**LUMO | A smart home solution**

# TACKLING HOUSEHOLD FOODWASTE IN AUSTRALIA

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# Executive Summary

This paper addresses the issue of household food waste in Australia and its contribution to global warming.
Currently, Australia wastes 250 years' worth of food each year and one-third of it comes from households. A number of reasons causes Australian residents to waste food including:

- Lack of visibility in fridge
- Busy lifestyle
- Health concerns of leftovers

By 2030, this issue will grow larger as the population of Australia increases. The demand of will food rise is likely to rise proportionately to the growth of the population and more food waste will occur.

To address this issue, we propose LUMO. It is a smart home solution initiative developed by team Boundless & Beyond and incorporates deep technology from ATTRACT.
It comprises of two products:

- MyView - A small roaming robotic.
- MyFood - A personalised, adaptive and responsive meal planning software.

The solution will assist with meal planning and support Australian residents to consume their food before expiration.

We envision this solution to be used across Australian Households and will support society to adopt a more sustainable lifestyle by becoming more responsible and mindful of their food management.

# Meet the Team

**Gab**
Industrial Designer

Gab holds a bachelor's degree in Industrial Design from the University of the Philippines - College of Fine Arts. Specializing in Point-of-Sale manufacturing, he has extensive experience in technical and conceptual product designing for brand clients. Proficient in both 2D and 3D software, Gab approaches problem solving with an open and creative mindset.

**Nishita Chauhan**
Communication Designer

Nishita Chauhan is a dedicated individual currently pursuing a Master's degree in Design, with a specialization in communication design, particularly focused on lettering and typography. She is adaptable, self-motivated and a down-to-earth individual with a creative mind. Nishita's eagerness to learn and consistently improve her skills reflects her commitment to personal and professional growth.

**Ringo**
Communication Designer
www.linkedin.com/in/ringo-ma

Ringo is a visual communication designer with a completed bachelor's degree in design. He is adept at creating various designs including publication, logos, systems and editing videos. With a flexible and creative mindset, Ringo is proficient in creating radical and innovative ideas to problems.

# THE SCOPE

This project is under the Challenge Based Innovation (CBI) A3 program.

CBI A3 is a global student program initiated by the Design Factory Melbourne. The program is partnered with Ideasquare CERN and ATTRACT to explore the applications of deep technology from CERN, ATTRACT and Centre Dark Matter to address societal needs for 2030. Their aim is to nurture the next generation of creative innovators. (CBI DFM, 2024)

Under this project, there were three requirements:

1. Identify a major issue relating to the Sustainable Development Goal (SDG) 12 - responsible consumption and production and design a radical and innovative solution.
2. Incorporate deep technology from CERN, ATTRACT or Centre Dark Matter in the solution to address the major issue.
3. Design the solution for the future of 2030 and beyond.

Our team identified a number of major issues in Australia including disposal of fast fashion, disposal of e-waste and the degradation of agricultural soil. By exploring and examining the numerous issues impacting Australia, the team selected to address household food waste.

**Partnered with**

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12
RESPONSIBLE
CONSUMPTION
AND PRODUCTION

## Each year, Australia wastes

# 250 YEARS

## worth of food

### Food waste

Each year, Australia wastes 7.6 million tons of food and amounts to one third of the country's food production (CSIRO 2023).

This is enough to feed the entire nation for 250 years (See Appendix F.1 Subtopic: Food waste in years) and costs the Australian economy $20 billion dollars (DCCEW 2017 p. 6).

### From households to landfill

At least 1/3 of Australia's total Food waste goes to landfill (Food Innovation Australia 2023). The breakdown of organic material such as food releases methane gas which is 28 to 36 times more potent than c02 (Queensland Government 2024).

### Contributing to
## Global Warming

The release of methane can accelerate the process of global warming.
As the climate rises, this can increase the frequency of extreme weather events including droughts (Naughtin et al. 2022, p. 10).

This can amplify global food insecurity as agricultural production is affected causing food shortages (CSIRO Futures 2023, p. 2) and increasing food prices (Australian Academy of Science 2021).

## But why does it happen?

Lack of fridge visibility

Health concerns of leftovers

Not wanting to eat leftovers

Food Preference

Overcooking Portion sizes

# 1/3

**of Australia's food waste comes from households**

Busy scehdule

Confusion of the expiry dates

## Household Food waste

One of the biggest sources of food waste comes from households, which accounts to one-third of Australia's total food waste (Foodbank 2023). Household food waste occurs for a variety of reasons, which is supported through our survey of 35 participants and secondary reseach. This includes:

- ***Disliking Leftovers***
  - Some Australian residents find leftovers unappealing, describing them as 'a bit gross' (ABC, 2023). This behaviour is echoed in Aloysius et al.'s (2023, p. 5) review on food waste behaviors, where leftovers are often avoided due to perceptions of them being unclean and of lower quality in taste and appearance.
- ***Health concerns of leftover***
  - Australian residents are unsure if leftovers are safe to reheat (Foodbank 2023). Additionally, these consumers may have the belief that leftovers are unhealthy and fear getting sick (Aloysius et al. 2023, p. 5)
- ***Overcooking portion sizes*** (Haque et al. 2022, p. 3795)
- ***Food preferences***
  - Eating the same meal can be boring and lead to the behaviour of wasting food (Aloysius et al 2023)
- ***Busy lifestyle***
  - Busy lifestyles can influence Australians to have poorer food handling practices and constrained grocery choices due to time (CSIRO 2023).
- ***Confusion between expiry and best-before dates*** (Foodbank 2023)
- ***Lack of visibility in fridges***
  - Poor visibility in the fridge often causes food items to be forgotten, resulting in spoilage and waste (Anananda et al. 2021).
- ***Allowing food to become expired***
    - From our research, the most common reason (46%) of discarding food was due to the food becoming expired or spoiled. There was no strong commonality of the reasons for allowing food to become spoiled as there was a variety of challenges our participants faced including:
      - *"Ingredients going bad or not lasting long enough"*
      - *"Too busy"*
      - *"not having meal preparation leads to buying takeaway food or eating out"*

From our research Food waste is primarily caused by poor behaviors and practices in managing food. To reduce household food waste, a solution is needed to address and improve these current food management behaviors and practices.

# In the future

# 2030

Despite global efforts to address climate change, the impact of extreme weather events on agricultural production and food transportation has intensified. This has made it more difficult for the population to prepare their meals due to higher food prices and food shortages.

Australia has made significant progress in establishing sustainable systems, including improved food waste management. However, the country is struggling to cope with the escalating volume of food waste as households seek to adjust to a changing landscape of more expensive food options.

# FOGO

## 3-BIN SYSTEM IMPLEMENTED ACROSS AUSTRALIA

One of the biggest sources of food waste comes from households, which accounts to one-third of Australia's total food waste.

# CROPS DYING BECAUSE CLIMATE CHANGE

# From now...

**FOGO Implemented nation-wide**

**Rising cost of living expenses**

# A STEEPLE Analysis

**Social**

The Australian population is expected to increase to reach 34.3 and 45.9 million people by 2071 (ABS 2023). The increasing population is projected to increase food demand, whereby the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) (2023) claims the "Australia's household food consumption expenditure increases from $92 billion in 2016-17 to $165 billion in 2049-50, an average increase of 1.8 per cent a year".

**Technology**

Australia may become a leader in green hydrogen by 2030. CSIRO (2022) claims Australia has the potential to become a leading producer and exporter of green hydrogen. This may indicate that applied technology to reduce food waste may be powered by green hydrogen. However, significant infrastructure will be needed to realise the potential (ibid.).

**Environmental**

As a result of global warming, Australia is likely to experience more extreme weathers and temperatures (CSIRO 2022) by 2030. This will likely affect agricultural production and impact food prices.

**Food shortages due to reduced agricultural production**

**Agricultural production suffering from global warming impacts**

# ...to 2030

**Economic**

By 2030, low income and high living expenses are predicted to remain the primary drivers of food insecurity in Australia. Currently an estimated 21% of Australians experience disrupted eating habits and reduced intake (CSIRO 2023). For instance, financial housing stress is anticipated to affect 17% of Australians, with households likely to spend 30–50% of their income on housing costs, a significant increase from 14% in 1994–95 (CSIRO 2022).

**Political**

Currently, the Australian government are carrying out strategies to improve the health and wellbeing of Australian residents. These initiatives include Australia's National Preventive Health strategy and National Obesity Strategy (CSIRO 2023). By 2030, its expected that these strategies may shift social attitudes towards food by promoting healthier eating habits and educating consumers about food sustainability.

**Legal**

Victoria implemented the Circular Economy (Waste Reduction and Recycling) Act 2021 to regulate the state's waste and recycling sector, aiming for more recycling, less waste, and landfill (Victoria State Government 2022). This is expected to lead to improved infrastructure and support for food waste systems by 2030

**Ethical**

By 2030, its expected that there may be issues to introduce A.I. to be positively received in Australia. Currently, implementation of A.I systems to reduce food waste in the community may not be well accepted as 68% of Australians do not trust A.I.. However, 71%-81% would be willing if there was an ethics mechanism in place (CSIRO 2022).


In light all these efforts to improve Australia's fight on food waste, we introduce, **LUMO!**

**LUMO is an initiative mainly designed to help Australian households reduce food waste through effective meal planning and education on how to better handle and store food products in their refrigerators.**

With LUMO, we are proposing a mini-robot companion called MyView that automatically moves around inside the fridge to scan and monitor the quality and quantity of food items. Along with MyView, we also introduce MyFood, a smart software companion that uses artificial intelligence to analyse the user's food preferences and recommends optimal meal plans based on the items you have in stock, ensuring that all food is used efficiently and minimising waste. Our solution includes assisting families in improving their food consumption through efficient meal planning, expiration management, and personalised recipe recommendations. Moreover, these two solutions will help support stock management of food in the fridge and ensure a healthy intake of household members.


