

# Totally Legit Balkans

# Integrative Project

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Cristian-Petru Marza  
Eric Tiganasu

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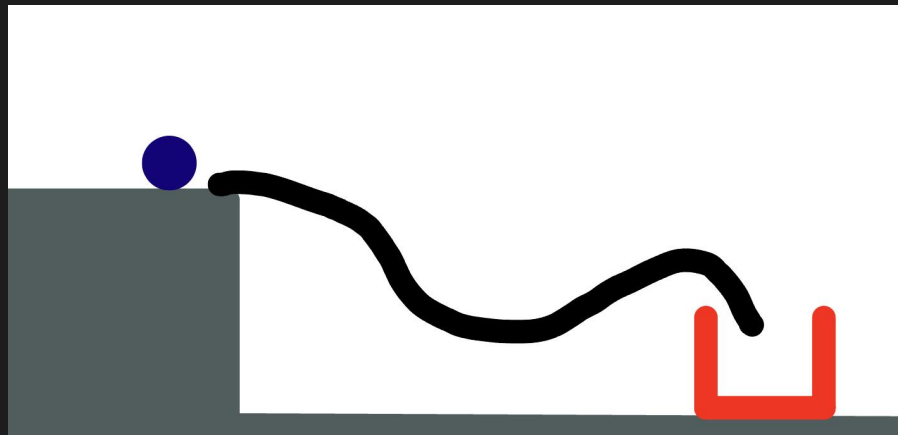
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Encyclopædia Britannica, Inc. "Balkans." Encyclopædia Britannica,  
<https://www.britannica.com/place/Balkans/In-the-Roman-Empire#/media/1/50325/110370>. Accessed 29 Jan. 2025.

# Physics Drawing

-Adriano's Idea



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- Puzzle Solving Game
- Runs on 2D Physics Engine
  - Takes into account gravity, collisions, and object interactions

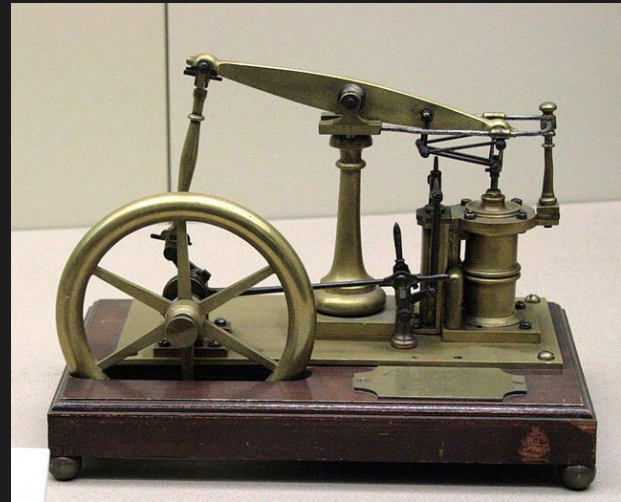
# Steam Engine

## Andrei's idea

- Simulating the mechanical movement of a steam piston engine
- Touching on the concepts of:
  - Force over time
  - Pressure vessels
  - Heat transfer
  - Mechanical engineering of the valve gear
- Inputs:
  - Changing the amount of fuel in the firebox
  - Moving the throttle and reverser

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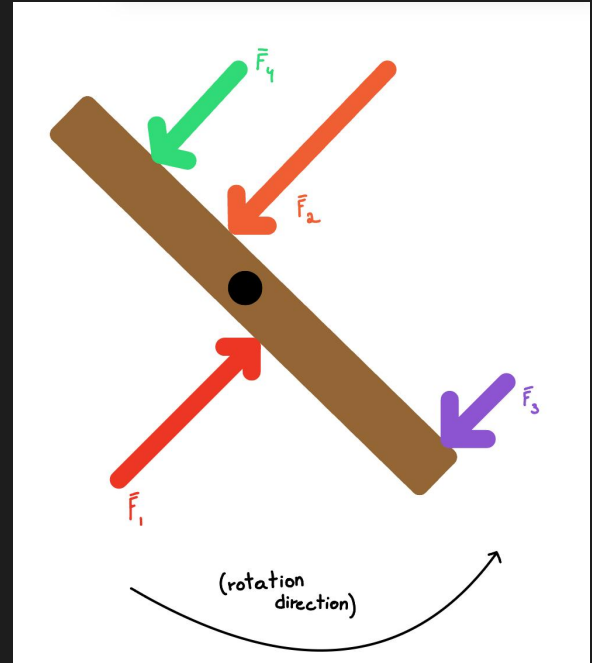


Tamorian. "Model of a beam engine." Wikimedia Commons, 12 Apr. 2007.  
<https://commons.wikimedia.org/wiki/File:JamesWattEngine.jpg>. Accessed 29 Jan. 2025.

