TOYOTA mobility FOUNDATION

LUDDY
SCHOOL OF INFORMATICS, COMPUTING, AND ENGINEERING

MOUNT PLEASANT
CHRISTIAN CHURCH

Capstone Project

Mobility & Logistics Optimization for Food Pantries

Final Presentation

(05/02/2025)

Team Members

Janhvi

UI/UX Designer

Amirta Varshini

UX Designer

YenTzu

UI/UX Designer

Sridharan

Product Designer

Research Overview

Contextual Inquiry and Participatory Shadowing

Goal: Understand workflows, challenges, and unmet needs in inventory management and volunteer coordination.

Findings:

- New volunteers needed 3–4 task clarifications/hour.
- 70% of donations required sorting.
- Inefficiencies from reliance on key individuals, unclear guidance, and informal systems.

Opportunities:

- Standardize processes and task instructions.
- Improve volunteer training and guidance.

Interview

Goal: Identify inventory management challenges and inefficiencies.

Findings:

- No formal system; rapid flow limits tracking.
- Gaps in volunteer training and impact reporting.

Opportunities:

- Simplify inventory and volunteer processes.
- Add tools for tracking and reporting impact.

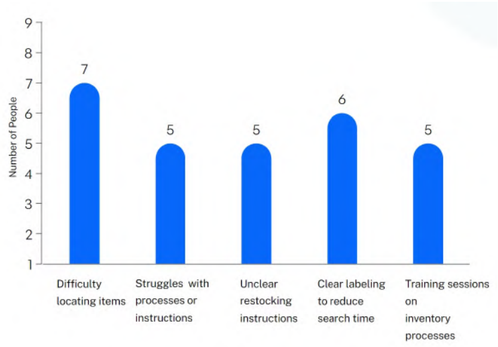
Volunteer Survey

Goal: Identify challenges in locating items, restocking, and inventory processes.

Findings: Feedback from 9 experienced volunteers.

Opportunities:

- Enhance labeling and signage. Update inventory instructions.
- Provide training to boost efficiency and confidence.



Persona

Warehouse & Inventory Coordinator

Jason

"Efficiency is about tracking every detail and valuing every contribution."

Age: 42, operations manager overseeing daily tasks

Goals:

- Implement structured inventory tracking (case quantity, weight, product type).
- Reduce manual tracking, improve inventory visibility.
- Streamline volunteer task management to avoid redundancy.

Challenges:

- Inconsistent tracking, no dedicated system.
- High volunteer turnover, requiring simple onboarding.
- Limited resources for barcode/digital tracking.
- Storage constraints, making organization difficult.

Needs:

- Centralized system for tracking pallets, weight, and barcode scanning.
- Volunteer task management integration to avoid overlaps.
- Simple and user-friendly platform accessible to volunteers.
- Automated tracking for inventory movement with alerts for aging stock.

Problem Statement

How might we design a system that simplifies **inventory tracking** and improves **volunteer task coordination** at the IMPACT Center, enabling more efficient resource management and reducing reliance on specific individuals?

Proposed Solution

Physical Pantry Optomization

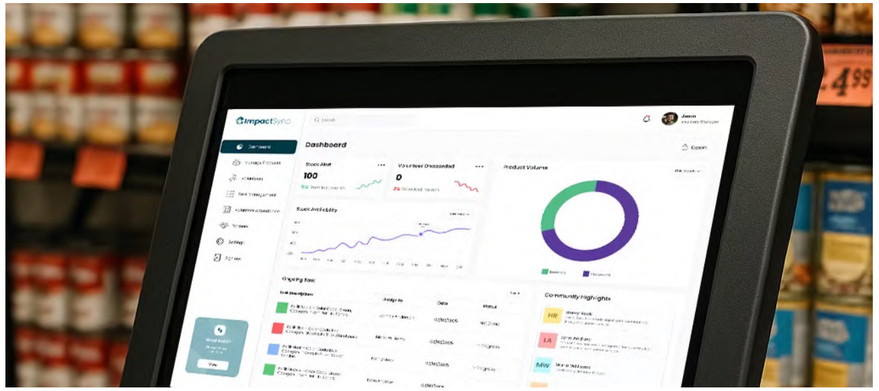
Changes:

- Rearrange storage for better accessibility.
- Implement clear labeling of boxes and items.
- Use color-coded categories for easier sorting and identification.

Impact:

- Over 70% reduction in item search time during baseline testing.
- Volunteers are more independent, needing less staff support.

Unified Inventory & Volunteer Management System



Platform: Web application and kiosk.

Findings:

- Real-time inventory tracking with alerts.
- Digital volunteer check-ins, task assignments.
- Simple, accessible interface suited for all user types, including older volunteers.

Impact: Minimizes reliance on key individuals like Jason, improves volunteer readiness, and enhances overall operational efficiency.

Establishing Success Metric - Before Solution Implementation

During our initial visit we set out to establish a **success metric** to measure the effectiveness of our solution. We identified **time taken to locate inventory** without Jason's assistance as a key indicator.