MYVIEW

PRODUCE TRACKING

MEAL PLANNING ASSIST

SCANNING CAPABILITIES

# MYVIEW

MyView is a device that scans the quality of fresh food and leftovers stored in your fridge. It can detect harmful bacteria, contamination, and other harmful particles on items like fresh produce to prevent unwanted consumption. Additionally, MyView provides real-time quantity information, helping users track their groceries more effectively and improve their food stock management and grocery purchasing habits.

It has a small, compact, and low-profile design that allows it to effortlessly navigate around obstacles inside the fridge. With wheels that mimic the feet of a gecko, it can climb over vertical surfaces and stick upside-down. Equipped with a 360-degree rotation view mechanism, MyView can scan the quality status of food items from any angle and spot within the fridge.


LUMO

# ATTRACT TECHN

We propose combining two cutting-edge technologies from ATTRACT called VISIR2 and HYLIGHT, into a single, enhanced device installed inside MyView. This device integrates Visible (VIS) and Shortwave Infrared (SWIR) spectral ranges with hyperspectral cell analysis, functioning as a vision camera, an infrared sensor, and a bacteria identifier adapted into a singular biosensor component.

# VISIR2


Figure 1. High resolution imaging objects on and around roadway surfaces in high detail (Kueh 2020).

VISIR2 is a dual-camera device that uses Visible imaging (VIS) which gives vision like a camera and Shortwave infrared (SWIR) sensor that can collect valuable information through reflection of light gathered from object compositions (ATTRACT 2022). The functionalities of the VIS-SWIR spectral ranges can be applied in various fields, including automotive, industrial automation, and environmental conservation; for example, it can be used for early detection of wildfires and enhancing safety features in vehicles by detecting water and ice on the road (ATTRACT 2022). This imaging technology can also be used for product sorting, food quality control and moisture detection in food processing companies (Grodzki, 2020 & Kowa Optimed, 2024)

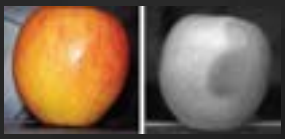



Figure 2. The same apple with visible vs. SWIR lighting and sensors (Photonics Media 2024).


Figure 3. Ability to see the levels in plastic bottles, even those opaque to the eye (Photonics Media 2024).

We envision using VISIR2's high resolution vision imagery to see the form and colour of all food items that are kept in the fridge and its infrared sensor to identify the amount of food through plastic containers, spot contamination and moisture that indicates mould or bruises in fresh items such as fruits and vegetables.

# OLOGY

# HYLIGHT

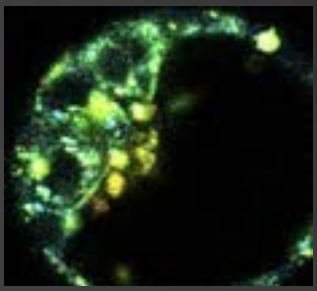


Figure 4. Embryo selection through natural auto-fluorescence of key cellular compounds (ATTRACT, 2022).

Whereas HYLIGHT, is a non-invasive diagnostic device that uses hyperspectral analysis and artificial intelligence to classify the healthiness of human embryos (ATTRACT 2022). It uses the natural auto-fluorescence or light emitted by cellular compounds to classify metabolic profiles of embryos (ATTRACT 2022). which is light that is absorbed and emitted by organisms. This new approach is a safe, non-invasive method that minimises damage to embryos, assisting medical experts in helping couples become parents through vitro fertilisation (IVF) techniques (ATTRACT 2022). HYLIGHT is capable of detecting multicellular organisms like embryos it can also detect unicellular organisms such as bacteria and viruses.

Figure 4. Image of a control (two left panels) and a metabollically stressed embryo (two right panels). (HYLIGHT 2022)

We imagine HYLIGHT's hyperspectral imaging can be used to detect any foreign substances, bacterias, viruses and harmful diseases in ugly looking fruits and vegetables, most especially in soon-to-expire products to avoid the risk of using bad quality ingredients and spoiled food.

## SCANNING CAPABILITIES

Having all these capabilities by VISIR2 and HYLIGHT and combining it into MyView, it will offer real-time visual of the current stock inside the fridge to allow users to remotely identify items they need for their next grocery shopping trip. It can also scan through plastic and glass materials such as food containers and bottles that are opaque or clear to assess volume and quality, facilitating better food stock and ingredient management. Furthermore, MyView detects harmful bacteria and early signs of moisture that can lead to mould or spoilage of food items.

**VISIR2**

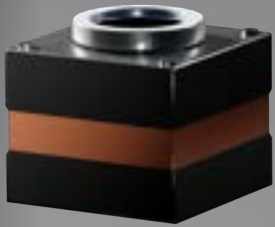
**HYLIGHT**

**Normal Imaging**

**Short-Infrared Sensor**

**Hyperspectral Analysis**

# THE CAMERA



**3-in-1 Biosensor Camera**
(Image shown is for illustration purposes only.)

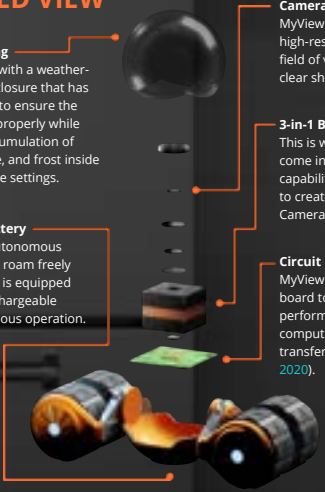
The main body of MyView will house a 3-in-1 biosensor camera equipped with normal vision, an infrared sensor, and autofluorescence capabilities. We envision this device to be compact, offering a wide field of view, the ability to focus on short distances, and night vision.

The casing of MyView is made from Polytetrafluoroethylene (PTFE) and Perfluoroalkoxy (PFA) plastics. These low-temperature thermoplastics are electrically and chemically resistant, making them ideal for operating in temperatures ranging from -250°C to 250°C (Dechengwang Fluoropolymer 2023).

# EXPLODED VIEW

**Dome Glass Casing**
MyView is capped with a weather-rated dome glass closure that has tight seal features to ensure the camera functions properly while preventing the accumulation of humidity, moisture, and frost inside in cold temperature settings.

**Rechargeable Battery**
As MyView is an autonomous device designed to roam freely inside the fridge, it is equipped with a wireless rechargeable battery for continuous operation.



**Camera Lens**
MyView's camera lens captures high-resolution imagery with a wide field of view and can even collect clear short distances captures.

**3-in-1 Biosensor Camera**
This is where ATTRACT technologies come into play, combining the capabilities of VISIR2 and HYLIGHT to create the 3-in-1 Biosensor Camera for MyView.

**Circuit Board**
MyView will come with a circuit board to help MyView electronically perform essential tasks like computing, communicating, and transferring data (Imagineering Inc 2020).

(Image shown is for illustration purposes only.)

# MOVEMENT & MECHANISMS

**Gecko Adhesive**
MyView's wheels incorporate adhesive technology that replicates the toes of a gecko, enabling it to dynamically move, climb, and stick to surfaces inside the fridge. This adhesive creates a strong grip allowing MyView to effortlessly carry its own weight.

**360 View Rotation**
MyView can scan the quality status of food items from any angle and spot within the fridge by the help of its 360-degree rotation view mechanism.

**Autonomous Compact Device**
MyView's small, compact, and low-profile design allows it to effortlessly navigate around obstacles inside the fridge. It is equipped with short-range proximity sensors to detect the presence and absence of objects around it (Domi 2023), ensuring smooth and efficient movement.

# GECKO ADHESIVE

Figure 5. Gecko Toe Surface (Tian, 2013).

This gecko adhesive replicates the gecko's feet which have thousands of tiny hair-like structures called spatulae. These spatulae allow geckos to create temporary molecular attraction called the Van der Waals forces (Tian, 2013). This attractive force allows MyView to support its own weight when interacting to different surfaces. Below are examples of existing technology that uses the concept of a gecko feet.

Figure 4.
**Gecko Robotics**
Gecko's robots climbing pipelines, boilers, tanks, ship hulls, and much more for manufacturing and maintenance purposes (Roof 2023).

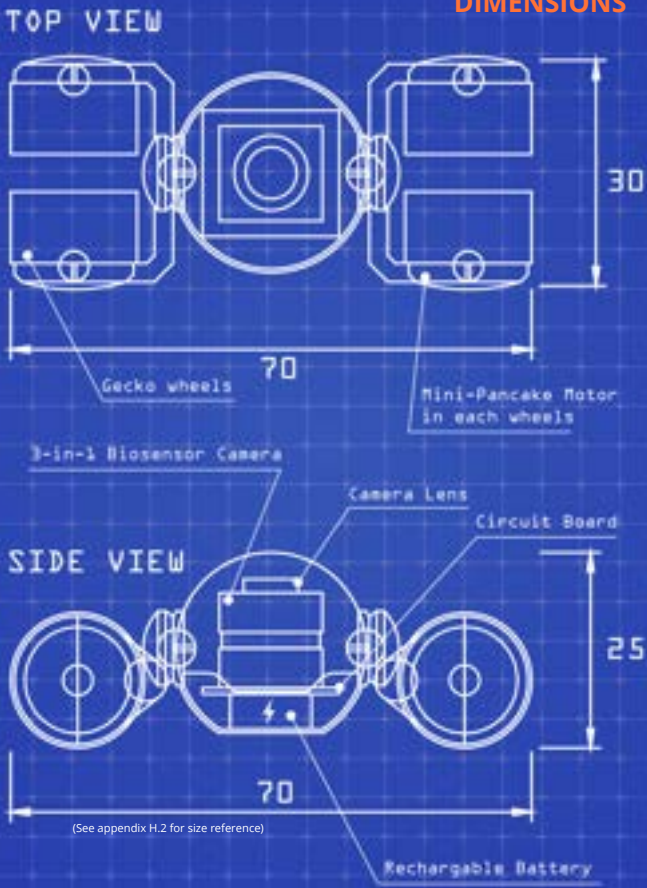
Figure 5.
**NASA's LEMUR**
Robot using special gripping technology that has helped lead to a series of new, off-roading robots that can explore other worlds (NASA & JPL-Caltech 2019).

