

AP CSA Educational Game Design Document

PROJECTILE DUEL

Projectile World

www.greenfoot.org/scenarios/20157

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[www.github.com/SujalN/EducationalGame.git](https://github.com/SujalN/EducationalGame.git)

Description

The original target-shooting game includes a user-controlled launcher, different types of projectiles, and different targets to hit. The user can control the angle of launch by using the up and down arrow keys. After choosing an angle, the user can then press the Z, X, C, or V key to launch a small bomb, fireball, missile, or giant soccer ball respectively. The objective of the game is to make the projectiles hit the various different objects spawned at random locations at the start of the game. Our modified version of the game would have more complicated controls, as the user would be able to type in the angle of launch and the initial velocity. The projectiles will travel based on the kinematic equation $d = v_o t + \frac{1}{2}at^2$, where d is displacement, v_o is the initial launch velocity, a is acceleration, and t is time. To measure displacement, the game will have its own scale of meters. The projectile will experience a downward acceleration of 9.8 meters per second squared based on the acceleration due to gravity. Furthermore, this will be a local multiplayer game in which two launchers must hit projectiles at each other instead of stationary objects in order to score points. At the start of the game, each player will place their launcher at any location in the world. After the launchers are placed, the players can set the conditions to launch their projectiles to hit each other's launchers and compete to score as many hits as possible.

Educational Value and Outcomes

This game is directed towards middle school and high school students as an introduction to two-dimensional kinematics. The desired learning objectives are the basic functions of projectile motion as well as the knowledge of the relationship between acceleration, velocity, and position. As students in AP Physics, we hope that this will provide a background to other students planning to take this challenging course in their senior year. Students will utilize the kinematics equation $d = v_o t + \frac{1}{2}at^2$ to determine the motion of their projectile, and the local multiplayer feature allows the student to share their experience with another player. We hope this game will allow students to become familiar with this foundational kinematics equation and further their knowledge in this specific area of the physics course.

Modifications Required

Our primary goal is to transform the existing game into an educational game through the implementation of the foundational kinematics equation mentioned above. While the existing scenario provides a rough outline of our goal's outline, it fails to provide the physics-related aspects. Therefore, we intend to incorporate the kinematics equation to change the trajectory of the objects shot from the actor in an effort to demonstrate how different variables produce different results. From its current state, the game includes a launch actor with basic keyboard controls, allowing it to shoot projectiles based on angle and object type. The modifications to this part of the game would entail a shift in these factors, allowing the equation values to be the determining factors in the object's final displacement. In addition, we are aiming to provide an opportunity to simulate an experimental scenario, where users can play with various launcher locations and different angles. In this sense, the player will be able to enhance their knowledge regarding the functionality of the displacement equation and how it contributes to real-life situations. The final modifications we hope to make are strictly visual appeal, including actor images and sound variations.

Topics From Summer Homework

The current game provides us with a rough outline we could use to develop this game but in making the modifications suggested in the above paragraph, we are going to need to incorporate some features from the topics we looked at in the summer hw. Classes are essential in fulfilling our goal. Classes are templates used to create objects. They define what each object of the class will do when it enters the gameboard. We are going to need to modify many of the classes that pre-exist in the creation of our modified game. For example, to change the sounds and the images the player makes, we are going to need to directly modify the hardcode in the Player class. Changing the image of the player and the objects that it launches would also require a modification of classes. Also, if we are going to allow the user to input initial velocity and launch angle, we are going to need to input the scanner class that allows for user input in java. If we are going to allow user input, we better also include input validation. For that very purpose, we are going to incorporate while loops, blocks of code set to loop until a condition has been satisfied. So the student can gain an even deeper picture of what is happening, we can use Java's math library to calculate the air time and the height after each consecutive attempt.