

Intevion Vehicle Controller Manual v2.0.0



Introduction	3
Basic Configuration	4
Vehicle Controller	6
Main Properties	6
Engine Properties	7
Transmission Properties	7
Steering Properties	8
Brakes Properties	8
Advanced	8
Wheel Controller	9
Properties	9
Scripting API	9
VehicleController class	9
Properties	9
Events	13
Methods	14
WheelAxle class	14
Properties	14
WheelController class	15
Properties	15
Support	17

Introduction

The Intevion Vehicle Controller is a lightweight vehicle controller with a convenient API. It is based on the Wheel Collider and suitable for action games. The second version of the Intevion Vehicle Controller has been completely re-worked, many aspects of the controller have been improved and vehicle behaviour became more realistic.

With Intevion Vehicle Controller you can build different kinds of vehicles with any number of axles and wheels, and with different drivetrains types: Rear-Wheel Drive, Front-Wheel Drive or Four-Wheel Drive. Also the controller allows to configure any number of wheels on a single axle.

The Intevion Vehicle Controller controls only the vehicle behaviour. All other things, like visual effects, sound effects, camera behaviour, lies outside the responsibility of the controller. This allows you to choose any other assets for these purposes which you want or which more suitable for your task. You can implement own components too. In demo scene are shown several examples which you can examine (skid-marks controller, engine SFX controller and camera controller). With Intevion Vehicle Controller you also can choose any input system to implement player input, or you can attach any AI to control the vehicle.

The Intevion Vehicle Controller also provides:

- Three type of transmission: Automatic, Semi-Automatic and Manual.
- Adjustable center of mass.
- Auto-calculation of the steering geometry. You can configure any number of steering axles.
- Anti-roll bar that prevents the vehicle from roll over.
- Simple anti-lock brake system (ABS).
- The downforce on every axle separately. Increasing of the downforce increase the grip with road.
- Convenient API to control the vehicle.

Basic Configuration

Prepare your vehicle model. Split it on vehicle body prefab and wheel prefab.



Pic. 1



Pic. 2

Drag VehicleChassis prefab from this asset to the scene or to the hierarchy. This prefab has Rigidbody and Vehicle Controller components already attached and has two wheel axles by default. Rename game object, for example, to PlayerVehicle. We recommend to start with parameters provided in prefab. Later you can to experiment with them as you wish.

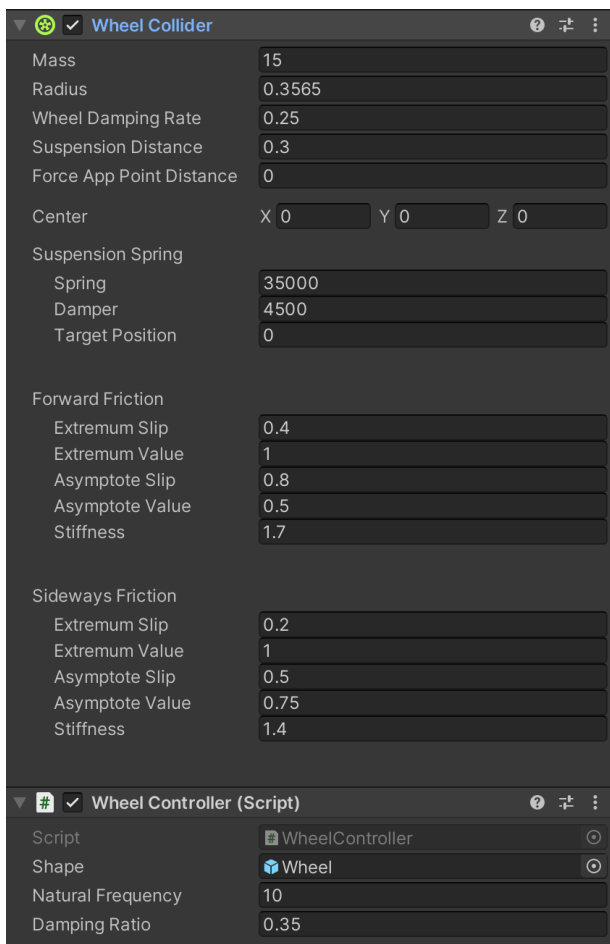
Drag your vehicle body prefab to the hierarchy and make it as a child of the PlayerVehicle game object. Add collider component to the vehicle body game object if it is not added yet. Don't forget to enable Convex checkbox for mesh colliders in inspector.

