KartGame Template

Reference Documentation

This document serves as an introduction and overview to the different systems included in the kart game template.

Throughout the kart game template there are references to interfaces rather than objects. This is achieved using an attribute called RequireInterface which is implemented in the project. This can be applied to UnityEngine.Object serialized fields and then rejects any objects which do not implement the interface.

The kart itself is separated into several systems. The following is a summary of each.

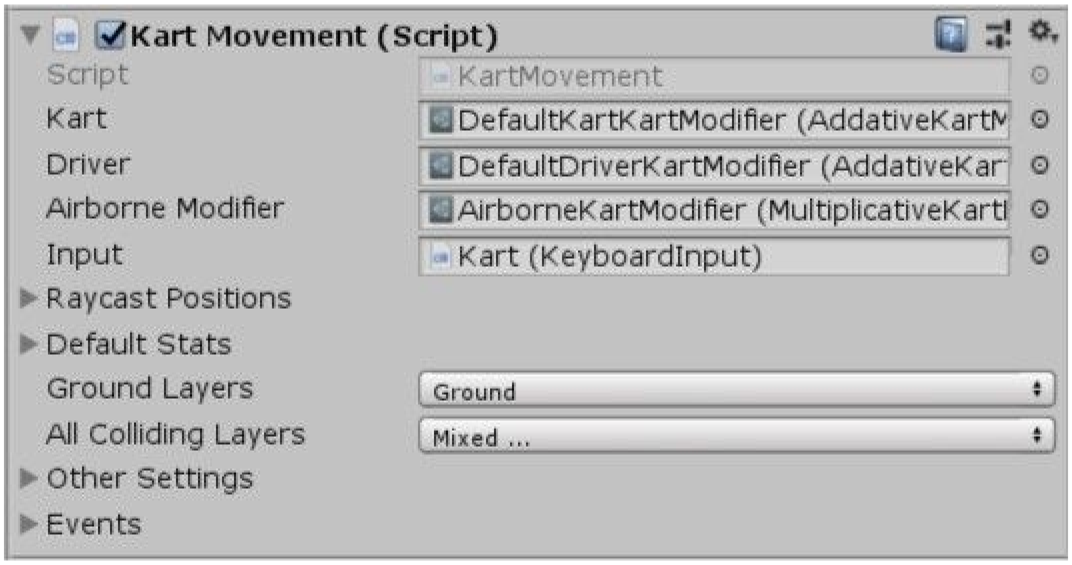
Kart Systems

Input

Input is represented by any object implementing the IInput interface. The examples given in the template are MonoBehaviours which allow for gamepad and keyboard user input with both examples present on the kart prefab. The keyboard input is enabled and referenced by the other scripts by default. Although the only example implementations for IInput are user inputs, it could also be implemented by an AI system for other karts.

Movement

Movement is represented by a MonoBehaviour called KartMovement. It takes information from its IInput reference and its own physics implementation to allow the kart to move. These are combined with the kart's stats to define how the kart moves. The kart prefab has a set of default stats, these should function as a default across all karts and should only be tweaked to affect all karts. The stats for an individual kart can be modified using implementations of the IKartModifier interface. Each kart has a collection of objects implementing the IKartModifier interface to modify its default stats to get the stats it uses for velocity calculations. These are deliberately agnostic of concrete implementations so that they can be used for things such as the kart driver, the kart type, powerups, etc. The kart uses a kinematic rigidbody and its own physics implementation and so needs to know what to collide with. It has layer masks to define what it should treat as the ground and all the layers it can collide with. The latter should include the ground layer.

