COCA 201 – Low Fidelity Prototype: Drawer Timer Project

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Abstract
This paper will outline and describe the low fidelity modeling of the Drawer Timer, which is a COCA 201 assignment. The following paper will go into depths on the design, development, user feedback, and more related to the production of this creative computing project. Some of the more in depths explorations of this project will be the design and development, and usage scenarios. This will help in the development of a well researched and critiqued concept. Low fidelity prototypes, like the one in this paper, help to iron out large conceptual issues in a cheap and effective manner. The user feedback on these models assists in bringing outside voices to the project, to assume that the project resists human concept errors.

Author Keywords
Human-Computer Interaction; Creative Computing; Food Waste; Environmentalism; Low-Fidelity; Prototype;

Title Page
In this project we hope to show how technology can be used to help solve issues of food waste and household waste in our everyday lives. The goal of the drawer timer is to help busy people trying to eat healthy with preventing waste in their fridges.

Many people buy fresh produce, and then have it go bad in their fridges drawers. Our target audience is young people who aren't used to the periods of time for which produce can stay fresh in the fridge, and busy people such as single parents who may not have the time or energy to use food before it goes bad. Other issues that our device could address, either through this project or potential future iterations of this design, would be that people may not know what to do with leftover vegetables. A potential functionality that could address this would be a way for the device to suggest recipes or uses for remaining food. This would help the device appeal to the target audience, as it would help create opportunities for those groups to use the food to eat healthy, or feed their families healthy meals. Additionally, this device would be helpful in houses with multiple roommates, where food maybe left in the fridge until it goes bad, creating a mess that needs to be cleaned and conflict between members of the house.

The device would give a gentle reminder to the user that they need to either use food before it becomes waste, or dispose of it in an eco-friendly way such as composting. The device will have the broadest impact if it can be made small, cheap, and easy for an average person to install on their home fridge. In keeping with the concept of waste reduction, the device would also ideally run on rechargeable batteries to reduce the creation of disposable battery waste.

Ideally, our device will promote reflection on the amount of household food waste that is produced, as well as individuals eating habits. We want the users of the device to find that it provokes them to live a healthier and less wasteful lifestyle, while being simple and discreet in their homes.

Related Work

The issue of food waste is growingly prevalent in an environmentally conscious world. In the HCI community, food waste has been discussed with findings that indicate that users care about the amount of food waste they produce and that they would be inclined to reduce it. In a 2012 study on recycling and food waste practices, it was found that participants felt guilt and shame about the food waste they produced [1]. It was theorized that these aversive feelings in tandem with societal influences and pressures would lead to self-led behavioral change in this issue. However, this alone cannot make enough of a difference. Despite our increased eco-conscious society, still 58% of food produced in Canada is lost or wasted each year [2].In a study on the visibility issues relating to food waste, it was pointed out that visibility plays a large role in the consumption of food. Food waste occurs for many different reasons and increasing the visibility of food would only benefit food organization and cooperation in multi-person households. Technologically advanced solutions were suggested including mobile and digital food diaries, inclusion of social media, and camera surveillance of the refrigerator [3].

Though these suggestions are able to incorporate technology with the user experience, they require the rigid logging of food within a household, which is impractical and inaccessible for most people. Our drawer timer project allows users to be reminded of their food without the dedication of time necessary to

be logging their food. The colour-changing nature of our project increases visibility without complete reorganization or restructuring of the user's refrigerator.

Examples of products that aim to reduce food waste are Wasteless and EatChaFood. Wasteless [4]is an Israel based start up, focussed on reducing food waste in grocery stores. The project works by using small automated tags that reduce the price of items, as the best-before date comes closer. This is referred to as dynamic pricing. This project is related to the Drawer Timer in the sense that they both rely on attachable tags, that help consumers utilize food and reduce waste. Also both projects have great focus on the importance of using food before they spoil. However, the Drawer Timer fills a gap that Wasteless leaves, by extending this technology into individual's homes.

Figure 1: Dynamic Price tags in action.