Baseline Test:

- One team member created a **list of 11 items**.
- Another team member searched for them under the current warehouse arrangement.
- **Total time: 14 minutes 12 seconds.**

Key Insight:

Difficulty in locating inventory leads to inefficient search times and increased dependency on Jason. A lack of organization and clear structure highlights the need for a more efficient system.

Storyboard

(Error State)

A volunteer arrives at a food pantry for their shift. They check a whiteboard for assigned tasks, but it is smudged and outdated. The volunteer looks confused as some tasks are missing.

A volunteer searches the pantry storage area for canned beans. The shelves are cluttered, and nothing is labeled. The volunteer looks frustrated after spending 10 minutes searching but not finding the item.

A group of volunteers in a pantry ask Jason, the inventory coordinator, where various items are stored. Jason looks overwhelmed as he is already busy with other tasks, frequently interrupted.

A volunteer assumes an item is out of stock because they can't find it. Later, Jason confirms that it was available but stored in a different area. The volunteer looks frustrated as valuable time was wasted.

A group of pantry volunteers look frustrated and inefficient as they try to complete their tasks. Jason, the inventory coordinator, is overwhelmed with constant interruptions. The lack of an organized system affects overall productivity.

Concept Validation Meeting with Jason

Meeting Duration: 60 minutes

Agenda:

1. **Sharing Our Ideas & Approach**
   - Present our initial concept and solution direction.
2. **Identifying Potential Challenges & Refinements**
   - Gather insights to address potential issues and improve feasibility.
3. **Exploring Alternative Ideas & Enhancements**
   - Discuss additional approaches that could strengthen the solution.
4. **Aligning Item Categorization with Pantry Operations**
   - Ensure our classification method meets operational needs.
5. **Defining Key Performance Indicators (KPIs)**
   - Assess measurable success metrics through an on-site evaluation.

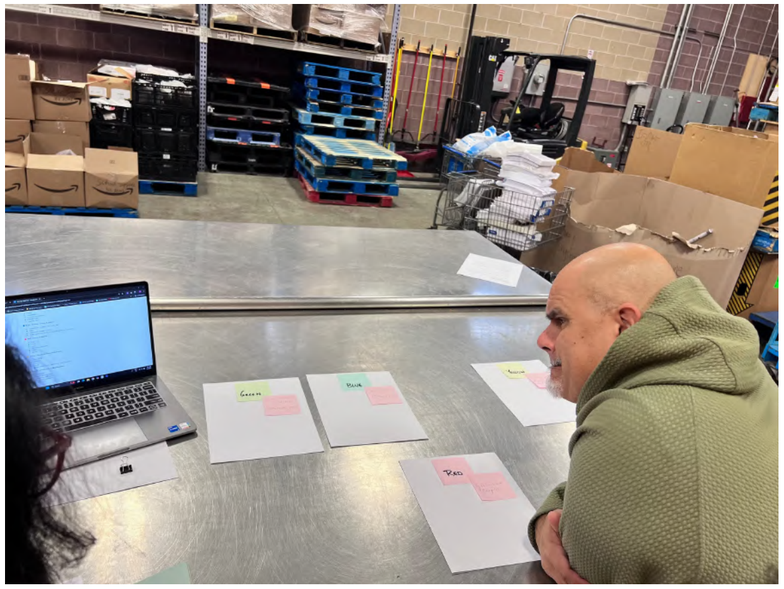
Key Takeaways from the Meeting

1. Barcode Scanning Feasibility

- Scanning individual UPC codes for every item would be overwhelming.
- However, a **product-based barcode system** (one barcode per product type) would be beneficial.
- Volunteers could **scan a category barcode** and enter manual quantities, making tracking more efficient.

2. Volunteer Experience & Accessibility

- Many volunteers **are older adults** with limited technological experience.
- A system that is **too complex could create usability barriers.**
- Any solution should be **simple, intuitive, and easy to navigate** for volunteers.