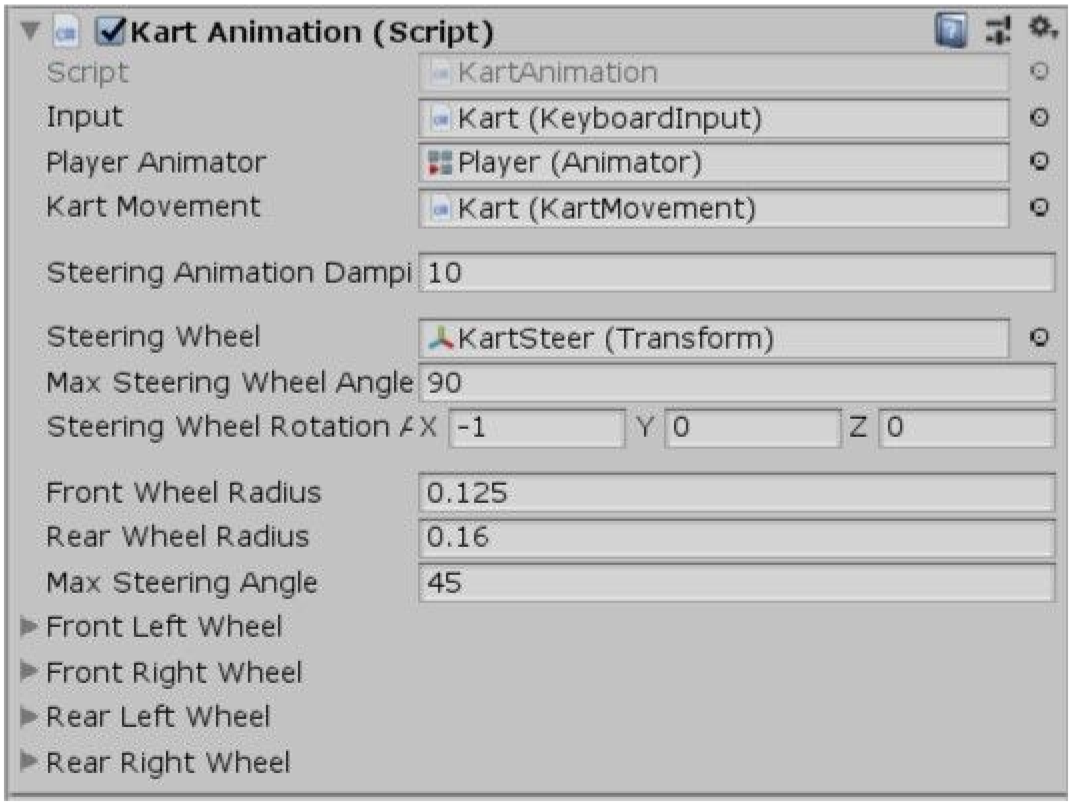


Kart Movement (Script)

Script	KartMovement
Kart	DefaultKartKartModifier (AddativeKartM
Driver	DefaultDriverKartModifier (AddativeKar
Airborne Modifier	AirborneKartModifier (MultiplicativeKartI
Input	Kart (KeyboardInput)
Raycast Positions	
Default Stats	
Ground Layers	Ground
All Colliding Layers	Mixed ...
Other Settings	
Events	

Animation

The kart has three sources of animation: the kart model is animated, the driver/player is animated and the kart wheels and steering wheel are procedurally animated. The KartAnimation MonoBehaviour manages these different animations.

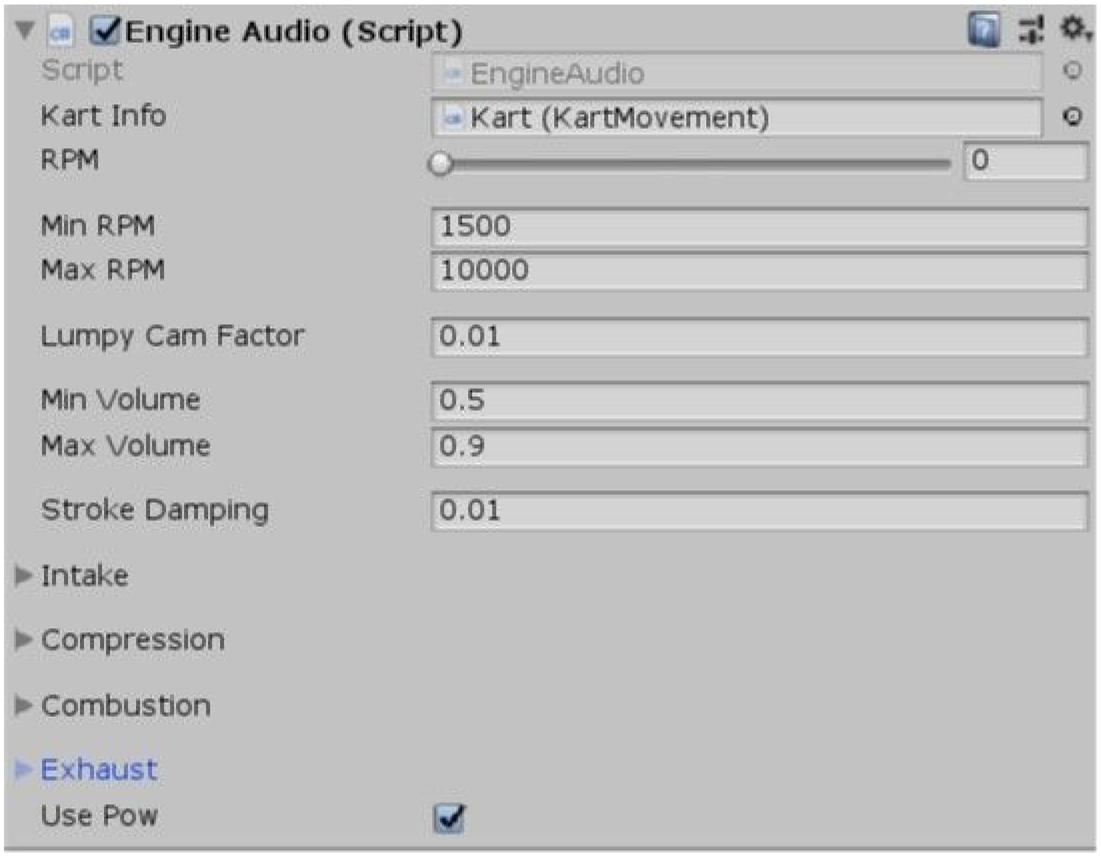


Kart Animation (Script)

