

Grocery Getter

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15494 Cognitive Robotics: The Future
of Robot Toys

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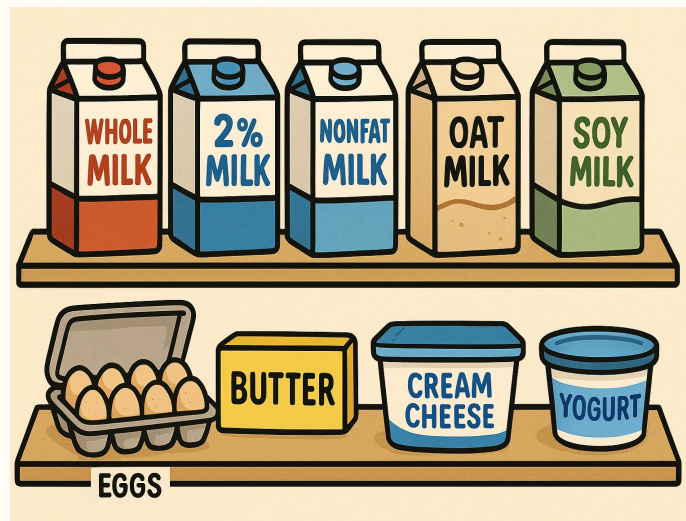
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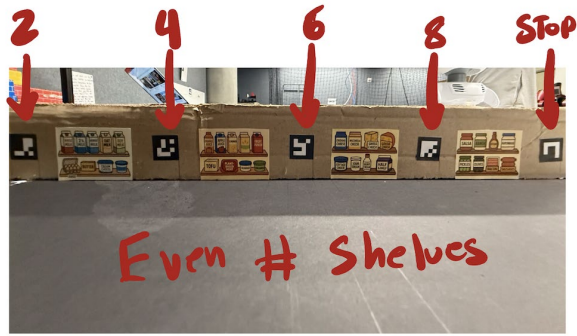


Problem

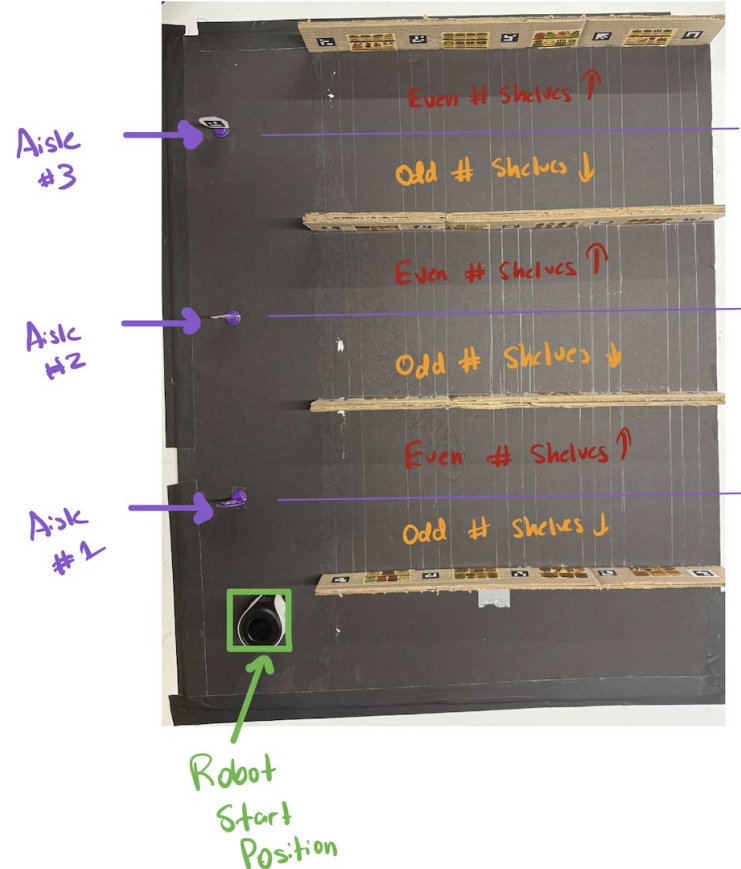
- Automate picking up grocery store items
- Automate getting inventory of a grocery store

Grocery Store Layout

Robot POV



Birds-eye



Approach

Overall:

- Use April tags to simulate aisles

- Create pose estimates with aruco tags placed between shelves

Inventory:

- Store important information such as aisle, shelf, row, position on row, and pose

