ECSE 542 Milestone #1

Indoor Navigation and Product Finder for Grocery Stores

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Project Overview and Design Context

This project develops a smartphone-based indoor navigation system to help users locate products in unfamiliar grocery stores. The system uses visual SLAM (Simultaneous Localization and Mapping) technology to enable one-photo localization, where users capture a single image of their surroundings to determine their position within a pre-mapped store. The design prioritizes minimal user effort and multimodal feedback to create an accessible, efficient navigation experience. The core interaction flow follows four main stages: (1) camera capture for instant localization, (2) product search via text input or category selection, (3) audio announcement of current and destination locations, and (4) visual map-based navigation with a clear path display.

Design Work Explanation

The initial design sketches included in this submission (see Figure 1 below) illustrate the key UI components and user flow across ten screen states. Screens 1-5 (top row) show the search and selection process: Screen 1 displays the category-based search with aisles organized by product type (Fruits, Dairy, Meat, Snacks, Beverages), offering an alternative to text search. Screen 2 shows a simplified text search interface with a "Select" button. Screen 3 presents type and voice input options with icon buttons. Screen 4 demonstrates a minimal search interface combining both search and selection. Screen 5 shows an enhanced category view with the search bar integrated above the aisle categories (Fruits, Dairy, Meat, Fish, Snacks, Beverages).

Screens 6-10 (bottom row) illustrate the navigation and wayfinding sequence after product selection. Screen 6 confirms the selected item and displays "You are here" with the user's current location marker and directional arrows indicating the path, along with a "Turn Right" instruction. Screens 7-10 show progressive refinement of the map-based navigation interface, displaying a top-down store layout with the user's current position marked by a pin icon, aisle representations as horizontal bars, directional arrows showing the path to follow. Each screen emphasizes the "Turn Right" instruction, demonstrating how the system guides users step-by-step through the store.

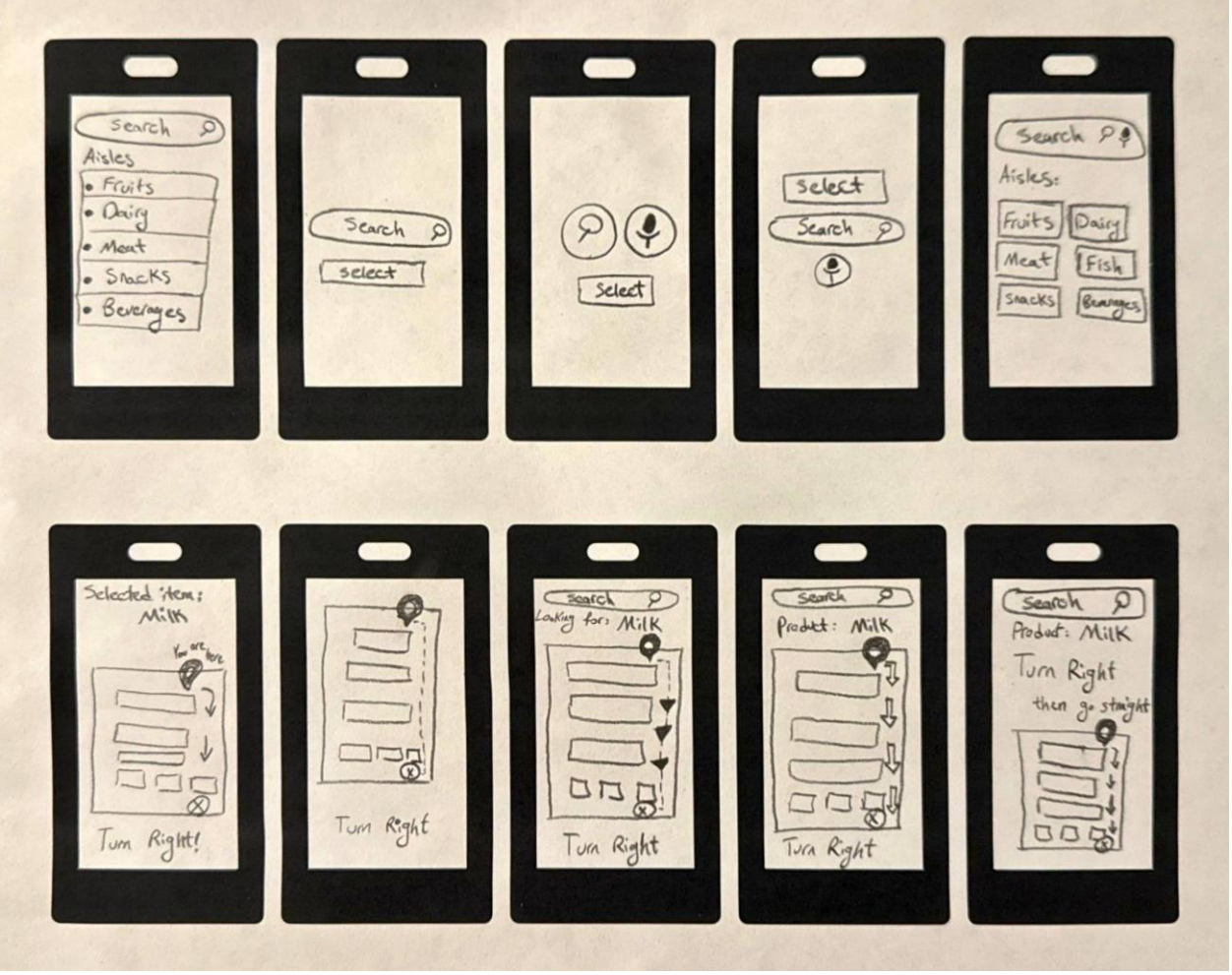

Figure 1: Initial UI sketches showing the complete user interaction flow from search to navigation

