Oregon State University

Computer Science
College of Engineering

Smart Compost Bin

for Measurement of Consumer Food Waste

November 8, 2024



soundbendor lab

Food Waste is a Major Problem

Economic

- 1.3 billion tons wasted annually
- enough to feed 3 billion people
- $1 trillion in economic loss

Societal

- 783 million people battle hunger
- raises inequity between countries
- waste uses 30% of agricultural land

Environmental

- accounts for ⅓ of greenhouse gases
- 10% of emissions from wasted food
- wastes ¼ of water supply

Consumer

- majority at retail and consumer level
- household waste is 61% of all waste
- 81 kg of waste per household

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Consumer Waste is Not Measured

Current approaches:

- expensive
- time-consuming
- burdensome
- prone to human error

Challenges:

- only 20% use direct measurements
- reported rates are highly variable
- data is not reproducible
- studies tend to underestimate

“What gets measured gets managed”

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Proposal:

- AI-assisted device that accurately quantifies consumer food waste

Target:

- consumer kitchen
- commingled waste
- automatic measurements

Goals:

- intuitive and easy to use
- minimal burden on user
- build a dataset of images for CV

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Smart Compost Bin



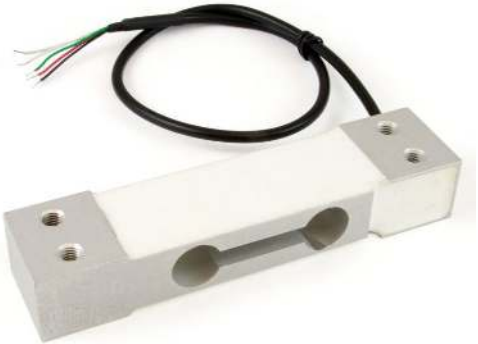
Electronics and Sensors

Table 1: List of electronics and sensors included in the design.

Component	Part	Purpose
Processor	Raspberry Pi 5 4GB	Communicates with sensors; uploads to database.
Camera	Intel RealSense D401	Takes 2D and 3D image.
Thermal camera	110° MLX90640 IR Matrix	Generates thermal image and heatmap.
Gas sensor	Bosch BME688	Measures temperature, humidity, tVOC, and pressure.
Hall Effect	Melexis US5881LUA	Detects when the lid is opened and closed.
Microphone and DAC	Waveshare USB Sound Card	Records speech audio, prompts user.
Load cell amplifier	NAU7802 24-bit ADC	Measures value from load cell.
Load cell	10kg Single-Point (C3 Grade)	Measures mass of food items.

