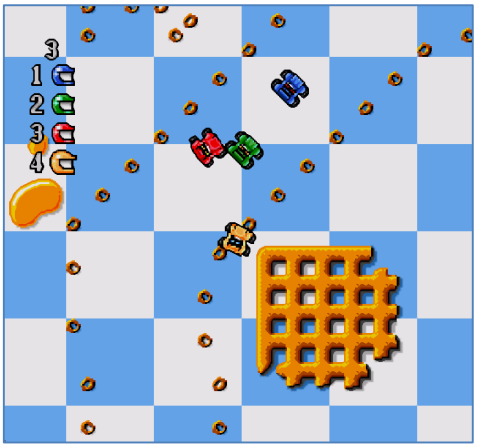
TÉCNICO LISBOA

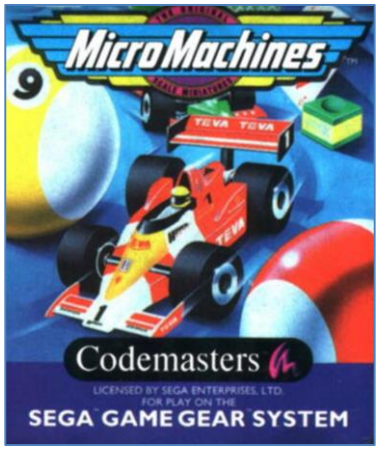
AVT 2018/19

Exercise 3

Introduction

The Micro Machines game was the first of a series based on the known toy cars sets with the same name. This game was originally released in 1991 and several versions were launched for a wide range of platforms till 2006. The player controls a car to play in unconventional environments such as a kitchen or garden. The car has to go through a track avoiding different types of obstacles. To hit or climb over obstacles the car slows down or becomes more difficult to control. You can watch about seven minutes of gameplay[1] in the channel NESguide of Youtube.





Recently several versions of the game have appeared, including some re-implementations with the original graphics, illustrated in the previous figure, with the cover of the game. Some of these versions can be played online[2].

[1] https://www.youtube.com/watch?v=BMpZznee74I
[2] http://www.classicgamesarcade.com/game/21618/micro-machines-driving-racing-game.html

Work to do

The main goal of AVT laboratory work this year is to recreate this classic in a 3D version, by using **C++** and **OpenGL version 3.3+**, in a first phase (2 assignments) and **WebGL** with **Google Cardboard** VR *headset*, in a second phase (1 assignment). The idea is to maintain the original gameplay but changing the graphic perspective for a 3D appearance. You can see an example for inspiration in the figure below.

The laboratory work corresponding to the Micro Machines 3D is divided into nine lab classes: 6 exercises and 3 assignments. Each assignment will be evaluated during the semester according to a calendar provided in the Presentation class and corresponds to a certain percentage of the final grade. In each of these assessments there are specific objectives and tasks so they can explore the various components of the AVT program.

The rest of this document refers to the developing tasks for Exercise 3.

Objectives

The objectives for the lab work at 10th October are to understand and implement the architecture of an interactive graphical application and explore the basics of modeling.

Tasks

The tasks for this assignment are:

1. Model the table as well as the road and their margins by using a cube for each element. Model the car, orange and small packets of butter, by using simple three-dimensional geometric objects (cubes, cylinders, cones, spheres and torus). The car should be composed of more than a geometrical object, a minimum of five objects. It is suggested to represent the car's wheels and cheerios with torus. For now, you can use the **basic_geometry.cpp** library that was released in Exercise 2 referring to the demo Phong Lighting. Later, groups can improve the graphic quality of the models by using modeling tools and the respective loaders for Modern OpenGL.

2. Set three virtual cameras: a fixed camera to provide a top view of the scene by using an orthogonal projection (similar to a 2D view of the original game), another fixed but perspective camera to provide also a top view, and a third moving perspective camera, which must be placed behind the car and follow your movement (the car should be visible). It must be possible to switch between the three cameras by using the keyboard keys “1”, “2” e “3”.

3. To orient the moving camera with the mouse movement and simultaneously pressing its left key.

4. To control the movement of the car with the keyboard using the 'O' key to move the vehicle to the left, 'P' to move to the right, 'Q' to move forward and 'A' to move backward. The car should not reach full speed immediately after pressing the key or stop immediately when the key is released. The car should have a uniformly accelerated movement, considering as scalar the velocity and acceleration: the direction of movement is defined by a 3D vector.

5. To start implementing (partially) the movement of the oranges. This should be a uniform rectilinear movement, but these elements should rotate as they are moving. Different oranges should move with different speeds and their speed increase with the playing time, ie as the user is playing longer, faster oranges move. After leaving the field of play (table) oranges should disappear and reappear **randomly** after a while elsewhere in the table.