

# LionFoodTracker

Nittany Ai Challenge 2023



## Our Team

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## Overview

Food waste is a significant problem in America and the world. According to the United States Department of Agriculture (USDA), an estimated 30-40% of the food supply in the United States goes to waste, with a value of approximately \$161 billion in 2020 alone. Penn State is no exception to this problem, as a study conducted by the university found that up to 30% of the food served in campus dining halls goes to waste. According to the Daily Collegian (Agrawal, 2017), the food waste problem has been regularly occurring in this community and is carried out by approximately 10,000 Penn State students who normally have food at the dining hall. All in all, there are around 455,000 pounds of food waste each semester. It is not a problem that only happens at Penn State, as many dining halls in other universities across the world experience this food waste problem as well.

This waste not only has economic implications but also has significant environmental and social impacts, contributing to greenhouse gas emissions and wasting resources that could have been used to feed those in need. Furthermore, it exacerbates hunger and poverty, as it results in less food available to feed the population. It is crucial for individuals and institutions to take action to reduce food waste.

Our solution aims to reduce food waste at university dining halls through using food detection and food quantity estimation AI. To do this, our team has been developing an iOS app using Swift that allows students to take a picture of their food and get rewards. We are also working on a dashboard website that shows the various data visualizations automatically generated by our data analytics pipelines to dining hall staff. These analyses will support the

staff to make informed and strategic decisions such as ordering food that is more accurate to student consumption.

## Use Case

Our food waste management system is designed for university dining halls and other food service providers who want to reduce their food waste. We believe our system will be particularly useful for these organizations as they often generate large amounts of food waste.

Our system will be able to generate different data analyses and visualizations to evaluate food waste. This will be of great help to both the economical benefit and environmental protection. The system will continuously update and inform the organizations about the food waste assessment such that the administrators will be able to make corresponding adjustments to food purchasing and preparation practices. In the future, we plan to expand our focus to include local restaurants.

### Mobile App:

- Camera → Dining hall users can utilize the camera feature to take before & after pictures of their meals to collect data to train the AI. (Currently, we have an upload image feature on the prototype, in the future, we will only have the camera option)
- Menu → Dining hall users can view the menu of each dining hall on their campus.
- Rewards → Dining hall users can earn rewards when they take more pictures of their meals and redeem them for free food & beverages. For the future, we plan on collaborating with local businesses. Restaurants can gain exposure by providing free

incentives (food) to our user base while having the opportunity to associate themselves with green tech.

Website App:

- Kitchen administrators can view various data gathered from the user, which includes the total amount of food served, the total amount of food wasted, the total amount of food eaten, the most/least popular food served & wasted, and user feedback on the food. The data can be viewed daily, weekly, monthly, or yearly.

## Technology

We are developing 2 technologies: Our food waste management system is built on top of the LogMeal API. The LogMeal API is a RESTful API that provides a way for users to log their food waste data. The API is built using Python and Flask and runs on a cloud-based server. We are using Swift language to develop the mobile app for the iOS platform. The app connects to the LogMeal API to retrieve and display user data.

Specifically, the LogMeal API(<https://logmeal.es/api>) provides 6 food AI APIs and we are going to use 3 of them: Food Type Detection, Food Quantity Estimation, and Nutritional Information. Each API can be implemented to recognize the type of food, the quantity of food, and the nutrition.

In the future, we will also develop a system that can utilize a database to store user data and a front-end user interface that is built using HTML, CSS, and JavaScript.

## Data Sources

To gather the data, we are going to create a focus group of students who are willing to help us. The focus group will be taking pictures of their meal at the dining hall, and all pictures will be used as a dataset to test the technology. We are going to compensate the focus group with the funded money. Users ultimately upload the data through the API by providing information such as the type of food, and quantity.

The LogMeal API also provides data on the type of food and the quantity of the food.. In addition, we are going to use publicly available food pictures as a training set and a testing set. We are continuously updating our data sources to ensure that our system provides users with the most up-to-date and accurate information.