Electronics and Sensors









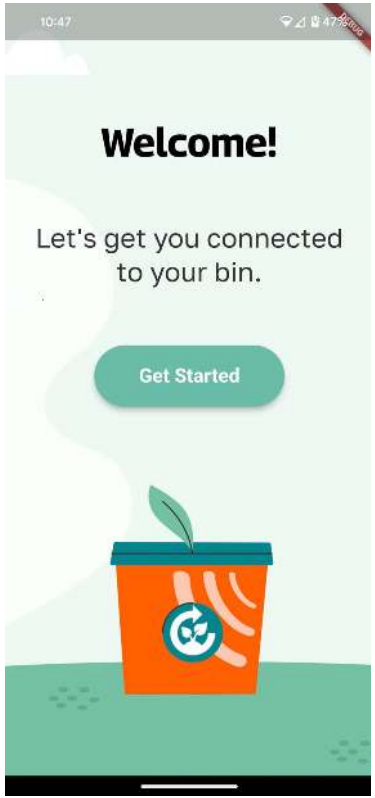


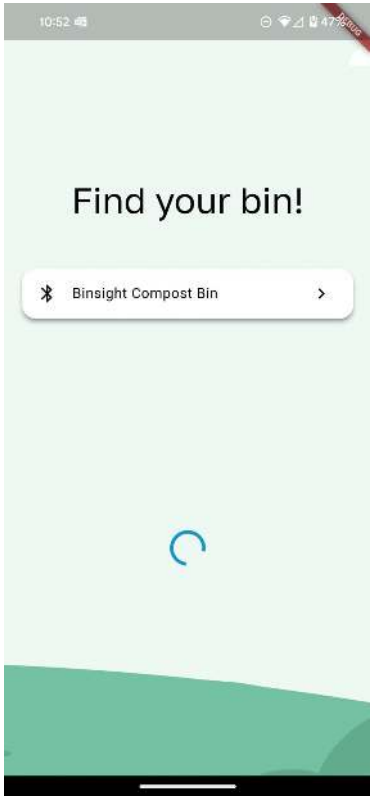


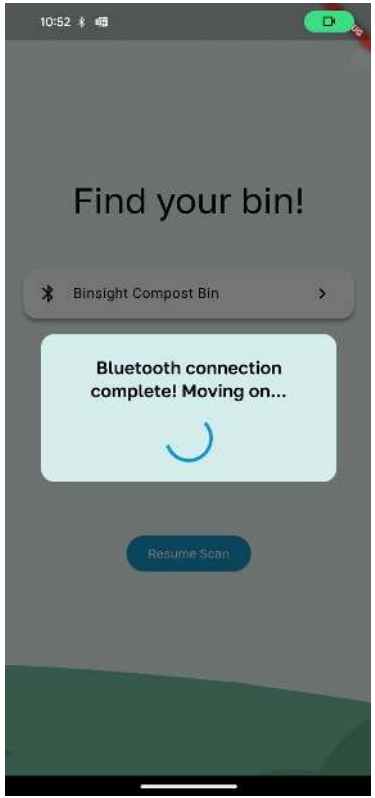


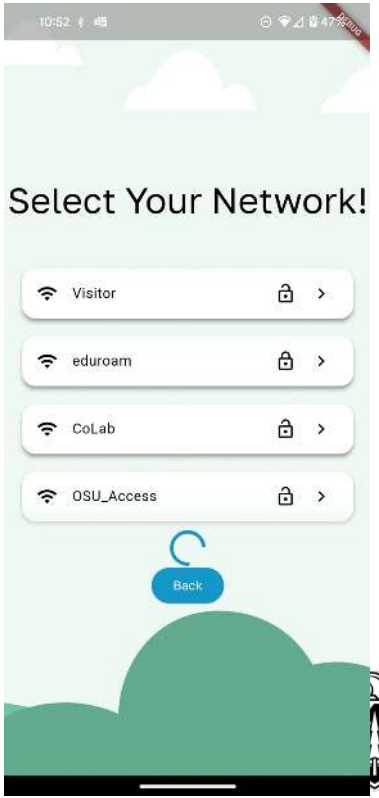
Mobile App

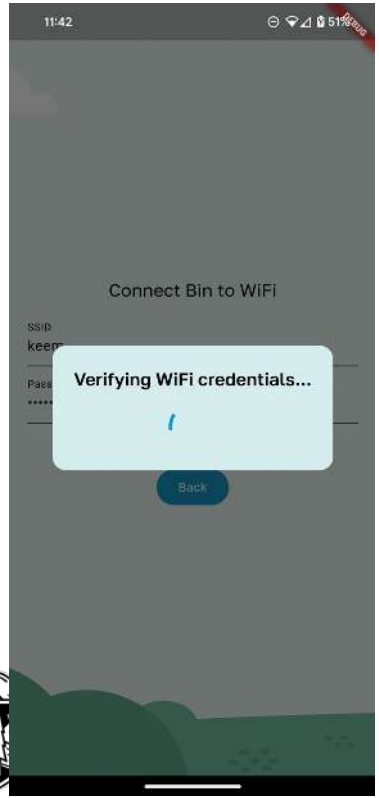
WiFi Connection