Script	KartAnimation
Input	Kart (KeyboardInput)
Player Animator	Player (Animator)
Kart Movement	Kart (KartMovement)
Steering Animation Dampi	10
Steering Wheel	KartSteer (Transform)
Max Steering Wheel Angle	90
Steering Wheel Rotation A	X -1 Y 0 Z 0
Front Wheel Radius	0.125
Rear Wheel Radius	0.16
Max Steering Angle	45
Front Left Wheel	
Front Right Wheel	
Rear Left Wheel	
Rear Right Wheel	

Audio

The kart plays various audio clips, the audio sources for which are together under the Audio child gameobject of the kart prefab. Also included there is the EngineAudio MonoBehaviour, which adjusts the sound of the kart's engine procedurally.



Engine Audio (Script)

Script	EngineAudio
Kart Info	Kart (KartMovement)
RPM	0
Min RPM	1500
Max RPM	10000
Lumpy Cam Factor	0.01
Min Volume	0.5
Max Volume	0.9
Stroke Damping	0.01
▶ Intake	
▶ Compression	
▶ Combustion	
▶ Exhaust	
Use Pow	✓

Timing

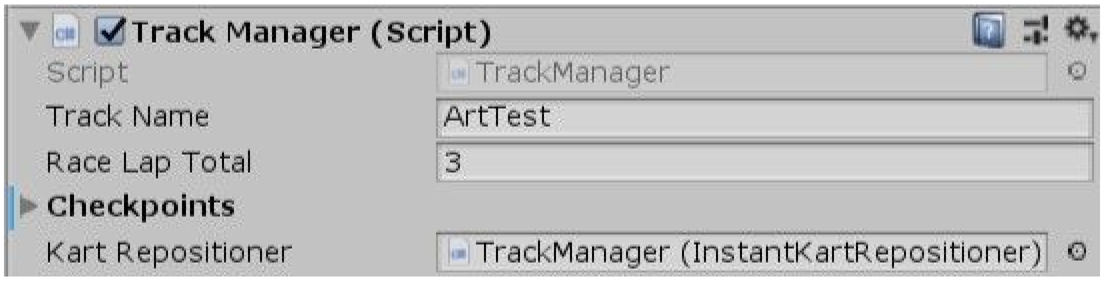
The timing for a track is handled by a separate prefab called TrackManager and the TrackManager MonoBehaviour. It records timing information for all objects in the scene implementing the IRacer interface. The Racer MonoBehaviour is the default implementation of this and exists on the kart prefab.

The other important collection of systems in the kart game template is the track. This works as follows:

Track Systems

Manager

All the systems of the track flow through the central point of the TrackManager. It is responsible for dealing with the timings and positions of each of the racers. It uses Checkpoints and implementations of the IRacer interface to achieve this. The TrackManager is also responsible for starting and stopping the race. There are public methods called StartRace and StopRace to do this. These will enable and disable control of all the racers.