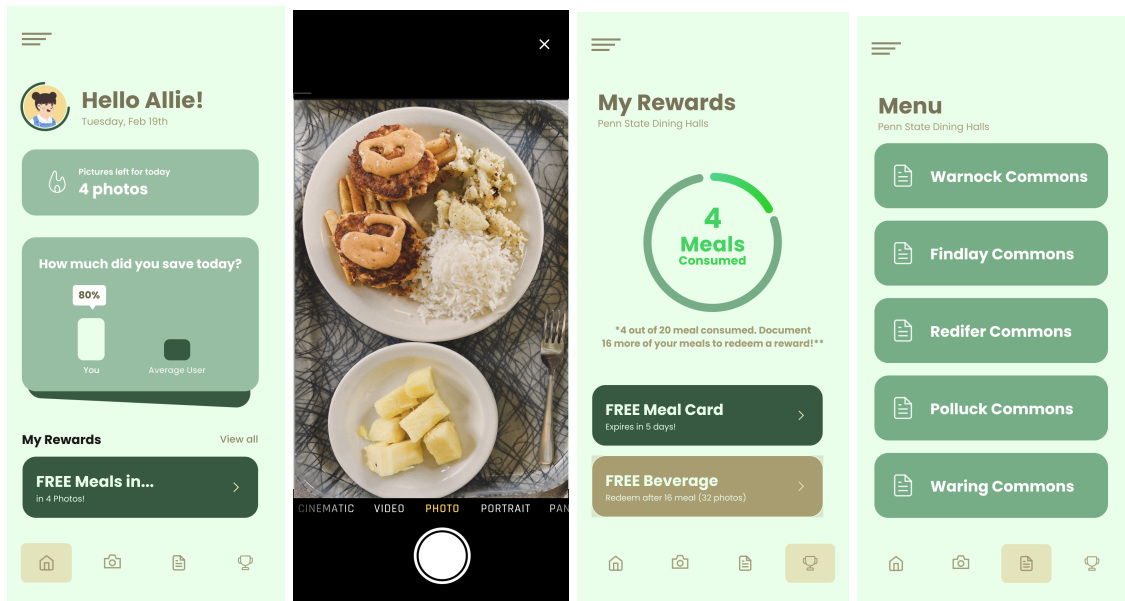
## Security/Privacy

Our app prioritizes the privacy and security of user data. All user data is encrypted both in transit and at rest. Access to user data is restricted to authorized personnel only. User data is anonymized and aggregated for data analysis and reporting purposes.

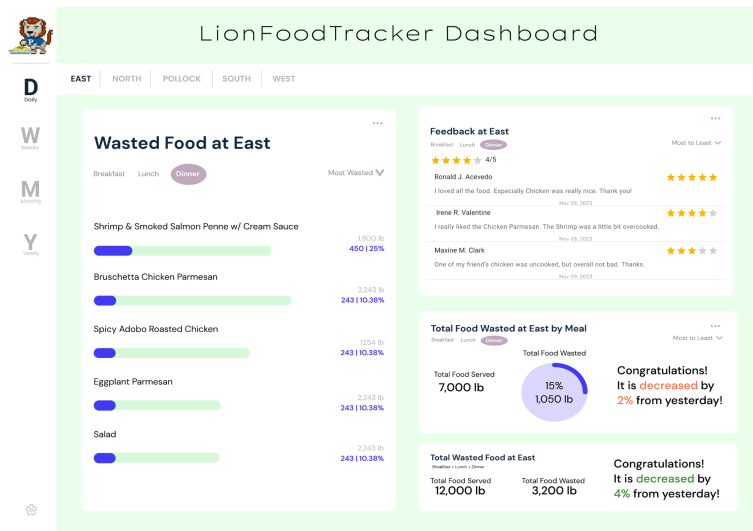
Furthermore, we are planning to use FaceID for LogIn which can help prevent unauthorized access to user data or devices, thereby increasing the overall security of the system. Additionally, FaceID is designed to protect user privacy by securely storing facial recognition data on the device and not transmitting it to external servers or third-party applications.

## User Interface

We have two user interfaces for different users: The LionFoodTracker application which is for the users who take pictures at the dining halls, and the dashboard website which is for dining hall staff who look at the analyzed data.



The user interface of our application is designed to be simple and intuitive. Users can sign in with their school emails. The **home page** shows brief statistics of users' data: the number of photos left per day, how much food they saved, and the information about the rewards. There is a menu bar at the bottom with four icons: home, camera, menu, and reward. Once they click the camera button, it will lead them to a **camera page** where they take pictures of their food before and after they eat. The **menu page** allows them to view the menu at each dining hall, and finally, the **reward page** shows the status of the reward system.