Now you need to create and configure wheels. Create wheels as a child game objects of the vehicle. Attach WheelCollider and WheelController components to every wheel (Pic. 3) and adjust position for each wheel according your vehicle chassis. Then take the wheel prefab and drag it to the Shape parameter in the inspector. Configure WheelCollider parameters, but leave default values for the following parameters: Force App Point Distance, Spring and Dumper. These parameters are updated by Vehicle Controller automatically. We recommend also slightly increase stiffness and decrease extremum slip values for sideways friction on the rear wheels (see the demo scene for example).

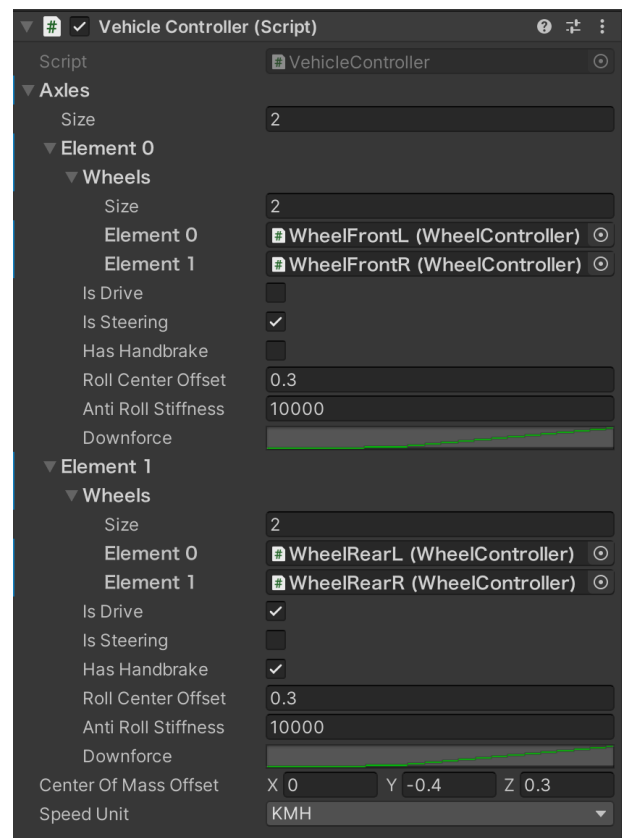
Select PlayerVehicle game object and unfold the Axles section of the Vehicle Controller component in the inspector (Pic. 4). You will see the properties of each axle. Configure here which axle will be drive and which will be steering. Then unfold the Wheels section and attach created wheels to the Vehicle Controller.

When the basic setup will be done create and attach the custom player input controller (see PlayerInputController script in demo scene for example). You can choose which input system you will use: built-in Input Manager or new Input System. If you chose built-in Input Manager we

recommend to set Gravity and Sensitivity properties for Horizontal and Vertical input axes to 1000 to make your vehicle more responsive to control input.



Pic. 3



Pic. 4

Vehicle Controller

Main Properties

Axles	List of wheel axles settings. You can configure vehicle chassis with any number of axles.
Wheels	List of wheels. Every wheel in the list must has WheelController component attached. Axle can has any number of wheels, one or more.
Is Drive	Enable the checkbox if the axle should be drive.
Is Steering	Enable the checkbox if the axle should be steering.
Has Handbrake	Enable the checkbox if the axle should have handbrake.
Roll Center Offset	The offset of effective roll center from center of mass of the vehicle. Moving roll center downwards introduces more roll when cornering, while moving it upwards results in less roll when cornering. The roll center is typically below the rigid body center of mass.
Anti Roll Stiffness	The stiffness of the anti-roll bar. The anti-roll bar prevents the vehicle to roll over.
Anti Roll Force Threshold	Anti-roll force is applied when the suspension travel is greater than this value.
Downforce	The curve that defines the downforce on the axle vs vehicle speed. Increasing of the downforce increase the grip with road. Is recommended that downforce will be slightly greater for rear axles, that will makes the vehicle more stable on high speed.
Center Of Mass Offset	The offset of the vehicle center of mass.
Speed Unit	The speed unit in which the VehicleController accepts and returns speed values. For example if Speed Unit is specified as KMH then Maximum Forward Speed property assume that the speed will be specified in this units. This also true for other properties related on speed. Can be KMH and MPH.

