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AR Food Recommender (SnaX-Ray Cart Dash)

CSC 216/416 : AR/VR Interaction Design - Professor Zhen Bai

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Members and Contributions

Member	Contribution
Alishba	Brainstorming, Design, Paper and Physical prototypes, Personas
Alex	Brainstorming, Design, Storyboards, Existing applications
Erfan	Brainstorming, Design, Paper and Physical prototypes, Technical research (OptiDot), Existing Applications

Problem Description

The challenge of promoting healthy eating habits among children has become increasingly complex in today's digital age. While children are becoming more independent in their food choices, they often lack the knowledge and tools to make informed decisions about nutrition, especially when dealing with specific dietary requirements or health goals. Traditional food recommendation systems typically prioritize commercial interests over health benefits, leading to repetitive suggestions that may not align with individual nutritional needs. Furthermore, there's a growing need to educate children about both healthy eating and the digital tools that influence their choices, particularly AI-based recommendation systems that are becoming ubiquitous in their daily lives.

The AR Food Recommender project (Game name: SnaX-Ray Cart Dash) addresses these challenges through an innovative educational game that combines nutrition education with AI literacy. By creating an interactive environment where children act as virtual shoppers, the system helps them understand the connection between food choices and health outcomes while learning how AI-powered recommendations work. The project specifically targets diverse user needs, from children with medical dietary restrictions to those with general wellness goals, ensuring that healthy eating education is both inclusive and engaging. This approach not only promotes better food choices but also empowers children to become more informed and confident in their dietary decisions while developing a critical understanding of AI-based recommendation systems.

Motivation for Using AR/VR

The integration of AR/VR technology in our food recommender system provides a powerful and engaging platform for children's nutritional education. Unlike traditional educational methods that rely on passive learning, AR creates an immersive, interactive environment where children can actively explore and learn about food choices in real-time. By allowing young users to scan food items and receive immediate feedback through an engaging

visual interface, the technology bridges the gap between abstract nutritional concepts and practical decision-making. The gamification elements of virtual shopping and immediate consequence visualization make the learning process both entertaining and meaningful, helping children develop critical thinking skills about their food choices. Our engaging virtual trainer character also reacts to each choice, providing personalized feedback and motivation based on user performance, making the experience even more interactive. This hands-on approach is particularly effective for our target audience of pre-teens, who are not only technology-savvy but also at a crucial age for developing independent decision-making skills about their nutrition and health.

Related Applications

The AR Food Recommender builds upon and extends concepts from existing educational applications in both nutrition and AI literacy domains. The **USDA's MyPlate Match Game** demonstrates the effectiveness of gamification in nutrition education, where children learn about food groups and balanced diets through interactive gameplay. Similar to MyPlate Match Game, our project incorporates engaging game mechanics, but extends beyond basic nutrition education by introducing real-time AR feedback and personalized health considerations. The virtual shopper role and performance-based reward system in our application transform abstract nutritional concepts into practical, consequence-driven learning experiences.

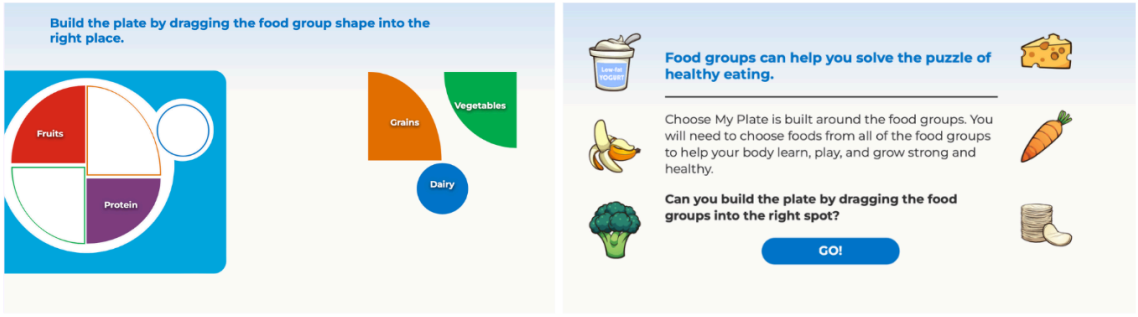


Fig 1. MyPlate Match Game's interface

BeeTrap's innovative approach to teaching AI literacy through bee pollination mechanics inspired our project's educational component about recommendation systems. While BeeTrap uses natural systems to explain AI concepts, our project contextualizes AI literacy within real-world food choices, helping children understand how recommendation systems influence their dietary decisions. By combining these elements with AR technology, our system addresses both the "what" and "why" of healthy food choices. The project goes beyond BeeTrap's focus on recommendation diversity by incorporating personal health profiles (such as gluten intolerance or weight management goals), demonstrating how AI can be used to make personalized, health-conscious recommendations rather than just diverse ones.

