

SmolKat: A Smart Kitchen Assistant

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Application Area

Problem: Food waste is generated when perishable food is not used in time.

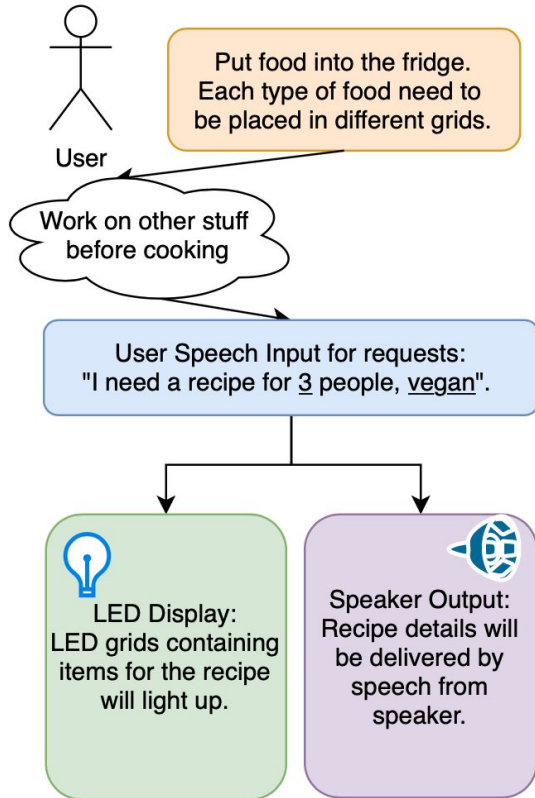
- People don't see the items at the back of the fridge, thus forget about them.
- People don't know a good recipe to use the food they bought.

Goal: Design a system to reduce food waste from the fridge.

- Track ingredients in the fridge
- Recommend recipes based on the food available
- Highlight food item for easy user experience