# Torque Simulator

## -Cristian's Idea

- Program allowing the creation of a torque simulation
  - Torque
  - Rotational velocity
  - Generating energy with magnetism

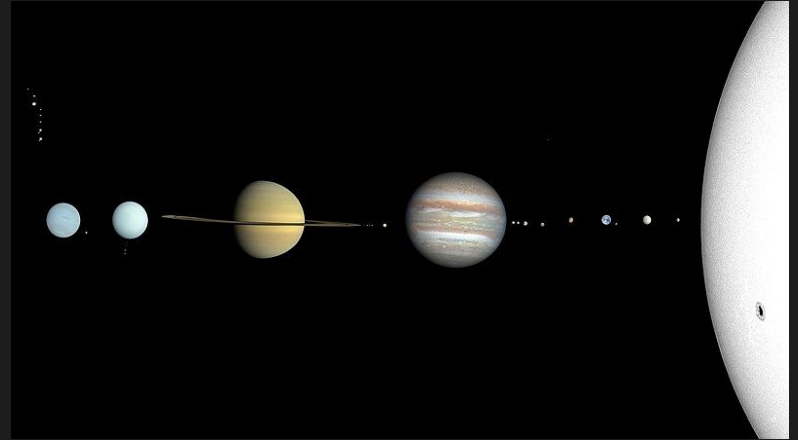


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# Space Simulator

-Eric's Idea

- Gravity (Newton's Law of Universal Gravitation)
- Planetary Motion (Kepler's Laws)



CactiStackingCrane, "OUR SOLAR SYSTEM IMAGINE." *Wikimedia Commons*, 19 Apr. 2022,  
[https://commons.wikimedia.org/wiki/File:Solar\\_System\\_true\\_color.jpg](https://commons.wikimedia.org/wiki/File:Solar_System_true_color.jpg). Accessed 29 Jan. 2025.

# Recap

Project Ideas	Description
Team Member's name and Project Idea 1:	Adriano Soldera - Physics Drawing
Team Member's name and Project Idea 2:	Andrei Popescu - Steam Engine
Team Member's name and Project Idea 3:	Cristian-Petru Marza - Torque Simulator
Team Member's name and Project Idea 4:	Eric Tiganasu - Space Simulator
Selected Project Ideas and why:	The chosen project is the Space Physics Simulator. This is because it is the most interesting idea, as the team felt that most people don't realize both the scale and the overall behavior of space, and more specifically the solar system. In comparison to other ideas, the Space Physics Simulator allows for a project with multiple physical notions and multiple user inputs while being doable in the suggested time frame.

# Advantages vs. Disadvantages

## Rejected Ideas

Physics Drawing → Time-consuming

Steam Engine → Little possibilities for user interaction

Torque Simulator → Singular physics notion

## Space Physics Simulation

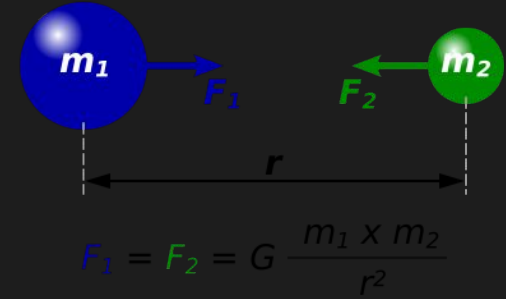
→ Feasible in allocated time

→ Lots of user interaction possibilities

→ Multiple physics and mathematical notions

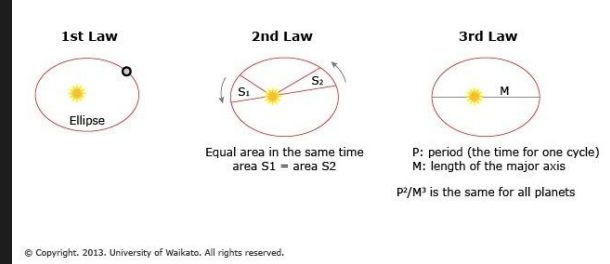
# Concept

- Newton's Law of Universal Gravitation



Dna-Dennis. "Gravitational constant equation." *Wikimedia Commons*, 24 Jan. 2008, <https://commons.wikimedia.org/wiki/File:Newton'sLawOfUniversalGravitation.svg>. Accessed 29 Jan. 2025.

