IMPERIAL

Fridge Buddy

Fridge Buddy is a smart fridge sticker designed for seniors to help manage food in the fridge and remind food of upcoming expiration dates. The product features an inked screen display, which the user interacts with by rotating and pressing to manually enter food information, as well as simple icons and numeric visualisations of the content. Technically, Fridge Buddy uses the LVGL library to build the user interface and an input module to control the display, ensuring simple and intuitive operation. It aims to solve the food management problems of elderly users due to memory loss and sensory fading, reducing waste and improving quality of life.

Design in Context Team 6

Alexis Graciela, Feilian Zhang, Huiyu Lei, Yi Huang

10/12/2024

Research Summary

Insights

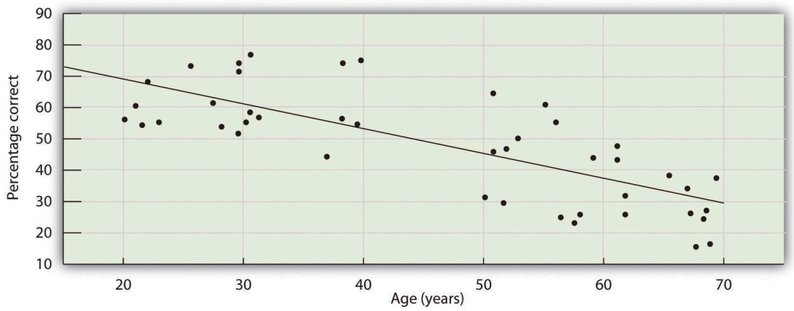
About older people

Memory Loss

Elder people can forget food in the fridge, leading to expired items being consumed or unnecessary purchases, which causes waste and even health risks.

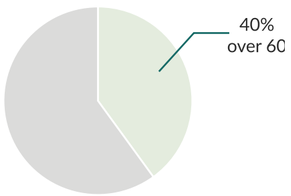
Sensory Decline

Our taste and smell start to decline at our 50s or 60s. This reduces life quality and stops old people from detecting food expiry quickly and precisely themselves.
As shown in the picture, the ability to identify common odourants goes down greatly while aging. [1]

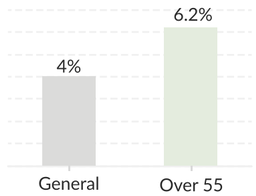


Hoarding Behaviour

Hoarding is when somebody collects or accumulates a large number of things. Hoarding behaviour can occur among all age groups but is specificity common among elder people. Megan Karnes is an activist and founder and chair of the charity Hoarding UK. She says: “It is not only an older person’s disorder, but I would say probably 40% of our participants are people over 60.” [2] A study conducted by researchers at Johns Hopkins University School of Medicine found that the overall prevalence of hoarding behavior is around four percent, but this number increases to 6.2 percent for those age 55 and older. [3]



40% of hoarders are over 60



Percentage of people with hoarding behaviour

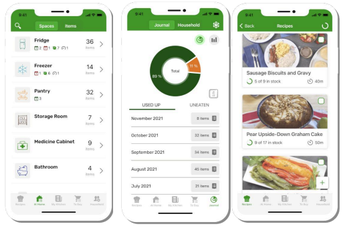
Global Food Waste and Healthy Eating

Globally, food waste is not only a waste of resources, but also has far-reaching implications for environmental and economic sustainability. We use our products to help users reduce waste at the household level and to help older people manage their health.

Market Research

Cozzo APP

Cozzo is a food, home & personal supplies manager, combined with versatile shopping and meal planners that help users avoid food waste by tracking what they have and when the food expire. [4]



Innoscentia Smart Label

As food degrades, spoilage bacteria follow a predictable growth curve, releasing gases as part of their metabolism[5].

Samsung Bespoke Refrigerator

A Bespoke refrigerator features AI Family Hub™+ with large screen and changeable door panels. [6].

