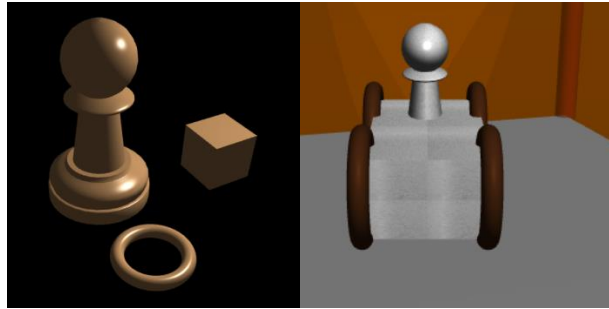


AVT – Technical Report (Group 6)

Camila Bacelar Bertelli
Susanne Wulz
Teresa Ferreira Nunes Galvão Correia

Our project simulates a mars rover mission scenario using C++ and OpenGL. Below we explore all the components and features we implemented.

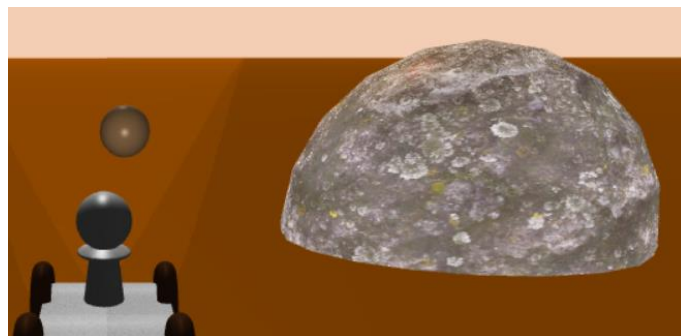
Graphic Modelling: Rover



Rover movement:

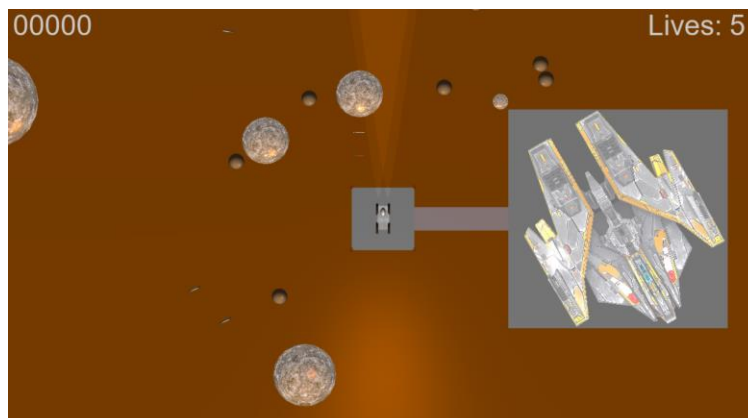
Q (rover moves forward); **A** (rover moves backwards); **O** (rover turns left); **P** (rover turns right)

Graphic Modelling: Rolling Rocks, Static Rocks

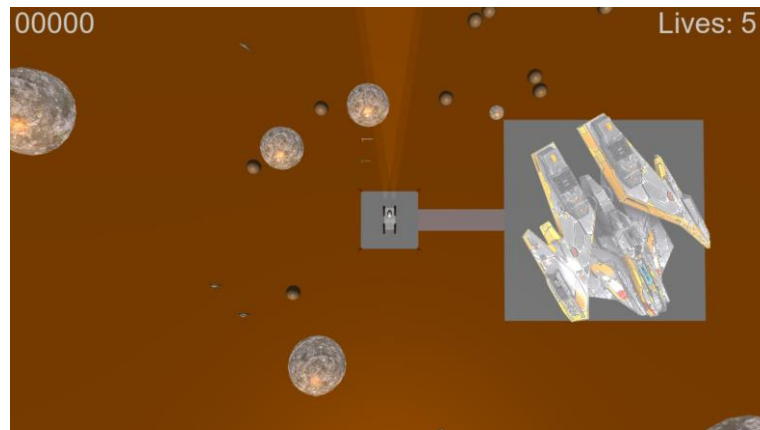


Cameras

- Ortogonal Camera Projection:



