

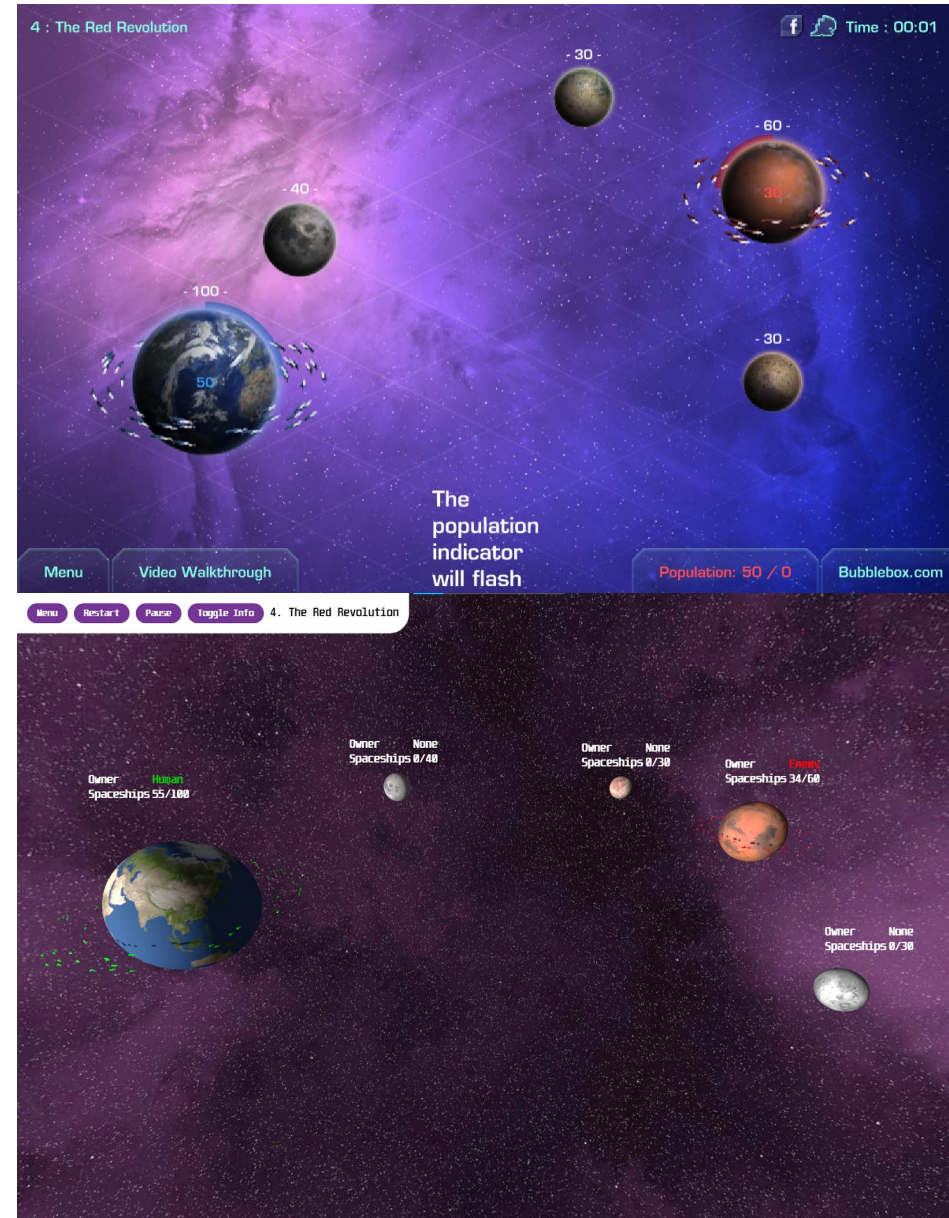
Solarmax 3D

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Introduction to Computer Graphics – 2022/2023 – Project

Introduction

- Inspired on **Solarmax (2D)**
- Space-themed strategy game
- Players have a fleet of spaceships
- Goal: colonize all planets in the level
- Created using basic Three.js