# MATERIALS & COMPONENTS

**Durable & Waterproof**
We envision MyView to be built with durable Polytetrafluoroethylene (PTFE) and Perfluoroalkoxy (PFA) plastics, enabling it to withstand cold temperatures and resist moisture and chemicals from affecting its electrical components (Dechengwang Fluoropolymer 2023).

**Lightweight**
It should also be lightweight enough to ensure that the wheels, equipped with a gecko adhesive mechanism, can effortlessly carry their own weight and adhere to various surfaces with ease.

# DIMENSIONS




(See appendix H.2 for size reference)

(Image shown is for illustration purposes only.)

# ADDITIONAL FEATURES

Additionally, MyView will have its own charging pod inside the fridge to ensure it remains powered and ready for continuous operation. As MyView captures and collects data on food items in the fridge, it will also have wireless connectivity to send this real-time data to MyFood, allowing it to create meal plans accordingly. MyView isn't limited to fridge installation; it's versatile enough to operate in various areas of the kitchen and dining space, including pantries or storage cabinets where other food products are stored.

# MYVIEW LIMITATIONS

While MyView offers numerous benefits, there are several potential limitations to consider. Firstly, the advanced technology and materials used in MyView may lead to high production costs, making it expensive and potentially inaccessible to many consumers.

Although designed to be durable, constant exposure to cold and moisture could wear down the device over time. This is particularly true for the batteries, as low temperatures can decrease their capacity and discharge rate and may result in slower and less efficient charging (Renogy marketing team 2023). Maintenance or repairs may be required, adding to the overall cost.

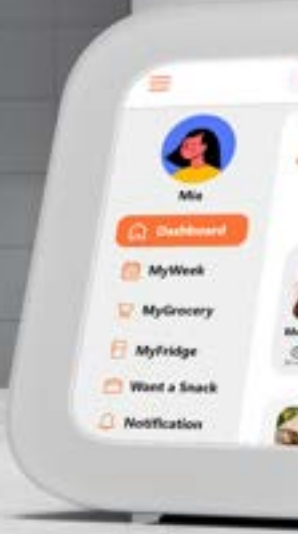
As fridges can be humid inside and moisture can create water on surfaces, the gecko adhesive may not work properly if there is water or other liquid substances on the surfaces. This is because van der waals adhesion relies on close contact with a dry surface area (Stark et al. 2015). Further and advanced developments of gecko adhesive may be needed, especially when applied to a small-scale device like MyView.

Given MyView's compact design, the internal electrical and mechanical components will also need to be downsized. This miniaturization process, particularly for imaging technologies like VISIR2 and HYLIGHT, can escalate production costs. The need for high-precision manufacturing and specialised materials further contributes to the expense of producing and acquiring the device (ROHM Semiconductor 2021).

# MYFOOD

MyFood is an advanced, adaptive and responsive software designed to reduce household food waste. It has self-training AI Technology to help families manage their food efficiently.

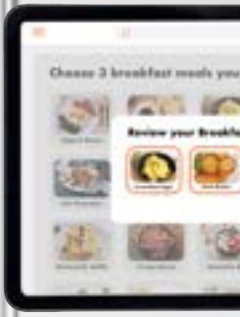
MyView, the smart technology, keeps track of food in the fridge. It continuously monitors items and ingredients, providing real-time status and intercommunicating data on food quality and quantity with MyFood. This integration ensures the software has accurate and up-to-date information about the user's food inventory, including items nearing expiration dates.



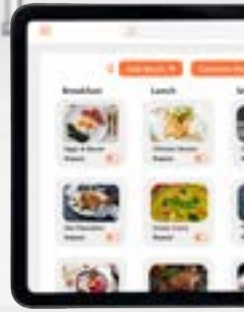


LUMO
MYFOOD
Proteins
Seasonal Produce
Dairy
Calorie
Cuisines
Portion
Moderation
Save Money
Edit
Filter
Turkey Sandwich
Glass Noodle Salad
Chicken Sandwic


Mia, Choose the
meals you eat in a day


Choose 3 breakfast meals you


Choose min. 3 breakfast meals you like


Breakfast
Lunch

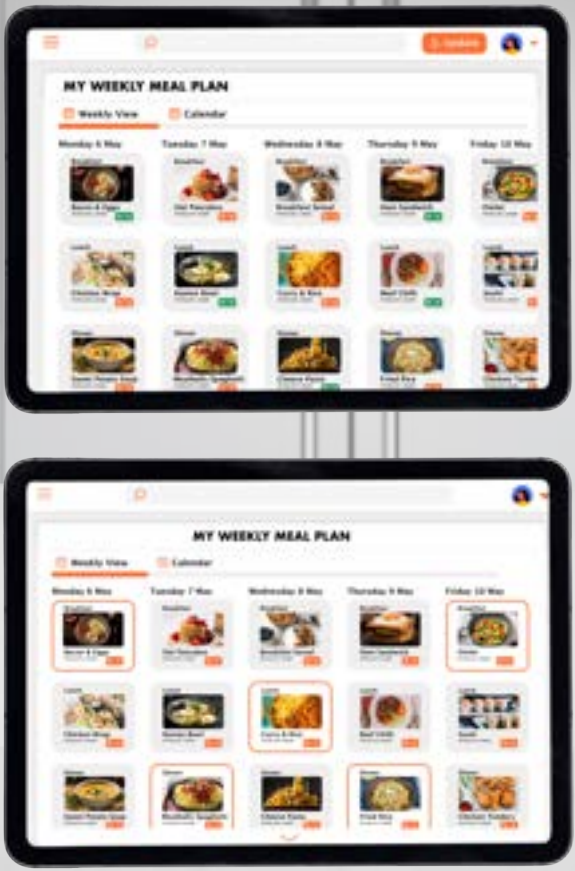
MyFood uses a self-trained AI system that learns the preferences and habits of each member of the household. It starts by asking users to select their top three meal preferences which allows MyFood to learn their choices. This helps the AI understand their dietary preferences and restrictions, enabling more efficient food management.

MyFood then displays the user's top picks on the screen for review and modification. After the user confirms their selections, MyFood presents these choices for all meals of the day, including breakfast, lunch, snacks and dinner. This allows users to review and adjust their preferences as needed. MyFood uses this detailed information to help users and their families plan meals efficiently and ensure food is consumed before it expires or ends up in the bin.

After receiving and reviewing the data, MyFood analyses the information, including updates and data from MyView, to generate personalised meal plans and recipe suggestions. The software takes the following key considerations into account:

- The types of ingredients and their quantities
- Food items that are closer to their expiration dates
- Users' dietary preferences, restrictions and favourite recipes

Users get the option to stick with the suggested meal plan, add and generate more meals, as well as make edits and changes as required.


MY WEEKLY MEAL PLAN
Weekly View
Calendar
MY WEEKLY MEAL PLAN
Weekly View
Calendar

Based on the suggested meal plan, MyFood considers the user's top picks for breakfast, lunch, snacks and dinner to generate a comprehensive weekly meal plan, ensuring that meals align with their preferences. It simplifies the process by generating easy-to-follow recipes based on available ingredients. Users can customise these recipes to suit their preferences, making meal preparation flexible and stress-free. This helps users efficiently manage their food, reduce waste and save time on meal planning.

As users interact with the software, MyView continually monitors changes in the fridge. Whether new items are added or existing ones are consumed, MyView updates the data in real time. This information informs MyFood to plan meals accordingly, considering leftovers and food that may soon expire. MyFood notifies users about the updates on the home screen. Upon clicking the notification, users can either stick with the updated plan or choose alternative options.


MyFood goes beyond meal planning by assisting with grocery shopping.

By generating shopping lists based on meal plans, it considers factors like seasonal availability of fruits and vegetables, current market prices and ongoing sales and discounts at supermarkets. Users can specify amounts, quantities and explore various supermarket options. This feature helps families plan meals with affordable ingredients and make the most of supermarket discounts, ensuring they save money while grocery shopping.

Once the grocery list is saved based on the user's choices and preferences, MyFood displays updates, changes and items removed from the previous suggestion. This allows users to review and ensure everything aligns with their preferences before finalizing their shopping plans.


**Multiple Device Integration**

We envision MyFood being seamlessly integrated into various devices such as smartwatches, tablets, and smart home assistants. Smartwatch integration allows users to receive real-time notifications about food inventory updates, meal suggestions and grocery list reminders.

This ensures that users stay informed about their food status, even on the go. This multi-device compatibility will ensure that users can access MyFood's features from anywhere in the home or when on the move, enhancing overall convenience and user experience.

**Efficiency and Sustainability with MyFood**

While current apps like SamsungFood (2024), assist in organizing recipes, meal plans, and grocery lists, MyFood stands out due to its self-training capability that learns families' choices over time. Its advanced features include real-time inventory tracking, automatic adjustment of leftovers or extra ingredients and personalised recommendations.