- Kepler's Laws



University of Waikato. "Kepler's laws." *Science Learning Hub Pokapū Akoranga Pūtaiao*, 27 Mar. 2013, <https://www.sciencelearn.org.nz/images/277-kepler-s-laws>. Accessed 29 Jan. 2025.

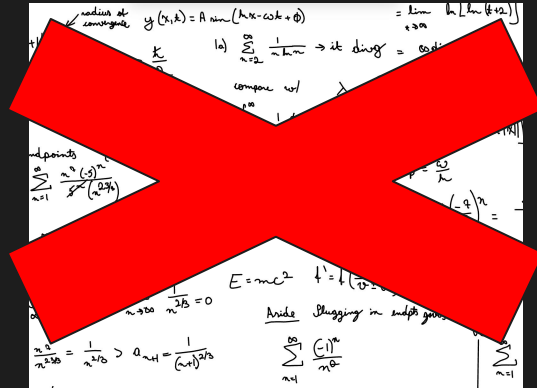
- Vector Analysis



# Concept Aspects

Problem → Perfection and scale of a solar system

Solution →



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# Variable Parameters



- Number of planets
- Style of UI
- Planet masses
- Speed of the simulation
- Velocity of a body

"Jupiter Transparent." *Nine Planets*, 2 Mar. 2020, <https://nineplanets.org/planets-transparent-background/>. Accessed 29 Jan. 2025.

# Typical Input

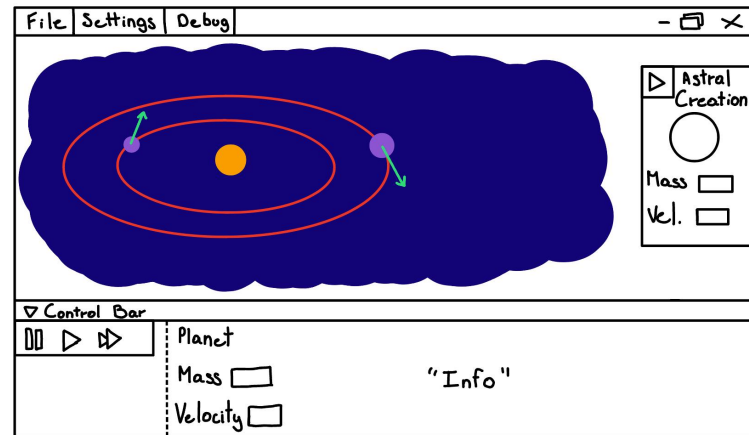
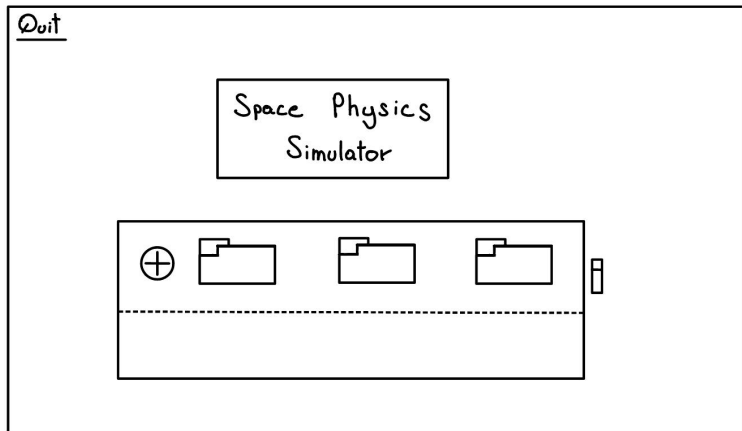
- Changing the planet system by adding and removing objects
- Changing the timescale so we can simulate decades or centuries in mere minutes
- Changing specific parameters of planets for full control, such as:
  - Mass of a body
  - Velocity of a body

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# Typical Output

- The application responds by updating the simulation accordingly:
  - The forces change in real time
  - The orbits change their visualized path accordingly
  - The style of the orbit

