PROJECT REPORT
CSE4500 Platform Computing
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LAB: Project 3 – Physics Projectile App 3

Report

Describe in one paragraph how we derived the math formulas for the distance and height of a projectile fired at an angle θ and velocity v. Then describe how we turned these formulas to JavaScript functions.

Using known physics equations for projectile motion, we start by splitting the velocity vector into its horizontal and vertical components. There are no forces on the projectile in the horizontal direction while it is in flight, and the only force in the vertical direction is a constant negative acceleration due to gravity at -9.81m/s^2. Using the launch angle θ and the provided velocity vector, we compute the horizontal and vertical velocity components using the pythagorean theorem. We then calculate the time it takes for the projectile to reach its maximum height using the initial vertical velocity against the force of gravity. That time is doubled to give us the total flight time of the projectile, which can then be used to calculate the maximum height and distance travelled.

To implement these equations in JavaScript, first we used a step-by-step algorithm to keep track of all the caluclations that needed to be made. We set an onclick function on the Calculate! button that takes in the user-provided (after validation) inputs for initial velocity and launch angle. The calculate() function then calculates the time it takes to reach the apex, doubles that to get the total travel time, and uses that time to call two other functions to calculate height and distance. The problem is made simpler by breaking different pieces of the calculation into their own functions.

Source Code

```
<!-- CSE-4500 Platform Computing SPR23
     Nathan Bush - 007463099
     Project 3 - Project3.html -->


<!DOCTYPE html>
<html lang="en">
<head>
    <title>Physics Simulator App</title>
    <link rel="stylesheet" href="css/jquery.mobile-1.3.1.min.css">
    <script type="text/javascript"
src="scripts/chromeFileProtocolFix.js"></script>
    <script type="text/javascript" src="scripts/jquery-1.8.3.min.js"></script>
    <script type="text/javascript" src="scripts/jquery.mobile-
1.3.1.min.js"></script>
    <script type="text/javascript"
src="scripts/projectileCalculations.js"></script>
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
</head>
<body onload="initialize()">
    <div data-role="page">
        <div data-role="content">
            <label>Angle:</label>
            <input type="number" name="angle" id="angle" min="0" max="90"
placeholder="In degrees">
            <label>Velocity:</label>
            <input type="number" name="velocity" id="velocity" min="0"
max="299792458" placeholder="In meters/second">
            <br>
            <button onclick="update();">
                Calculate!
            </button>
            <br>
            <table id="data">
                <tr>
                    <td>Max Height:</td>
                    <td id="height">0</td>
                    <td>meters</td>
                </tr>
                <tr>
                    <td>Distance Travelled:</td>
                    <td id="distance">0</td>
                    <td>meters</td>
                </tr>
```

```
            </table>
        </div>
    </div>
</body>
</html>
```

```
// CSE-4500 Platform Computing SPR23
//      Nathan Bush - 007463099
//      Project 3 - projectileCalculations.js


function initialize()
{
    var angleInput = document.getElementById("angle");
    angleInput.addEventListener("blur", validateAngle);

    var velocityInput = document.getElementById("velocity");
    velocityInput.addEventListener("blur", validateVelocity);
}


function validateAngle()
{
    var angleInput = document.getElementById("angle");
    if (angleInput.value < 1 || angleInput.value > 90)
    {
        alert("Angle value must be between 1 and 90");
        angleInput.value = "";
    }
}


function validateVelocity()
{
    var velocityInput = document.getElementById("velocity");
    if (velocityInput.value < 1)
    {
        alert("Velocity value must be greater than 0")
        velocityInput.value = "";
    }
    else if (velocityInput.value > 299792458)
    {
        alert("Too fast! The velocity value cannot exceed[...]");
        velocityInput.value = "";
    }
```

```
}


function update()
{
    var angle = document.getElementById("angle").value;
    var velocity = document.getElementById("velocity").value;
    calculate(angle, velocity);
}


function calculate(angle, velocity)
{
    var horizontalVelocity = velocity * Math.cos((angle * Math.PI) / 180);
    var verticalVelocity = velocity * Math.sin((angle * Math.PI ) / 180);
    var tMaxHeight = verticalVelocity / 9.81;
    var tLanding = 2 * tMaxHeight;

    document.getElementById("height").innerHTML = calcHeight(verticalVelocity,
tMaxHeight).toFixed(3);
    document.getElementById("distance").innerHTML =
calcDistance(horizontalVelocity, tLanding).toFixed(3);
}


function calcDistance(horizontalVelocity, time)
{
    var distance = horizontalVelocity * time;
    return distance;
}


function calcHeight(verticalVelocity, time)
{
    var height = (verticalVelocity * time) - (0.5 * 9.81 * time * time);
    return height;
}
```

Screenshots

Browser render: Project3.html