Engine Properties

Start Engine	Enable the checkbox if the engine should starts in Start event function.
Engine Start Time	The time in seconds that determines how long the engine starts.
Idle Engine RPM	The engine RPM in the idle state.
Maximum Engine RPM	The maximum RPM that engine can reach.
Upshift Engine RPM	When engine RPM reaches this value the automatic transmission upshifts gear.
Downshift Engine RPM	When engine RPM reaches this value the automatic or semi-automatic transmission downshifts gear.
Engine Torque	The curve that defines the engine torque vs engine RPM.
Engine Revving Time	The time in seconds that determines how fast the engine reaches possible maximum RPM on gear with ratio 1:1, when wheels aren't on ground. For other gear ratios the time calculates automatically using this value.
Maximum Forward Speed	The maximum forward speed. Set to 0 if you want to limit speed only by the engine torque curve.
Maximum Reverse Speed	The maximum reverse speed. Set to 0 if you want to limit speed only by the engine torque curve.

Transmission Properties

Transmission Type	The transmission type. Can be Automatic, Semi-Automatic and Manual.
Gear Ratios	The list that defines the number of gears and their ratios. The reverse gear has the same ratio as the first gear.
Final Drive Ratio	The final drive ratio of the vehicle.
Shift Time	The shift time is the time interval between gear changes in a transmission.

Steering Properties

Maximum Steer Angle	The curve that defines the maximum steer angle vs vehicle speed.
Ackerman Ratio	Determines how close the steer angles match to the Ackermann steering geometry. Where 1 means perfect match and 0 means that Ackermann steering geometry is not used at all.
Emergency Steering Threshold	When the skid factor is greater than the emergency steering threshold, the steering angle is maximized.
Steering Sensitivity	Determines how fast the steering wheels react on steering input.

Brakes Properties

Brake Torque	The brake torque value.
Brake Drag	This value appends to the rigidbody drag when vehicle brakes. It makes the brakes more efficient.
ABS	Enable the checkbox to enable anti-lock braking system.
Deceleration Torque	The deceleration torque value.
Handbrake Torque	The handbrake torque value.
Handbrake Drag	This value appends to the rigidbody drag when handbrake is on. It makes the handbrake more efficient.

Advanced

Critical Speed	The speed threshold of the sub-stepping algorithm.
Speed Below	Amount of simulation sub-steps when vehicle's speed is below speedThreshold.
Speed Above	Amount of simulation sub-steps when vehicle's speed is above speedThreshold.

Wheel Controller

Properties

Shape	The wheel model.
NaturalFrequency	Natural frequency of the suspension spring.
DampingRatio	Damping ratio of the suspension spring.

Scripting API

VehicleController class

Properties

AttachedRigidbody	<pre>public Rigidbody AttachedRigidbody</pre> <p>The rigidbody attached to the VehicleController (Read Only).</p>
Axles	<pre>public WheelAxle[] Axles</pre> <p>Returns the list of the WheelAxle objects.(Read Only).</p>
Wheelbase	<pre>public float Wheelbase</pre> <p>The wheelbase is the horizontal distance between the centers of the front and rear wheels. For road vehicles with more than two axles (e.g. some trucks), the wheelbase is the distance between the steering (front) axle and the centerpoint of the driving axle group (Read Only).</p>
WheelsGrounded	<pre>public bool WheelsGrounded</pre> <p>Returns true when at least one wheel is grounded (Read Only).</p>