ECE Areas: Software, Hardware

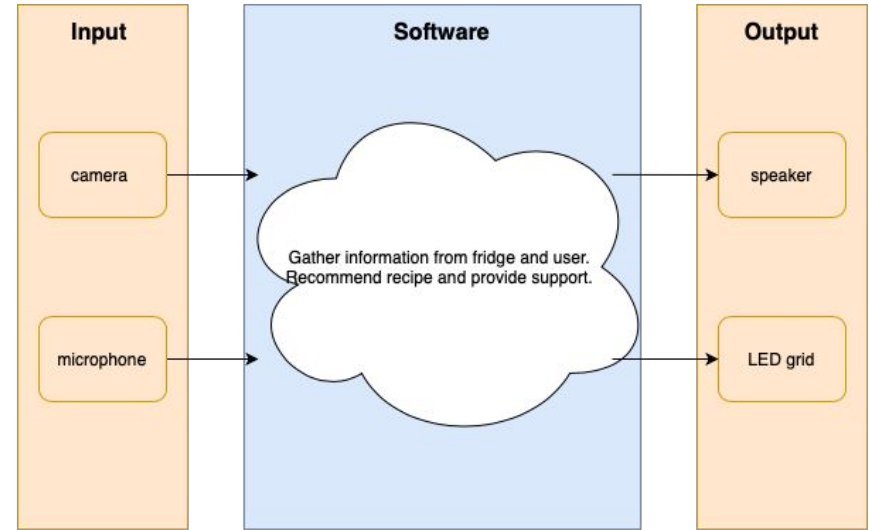
Solution Approach



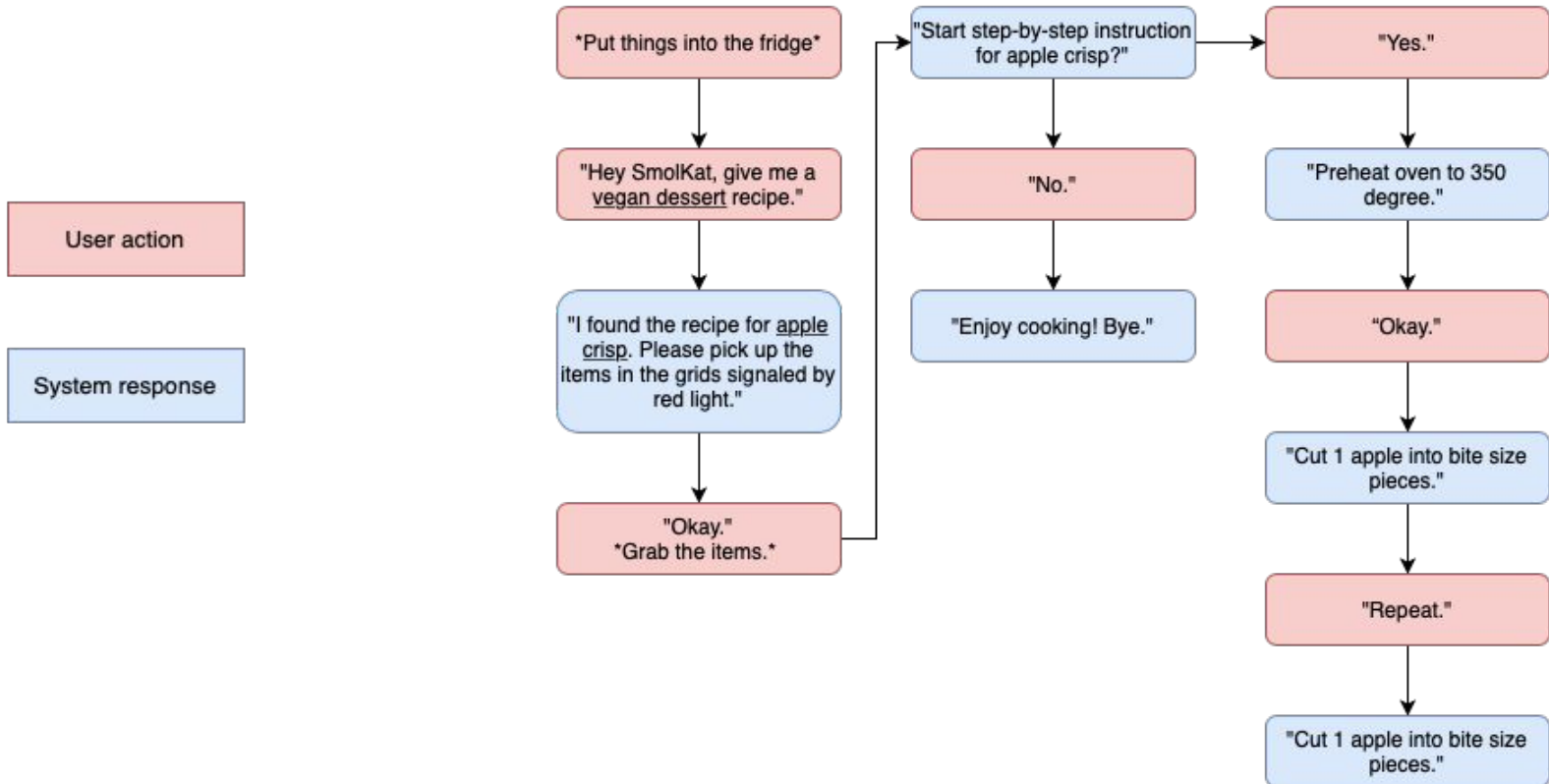
System Specification: Overview

Project Requirement Simplification

- Inside fridge → Outside of fridge
- Fridge shelf → A piece of glass with LED grid
- Piled food → Single layer of food
- 10 food items
- 10 verbal keywords (i.e, vegan, dessert)
- 30 recipes