Deployment



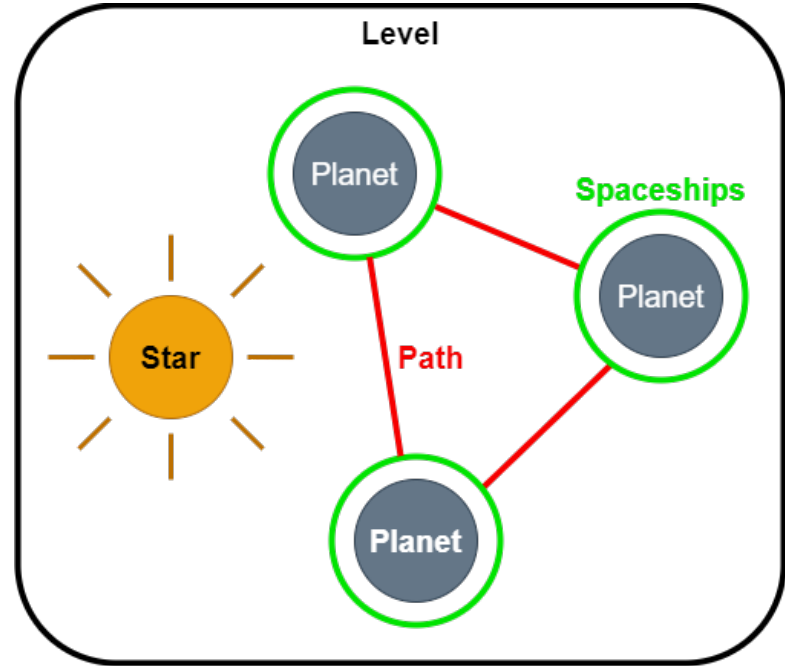
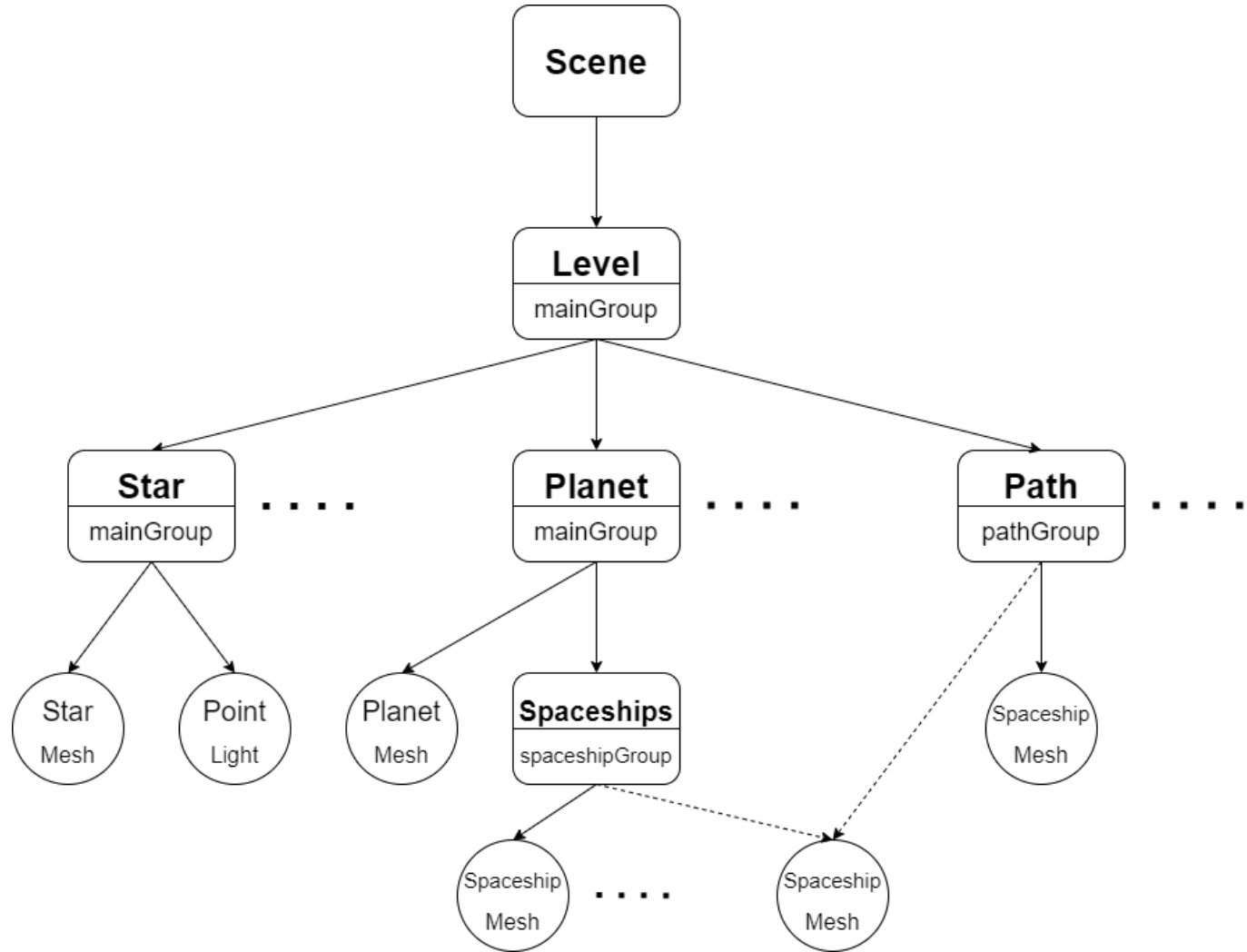
<https://joaomfonseca.github.io/icg-project/>