AnyWheelGrounded	<pre>public bool AnyWheelGrounded</pre> <p>Returns true when at least one wheel is grounded (Read Only).</p>
AnyDriveWheelGrounded	<pre>public bool AnyDriveWheelGrounded</pre> <p>Returns true when at least one drive wheel is grounded (Read Only).</p>
SpeedUnit	<pre>public SpeedUnit SpeedUnit</pre> <p>The speed unit. Can be KMH and MPH.</p>
EngineState	<pre>public EngineState EngineState</pre> <p>The engine state. Can to have following values: Starting, Started, Working, Stopped (Read Only).</p>
DrivingState	<pre>public DrivingState DrivingState</pre> <p>The driving state. Can to have following values: Idling, DrivingForward, DrivingBackward, RollingForward, RollingBackward, Braking (Read Only).</p>
Throttle	<pre>public float Throttle</pre> <p>The vehicle throttle value (Read Only).</p>
Speed	<pre>public float Speed</pre> <p>The vehicle speed in speed units (Read Only).</p>
IdleEngineRPM	<pre>public float IdleEngineRPM</pre> <p>The engine RPM in the idle state (Read Only).</p>
MaximumEngineRPM	<pre>public float MaximumEngineRPM</pre> <p>The maximum RPM that engine can reach (Read Only).</p>
EngineRPM	<pre>public float EngineRPM</pre> <p>The current engine RPM (Read Only).</p>

EngineTorque	<p><code>public AnimationCurve EngineTorque</code></p> <p>The curve that defines the engine torque vs engine RPM.</p>
MaximumForwardSpeed	<p><code>public float MaximumForwardSpeed</code></p> <p>The maximum forward speed. Set to 0 if you want to limit speed only by the engine torque curve.</p>
MaximumReverseSpeed	<p><code>public float MaximumReverseSpeed</code></p> <p>The maximum reverse speed. Set to 0 if you want to limit speed only by the engine torque curve.</p>
TransmissionType	<p><code>public TransmissionType TransmissionType</code></p> <p>The transmission type. Can be Automatic, SemiAutomatic and Manual.</p>
GearRatios	<p><code>public float[] GearRatios</code></p> <p>The list that defines the number of gears and their ratios. The reverse gear has the same ratio as the first gear.</p>
FinalDriveRatio	<p><code>public float FinalDriveRatio</code></p> <p>The final drive ratio of the vehicle.</p>
ShiftTime	<p><code>public float ShiftTime</code></p> <p>The shift time is the time interval between gear changes in a transmission.</p>
Gear	<p><code>public int Gear</code></p> <p>The current gear. 0 means the neutral gear, -1 means the reverse gear (Read Only).</p>
GearRatio	<p><code>public float GearRatio</code></p> <p>The current gear ratio (Read Only).</p>

MaximumSteerAngle	<p>public AnimationCurve MaximumSteerAngle</p> <p>The curve that defines the maximum steer angle vs vehicle speed.</p>
AckermannRatio	<p>public float AckermannRatio</p> <p>Determines how close the steer angles match to the Ackermann steering geometry. Where 1 means perfect match and 0 means that Ackermann steering geometry is not used at all.</p>
SkidFactor	<p>public float SkidFactor</p> <p>The dot product of the Transform.right vector and normalized velocity vector of the vehicle (Read Only).</p>
EmergencySteeringThreshold	<p>public float EmergencySteeringThreshold</p> <p>When the skid factor is greater than the emergency steering threshold, the steering angle is maximized.</p>
SteeringSensitivity	<p>public float SteeringSensitivity</p> <p>Determines how fast the steering wheels react on steering input.</p>
BrakeTorque	<p>public float BrakeTorque</p> <p>The brake torque value.</p>
BrakeDrag	<p>public float BrakeDrag</p> <p>This value appends to the rigidbody drag when vehicle brakes. It makes the brakes more efficient.</p>
ABS	<p>public bool ABS</p> <p>Used to enable or disable anti-lock braking system.</p>
DecelerationTorque	<p>public float DecelerationTorque</p> <p>The deceleration torque value.</p>

HandbrakeEnabled	<pre>public bool HandbrakeEnabled</pre> <p>The handbrake state. You can change it by assigning true or false value to the property.</p>
HandbrakeTorque	<pre>public float HandbrakeTorque</pre> <p>The handbrake torque value.</p>
HandbrakeDrag	<pre>public float HandbrakeDrag</pre> <p>This value appends to the rigidbody drag when handbrake is on. It makes the handbrake more efficient.</p>
SuspensionTravelThreshold	<pre>public float SuspensionTravelThreshold</pre> <p>Anti-roll force is applied when the suspension travel is greater than this value.</p>