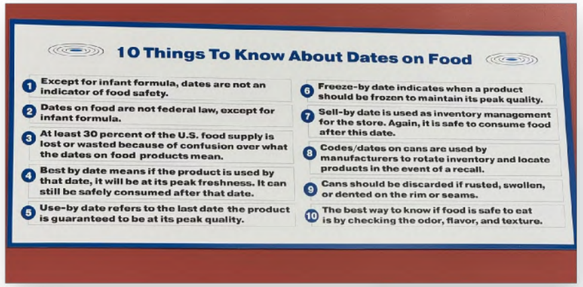


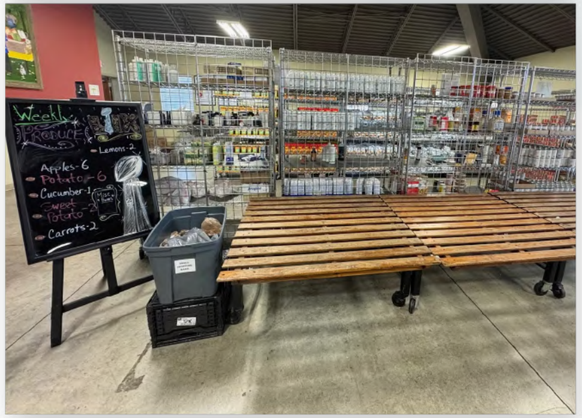
Continued Key Takeaways

3. Storage & Item Categorization

- Inventory arrives in different containers: **pallets, bulk bins (Gaylords), and collapsible crates.**
- Jason prefers tracking inventory based on **broad categories rather than specific brands.**
- He emphasized that **color-coded categorization** for different food types is useful.
- Proposed refined categories:
  - **Green:** Fresh produce & refrigerated items.
  - **Blue:** Frozen proteins and meals.
  - **Red:** Staples and canned goods.
  - **Yellow:** Snacks & ready-to-eat items.
  - **Orange:** Condiments and miscellaneous items.
  - **New Category:** Bulk preparation for large community meals

Continued Key Takeaways





4. Stock Rotation & Expiration Tracking

- Expiration dates **aren't always reliable**, so Jason prefers a **"date received" tracker** instead.
- Some items move quickly (e.g., **milk, drinks, snacks**), while others sit for a month or longer.
- A system to **track stock movement and send alerts for older inventory** would be useful.

5. Volunteer Task Management Integration

- A system that integrates **volunteer registration, task assignments, and attendance tracking** would improve workflow.
- Volunteers should be able to **self-select tasks** and log their completed work digitally.
- Preventing **task overlap** and ensuring efficient coordination is a key goal.

6. Budget & Feasibility Concerns

- Jason was unsure about available budget for a **digital inventory system.**
- Any solution must be **affordable, easy to implement, and low-maintenance.**
- Monthly fees for system deployment and maintenance might not be feasible without donor support.

Establishing Success Metric - After Mock Solution Implementation

During our meeting, we also implemented a **structured categorization system** to improve inventory management.

Baseline Test:

- We **reorganized two shelves** using our proposed categorization method.
- A different team member repeated the task with a **new 11-item list**.
- **Total time: 4 minutes 8 seconds.**

Key Insight:

By organizing inventory more effectively, **search time was reduced by over 70%**, proving that our categorization method significantly improves efficiency and reduces volunteer dependence on Jason.

Storyboard with new solution

(Recovery State)

A volunteer uses a tablet-based system or kiosk instead of a smudged whiteboard. Tasks are digitally assigned, updated in real-time, and clearly categorized.

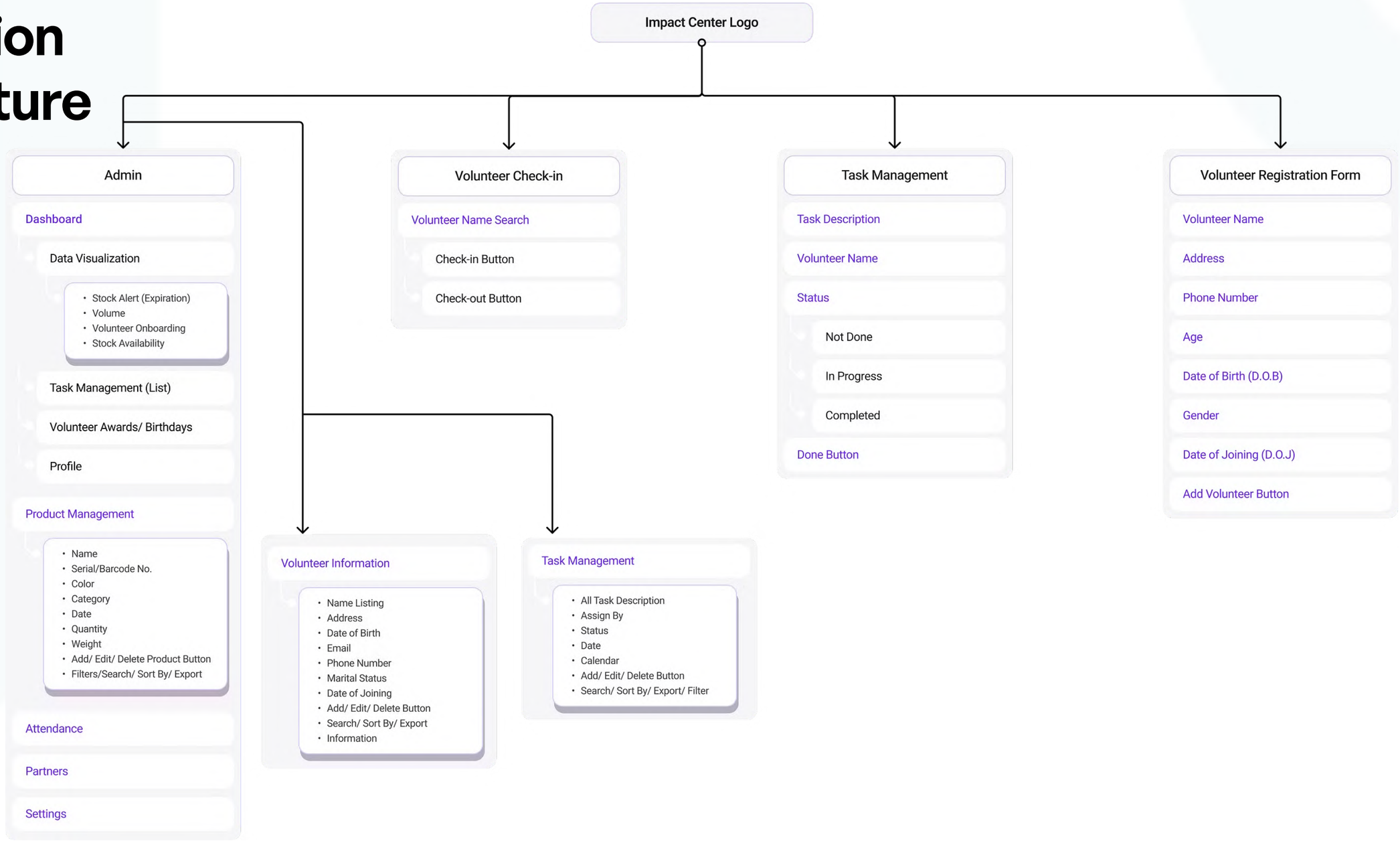
Volunteers navigate neatly labeled shelves with color-coded sections. One volunteer confidently picks an item from a properly organized shelf.

