ML-Racing

Conor Dempsey

Project Engineering Year 4

Bachelor of Engineering (Honours) in Software and Electronic Engineering

Galway-Mayo Institute of Technology

2021/2022

Overview

- ML Racing is a racing game designed in the Unity Game engine that incorporates machine learning to create an AI through ML-Agents that will race competitively against the player.
- The game uses C# scripts to create a car controller that can be used by both the player and the AI to drive the car around a track. The controller uses real life physics like acceleration, braking and torque in order to give the player an immersive driving experience
- Using the ML-Agents package and python API an ‘agent’ can be trained to learn how to manoeuvre around any track without any specific track knowledge or user input.
- The car model was acquired on the Unity asset store and was designed in blender. The track model was designed using EasyRoads, an extension for Unity that allows the programmer to create custom tracks.

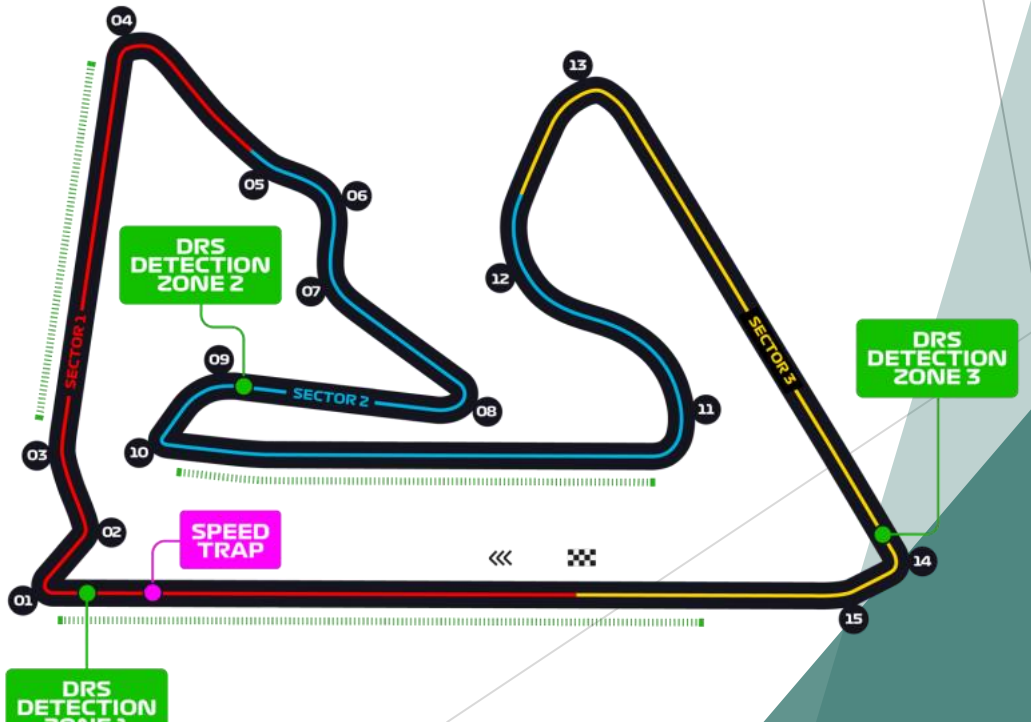
Racing

- One of the essential parts of my project is the aforementioned car controller, this is a C# script that drives and turns the car. The unity library comes with predefined functions for things like torque, breaking force and acceleration.

- By adding a function to receive player inputs the game uses these inputs and the functions mentioned above to create a close simulation to how a real life car drives.
- Wheel colliders allow the car to have a reference to where the wheels are and this also allows us to add an animation for turning the wheels.
- A checkpoint system keeps track of wether the player is correctly navigating the track.

