Fluid Dynamics Simulation

Deliverable 1

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Project Ideas

Brendon	Space Probe Landing Game	Will have to control and safely land a probe onto different planets and terrains. Implementation of different gravities for each planet, fuel meter for the probe, as well as the forces acting on the probe itself
Eric	Nutrition Manager	Ability to create plans and record meals, snacks and drinks. Graphs to track daily nutritional value. Ai chatbot for questions and advice (Rasa, Dialogflow).
Hamza	Fluid Dynamics	Ability to simulate different fluids with different properties such as buoyancy, density, viscosity, etc. Menu to select different fluids, objects, and various tools for editing. Graphs to track forces acting on added objects in the scene (if we have extra time)..
Kamran	Electric Field Lines Visualizer	Ability to visualize the field lines created by one or more charged bodies. Uses vectors and the electrical field formulas in order to calculate both the density of the lines and the electrical force.
Chosen project	Fluid Simulation w/ Buoyancy Physics	

Concepts

- Will use Euclidean and Lagrangian fluid dynamics
- Will also make use of the concept of buoyancy (Archimedes' Principle on the Buoyant Force)
- Density & Mass relationships
- Fluid layering based on density

Concept Aspects

Parameters that will affect the simulation/animation

Sliders to control number of particles, and their velocity

Sliders for the weight and size of the object

ComboBox for the type of material of the object

ComboBox for type of liquid (viscosity and density)

(Concept Aspects cont.)

Problems Addressed

How do masses interact with fluids?

The simulation will allow the user to experiment with masses, fluids and buoyancy.

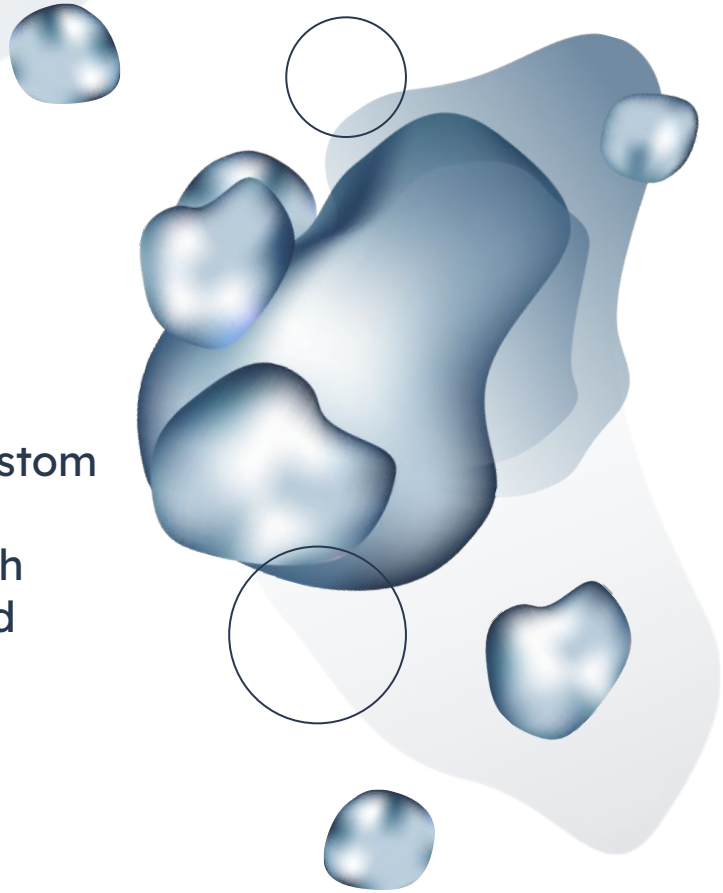
How is energy, velocity, etc. transferred from particle to particle in fluids?

The simulation will integrate the concepts of Lagrangian and Euclidean fluid dynamics.

Typical Input

The user can...

1. Select/add liquids from presets or with custom density values.
2. Drag and drop objects from presets or with adjustable masse, shape, surface area and material type.
3. Start/stop the simulation.
4. Reset the simulation.



Expected Output

- The user can, in real time, see the object that they have chosen either float or sink in the liquid of choice

- It will also allow the user the drag around the object and see how it interacts with the surrounding particles
- Adjustable viscosity allows the user visualize the fluid behaving like water, honey, or other substances.