Fig 2. BeeTrap's interface

"Bee and I need diversity!" Break Filter Bubbles in Recommendation Systems through Embodied AI Learning Zhou et al(2024)

OptiDot is a tangible interface that teaches AI concepts by illustrating the dot product, a key element in recommendation systems. OptiDot's approach to making abstract math concepts accessible inspired our design of the SnaX-Ray Checkpoints, which leverage AR to visualize food recommendations based on personal health data. By adapting OptiDot's hands-on learning approach into an AR format, SnaX-Ray Checkpoints make AI-based health recommendations interactive and easy for children to understand within the context of real-world food choices.

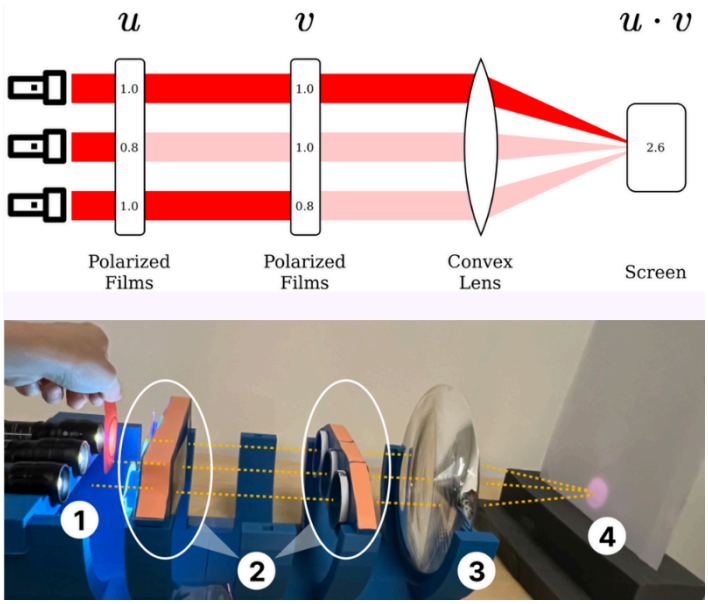


Fig 3. OptiDot's illustration and tangible interface

OptiDot: An Optical Interface for Children to Explore Dot Product and AI Recommendation Zhou et al(2024)

Our game also draws inspiration from **Diner Dash**, a restaurant simulation in the point-and-click genre that influenced our approach while designing gameplay. Similarly,

Freshland Market, an AR retail application, inspired the immersive shopping elements of our game, as it enhances grocery shopping with interactive, AR-based experiences.

Fig 4. Diner Dash Game's overview

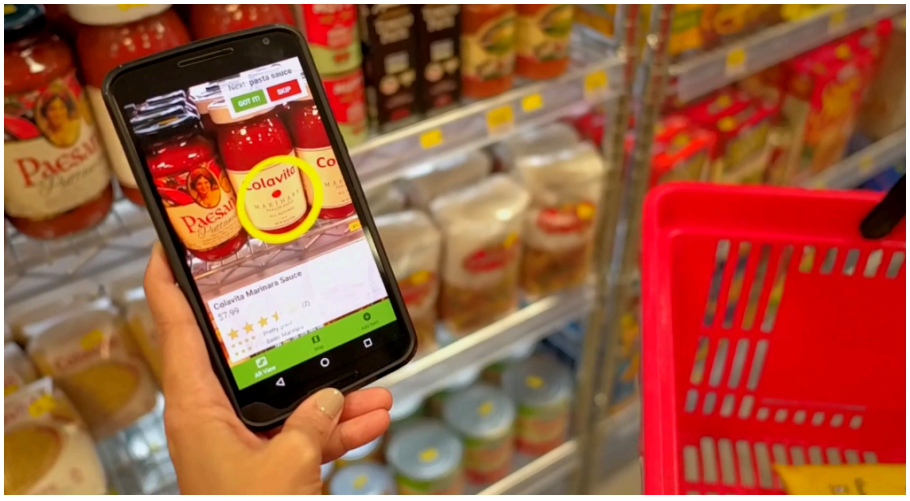


Fig 5. Freshland Market's use case

Proposed Solution

Our AR Food Recommender system is designed as an interactive educational platform set within the Strong Museum's mini Wegmans shop, transforming the physical space into an augmented learning environment. The solution combines AR technology with AI-powered recommendations to create an engaging experience where children act as "shopper helpers," learning about healthy food choices through practical, hands-on scenarios.

Display Technology: We propose using mobile device displays (smartphones/tablets) as the primary AR interface, justified by:

- Accessibility and familiarity for our target age group (11-12 years)
- Seamless integration with the physical mini Wegmans shop environment
- High-quality cameras for scanning food items and reading nutritional information
- Portable form factor that allows natural movement through store aisles
- Cost-effective solution enabling wide accessibility

Tracking Technology: The system utilizes visual-based tracking (using cameras, image recognition and barcode scanning) as the primary tracking technology, chosen for:

- Precise object recognition optimized for food item detection in the store setting
- Real-time tracking and analysis of nutritional information
- Reliable performance under various store lighting conditions
- Integration with the SnaX-Ray Checkpoint system for dietary analysis

3D Interaction Design: The interaction system is designed to progress through three distinct phases, each with specific interaction patterns:

Phase 1 - Learning the Basics:

- Simple tap-to-scan interactions for food item recognition
- Clear AR overlays showing basic nutritional information
- Intuitive navigation arrows guiding users through the store

Phase 2 - Dietary Restrictions:

- Interactive virtual customer profiles with specific dietary needs
- Real-time feedback through virtual coworker reactions
- Gesture-based item selection and cart management

Phase 3 - SnaX-Ray Checkpoint:

- Advanced AR visualization of food-preference matching using virtual light rays
- Interactive 3D models showing dietary compatibility
- Visual feedback system demonstrating health impact of choices

Development Platform Unity with ARCore integration serves as our development platform, selected for:

- Robust AR capabilities suitable for the retail environment
- Seamless integration with the OptiDot system (which has been built

- Efficient handling of multiple AR overlays and interactions
- Strong performance optimization for mobile devices
- Built-in physics engine for realistic object interaction
- Capability to create engaging game mechanics and reward systems

This technical framework supports our educational objectives while creating an immersive experience within the physical store environment. The progressive phase structure ensures that children gradually build their understanding of both nutrition concepts and AI-powered recommendation systems through hands-on interaction with real products in a familiar retail setting.

Personas

In designing personas for our AR food recommender app, we took a comprehensive approach by creating two distinct yet complementary user profiles that represent different segments of our target audience. We deliberately chose to represent both a child with a specific dietary restriction (Jake with gluten intolerance) and a child with a general health goal (Emma focusing on weight gain). This contrast allows us to demonstrate how the app can serve both medical necessity and general wellness objectives, while maintaining its educational value for different use cases.

Our personas were carefully crafted to represent the pre-teen age group (11-12 years), a critical period when children begin to take interest in their own health decisions and develop independence in food choices. Both Jake and Emma share an affinity for technology and interactive experiences, making them ideal candidates for testing an AR-based solution. We incorporated realistic challenges such as difficulty in reading labels, feeling overwhelmed by information, and the social-emotional aspects of dietary needs. This balanced approach ensures that our design considerations encompass both specific medical needs and general wellness goals, making the app valuable for a broader range of users while maintaining its educational and practical utility.

Persona 1: Jake Williams - The Curious Young Shopper

(Image created using ChatGPT)

Demographics:

- **Age**: 11
- **Occupation**: Student
- **Health Condition**: Gluten Intolerance
- **Dietary Needs**: Gluten-free products

Background

Jake is an active 11-year-old who loves sports and video games. He was diagnosed with gluten intolerance a few years ago, which means he can't eat some of his favorite foods like regular pizza and bread. Jake's parents have been guiding his food choices, but recently, he's become more interested in learning about his own condition. He loves technology and enjoys interactive experiences like VR and AR.

User Goals

- Learn more about his gluten intolerance in a fun and interactive way.
- Use the AR app to find gluten-free alternatives to the foods he loves.
- Understand how the recommendation system works and how it selects foods based on his health needs.
- Make his own food choices confidently when shopping with his parents.

Narrative Story

Jake loves going to the grocery store with his parents because it feels like a treasure hunt. However, it can also be frustrating when he sees foods he can't eat due to his gluten intolerance. One day, his parents introduce him to an AR food recommender app that allows him to scan items in the store and see which ones are gluten-free. The app also teaches him about why certain foods are recommended for him through a fun, interactive explanation. Jake is thrilled that he can understand his dietary restrictions better and make decisions for himself with the help of the app.

Roadblocks

- Limited understanding of what gluten intolerance means and why certain foods are off-limits.
- Often overwhelmed by too much information on food labels, making it difficult to know what he can and can't eat.
- Feels left out when he can't eat the same foods as his friends, and wishes there were more exciting gluten-free options.

Further Information

Jake loves technology, especially games and interactive learning. He's always up for an adventure and is excited by the idea of using AR to learn more about his health condition. His parents want him to understand his dietary needs so he can make informed choices in the future, and they hope the app can foster his curiosity about food in a positive way.

Persona 2: Emma Johnson - The Health-Conscious Tween

(Image found through google Search)

Demographics

- **Age**: 12
- **Occupation**: Student
- **Health Goal**: Gaining weight
- **Dietary Needs**: High-calorie, nutritious foods to support healthy weight gain

Background

Emma is a 12-year-old who has always been on the lighter side and recently started focusing on gaining weight in a healthy way. She enjoys physical activities like swimming and biking but doesn't know much about nutrition. Her parents have encouraged her to start learning about which foods can help her reach her goal, but she often finds it overwhelming. She loves using her phone for games and apps, so she's intrigued by the idea of using an AR food recommender to help her choose the right foods.

User Goals

- Learn about foods rich in healthy fats, proteins, and calories that support weight gain.
- Discover new, nutritious options without relying on junk food.
- Use the AR food recommender to identify high-calorie, nutrient-dense foods while shopping.
- Make informed decisions about her diet with the help of interactive, engaging content.

