Group I Design Brief: Smart Fridge

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1 Overview

Our product aims to tackle two grand challenges; 'Ageing society', to help people improve their diet and live longer lives and 'Artificial Intelligence and data', to use AI to prevent chronic diseases. Chronic degenerative diseases (CDDs) are estimated to cause almost 17 million premature deaths a year worldwide [1] and globally over 70% of public health spending is used to manage CDDs [1]. Even when not leading to deaths, CDDs drastically reduce an individual's quality of life [2]. Nutrition is a key contributor to an individual's health and CDDs are attributed in part to poor nutrition [1]. Unfortunately, getting proper nutrition can sometimes be a problem of access and, while enough food is produced to feed everyone, over a billion tons of food is wasted per year [4]. Much of this waste occurs before the consumer, but regardless reducing food waste at home remains important. Ultimately, improving one's diet while minimizing food waste is time intensive and challenging, which is why our product aims to simplify this task.

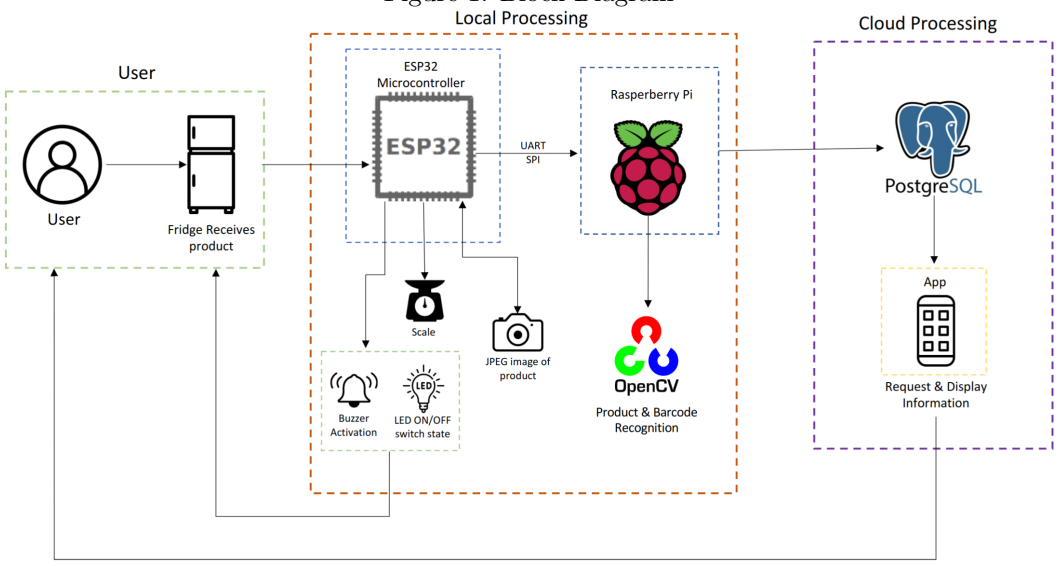
Our product is the Smart Fridge, which aims to help the user "eat better without thinking about it." It is a device which tracks the inventory of a fridge and presents the data live on an app that the user can access remotely. This means that they never have to guess what is in their fridge and will be presented with insights about the fridge's contents, such as recipe recommendations, nutritional facts, or expiry dates reminders. All this information will aid our users in living healthier lives, saving time, and preventing food waste.

The Smart Fridge stands out from other products on the market as using computer vision to automatically track the inventory has not been explored in the consumer space and other food inventory systems require more interaction from the user.

By January 2023 we will have produced a working proof of concept with documentation.

2 Technical Outline

Figure 1: Block Diagram



The Smart Fridge is designed to be unobtrusive at its core. In Figure 1 a system level overview can be seen. Alongside this diagram, a MoSCoW Table 1 was produced to showcase the priority of features. The heart of the hardware design is the ESP32 microcontroller which interfaces with a pressure sensor, an OV2640 camera module and HAL effect switches. The HAL switches detect when the fridge opens and then the OV2640 takes pictures. The camera will capture several images of the item entering or exiting the fridge. By measuring pressure, the changes in weight can be registered, helping determine if an item has been removed or added. Data is then sent to the Raspberry Pi over a serial connection. A motherboard shall be produced to distribute power to the devices, as well as connect the sensors to the ESP. If the door is left open, a buzzer will sound, reminding the user to close the door.