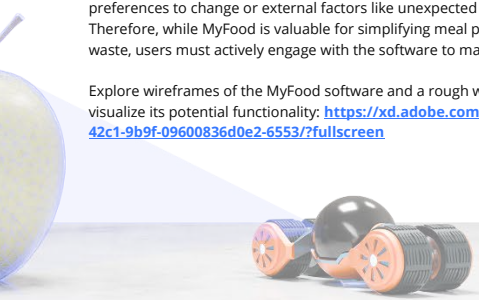
MyFood's efficient meal planning and grocery management save users considerable time and effort. By planning meals ahead and making a precise grocery shopping list, it reduces the need for frequent trips and helps avoid impulse purchases.

By ensuring that all food items are utilised before they expire, MyFood significantly cuts down on household food waste. Its real-time updates and adaptive meal planning indicate that users are constantly aware of what needs to be used, preventing food from being forgotten and discarded.

**Limitations**

While MyFood offers impressive features for household food waste management, its important to acknowledge some limitations. One practical consideration is the support of accurate input and data maintenance from users. Since the software's effectiveness relies on users consistently updating their food inventory and preferences, there's a risk of inaccurate meal planning or recommendations if this data needs to be kept up-to-date. While the AI can adapt and learn over time, its effectiveness still depends on the quality of the data it receives (Aroyo et al. 2021). Additionally, while MyFood aims to reduce food waste by suggesting recipes based on existing ingredients, it may overlook the potential for user preferences to change or external factors like unexpected guests or dietary shifts. Therefore, while MyFood is valuable for simplifying meal planning and reducing waste, users must actively engage with the software to maximise its benefits.

Explore wireframes of the MyFood software and a rough working prototype to visualize its potential functionality: **https://xd.adobe.com/view/300076bd-d143-42c1-9b9f-09600836d0e2-6553/?fullscreen**



**Conclusion**

MyView and MyFood together revolutionise home food management, fostering a seamless experience of monitoring and planning meals. MyView's cutting-edge biosensor technology enable effortless scanning and access within the fridge, while MyFood complements this with personalised meal plans and real-time inventory tracking. Together, LUMO represents a holistic solution that promotes sustainability and environmental responsibility. In the future, we anticipate this solution to be personalised and adaptable, aiming to reduce of household food waste.

Lumo Concept Vid
YouTube

**Link to LUMO Concept video**
**https://www.youtube.com/watch?v=W3tq9Vywq2Y**

LUMO IN

2024 2035 2040

## STAKEHOLDERS

LUMOOO

LUMBIN

# MPLEMENTATION STRATEGY

LUMO

2045 | 2050 | 2055 | 2060

# Implementation Strategy

We envision LUMO to be implemented in the world in peoples fridges and in different business sectors such as hospitality, retail and logistics.

**By 2035,**
Smart fridges, like the Samsung Smart Fridge, are already available on the market, featuring built-in cameras that allow users to remotely view their food items. These appliances are now integrating artificial intelligence to recognise different kinds of food, such as fruits and vegetables, and remind users of expiration dates. Additionally, these smart fridges can connect with various smart home devices, such as smart ovens and stoves, and have access to meal planning apps (Samsung n.d.). While VISIR2's materials are expensive, implementing a visible camera and infrared sensor is feasible and could pave the way for smart fridges to incorporate VISIR2 functionalities in the near future. On the other hand, we envision that HYLIGHT will be developed further to function as a camera.

**By 2045,**
We predict that VISIR2 and HYLIGHT will be combined to create a 3-in-1 camera component capable of detecting food spoilage. By this time, we envision that smart fridges will have advanced artificial intelligence and built-in tracks, allowing the camera to have a wider field of view of food items. MyView would be exclusive to larger businesses, such as food distributors like MetCash and Westfarmers, for managing food stock quality and quantity information (ex. MyView functioning in food distribution to regulate temperature requirements of food items being transported in delivery trucks). For traditional fridges, an affordable mountable normal camera option will be available for low to middle-class household users.

**By 2055**
The LUMO initiative will now be recognized by governments and endorsed by major appliance companies to support sustainable practices in households. MyView and MyFood functionalities have been miniaturised and enhanced by tech and research developers. MyFood software has been adapted for compatibility with various smart home devices, including those from Amazon, Google, and Apple, and continues to be adapted for other mobile and wearable devices. MyView and MyFood will be introduced on social media and broadcasted on the news as innovative solutions for managing food in households, and they are set to be available commercially soon.

**By 2060**
MyView is now an autonomous robotic device that can freely navigate any traditional fridge, while MyFood has been adapted to a wider range of smart devices than before. We envision LUMO being officially released to the public, with marketing campaigns and advertising agencies introducing it for purchase. LUMO will continuously evolve and improve its functionalities and form to promote sustainability practices and awareness towards food waste.

# Stakeholder Map

Here are the stakeholders we envision participating in the development of LUMO in the coming years:


To develop the concept of LUMO, we envision the key players to be Australian households, retail and grocery chains, food distributors and the hospitality sector, as these stakeholders are particularly invested in food planning and management most especially concerning food waste. The hospitality and retail sector produces significant food waste and would benefit from sustainable practices facilitated by LUMO. Additionally, food waste departments like FOGO could benefit from LUMO's ability to minimise food waste in landfills. Lastly, we would require cooperation from tech developers to make MyView and MyFood a reality. Their expertise will be essential in creating and refining the technology needed for these innovative solutions.

# Value & Impact

LUMO can provide benefits in improving the consumption and relation of food including:

***Sustainability:*** Encourages and support eco-friendly practices by suggesting recipes that use up ingredients and reduce waste.

***Mindfulness:*** Raising awareness among users to be more considerate when managing food.

***Resource Efficiency:*** Supports users to optimise available ingredients to avoid food waste and contributing to negative global impact.

***Health and Nutrition:*** Promotes healthier eating habits by suggesting balanced recipes and reducing reliance on processed foods.

***Cost Savings:*** Helps Australian households to save money by ensuring available food at home are finished and providing meal planning, leading to more efficient grocery shopping.

***Convenience:*** LUMO simplifies meal planning and preparation by offering tailored suggestions based on what users have at home.

***Environmental Impact:*** Contributes to reducing the overall carbon footprint by minimising food waste and promoting sustainable consumption habits

**Meal planning can avoid**

# 27kG

**of food wasted each year**

**With LUMO's meal planning capabilities...**

**It can reduce Australia's household food waste by**

# 29%

See Appendix F.2 Subtopic: Food waste reduction from LUMO)

## Conclusion

Food waste is a major issue in Australia. In particular, household food waste plays a significant role in generating food waste. Various reasons influence Australian residents to waste food, however, it is predominately due to poor behaviour and practice towards food.

To address these issues, LUMO is introduced as a solution to encourage and support Australian residents to adopt a more sustainable practice towards food management.

Thereby, we envision that the introduction of LUMO into people's home will reduce the volume of food waste in Australia and encourage a more sustainable lifestyle.

# Team Reflection

**Ringo**
*Visual Communication Designer*

"This project has been a valuable learning experience. It has helped me to develop a more open mindset and to critically analyse aspects of problems and solutions in how it fits into a wider system."

**Gab**
*Industrial Designer*

"This project expanded my thinking through exploring futuristic ideas merging advanced technology and design. The program was tough and it really tested my research and creativity skills. Nevertheless, it was truly rewarding which offered me a valuable personal experience."

**Nishita Chauhan**
*Communication Designer*

"This project has provides me with valuable insights and a profound sense of personal growth. I am grateful for the lessons learned and the experiences gained, all of which have shaped me into a more capable and adaptable individual."

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JUST

# Appendices

## Appendix A
# Fruffle

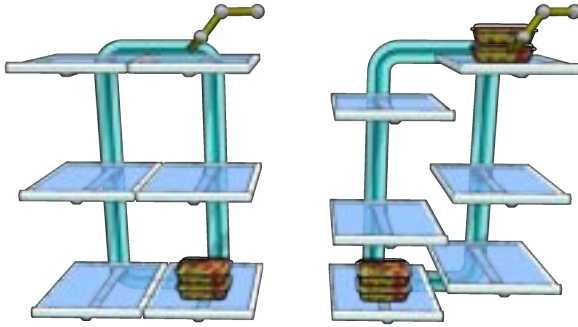


Figure A1

One of the first and main ideas that our team presented in relation to solving food waste in Australian households was an advanced fridge we called Fruffle (See Figure A2). It is an advanced storage system designed to scan and check perishable food items and send reminder to users to prioritise consuming over disposing of leftover items as much as possilble.

Figure A2

This concept is an improved version of smart freezers that are existing today such as Samsung Family Hub - Smart Fridges that has cameras inside to let you view its contents remotely via a smartphone app, helping you keep track of what you need while you're out shopping (Samsung, n.d.).

In addition to the camera features, we incorporated ATTRACT technologies such as VISIR2 and HYLIGHT, similar to what MyView utilises, to monitor the quality and quantity of food in the fridge. Furthermore, Fruffle is equipped with a robotic arm similar to the CERNBOT (CERN, n.d.) and shuffling shelf mechanisms (See Figure A1). These features assist in organising food items, helping users identify which items need to be consumed first before they spoil or expire.

FRUFFLE

## Appendix A
# Fruffle

Figure A3

Although our team initially chose the concept of Fruffle to present, we received feedback that led us to move on from the idea.