Models

- Planets & Stars
 - SphereGeometry
 - MeshPhongMaterial (+ custom texture)
- Spaceships
 - ConeGeometry
 - MeshPhongMaterial (+ emissive of intensity 0.2)



Scene Graph



Animation

- Planets & Stars
 - Fixed tilt (around Z)
 - Rotation on own axis (around Y)
- Spaceships
 - Fixed rotation (around X)
 - Orbit around planets / rotation of group (around Y)
- Paths
 - Spaceships points to destination planet
 - Spaceship moves towards planet
- Entities have animate function that is called on each frame

```
this.mesh.rotateZ(tilt);
```

```
this.mesh.rotation.y += this.rotationSpeed;
```

Ball#animate

```
this.geometry.rotateX(Math.PI / 2);
```

```
this.spaceshipGroup.rotation.y += this.orbitSpeed;
```

Spaceship#animate

```
this.spaceship.lookAt(this.targetBall.position);
```

```
const displacement = this.direction.clone().multiplyScalar(this.spaceship.speed);  
this.spaceship.mesh.position.add(displacement);
```

Path#animate

Illumination

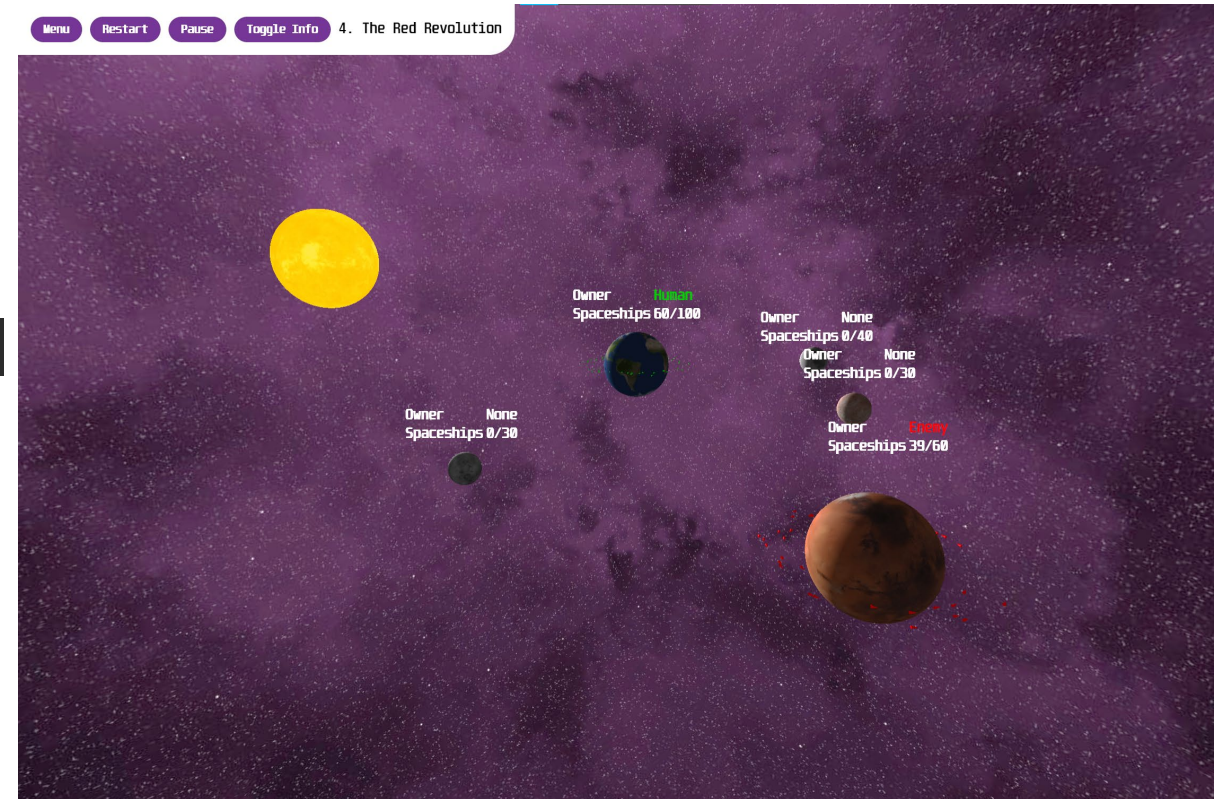
- Ambient lighting is present in the environment
 - AmbientLight
 - White light
 - Intensity of 0.1

```
const ambientLight = new THREE.AmbientLight(0xffffff, 0.1);
```