The Raspberry Pi acts as the bridge between the fridge and the Supabase backend (hosted on AWS). The image will be run through OpenCV to detect barcodes, and by maintaining a database of barcodes and associated items we can

identify items using the barcodes. However, for barcode-less products, OpenCV's object detection libraries will be used to identify the item. Furthermore, Optical Character Recognition (OCR) will be implemented to extract expiry dates.

The identified product and expiration data will then be sent from the Pi to the PostgreSQL server using the GraphQl API. The user will be able to view the contents of their fridge from the React App or website, as well as edit the products currently listed, in case of missing items. They will also receive notifications if items are going to expire. By looking at the contents of the fridge, recipes will be suggested, and nutritional information will be provided by plugging into existing APIs[4].

Table 1: MoSCoW

Must	**Should**	**Could**	**Wont**
Track inventory with minimal user input	Track inventory without user input		
Track Expiration date	Track Expiration Date with minimal user input	Track Expiration Date without user input	Expired Food Detection
Work in cold temperature			
Be a normal fridge feel seamless		Generate Shopping List	Suggested Shopping / Automatic Shopping
	Suggest Recipes		
	Give Nutritional Information	Make Nutritional Suggestions	Calorie / Macronutrient tracking
Website or App	Website and App		

3 Sustainability

The Smart Fridge is a product with sustainability at its core. Energy usage is kept low by using minimal power consumption components such as ESP32 and the RPi and further reduced by only processing data when the door is opened. The backend is also powered by open-source software, meaning everything could be selfhosted if our servers shut down. Electronic waste is also reduced by presenting information on the user's device instead of a dedicated screen on the fridge. Our product will also aim to achieve the UN Sustainable Development Goals by minimizing food waste, freeing up time and encouraging healthy food habits.

Goal 2 Zero Hunger: The recipes recommended by the app will help the user improve their nutrition by suggesting better meals. On top of this, food waste will also be reduced at home, by notifying users of upcoming expiration dates. On average, a person in Europe will waste 100kg of food every year [4].

Goal 3 Good Health and Well-being: A core part of maintaining a healthy lifestyle is to have the required amount of nutrition. Without these important nutrients, the likelihood of CDDs is increased. As mentioned previously, the insights provided by the app help with nutrition.

Goal 8 Decent Work and Economic Growth: Meal planning and food preparation can take a large amount of time. The user could instead use this time on themselves and relax. When stress free, people perform better at work.

Goal 12 Responsible Consumption and Production and Goal 13 Climate Action: Goal 12 and 13 are approached in a similar way for this product, since reducing waste is an example of responsible consumption and lessens the impact of climate change. In 2007 1.4 billion hectares of land were used to produce food not consumed [4]. To further reduce energy consumption, the user will be reminded to close the fridge by a buzzer.

4 Management

To ensure that the fridge is designed and constructed in a logical and efficient way, a Gantt chart has been produced showing the expected outcomes on a weekly basis (seen in Figure 2). Furthermore, Table 2 shows a list of foreseeable risks compared to the values of a risk matrix. By following these two guides, a solid proof of concept will be produced by the final presentation and report deadlines.