While the functions of Fruffle are promising for reducing food waste, the Fruffle Smart Fridge is likely to be accessible only to high-end users and not affordable for low to middle-class households. Currently, smart fridges in 2024 start at a minimum of AUD 3,500, which is considered expensive. Additionally, the camera is fixed on the fridge door, which limits its view to only the front items. Thus, items hidden behind other food items may not be scanned for data collection. Therefore, our team sought to develop more ideas that would be accessible to a broader range of users which led eventually led us to developing the concept of MyView, a smaller, flexible component that can be installed inside existing fridges without having to need to replace appliances and buying a new one.

FRUFFLE

## Appendix B

As part of the design process to reduce household food waste, we had a Design Fest where our team engaged in a collaborative and iterative design phase. Each member generated diverse ideas, which were then shared, discussed and clustered to identify the most promising concepts. Through the process of refinement, we developed detailed prototypes and continually improved them based on team feedback to enhance functionality and usability. This iterative process of brainstorming, prototyping, testing and refining culminated in a well-rounded, practical solution designed to effectively minimize household food waste.

### C1: Subtopic 1st week: Concepts on Service Design

### SustainSpace Kitchen

While ideating to tackle household food waste, Nishita started by imagining kitchens of the future. This led to the idea of developing a smarter and more sustainable kitchen space, which she envisioned as the SustainSpace Kitchen. Nishita saw it as a comprehensive solution to address the challenges of food waste and sustainability in households. By integrating innovative features such as the Smart Food Analyzer, Food Preservation Pods, and Virtual Food Designer, as shown in Figure B1, the aim was to revolutionize how people interact with their kitchen environments. The Smart Food Analyzer offers real-time feedback on food quality, empowering users to make informed decisions about consumption and meal planning. Food Preservation Pods provide eco-friendly methods to extend the shelf life of perishable items, reducing waste and saving money. The Virtual Food Designer encourages creativity by encouraging users to experiment with recipes and ingredients efficiently. Thought was given to include a gamified food waste tracker to motivate waste reduction through friendly competition and rewards, fostering community engagement and responsibility. The goal was to empower people to live sustainably and enjoy cooking with this innovative approach.

### Integrating of Technology

Within SustainSpace, technology played a crucial role in enhancing kitchen functionality. Firstly, Hylight was considered for integration into the Smart Food Analyzer, increasing its ability to evaluate food quality with greater precision. This advancement would enable more accurate assessments of attributes like ripeness and nutrient levels. Augmented Reality (AR) was explored to project holographic representations of ingredients and cooking instructions directly onto kitchen surfaces. This immersive experience could revolutionize meal preparation. Additionally, Gesture Recognition technology was imagined for easy interaction within the Virtual Food Designer, letting users control virtual ingredients effortlessly with hand movements. Furthermore, Artificial Intelligence would analyze user preferences and dietary needs to offer personalized recipe recommendations and cooking guidance, while also providing access to a wide range of recipes and tutorials to inspire cooking creativity.

As illustrated by Nishita in Figure B2, the concept of envisioning MyFood across various devices in the future draws inspiration from the AR innovation of the SustainSpace Kitchen. This idea came from Nishita's anticipation of the future landscape of kitchen technology. The concept further developed by integrating MyFood across various devices, ensuring its accessibility through smartphones, tablets and smartwatches, along with holographic projections as we were developing ideas for the future.

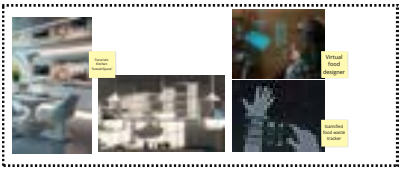
# Appendix B

**Figure B1.1**

## IDEA NAPKIN: SustainSpace Kitchen

**Describe your idea in one sentence:**

SustainSpace Kitchen is a revolutionary kitchen system designed to revolutionize food management in households of the future.




**How does your idea work in more detail? What issue does your idea solve?**

- SustainSpace Kitchen integrats system through a central control panel or voice-activated commands, accessing features such as the Smart Food Analyzer, Food Preservation Pods and Virtual Food Designer.
- The Smart Food Analyzer provides real-time feedback on the quality and freshness of food items.
- Food items identified as ripe or near expiration can be stored in the Food Preservation Pods, where they are preserved using eco-friendly methods until ready for use.
- The Virtual Food Designer allows users to experiment with different recipes and meal ideas, reducing food waste by ensuring that ingredients are used efficiently and creatively.
- A gamified food waste tracker shall encourage users to track their consumption habits and minimize food waste through friendly competitions and rewards.
- Users earn points for reducing waste, implementing sustainable practices, and sharing eco-friendly recipes with the community.

**What are the benefits to the user and other stakeholders?**

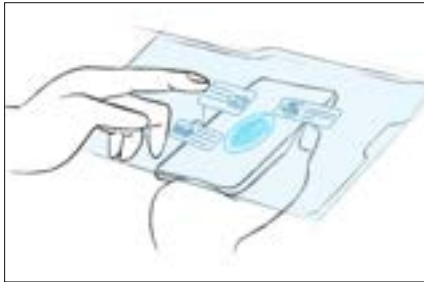
- Users minimize food waste by providing real-time feedback on food quality and offering eco-friendly preservation solutions.
- Food prevention pods extend the shelf life of perishable foods without the need for artificial preservatives, reducing food waste and saving money for the household.
- The Virtual Food Designer inspires users to explore new recipes and culinary combinations, fostering creativity and experimentation in the kitchen.

**What is the point of difference?**

- Users minimize food waste by providing real-time feedback on food quality and offering eco-friendly preservation solutions.
- Users can place fruits, vegetables, and other perishables on the analyzer's platform to receive instant feedback on their condition, helping them make informed decisions about meal planning and consumption.

**CREATOR:** Nishita

**Figure B1.2**



# Appendix B

**Figure B2**

## IDEA NAPKIN: Community Kitchen

**Describe your idea in one sentence:**

A semi-autonomous community kitchen for people to gather and eat without needing worry about meal planning and cooking


**How does your idea work in more detail? What issue does your idea solve?**

A community kitchen where dinner is prepared and served to the local community.
Most of the cooking will be run by machines/robotics to minimize labor.

The local community kitchen may be supported by memberships, which would cover for the residents dinner. Thereby, Lessing the expense on groceries for dinner

**What are the benefits to the user and other stakeholders?**

- It will minimize food waste by having the community do all the meal planning and cooking for dinner
- It may strengthen the community by creating a place for gathering
- It will be a cost-effective and time saving method for dinner

**What is the point of difference?**

Residents would have less worry about dinner expenses and meal planning for dinner.

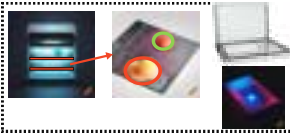
**CREATOR:** Ringo

**Figure B3**

## IDEA NAPKIN: Insert idea name...

**Describe your idea in one sentence:**

An advanced fridge tray/shelves that uses scanning feature to assess food condition and display expiration details.



**How does your idea work in more detail? What issue does your idea solve?**

- old/broken original shelves can be replaced by this customed and advance shelves/ tray (might need the participation of companies)
- The shelves scans any food you place on it and with ai, visir 2 and hylight it will tell you the status of the food like volume and quantity and display it infront of the shelf or you can check it in a mobile app.
- Advanced mats with the same function can be placed in pantrys/cabinets where it can be customed and ordered to fit size needs.
- Instead of a camera attached to the door. It scans top and bottom of each shelves to have accurate visual
- shelves uses color indication to represent storage life. (ex. fresh (green), still edible (orange), spoiled (red)

**What are the benefits to the user and other stakeholders?**

- Users can just buy the shelves instead of buying a whole new fridge/ smart fridge (beneficial for middle class and below)
- Can be used not just in the fridge but also pantrys/ cabinets

**What is the point of difference?**

- Cheaper option instead of buying a new whole fridge
- Customizable for new and old fridge (provided that its supported by manufacturers)
- Colors help users to capture which food needs to be consumed first
- Makes sure that users are not in risk of consuming unedible food and keep them have a healthy diet.

**CREATOR:** Gab

As shown in the Figure B2, Ringo thought of introducing a community kitchen initiative where dinner is prepared and served to local residents, primarily operated by machines and robotics to simplify processes and minimize labor. Through a membership-based system, residents gain access to freshly prepared dinners without the burden of grocery expenses, as the community kitchen takes charge of meal planning and cooking. This innovative concept not only tackles food waste effectively but also creates a communal space for residents to come together, fostering a sense of unity and belonging within the neighborhood.

With an emphasis on cost-effectiveness and time-saving, this initiative reduces the stress associated with dinner expenses and meal preparation, allowing residents to enjoy their evenings to the fullest. Moreover, by leveraging automation and technology, the community kitchen ensures consistent quality and efficiency in meal production, enhancing overall satisfaction and convenience for its members.

Gab came up with the idea to revolutionize the kitchen storage with custom advanced shelves/trays equipped with AI technology as shown in the Figure B3. These innovative shelves scan food items upon placement, utilizing AI, Visir 2 and Hylight technology to provide real-time status updates on volume and quantity. Whether displayed on the shelf or accessed via a mobile app, users can easily monitor the condition of their stored items.

Similar advanced mats can be customized for pantries and cabinets, ensuring organized and fresh storage. By replacing traditional shelves, this solution offers a cost-effective alternative to purchasing new refrigerators, especially beneficial for middle-class and lower-income households. With color-coded indicators representing storage life, users can prioritize consumption and reduce food waste, all while maintaining a healthy diet and ensuring food safety.

# Appendix B

## C2: Subtopic 2st week: Concepts on Future

**Figure B4**

### IDEA NAPKIN: Smart Food Storage

**Describe your idea in one sentence:**

A Smart tabletop food storage appliance where you can keep your leftover in containers that have temperature and moisture sensor control to keep food longer and safe to eat.