- Perspective Camera Projection



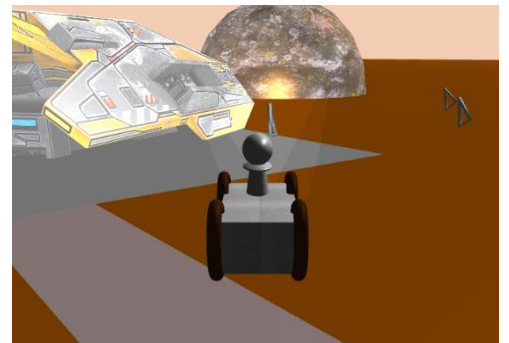
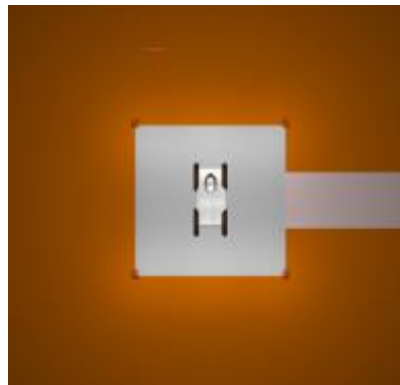
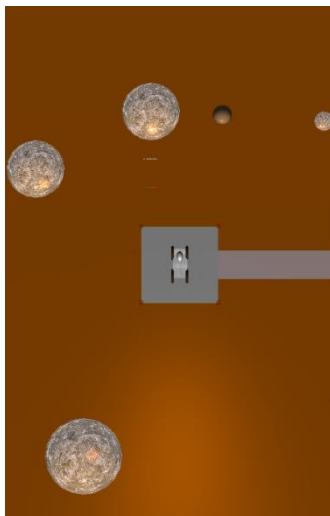
- Following rover camera



Lights: Directional Light, Point Lights, Spotlights

Six pointlights around the rover's landing site (can be activated with the 'C' key):

Spotlights as headlights of the rover (can be turned of with the 'H' key):



Collision Detection

We check for every object on the screen (except billboards) if it collides with the rover, checking if the rolling rocks collide with something as well. In the second case the rocks disappear, being created again in a random location around the rover. The collision was detected using AABB.

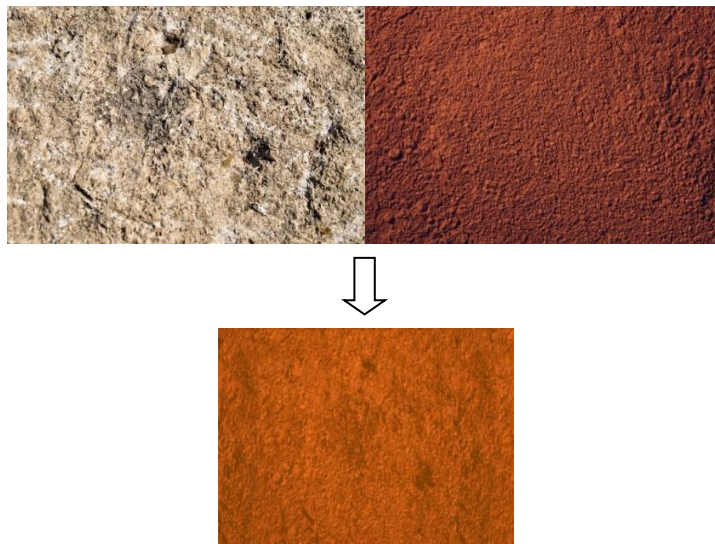
Texture Mapping

- One Texture



- Multitexturing

Possible to activate it the 'T' key and it is applied to the mars terrain.



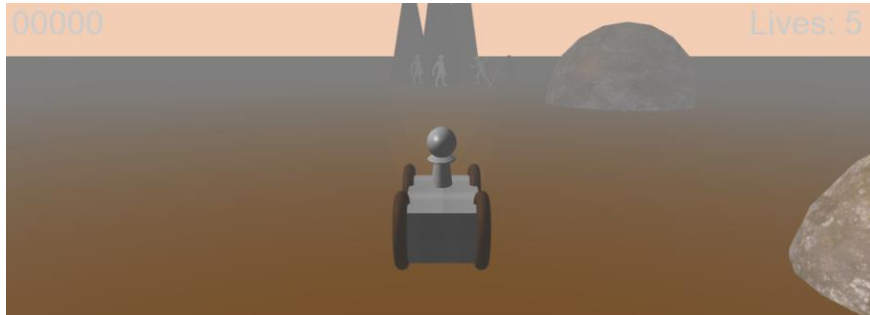
Transparency

We applied the technique to the pillars of the rover's landing site, being possible to view every opaque object through them.



Fog Effect

It's possible to activate it with the 'F' key and it is calculated in the fragment shader with the exponential function: $f = e^{(-density \cdot z)}$, where z is the distance between the object and the camera and the density a previously set constant.