Figure 2: Gantt Chart

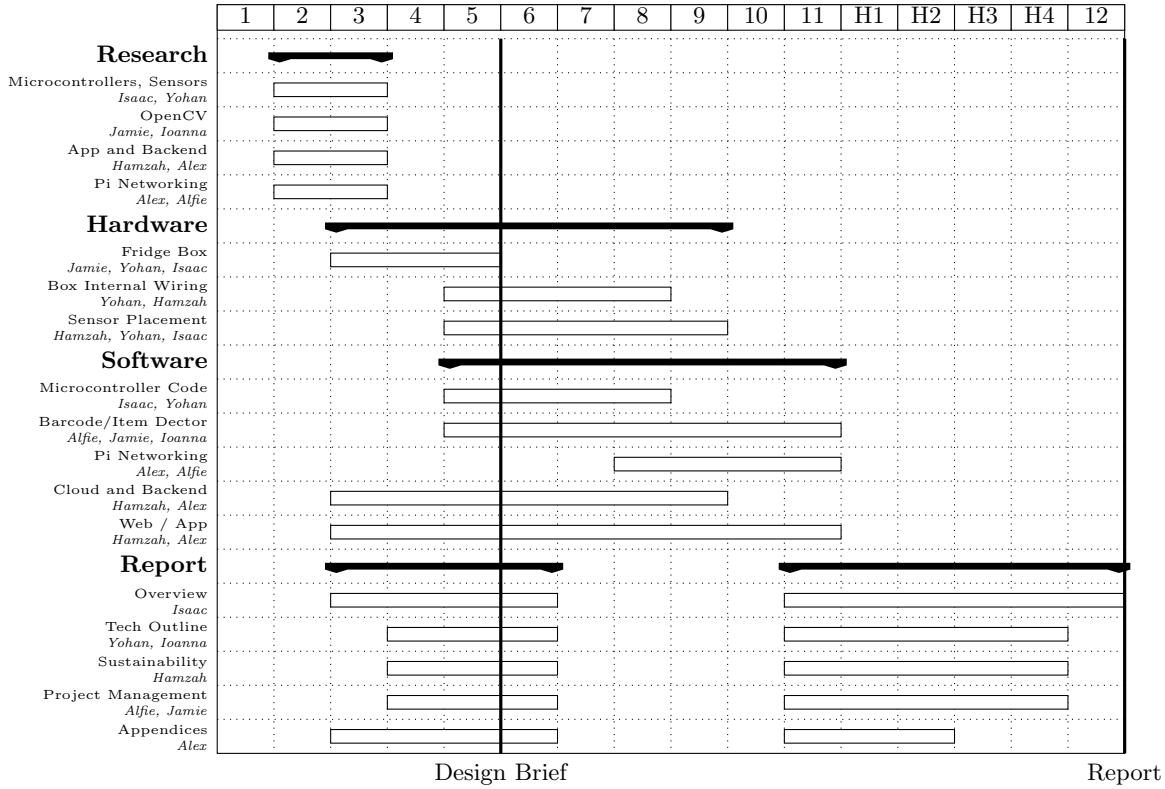


Table 2: Risk Matrix

Risk	Probablity	Impact	Risk Score	Proposed Solution	New Risk Score
Barcode not in Image	Probable	Large	16	Allow user to add item manually (app)	12
Barcode not in DB	Possible	Medium	9	Allow user to add barcode manually	4
OpenCV can't determine object	Probable	Medium	12	Allow user to add item manually (app)	6
Hardware damaged due to moisture/temp in Fridge	Probable	Severe	20	Coat hardware with protection and keep airtight	10
Finger caught in door	Rare	Small	2	Do no use excessively strong magnets	1
Issues with server	Unlikely	Large	8	Carry out regular server maintance	4

As for costing, the "Fridge" outer shell we require $2m^2$ of acrylic, approximately £30. ESP32-Cam costs £11, RPi £32 and Weight Sensor £9 [5][6][7]. Smaller components will be provided by the UG Labs.

4.1 References

[1] Di Renzo, Laura et al. \Diet, Nutrition and Chronic Degenerative Diseases."
Nutrients vol. 13,4 1372. 20 Apr. 2021, doi:10.3390/nu13041372

[2] DigitalHealth. (2022, Apr 7). Digital solutions for the prevention of chronic diseases [Online]. Available:
https://www.digitalhealth.net/2022/04/digital-solutions-for-the-prevention-of-chronic-diseases/ [Accessed 27 October 2022]

[3] Edamam-Food Database https://www.edamam.com/ [Accessed 31 October 2022]

[4] United Nations, \Food Wastage Footprints," 2013. [Online]. Available:
https://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/Factsheet_FOOD-WASTAGE.pdf. [Accessed 27 October 2022].