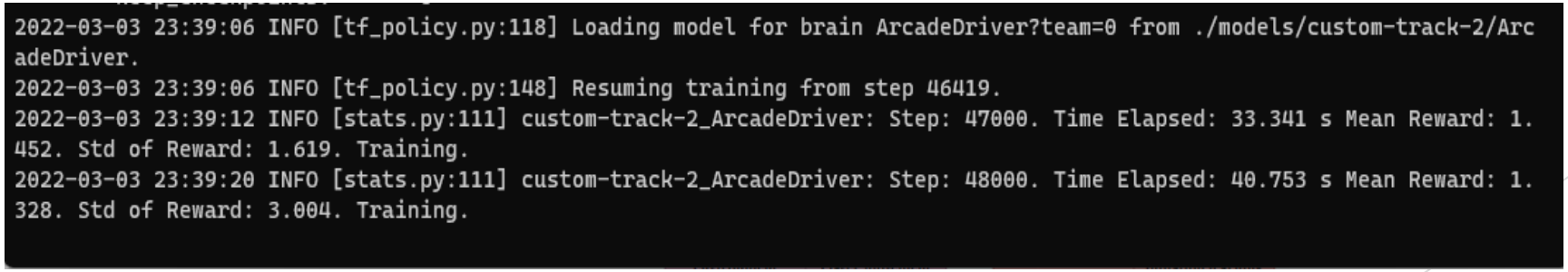
Game Design

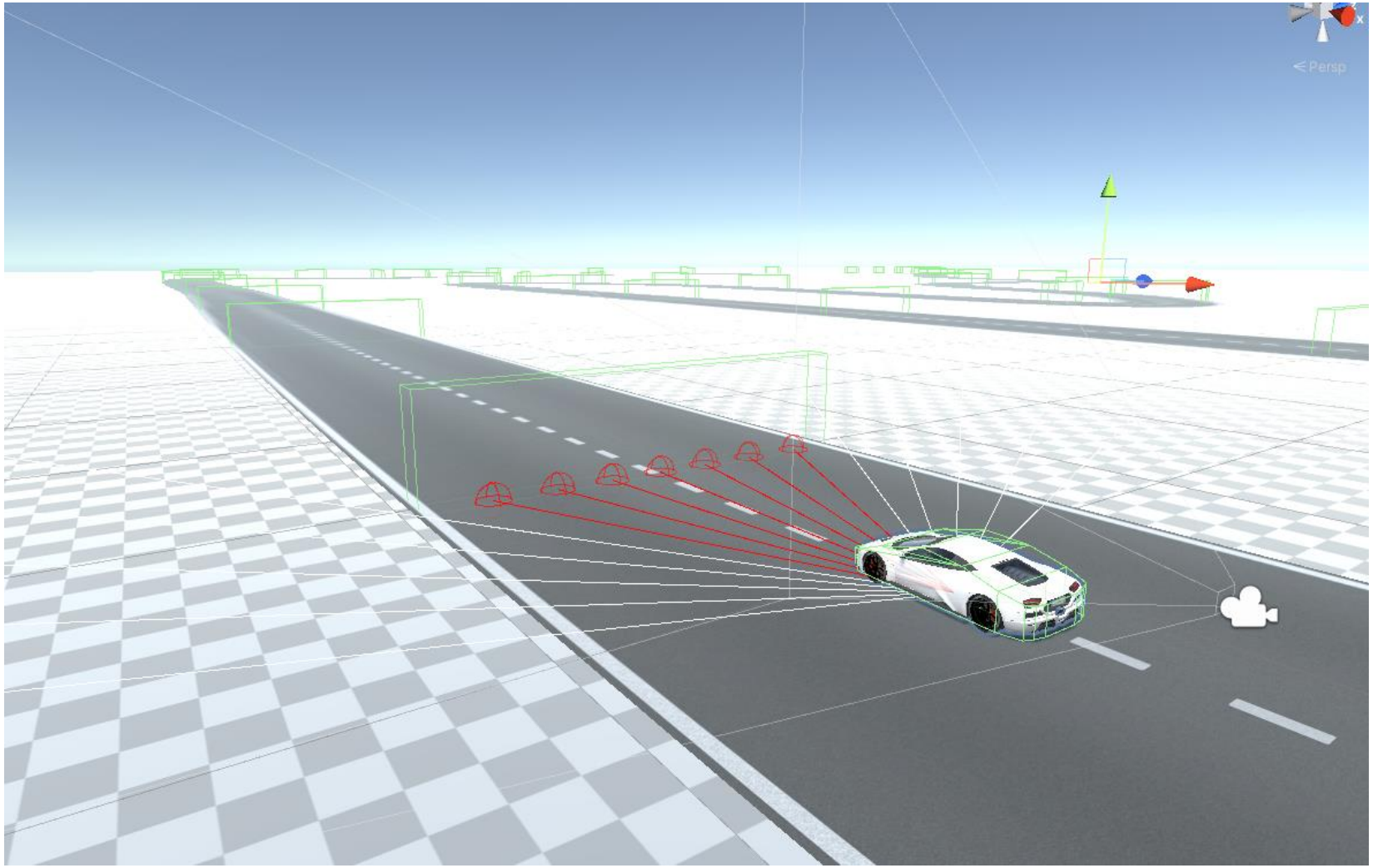
- As part of my game I had to research game design and how to create models for the car and track.
- After spending some time using Blender I decided against creating my own models due to time constraints and choose to clone a car model from the unity asset store and to use an extension in unity to design the track. The track is loosely based on the Bahrain Grand Prix Circuit. Once complete I added the checkpoints using 3D cubes.



ML-Agents

- ML-Agents is a software that allows programmers to create intelligent agents that can be fully trained to complete almost any task within a game.
- The car controller mentioned previously is also used in training and driving the Agents. By using a function to set the inputs for driving and turning the car the ML-Agents software can take these controls and use reinforcement learning to train itself.
- The checkpoint system in this game is also a vital part of the training process, by casting raycasts from the car the Agent can detect the checkpoints as it drives around the track gaining rewards for each correct checkpoint and losing points for each missed checkpoint.




Persp