Volunteers find items independently without relying on Jason. Jason is seen overseeing operations calmly instead of being frequently interrupted.

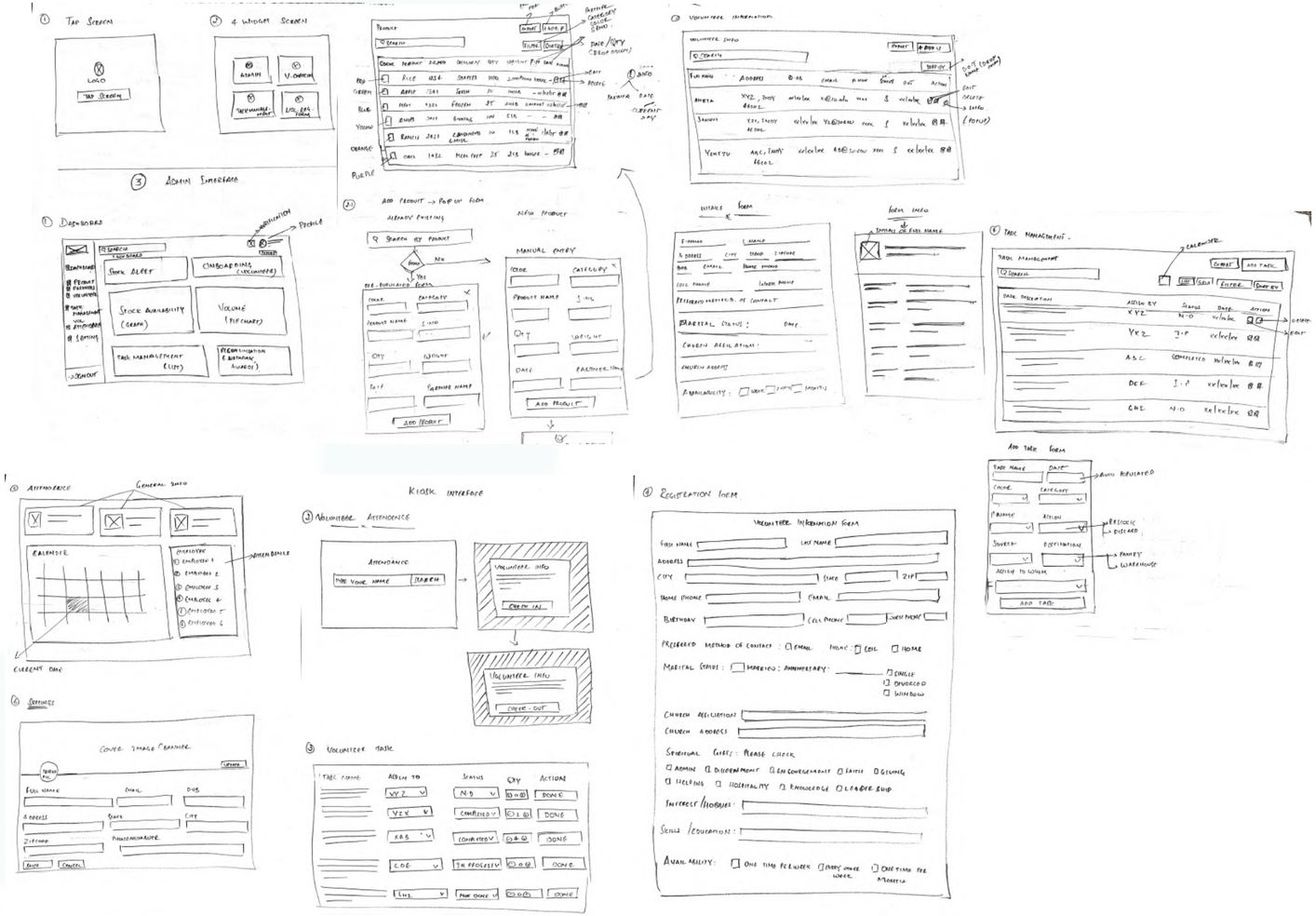
A digital system automatically tracks inventory levels, reducing errors and miscommunication. Volunteers and staff instantly check stock availability and restocking needs.