**How does your idea work in more detail? What issue does your idea solve?**

- See through food storage so it can be managed and not forgotten by user
- It can heat your food at the right temperature and can be controlled remotely
- chills and freezes your food at the right amount of temperature to keep it longer
- connected to an phone app
- notifies you of food status or when it starts to expire/spoil

**What are the benefits to the user and other stakeholders?**

- Has AI that reads the status of leftover food. Similar to a smart fridge but smaller and more focused on solving food waste. Making it smaller can lessen the cost and will be more suited to different lifestyles
- The appliance itself is mainly to avoid throwing out food that way users are more aware and consious about food waste

**What is the point of difference?**

It will help make sure your food is stored properly and can even help in busy schedule. Can be placed on top of a dining table for easy access. Could possibly help with food waste reduction.

**CREATOR:** Gab

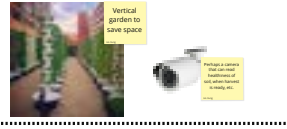
Gab thought of a revolutionary food storage solution designed to combat food waste and promote efficiency in managing leftovers. This innovative appliance features transparent storage compartments, allowing users to easily monitor their food inventory and prevent items from being forgotten. Equipped with heating and cooling capabilities, the device ensures that food is stored at optimal temperatures to prolong freshness and reduce spoilage. Connected to a smartphone app, it provides real-time notifications about food status and expiration dates, empowering users to make informed decisions about consumption. With built-in AI technology, the device intelligently assesses the condition of leftover food, offering tailored recommendations to minimize waste. Compact and versatile, it can be placed on a dining table for convenient access, making it suitable for various lifestyles and busy schedules. By promoting awareness and consciousness about food waste, this solution aims to revolutionize how we manage and preserve our food, ultimately contributing to a more sustainable future.

**Figure B5**

### IDEA NAPKIN: Community Garden

**Describe your idea in one sentence:**

A semi-autonomous community farm in the suburbs.




**How does your idea work in more detail? What issue does your idea solve?**

The farm will have robotics to help partially maintain the farm. For example, there will be sensory technology to monitor the quality of soil, when water is needed, etc. However, it will also need the community's contribution by harvesting.

The place would also serve as composting for nearby households to discard their food.

**What are the benefits to the user and other stakeholders?**

- The local community would an alternative access to low costing food and help balance their diets.
- It would strengthen the community by creating a place for the community to work together.
- The community would be more independent and less affected by supermarkets

**What is the point of difference?**

- Cheaper alternative to supermarkets
- A local access to discard food waste to be composited

**CREATOR:** Ringo

Ringo envisioned a multifaceted community farm that integrates robotics for maintenance while relying on community participation for tasks such as harvesting. The farm serves as a composting site for nearby households, offering them a convenient solution for food waste disposal. This concept aims to provide the local community with access to affordable food options, helping to balance their diets and strengthen community bonds through collaborative efforts. By offering a local alternative to supermarkets, the community becomes more self-sufficient and less reliant on external sources. Overall, this project offers a cheaper alternative for food shopping and provides a convenient solution for food waste disposal, contributing to a more sustainable and resilient local food system.

## Appendix B

**Figure B6**

# **IDEA NAPKIN:** Farm to Table Transparency

**Describe your idea in one sentence:**

Ilmplementing blockchain technology to enhance transparency in the food supply chain, creating an interactive and socially responsible dining experience.


**How does your idea work in more detail? What issue does your idea solve?**

**Households:** Vertical gardens or indoor farming systems in households could be used to grow fresh herbs, vegetables, and fruits year-round. These compact and efficient gardening solutions provide nutritious produce and promotes sustainable living by reducing reliance on store-bought produce and minimizing transportation emissions.

**Resturants:** A prominent vertical farming display within the restaurant space, featuring hydroponic towers or living walls where herbs, greens, and specialty produce are grown. This vertical farm serves as both a functional source of fresh ingredients and an aesthetic focal point that enhances the restaurant's ambiance and visual appeal. Every scrap is repurposed into compost or energy. Diners and resturants engage in interactive experiences, tracing the journey of their meal from farm to table through blockchain transparency.

**What are the benefits to the user and other stakeholders?**

1. **Carbon Footprint Tracking (household):** Utilize blockchain to track and manage household carbon footprints by recording energy consumption, transportation habits, and waste generation.
2. **Sustainable Supply Chain Management**:To trace the origins of the products. By scanning product labels or QR codes, consumers can access information about sourcing practices, ethical labor standards, and environmental impact throughout the supply chain.
3. **Traceability**: Consumers can trace the origins of their food products back to the source, ensuring authenticity and quality.
4. **Transparency**: Through blockchain technology, diners and resturants have access to transparent information about the sourcing and production of ingredients.
5. **Efficiency**: Blockchain technology streamlines supply chain processes by reducing paperwork, eliminating manual errors, and automating record-keeping tasks.

**What is the point of difference?**

1. **Unique Experience**: Diners enjoy an interactive dining experience where they not only savor delicious meals but also participate in the sustainability narrative, making each visit memorable and meaningful.
2. A commitment to social responsibility by prioritizing sustainable practices

**CREATOR:** Nishita

Nishita imagined a dining experience where blockchain technology makes food transparency and traceability a priority, changing how we engage with our meals, as displayed in Figure B4.

This concept promotes sustainability in both households and restaurants through vertical gardens and indoor farming systems. In homes, these systems allow for year-round growth of fresh herbs, vegetables, and fruits, reducing dependence on store-bought produce and transportation emissions. In restaurants, consumers can easily trace the origins of their meals by scanning the food items to gain access to detailed information about sourcing practices, labor standards, and environmental impact. Both settings use blockchain to track carbon footprints and provide transparency in the supply chain, ensuring authenticity and promoting sustainability. Diners can gain an understanding of the journey their meal has taken from farm to table by tracing it through blockchain technology.

This concept underscores the potential of technology to drive social responsibility and promote sustainable practices in the food industry. Later, this concept was further utilized in the development of SkyHigh, where food waste is converted to compost for energy.

## Appendix B

## C3: Subtopic 3st week: Concepts on Behaviour Change

**Figure B7**

# IDEA NAPKIN: Smart Food Management System

**Describe your idea in one sentence:**

A Upcycling and Composting Solutions integrated into the Smart Food Management System (SFMS) designed to efficiently break down organic waste

**How does your idea work in more detail? What issue does your idea solve?**

**In-Built Composting Units:**

- These units utilize aerobic composting methods, which require oxygen to decompose organic matter rapidly.
- Aerated composting systems will have rotating drums or trays that mix and aerate the compost, accelerating the decomposition process and minimizing odors.
- The composting units will be equipped with sensors and controls to maintain optimal conditions such as temperature, moisture levels, and airflow.
- Users can easily add food scraps to the composting unit through a designated input compartment, ensuring convenient waste disposal without any mess.

**What are the benefits to the user and other stakeholders?**

- The composting process converts food scraps into nutrient-rich compost suitable for use in urban gardening initiatives, community green spaces, or household plants.
- As organic waste decomposes, beneficial microorganisms break down the materials into humus, a dark, crumbly substance rich in essential nutrients.
- Compost serves as a natural fertilizer, enriching soil health, promoting plant growth, and enhancing overall ecosystem resilience.
- Users can periodically harvest mature compost from the composting units and distribute it to local community gardens or use it to nourish their indoor or outdoor plants.
- Improved soil health, reduced greenhouse gas emissions, and enhanced community resilience can generate positive returns on investment over time.
- Governments, municipalities, and non-profit organizations may offer subsidies, grants, or tax incentives to support composting and food waste reduction initiatives. These incentives can help offset the initial investment and encourage more widespread adoption of sustainable practices.

**What is the point of difference?**

- The SFMS is equipped with innovative upcycling modules capable of transforming leftover ingredients and food items into new products with extended shelf life.
- These modules employ advanced food processing technologies such as dehydration, fermentation, and preservation to convert surplus fruits, vegetables, and proteins into value-added products.
- Examples of upcycled food products include homemade sauces, broths, jams, pickles, dried fruits, vegetable chips, and protein-rich snacks.
- Users can customize the upcycling process based on their preferences and dietary requirements, experimenting with different flavors, textures, and ingredients.
- Upcycled food products offer a sustainable alternative to store-bought equivalents, reducing reliance on single-use packaging and minimizing environmental impact.

**CREATOR:** Nishita

**Integration of Technology**

VISIR2

The SWIR light reflected by food items can provide valuable information about their composition, freshness, and quality.

Integrating VISIR2 imagers into the SFMS could enable real-time inspection of food items, allowing users to identify spoilage, contamination, or other quality issues that may lead to food waste.

The ability of VISIR2 to discriminate between VIS and SWIR spectral ranges can aid in monitoring storage conditions for perishable foods.

VISIR2 technology within the SFMS can enhance food safety, quality assurance, and supply chain efficiency, ultimately contributing to the reduction of food waste

Random Power

Random Power algorithms could predict optimal composting conditions based on historical data, facilitating more efficient composting.

Nishita's idea centers around in-built composting units integrated into households, aiming to revolutionize waste management and promote sustainable practices. These units utilize aerobic composting methods, featuring rotating drums or trays that aerate and accelerate the decomposition process while minimizing odors. Equipped with sensors and controls, they maintain optimal conditions for decomposition, ensuring efficient conversion of food scraps into nutrient-rich compost. This compost can then be used to enrich soil health in urban gardening initiatives, community green spaces, or household plants, promoting overall ecosystem resilience. Additionally, the concept includes innovative upcycling modules capable of transforming leftover ingredients into value-added products, such as homemade sauces, broths and dried fruits. By encouraging users to customize the upcycling process and reduce reliance on single-use packaging, the idea promotes sustainability and minimizes environmental impact.