Narrative Story

Emma wants to feel stronger and healthier, so she's starting to focus on her diet. She's unsure of where to begin, and reading nutrition labels feels confusing. One day, she tries the AR food recommender app in the grocery store and is surprised by how easy it is to scan food items and get recommendations for high-calorie, nutritious options. The app helps her learn about healthy fats, proteins, and carbohydrates, which are important for gaining weight. She feels more confident about her choices and even starts enjoying her shopping trips.

Roadblocks

- Confusion about what foods are best for gaining weight in a healthy way.
- Difficulty reading and understanding food labels and nutritional information.
- Temptation to choose unhealthy, high-calorie snacks that don't offer proper nutrition.

Further Information

Emma loves using technology, especially when it's fun and engaging. She wants to gain weight in a way that helps her feel healthier and stronger, but she doesn't want to compromise her health by eating junk food. The AR food recommender app helps her learn about healthy choices and makes shopping less intimidating.

Storyboard

Jake

Jake is a 11 years old boy who is gluten-intolerant. Normally, his parents would pick the food for him because he doesn't know that much about what kinds of food he can take. However,

(Image generated by Gemini)

Jake's parents heard about the AR food recommender and decided to let Jake use it as a way to learn about what foods he can take by himself. As a Result, Jake started to play a food recommender game in the supermarket and after he plays the role of shopper and grabs certain foods to the virtual customers in game who has gluten-intolerance as well. He realized that the foods he thought are "ok" to eat are definitely uneatable by people who have gluten-intolerance conditions. He leant this by seeing the customers in the game getting really sick . After use of AR food recommender, both Jake and his parents are happy about the fact that learnt lots of knowledge about what type of food he can take and that is extremely helpful.

Emma

Emma's parents introduce her to the AR food recommender app. Emma smiles, intrigued, holding her phone while browsing the app interface.

(Image generated by Gemini)

Emma stands in a grocery store aisle, holding up her phone to scan food items. The app displays options like "Healthy Fats" and "Protein-Rich Foods."" The app explains which foods are nutrient-dense, highlighting items like avocados, nuts, and whole-grain snacks. Emma looks surprised and happy, understanding more about these foods.
feels unsure about what foods to eat to gain weight healthily, as her parents have suggested.
The app explains which foods are nutrient-dense, highlighting items like avocados, nuts, and whole-grain snacks. Emma looks surprised and happy, understanding more about these foods.