Volunteers efficiently complete tasks with minimal confusion, smiling as they work. Jason is managing operations smoothly without interruptions.

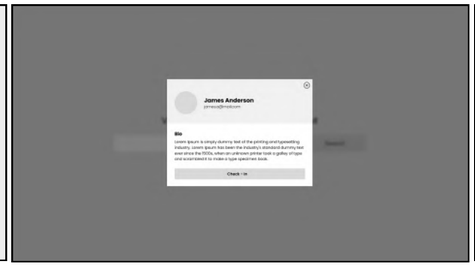
Information Architecture

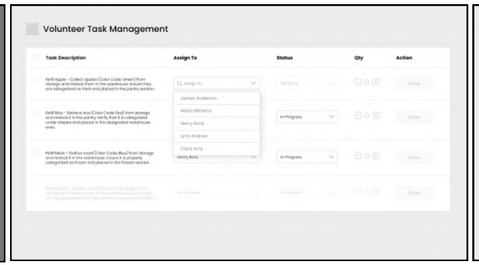


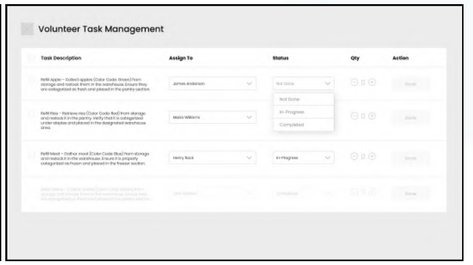
Initial Sketches & Paper Prototype

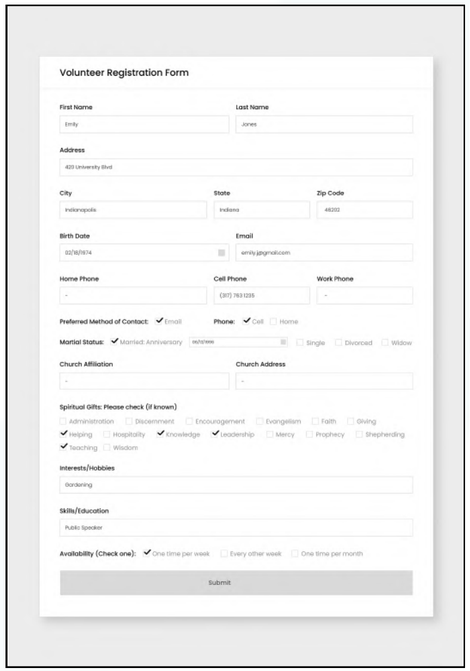


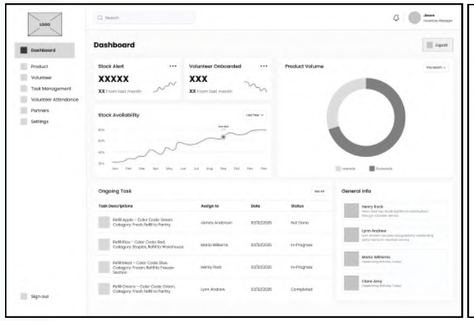
Low-Fidelity Prototype

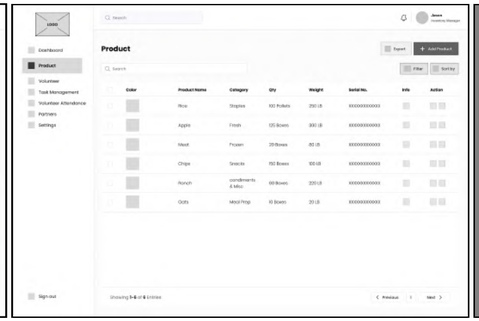


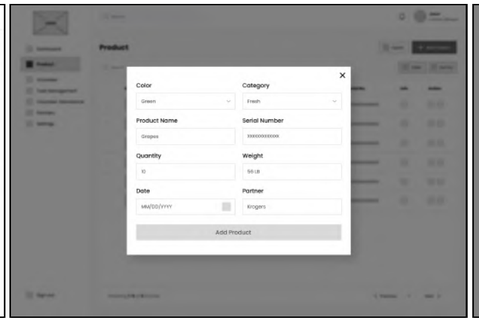


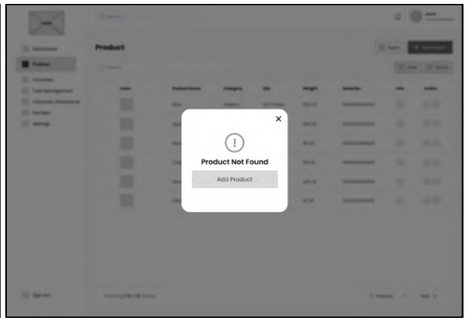


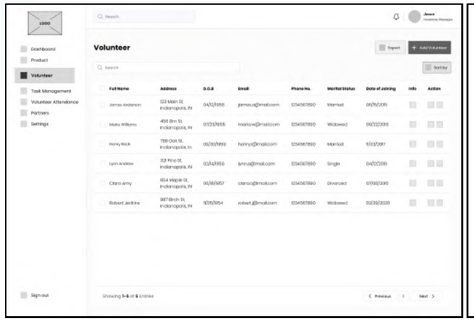


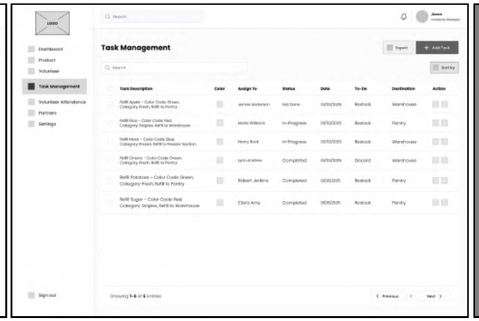


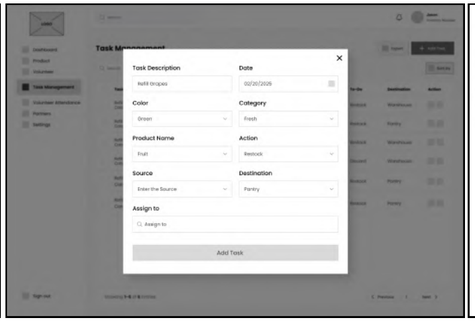


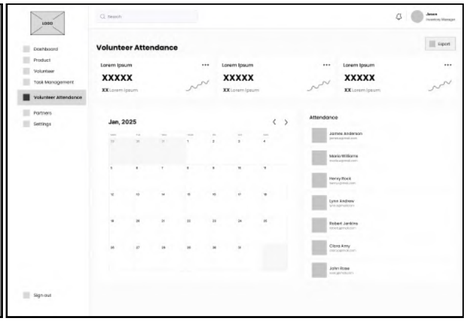












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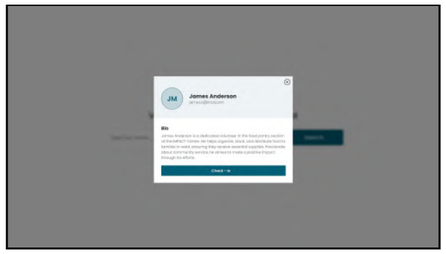