Ovie Smartware

Ovie LightTags help users track the food the have. Users can press once for every day they want to track, up to 30 days[7].

Target Users

Older people who need to manage their food

With memory loss

Food hoarders

Money & food saver

With sensory decline

Design Opportunity

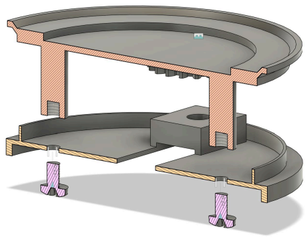
Core issues
Elderly users are prone to forgetting to dispose of food that is about to expire due to memory loss, deteriorating senses and food hoarding habits, leading to waste and health risks.

We provide smart solutions for seniors who need to manage their food, helping them to reduce waste, save money, and improve the convenience and health of their daily lives through proactive reminders and simplified operations.

[1] Braun, T., Doerr, J.M., Peters, L. et al. Age-related changes in oral sensitivity, taste and smell. Sci Rep 12, 1533 (2022).
[2] Sarah Munson, Why do old people hoard?, https://www.homecare.co.uk/advice/hoarding-and-the-elderly#h-why-do-older-people-hoard, 2024.
[3] Anne-Marie Botek, Dangers of Hoarding Behavior Become More Severe With Age, https://www.agingcare.com/articles/hoarding-behavior-becomes-more-severe-with-age-146409.htm
[4] Cozzo, https://cozzo.app/
[5] Innoscentia, https://www.innoscentia.com/
[6] Samsung, https://www.samsung.com/us/home-appliances/bespoke/refrigerators/
[7] Ovie, https://ovie.life/?srsltid=AfmBOoqbdceLSbVaJybY3JVcwQ09EHuG3VLRV57ReBKzlfHPr3pkXXGS

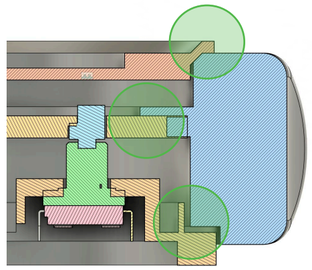
Product Breakdown

DFA/DFDA and Bill of material



Bolt used for assembly

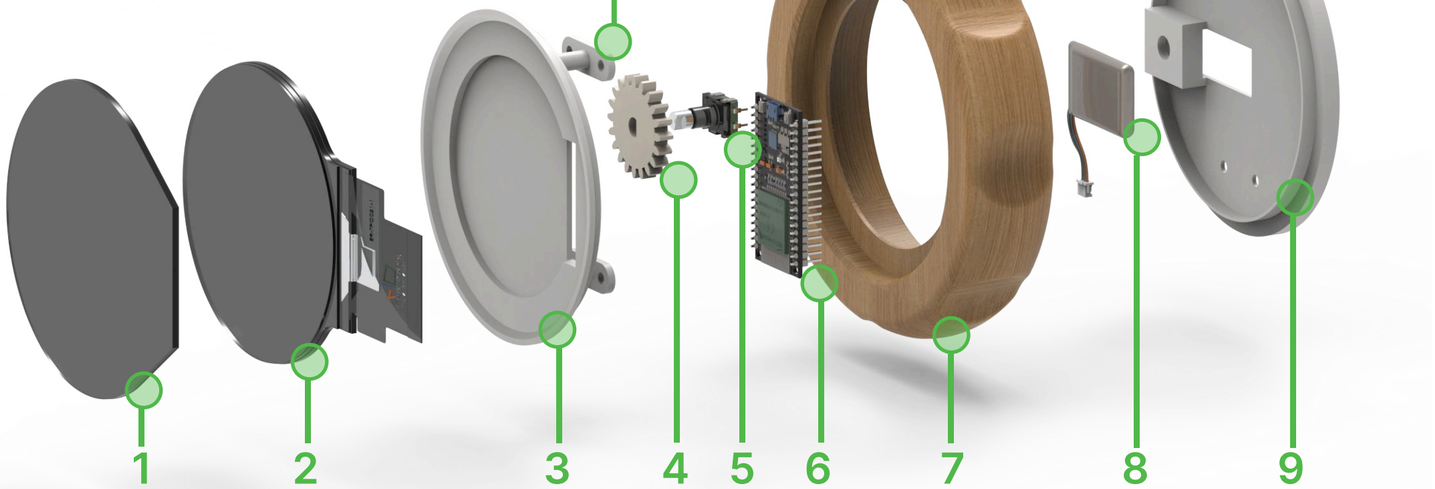
For 3D-printed prototypes, bolts and nuts were used as threaded holes can't be printed precisely. In manufacturing, threaded holes will be injection-molded to improve strength, simplify assembly, and align with DFA principles.



