

University of Nevada, Reno
Computer Science and Engineering

Virtual Reality Physics Lab

Project Part 4: Progress Demo

Team 10:

Nicholas Bolling
Christopher Lewis
Andrew Munoz
Willem Zandbergen

Instructors

Sergiu Dascalu & Devrin Lee

External Advisors

Eelke Folmer & Benjamin Brown

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1 Abstract

The goal of Team 10's Virtual Reality Physics Lab is to utilize a new, revolutionary product for educational purposes. Virtual reality hardware, such as that in the HTC Vive, allows for personalized, immersive experiences which can address all forms of VARK (Visual, Aural, Read/write, Kinesthetic) learning. Very few environments outside of private tutoring have the same potential for an entertaining, educational experience. The VR Lab project will be filling this gap currently present in the virtual reality repertoire. The final product of the VR Lab will provide an immersive and educational experience into kinematic physics while promoting STEM (Science, Technology, Engineering, Mathematics) principles.

2 Use Cases/Requirements Implemented for Progress Demo

The use cases listed below have all been implemented and will be showcased during the progress demo.

Number	Name	Description
UC01	Teleportation	The user will be able to teleport to an intended destination. This will be done by pointing at the destination, pulling the trigger on the controller, and then teleporting to the intended destination.
UC02	Movement	The user will move within a fixed space without teleportation. This will be done by tracking the player's movement throughout the space/environment.
UC03	Start Game	From a splash screen a user will be able to access a specific simulation. Before the user starts the simulation a user can load their intended profile, check specific options for their simulation, and click on a start button to start the game. If the user's profile is not there the user can make a new profile.
UC06	Object Intractability	The user will be able to interact with placed objects in the environment, including shooting a projectile or interacting with a scoreboard. From there physics will be accurately represented on a canvas for the user to see.
UC07	Firing Projectiles	The user will be able to fire a projectile from a manipulable object toward an intended target. The data for that projectile will be processed and the projectile's line of motion will be displayed in real-time.
UC09	Object Spawning	While in the simulation the user will be able to spawn given objects at will and place them in the environment. From there the user will be able to interact with those objects and display data about them on an in-game canvas.

The functional requirements that have been met are mostly from the Tier One functional requirements that were compiled in Project 1. They are listed below as follows:

Tier One Functional Requirements:

Requirement	Description
FR1.1	The system will enable the user to point at an intended destination with a curved ray.
FR1.2	The application will have the ability to let the player freely move around in a small space without teleportation.
FR1.3	The program will have a splash screen with the game title.
FR1.4	The program will have an interactable start button that will initiate the simulation.
FR1.5	The system will allow the player to shoot a projectile from an object.
FR1.6	The system will allow for data about the objects to be displayed on an in-game canvas.

Tier Two Functional Requirements:

Requirement	Description
FR2.2	The program will allow the user to be able to spawn objects in the environment.

3 Use Cases/Requirements to be Implemented in the Future

The use cases listed below still need some work to be fully functional in future releases of the VR Physics Lab. Use Cases 4,5, and 8 are partially implemented, however are not fully functional at the time of the progress demo.

UC04	View Scores	The user can view their scores to different activities in the game. For example, they will be able to see how much force they applied to certain object, such as a ball, and try to increase the amount of force applied to allow it to travel a farther distance and the user will receive a score.
UC05	Load Environment	The user will be able to load an environment with their profile. If the profile does not exist the user can create a new profile. The environment will be a catered toward a specific task or goal for the user to overcome.
UC08	Save Progress	The user will be able to save their scores and progress on the different activities available. Saving will start once the player selects the save option and will then be followed by a screen that shows different users save files and asks the user which file they wish to save their game to.
UC10	Obtain Points and Achievements	During the simulation the user will be able to obtain points for specific actions. The points can be a score or experience toward further actions in the game. From there the user may obtain an achievement for their actions in the specific simulation.
UC11	Configurable options	From an in game options screen the user will be able to toggle specific enhancements. The enhancements will be toggling air resistance in the simulation and colorblind modes. Colorblind modes available will be: Protanopia, Deuteranopia, and Tritanopia.

The functional requirements that will be implemented in the future are mostly from the Tier Two functional requirements that were compiled in Project 1. These requirements are listed below as follows:

Tier One Functional Requirements:

Requirement	Description
FR1.7	The system will have the ability to save user profiles.
FR1.8	The system will enable the ability to load the user's profile.

Tier Two Functional Requirements:

Requirement	Description
FR2.1	The program will have a line of motion for the intended projectile.
FR2.3	The program will have a scoring system.
FR2.4	The application will allow the player to choose separate environments.
FR2.5	The application will have intended targets for the player to hit.
FR2.6	The application will have an interactable options screen.
FR2.7	The application will have different types of projectiles that the player can use.

4 Summary of Current Project Status

The progress on our project has been back and forth as implementation and refactoring for another implementation is required, like before teleportation we need to be able to have a world and camera to spawn in. Almost all the groundwork is done with movement and interaction, our main concerns for the Virtual Reality experience. Physics with player and objects are working correctly and have been implemented, as well as a menu and main kinematics worldspaces have been created/linked. All of our implementation so far has gone well, and we are nearing the final touches to the project to ensure we meet proper requirements and quality standards that we expect.

5 Contribution of Team Members

Working hours:

Andrew: 1.5 hours + (10 hours for development)
Modified Teleportation curved arc, Lever/Cannon controls, game logic, created models, UI user profile, Use Case/Requirements Implemented and to be Implemented

Chris: 13 hours for development
Object Interaction, Texture mapping, core gameplay mechanics, load game pipeline, cannon mechanics

Nick: 8 hours for development
Summary of Current Project Status, cannon gameplay, scene transition, UI, object interaction

Will: 4 hours
User tests, code cleanup and refactoring, game object management