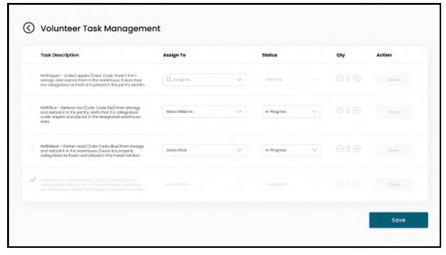

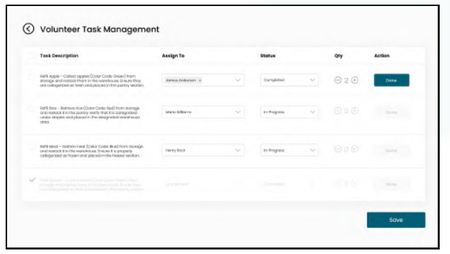

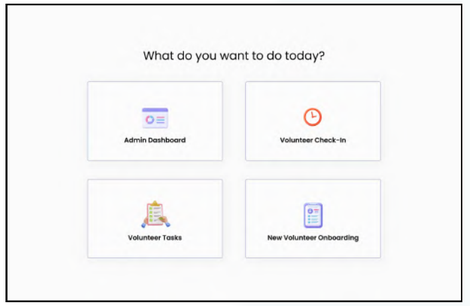

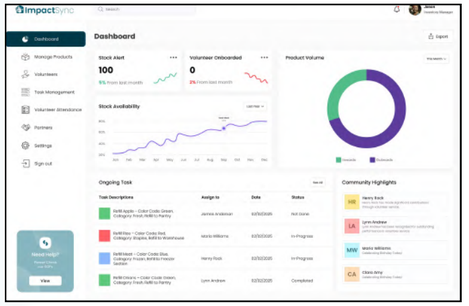

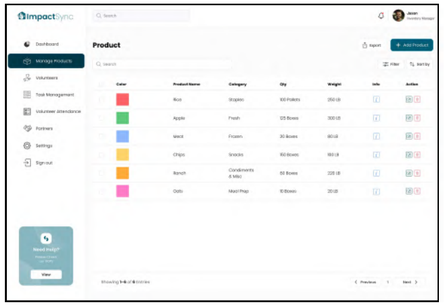

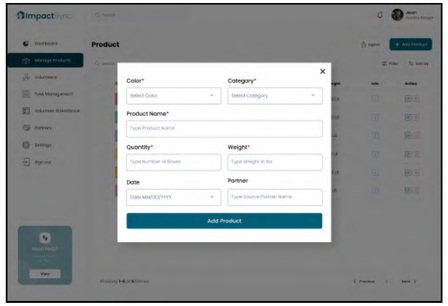

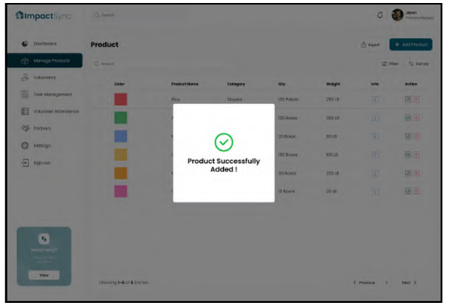