System Specification: User Interface



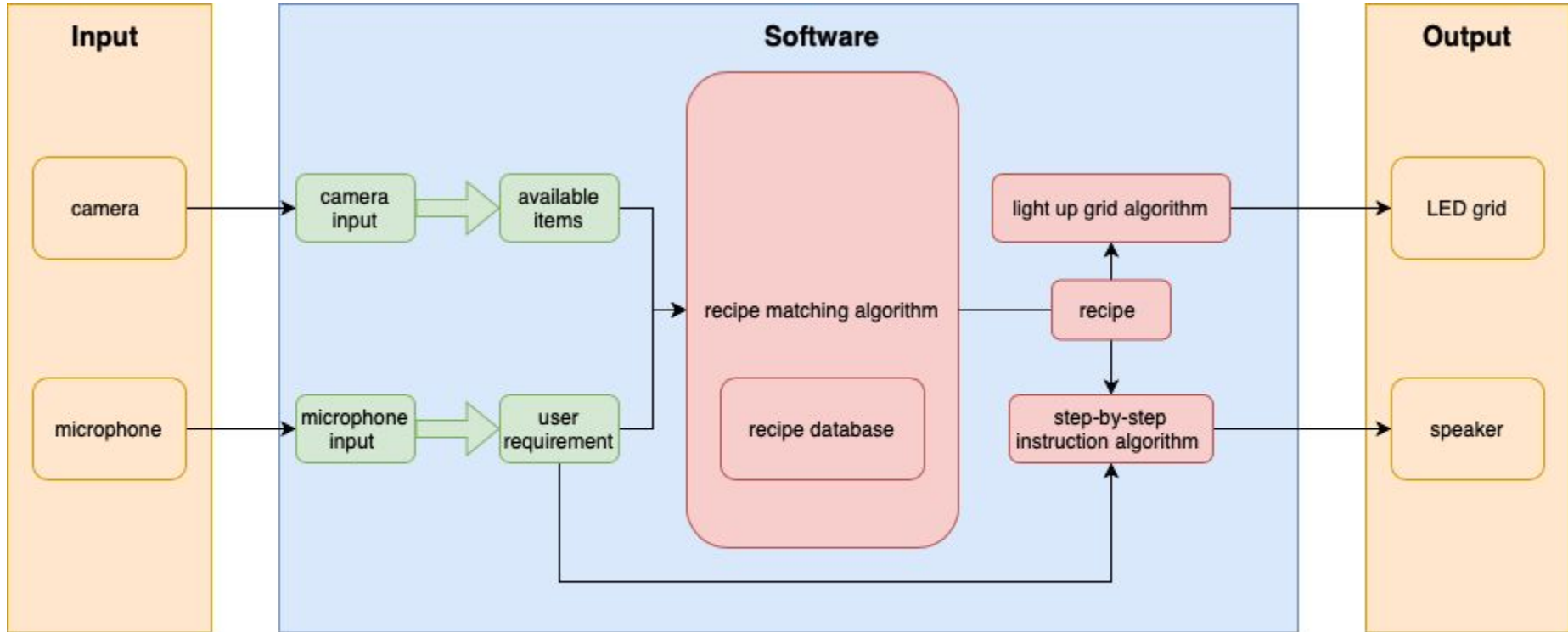
Implementation Plan:

hardware peripheral

external library

our implementation

on board



Implementation Plan: Hardware

Ready-to-use: camera, microphone, speaker

LED grid

- Made with LED strips
- Connect to Jetson nano via GPIO

Processor: Jetson nano

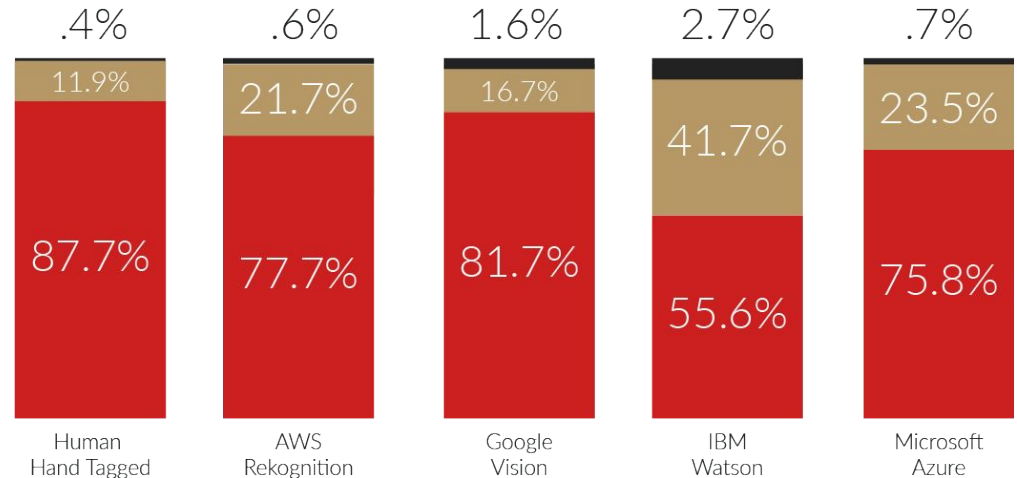
- Everything will be on board

Implementation Plan: Image Recognition

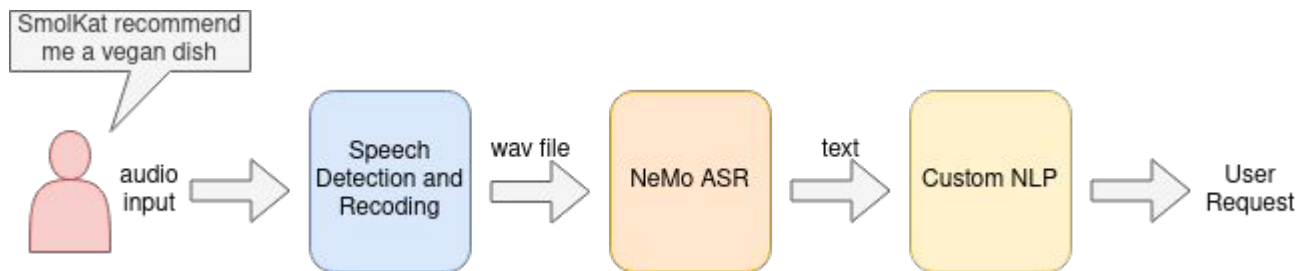
Image Recognition: Google VIsion API

Output: Classify the item in fridge

Overall Score by
Recognition Engine



Implementation Plan: Speech Recognition



Nvidia NeMo Open source library with pretrained models

Audio wav → Text

Natural Language Processing:

Text (user input) → SmolKat-only commands (function variables)

Implementation Plan: Recipe Recommendation

Recipe Dataset

- Recipe1M+ (Ingredients, Steps of Instructions)

Data (user input text) preprocessing

- Add tags to recipes (vegan, non-dairy, for x people)

Recommendation

- Filter recipes based on the (1) input tags from speech and (2) ingredients from image recognition results by scanning the fridge
- If multiple qualified recipes are found, provide the list of recipes