- Star emits light to the entire level
 - PointLight
 - White light
 - Intensity of 0.1
 - Distance of 10000

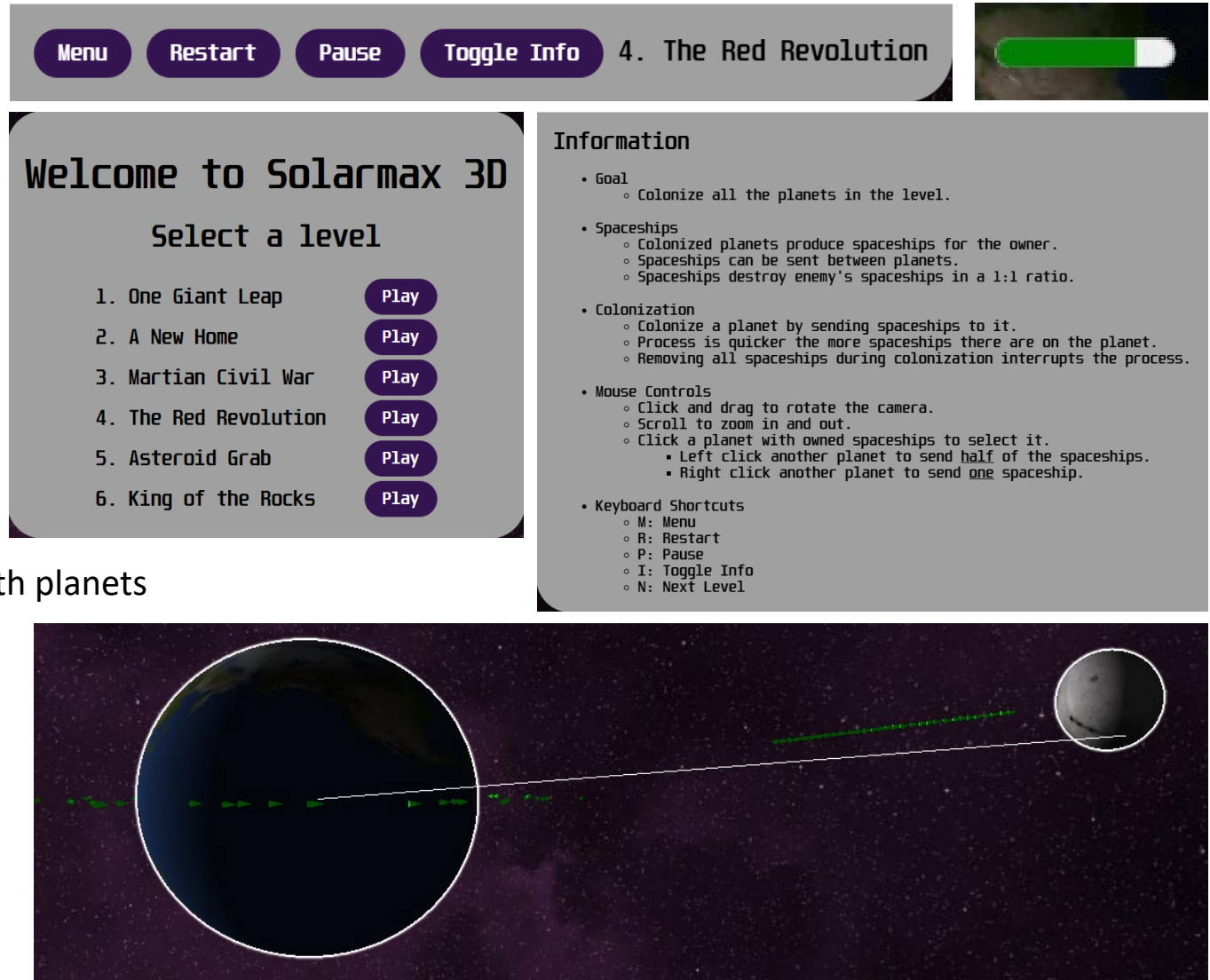
```
const light = new THREE.PointLight(0xffffff, 1, 10000);
```