## Appendix B

**Figure B8**

# IDEA NAPKIN: Urban Lane Farm

**Describe your idea in one sentence:**

A semi-autonomous community farm the city laneways

**How does your idea work in more detail? What issue does your idea solve?**

We imagine the unused laneways in Melbourne city are transformed into vertical community farms. The walls would be replaced with crops from the bottom to the top. There will also be an aquaponic installed on the rooftop.

People will take part by harvesting the ground groups and the rest will be harvested by crops. These farms will also be used as a compost site to transform compost into energy or be used for production purposes.

**What are the benefits to the user and other stakeholders?**

- The local community would an alternative access to low costing food and help balance their diets.
- It would strengthen the community by creating a place for the community to work together.
- The community would be more independent and less affected by supermarkets

**What is the point of difference?**

- Cheaper alternative to supermarkets
- A local access to discard food waste to be composited

**CREATOR:** TEAM

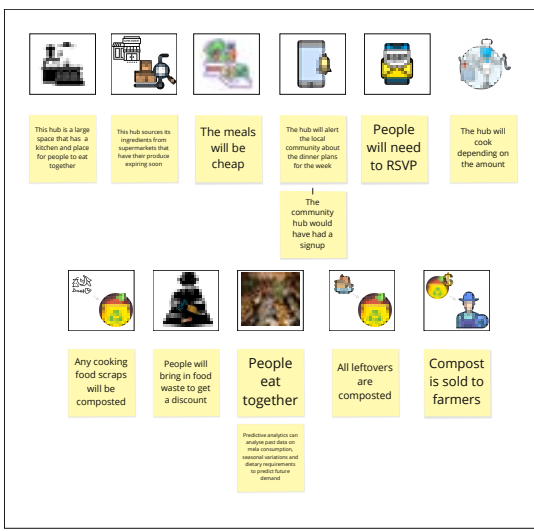
Our team envisions transforming the unused laneways in Melbourne into vibrant vertical community farms. These farms would feature crops growing from the bottom to the top of the walls and an aquaponic system installed on the rooftops. Community members would participate by harvesting crops at ground level, while higher crops would be harvested by automated systems. Additionally, these farms would serve as composting sites, converting organic waste into energy or using it for production purposes.

## Appendix B

This initiative would provide the local community with affordable access to fresh produce, promoting balanced diets. It would also encourage community spirit by creating a shared space where residents can collaborate. The prototype displayed in Figure B8 and the concept aims to increase community independence, making them less reliant on supermarkets, and offer a cheaper alternative for fresh produce. Moreover, it provides a local solution for food waste disposal, which would be composted on-site. The idea was to create a self-sustaining, eco-friendly community that enjoys both the social and economic benefits of local food production.

We expanded and evolved the idea into an innovative concept that is a Community Hub. The community hub is a spacious facility equipped with a kitchen and communal dining area, where people can gather to enjoy affordable meals sourced from supermarkets with expiring produce. The hub operates on a RSVP basis, with weekly dinner plans communicated to the local community. Meals are prepared based on RSVP responses to minimize waste. Any food scraps generated during cooking are composted on-site, incentivizing community members to bring in food waste in exchange for discounts. The hub fosters social dining experiences while utilising predictive analytics to anticipate future meal demand based on past consumption patterns, seasonal trends, and dietary preferences. The following Figure B9 illustrates the concept of the community hub:

**Figure B9: Cheap Meals for all (Community hub)**



## Appendix C

# Eye tech

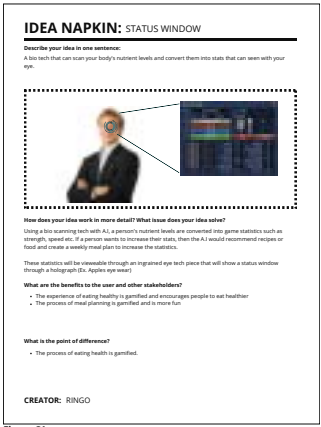



**Figure C1**

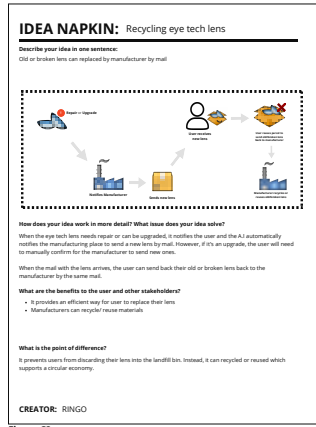



**Figure C2**

During the design festival, Ringo created the idea of using an eye tech that can scan the user's nutrient levels, convert them into stats and create a meal plan accordingly. This can be all seen by the user's eye as a holographic screen (as shown in Figure C1) which is similar to Apple's Vision Pro. This idea was to gamify the experience of managing health and meal planning. This eye tech concept was further developed, whereby Ringo created the recycling process of the product (as shown in Figure C2).

Additionally, the team created a physical prototype (as shown in Figure C3) to visualise how it would look like during class presentation. The team came create two storyboards (as shown in Figure C4) to further demonstrate another application of the eye tech and a detailed process of the recycling process.

The final iteration of the concept was a service blueprint (as shown in Figure C5) that illustrates the process of using the eye tech. The service blueprint was useful to understand the strong and weak points of this idea.

While this idea was radical in that it is a new innovation and would transform the way we use digital applications, there was no current technology that was in development that can replicate the concept using a contact lens. Hence, we moved on from this concept.


**Figure C3**

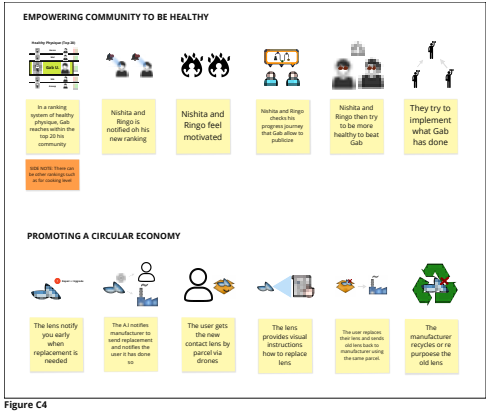



**Figure C4**

# Service blueprint of eye tech concept

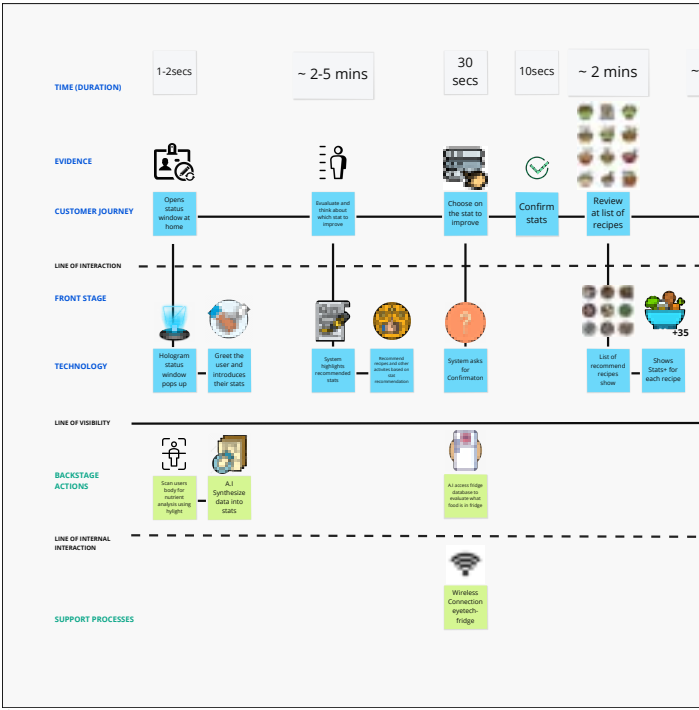
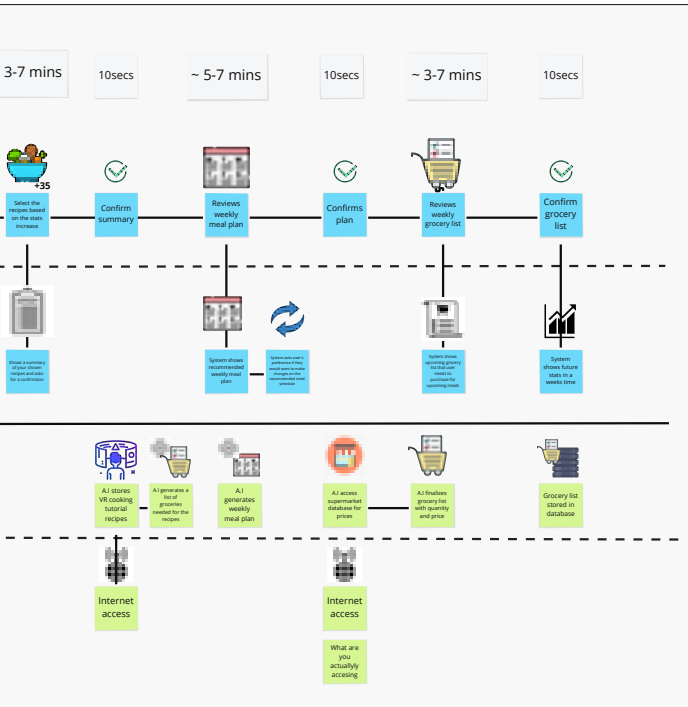



**Figure C5**


3-7 mins
10secs
~ 5-7 mins
10secs
~ 3-7 mins
10secs
+35
Select the recipes based on the stats increase
Confirm summary
Reviews weekly meal plan
Confirms plan
Reviews weekly grocery list
Confirm grocery list
Shows a summary of your chosen recipes and asks for a confirmation
System shows recommended weekly meal plan
System asks user's preferences (swap and remove) to make changes on the recommended meal schedule
System shows recommended grocery list that users needs to purchase for upcoming meals
System shows future stats im a weeks time
A.I stores VR cooking tutorial recipes
A.I generates a list of groceries needed for the recipes
A.I generates weekly meal plan
A.I access supermarket database for prices
A.I finalizes grocery list with quantity and price
Grocery list stored in database
Internet access
Internet access
What are you actuallyly accesing

## Appendix D
# SKYHIGH


**Figure D1 (Poster by Gab)**

After weeks of prototyping and conceptualising more ideas we got to a point to developing the concept of SkyHigh. SkyHigh is a flying community space where food waste will be reduced throughout the supply chain which also includes SkyHigh robots onboard to cook balanced and healthy dinner meals for the local community at an affordable purchasing price.