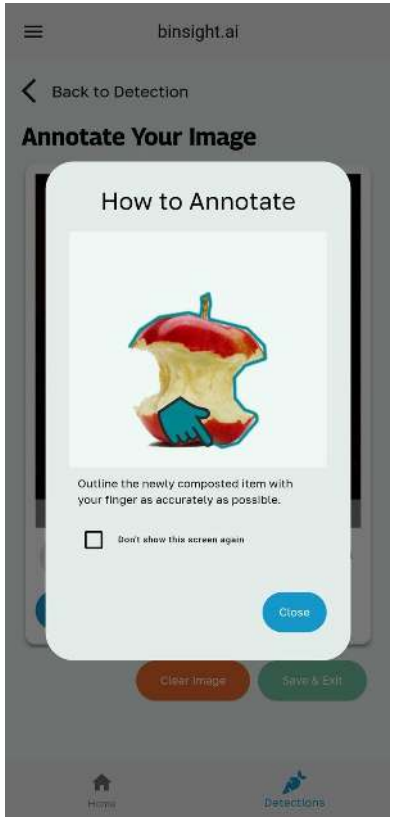




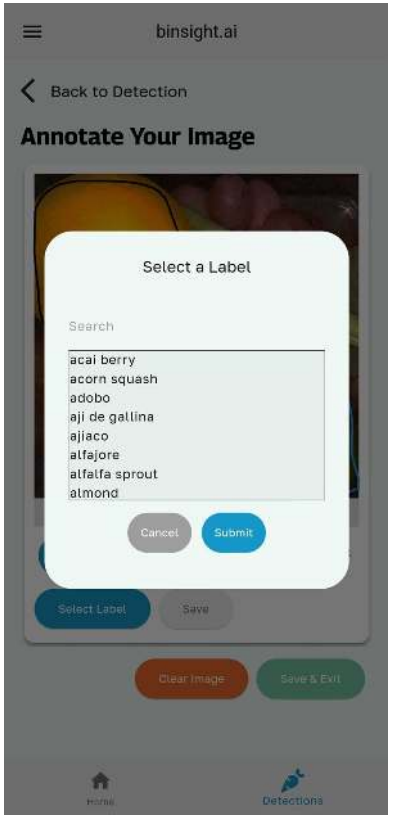


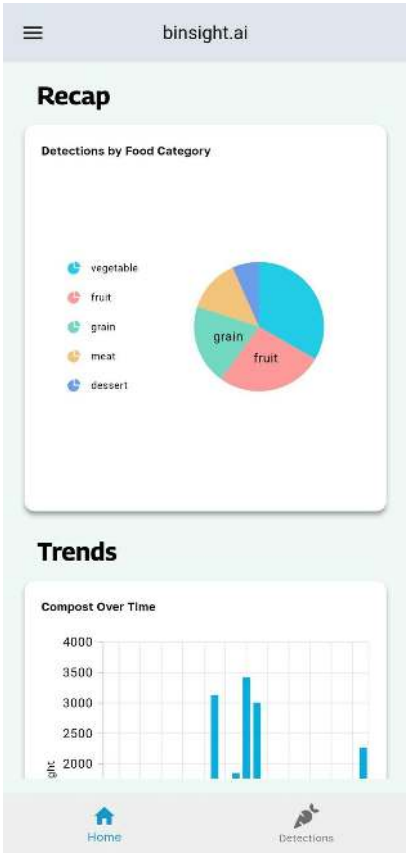
Mobile App

Item Annotation









System Diagram

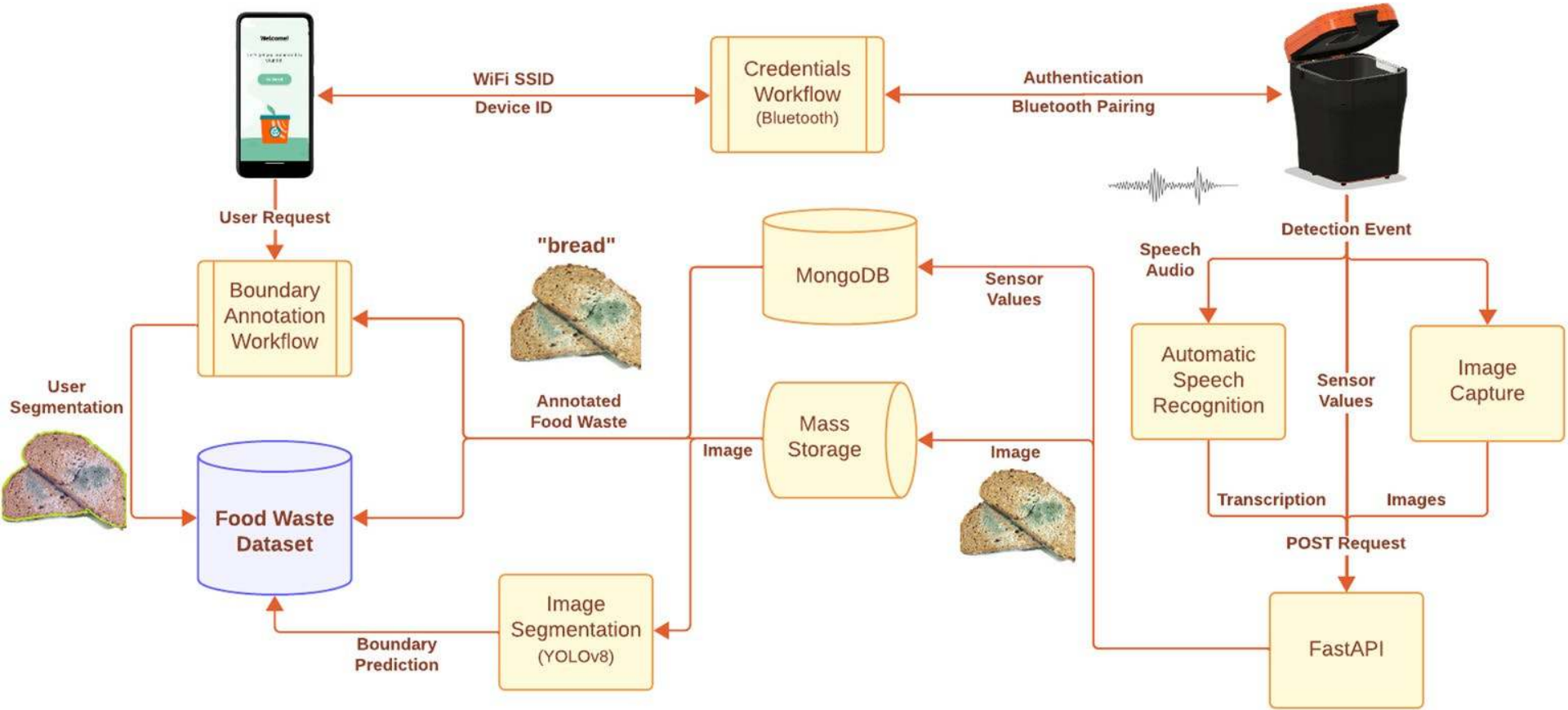


Table 2: List of datasets segmenting images of food.

Dataset	Source	Year	*n* images	*n* labels	*n* items
COCO	[20]	2017	328,000	91	2.5M
FoodSeg 103	[23]	2021	7,118	104	42,097
UECFoodPix	[25]	2020	10,000	103	36,929
Food201	[38]	2017	12,093	208	55,412

However, no datasets exist for partial food and discarded food waste!