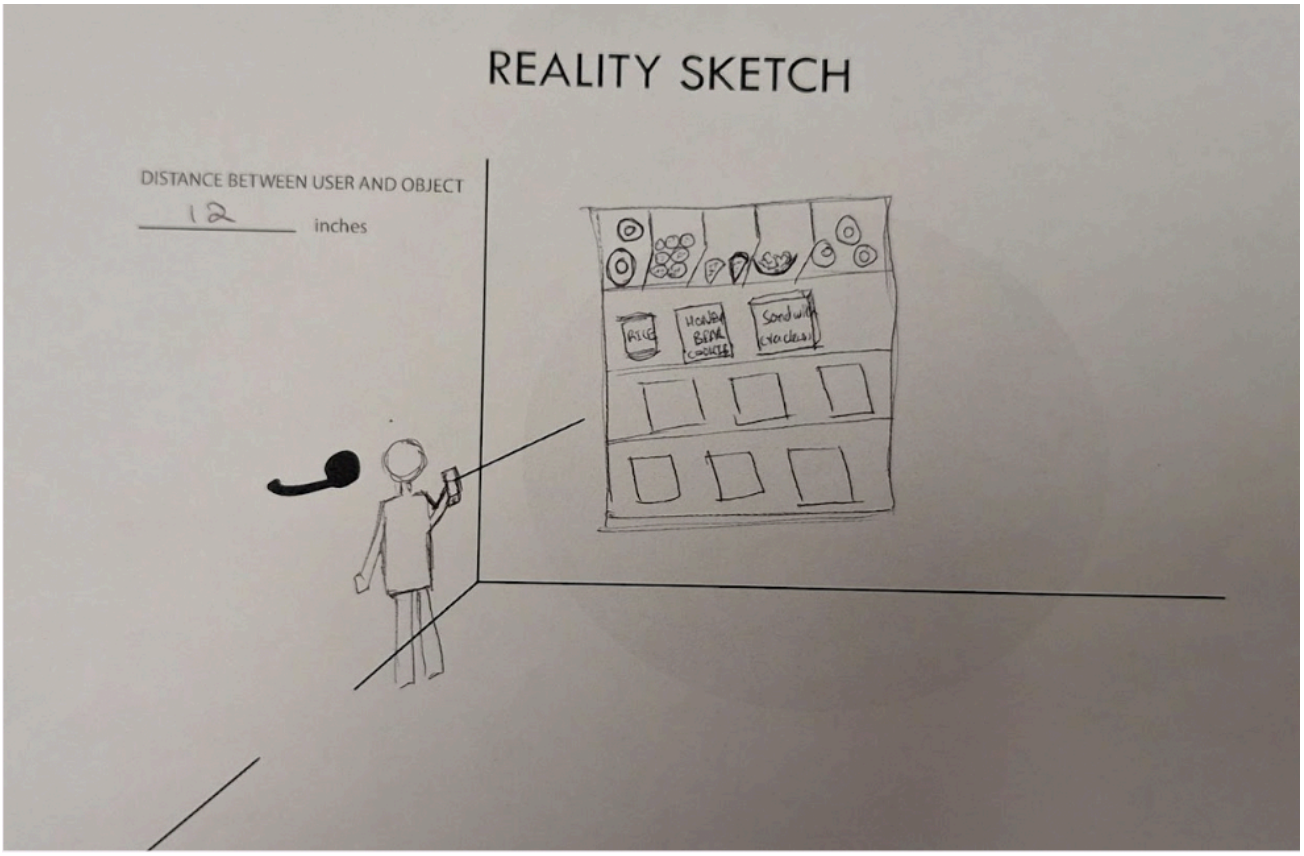
Low-fidelity Prototype

Paper Prototype

For our initial prototyping phase, we adopted a paper-based approach to rapidly visualize and iterate on key concepts of the AR Food Recommender system. This low-fidelity prototyping allowed us to explore different user interface layouts, interaction flows, and feedback mechanisms before moving to digital implementation. We created simple sketches of various screens and AR overlays, focusing on how nutritional information would be displayed, how the SnackRay Checkpoint would function, and how feedback would be presented to young users.

Reality Sketch

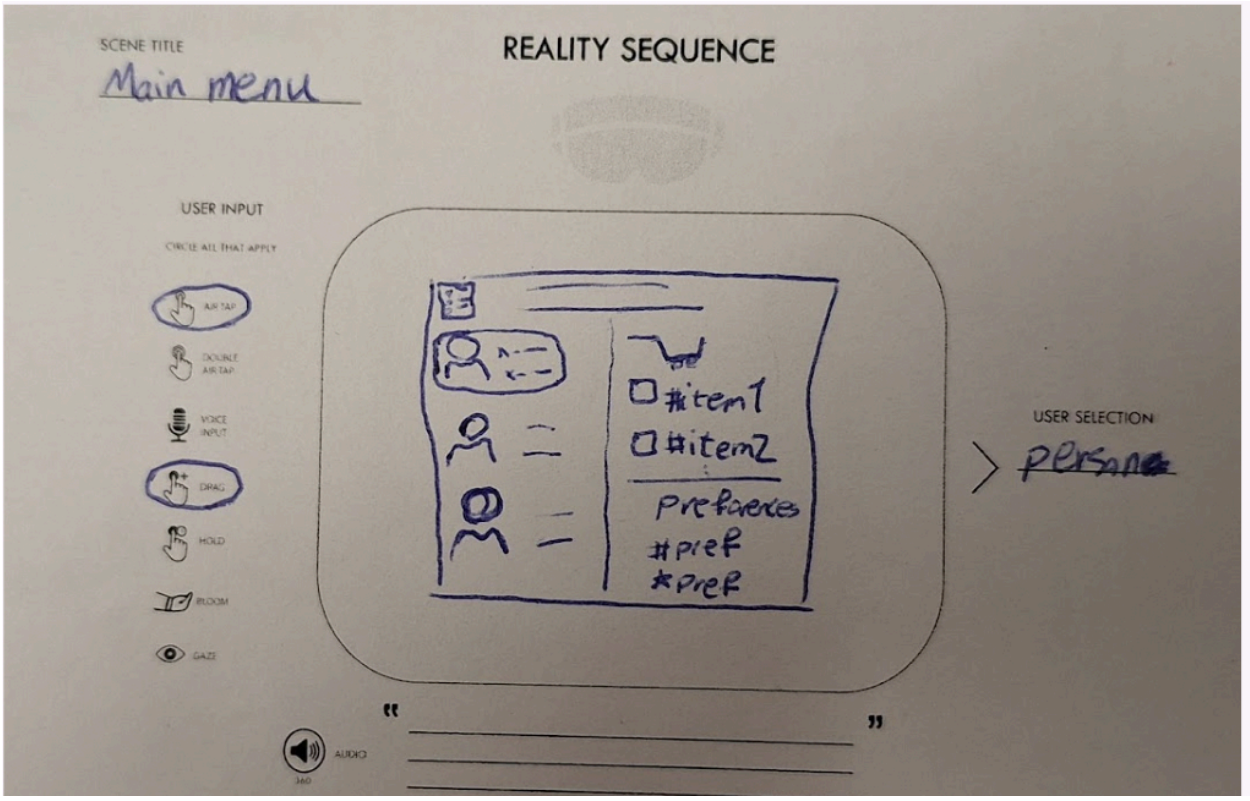
Our reality sketch depicts a key interaction scenario where a young user is actively engaging with the AR Food Recommender system in a grocery store aisle. The sketch shows a child holding a mobile device in front of store shelves, with AR overlays visualized through simple drawings. The scene captures the essence of our application's core functionality: the child acting as a shopper helper, using their device to scan food items while AR elements display nutritional information and dietary compatibility. The sketch emphasizes the spatial relationship between the user, the physical environment, and the virtual elements, helping to communicate how the final AR experience would integrate with the real-world shopping environment.