- All objects receive and cast shadows between each other



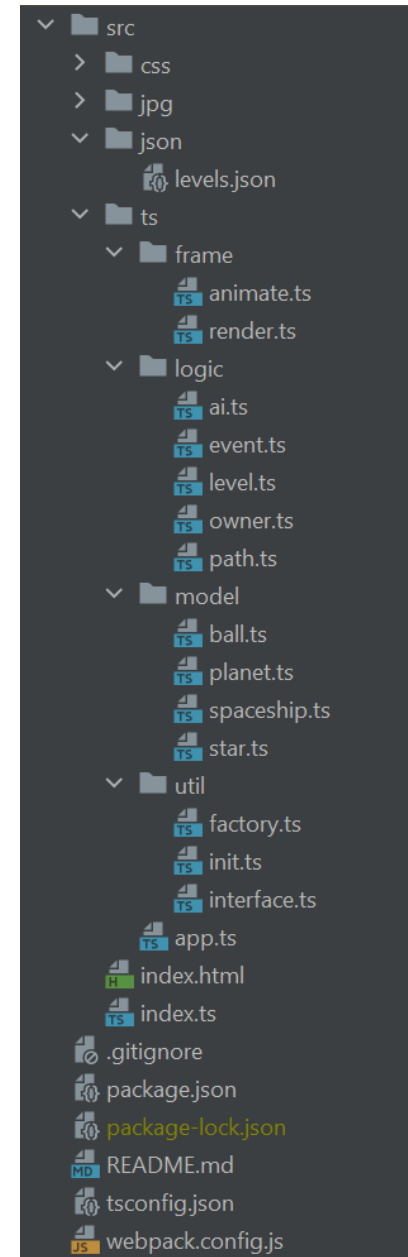
User Interaction

- UI Elements
 - Main menu
 - Navbar buttons
 - Labels above planets
 - Colonization progress
 - Information panel
- Mouse controls
 - OrbitControls: rotation, zoom
 - Raycaster & OutlinePass: interaction with planets
- Keyboard shortcuts
 - M: Menu
 - R: Restart
 - P: Pause
 - I: Toggle Info
 - N: Next Level