[5]https://thepihut.com/products/esp32-camera-module-development-board-ov2640 [Accessed 21 October 2022]

[6]https://thepihut.com/products/raspberry-pi-3-model-a-plus [Accessed 21 October 2022]

[7]https://www.amazon.co.uk/Weight-Sensor-Weighing-Arduino-Raspberry-Black/dp/B07G29TKRH/ [Accessed 21 October 2022]

SAGE-HDR (v3.6 19/10/22)

Response ID	Completion date
956732-956714-100844438	19 Oct 2022, 14:39 (BST)

1	**Applicant Name**	Isaac Baglin
1.a	**University of Surrey email address**	ib00304@surrey.ac.uk
1.b	**Level of research**	Undergraduate
1.b.i	**Please enter your University of Surrey supervisor's name. If you have more than one supervisor, enter the details of the individual who will check this submission.**	David Carey
1.b.ii	**Please enter your supervisor's University of Surrey email address. If you have more than one supervisor, enter the details of the supervisor who will check this submission.**	ib00304@surrey.ac.uk
1.c	**School or Department**	Electrical and Electronic Engineering
1.d	**Faculty**	FEPS - Faculty of Engineering and Physical Sciences

2	**Project title**	Smart Fridge

3	**Please enter a brief summary of your project and its methodology in 250 words. Please include information such as your research method/s, sample, where your research will be conducted and an overview of the aims and objectives of your research.**	Our product is a smart fridge which detects what is going in and out of the fridge using a camera to film a product entering the fridge. There is also a weight sensor which will be placed into the fridge to find the weight of the items. This data will be connected to a raspberry pi which will use opencv to identify the item by its barcode. The barcode and weight information will be stored on a server and an app will display to the user the inventory of the fridge. The project will be conducted on the university campus and we will not use peoples personal data. The aim of the project is to build a device which allows the user to keep track of their inventory so that they don't unnecessarily buy too much food therefore not wasting any food.

4	**Are you planning to join on to an existing Standard Study Protocol (SSP)? SSPs are overarching pre-approved protocols that can be used by multiple researchers investigating a similar topic area using identical methodologies. Please note, SSPs are only being used by 3 schools currently and cannot be used by other schools. Using an SSP requires permission and sign-off from the SSP owner**	NO

5	**Are you making an amendment to a project with a current University of Surrey favourable ethical opinion or approval in place?**	NO

6	**Does your research involve any animals, animal data or animal derived tissue, including cell lines?**	NO

8	**Does your project involve human participants (including human data and/or any human tissue*)?**	NO

9	**Will you be accessing any organisations, facilities or areas that may require prior permission? This includes organisations such as schools (Headteacher authorisation), care homes (manager permission), military facilities, closed online forums, private social media pages etc. This also includes using University mailing lists (admin permission). If you are unsure, please contact ethics@surrey.ac.uk.**	NO

10	**Does your project involve any type of human tissue research? This includes Human Tissue Authority (HTA) relevant, or non-relevant tissue (e.g. non-cellular such as plasma or serum), any genetic material, samples that have been previously collected, samples being collected directly from the donor or obtained from another researcher, organisation or commercial source.**	NO

11	**Does your research involve exposure of participants to any hazardous materials e.g. chemicals, pathogens, biological agents or does it involve any activities or locations that may pose a risk of harm to the researcher or participant?**	NO

12	**Will you be importing or exporting any samples (including human, animal, plant or microbial/pathogen samples) to or from the UK?**	NO

13	**Will any participant visits be taking place in the Clinical Research Building (CRB)? (involving clinical procedures; if only visiting the CRB to collect/drop-off equipment or to meet with the research team (i.e. for informed consent/discussion) select 'NO').**	NO

14	**Will you be working with any collaborators or third parties to deliver any aspect of the research project?**	NO

