for the larger market place and does have a number of minor flaws that would need to be overcome if it was to enter the market place. It would be interesting to see how it would perform when the theory is put in to practice and whether it would collate any interesting and unseen data patterns. However unfortunately due to the nature of the project, this cannot be achieved without the fridge being put into mass production, or at least, into a pilot production. Despite this, the technology is there so it is deemed an overall success at a prototype level.

▪ Sketches, designs, schematics






E+
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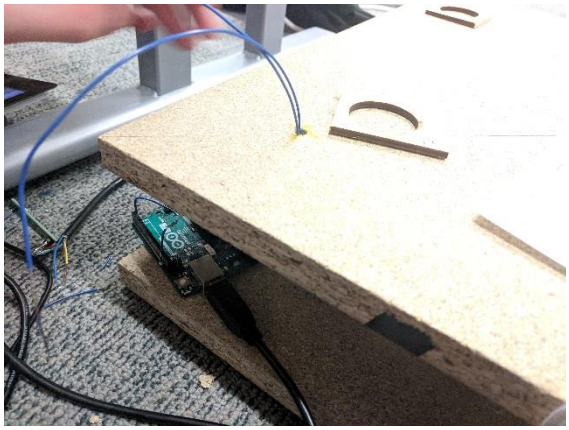
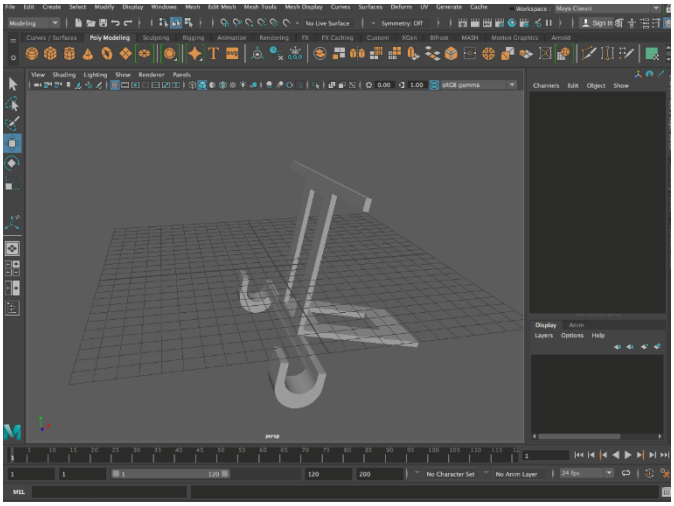
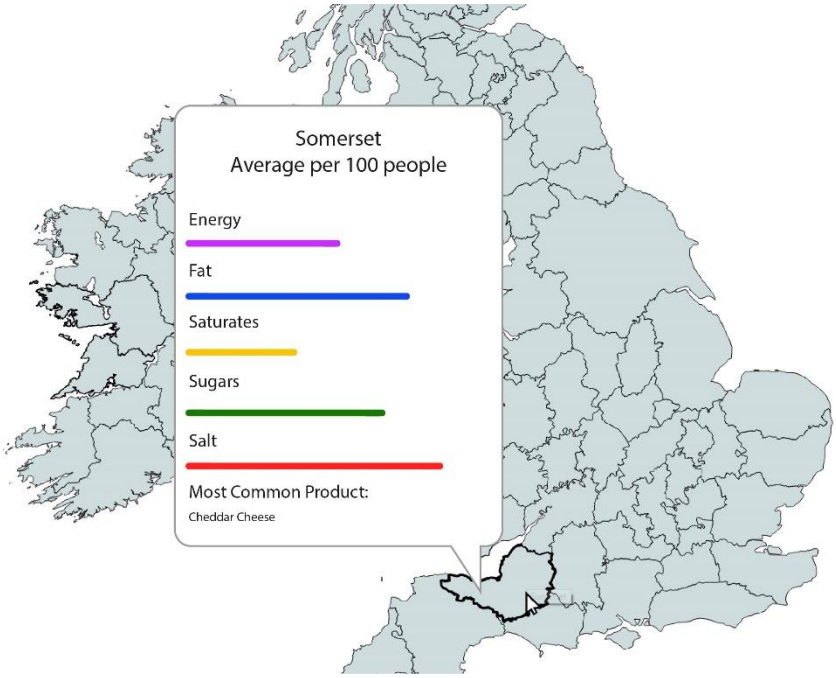


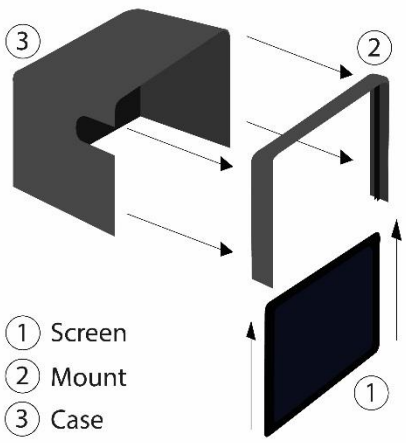

AMBIANO

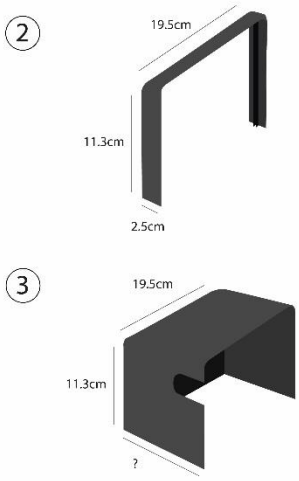

SAMSUNG
Scan Product
Inventory
Scanner
Recipe
10/01/2019 11:23
View UK Statistics
AMBIANO