Reality Sequence

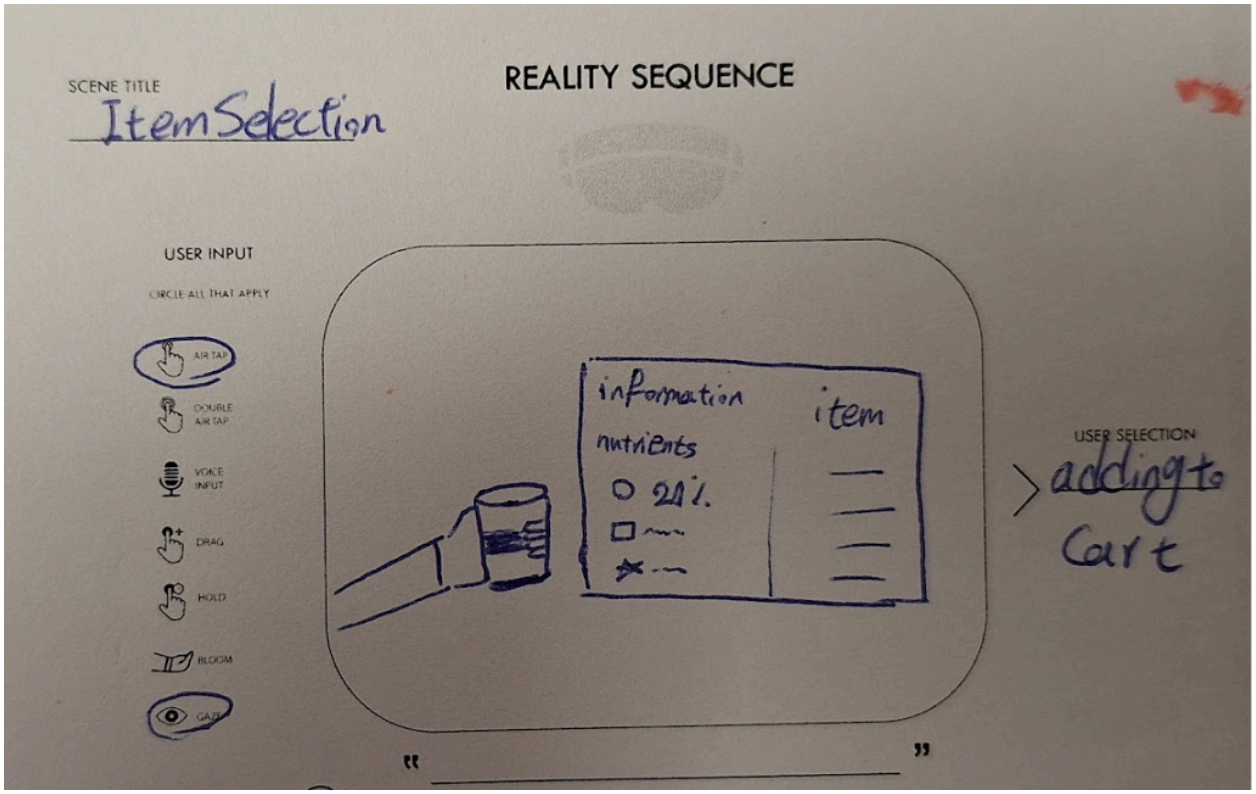
Step1 - Customer Profile Interface:

The sequence begins with an interactive display showing customer profiles and their food requirements. On the screen's left side, users can view detailed customer profiles, including Jake with his gluten intolerance and Emma with her weight gain goals. The right side of the screen lists specific food requests and dietary preferences for each selected customer. Using air tap and drag gestures, young shoppers can interact with these profiles, exploring customer details and their specific dietary needs. This initial interface sets up the shopping mission by clearly presenting who they're shopping for and what dietary considerations they need to keep in mind.