15	**Are you conducting a service evaluation or an audit? Or using data from a service evaluation or audit?**	NO

16	**Does your funder, collaborator or other stakeholder require a mandatory ethics review to take place at the University of Surrey?**	NO

17	**Does your research involve accessing students' results or performance data? For example, accessing SITS data.**	NO

18	**Will ANY research activity take place outside of the UK?**	NO

19	**Are you undertaking security-sensitive research, as defined in the text below?**	NO

20	**Does your project require the processing of special category1 data?**	NO

21	**Have you selected YES to one or more of the above governance risk questions on this page (Q10-Q20)?**	NO

22	**Does your project process personal data2? Processing covers any activity performed with personal data, whether digitally or using other formats, and includes contacting, collecting, recording, organising, viewing, structuring, storing, adapting, transferring, altering, retrieving, consulting, marketing, using, disclosing, transmitting, communicating, disseminating, making available, aligning, analysing, combining, restricting, erasing, archiving, destroying.**	YES
22.a	**Please ensure that your protocol provides the details on what you will collect, the purpose and how you will manage the data in your study. Alternatively, provide a separate data management plan.**	I understand that in my protocol or data management plan I will detail how personal data will be processed.
22.b	**Who is the Data Controller for your study? For Undergraduate and Postgraduate Taught students, the University of Surrey is usually the data controller.**	University of Surrey

22.c	**Will you be sharing identifiable or pseudonymised data with persons external to the University of Surrey?**	NO
22.d	**Will you be obtaining potential participant contact details from publicly available information, databases and/or other sources?**	NO
22.e	**On completion of your project, do you intend to retain personal information for future research purposes?**	NO
22.f	**Please ensure that you adhere to the data protection guidance**	I am an UG or PGT student and I understand that I have to abide by the 'Data protection and security for undergraduate and postgraduate taught student projects' policy found at https://research.surrey.ac.uk/ethics

23	**Are you using a platform, system or server external to the University approved platforms (Outside of Microsoft Office programs, Sharepoint or OneDrive)?**	YES
23.a	**Please list the platforms, systems and/or servers that you are using in your research.**	AWS

23.b	**Are you collecting personal data via a platform, system or server external to the University approved platforms?**	NO
23.c	**Are you collecting special category data3 via a platform, system or server external to the Unviersity approved platforms?**	NO
23.d	**Are you collecting audio and/or video recordings?**	NO
23.e	**You must delete all research data including personal information from the external platform, system or server you are using upon completion of your research. Students: Your supervisor must support the use of the external platform, system or server and must agree to taking on the responsibility to ensure you delete the data upon completion of your study.**	Students: My supervisor has approved the platform, system or server I am using and I will delete all data from external platforms, systems or servers used upon completion of my research and my supervisor agrees to take on the responsibility to ensure this.

24	**Does your research involve any of the above statements? If yes, your study may require external ethical review or regulatory approval**	NO

25	**Does your research involve any of the above? If yes, your study may require external ethical review or regulatory approval**	NO

26	**Does your project require ethics review from another institution? (For example: collaborative research with the NHS REC, the Ministry of Defence, the Ministry of Justice and/or other universities in the UK or abroad)**	NO

27	**Does your research involve any of the following individuals or higher-risk methodologies? Select all that apply or select 'not applicable' if no options apply to your research. Please note: the UEC reviewers may deem the nature of the research of certain high risk projects unsuitable to be undertaken by undergraduate students**	NOT APPLICABLE - none of the above high-risk options apply to my research.

28	**Does your research involve any of the following individuals or medium-risk methodologies? Select all that apply or select 'not applicable' if no options apply to your research.**	NOT APPLICABLE - none of the above medium-risk options apply to my research.

29	**Does your research involve any of the following individuals or lower-risk methodologies? Select all that apply or select 'not applicable' if no options apply to your research.**	NOT APPLICABLE - none of the above lower-risk options apply to my research.