The dashboard website is simple enough to interpret the result. It has 3 different options: daily, weekly, monthly, and yearly to provide various data analyses. Also, the users can view data from 5 dining halls in one screen

by clicking through the buttons. On the dashboard, we have 4 sections. The **Wasted Food section** has a horizontal bar graph that shows the amount of food taken by the food type, and the amount of food wasted by the food type. The data of the food served is green, and the wasted food is purple. The users can utilize the filter button to sort the data by most wasted food to least wasted food, or most served food to least served food. The **Feedback section** shows the ratings and feedback from students. The **Total Food Wasted section** shows the total amount of food served by time (breakfast, lunch, and dinner), the total amount of wasted food by time, and a brief summary of an analysis.

## Development Timeline

As part of our ongoing efforts to improve our project, we are currently using the Logmeal API, but we are also exploring other APIs that we can use. Building on the foundation provided by the Logmeal API, we are planning to develop our own AI that will enhance the accuracy and effectiveness of the system for pictures of dining hall food.

## **April**

We will continue to communicate with the dining halls after the prototype phase, receiving feedback about our product design in the process. From there we can make any changes that they feel are warranted. We will also keep honing the accuracy of our AI as well to ensure that dining halls receive the data they deserve. At first, the team will supply our own pictures of dining hall food for the AI to analyze. During this month, we will also try to implement our solution in React Native to accommodate both Android and iOS users.

## **May - June**

In May as well as June, we will start to expand our pictures of food outside our team's pictures to get more of a variety. This could be through asking other students to take pictures of their dining hall food and providing a sort of incentive for helping with our data collection. This will allow our AI to take in more food types and be able to more correctly identify more situations and food. Along with these expansions, we will continue to improve our UI.

## **July**

In this month, we will focus mainly on user testing. We will be able to concentrate our testing into a smaller sample size since only one dining hall will be open in the summer session (either Pollock or Redifer). Because of this, it allows for a good control experiment since it is much more manageable to collect data this way rather than having all dining halls open. From these tests, we will be able to improve our AI's accuracy even further, as well as gain invaluable feedback from the students and dining halls for overall user experience, in preparation for the submission and presentation.



## August 8th

By this point, we will have finalized all changes and be prepared to present our MVP for the panel of judges.

## Team Capabilities

Our team is made up of 5 individuals with diverse backgrounds and skills that equip us to effectively tackle our proposed idea of reducing food waste. We have team members who have experience in programming, data analysis, UI/UX design, and have first-hand experience in dining halls. Two of our team members major in Computer Science and possess expertise in both front-end and back-end development with a great knowledge of various programming languages. The other two members major in Computational Data Science and have knowledge in database management, data analysis, and a programming language for statistical analysis, R. We also have a team member studying Human-Centered Design and Development and Diversity & Inclusion who has a background in UI/UX research and design. Lastly, we have a Ph.D. student who studies Informatics and specializes in data management and data visualization.

We highly value our collaborative work with Jamie Robinson, our mentor and the senior assistant director, who provides us with valuable insights and immediate feedback on the food waste situation. We also have guidance from assistant professors to support us in our efforts.

With this combination of technical and content expertise, our team is capable of developing a user-friendly and efficient mobile application that addresses the problem of food waste in buffets for all of our users. Users will play a vital role in providing data by taking before and after photos of the meal they consume. Our goal is to reduce waste using the Logmeal API, which supports the food detection process, to gather data on trends and patterns with user activity.

## References

LogMeal API documentation: <https://api.logmeales/docs/>

Swift programming language documentation: <https://swift.org/documentation/>

Flask documentation: <https://flask.palletsprojects.com/en/2.1.x/>

<https://github.com/AIcrowd/food-recognition-benchmark-starter-kit>

<https://paperswithcode.com/dataset/foodx-251>

<http://123.57.42.89/FoodComputing-Dataset/ISIA-Food500.html>

[https://www.collegian.psu.edu/news/campus/food-waste-from-campus-dining-commons-could-feed-fans-of-four-sold-out-penn-state/article\\_e7477c52-bf72-11e7-bf44-273401e7ee3e.html](https://www.collegian.psu.edu/news/campus/food-waste-from-campus-dining-commons-could-feed-fans-of-four-sold-out-penn-state/article_e7477c52-bf72-11e7-bf44-273401e7ee3e.html)

<https://www.usda.gov/foodwaste/faqs>