Events

EngineStateChanged	<pre>public event Action<EngineState> EngineStateChanged</pre> <p>Event raised when the engine state is changed. The current engine state is transmitted to event handler.</p>
DrivingStateChanged	<pre>public event Action<DrivingState> DrivingStateChanged</pre> <p>Event raised when the driving state is changed. The current driving state is transmitted to event handler.</p>
GearShifted	<pre>public event Action<int> GearShifted</pre> <p>Event raised when the gear shifted. The current gear is transmitted to event handler.</p>

Methods

StartEngine	<pre>public void StartEngine()</pre> <p>The method starts vehicle engine.</p>
StopEngine	<pre>public void StopEngine()</pre> <p>The method stops vehicle engine.</p>
Drive	<pre>Drive(float drivingInput)</pre> <p>The method drives the vehicle according to the driving input value.</p>
Steer	<pre>Steer(float steeringInput)</pre> <p>The method steers the vehicle according to the steering input value.</p>
ShiftGear	<pre>public void ShiftGear(int gear)</pre> <p>The method shifts the gear of the manual or semi-automatic transmission.</p>

WheelAxle class

Properties

Wheels	<pre>public WheelController[] Wheels</pre> <p>Returns the list of WheelController objects (Read Only).</p>
LocalPosition	<pre>public Vector3 LocalPosition</pre> <p>The local position of the axle relative to the vehicle (Read Only).</p>
IsDrive	<pre>public bool IsDrive</pre> <p>Returns true if the axle is drive.</p>

IsSteering	<pre>public bool IsSteering</pre> <p>Returns true if the axle is steering.</p>
HasHandbrake	<pre>public bool HasHandbrake</pre> <p>Returns true if the axle has handbrake.</p>
RollCenterOffset	<pre>public float RollCenterOffset</pre> <p>The offset of effective roll center from center of mass of the vehicle. Moving roll center downwards introduces more roll when cornering, while moving it upwards results in less roll when cornering. The roll center is typically below the rigid body center of mass (Read Only).</p>
AntiRollStiffness	<pre>public float AntiRollStiffness</pre> <p>The stiffness of the anti-roll bar. The anti-roll bar prevents the vehicle to roll over.</p>
AntiRollForceThreshold	<p>Anti-roll force is applied when the suspension travel is greater than this value.</p>
MotorTorque	<pre>public float MotorTorque</pre> <p>The motor torque on the axle.</p>
BrakeTorque	<pre>public float BrakeTorque</pre> <p>The brake torque on every wheel on the axle.</p>

WheelController class

Properties

Axle	<pre>public WheelAxle Axle</pre> <p>Returns the WheelAxle object.</p>
-------------	---

Collider	<pre>public WheelCollider Collider</pre> <p>Returns the WheelCollider object (Read Only).</p>
LocalPosition	<pre>public Vector3 LocalPosition</pre> <p>The local position of the wheel relative to the vehicle.</p>
Radius	<pre>public float Radius</pre> <p>The radius of the wheel.</p>
IsDrive	<pre>public bool IsDrive</pre> <p>Returns true if the wheel is drive (Read Only).</p>
IsSteering	<pre>public bool IsSteering</pre> <p>Returns true if the wheel is steering (Read Only).</p>
HasHandbrake	<pre>public bool HasHandbrake</pre> <p>Returns true if the wheel has handbrake (Read Only).</p>
NaturalFrequency	<pre>public float NaturalFrequency</pre> <p>Natural frequency of the suspension spring.</p>
DampingRatio	<pre>public float DampingRatio</pre> <p>Damping ratio of the suspension spring.</p>
MotorTorque	<pre>public float MotorTorque</pre> <p>The motor torque on the wheel.</p>
BrakeTorque	<pre>public float BrakeTorque</pre> <p>The brake torque on the wheel.</p>
RPM	<pre>public float RPM</pre> <p>The current RPM of the wheel (Read Only).</p>

SuspensionTravel	<code>public float SuspensionTravel</code> The current suspension travel (Read Only).
IsGrounded	<code>public bool IsGrounded</code> Returns true if the wheel collides with something, otherwise returns false (Read Only).
GroundHit	<code>public RaycastHit GroundHit</code> Returns ray cast hit information If the wheel is on the ground (Read Only).

Support

All you questions and bug reports you can send here support@intevion.com.