30	**Declarations**	• I confirm that I have read the University's Code on Good Research Practice and ethics policy and all relevant professional and regulatory guidelines applicable to my research and that I will conduct my research in accordance with these. • I confirm that I have provided accurate and complete information regarding my research project • I understand that a false declaration or providing misleading information will be considered potential research misconduct resulting in a formal investigation and subsequent disciplinary proceedings liable for reporting to external bodies • I understand that if my answers to this form have indicated that I must submit an ethics and governance application, that I will NOT commence my research until a Favourable Ethical Opinion is issued and governance checks are cleared. If I do so, this will be considered research misconduct and result in a formal investigation and subsequent disciplinary proceedings liable for reporting to external bodies. • I understand that if I have selected 'YES' on any governance risk questions and/or have selected any options on the higher, medium or lower risk criteria then I MUST submit an ethics and governance application (EGA) for review before conducting any research. If I have NOT selected any governance risks or selected any of the higher, medium or lower ethical risk criteria, I understand I can proceed with my research without review and

		acknowledge that my SAGE answers and research project will be subject to audit and inspection by the RIGO team at a later date to check compliance.

31	**If I am conducting research as a student:**	• I confirm that I have discussed my responses to the questions on this form with my supervisor to ensure they are correct. • I confirm that if I am handling any information that can identify people, such as names, email addresses or audio/video recordings and images, I will adhere to the security requirements set out in the relevant Data Protection Policy

EEE3035 Engineering Professional Studies

Semester 1 2022/23 - Year 3 Group Project

Equality Impact Assessment

Question	Response
1. Name of the project being assessed; include the group letter	Smart Fridge Group I
2. Summary of aims and objectives of the project	A system of cameras and sensors to automatically detect what items are being placed into and taken from the fridge (alongside collection possible other data about the items such as expiration data, weight, etc). This information is then presented to the user, alongside recommendations such as recipes or shopping lists.
3. What involvement and consultation has been done in relation to this project? (e.g. with relevant groups and stakeholders)	There was a brief discussion with the project supervisor to get approval for the development of the smart fridge idea. The members of the group received training to use the University of surrey makerspace to develop the project.
4. Who is affected by the project?	Only the users of the Smart Fridge
5. What are the arrangements for monitoring and reviewing the actual impact of the project?	We will consult the project supervisor throughout the project to ensure that we minimize the impact of the project.

Protected Characteristic Group	Is there a potential for positive or negative impact?	Please explain and give examples of any evidence/data used	Action to address negative impact (e.g. adjustment to the project)

Disability	Negative Impact Positive Impact Negative Impact	People with motor problems would not be able to use the Fridge. People with vision impairments might find it easier to view the contents of their fridge on an app rather than need to look closely at labels. People with allergies or intolerances getting recommended recipes which use a food they are allergic to.	There are 3rd party products available which make it easier for disabled users to open fridges and place items within it such as extended handles for the door. On the app we can promote these products to help reduce this negative impact whilst also potentially gaining additional profit through advertisements. Allow users to input which products they are allergic to, so they aren't promoted to them.
Gender reassignment	No known impact		
Marriage or civil partnership	No known impact		
Pregnancy and maternity	No known impact		
Race	No known impact		
Religion or belief	Negative impact	In some religions eating specific types of food such as pork is against their belief. Therefore, if our recipes promote these products, the user might feel discriminated against by the product	Allow the user to manually block recommendations for specific types of food that is prohibited by their religion.
Sexual orientation	No known impact		
Sex (gender)	No known impact		
Age	Positive Impact	Elderly people are more susceptible to memory loss issues,	

		therefore a product which automatically keeps inventory for them as well as reminds them when something is out of date will positively impact them.	

Evaluation: On the basis of your responses above, please complete the table below with one member of the group signing off the form.

Question	**Explanation / justification**	
Is it possible the proposed project could discriminate or unfairly disadvantage people?	If we address the potential negative impacts as above, our product will not discriminate or unfairly disadvantage people.	
Final Decision	**Tick the relevant box**	**Include any explanation / justification required**
1. No barriers identified, therefore project will proceed.	X	Any potential bias of the customer has been considered and will be addressed when building the product.
2. You can decide to stop the project because the data shows bias towards one or more groups.		
3. You can adapt or change the project in a way which you think will eliminate the bias.		
4. Barriers and impact identified, however having considered all the available options carefully, there appears to be no other proportionate ways to achieve the aim of the project. Therefore, proceed with caution with the activity knowing it may favour some people less than others, providing justification for this decision.		