EatChaFood [5] is a prototype app designed to keep track of the supply and location of food currently in the user's home. This app was designed in order to reduce the amount of food waste by informing the user of the contents of their kitchen to minimize the amount of forgotten or duplicate items. This project relates to our Drawer Timer as they both aim to reduce food waste by implementing technology in the user's home. A study which involved interviews, in-home tours and Fridge Cams to monitor the food habits of 14 households, concluded that food waste was the unintended result of multiple moments of consumption such as shopping and cooking. [6]

The goal of the Drawer Timer and the EatChaFood app is to eliminate those moments by helping consumers be more aware of what they buy and when to use them. However, a possible problem consumers may face with the EatChaFood app is the lack of accessibility and inconvenience. Users would have to log every single item into the app which is tedious and time consuming. As well, not every household has access to a smartphone which can support the application or it may not be the easiest to use by someone who isn't tech savvy. The Drawer Timer addresses those issues by having it be a visual representation rather than rely on the user to open an app. That way, they can easily see the colours of the drawer change as time goes by and use those items before they go bad.

Design Concept

Food waste often occurs when food is left in the refrigerator for too long. Produce is often kept in the crisper drawers in an effort to keep it fresher for longer, however this also acts as a barrier in using the food.

While the produce is kept out of sight, out of mind, days may go by while the user forgets that the food exists. Not only does this contribute to the issue of food waste, but the user loses money each time their produce expires.

User Characterization

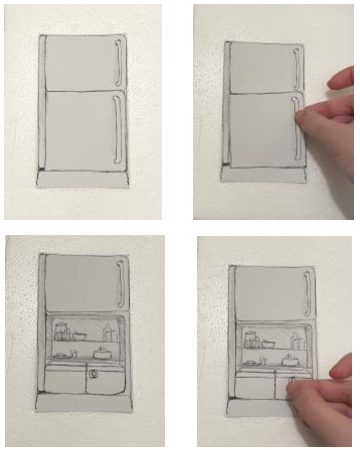
Our typical user would be anyone who cooks for themselves on a regular basis. We will gain access to our users by creating a questionnaire so we can understand their needs. When interviewing our users, we will question them on how often they notice their produce and food expires before they are able to use it. Furthermore, we will question them on the monetary effects they perceive are related to their food waste.

The Drawer Timer's user can be characterized as overly busy university students with an eye on the environmental impact. The users are young University students in their early 20s. Often these individuals are in school full time and work part time. They need help keeping track of their produce, and are looking to save money, by not wasting large amounts of food. The product will lean into the aesthetically pleasing and easy-to-use product that most university students look for. Additionally it is important that the product is youthful and friendly.

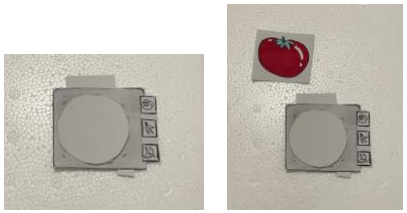
Design

The main design of this project revolves around a small cube-like structure. The small square will have a clip on attachment that the user can stick on the crisper of their fridge, a shelf in their pantry, or any place where produce is kept. The square will be simple in form, with three buttons to determine settings, one reset button, and one large colour-changing light. As the produce goes bad, the light will change from green, to yellow, to red. This will remind the user to use up their food, before it is inedible. To help illustrate the design of this project, paper prototypes have been constructed to show the user experience, from start to end:

Figures 2-5: First, the user will place the drawer timer into their space:



Figures 6-9: Next the timer's setting is selected. For this example, vegetables (tomatoes):



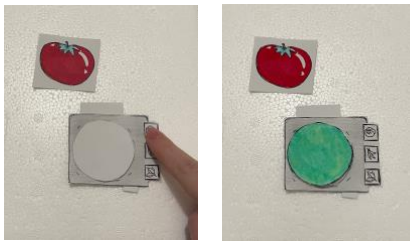


Figure 10: As the fruit slowly goes bad, the light changes, meaning the user now knows to use up their produce:

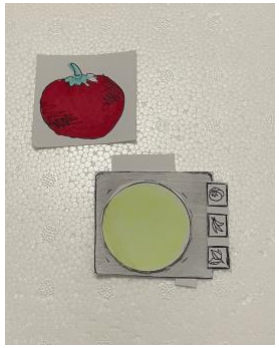
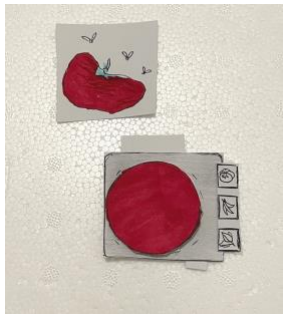
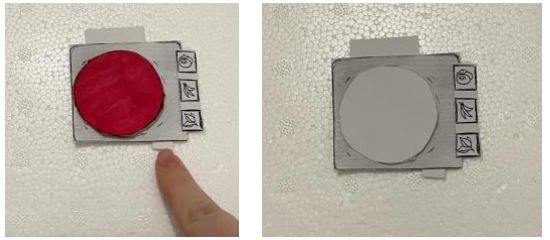


Figure 11: As time passes, the fruit goes bad, and a red light warns users from using it:



Figures 12 and 13: Finally, the timer is reset:



By utilizing these low fidelity paper prototypes, we have been able to more concisely aid in the development of this model. Additionally, getting user feedback on this actual interaction, as opposed to theoretical or explained interaction is a crucial step. The tracking of user input, and machine output is clear through prototyping. The user inputs the type of produce they get, and the machine outputs time remaining in the form of light.

Additionally this project must incorporate the principals of everyday interactivity, through making something user friendly and simple. The lights must not be jarring and harsh, but rather soft and friendly. The images of fruit, vegetable, and leafy greens must be clear and understandable to individuals of a wide background and language base. Overall, these prototype showcase the ways in which the user will use this product to reduce their food waste emissions.

Development

The device prototype will use the buttons on the front to take input from the user determining which type of produce is being selected, and how long the timer should be set for. Buttons with icon prompts are a simple input method to understand, as well as being

Figure 14: An example of an Arduino microconroller. Source: https://www.flickr.com/photos/sparkfun/8406865680/
This would be used as the products microcontroller, as outlined in the Development section of this paper.

non-linguistic, meaning that they can be used by someone who speaks any language without needing to be translated. As the device's timer runs out, it will use the LEDs to display output to the user. LEDs are a good method of output as they consume very low amounts of power while still being highly visible. The green, yellow, red, colour scheme is another non-linguistic design element, where it will be understood by everyone regardless of language. The programming for the timer could be done in C++, as that is the programming language that the Arduino IDE works in.

By creating a low fidelity prototype, we were able to review the technical properties of the device without the time and resource expense of creating a functioning model. This low fidelity prototype was developed using a simple paper prototyping technique. A paper model was constructed that showcases the basic input, output, and functionality of the device. In future iterations of prototyping, a high fidelity model will be created likely using an Arduino microcontroller, electronic buttons, and LED lights. This model will closely reflect the full functionality of the Drawer Timer. We do not currently have immediate access to Arduino microcontrollers, but they can be easily purchased online. The other elements required for the higher fidelity stages of development can also be easily ordered online, and will be acquired when the next stage of prototyping begins.

Due to the fact that replaceable batteries generate waste as they are used up, future models of the device may also use rechargeable batteries, in order to be more consistent with the devices goals of reducing household waste. It is possible that the initial high fidelity prototypes will have replaceable batteries, as the goal of a high fidelity prototype would be to test the input and output interactions of the device. As long as the change to rechargeable batteries would not interfere with the actual functionality of the system, they could be added at a further prototyping stage.

Usage Scenarios

Users can use the Drawer Timer in order to limit the amount of food waste in their household with the help of visual cues. The device can be placed in a fridge drawer which contains food items and over time, the light will change colour according to how long the items have been in the fridge and alert the user when they are about to go bad.