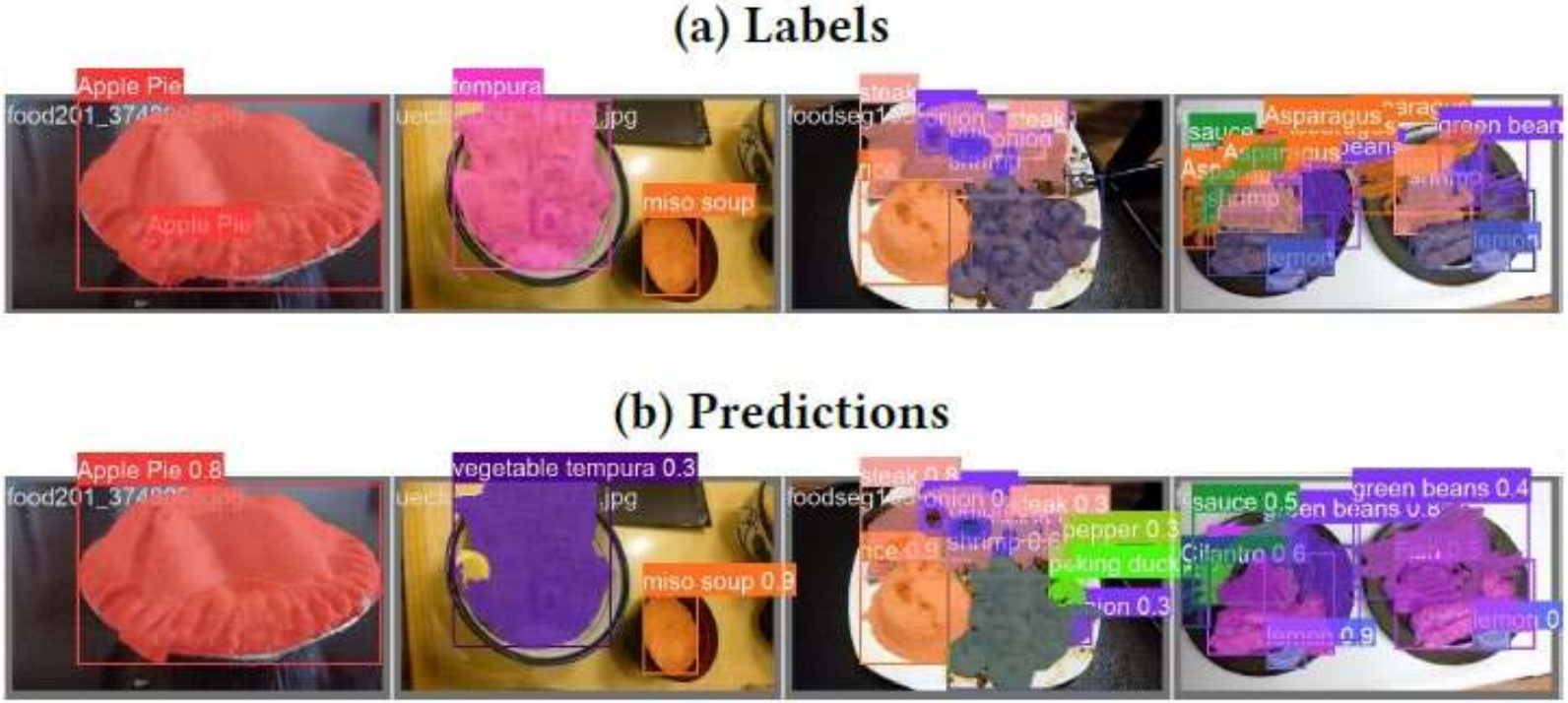
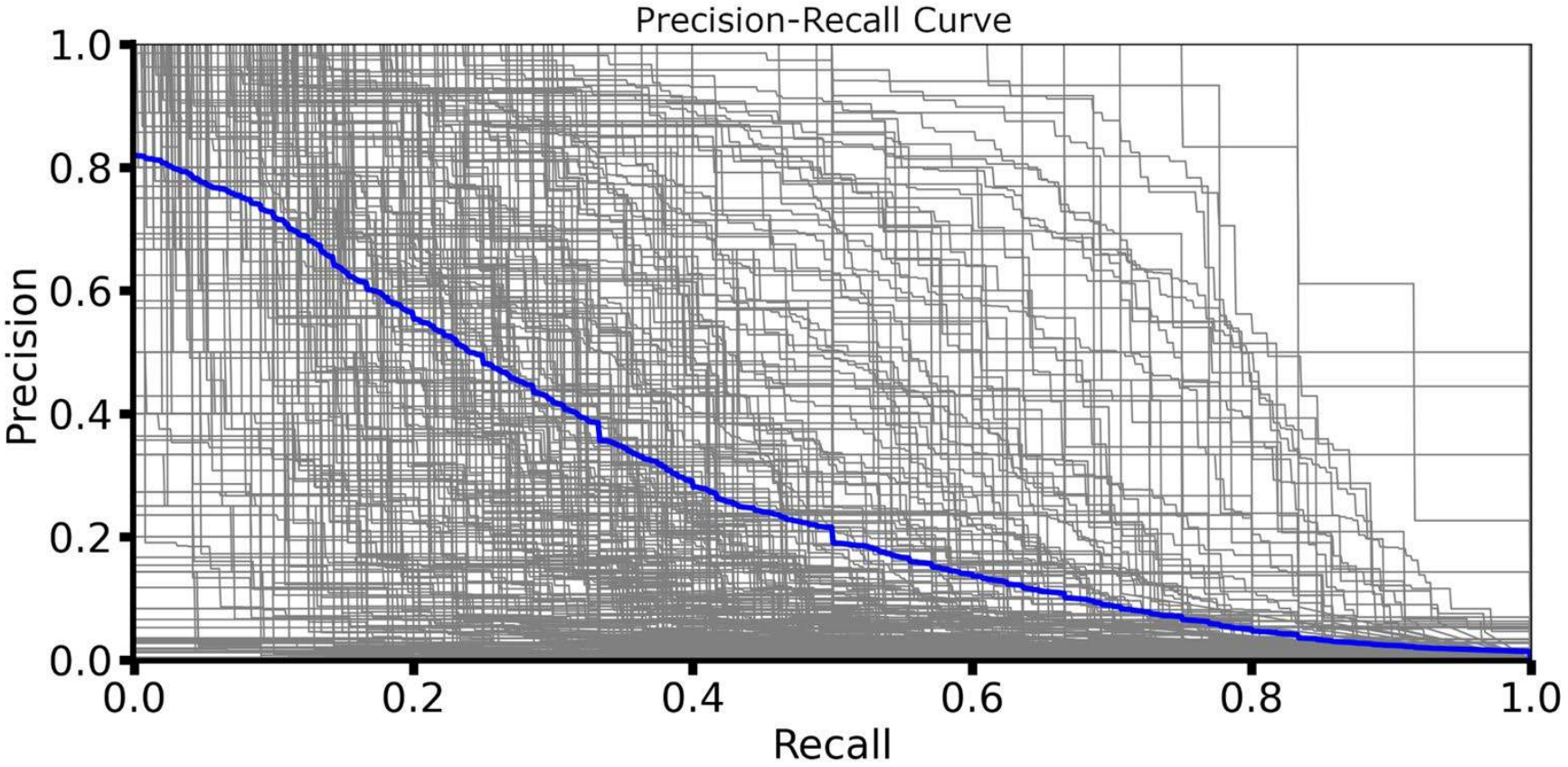


Figure 4: Examples of detections on food image test subset.

Computer Vision

Performance



Computer Vision

Compost

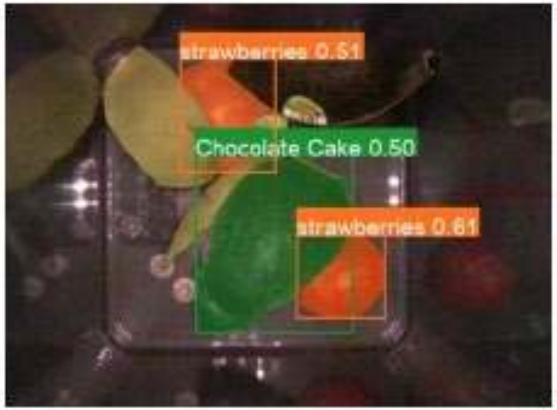






Figure 6: Examples of detections on compost bin images.

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Manufacturing



Manufactured *n=55* buckets



Status and Next Steps

Status

- designed device
- built n=55 buckets
- created mobile app



Next Steps

- deploy human subject study
- collect images and data
- train computer vision model

Funding and Support







Demo

- https://sb-binsight.dri.oregonstate.edu:30081/
- ae9e01c90bb6af06

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