Confirm that this EIA will be included in the project report.	Yes
Date Completed	18/10/2022
Review date (before the final project report)	22/10/2022

EEE3035 Engineering Professional Studies

Semester 1 2022/23 - Year 3 Group Project

DATA MANAGEMENT PLAN

PROJECT TITLE: Smart Fridge

Group Letter and Group Members: Group I
Isaac Baglin
James Gomez
Hamzah Hasnain
Yohan John
Ioanna Papanikolaou
Alexandre Symeonidis-Herzig
Alfie Walding

Project Description (5 lines max):
A system of cameras and sensors to automatically detect what items are being placed into and taken from the fridge (alongside possibly collecting other data about the items such as expiration date, weight, etc.). This information is then presented to the user, alongside recommendations such as recipes or shopping lists.

1. DATA COLLECTION
What data will you collect or create?

Data produced from this project will fall into several categories:

1. Inventory list of items currently in fridge
    - Item properties such as weight, quantity, expiration, etc.
2. Database of barcodes and matching items
3. Items from recipes or shopping list APIs
    - This data will not be stored, only generated for the user on demand

How will the data be collected or created?

A camera will be used with computer vision software to identify what item is being placed into the fridge. It will scan for a barcode and store the inventory on a database, the camera will also collect more information such as expiry dates if possible. The weight of the item placed in the fridge will also be recorded. The user will be able to interact with this data via a webpage/app, allowing for correction in the inventory and adding secondary data such as expiration dates.

2. DOCUMENTATION AND METADATA
What documentation and metadata will accompany the data?

The data is stored using PostgreSQL, and all the columns will have titles and associated value types (i.e., quantity will be stored as integers and item IDs as UUID). Each item, barcode and

user will also have a uniquely generated UUID. Information such as when an item or barcode was added will also be stored.

3. ETHICS AND LEGAL COMPLIANCE

How will you manage any ethical issues?

When the camera captures the item as it enters the fridge, the user's hand might be in the frame. This might come under personal data therefore we will process the image locally on the fridge. This means that the computer vision software in the fridge will process the image and scan only for the barcode. Once this is done the barcode information will be sent to the server not the image. The image is then deleted and never sent on to the server. At no point will we have access to this personal data. Also, non-food items such as medicines will not be recorded by the server as we will not add these barcodes to the database (nor allow users to manually add them).

How will you manage copyright and Intellectual Property Rights (IPR) issues?

The API's, datasets and libraries used in the Arduino IDE, OpenCV and the server will be open source therefore we will not encounter any IPR and copyright issues as we are not using other companies' private data.

4. STORAGE AND BACKUP

How will the data be stored and backed up during the research?

Data will be processed locally on raspberry pi and then stored on Supabase's servers (which uses AWS). Supabase backups the data regularly and ensures that the data is secure.

How will you manage access and security?

Supabase's PostgresDB API only gives users access to their own data. This is secured behind an OAUTH sign-in provided by Supabase. Currently admin account can view all the data, but hashing can be employed to help protect privacy.

5. SELECTION AND PRESERVATION

Which data are of long-term value and should be retained, shared, and/or preserved?

We do not intend to keep any of the data long term, and it is the responsibility of the user to delete and edit the data from the database via the app/website.

What is the long-term preservation plan for the dataset?

The images will be deleted from the pi as soon as the barcode has been detected. This should feel instantaneous to the user. The barcode and weight data are then sent to the server where the user can then edit their inventory as they please. Given that we are dealing with food, the product will be removed by the user once it has been removed from the fridge or manually by the user. This means that each piece of data collected will be removed within a couple of weeks of it being added to the server. Therefore, individual pieces of data will not be stored long term. Supabase's DB backups will ensure that the data is protected and not lost even if it is stored longer than expected.