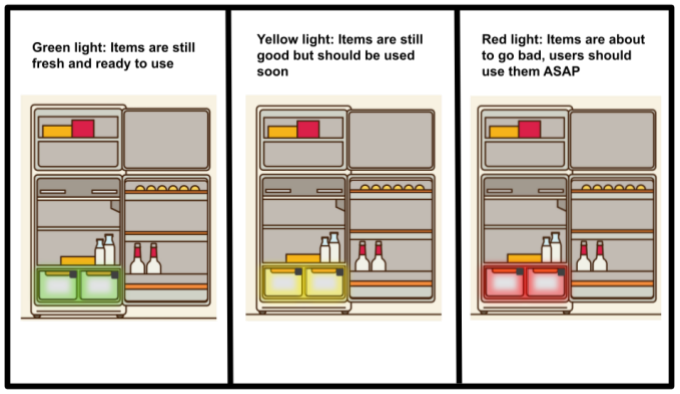


Figure 15 : Fridge drawer usage of Drawer Timer.

The Drawer Timer can also be used to indicate the ripeness of produce. Oftentimes, consumers will buy produce which has not yet ripened in hopes of using it later. However, sometimes these products can be

forgotten and go bad and result in food waste. Since the device can be used on any container, users can simply place the Drawer Timer on a container to be notified when the items are ready to be used!

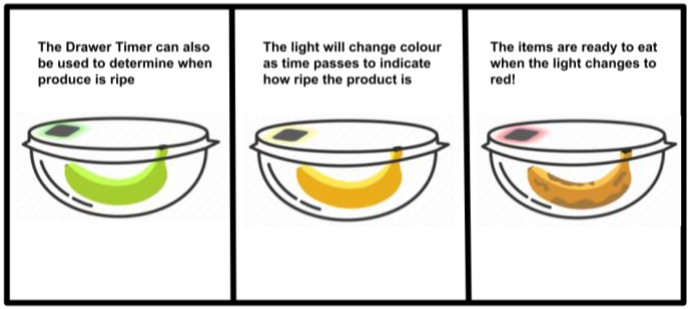


Figure 15 : Fridge drawer usage of Drawer Timer.

User Feedback

The *Method:*

Before the user testing of our project, we began by asking our users about their food habits and waste production. Then we placed our low-fidelity prototype in the refrigerator drawer of our users. The purpose of the Drawer Timer is to remind users of their food in the refrigerator before it expires. So, although the low-fidelity prototype did not have all the functionality that the final project will, it could still serve as a reminder of the presence of their food.

Our users who performed the testing were all female students. In their questioning in the beginning, they identified that they often let their food expire, and thus waste their food. As students, they are busy with schoolwork and jobs. Finally, they estimated that they cook one to two meals a day for themselves and often eat leftovers.

The Findings:

Data was captured from these procedures by conducting a survey at the end of one week of having the Drawer Timer low-fidelity prototype in the users' refrigerator. One thing that users pointed out should be considered was the placement of the Drawer Timer in the drawers. They explained that if it falls to the bottom of the drawer, under the food, it will become hidden and therefore, not serve its purpose. A mounting device or system should be considered.

Despite this, the presence of the prototype did help to remind the users to open their drawers and see what is inside. Users did not feel that the interface was very obvious or engaging, but with the eventual introduction of the light from the Drawer Timer, its function will become much clearer.

The Recommendations:

Some changes that we may make to the user interface would be to figure out a mounting system consisting of sticky tack, glue, magnets, or another material to mount it on the side of the drawer. Another change that the users suggested that would be beneficial to the project was to connect the Drawer Timer to a motion

sensor so that it does not have to stay on and waste battery life all day. Or to connect the Drawer Timer to the refrigerator light so that when it is opened, the light will turn on.

Figure 17: Low-fidelity prototype in user's refrigerator drawer

While collecting the data for the User Feedback section of this paper, a short table was constructed to summarize and organize the opinions given by the users.

The following table of data was collected to summarize the user feedback collected from the low fidelity model:

	Age	Occupation	Pros on Prototype	Areas to improve
User A	19	Student	Serves as reminder for produce that will expire	Mounting system for prototype
User B	20	Student	Aesthetically pleasing by adding colour to refrigerator	Worries about battery life and longevity Suggest motion sensors
User C	19	Student	Idea is beneficial, especially for students who are often cooking for themselves for the first time	Limiting factor: prototype will only work in clear drawers Perhaps mounting on the outside of a drawer should be considered

References

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