With SkyHigh, we envision financially struggling households being relieved of the need to plan and cook dinner by coming to SkyHigh. This concept aims to eliminate the inefficiencies of meal preparation, such as poor time management, food spoilage, overbuying, and catering to different preferences within families. By doing so, SkyHigh seeks to simplify meal planning and reduce food waste.

It also had the application of VISIR2, HYLIGHT, and artificial intelligence whenever entering the SkyHigh to ensure the monitoring of food intake and promote a healthy diet for users. This technology helps users make better daily food choices and avoid foods that might be harmful to their health.

## Appendix D
# SKYHIGH

**Figure D2 (Vector Map by Nishita)**

The idea of SkyHigh was to unite the community and raise awareness about the issue of food waste, aiming to reduce waste not only in the consumer sector but across all sectors, including production, processing, distribution, and retail. By effectively collecting and reusing food products throughout the food chain and offering them at lower prices, SkyHigh seeks to minimize waste and promote sustainable consumption.

However, our team received feedback that the idea was too broad and diverted our focus from our main problem, which is food waste in households. Additionally, concerns were raised about SkyHigh's energy efficiency despite of converting compost that are brought to SkyHigh and converting it to Biogas fuel. Since the concept involves flying, it would likely consume a lot of resources, contradicting the primary goal of sustainability.

**Figure D3 (Hero Image by Gab, Edited by Ringo)**

Appendix E

# MyView as a drone

Before MyView became a roaming robotic with wheels, the initial idea was to have it as a tiny drone flying inside the fridge.

**Sketches**

Figure E1 shows the early drone concept created by Gab and Ringo on a whiteboard.
It explored how the drone can be compact and different existing drones.

**Refined Sketch**

Gab created a refined sketch of MyView as shown in Figure E2. A sphere form was selected with a cartoon face to create a cute and friendly looking drone. Two retractable propellors were included to have the drone be more compact when not in use.

**Prototyping**

Figure E3 shows physical prototypes using blue form to further examine and explore the forms. From a sphere form, an attempt to look at how different forms was explored in version 01 and version 02. In this exploration, we concluded that perhaps it did not need two propellors but one, inspired from helicopters. Hence, the drone transformed into a tear drop with single propellor. The tear drop form was to allow the propellors to tilt on an angle and provide more mobility.

**Conclusion**

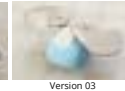
After more discussions, the team decided to move on from the idea of a drone. The main reason was the issue of whether having a tiny drone inside a fridge is feasible.

**Figure E1**

**Figure E2**

Version 01

Version 02



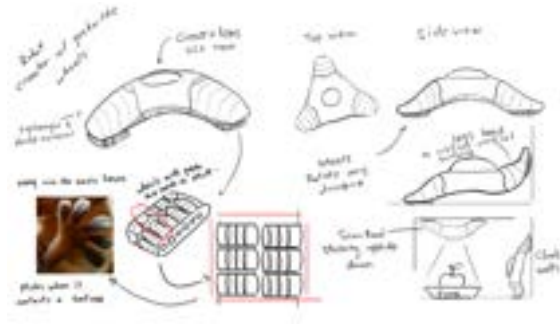
Version 03

Version 03

**Figure E3**

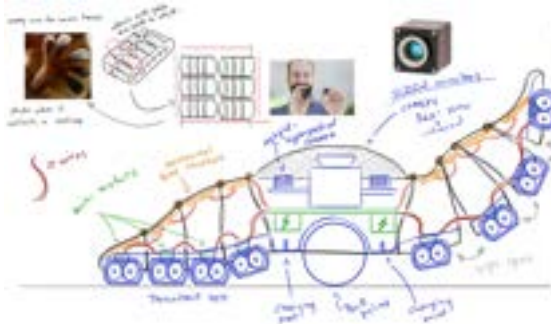
## Appendix F
# MyView as a starfish

**Figure F1**



After considering the concept of a flying MyView, our team had to decide whether to equip MyView with wheels or legs similar to a starfish. Gab believed that legs might allow MyView to move more efficiently around the fridge, especially when navigating over food items and making better contact with surfaces (See Figure F1). Gab attempted to improve the concept and created sketches that integrated legs with wheels and included gecko adhesive to facilitate easier navigation (See Figure F2). Although the starfish design showed potential, its complexity and time constraints led the team to opt for a more straightforward and simpler design.

**Figure F2**



Appendix G

# Calculations

This appendix includes all calculations that were made to show the statistics in the report. We acknowledge that ChatGPT was used to assist in the calculations.

## G.1 Subtopic: Food waste in years

7.6 million tons of food is wasted each year in Australia (DCCEEW 2022).
**How long would it take for all of Australia to consumer 7.6 million tons of food in years?**

**KEY DATA**
**Australia's population as at 2023:** 26,821,557 people (ABS 2024)
**Amount of food eaten per day:** 3.1 kg per person (ABS 2014)
**Amount of food wasted per year:** 7.6 million tons (DCCEEW 2022)

**CALCULATION**
Total daily consumption for 26,821,557 people:
26,821,557 people * 3.1 kg/person = 83,090,927.7 kg/day

*Convert 7.6 million tons to kilograms:*
7.6 million tons * 1000 kg/ton = 7,600,000,000 kg

*Calculate how many days it would take for 26,821,557 people to eat all the food:*
7,600,000,000 kg / 83,090,927.7 kg/day ≈ 91,448.24 days

*Converting days to years:*
91,448.24 days / 365 days/year ≈ **250.65 years**

So, it would take approximately 250.65 years to feed 26,821,557 people with 7.6 million tons of food, assuming each person consumes 3.1 kg of food per day.

# G.2 Subtopic: Food waste reduction from LUMO

Mealime (2020) states from the use of their service, "creating one meal plan every 2 weeks equates to approximately 60lbs (approx. 27kg) of avoided food waste per year".
Assuming that this applies to Australian individuals and LUMO is able to replicate similar results, ***how much household food waste can be reduced?***

First, we calculate the total food waste that can be avoided for the entire population of Australia.

**GIVEN:**
**Food wasted avoided per person:** 27 kg (Mealime 2020)
**Australia's population as at 2023:** 26,821,557 people (ABS 2024)

**CALCULATION:**
Total food waste avoided = Food wasted avoided per person × Population
Total food waste avoided = 27 kg/person × 26,821,557 persons
Total food waste avoided = **724,136,539 kg**

So, the total food waste would be approximately 724,136,539 kilograms

---

Lastly, we calculate the percentage of food waste that LUMO can avoid for household food waste

**GIVEN:**
**Total household food waste in Australia** = 2.5 million tonnes = 2,500,000,000kg
**Food waste avoided by LUMO:** 724,136,539 kg

**CALCULATION:**
Calculate the percentage of food waste that Myfood can avoid:
Percentage of food waste avoided = (Amount of food waste avoided / Total food waste) × 100

Percentage of food waste avoided = (724,136,539 kg / 2,500,000,000 kg) × 100
Percentage of food waste avoided ≈ (0.2897) × 100
Percentage of food waste avoided ≈ **28.97%**

So, LUMO can avoid approximately 28.97% of the total household food waste in Australia.

## Appendix H
# LUMO Prototype and Showcase

**Figure H1**

The team decided to create a physical prototype to demonstrate what MyView might look like in reality. Gab 3D-modeled MyView for 3D printing and painted it black and orange (see Figure H1).

The prototype was designed at a 1:1 ratio, comparable to a Hot Wheels car, which we believe is the optimal size for easy navigation within the fridge (see Figure H2). Additionally, the team also decided to create a larger 1:5 scale so that we could present the prototype with a functioning camera. Ringo helped in installing and programming a RasberryPi camera to demonstrate how MyView might see an object with a 3-in-1 biosensor device that incorporates Attract's VISIR2 and HYLIGHT technologies.

**Figure H2**

In Figure H3, Ringo constructed a fridge display made out of wood and acrylic to demonstrate how MyView moves and navigates through obstacles on various surfaces within a real fridge. This presentation allowed us to showcase how MyView behaves on shelves, walls, and ceilings, as well as around randomly positioned food products.

**Figure H3**

Appendix H

# LUMO Prototype and Showcase


Figure H4 (LUMO POSTER by Gab & edited by Ringo)

Figure H5 (Team Poster by Nishita & edited by Ringo)

Figure H6 (LUMO Showcase by Team B&B)

Figure H7 (LUMO Showcase by Team B&B)


LUMO
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