6. DATA SHARING

How will you share the data?

We will not share data with other researchers or customers. The data will be processed locally on the device and then sent to the server where the user only has access to it on the app. The data will be sent via the internet from the raspberry pi in the fridge to the server. Once the product is set up logins will need to be considered so that people can access their data.

If the users wish to use third-party API for information such as nutritional facts or recipe suggestions, they will opt into this service, and we will share the data with those API providers after removing the unique user ID from the data.

Are any restrictions on data sharing required?

As mentioned, any data sharing will be fully opt-in from the users. Data such as usernames, passwords and emails will never be shared (and will all remain fictional during this project).

7. RESPONSIBILITIES AND RESOURCES

Who will be responsible for data management?

The Project Group will be responsible for the collection, processing, and delivery of the data to the server. And the third-party cloud provider, Supabase, will be responsible for the security and protection of the data on the server.

What resources will you require to deliver your plan?

Supabase provides limited free cloud hosting using AWS, meaning no additional resources are required. If this cloud hosting runs out, or proves insufficient, resources may be required to host the cloud infrastructure.

A Meeting Notes

A.1 Week 2: Meeting on 3/10/2022 at 3pm

- Every member showed up for an hour-long meeting in the library group study room.
- Discussed the project specification and overview of the project and as a group we brainstormed ideas.
- Decided to use Notion as a file sharing tool. Ioanna took the meeting notes.
- Our ideas were a facial recognition app for driverless vehicles, skin disease detector, a carbon footprint calculator, and a computer vision fridge.
- Our aim before the next meeting was to research the feasibility of each idea and pick an idea.

A.2 Week 3: Meeting on 10/10/2022 at 1pm

- Every member showed up for an hour-long meeting in the library group study room.
- Group unanimously agreed on the smart fridge idea. Alexandre took the meeting notes.
- We drafted a Moscow graph to agree what features were essential for the operation of the product.
- Isaac and Yohan agreed to work on the microprocessor and module side of the hardware team and Alfie, Ioanna and Jaime agreed to work on the raspberry pi together. This includes the OpenCV code and the design of the box. Alexandre and Hamzah will both work on the server and website side of the project using AWS.
- Each group was assigned to research what was needed in each of their sections.

A.3 Week 3: Meeting on 12/10/2022 at 2pm

- Everyone Turned Up (6 in person and 1 online (due to Covid)) in the maker space. Isaac took the meeting notes.
- As a group we compared what research we had done up until that point and agreed on what components we were using.
- We also built a block diagram, so we knew what dependencies each team had on another.
- The design brief was discussed, and the sections were split between the members. Isaac was assigned to the overview, Yohan and Ioanna were assigned to the technical overview, Hamzah was assigned to the sustainability section, Jamie and Alfie did the Project management and Alexandre was responsible for the appendices.

A.4 Week 4: Meeting on 17/10/2022 at 2pm

- This was an online meeting to talk briefly about the progress of the design brief.
- Parts of the appendices and technical outline were discussed as a group so that we were all on the same page when completing our own sections.

A.5 Week 4: Meeting on 19/10/2022 at 2pm

- This meeting was held in the makerspace and the notes were taken by Isaac.
- Alexandre and Hamzah should demonstrations of the first version of their server and website on AWS.
- Jaime presented an early design for the box and Ioanna and Alfie discussed the OpenCV and the raspberry pi's compatibility with the esp32 microprocessor. It was decided that we would use serial communication and send the image data as a base64 string.
- Isaac and Yohan started to place in orders for the components needed for the project.
- We agreed to add our sections of the report to a shared file by Friday 21st of October.
- Alfie, Ioanna and Jaime started coding for the OpenCV, and Isaac and Yohan started to test some of the components which were already available in the makerspace on breadboard.
- Alexandre and Hamzah continued refining the web design and server.
- By the end of the week the weight sensor and HAL sensor were working on breadboard with the correct code outputting the expected results.