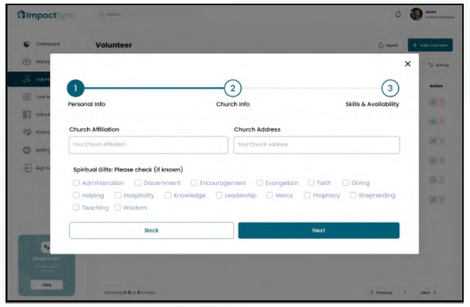

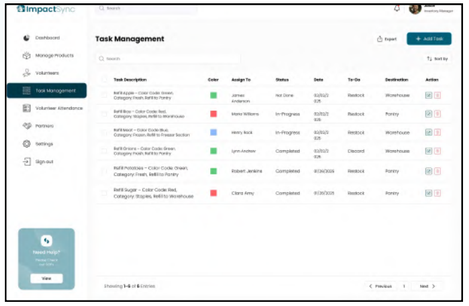

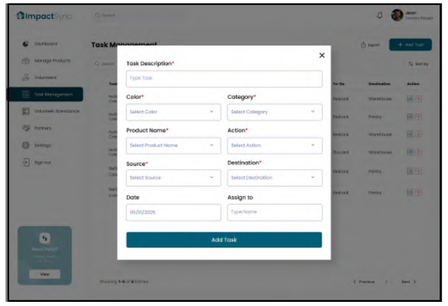

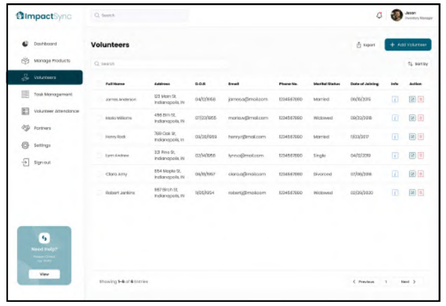

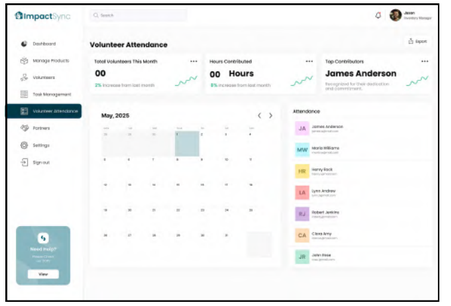

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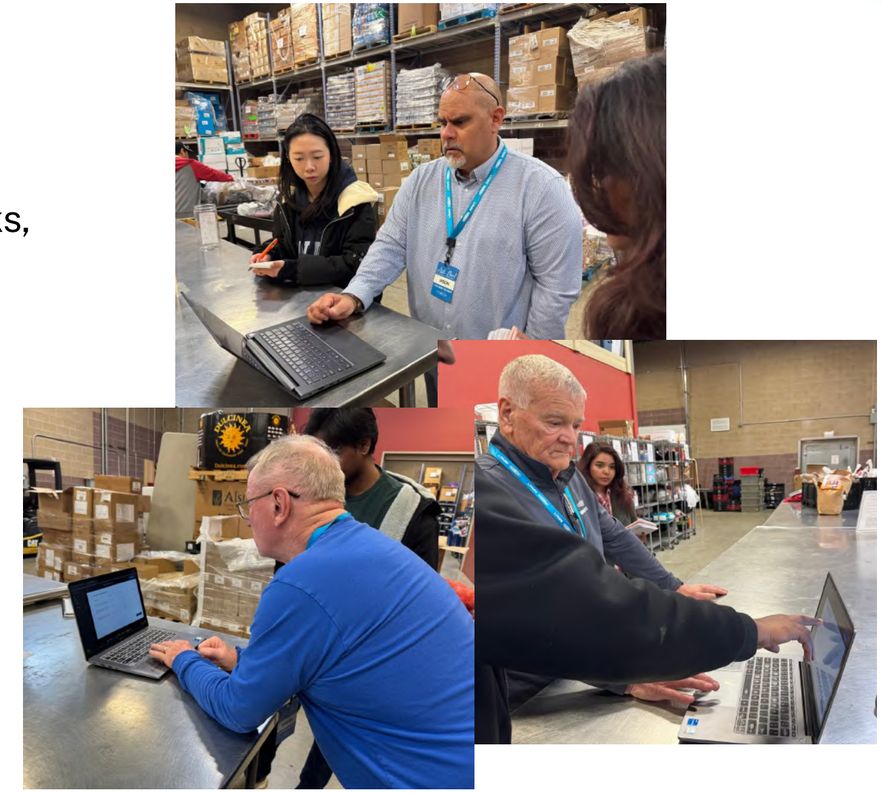
Usability Evaluation Summary