REB Summary

Title of Project:

Indoor Navigation and Product Finder for Grocery Stores

Project Description:

This study evaluates the usability and effectiveness of a smartphone-based indoor navigation system that helps users locate products in unfamiliar grocery stores. The system uses visual SLAM (Simultaneous Localization and Mapping) technology to enable one-photo localization, where users capture a single image to determine their position within a pre-mapped store, then receive guidance to navigate to desired products. Participants will complete usability tasks and interviews to assess the system's learnability, efficiency, and user satisfaction.

Number and type of participants:

3-5 adult participants (18 years or older) per testing iteration, for a total of one iteration throughout the semester. Participants must own a smartphone (iOS or Android), have experience shopping in

grocery stores, and be comfortable using mobile applications. There are no restrictions on gender. Participants will be everyday grocery shoppers representing typical end-users of the system.

How and from where are they recruited:

Participants will be recruited through personal networks including friends and classmates of the student investigator. Recruitment will use the standardized Call for Participation document distributed via casual interaction, social media, email, or word-of-mouth. Interested individuals will contact the student investigator (Kasra Jabbari at kasra.jabbari@mail.mcgill.ca) to volunteer.

What risk could this study entail for participants?

The study poses minimal risk to participants. Potential risks include minor inconvenience from time commitment (30 minutes per session) or mild frustration from interacting with an early-stage prototype that may have usability issues. Navigation tasks in actual grocery store environments could pose slight physical risks such as distraction while walking or collision with store fixtures or other shoppers.

How can these risks be mitigated?

Time-related risks are mitigated by clearly communicating the expected 30-minute session duration upfront and allowing participants to withdraw at any time without penalty. Frustration is minimized by emphasizing that the study evaluates the system, not the participant, and by allowing participants to skip any tasks or questions they prefer not to complete. Physical safety during naturalistic observation is addressed by instructing participants to prioritize their safety over task completion.

Interview Script

1. Introduction

"Hi, and thank you for participating in this usability study today. My name is Kasra Jabbari, and I'm a graduate student at McGill University conducting research on indoor navigation systems for grocery stores. Today, I'd like to get your feedback on a smartphone application designed to help people find products in unfamiliar grocery stores. The system uses your phone's camera to determine your location and visual maps to guide you to items you're looking for."

Ground Rules:

"Before we begin, I want to emphasize a few important points:

- We are testing the app, not testing you. There are no right or wrong answers.
- Please think aloud as you interact with the system. Tell me what you're thinking, what you like, what confuses you, or what frustrates you.
- Your honest feedback is what helps us improve the design.

- This session will take about 30 minutes.
- You can stop at any time or skip any question you prefer not to answer.
- Your responses will be kept confidential as outlined in the consent form you signed."

2. Pre-Task Interview Questions

Background and Shopping Experience:

Q1: How often do you shop for groceries?

- Daily
- Weekly
- Monthly
- Other:

Q2: Can you describe a recent experience shopping in an unfamiliar grocery store?

Q3: When you can't find a product in a store, what do you typically do?

Q4: Have you ever used a navigation or wayfinding app? (e.g., Google Maps, mall directories, indoor navigation apps) If yes, Which ones?

Q5: What do you like or dislike about those navigation apps?

Q6: On a scale of 1-5, how comfortable are you using smartphone apps?

Q7: What's the most frustrating part about finding products in grocery stores you're not familiar with?

3. Task-Based Testing

"I'm going to ask you to use this app prototype to help you locate the milk section. Please remember to think aloud as you go through this task. Tell me what you're thinking, what you like, what confuses you, or what frustrates you. First, please use the app to take a photo of your surroundings to help the system figure out where you are in the store. Next, search for 'milk' using the app. As you interact with the app, feel free to explore any features you notice."

4. Post-Task Interview Questions

Q8: On a scale of 1-5, how easy was it to complete the task of finding a product using this app?

Q9: What made it easy or difficult?

Q10: How clear were the directions provided by the app? What could be improved?

Q11: Did you find the map view helpful? Why or why not?

Q12: Was the audio announcement useful? Would you prefer just visual, just audio, or both?

Q13: Was there anything missing that you expected to see?

Q14: Would you use this app if it were available in your local grocery stores? Why or why not?

Q15: Do you have any other suggestions or comments?

5. Closing

"Thank you so much for your time and valuable feedback today. Your insights will really help improve this navigation system and make it more useful for shoppers. As mentioned in the consent form, your participation is complete and your data will be kept confidential. It will only be used for this research project."