Rotary ring design

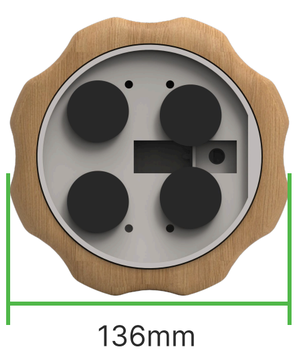
The design ensures the ring is securely fixed in place to minimize wobbling and no additional components are required for assembly. This simplifies the structure and streamlines the assembly process. The 'indented' design enables the switch function when pressing the knob

Fridge buddy prototype bill of material				
Number	Part Model	Quantity	Unite cost	Cost
1	2.8inch RGB Round Touch Display	1	£25	£25
2	ST7701 LCD Chip	1	£5	£5
3	Screen tray	1	£0.6	£0.6
4	Spur gear	1	£0.2	£0.2
5	Rotary encoder	1	£2	£2
6	ESP32-S3-LCD-Driver-Board	1	£10	£10
7	Knob ring	1	£1.2	£1.2
8	Lipo Battery	1	£5.99	£5.99
9	Bottom tray	1	£0.7	£0.7
			Total cost	£27.74

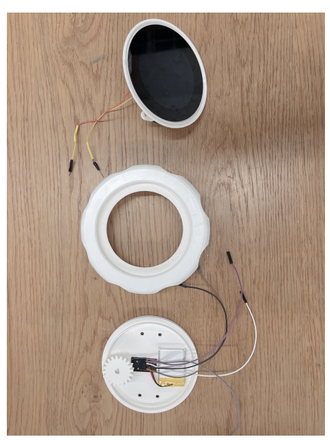


Key Features

Fridge Buddy provides an efficient and caring solution for elderly people's **food management** through the **intuitive interaction of rotating and pressing**, the **simple interactive interface** of the ink screen, the **recording of fridge food information, expiry date reminders**, while simultaneously enhancing the user experience with **fun** interactions.

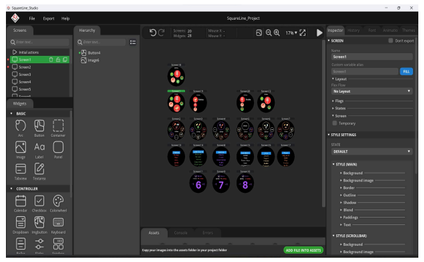


Assembly



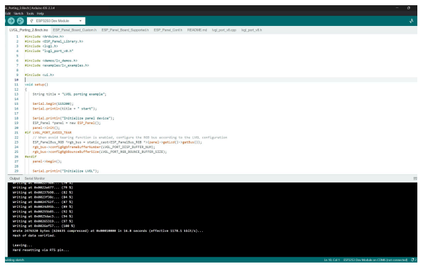
Technologies and Features

Technical Specification



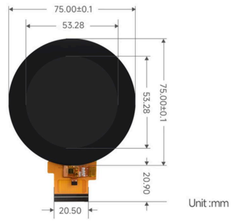
Squareline Studio

A visual design and development tool used for creating user interfaces for the screen. It utilises **LVGL library** and create customized C++ codes and deploy interactive graphical layouts for the round TFT display.