We evaluated the system internally and externally to identify usability issues, validate design choices, and improve user experience.

→ Internal Usability Evaluation

1. **Cognitive Walkthrough**

- **Evaluators:** 3 internal team members
- **Task Evaluated:** Navigating inventory, Adding Inventory items, assigning tasks, Vlounteers check-ins and onboarding.
- **Focus Areas:** Step-by-step user interactions, clarity of labeling, and system feedback



Key Findings

- Labeling inconsistencies caused hesitation during task completion
- Lack of immediate visual/auditory feedback after adding items
- Led to design improvements: consistent labels, success messages, and clearer button functions

External Usability Evaluation

2. Think-Aloud Protocol

- Participants: 4 volunteers & staff
- Tasks: Navigating inventory, Adding Inventory items, assigning tasks, volunteers check-ins, and onboarding.

Key Findings

- Participants found color-coded categories intuitive, which enabled them to identify item locations more quickly.
- On-screen prompts helped reduce confusion during task completion.
- Volunteers felt more independent, requiring less assistance from staff.
- Navigation and task flows were described as clear, smooth, and efficient.

3. System Usability Scale (SUS) Survey

- Participants: 6
- Post-test usability rating

Key Findings

SUS Score: 71.67

What Users Liked

- Faster retrieval with color codes.
- Clear guidance increased confidence.

Areas for Refinement

- Some older users struggled with tech.
- Unclear form field labels caused confusion.

Refinements Informed by Usability Testing

1. **Improved Clarity & Guidance**

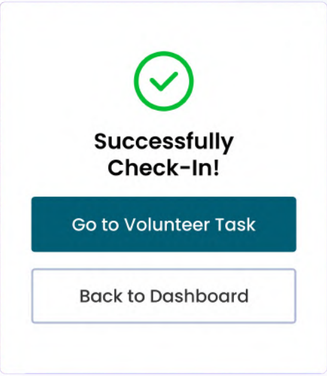
- “Click to Begin” text added to landing screen.
- Admin flow now includes a successful authentication and loading screen after PIN entry.
- Labels updated across flows for consistency (“Products” → “Manage Products”)
- Success messages are improved for clarity and effectiveness.

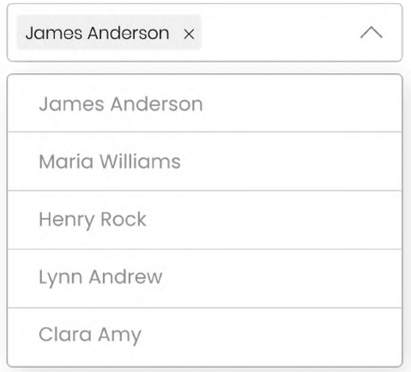
2. **Smarter Task Flow for Volunteers**

- Post check-in popup: “Go to Volunteer Tasks” or “Back to Home”
- Task completion now ends with a “Save” button and confirmation message.
- Multi-select enabled for tasks needing multiple volunteers.
- Check-in and task flows simplified for ease of navigation.

3. **Streamlined Volunteer Onboarding**

- Registration form split into 3 shorter segments
- Progress bar added to reduce uncertainty and support task completion





Next steps

1. Multilingual Accessibility: Implement multilingual support to accommodate diverse volunteer and client populations.

2. Real-World Development: Launch a pilot deployment in a real pantry environment to test system performance and usability.

3. Continuous Improvement: Gather long-term feedback from staff and volunteers to inform future iterations.

4. Offline Readiness: Investigate offline capabilities to support locations with limited or inconsistent internet access.

Conclusion

Grounded in real pantry workflows and stakeholder feedback, our design effectively addressed challenges such as unclear task assignments, fragmented processes, and volunteer confusion. By applying a human-centered approach, we streamlined coordination and reduced reliance on key individual, creating a more intuitive and efficient experience for all users.

Thank you !