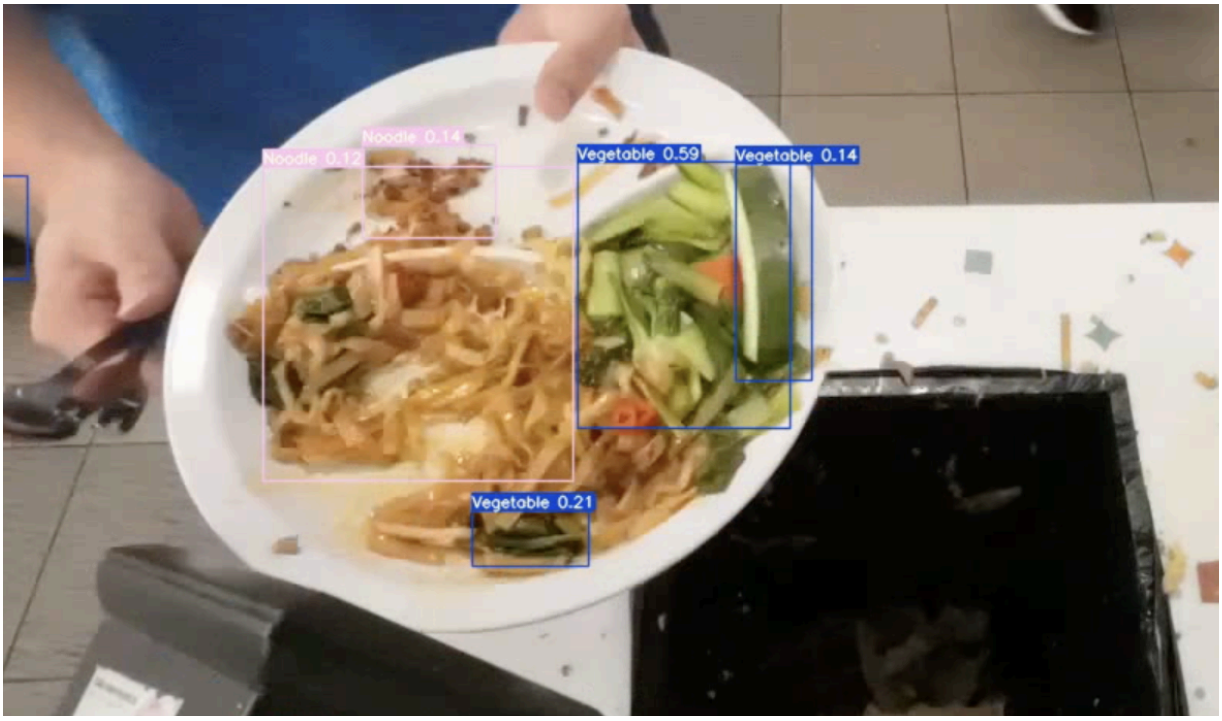
The Bin Project Demo Report
UWCSEA East, Oct 2nd-13th



*Food waste on Monday Oct 9th, as captured by our AI camera with **90% accuracy***

Summary

By analyzing the food waste captured on the AI camera from the last two weeks, we have identified the **Pad Thai** dish from the World Kitchen as disproportionately wasted. This single food type accounts for **60% of total waste**. We recommend that Sodexo **reduce portion sizes for Pad Thai by 15%**. We expect this to **lower food waste by 48%** on days when Pad Thai is served, in addition to the existing 30% reduction in food waste over the last period. This report details our methodology, data, and further recommendations.

Methodology

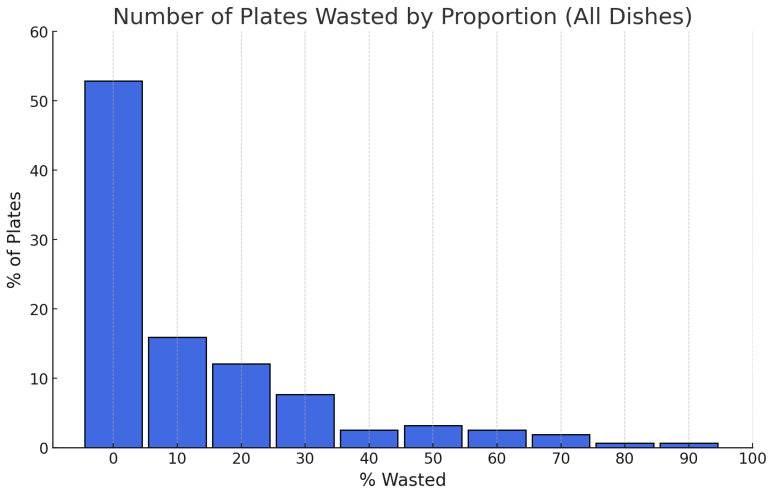
A total of **3161 plates** were captured across the two weeks from Oct 2nd to 13th. The **type** and **proportion wasted** of each plate discarded was identified by a **machine learning model**, with manual verification.