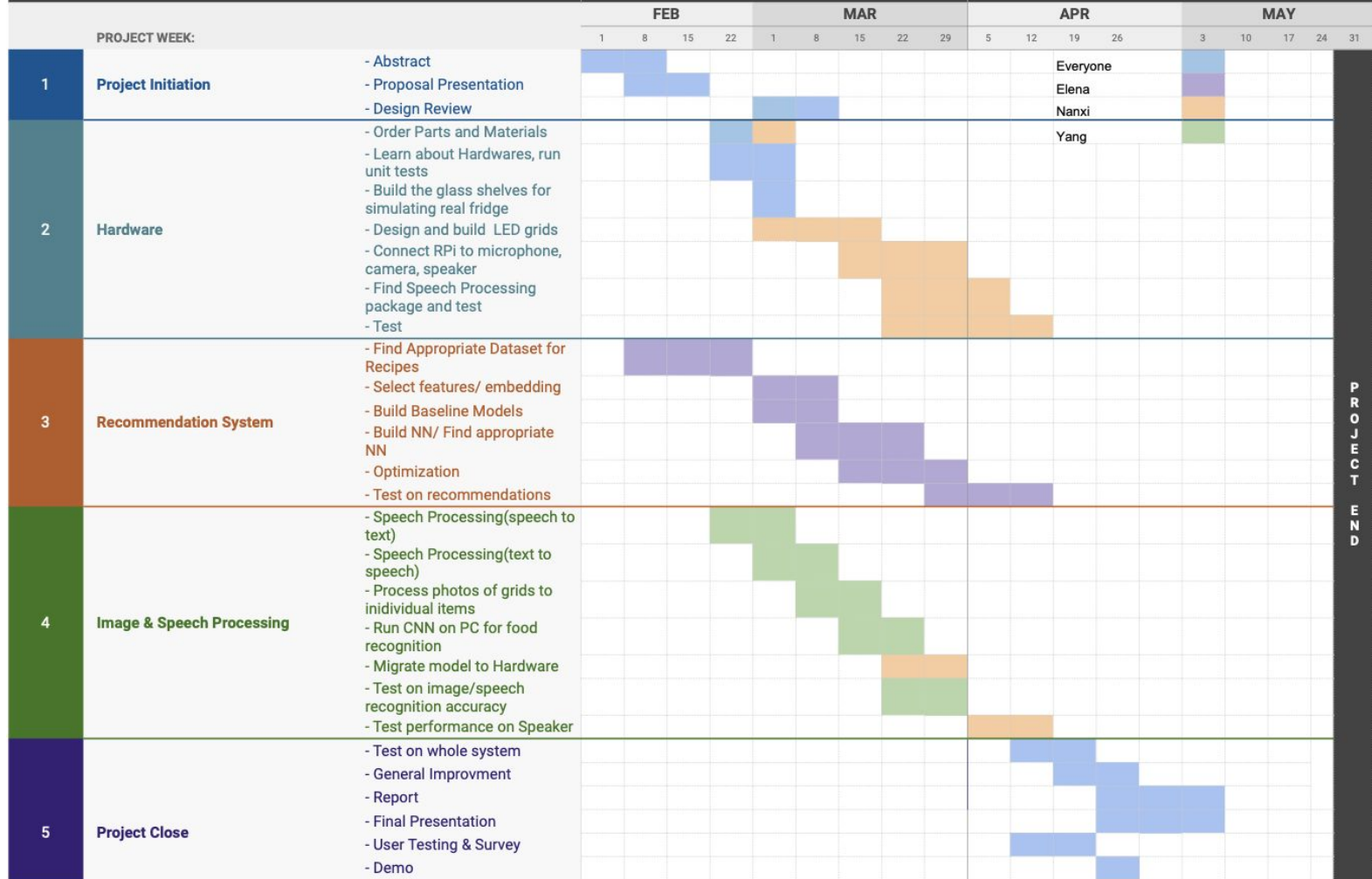
Retrieved Recipe

Ingredients	Instructions
sushi rice	1. Make 2 bowls of sushi rice.
salmon	2. Slice the salmon into 24 ultra-thin slices, and cut the avocado and cream cheese into long, thin strips.
avocado	3. Place a small bowl-worth of sushi rice on plastic wrap and spread it out to the size of a nori sheet.
cream cheese	...
nori	4. Cut the rolls while wiping the knife with a wet cloth between each cut.
	5. Shown in the photo on the left is avocado, and to the right is mini cucumber.

Metrics and Validation

Description	Goal	Verification Method
System Latency	1 second	Record time from end of user input to start of system output. Full integration test.
Image Processing Latency	2 seconds	Record time from image input to result output of ML model
Speech Recognition	90% accuracy	Accuracy on test dataset of audio recorded with selected microphone
Food Recognition	90% accuracy	Accuracy on test dataset of images taken with video hardware

Project Management: Schedule



PROJECT END