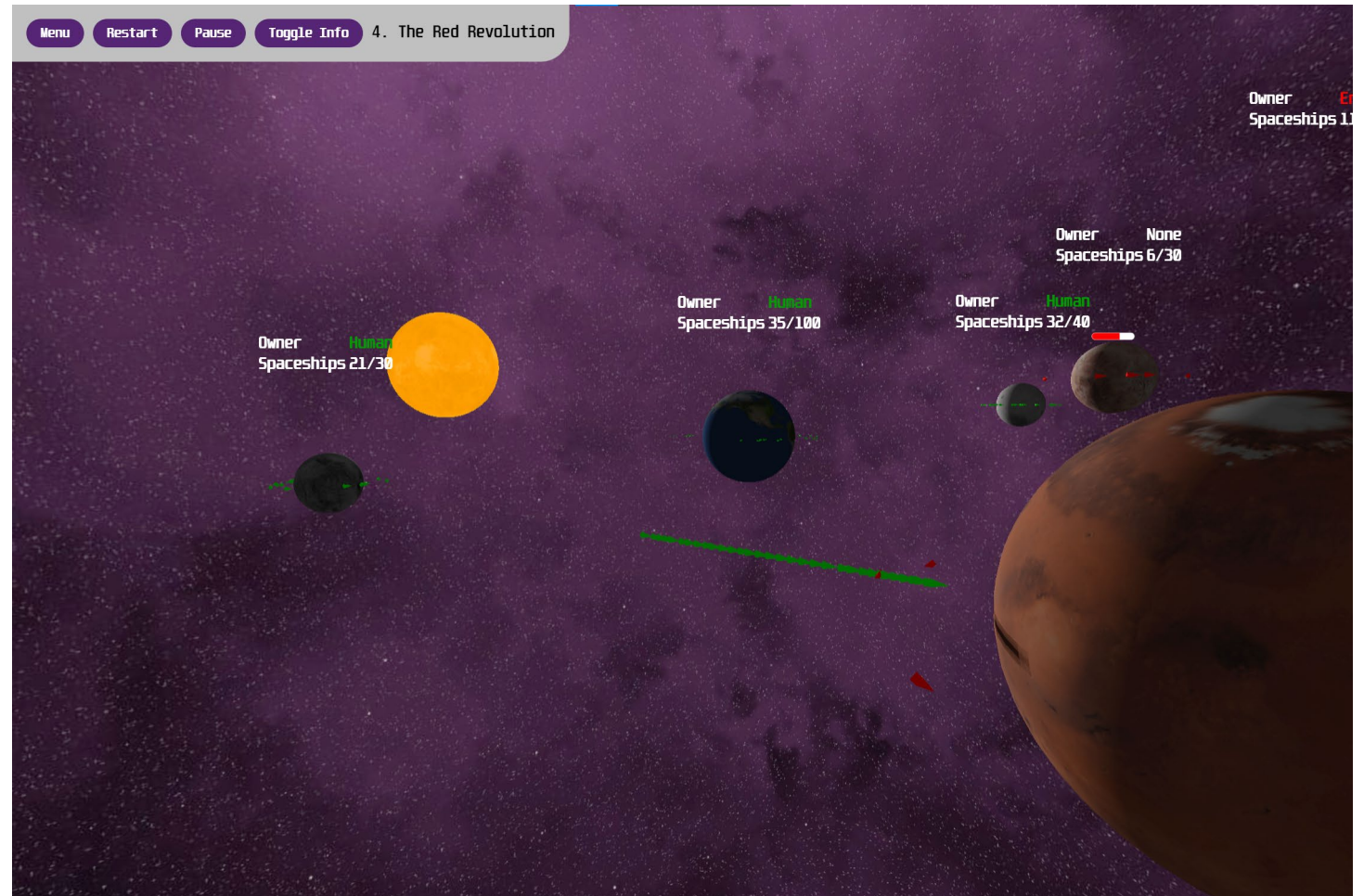
Development

- Coded in **TypeScript** (transpiled to JavaScript)
 - Strong static typing – variables, function parameters and return values
 - ECMAScript support (ES6) – modern JavaScript features
 - Can compile to any JavaScript version
- Follows some OOP practices
 - Classes
 - Design patterns - factory
- Bundled with **Webpack**
 - Optimization of the code
 - **bundle.js** ~ 499 KB
- Deployed in **GitHub Pages**
- Problems: creating UI elements (menu, navbar) using basic HTML, CSS and JS



Conclusions

- Understanding of 3D graphics
- Practical experience with Three.js
- Future applications



References

- Solarmax 2D
 - <https://kbhgames.com/game/solarmax>
- Examples from ICG practical exercises
 - <https://elearning.ua.pt/>
- Three.js Documentation
 - <https://threejs.org/docs/>
- Solar System Textures
 - <https://solarsystemscope.com/textures/>
- Tutorial: Hosting a Webpack Project with GH-Pages
 - <https://learnhowtoprogram.com/intermediate-javascript/team-week/hosting-a-webpack-project-with-gh-pages>
- Project repository on GitHub
 - <https://github.com/joaomfonseca/icg-project>
- Deployment on GitHub Pages
 - <https://joaomfonseca.github.io/icg-project/>