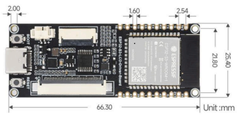
Arduino IDE

The integrated development environment used to program the ESP32-S3. LVGL library and functions are used to setup the **TFT display** and **input rotary encoder**



2.8 inch TFT Round display

A **colored e-paper display** would have been the ideal choice for its **low power consumption** and **extended usability**, obtaining one in the UK within our timeframe proved challenging. Therefore, we used a 2.8-inch TFT display to ensure timely development without compromising functionality.



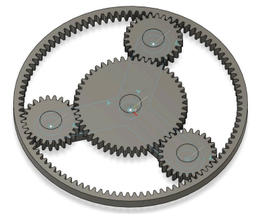
ESP32-S3

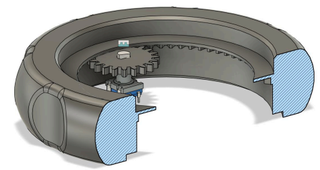
ESP32-S3 microcontroller is used to drive the system due to its **miniture size** and compatibility with **LVGL GUI library**.

Rotary encoder

A physical input device that allows users to **navigate menus or adjust settings** by rotating the knob.

Design of Knob Mechanism





The design of our knob is inspired by the planetary gear system, which enables precise detection of rotational movement. By integrating this setup, the rotational input of the knob is translated into signals that will be captured by the rotary encoder.
The 'cap' of the knob is designed to incorporate a press-switch mechanism, allowing the knob to serve dual functions: rotational adjustments and a press-to-select command. This combination of features not only enhances user experience but also optimizes the mechanical design for intuitive control.

Value Propsition

Streamlined Food Expiration Management

The product design focuses on intuitive and simple interactions to help older users easily manage their food storage as their memory and sensory abilities deteriorate, avoiding health risks due to expired food.

Blending Functionality with Enjoyment

With a clear ink screen display, intuitive rotate and press interactions, and fun visual feedback, Fridge Buddy meets practical needs while adding fun and ritual to everyday life.

Championing Sustainability by Reducing Food Waste

By reminding users of food that is about to expire, Fridge Buddy helps users use stored food more efficiently, reducing food waste at source and contributing to global sustainability.