- PilotToPose to the beginning of aisles, then to the shelves relative to Aruco marker's positions

Retrieval:

- Use a list to keep track of items needed

- Split the logic off where the item is compared to the previous item and move aisles/shelves/rows accordingly

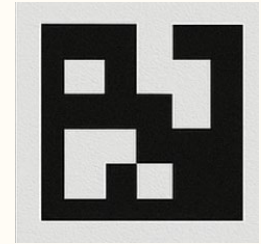
Most Interesting aspects of solution

GPT preamble - takes in our huge info dictionary of aisle, shelf, row, position on row, and pose and is able to match your requests to the closest item in its inventory

“Perfect shopper” - only buys exactly what you need and knows the exact locations of said items

ArucoTAGS - Using ArucoTAGs to improve our pose prediction through vision.

Natural Inputs - will answer even to vague inputs like ‘I am thirsty’



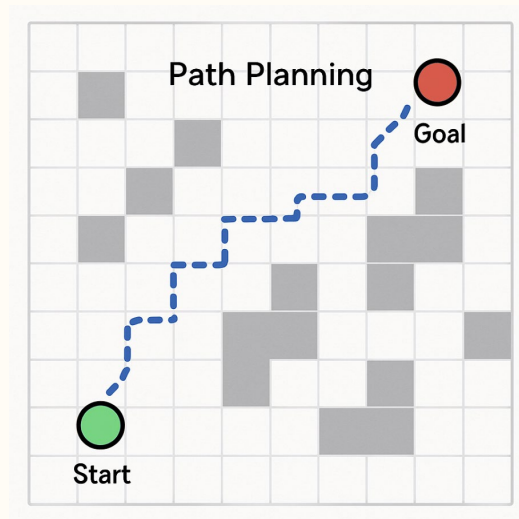
Results

Successes:

- Image generation (though it was hard)
- Aruco-based shelf alignment/driving
- Effective pathplanning + item retrieval

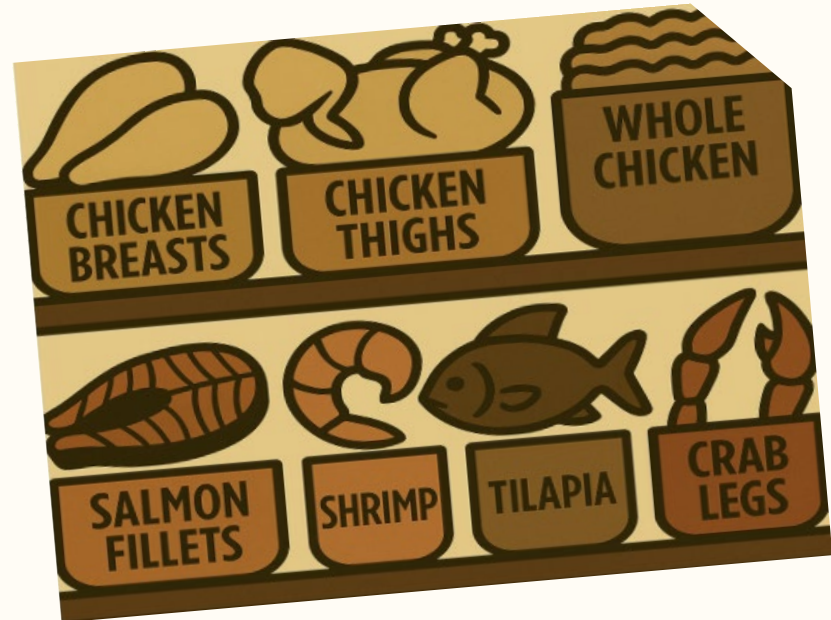
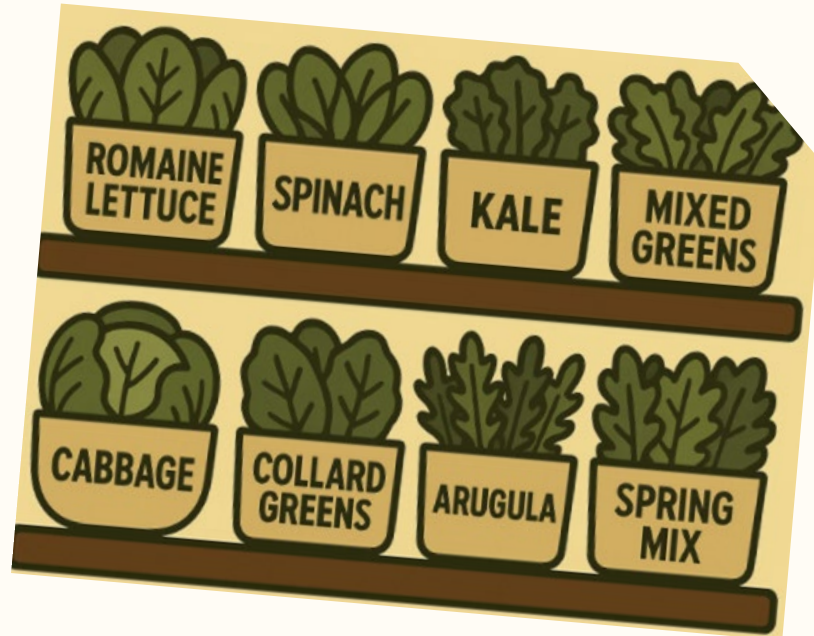
Challenges:

- Multiple direction aisle traversal/more natural paths -> wall defs
- Takes a while to send and receive image input from GPT
- Crude driving -> PilotToPose to aruco then shelf
- Zeroing out worldmap+particle filter to reset aisles -> current implementation
- April tags



AI generated shelves

We generated all of the grocery shelves populating our store using ChatGPT. The prompt stated: "Use clipArt style animation and assort 3-4 items on each shelf" with the items on the next slide provided.



Grocery Store Inventory

AISLE 1: DAIRY & REFRIGERATED ITEMS

1. Basic Dairy (milk, eggs, butter, yogurt)
2. Cheese & Dairy Products (variety of cheeses and creams)
3. Beverages (fruit juices and plant-based proteins)
4. Refrigerated Condiments (dips, sauces, and prepared foods)
5. Leafy Greens (lettuce varieties and salad greens)
6. Fresh Herbs & Vegetables (cooking herbs and aromatics)
7. Root Vegetables (potatoes, onions, and other root vegetables)
8. Everyday Vegetables (common cooking vegetables)

AISLE 2: FRUITS, SPICES & BAKING

1. Everyday Fruits (common fruits)
2. Seasonal & Tropical Fruits (specialty and exotic fruits)
3. Cooking Spices (common seasonings and spices)
4. Cooking Oils & Sauces (oils and liquid condiments)
5. Cereals and Chips (breakfast cereals and snack chips)
6. Sodas (carbonated beverages)
7. Snacks (cookies, crackers, and baking staples)
8. Baking Supplies (flour, leaveners, and baking ingredients)

AISLE 3: MEATS, BAKED GOODS & FROZEN FOODS

1. Red Meats (beef, pork, and variety meats)
2. Poultry & Seafood (chicken, turkey, and fish)
3. Breads (loaves and rolls)
4. Sweet Baked Goods (pastries and breakfast items)
5. Frozen Basics (frozen vegetables and prepared meals)
6. Ice Cream Varieties (ice cream flavors)
7. Starches (frozen potato products and dry grains)
8. Canned & Jarred Goods (shelf-stable foods and spreads)

Almost 200 items!

[FIND FULL LIST HERE](#)

Prompts we can answer to

- Grocery lists

- I want to get cheddar cheese, heavy cream, and orange juice

=> ['#search [cheddar cheese, heavy cream, orange juice]']

- Recipes

- I want to make Mac and Cheese tonight. Find me the ingredients
- I want to make Mac and Cheese tonight. I have Cheddar cheese and butter at home.

=> ['#search [cheddar cheese, milk, butter, pasta]']

=> ['#search [milk, pasta]']

- General Queries

- I am craving something sweet
- I need things for breakfast

=> ['#search [chocolate chip cookies]']

=> ['#search [eggs, bacon, orange juice]']

- Miscellaneous

- I am thirsty

=> ['#search [apple juice]']

Screenshots of World Map and Camera View

One completed aisle: Camera View and World Map

Videos can be found here:

https://drive.google.com/drive/folders/1Hsst_YKFYHKZy4DL62tPYG16e5MRumnD?usp=share_link

Videos of Grocery Getter

Inventory:

Grocery Run:

Videos can be found here:

https://drive.google.com/drive/folders/1Hsst_YKFYHKZy4DL62tPYG16e5MRumnD?usp=share_link

For the Future...

Building landmark walls to create a more precise WorldMap

Adding in doorways between aisles for better localization

Centering around shelves using more than one Aruco