

Grocery Store Simulator

CSE 493V Final Project Report

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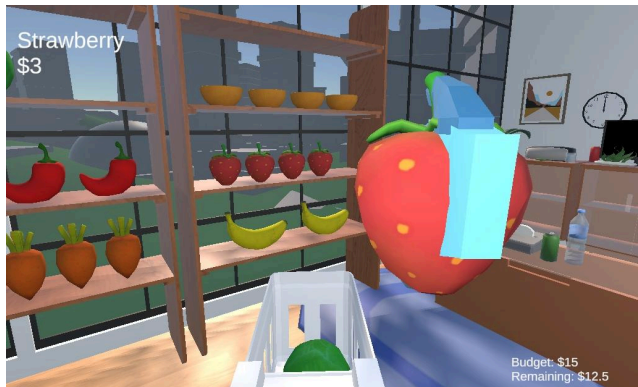


Figure 1: Screenshot of the immersive grocery store simulator. The user is in the virtual supermarket, holding a strawberry and with a lettuce in their basket, while tracking their budget in the top and bottom corners of the screen. This visual illustrates the user's task of balancing their purchases within a limited budget while navigating real-time shopping challenges.

ABSTRACT

This report describes the development and design of an immersive grocery store simulator aimed at enhancing essential life skills in college students and young adults transitioning to independent living. The simulator allows users to navigate a virtual grocery store environment using handheld controllers, where they are tasked with completing various challenges such as budgeting for a week's worth of groceries, planning meals on a budget, and adapting to obstacles like out-of-stock items and dietary restrictions. The system incorporates timed challenges to simulate real-world pressure, encouraging users to make informed, strategic decisions. The objective of the simulator is to improve participants' budgeting, shopping, and meal planning skills, equipping them with the tools necessary for managing personal finances and food procurement. This report discusses the design choices, technical implementation, and educational outcomes of the simulator, offering insights into how virtual environments can be used to teach practical, real-world skills in a controlled, interactive setting.

1 INTRODUCTION

Many college students and young adults living on their own for the first time, lack the ability to budget and meal plan, both essential but overlooked life skills. There are countless stories of college students relying on ramen and takeout, often compromising their nutrition, budget, or both. By creating an immersive, interactive grocery shopping simulator, we provide a hands-on learning experience in essential life skills that are rarely taught in school and often learned through trial and error.

There are currently limited technology-driven tools available for practicing financial literacy and meal planning that offers an opportunity for real-world, interactive experiences. Current applications of virtual and augmented reality technology have been explored in education and other domains such as medical training and flight simulation, yet the technology has not been explored for grocery shopping and budgeting education. This project will combine VR and time sensitive, scenario-based challenges for the grocery shopping experience to allow individuals the opportunity to experience a grocery shopping experience, navigate a budget, solve for obstacles, such as unavailable items, dietary restrictions, and practice decision making. We reviewed, researched, and developed an activity to enhance decision-making, budgeting, and meal planning. This simulator may also inform future thinking in the day-to-day lives of all those enrolled in this experience, as well as inspire future development of AR/VR for any areas of personal finance and/or life skill programs.

1.1 Contributions

Our primary technical contributions are:

1. Creating a virtual environment that mimics real-world shopping experiences, such as product selection, budget constraints, time constraints, and checking out.
2. Implementing object collisions in the shopping cart and grabbable objects using Unity's XR interaction asset. This allows users to pick up items off the shelf and place them in the basket.

3. Detecting when a user places an item in their cart and automatically updating their budget based on item cost.

2 RELATED WORK

In the domain of virtual reality (VR) simulators, numerous applications exist, including those designed to simulate various aspects of daily life, such as grocery shopping. These simulators range from simple training tools to more complex, fully immersive experiences. Notably, VR-based simulations have been utilized in fields like retail training, educational tools, and experiential learning. However, the primary goal of our project is not to create something entirely novel or to compete with these existing solutions. Rather, our focus is on developing a personalized grocery store simulator as part of a learning experience in VR development.

Our intent is to leverage this project as a way to refine our skills in VR design and development while crafting a fun, interactive simulator. As such, we do not aim to build upon or directly challenge any specific existing works or products. This project serves as an opportunity for practical application and hands-on learning, rather than as an effort to create an innovative product within the broader market of VR simulators.

Given that our goal is not to introduce a competitive or groundbreaking solution, we do not include a detailed review of competing work here. Instead, we view this project as a tool for personal and educational growth, rather than a step toward a larger commercial or academic endeavor.

3 METHOD

Our approach was to simulate a real-world grocery shopping experience, such as limited budgets, time constraints, and unpredictable factors like stock shortages. We hypothesize that simulating real-life shopping obstacles will enhance financial literacy and decision-making skills in young adults and college students.

The first component to our project is creating a real-world grocery shopping experience. We built the scene using low-poly assets found in the Unity assets store. The objects we used include fruits, vegetables, shopping cart, grocery store shelving, and a checkout area. We weren't able to find an exact checkout asset so that was built with a combination of an office desk, 3D plane as the conveyor belt, and a cash register object. Our grocery store selection is not as robust as a real-life grocery store and we focused

mainly on whole foods and ingredients, omitting things like snacks and seasonings.

The second component of our project is budgeting and meal planning. At the beginning of the game, based on the scenario chosen, users can opt into a time constraint, a budget, and a recipe they must shop for. This helps simulate a real-life scenario where we have a meal we want to cook, a budget for that meal, and also limited time shopping due to different factors like class or work. Users then navigate through the store, picking up items and placing them in the shopping cart. When they place items in the shopping cart, the cost of the item is deducted from their budget and their shopping list is updated.