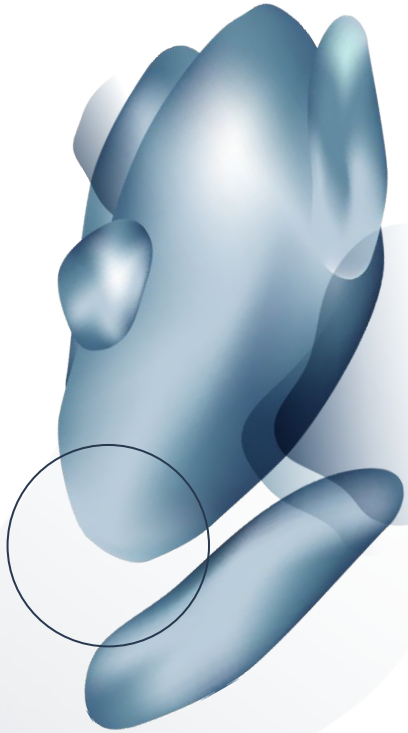
Feasibility

Primary Changes

- Wireframes and tasks (10 Feb)
- Create dynamic animation for particles (10 Feb)
- Skeleton with empty methods (17 Feb)
- Implement External Library (17 Feb)
- Begin GUI and visual elements (24 Feb)
  - (Submenus/menu bar, pop-out window)
- Implement physics and global variables (24 Feb)
  - link GUI parameters with global variables

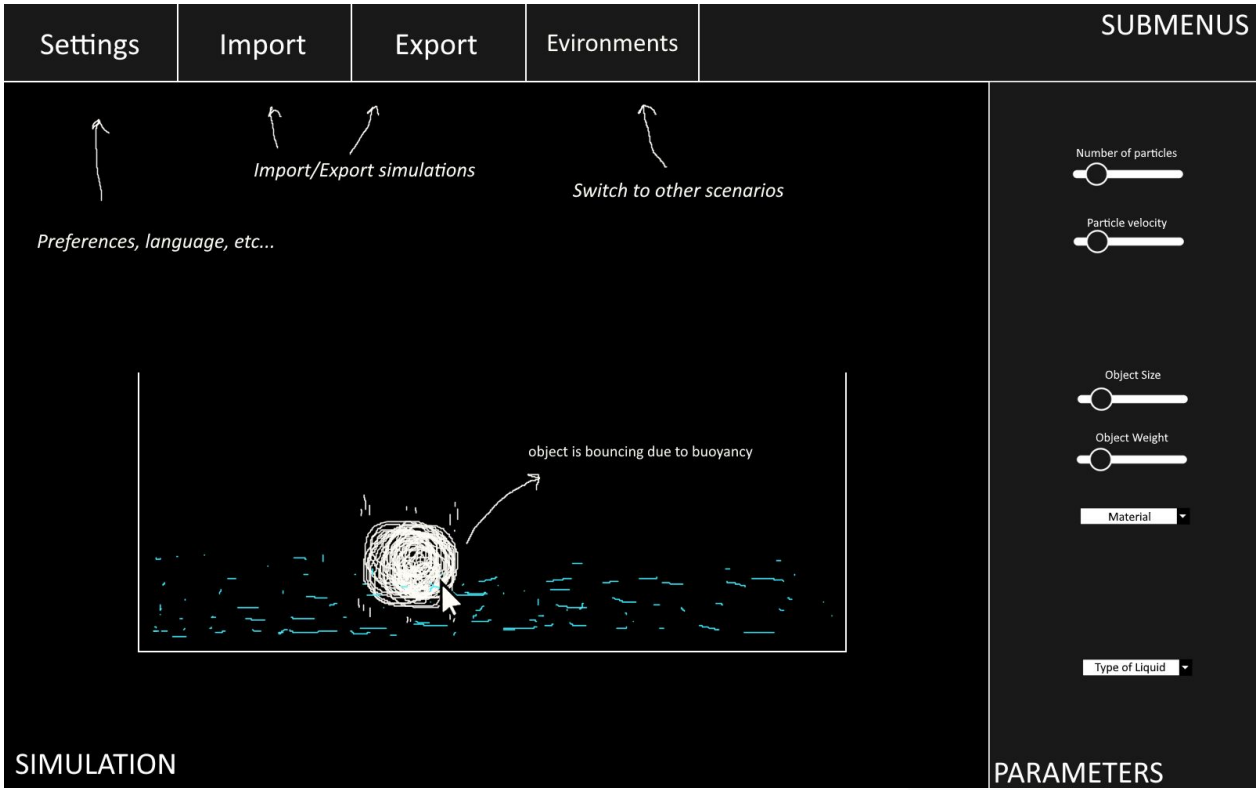
Minor Changes

- Css styling
- Security feature
- User guide



Individual Part

Brendon	UI, working on animation and effects
Eric	Integrating External libraries/data, css styling, preferences (part of settings)
Hamza	Implement particle physics for different liquids
Kamran	Implementing fluid-interactive rigid body physics and buoyancy


Settings
Import
Export
Evironments
SUBMENUS
Preferences, language, etc...
Import/Export simulations
Switch to other scenarios
object is bouncing due to buoyancy
SIMULATION
Number of particles
Particle velocity
Object Size
Object Weight
Material
Type of Liquid
PARAMETERS

Thank you!