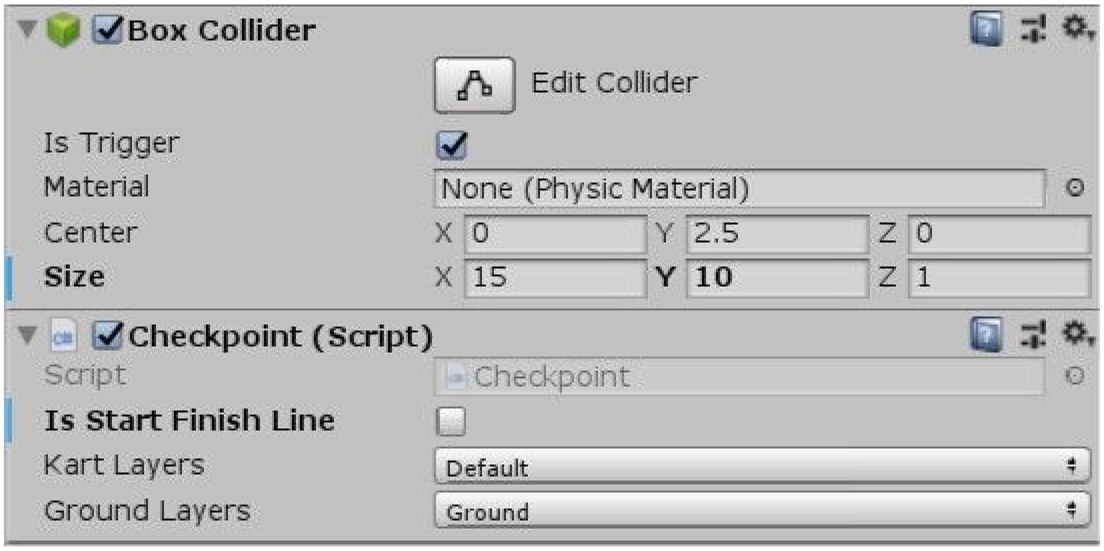


Track Manager (Script)

Script	TrackManager
Track Name	ArtTest
Race Lap Total	3
Checkpoints	
Kart Repositioner	TrackManager (InstantKartRepositioner)

Checkpoints

A Checkpoint represents a part of the track that each racer must pass through in order to complete a lap. It works using a BoxCollider as a trigger and reporting when objects implementing the IRacer interface pass through it. When karts become stuck, fall off the track or are out of bounds they can be repositioned. The last checkpoint a racer goes through is the place they will be repositioned. One checkpoint must be the start-finish line of the track. It is recommended that a track has a minimum of 3 checkpoints roughly equidistant around the track. This will ensure that driving half way around the track and driving back does not complete a lap.



Box Collider
Edit Collider
Is Trigger ✓
Material: None (Physic Material)
Center: X 0 Y 2.5 Z 0
Size: X 15 Y 10 Z 1

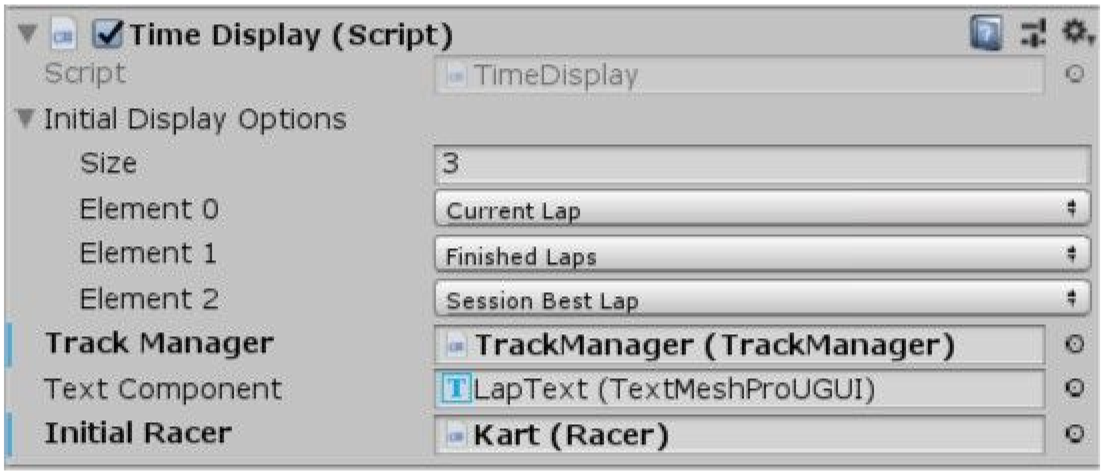
Checkpoint (Script)
Script: Checkpoint
Is Start Finish Line ☐
Kart Layers: Default
Ground Layers: Ground

Repositioning

The TrackManager prefab has two scripts in addition to the TrackManager MonoBehaviour: InstantKartRepositioner and KartRepositionTrigger. The latter is an example implementation of how to trigger a kart to be repositioned. Games made using this template will need to implement triggers which are specific to their needs such as detecting when a kart is out of bounds. InstantKartRepositioner is an example implementation of how a kart could be repositioned. Games made using this template will need to implement repositioners which serve their own needs.

Time Display

The TimeDisplayCanvas prefab has a TimeDisplay script on. This is responsible for displaying information about the lap/race time of a specific racer. It contains a collection of display options. Adding elements to this collection will allow you to see additional pieces of information. Setting different display options at runtime is possible using the RebindDisplayOptions method. This creates garbage and should be used sparingly. It should be noted that this class deals with strings and so creates a small amount of garbage each frame.



Time Display (Script)

Script	TimeDisplay
Initial Display Options	
Size	3
Element 0	Current Lap
Element 1	Finished Laps
Element 2	Session Best Lap
Track Manager	TrackManager (TrackManager)
Text Component	LapText (TextMeshProUGUI)
Initial Racer	Kart (Racer)