4 IMPLEMENTATION DETAILS

The grocery store simulator was developed using Unity as the primary development environment, targeting the Oculus Quest 2 for VR functionality. The implementation focused on creating an interactive and immersive budgeting simulation within the constraints of VR, using a combination of hardware and software tools.

Hardware:

- Headset: Oculus Quest 2, chosen for its wireless VR experience, affordability, and standalone capabilities. It provided an ideal balance between performance and accessibility, allowing for an immersive experience without requiring an external PC.

Software:

- Unity: The core development platform used to build the simulator. Unity's robust support for VR development and its integration with Oculus SDKs allowed for an efficient workflow.
- XR Interaction Toolkit: This Unity package facilitated the creation of the interactive VR experience, providing essential functionality for user input, object interaction, and teleportation within the virtual space.
- XR Core Utilities: Utilized for managing input devices and optimizing the experience for the Quest 2 headset. This library helped streamline the handling of controllers and interactions in the VR environment.
- TextMeshPro: Used for handling dynamic text and UI elements within the simulator. It enabled us to create clear, readable text for in-game instructions, budgeting information, and feedback.

The development process also included using Unity's built-in physics and collision detection systems to simulate realistic interactions within the grocery store environment, such as object grabbing and manipulation.

Overall, the combination of Unity, the XR Interaction Toolkit, and Oculus Quest 2 hardware allowed for a smooth and efficient development process, resulting in an immersive and interactive VR experience for budgeting and meal planning.

5 EVALUATION OF RESULTS

Through the development of our grocery store simulator, we observed that users engaged more actively with budgeting concepts when confronted with time-sensitive and adaptive challenges. The inclusion of these dynamic elements encouraged participants to think critically about their spending choices, leading to deeper interactions with the simulator's core features. This suggests that such a simulation could have potential as a tool for fostering better financial habits and meal planning in real-life scenarios. Overall, the results highlight the simulator's ability to promote financial decision-making in a controlled, interactive environment.

6 DISCUSSION OF BENEFITS AND LIMITATIONS

Benefits:

- **Increased Engagement:** The adaptive challenges effectively kept users engaged by providing real-time feedback on their budgeting decisions, which helped reinforce the importance of responsible spending.
- **Practical Skill Development:** The simulator showed potential as a tool for developing long-term habits in budgeting, as it allowed users to experience financial decision-making in a low-risk, interactive environment.
- **Realistic Scenario Simulation:** By mimicking real-world grocery shopping, the simulator provided a contextual experience where users could practice budgeting under pressure, which may translate to better financial decision-making in real life.

Limitations:

- **Lack of User Testing:** Since we did not run a formal user study, our insights are based primarily on internal testing. Without broader user feedback, it's difficult to gauge the simulator's full potential and usability in a diverse audience.

- **Limited Scope:** Currently, the simulator focuses only on basic budgeting and meal planning. It does not include more complex financial elements like multi-item discounts, coupons, or recurring grocery purchases that could add depth to the experience.
- **Single-Player Focus:** The current version of the simulator is a single-player experience. The absence of multiplayer interaction limits opportunities for collaborative decision-making or social learning around budgeting.

These benefits and limitations provide important insights into the simulator's current effectiveness, while also highlighting areas for improvement.

7 FUTURE WORK

While our grocery store simulator demonstrates the potential of VR for learning about budgeting and meal planning, several opportunities for future development and enhancements exist. Below, we outline some key areas that could further enrich the user experience, expand the simulator's capabilities, and improve its overall effectiveness.

1. **Multiplayer Features:**
Adding multiplayer functionality would allow users to collaborate or compete in budgeting tasks, enhancing engagement and reflecting real-world decision-making dynamics.
2. **Cultural and Dietary Customization:**
Expanding the simulator to include different cultural food markets and dietary needs would make it more relatable and applicable to a broader audience.
3. **Advanced Budgeting Scenarios:**
Introducing features like sales, loyalty programs, and recurring expenses would make the simulation more complex and realistic, helping users develop better long-term budgeting habits.
4. **User Testing and Feedback:**
Conducting formal user studies would provide insights to refine the interface and improve the overall experience based on real user behavior.
5. **Performance Optimization:**
Optimizing rendering and incorporating foveated rendering techniques could enhance performance and user comfort, especially in VR environments.
6. **AI Adaptation:**
Implementing AI to adapt challenges based on user behavior could personalize the experience, promoting better financial habits.

7. Real-World Data Integration:

Syncing the simulator with real-time grocery price data would create a more relevant and timely experience, reflecting economic changes.

By addressing these areas, the simulator can evolve into a more dynamic and effective tool for financial education, making budgeting more engaging and realistic for users.

8 CONCLUSION

In conclusion, this immersive grocery store simulator represents a new way to support college students and young adults in developing important skills in budgeting, meal planning and grocery shopping. By combining real life challenges with virtual interactivity, the system allows users to practice these essential life skills in a non-threatening, fun way. This project illustrates the possibilities of addressing daily issues related to first time living independently through the application of AR/VR. As more researchers look to apply similar solutions, this project may help lead to broader use of immersive learning tools in applicable education, improving financial literacy and independence among the younger generation. Continued development and testing of such tools could impact how life skills are taught and better equip individuals to live independently.

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