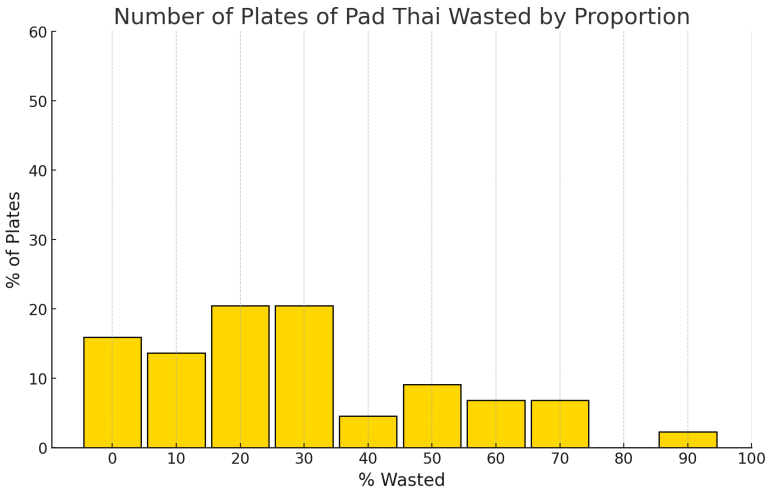
Data & Findings

From the database generated by our AI camera, we found the following:

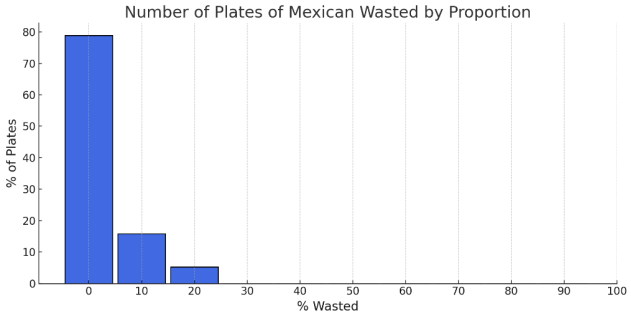
- The average amount wasted across all dishes is **12%**, while the average amount wasted of Pad Thai is **29%.**
- Only **16%** of Pad Thais sold were completely finished.
- On average, a cumulative amount of **39 whole servings (approx 12kg) were wasted** each day**.** Pad Thai accounted for **24** of these servings.

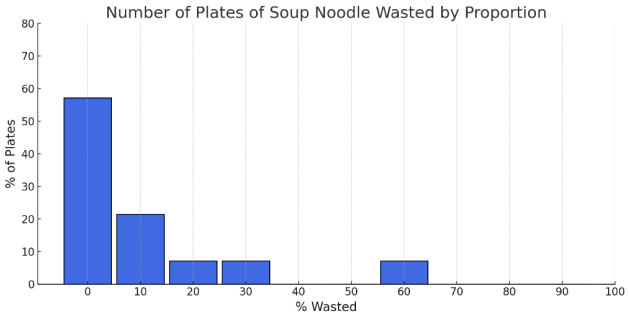
The disproportionate wastage of Pad Thai is also visually seen in the plots below, which show the % of plates that contained 0% waste, 10% waste, 20% waste, and so forth.

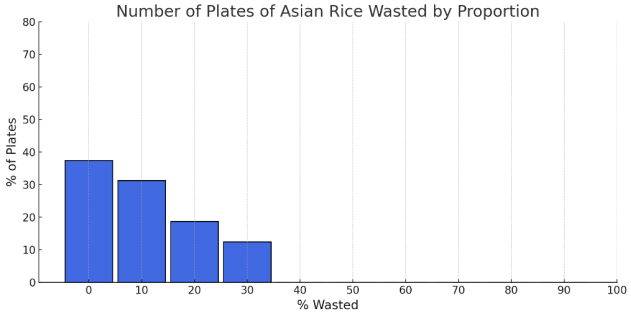


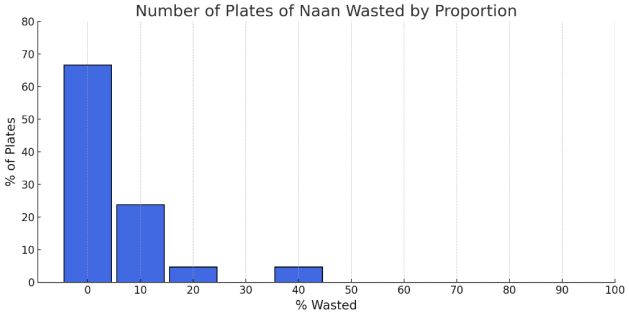


It is clearly observable that the distribution of Pad Thai wastage leans farther to the right – indicating **substantially higher wastage**. Plotting similar wastage distributions of other dishes (below), we see that they indicate drastically less wastage than the Pad Thai:









Recommendations

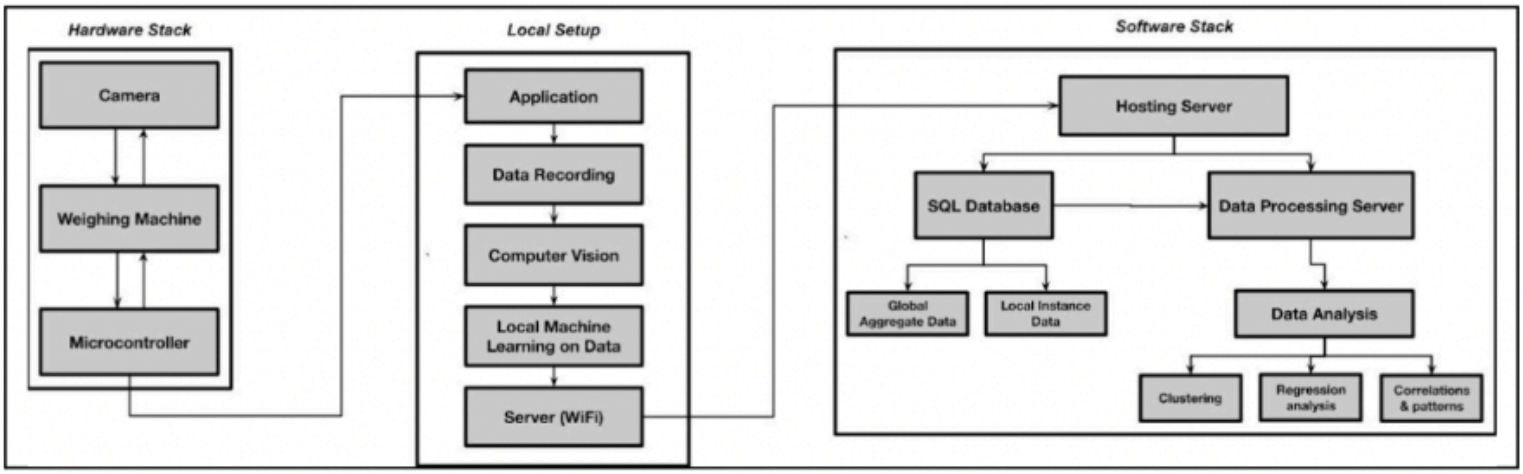
Based on these findings, we conducted further investigations into the **root causes** of Pad Thai's overwhelming wastage, through student and staff interviews & feedback. Here are the causes we distinguished and recommendations for addressing them.

Cause 1: The portion size for Pad Thai is excessive. Additionally, over the course of each lunchtime, the **portion sizes increase**: we observed that canteen staff scoop more Pad Thai into plates when they see the large amount of unserved food they have left.
Solution 1: Both the total stock and portion size of Pad Thai should be **reduced by 15%.** This value was calculated by approximating the wastage Pad Thai as a Gaussian distribution, then shifting its mean to align with the wastage distribution of other dishes.

Cause 2: Pad Thai is served as **a combo set** (as opposed to other food counters offering a few buffet-style choices).
Solution 2: We measured a very strong negative correlation between the number of choices offered at each counter and its wastage. That is, more choices, less waste. For instance, this is exemplified by the Mexican "build-your-own-bowl" counter with **80% of plates being completely finished**. The Pad Thai could be converted from a fixed set to an ***a la carte*** item, increasing customizability.

Technical Specifications

The current technology features an ESP-32 camera module attached to a 3D printed housing, and is stationed above the canteen bin. It captures all discarded food waste. Then, the module sends the information to a local device (a computer or phone) which will amalgamate the incoming data into a database.



Bin architecture diagram

We have opted for the YOLO (You Only Look Once) v7 model to drive the classification task in our project. By training YOLO v7 on our labeled dataset, we developed a model capable of classifying waste into predefined categories (eg. Pad Thai Noodles, fried rice) — currently, its accuracy is at 0.9 mAP (Mean Average Precision).