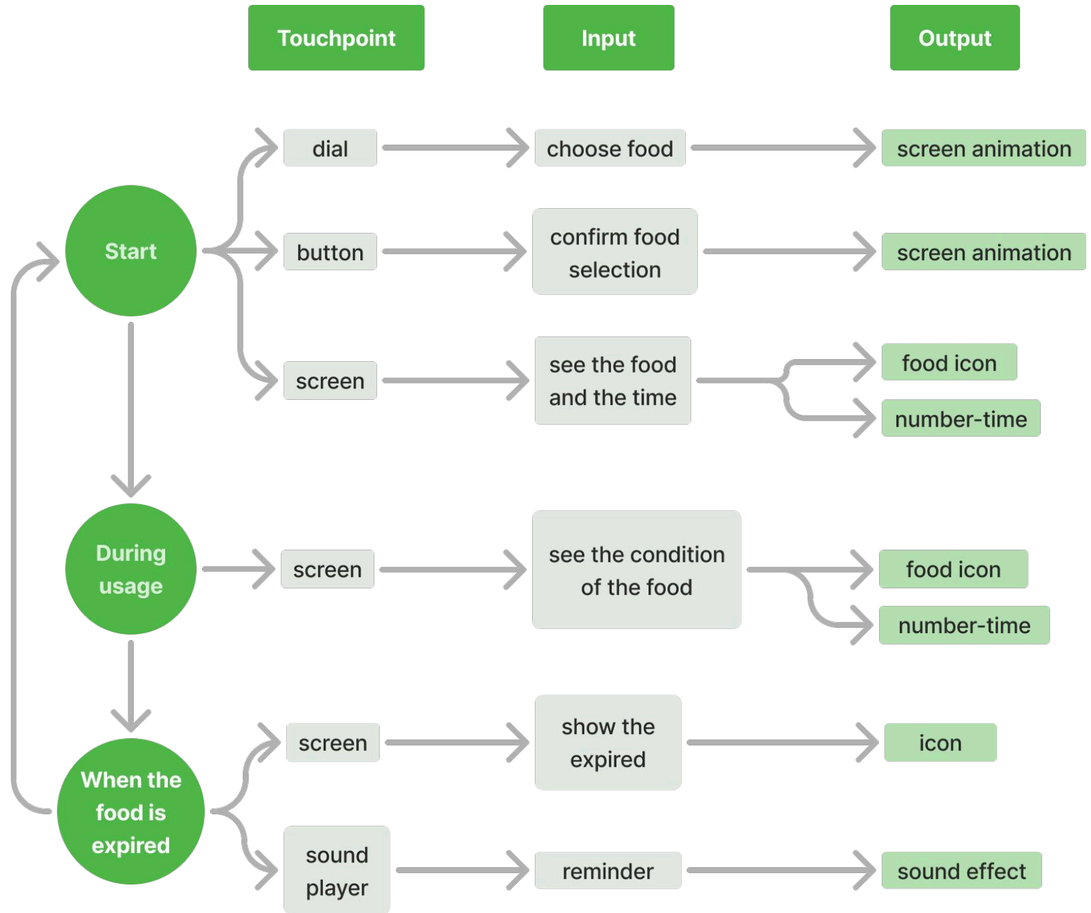
Testing Outcome

User testing revealed positive feedback on the tactile wheel design, including its indents, but suggested increasing icon sizes and simplifying the initial screen to show only food that needs to be eaten. Users appreciated the emphasis on items nearing expiration but noted a preference for a touchscreen interface due to familiarity and mentioned bananas are rarely stored in fridges. These insights highlight areas for refinement to enhance usability and alignment with user habits.