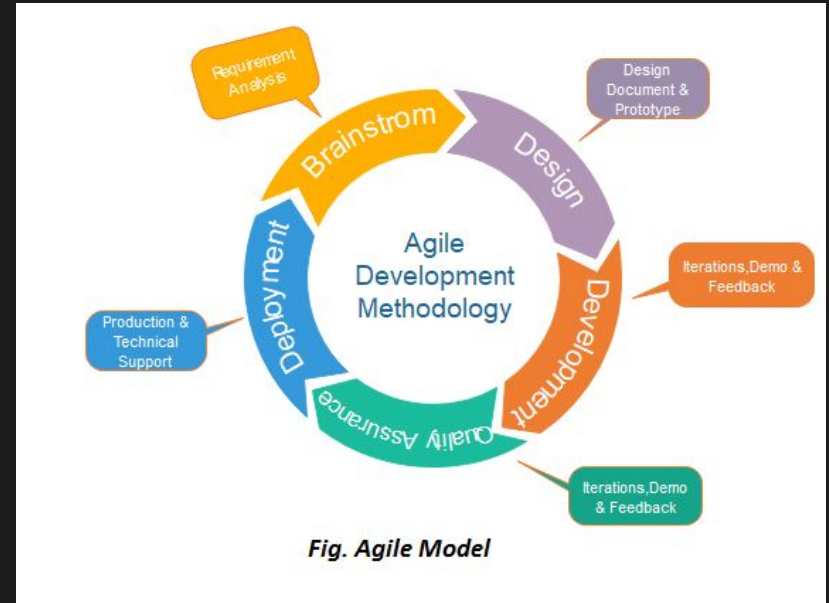
# User Interface - First-Look



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# Feasibility

- Agile methodology will be used
  - Several sprints with added-on features
- Thorough task division
  - Established timelines
  - Organization using Jira
- Communication
  - Learning from each other
  - Usage of Discord



"Fig. Agile Model." Javatpoint, <https://www.javatpoint.com/software-engineering-agile-model>. Accessed 29 Jan. 2025.

# JavaFX elements

A non-exhaustive list:

- Buttons
- Sliders
- Animations
- Interpolators
- Pane
- Canvas
- MVC
- FXML with Scene Builder
- Images
- Radio Buttons
- Text Fields
- Labels
- CSS

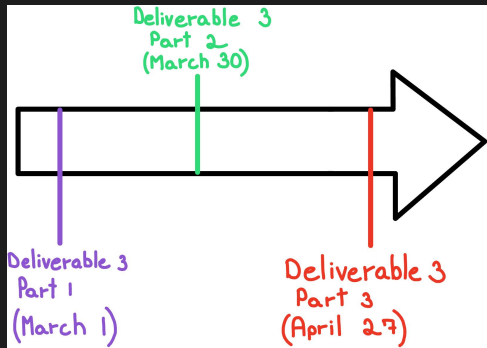
# Timeline

## Deliverable 3 Part 1

- Class and Method Skeletons
- First Implementation of User Interface
- User Interface Loading Class
- Design and Search for Basic Assets
- Basic Frame Resizing/Camera System Implementation

## Deliverable 3 Part 2

- Vector Math Class
- JSON File Handling Classes
- Implementation of Rendering System
- First Implementation of Physics Engine
- Basic Scene Selector Class
- Control/Inspector Panel



## Deliverable 3 Part 3

- Final Implementation of User Interface
- Complete Development of Physics Engine
- Implementation of File Watcher System
- Draggable Debug Components
- Documentation
- ToolTips and Help Menu
- Settings Menu

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# Cristian's Part

- User interface
  - Menu bar
  - Planet control bar
- Physics implementation
  - Kepler's Laws
  - Newton's Law of Universal Gravitation
- Camera and planet close-ups
- Settings menu and effects
- Asset management
- Saving and loading feature

# Eric's Part

- **Modification of system**
  - **Drag & Drop**
  - **Custom Planets**
    - **Set variables before initializing**
- **UI Loading Class**
- **Assets**
- **Physics**
  - **Gravitational Laws**
  - **Kepler's Laws**
- **Saving and loading using JSON**

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# Andrei's Part

- **Physics**
  - **Gravitational Laws**
  - **Kepler's Laws**
- **Rendering**
  - **Base object / Driver class**
- **Scene selector**
- **Inputs**
- **File Watcher**
- **Draggable Arrows for velocity**

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# Adriano's Part

- Various User Interface Components (Title Screen, Canvas/MainScene)
- Math and Vector Classes
- First Physics Implementation
- Various UI Features:
  - Popping out menus as separate windows
  - Hotkeys for UI management
- Settings Menu and Variables
- Documentation and Help Menus

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# Works Cited

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