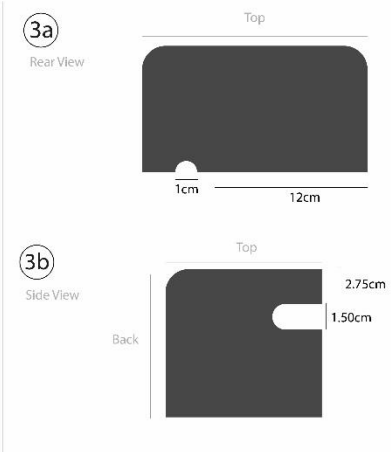

HUSKY

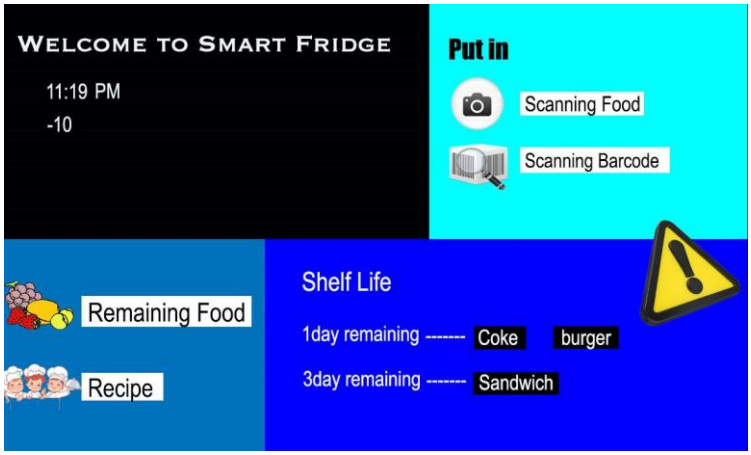



Somerset
Average per 100 people
Energy
Fat
Saturates
Sugars
Salt
Most Common Product:
Cheddar Cheese

