



NORTHERN

Physics Animations Web App

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Project Goal

The team's goal is to develop a program for the EMET faculty that can be easily run by their students to demonstrate key engineering principles. The program will need to have interactive animations that easily demonstrate the concepts involved. Easy deployment on multiple types of systems would be ideal for the end application. The problems to be simulated will include projectile motion, torque, and the force exerted on a spring stretched by a mass.

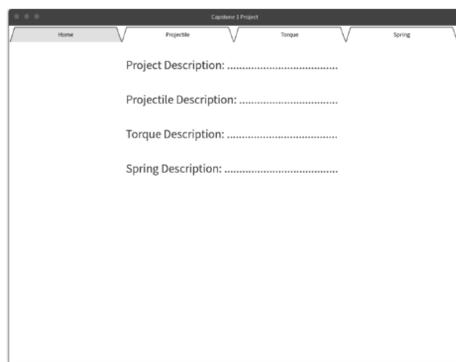
Objectives

The team will develop an application for use by the EMET faculty and their students. The application should intuitively demonstrate the concepts of projectile motion, torque, the amount a spring would stretch from a mass hanging from it. The application will also be usable on as wide a variety of systems as possible.

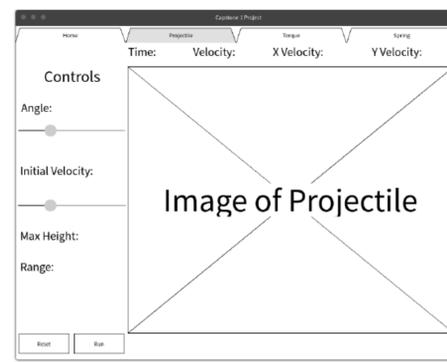
The projectile motion page will need to demonstrate a projectile's position and velocity for all times it is in flight. The torque page will need to demonstrate the magnitude of the torque vector, the applied force and the distance from the pivot point. The spring page will need to allow for different k values for the material of the spring, changing the mass of the weight attached to the spring, and show the displacement of the stretched spring.

The application will need to be interactive and allow the user to change multiple input variables for each simulation. For different inputs an animation needs to be generated that demonstrates the concept in an easy to understand manner. All animations should be to scale with their corresponding values and exact numbers should also be given as output. The application shall be made in HTML and JavaScript so that it can run in a web browser. This should allow the application to work on Windows, Mac OS X, and Linux with no compatibility issues. The program will then be fully developed by December and handed over to the EMET faculty.

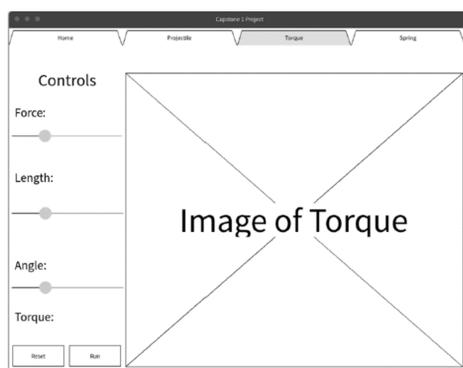
Web App Wireframes



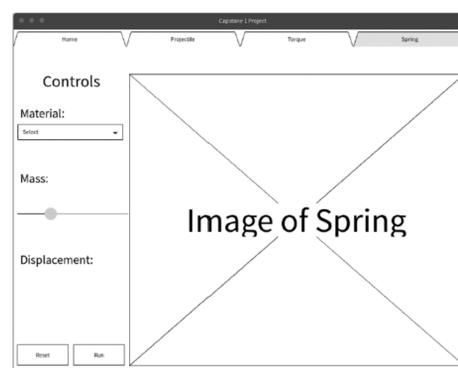
Home page wireframe



Projectile page wireframe

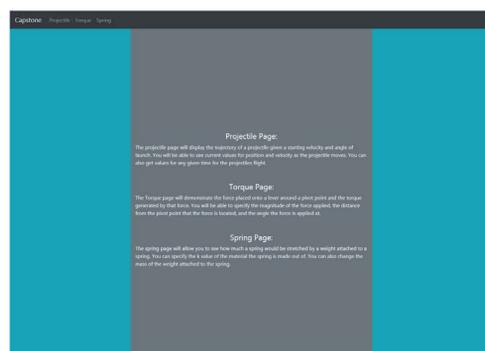


Torque page wireframe

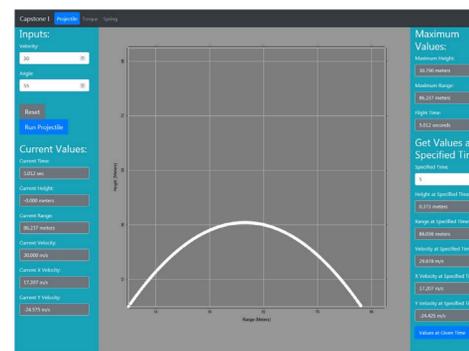


Spring page wireframe

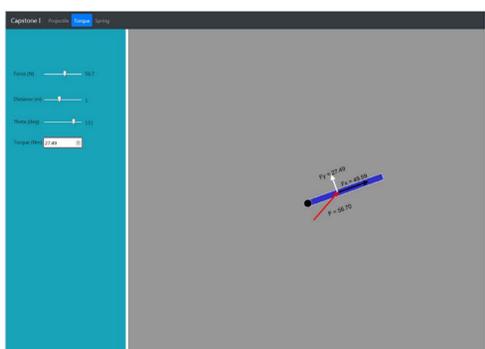
Final Web App Pages



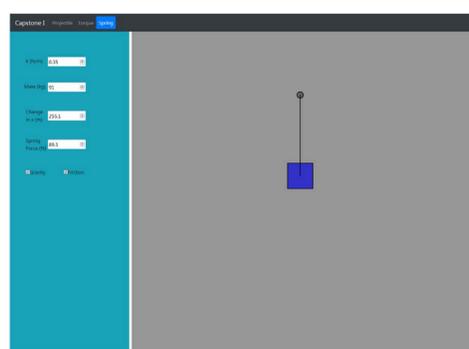
Final home page



Final projectile page



Final torque page



Final spring page

Formulas

• Projectile Motion

- Components of Velocity V_0 are $V_{x0} = V_0 \cos \theta$ and $V_{y0} = V_0 \sin \theta$
- Horizontal distance, $x = V_{x0} t$
- Horizontal velocity, $V_x = V_{x0}$
- Vertical distance, $y = V_{y0} t - \frac{1}{2} g t^2$
- Vertical velocity, $V_y = V_{y0} - g t$
- Time of flight, $t_f = \frac{2 V_0 \sin \theta}{g}$
- Maximum height reached, $H = \frac{V_0^2 \sin^2 \theta}{2g}$
- Horizontal range, $R = \frac{V_0^2 \sin 2\theta}{g}$

• Torque

Torque, $\tau = r F \sin \theta$

• Hooke's Law

$F = -kx$

Languages & Libraries

Programming Languages

JavaScript, HTML, and CSS

Libraries

P5.js and Bootstrap

Reasons for these technologies

After examining different languages and libraries the team concluded that using the p5.js library in JavaScript with HTML and Bootstrap CSS library would be the best choice for the program. This decision was reached based upon 3 criteria. The first criteria met was it should handle all calculations with a reasonable degree of accuracy. The second was it would make a user interface that is enjoyable to use and look at. Finally, the application should be usable on as wide a variety of systems as possible. By using these languages, the application should be usable on any system with a web browser.