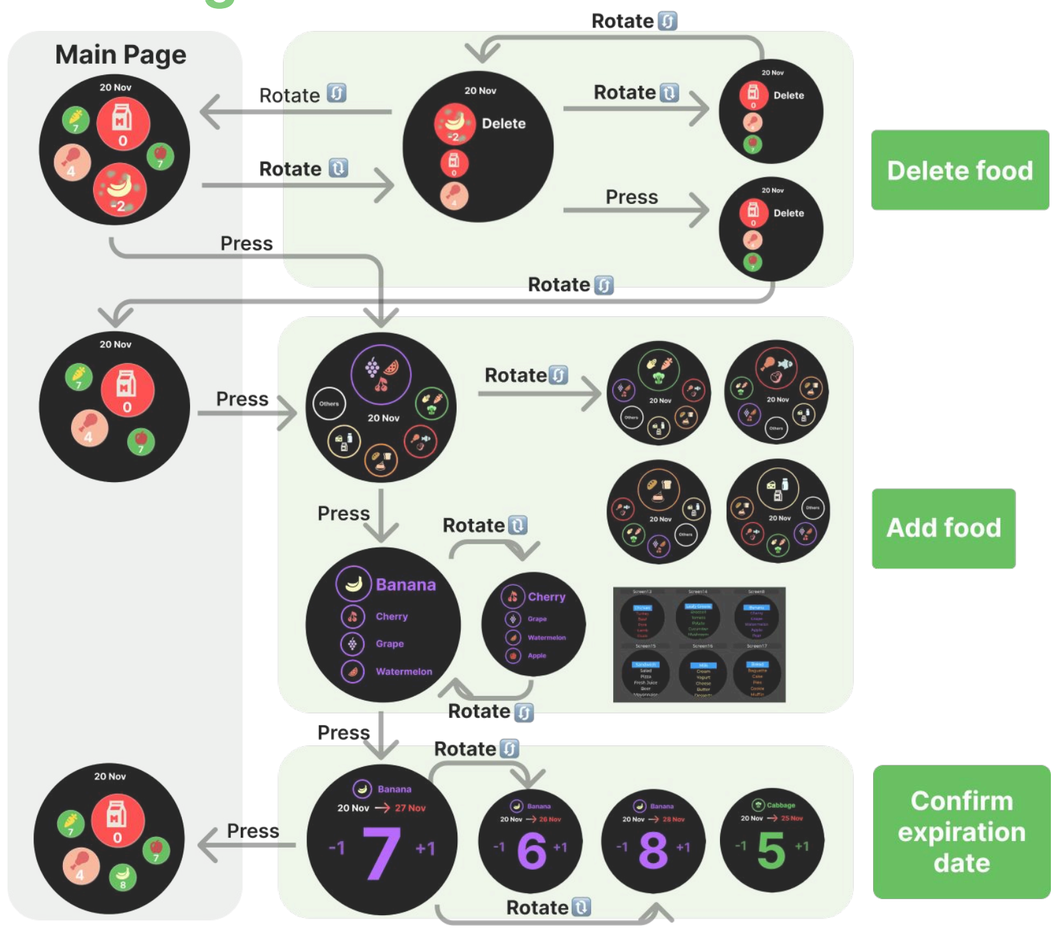
User Interface And Experience

Fridge Buddy's UI and user experience design focuses on simplifying interactions, highlighting information through an intuitive and clear interface, and enhancing the user experience through fun interactions and feedback.

User Flow

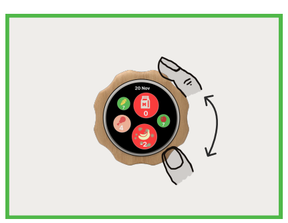


UI Design

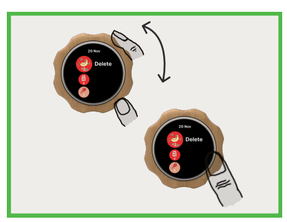


User Guide

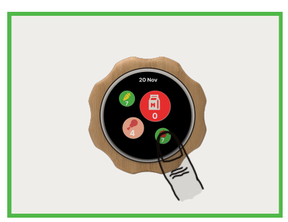
1 Attach the fridge sticker to the fridge and the screen lights up when a person is close to it



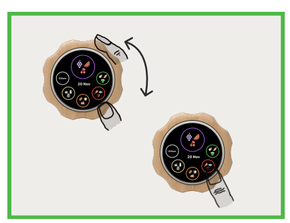
2 Show what's in the fridge on the homepage, alerts for expired and nearly expired food, and helps to manage the food in the fridge



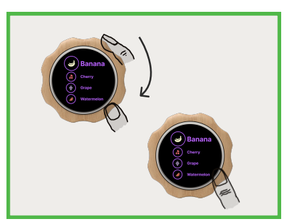
3 Rotate right to jump to the delete food page, select the food to be deleted by rotating it, press to confirm



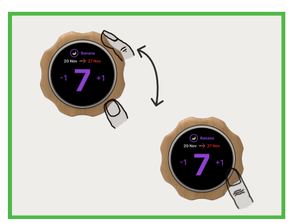
4 After deletion, rotate counterclockwise to the first row, then rotate counterclockwise to return to the main page



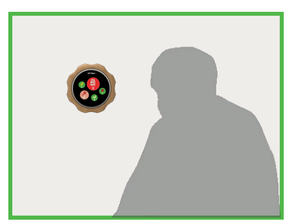
5 Press to jump from the home page to the page for selecting a food group, then select by rotating, then press to confirm



6 Select a specific food by rotating it, then press to confirm and jump to the date selection screen



7 The screen displays the average shelf life of each food item in the database, and the date can be adjusted autonomously by rotating it and then pressing to confirm it



8 Jump to the main page, which adds the food just added to the screen and shows what's in the fridge that's about to expire and what isn't