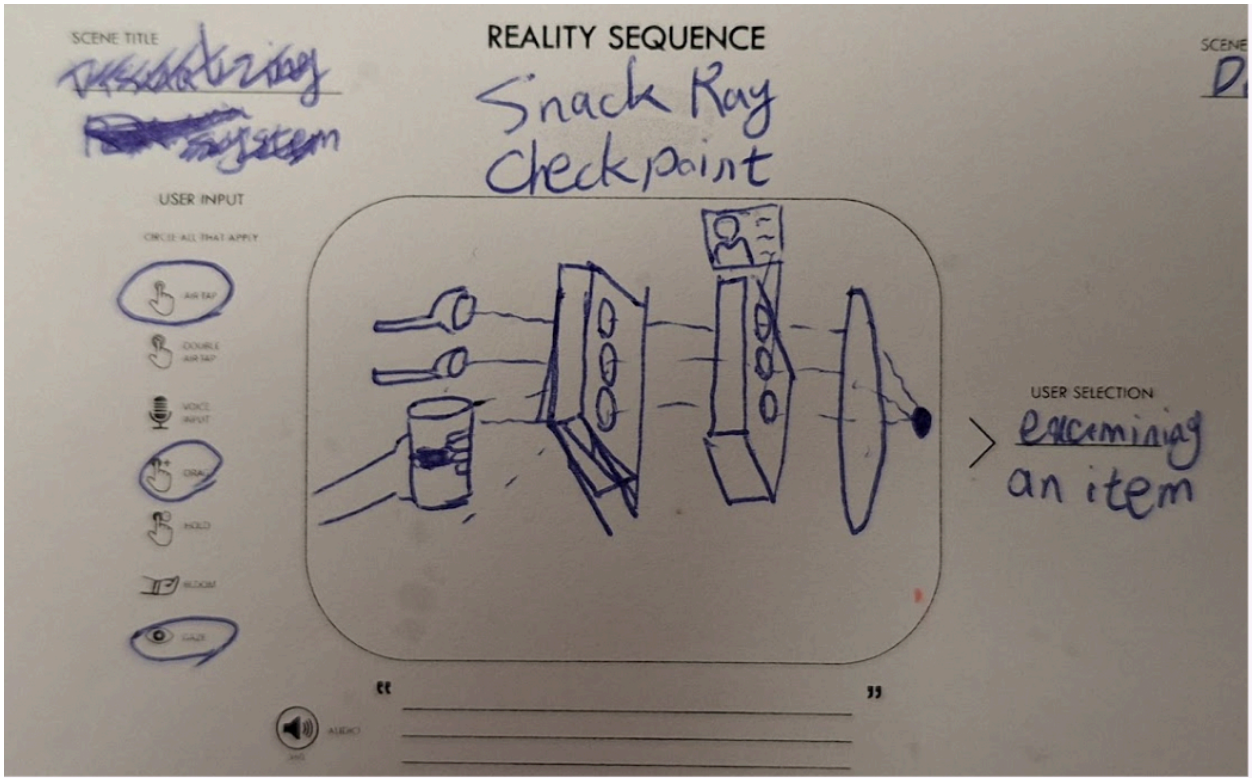
Step 2 - Item Selection and Cart Management:

In this step, we see a young shopper in front of a store aisle, holding their device to scan food items. The interface shows an AR scanning frame that helps users target specific products. Using air tap gestures, shoppers can select items of interest. Products can be easily added to the virtual shopping cart with a simple tap gesture. This interaction design keeps the experience intuitive and engaging, allowing young shoppers to make informed decisions about food choices while maintaining the natural feel of shopping in a physical store.



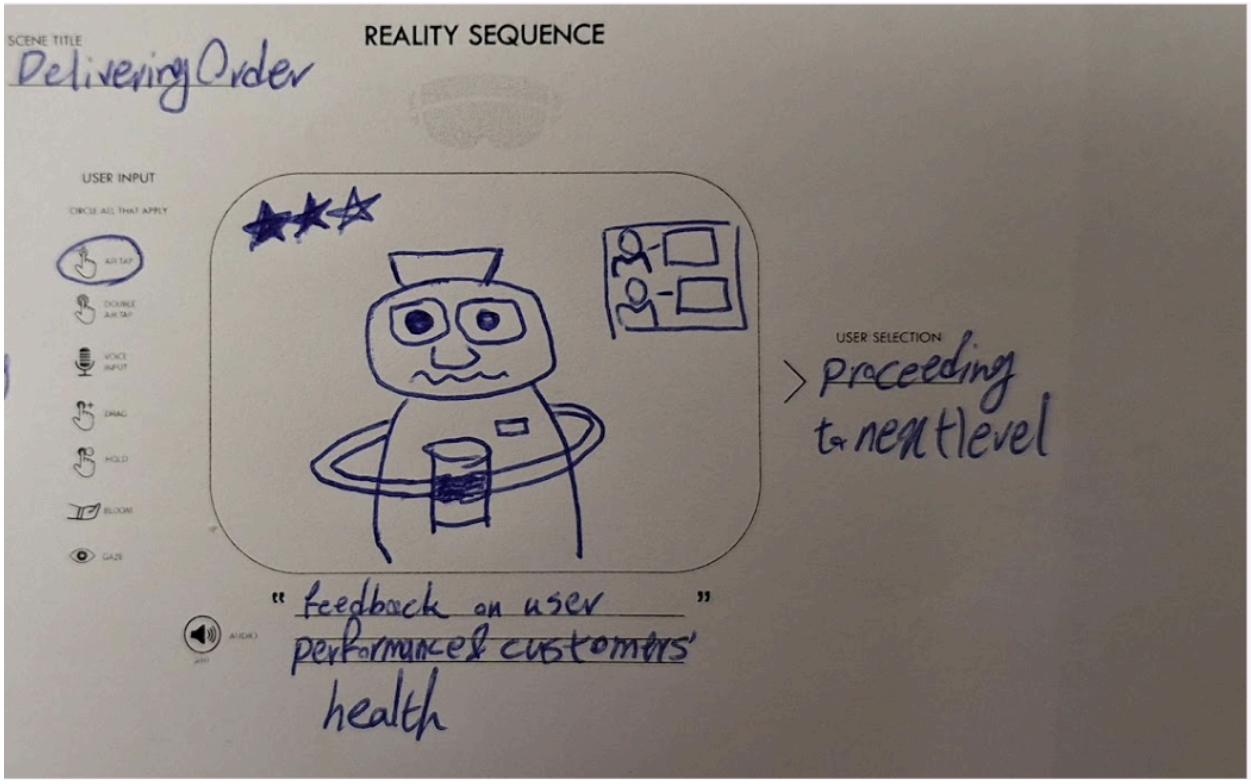
Step 3- SnackRay Checkpoint Analysis:

In this step, players provide the **SnaX-Ray Checkpoint** with both the customer's dietary information and the scanned item. Each of these inputs is represented visually as an angle adjustment of a set of lenses (inspired by the OptiDot concept), symbolizing how the lenses filter information based on health needs. The resulting light beam intensity then visually indicates whether the selected item aligns with the customer's dietary requirements. A bright, strong beam might signal a healthy match, while a dim beam could suggest an unsuitable choice.



Step 4- Performance Evaluation and Feedback

In this final step, users encounter their virtual trainer who evaluates their shopping decisions and provides performance feedback. The AR interface shows the boss character reviewing the selected items and their compatibility with the customer's dietary needs. Through a combination of visual feedback and character animation, the boss indicates whether the choices were appropriate - celebrating successful healthy matches or explaining why certain selections might not be optimal. The interface displays performance metrics such as accuracy in meeting dietary requirements and overall customer satisfaction. If the performance is good, users receive virtual rewards and encouraging feedback; if improvements are needed, the boss provides constructive guidance on making better choices next time.



Level Design

Level 1: Shop Smart 101
In this introductory level, players learn the basics of the **SnaX-Ray Cart Dash** game. They are presented with a list of virtual customers, each with specific dietary preferences and requests like "I'm looking for a cold and sweet brunch." Players navigate the aisles, scan items, and add selections to the customer's cart based on these descriptions. Once they've gathered all items, they deliver the cart to their virtual trainer, who provides feedback on their choices. The goal is to familiarize players with identifying customer needs and making thoughtful choices.

Level 2: Oops! Wrong Aisle
In this level, players face a new challenge: making correct food choices becomes essential, as ignoring dietary needs will lead to unhappy, sick customers. For instance, a lactose-intolerant customer might react poorly to a dairy dessert. This time, failing to account for dietary restrictions results in visible dissatisfaction from the customers and concern from the trainer, who warns, "Oh no, we're going to lose our job if we keep this up!" This level emphasizes the importance of being mindful and introduces consequences for incorrect choices.

Level 3: SnaX-Ray Perfection
The final level introduces players to the **SnaX-Ray Checkpoints**—a special AR tool they can use to scan and evaluate the healthiness of each item based on the customer's specific needs. Players now have the power to make precise, informed choices using the SnaX-Ray device, which highlights whether a selected snack is a good match for the customer's dietary profile. Successfully using the checkpoints to make

accurate selections earns praise from the trainer, showing players how they've mastered the skills of a health-conscious shopper.

Physical Prototype

In the physical prototype, the player acts as a personal shopper, holding their phone to scan an item (the pink furry ball) selected from the aisle. On the right side of the interface, the **SnaX-Ray Checkpoint**—represented as an orange virtual station—examines the scanned item against the dietary needs of the virtual customer. The checkpoint then displays either a red or green light, indicating whether the item is a suitable match (This might change in the final game). Users then decide to add the item to the cart or not. After delivering a cart, the virtual trainer appears to provide a somewhat funny feedback on the player's performance.

In the physical prototype the player as a personal shopper is holding his/her phone scanning an item taken from the aisle.

Project Timeline

Timeline	Deliverables
Week 1 (10/22 - 10/29)	Midterm Report and Presentation
Week 2 (10/30 - 11/07)	- Set up basic AR scanning functionality in Unity/ARCore for food item recognition - Implement simple customer profile system (featuring Jake's gluten-free scenario) with basic UI elements
Week 3 (11/8 - 11/14)	- Create SnaX-Ray Checkpoint prototype with visual feedback for food-health matching - Develop 5-minute gameplay loop showcasing scanning, decision-making, and health impact visualization - Polish demo elements: quick tutorial, reset functionality, and stable offline operation for Frameless presentation
11/15	Frameless Presentation
Week 4 (11/15 - 11/21)	- Enhance AR visualization quality and add real-time feedback from virtual coworker

	- Implement second customer profile (Emma's weight gain scenario) with expanded food options - Refine SnaX-Ray Checkpoint effects and improve performance optimization
Week 5 (11/22 - 11/29)	- Create final presentation materials - Polish user experience with improved UI, clearer tutorials, and smoother transitions - Conduct user testing with target age group and incorporate critical feedback Prepare final demonstration that showcases both customer scenarios (Jake and Emma)
Week 6 (11/30 - 12/4)	- Finalize project poster highlighting key features, user scenarios, and technical implementation of the AR Food Recommender system - Polish demo experience with backup builds, offline functionality, and multiple engagement options
12/5	Poster/Demo Reception