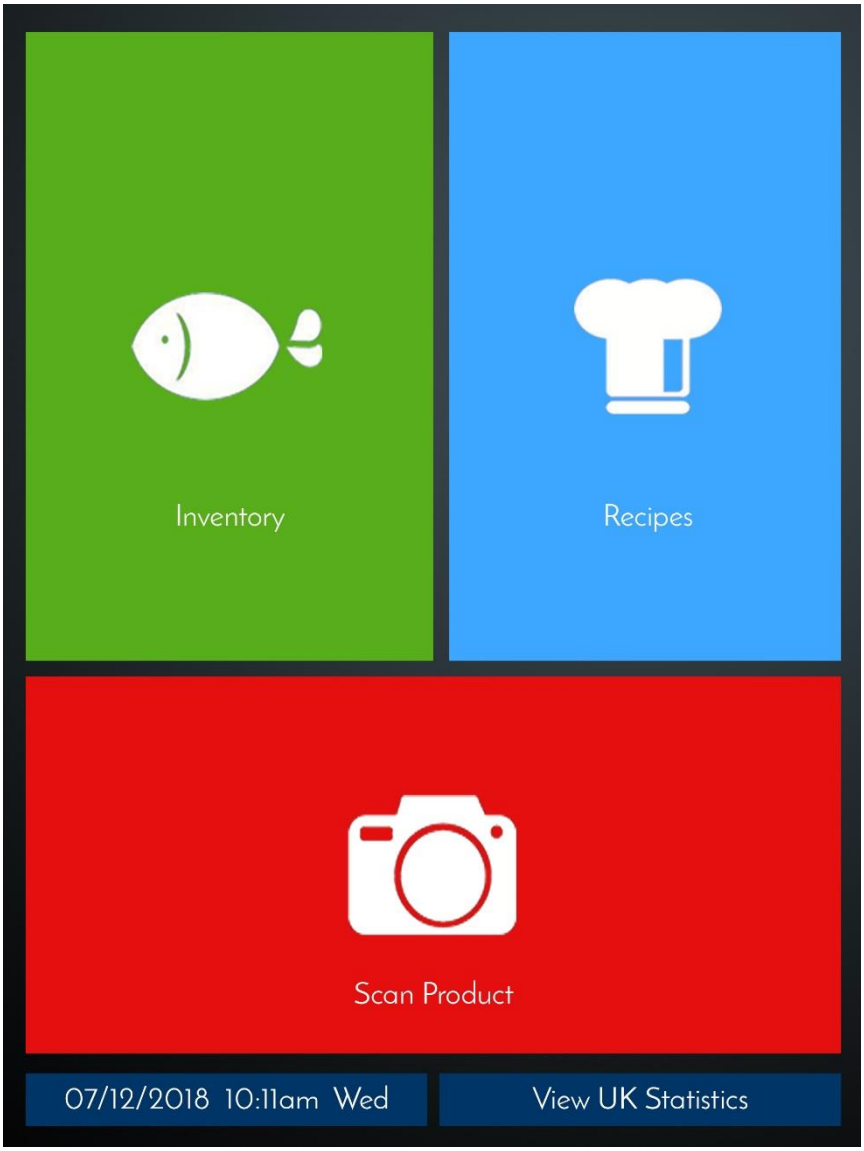

3
2
1
1 Screen
2 Mount
3 Case


2
19.5cm
11.3cm
2.5cm
3
19.5cm
11.3cm
?


3a
Rear View
Top
1cm
12cm
3b
Side View
Top
Back
2.75cm
1.50cm


WELCOME TO SMART FRIDGE
11:19 PM
-10
Put in
Scanning Food
Scanning Barcode
Remaining Food
Recipe
Shelf Life
1day remaining ------- Coke burger
3day remaining ------- Sandwich


Smart
fridge
Scan product
Food inventory
Recipe


Inventory
Recipes
Scan Product
07/12/2018 10:11am Wed
View UK Statistics

Instructions

Setup

1. Plug in the cable coming out of the back of the fridge (This should be an extension lead that had everything else connected to it). Ensure that everything has been connected inside and that there are not loose AC plugs or USB cables.
2. When everything is plugged in you can access the Raspberry Pi which is tuck into the base at the back of the Pi. (Due to functionality issues with the Raspberry Pi the system didn't run at full capacity when automatically loaded up so has to be set up manually.) To set up the Pi you need to plugin a keyboard and mouse.
    a. Open up the first terminal window and enter:
        i. "node-red -s /home/pi/.node-red/settings.js"
    b. Open up a second terminal window and enter:
        i. "cd /Desktop/Website"
        ii. "python ../simple-https-server.py"
    c. Open up the web browser and got to
        i. https://localhost:1881 *Make sure you put HTTP**S**:// as or else it will not work*
        ii. In the Node-Red window click on the button next to the node named "Weight Check". This will start running the Python script that reads the load cell data.
        iii. Also click the button next to "get ip – eth0". This runs the code that will update the server with the Raspberry Pi's current IP address. *This should run automatically on startup but is worth doing to ensure that it has worked.*
    d. Once the Pi has been set up you can unplug the keyboard and mouse and then replace the Raspberry Pi inside the base.
3. Once the Pi is setup you can switch on the tablet, open up the Chrome browser and go to https://smartfridge.crumbdesign.co.uk#1001. This will take you to a page which will then redirect you to the site being hosted by the Raspberry Pi. If you have any issues with security certificates click to say that you accept the risk.
    a. You may also need to let Chrome know that the site hosting the Websockets is safe. In order to do this simply copy the IP address in the address bar and then replace "8000" with "1881". You can then click to say you accept the risk with this site as well and when you refresh the interface site the websockets should be able to connect.

Please ensure that both the Raspberry Pi and the tablet are connected to the same network(NOT EDUROAM)

Scanning an item

1. In order to place an item in the fridge first open the fridge door. This should wake the interface up and it should then be ready to start reading data from the camera.
2. In order to scan an item just hold the item in front of the camera, you will see a popup come up counting down to when the photo will be taken.
3. There are 2 ways to scan food items
    a. You can either try holding the product in front of the camera to select it based on the brand or if it is a recognisable item such as a banana. If the system recognises it, you will be given a number of suggestions of what the system thinks you have and you can then select the right item.

    b. You can also try scanning a barcode on the product and if the barcode is recognised as belonging to a product from Tesco it will popup showing you what the product is[5].
4. If the product has been recognised you can add it to the fridge which will register that the product has been entered when it detects a positive change in weight. It will then add it to the database along with the registered weight of the item.
5. You can then either add in more of the same product, scan another item or cancel the current transaction.

Removing an item

1. To remove an item make sure the interface is working properly and then simply take the item out of the fridge.
2. When this has been registered on the Pi you should get a notification that an item has been removed and then be given a list of items of a similar weight.
3. Select the item that has been removed and then this popup should disappear and the removal should be registered.

Other tools

1. You can view items in the interface by clicking on Inventory.
2. You can view your recipe plan by clicking on Recipes.
    a. You can either view the weekly plan or all the recipes in the system by clicking the relevant buttons.
    b. If you want to add a new recipe you can do this by typing it into the search bar on the "view recipes" page.
3. If you want to view the visualisation you can do this by clicking on "View UK Statistics"

Links

Git Hub - https://github.com/ChrisSmith314/DAT602

[5] Some barcodes might be too small to be detected by the camera (Due to hardware issues with the tablet) If this is the case we have some products with larger barcodes attached for demonstration purposes.