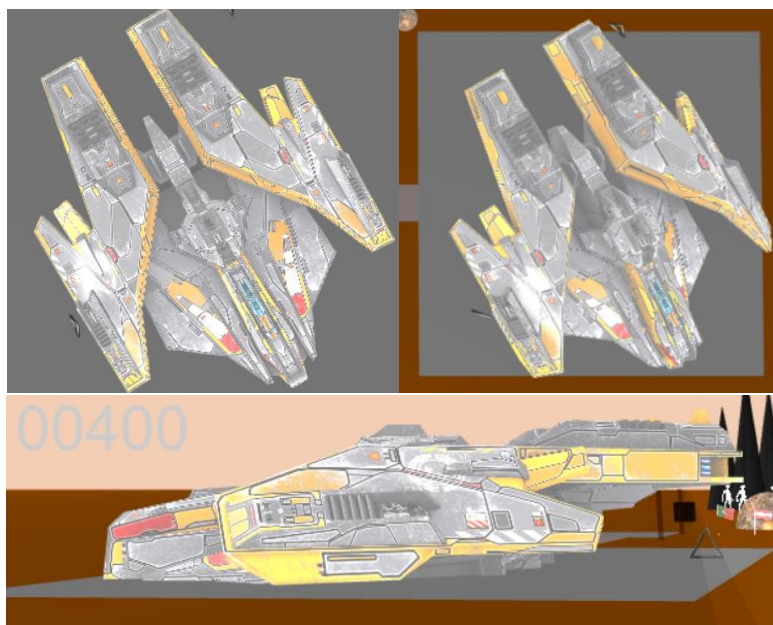


HUD (Lives / Point System) + Pause / Game Over Screens

We decided to implement a point system, where for each 1000 points (5 items) you collect, if you have less than 5 lives, you gain one back!

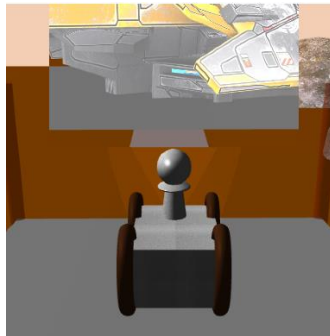
By pressing the 'R' key you can restart the game and to pause it press 'S'.

Assimp Objects



Rear-view Camera

Activated with the key 'Y', it creates a window with a rear-view camera of the rover.



Billboards: Aliens, Flags



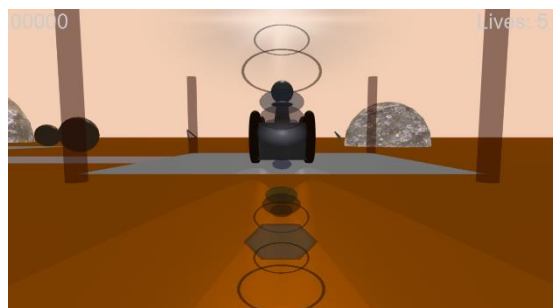
Particle System

We created the particle system to be associated with the acceleration of the rover on the martian terrain. While the rover's velocity is lower than 3 (absolute value) we create a new set of particles below the wheels.



Flare Effect

We used the directional light (positioned in the positive x-axis) to render the flare. When looking at it with the flare active (press 'L' key):



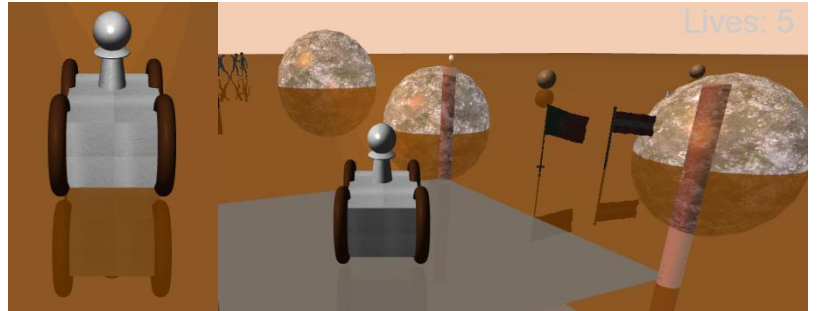
Planar Shadows

For the planar shadows we used the stencil mechanism and the directional light. This effect can be activated by pressing the key 'w'.

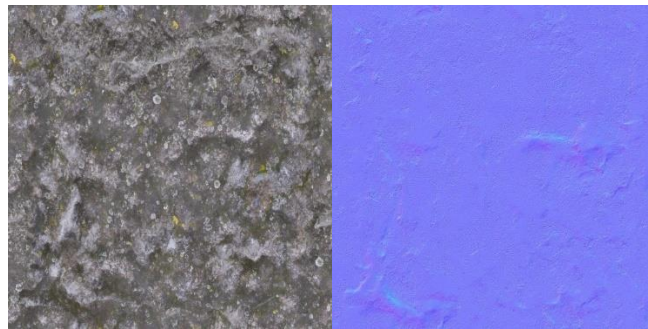


Planar Reflections

For the planar reflection we also used the stencil mechanism. This effect can be activated by pressing the key 'm'.



Bump-Mapping



Base Rock Texture & Normal/Bump Map (which will replace the calculated normals in the shader). Below, the first with only the base texture, the second with the previously calculated normals from the normal map. It can be activated with the 'B' key.

